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A Continuing Bibliography with Indexes

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NASA SP-7037(154)

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 154)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in October 1982 in

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

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

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 511 reports, journal articles, and other documents originally announced in October 1982 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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N82-10021*# Kansas Univ Center for Research, Inc, Lawrence Flight Research Lab
ICING TUNNEL TEST OF A GLYCOL-EXUDING POROUS LEADING EDGE ICE PROTECTION SYSTEM ON A GENERAL AVIATION AIRFOIL Final Report
David L Kohlman, William G Schweikhard and Alan E Albright
Sep 1981 37 p refs
(Grant NAG3-71)
(NASA-CR-165444, KU-FRL-464-1) Avail NTIS HC A03/MF A01 CSCL 01C

Test results show that the system is very effective in preventing ice accretion (anti-ice mode) or removing ice from an airfoil Minimum glycol flow rates required for antiicing are a function of velocity, liquid water content in the air, ambient temperature, and droplet size Large ice caps were removed in only a few minutes using anti-ice flow rates, with the shed time being a function of the type of ice, size of the ice cap angle of attack, and glycol flow rate Wake surveys measurements show that no significant drag penalty is associated with the installation or operation of the system tested T M

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A82-11317 # **Development of aircraft production engineering discipline at IIT, Bombay** N K Naik (Indian Institute of Technology, Bombay, India) *Aeronautical Society of India, Journal,* vol 31, Feb-Nov 1979, p 119-125

The aircraft production engineering courses offered at the Indian Institute of Technology, in Bombay, are discussed To demonstrate the value of the courses, the fundamentals of aircraft production are outlined, the discussion being confined to airframe production The loft-template method is described, and the principal loft-template scheme used in aircraft production is shown Also described are the theory and laboratory courses offered at the institute C R

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 154)

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IAA ENTRIES

A82-38146 Efficient optimum design of structures - Program DDDU. L -X Qian, W Zhong, Y Sui, and J Zhang (Dalian Institute of Technology, Dalian, People's Republic of China) *Computer Methods in Applied Mechanics and Engineering,* vol 30, May 1982, p 209-224 12 refs

An efficient optimization algorithm is developed for engineering structures subject to multiple constraints This highly non-linear and implicit problem is reduced to a combination of a sequence of quasi-linear constraints and explicit problems of the statically determined structures The method is based on the Kuhn-Tucker necessary conditions for optimality associated with a simple quadratic program designed simultaneously to determine the Lagrange multipliers and to delete non-active constraints A number of examples including trusses and wing structures show that the method is efficient when compared with other competing techniques (Author)

A82-38216 Forward-swept wings add supersonic zip. R DeMeis *High Technology,* vol 2, Jan -Feb 1982, p 33-40

A forward-swept wing aircraft is being built under an Air Force contract for test flying in late 1983 This design has many advantages over conventional aft-swept wing aircraft, including a naturally smoother area distribution, which lowers wave drag and allows a wider fuselage at the center of gravity and, thus, provides greater payload and fuel capacity However, since twisting of the wings caused by airflow produces extreme shearing forces, the forward-swept wing design has only recently become possible by means of structural tailoring of the wing using graphite-epoxy composite material which compensates for the unstable wing twisting under standard fighter-type flying conditions In addition, the design confers such a responsive, unstable configuration that computer control is necessary to augment pilot action Detailed explanations of the main aerodynamic features of the forward-swept wing design are given N B

A82-38222 # Composite use on helicopters. J Ray (United Technologies, Corp , Sikorsky Aircraft Div , Stratford, CT) *Astronautics and Aeronautics,* vol 20, July-Aug 1982, p 60, 61

Composite material used in components of the Sikorsky S-76 helicopter are reviewed Composite fiber reinforced with Nomex and an aluminum honeycomb is employed for the horizontal stabilizer The spar is equipped with caps made of unidirectional graphite-epoxy tape co-cured with Kevlar skin material Two plies of woven Kevlar cover the caps in order to prevent galvanic corrosion The inboard section of the spar possesses a precured torque tube of woven Kevlar cloth which is bonded to an aluminum core and provides the dominant load path for torsion and flexural shear The composite materials are responsible for a 17 4% reduction in the airframe/gross weight ratio and an increase of 20% in the range due to the smooth flush contour of the stabilizer and consequent drag reduction The fairings and doors of the S-76 are also made of laminated structures, and sandwich panels serve for the windshield support posts, internal frames, longitudinal elements and door jamb M S K

A82-38223 # Toward all-composite helicopter fuselage. L Marchinski (Boeing Vertol Co , Philadelphia, PA) *Astronautics and Aeronautics,* vol 20, July-Aug 1982, p 61, 62

The construction and benefits of using all-composite material for helicopter fuselages, particularly on the Boeing Vertol 234, are outlined The cabin floor of the 234 is made of four composite panels with fiber glass/Kevlar 49 face sheets and a Nomex honeycomb core Molded-edge rubber seals bonded into the floor assembly during co-curing and machined 7050 aluminum fittings at each end of the lateral, Kevlar beams under the lower side of the floor panels have contributed to a vibration rate of less than 0 03 g A 10% weight saving over that available with an all metal floor has been achieved, as well as greater impact resistance The success with the floor indicates that replacement of all-metal fuselages with Nomex-honeycomb structures offers a potential weight savings of 33% Further research is necessary into the effects of lightning strikes and electrical bonding M S K

A82-38224 # Committing composites to the Boeing 767. R Hammer (Boeing Commercial Airplane Co , Renton, WA) *Astronautics and Aeronautics,* vol 20, July-Aug 1982, p 62

Applications of Kevlar/graphite composites in the Boeing 767 aircraft are reviewed, noting the higher weight savings which were achieved than were offered by metal or fiber glass/epoxy materials Results from a NASA/Lockheed program testing the Kevlar composites in comparison with fiber glass parts proved the acceptability of using the Kevlar/graphite for 24 different aircraft components at a weight savings of over 2000 lb It is concluded that the employment and techniques involving composite technologies are at the same stage as aluminum technology was in the 1930s M S K

A82-38249 Mirage 2000 - Towards possible high series production aircraft (Mirage 2000 - Vers l'avion de série). J Morisset and N Beauclair *Air et Cosmos,* vol 20, July 10, 1982, p 26-42 In French

Design and performance characteristics of the Mirage 2000 aircraft are presented, noting modifications available for different combat missions The single-engined aircraft is equipped with multiple radar systems, can be used as an interceptor at high or low altitudes, is capable of carrying air-to-ground nuclear tipped missiles, and features two 30 mm cannons Fly by wire control is standard, and, the aircraft is stable at high angles of attack with a top speed of Mach 2 2 while carrying a full load at 60,000 ft The internal fuel stores are 3800 liters, and external stores can be added to extend the total range to 1500 km By wind 1980 the Mirage 2000 had been flight tested in 1677 sorties, with tests being done on five configurations of the aircraft Details of the design process, the use of composites in the aircraft structure, the operational features of the missile stores, the laser guidance system, and the electronics are provided M S K

A82-38281 # Aerodynamic behavior of a slender slot in a wind tunnel wall. D B Bliss (Princeton University, Princeton, NJ) *AIAA Journal,* vol 20, Sept 1982, p 1244-1252 8 refs Grant No AF-AFOSR-77-3337

A theoretical model for the flow through a single slot of finite length in a wall separating a uniform freestream and a quiescent fluid at different static pressures is constructed This problem is relevant to understanding the aerodynamic behavior of slots which are used in the test sections of some ventilated wall transonic wind tunnels The theoretical relationship which is obtained between the pressure differential across the slot and the flow through the slot shows both the linear and quadratic regimes observed in experiments The linear behavior arises from the acceleration of the cross flow into the slot downstream of the leading edge and from the interaction of streamwise stations along the slot, as well as from the effect of slot taper Analytical solutions are obtained for two slot planform shapes, and some other cases are solved numerically The quantitative agreement with experimental data is very encouraging (Author)

A82-38283 # Improved solutions to the Falkner-Skan boundary-layer equation. C A Forbrich, Jr (USAF, Armament Laboratory, Fort Walton Beach, FL) *AIAA Journal,* vol 20, Sept 1982, p 1306, 1307 11 refs USAF-supported research

The results of a state variable approach to computationally solve the Falkner-Skan equation over a wide range of boundary-layer acceleration parameters are presented The Falkner-Skan equation is concerned with flow past an infinite wedge with a particular vertex angle, and solutions are presented which are accurate to eight places for third order differential equations Iterative procedures for improving the order of accuracy are described, and an example is provided for the case of an initial wedge angle of 0 40 x pi The method is considered acceptable for the analysis of slightly accelerating and decelerating flows encountered in low drag and supercritical airfoils M S K

A82-38405 VHF radio link for ground-air-ground communications using an integrated voice-data modulation. G Benelli (Firenze, Università, Florence, Italy) *Electronics Letters,* vol 18, June 24, 1982, p 555, 556 Consiglio Nazionale delle Richerche Contract No 81,00,202

A possible realization of a data channel between aircraft and ground station is presented, which utilizes a combined amplitude-phase modulation Amplitude modulation is used to transmit a voice signal, while phase modulation is used for data transmission Performance of this system is evaluated through a computer simulation (Author)

A82-38422 The need for a dedicated public service helicopter design. R Morrison (Airborne Law Enforcement Association, Inc , Huntington Beach Police Dept , Huntington Beach, CA) *Vertiflite,* vol 28, July-Aug 1982, p 28-32

A proposal is made for NASA to undertake a program to develop a technologically-advanced modular helicopter designed specifically for public service use, that is, for emergency medical services, fire fighting, wildlife management, law enforcement, etc Public service helicopters currently in use have many unattractive features, such as high noise and cost, as a result of their original designs to satisfy military requirements, and are unable to meet the varied needs of public service operators The proposed helicopter would have a high speed (200-300 knots), combined with effective night, all-weather operation, and could yield national benefits of over $90 billion per year, including a greater ability to compete with foreign-made helicopters, a reduced response time in emergency situations, a greater effectiveness in law enforcement, and expanded job opportunities in the helicopter industry N B

A82-38423 JVX, what an opportunity. C C Crawford, Jr (U S Army, Aviation Research and Development Command, St Louis, MO) *Vertiflite,* vol 28, July-Aug 1982, p 34-39

US military officials have proposed the creation of a Joint Services Advanced Vertical Lift Aircraft Program (JVX) to design a family of advanced technology vertical lift aircraft which could perform numerous, multi-service missions and achieve initial operating capability in the early 1990s Six specific roles have been selected from the mission profiles to serve as a basis for molding requirements for a common multi-service air vehicle and the requirement for fulfilling world-wide self-deployment The six roles - combat search and rescue, long range requirements, special electronics mission, signal intelligence, Marine Corps JVX, and self-deployment - are described in detail and schematics showing each of the mission profiles are included A technical assessment group, which included representatives of the US Army Aviation Research and Development Command and NASA, reviewed possible configurations for the JVX and determined that tilt rotor configurations appear to offer the best possibility for a common multi-service design since they possess adequate hover efficiency, high-altitude and high speed capabilities as well as world-wide self-deployment Other configurations studied, including lift/cruise fan configurations, conventional helicopters, and the auxiliary propulsion ABC/compound helicopter, all have serious drawbacks and are considered less attractive for the JVX N B

A82-38439 # Minimal order time sharing filters for INS in-flight alignment. I Y Bar-Itzhack (Technion - Israel Institute of Technology, Haifa, Israel) *Journal of Guidance, Control, and Dynamics,* vol 5, July-Aug 1982, p 396-402 19 refs Research supported by the Israel Aircraft Industries, Ltd , and Ministry of Defence

Very simple reduced order filters which operate in a time sharing mode are proposed for in-flight and transfer alignment of calibrated inertial navigation systems (INS) such as those in fighter aircraft The coarsely aligned INS is flown for a short duration in a straight and level flight during which two second-(or third-) order time sharing filters estimate the level misalignment After removing the estimated level misalignment angles a third-(or fourth-) order filter is switched in to estimate the azimuth misalignment as the aircraft starts to maneuver in the lateral plane A true covariance simulation is carried out, which shows that the proposed filters successfully perform the fine alignment (Author)

A82-38441 # Adaptive filtering for an aircraft flying in turbulent atmosphere. H Okubo (Osaka Prefecture University, Sakai, Japan) *Journal of Guidance, Control, and Dynamics,* vol 5, July-Aug 1982, p 410-412 5 refs

On the basis of a sensitivity analysis for a simple scalar system, the deterioration of the Kalman filter performance resulting from incorrect noise covariance values is examined It is found that the increase in the error covariance relative to the optimum value depends largely on the ratio of the process and the measurement noise covariance values This is considered important in adaptive filtering problems when the system includes noises with extensively variable variance, such as the dynamics of aircraft flying through patches of atmospheric turbulence C R

A82-38442 * # Robust Kalman filter design for active flutter suppression systems. W L Garrard (Minnesota, University, Minneapolis, MN), J K Mahesh, C R Stone (Honeywell Systems and Research Center, Minneapolis, MN), and H J Dunn (NASA, Langley Research Center, Hampton, VA) *Journal of Guidance, Control, and Dynamics,* vol 5, July-Aug 1982, p 412-414 6 refs Contract No NAS1-15486

Additional insight is provided into the use of the Doyle-Stein (1979, 1981) technique in aeroelastic control problems by examining the application of the method to a flutter control problem The system to be controlled consists of a full-size wind tunnel model of a wing, plus an aileron, an actuator, and an accelerometer used to sense the motion of the wing A full-state feedback controller was designed using linear optimal control theory, and a Kalman filter was used in the feedback loop for state estimation The filter design procedure is explained along with that to improve closed-loop properties of the system The locus of the poles of the filter is examined as a scalar design parameter is varied The Doyle-Stein design procedure is shown to substantially improve the stability properties of an active flutter controller designed using the linear quadratic Gaussian control theory C D

A82-38443 * # Aerodynamic characteristics of a large-scale, twin tilt-nacelle V/STOL model. M D Falarski, M R Dudley (NASA, Ames Research Center, Moffett Field, CA), W Buchmann (Grumman Aerospace Corp , Bethpage, NY), and A Pisano (U S Naval Air Systems Command, Washington, DC) *(American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 19th, St Louis, MO, Jan 12-15, 1981, Paper 81-0150)* Journal of Aircraft, *vol 19, Aug 1982, p 627-633 6 refs*

A subsonic tilt-nacelle V/STOL aircraft configuration is described which is powered by two turbofan engines, mounted on a single carry-through structure that is designed to maintain the thrust axis close to the center of gravity at nacelle incidences of 5-95 deg Control during V/STOL operation, often from small ship platforms, is achieved by means of a vane assembly that is immersed in each turbofan's exhaust Wind tunnel test data have been obtained with an 11 2-m wing span model for the vertical-to-horizontal flight transition capability of the concept It is found that the aircraft can operate over a broad transition corridor, with sufficient maneuver capability about the trim points The control vane exhibited linear response characteristics over a large deflection range, with little influence from power, angle of attack or ground proximity in hover The model induced a positive ground effect in hover that increased as wheel height was approached and strake angle increased O C

A82-38445 * # Influence of unsteady aerodynamics on hingeless rotor ground resonance. W Johnson (NASA, Ames Research Center, Low Speed Aircraft Research Branch, Moffett Field, CA) *Journal of Aircraft,* vol 19, Aug 1982, p 668-673 16 refs
(Previously announced in STAR as N81-28056)

A82-38446 # U.S. Marine Corps AV-8A maintenance experience. L Scott and R W Morrissey (U S Naval Air Rework Facility, Cherry Point, NC) *(American Institute of Aeronautics and Astronautics and NASA Ames Research Center, V/STOL Conference, Palo Alto, CA, Dec 7-9, 1981, Paper 81-2657)* Journal of Aircraft, *vol 19, Aug 1982, p 694-696*

The basic structure of the AV-8A employs a 2014T6 aluminum alloy, with an epoxy primer and a polyurethane paint system, which have together been shown by U S Marine Corps maintenance experience to be proof against corrosion The vectorable engine nozzles and their drive system have proven to be so strong and reliable that vectoring has been used in forward flight for air combat maneuvering Only fatigue damage to the empennage primary structure has been experienced, and this problem is being addressed by a reduction of operational time at high power, together with a rebuilding of the ventral fin with solid rivets O C

A82-38447 # Estimation of the peak count of actively controlled aircraft. N J Meyerhoff and J Garlitz (U S Department of Transportation, Office of Air and Marine Systems, Cambridge, MA) *Journal of Aircraft,* vol 19, Aug 1982, p 698-700 5 refs

It is suggested by an analysis of preliminary data that a regression of the peak number of actively controlled aircraft on total daily operations yields an economical estimate of the peak instantaneous air count (AIC) over various air route traffic control centers (ARTCCs) It is possible to have a single general regression model for the entire continental U S , or separate models for each ARTCC In addition, peak models for terminal and en route centers appear possible, and improved estimates of peak ISC may be generated by regressing on component operations, consisting of departures, arrivals and overflights, rather than total daily operations O C

A82-38461 Complete flexibility and realism in radar simulation. C Buttars (International Aeradio, Ltd , Southall, Middx , England) *The Controller,* vol 21, May 1982, p 22, 23

A digital air traffic radar simulator, developed for International Aeradio's air traffic control training school, achieves complete flexibility and realism in all aspects of radar training The simulator uses a model flight information region to provide radar training capable of being applied anywhere in the world The system has the capability to operate up to seven studen controller displays, each allowing combined radar/procedural exercises to be run Three aircraft control units are provided, each capable of controlling 16 aircraft by keyboard input The electric data display shows full aircraft data, computer replies to keyboard injected demands, and aircraft reports either as a result of keyboard injection or automatically The simulator is programmed with the performance envelopes of 96 aircraft types (including indicated cruising speeds, rate of climb, descent speeds between three levels, and angles of bank), and allows only realistic flight characteristics Also programmed are international standard atmosphere, and turn and indicated air speed data, which permit the aircraft to realistically simulate actual flying conditions N B

A82-38462 **Future terminal area systems** P A Jorgensen (Selenia-Industrie Elettroniche Associate S p A , Rome, Italy) *(International Federation of Air Traffic Controllers' Associations, West European Conference, Rome, Italy, Nov 12-14, 1981) The Controller*, vol 21, May 1982, p 34, 35 6 refs

The development of a terminal area computer system able to interface with existing flight management systems is discussed, and this type of system is intended to provide greater fuel conservation and air space capacity, with improved safety during the descent phase of flights The system must be able to forecast a suitable approach routing, which will allow for a continuous descent of each aircraft, while also providing optimal distribution Utilizing such a system, a controller would concentrate on monitoring the separation between the aircraft and would only rarely need to intervene in the landing process Studies are being conducted to determine optimum approach patterns for such a system with regard to fuel conservation, safety and airspace capacity A graph of the actual measured fuel consumption found for three different patterns - the standard descent profile, the low drag/low power approach, and a low drag/delayed flaps approach - is presented N B

A82-38463 **The detection of low level wind shear. II.** P D Simmons *The Controller*, vol 21, May 1982, p 36-38

The Low Level Wind Shear Alert System (LLWSAS), a real-time micro-computer-controlled, data acquisition, analysis and display system for detecting horizontal wind shear near airports, is discussed, and the system's performance since its introduction by the FAA beinning in 1977 is analyzed The system collects wind direction and wind speed data from six anemometers located near approach and takeoff areas of the airport, computes the wind gusts, and alerts controllers to wind shears by visual and audible alarms, and the information is then relayed to pilots in the area While proof of the effectiveness of a system of this nature is extremely difficult to establish, it is noted that there have been no wind shear accidents in the US since 1977 One incident attributed to wind shear which occurred in Atlanta in 1979, but did not result in an accident, is discussed in detail While the LLWSAS did not dectect wind shear conditions, it is shown that the wind shear occurred outside of the range of the system, but at a distance which allowed the pilot to recover and land safely N B

A82-38464 **Fuel conservation: The airline - ATC.** P M Grundy *The Controller*, vol 21, May 1982, p 39, 40, 47

The air traffic control system has a greater impact on fuel conservation than any other factor in aviation, the most energy intensive industry in the world The article discusses various measures that could be adopted by airlines and air traffic controllers to increase fuel conservation These include reducing operating empty weights, flying at optimum altitude, direct routing, linear holding, speed control, flight planning, loading for favorable center of gravity to reduce trim drag, minimizing route mileage, and clearance priorities for more fuel demanding aircraft during landing N B

A82-38474 **A simplified approach to the free wake analysis of a hovering rotor.** R H Miller (MIT, Cambridge, MA) *(Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmisch-Partenkirchen, West Germany, Sept 8-11, 1981) Vertica*, vol 6, no 2, 1982, p 89-95 19 refs

(Previously announced in STAR as N82-18121)

A82-38475 **Calculation of the cross section properties and the shear stresses of composite rotor blades.** R Wörndle (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) *(Deutsche Gesellschaft fur Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 7th, Garmisch-Partenkirchen, West Germany, Sept 8-11, 1981) Vertica*, vol 6, no 2, 1982, p 111-129 10 refs

(Previously announced in STAR as N82-25334)

A82-38500 # **Wind shear - Its effect on an aircraft and ways to reduce the hazard. II (Uskok wiatru - Dzialanie na samolot, srodki zmniejszajace zagrozenie. II).** J M Morawski and T Smolicz (Instytut Lotnictwa, Warsaw, Poland) *Technika Lotnicza i Astronautyczna*, vol 37, May 1982, p 5-8 7 refs In Polish

A82-38722 † **Numerical methods for solving boundary value problems for noncavitating and cavitating flow past wing profiles (Chislennye metody resheniia kraevykh zadach beskavitatsionnogo i kavitatsionnogo obtekaniia kryl'evykh profilei)** N Iu Zavadovskii, S S Maslennikov, and A A Rusetskii (Tsentral'nyi Nauchno-Issledovatel'skii Institut, Leningrad, USSR) *Gidromekhanika*, no 45, 1982, p 3-12 6 refs In Russian

Algorithms are developed for the numerical solution of the following problems of the steady flow of an ideal incompressible fluid noncavitating flow past an airfoil section, noncavitating flow past a wing profile, and flow past a profile with partial cavitation An essential element of these algorithms is the computation of singular integrals and the solution of singular integral equations B J

A82-38781 **Symposium on Flows with Separation, Stuttgart, West Germany, November 23-25, 1981, Reports (Symposium über Strömungen mit Ablösung, Stuttgart, West Germany, November 23-25, 1981, Vorträge).** Symposium sponsored by the Deutsche Gesellschaft fur Luft- und Raumfahrt Cologne, Deutsche Gesellschaft fur Luft- und Raumfahrt, 1982 147 p In German and English (For individual items see A82-38782 to A82-38786)

Aspects of viscous transonic airfoil flow simulation are considered along with investigations regarding vortex formation at wings with bent leading edges, leading edge separation at delta wings with curved leading edges in supersonic flow, and measurement and visualization of skin friction on the leeside of delta wings in supersonic flow Attention is given to measurements of velocity distributions in the leading edge vortex of a delta wing by the laser-Doppler procedure, the topological structure of separated flows with three-dimensional boundary conditions, the calculation of boundary layers at fuselages, and a delta wing with a high vortex stability Other topics investigated are related to an experimental study concerning two- and three-dimensional separation, and a theoretical investigation of separated flows in cascades of fluid kinetic machines G R

A82-38783 # **Investigations regarding vortex formation at wings with bent leading edges (Untersuchungen über die Wirbelbildung an Flügeln mit geknickten Vorderkanten).** U Brennenstuhl and D Hummel (Braunschweig, Technische Universität, Brunswick, West Germany) In Symposium on Flows with Separation, Stuttgart, West Germany, November 23-25, 1981, Reports (A82-38781 19-02) Cologne, Deutsche Gesellschaft fur Luft- und Raumfahrt, 1982 4 p In German

It is pointed out that modern bomber aircraft employ presently almost exclusively wings with bent leading edges There is currently a shortage of wind tunnel data which can provide detailed information regarding the characteristics of flows around such wings For these reasons, an experimental program involving the study of a number of wings with the considered characteristics has been conducted in West Germany The first results obtained in connection with this program have already been reported by Brennenstuhl and Hummel (1981) The present investigation is concerned with the remainder of the results obtained in the investigation The effect of the angle by which the leading edge is bent on the flow characteristics is considered Attention is given to measurements concerning the pressure distribution and the flowfield G R

A82-38784 # **Leading edge separation at delta wings with curved leading edges in supersonic flow (Vorderkantenablösung an Deltaflügeln mit gekrümmten Vorderkanten im Überschall).** R Henke (Berlin, Technische Universität, Berlin, West Germany) In Symposium on Flows with separation, Stuttgart, West Germany, November 23-25, 1981, Reports (A82-38781 19-02) Cologne, Deutsche Gesellschaft fur Luft- und Raumfahrt, 1982 14 p 6 refs In German

Leeside flow types for delta wings are considered, taking into account the boundary provided by the Stanbrook-Squire region which divides the separation forms 'leading edge separation' and 'shock induced separation' Basic information regarding the flow over wings with curved leading edges was obtained in studies conducted by Henke (1980) and by Ganzer and Henke (1981) An evaluation of oil film pictures provided an impression regarding the interference characteristics for the various wing components A number of graphs are presented for the illustration of the obtained results Some of the pictures were obtained by means of a vapor screen technique and a schlieren method G R

A82-38785 * # **Measurement and visualization of skin friction on the leeside of delta wings in supersonic flow (Messung und Sichtbarmachung der Wandschubspannungen auf der Leeseite von Deltaflügeln im Überschall).** J Szodruch (Vereinigte Flugtechnische Werke-Fokker GmbH, Bremen, West Germany) and D J Monson (NASA, Ames Research Center, Moffett Field, CA) In Symposium on Flows with Separation, Stuttgart, West Germany, November 23-25, 1981, Reports (A82-38781 19-02) Cologne, Deutsche Gesellschaft fur Luft- und Raumfahrt, 1982 9 p 7 refs In German

The reported investigation was conducted with the aid of the NASA Ames High Reynolds Number Wind Tunnel The flow conditions considered involved free stream Mach numbers of 2 and 3, and a Reynolds number of approximately 10,000,000 p m The employed model was a delta wing with an angle of 70 deg A method reported by Tanner (1977) was used for the measurement of the skin friction This method involves the use of a laser interferometer to determine the change in the thickness of an oil film The procedure can also be employed for a visualization of skin friction in the form of interferograms The investigation shows that skin friction measurements can provide a significant contribution to a physical understanding of the flow processes at the delta wing G R

A82-38786 # **Measurements of velocity distributions in the leading edge vortex of a delta wing by the laser-Doppler procedure (Messungen**

von Geschwindigkeitsverteilungen im Vorderkantenwirbel eines Deltaflugels mit dem Laser-Doppler-Verfahren). K Anders (Institut fur Thermodynamik der Luft- und Raumfahrt, Stuttgart, West Germany) and E Wedemeyer (Institut von Karman de Dynamique des Fluides, Rhode-Saint-Genèse, Belgium) In Symposium on Flows with Separation, Stuttgart, West Germany, November 23-25, 1981, Reports (A82-38781 19-02) Cologne, Deutsche Gesellschaft fur Luft- und Raumfahrt, 1982 11 p In German

It is pointed out that there are significant differences between the flow around a delta wing and the flow observed in the case of a conventional wing with a large aspect ratio Vortex formation at the leading edges of delta wings produces nonlinear additional lift Under certain conditions, a complete change of the form of the flowfield will occur above a part of the wing, and the vortex will burst Pronounced turbulent mixing takes place, and the supersonic speed is significantly reduced This reduction leads to a considerable decrease of the lift Ludwieg (1960) has discussed a theory which explains the bursting process with an occurrence of instabilities The present investigation is concerned with a study of leading edge vortices on the basis of Ludwieg's theory Certain deviations of experimental data from results obtained on the basis of Ludwieg's theory can, perhaps, be explained by the unsymmetrical character of the vortex near the wall G R

A82-38922 **Calculation of level flow using radial grating (Berechnung der ebenen Strömung durch rotierende Radialgitter).** E M Steck (Karlsruhe, Universität, Karlsruhe, West Germany) *(Gesellschaft für angewandte Mathematik und Mechanik, Wissenschaftliche Jahrestagung, Würzburg, West Germany, Apr 21-24, 1981) Zeitschrift fur angewandte Mathematik und Mechanik,* vol 62, Apr 1982, p T 233-T 235 In German

A theoretical study of level flow through a rotating radial grating is conducted for the special case of ideal flow as well as for laminar flow in a high-viscosity newtonian fluid A system of equations and correlative boundary conditions are developed in order to obtain the frictional and friction-free flow in the form of the integral values of the pressure and efficiency as functions of volume, blade number, Reynolds number, blade angle variation, and radian ratio C D

A82-38937 # **A recursive terrain height correlation system using multiple model estimation techniques.** G L Mealy and W Tang (Analytic Sciences Corp, Reading, MA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 105-112 7 refs Grant No DAKK80-79-C-0268 (AIAA 82-1513)

This paper describes the results of an investigation of the performance capabilities of an extended Kalman filter (EKF) based recursive terrain correlation system proposed for low-altitude helicopter navigation The major disadvantage of this concept is its sensitivity to initial position error One method for reducing this sensitivity involves the use of multiple model estimation techniques In the multiple model approach, a bank of identical EKFs, each of which is initialized at a different point in the a priori uncertainty basket, is employed to ensure that one filter is initialized near the true aircraft position In this manner, the probability of filter convergence is increased substantially, leading to improved navigation performance (Author)

A82-38938 # **PNCS - A commercial flight management computer system.** M W Bird (Lear Siegler, Inc, Instrument Div, Grand Rapids, MI) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 113-123 5 refs (AIAA 82-1515)

The Performance Navigation Computer System (PNCS), a system in which performance optimization, multisensor navigation, automatic guidance, and display techniques have been integrated to provide fuel-efficient operation and a lower workload for the crew is described The PNCS guidance and flight planning capabilities derive from the integration of the optimum speed and altitude profiles computed by the performance management function with the lateral path and speed/altitude constraints of the flight plan The performance management functions determine the climb, cruise, and descent profile segments that minimize the total trip cost, while lateral, vertical, and speed commands are fed to the autopilot and autothrottle for automatic guidance to the optimized profile The navigation data base of the PNCS, which contains airport, route, and navigation aid data, simplifies the selection and modification of flight plans C R

A82-38939 # **Air-to-air missile avoidance.** G A Mandt and T L Neighbor (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 124-131 12 refs (AIAA 82-1516)

A methodology for developing real-time missile avoidance trajectories is presented The steps are as follows analyzing missile systems for vulnerabilities, *determining the tactics to exploit these vulnerabilities, and testing the tactics* against missile simulations to determine the location and extent of maneuver effectiveness It is noted that these maneuvers could then be placed into an on-board computer for real-time missile avoidance Also presented is a table look-up approach This approach permits maneuvering at longer ranges, appears better able to handle a multiple missile scenario as compared with an optimal control algorithms, and appears more feasible to implement C R

A82-38940 # **Pilot models for discrete maneuvers.** R K Heffley (Systems Technology, Inc, Mountain View, CA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 132-142 17 refs (AIAA 82-1519)

Discrete maneuvers comprise a class of piloting tasks which can include fixed-wing landing flare, gross change of heading, altitude, or airspeed, helicopter or VTOL transition to hover, and helicopter nap-of-the-earth dash and quick-stop While these maneuvers may appear to differ fundamentally from basic tracking tasks, pilot models can be constructed using the same mathematical forms Several examples of discrete-maneuver pilot models are presented along with accompanying flight and simulator data The value of such models is discussed with regard to handling qualities, simulator fidelity, and pilot training The main benefit is the ability to exploit pilot-in-the-loop analysis more effectively by formulating a complete pilot-vehicle-task context (Author)

A82-38941 # **Design and flight testing of digital direct side-force control laws.** S L Grunwald (USAF, Washington, DC) and R F Stengel (Princeton University, Princeton, NJ) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 143-151 15 refs Contract No N00014-78-C-0257 (AIAA 82-1521)

Three-input/three-output command augmentation control laws designed and tested in flight using Princeton University's variable-response research aircraft are discussed It is noted that the controllers were based on algebraic model-following, a fast and efficient method of direct digital synthesis for advanced control modes Pilot opinions of several command modes and controller-to-command pairings are presented here Flat turns, lateral translation, and roll control are investigated Of the command modes tested, foot pedals-to yaw rate, lateral stick-to-roll rate, and thumb lever-to-sideslip angle are found to give the best overall ratings C R

A82-38942 # **Simulator investigations of various side-stick controller/stability and control augmentation systems for helicopter terrain flight.** E W Aiken (U S Army, Aeromechanics Laboratory, Moffett Field, CA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 152-164 15 refs (AIAA 82-1522)

Two piloted simulator experiments were conducted to assess the effects of side-stick-controller characteristics and level of stability and control augmentation on handling qualities for helicopter terrain flight A composite of several evaluation tasks was flown with the aid of a head-up display of flight-control symbology Variations in force-deflection characteristics and the number of axes controlled through a side-stick were investigated Satisfactory handling qualities were achieved with a two-axis displacement controller and angular rate stabilization Attitude stabilization was required to maintain adequate handling qualities for either a three- or four-axis rigid controller (Author)

A82-38943 * # **The effects of the delays on systems subject to manual control.** R A Hess (NASA, Ames Research Center, Moffett Field, CA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 165-172 13 refs

Results are presented of an experimental study to determine the effects of time delays in manual control systems A simple, fixed-base laboratory simulation facility is used for determining pilot dynamics and tracking performance in a series of single-axis, compensatory tracking tasks In these tasks, three time-delay values and three controlled-element dynamics are used The delays are chosen to encompass values encountered in experimental and operational aircraft It is noted that the controlled-element dynamics replicate those found in many previous manual control studies, that is, the classical displacement, rate, and acceleration control systems The experimental effort is complemented with an analytical pilot modeling study where the parameters of a structural model of the human pilot are adjusted so as to provide excellent matches to the experimentally determined pilot dynamics The experimental and analytical studies both indicate that time delays cause significant changes in pilot equalization requirements C R

A82-38944 * # **Modal control of relaxed static stability aircraft.** R H Rooney, J C Chung, and E Y Shapiro (Lockheed-California Co, Burbank, CA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 173-176 Contract No NAS1-15326 (AIAA 82-1524)

A method is developed that assigns a selected portion of a closed loop system eigenstructure in accordance with certain desirable criteria The method is applied here to a relaxed static stability aircraft, the goal being to synthesize a control law that provides the unstable aircraft with handling qualities equal to or better than those of a comparable statically stable aircraft It is shown that by using the target system eigenstructure, good flight characteristics are achieved by the unstable aircraft It is also shown that improved characteristics can be obtained by assigning an orthogonal eigenvector structure C R

A82-38954 # An X-Wing aircraft control system concept. A J Potthast (Lockheed-California Co , Burbank, CA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 257-265 13 refs (AIAA 82-1540)

X-Wing aircraft technology development has, as an ultimate goal, a Vertical Take-Off and Landing (VTOL) aircraft with fast tactical response, long range, and high speed that can be operated from frigates and large destroyers The proposed aircraft combines a circulation control air rotor/wing and control system with a conventional aircraft fuselage and 'fan-in-fin' tail Cyclic and collective modulation of rotor/wing circulation control air combined with rotor/wing hub moment feedback and conventional feedback provides continuous stability and control during rotary, conversion, and fixed wing modes of flight The control concept is described and test results from full and 1/4-scale models are compared with predicted data Conclusions are drawn relative to concept application to the X-wing aircraft (Author)

A82-38969 # A design criterion for highly augmented fly-by-wire aircraft. C R Abrams (U S Navy, Air Development Center, Warminster, PA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 410-419 8 refs (AIAA 82-1570)

The present investigation is concerned with a versatile control criterion for highly augmented fly-by-wire aircraft which can provide optimized mission-oriented performance Based on an optimization process for a second order system, a Time Response Parameter (TRP) has evolved which can be adapted to a variety of mission phases and new flight modes The TRP approach has demonstrated definite trends with both Pilot Ratings and Pilot Induced Oscillation Ratings, and is also compatible with other transient response criteria The TRP criterion can be readily applied to high order, nonlinear, and multivariable control systems, and is easily computerized for continuous evaluation of control system design It is pointed out that the use of such criteria will promote the utilization of military aircraft as a weapons platform through more effective flight control design G R

A82-38980 # Generic faults and design solutions for flight-critical systems. S S Osder (Sperry Flight Systems, Phoenix, AZ) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 509-518 17 refs (AIAA 82-1595)

The term 'generic fault' is employed to describe design defects which elude the test and analysis procedures used to validate a redundant control system design Although the existence of such defects can be postulated in any type of system, the generic fault concept is especially significant in the flight-critical system application because it defeats the massive redundancy strategies which designers rely on to meet safety or reliability objectives Various types of generic faults are examined, taking into account computation and scaling, timing, logical errors, hardware and firmware defects, latent failure effects, and aspects of real-time clock failure A description is presented of solutions using decoupled, nonsynchronous architectures It is found that dissimilar redundancy and brick-wall separation strategies are viable approaches to overcome generic-fault vulnerabilities Their implementation requires unsynchronized channel operation G R

A82-38981 * # The use of differential pressure feedback in an automatic flight control system. D W Levy, J Roskam, and P D Finn (Kansas University Center for Research, Inc , Flight Research Laboratory, Lawrence, KS) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 519-524 Grant No NAG4-5 (AIAA 82-1596)

A feasibility study has been performed to evaluate the performance of a system whereby a control surface is positioned with differential pressure as the feedback variable Analogous to a position command system, the control surface is commanded to move until a certain differential pressure is achieved at a given point on the surface Frequency response tests and theoretical considerations indicate that the pressure feedback transfer function is first order, with a break frequency up to 50 rad/sec There exist applications to the outer loops of flight control systems as well Stability augmentation, gust alleviation, and stall prevention appear to be possible by feeding back differential pressure across lifting and control surfaces (Author)

A82-38982 # A preliminary laboratory evaluation of a reconfigurable integrated flight control concept. A P DeThomas (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) and S C Goel (Systems Control Technology, Inc , West Palm Beach, FL) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 525-530 5 refs (AIAA 82-1597)

The present investigation is concerned with the concept of virtual redundancy as a means of maintaining the reliability of the flight control function within an integrated architecture Virtual redundancy involves the reconfiguring of the system resources to create redundancy on demand Virtual redundancy is invoked by the system executive by causing some known good processor to compute a solution which can break the tie between disagreeing processors An implementation in software for the case of Virtual Flight Control redundancy is discussed Attention is given to an examination of virtual redundancy as a means of fault isolation for cross-channel monitoring when only two signals are present, a general assessment of the feasibility of virtual redundancy and system reconfiguration to enhance coverage and recover function lost due to failures, redundancy management, and failure detection and isolation G R

A82-38986 # The ideal controlled element for real airplanes is not K/s. C R Chalk (Calspan Corp , Buffalo, NY) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 556-560 (AIAA 82-1606)

The early experiments performed to generate data to support development of mathematical models of the human operator used simple controlled element transfer functions, including K, and K/s However, when the physical system being controlled has mass and the response state being controlled is position, the K and K/s transfer function forms are physically impossible because infinite acceleration capability would be required for abrupt commands It is found that the roll angular acceleration and the lateral linear accelerations at the pilot station are important considerations in flying qualities The angular and linear accelerations can become objectionably high when the roll damping is very high and the height above the X stability axis is large It is pointed out that roll ratchet is best explained by a model that assumes the pilot is closing the aileron loop on angular acceleration response cues G R

A82-38988 # An alternate method of specifying bandwidth for flying qualities. J Hodgkinson, J R Wood (McDonnell Aircraft Co , St Louis, MO), and R H Hoh (Systems Technology, Inc , Hawthorne, CA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 571-578 6 refs (AIAA 82-1609)

It is pointed out that the task of predicting the flying qualities of a modern fighter aircraft has been complicated by the use of highly augmented control systems Control systems intended to improve flying qualities have often degraded them instead These degradations were unexpected because the criteria used to predict the aircraft's flying qualities were invalid, or were incorrectly interpreted, for augmented aircraft Therefore, in the 'Proposed MIL Standard/Handbook - Handling Qualities of Piloted Airplanes', criteria for augmented aircraft are emphasized The bandwidth criterion specifies the quality of aircraft attitude dynamics A refined version of the bandwidth criterion is proposed The new version offers two specific advantages as compared with the original version It deals with the bandwidth sensitivity problem and, by using a Nichols chart, it encourages the designer to view the entire open- and closed-loop frequency responses simultaneously G R

A82-38989 # Investigation of low order lateral directional transfer function models for augmented aircraft. D E Bischoff and R E Palmer (U S Naval Material Command, Naval Air Development Center, Warminster, PA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 579-586 11 refs (AIAA 82-1610)

The high order transfer functions representing the lateral directional responses of augmented aircraft to pilot control inputs were matched in the frequency domain with two candidate low order equivalent forms (1) the complete three degree of freedom representation of roll and sideslip angle responses, and (2) the single degree of freedom roll mode and Dutch roll approximations Acceptable models were generally obtained for both forms Simultaneous matching of sideslip and roll angle responses and/or a priori information for the roots was required to match the full three degree of freedom forms The equivalent system models are discussed in terms of their match statistics and their modal parameters are compared against the requirements of the military flying qualities specification (Author)

A82-38990 * # An analysis of a nonlinear instability in the implementation of a VTOL control system during hover. J M Weber (NASA, Ames Research Center, Moffett Field, CA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926

19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 587-596 7 refs (AIAA 82-1611)
(Previously announced in STAR as N82-22281)

A82-38995 # Target acquisition system/air-to-surface weapon compatibility analysis. A R Mitchell (Analytic Sciences Corp , Reading, MA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 638-642 (AIAA 82-1618)

The paper presents a simple, closed form method which has been developed for compatibility analysis of an autonomous target acquisition system with an air-to-surface weapon The output is a probability distribution for expected target location at the moment of potential weapon release Compatibility is measured by the probability that the target lies in the footprint of the released weapon The method uses statistical input data on terrain masking, atmospheric obscuration, and the acquisition system timeline from first target detection through classification, designation and weapon release Generic results are presented for a hypothetical target acquisition system (Author)

A82-38998 # The Shiryayev sequential probability ratio test for redundancy management. J L Speyer and J E White (Texas, University, Austin, TX) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 658-666 10 refs (AIAA 82-1623)

An essential aspect in the design of fault tolerant digital flight control systems is the design of failure detection and redundancy management systems A decision rule, the Shiryayev sequential probability ratio test (SPRT), is used to detect failures between similar instruments, as well as between dissimilar instruments through analytic redundancy Unlike the Wald SPRT, which tests for the presence of failure or no failure in all of the data sequence, the Shiryayev SPRT detects the occurrence of a fault in the data sequence in minimum time if certain conditions are met The performance of the Shiryayev SPRT in detecting a failure between two rate gyros as compared to standard fixed interval schemes is presented, as is the performance for a single accelerometer failure using translational kinematic equations to form a parity relation for analytic redundancy (Author)

A82-39003 # X-29A flight control system design experiences. J Chin, H Berman, and J Ellinwood (Grumman Aerospace Corp , Bethpage, NY) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 703-713 11 refs (AIAA 82-1538)

The X-29A aircraft is a technology demonstrator consisting of a structurally tailored forward swept wing, an automatic camber control concept to increase aerodynamic efficiency, a high level of aircraft relaxed static stability (RSS), and a digital fly-by-wire flight control system using control laws designed via modern optimal control techniques A description is presented of the considerations exercised during the design and development of the flight control system (FCS), and attention is given to the uniqueness of the X-29A aircraft which led to high levels of RSS for minimum FCS requirements The advantages of RSS are discussed along with the longitudinal control requirements, the control modes, aspects of control law development, and questions of flight control system validation G R

A82-39009 * # The effects of atmospheric turbulence on a quadrotor heavy lift airship. M B Tischler and H R Jex (Systems Technology, Inc , Hawthorne, CA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 767-776 15 refs Contract No NAS2-10330 (AIAA 82-1542)

The response of a quadrotor heavy lift airship to atmospheric turbulence is evaluated using a four-point input model Results show interaction between gust inputs and the characteristic modes of the vehicle's response Example loop closures demonstrate tradeoffs between response regulation and structural loads Vehicle responses to a tuned discrete wave front compare favorably with the linear results and illustrate characteristic HLA motion (Author)

A82-39011 # Analyzing stable pad disturbances and design of a sensor vault to monitor pad stability. O D Starkey, J D Kerr, and L D Hall (Teledyne, Inc , Teledyne Geotech, Garland, TX) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 785-788 (AIAA 82-1585)

Among disturbing environmental mechanisms are tidal variations in gravity, natural and cultural seismic activity, and acoustic excitation of components An analysis is presented of these disturbances Also described is the development of a vault that isolates the sensors from external disturbances yet provides close coupling to the test pad Initial tests carried out on a prototype vault installed in February 1982 show that a feedback-type seismometer can include a sustained oscillation within its housing A possible analysis of this phenomenon is included C R

A82-39013 # Avoiding the pitfalls in automatic landing control system design. A A Lambregts (Boeing Commercial Airplane Co , Seattle, WA) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 799-809 (AIAA 82-1599)

This paper relates recent experiences at Boeing with the development and flight testing of improved automatic landing flare control laws for the B-737 and B-747 aircraft Some earlier designs and their limitations are reviewed Basic requirements for flare law initiation, command synchronization, feedback signal sources and characteristics, inner loop configurations, elevator control band width and throttle control are discussed Experiences and potential pitfalls in the development of integrated glide slope and flare control laws for improving an existing B-747-SP design and for a new B-737 SP-177 autopilot are described Analog computer design constraints are reviewed A 'variable tau' flare law concept, using groundspeed to reduce longitudinal dispersion and achieve a constant flare height are discussed as well as an 'explicit trajectory' flare control concept to achieve the same goals, along with flight test results New design options using digital computers are pointed out (Author)

A82-39016 # Flight control synthesis using robust output observers. E G Rynaski (Calspan Advanced Technology Center, Buffalo, NY) In Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers (A82-38926 19-18) New York, American Institute of Aeronautics and Astronautics, 1982, p 825-831 (AIAA 82-1575)

A brief investigation is made of the application of robust output observer theory to the design of flight control systems for advanced aircraft configurations Observer theory is seen as a natural design tool because the resulting observers are in themselves unobservable and do not increase the order of the closed-loop response, thereby more closely satisfying flying qualities requirements Examples are adduced to show that the observer configuration is not unique in either the observer poles or the output sensors and that many different control system configurations using a variety of sensors can be designed to yield identical closed-loop dynamic behavior In this way, it becomes possible to incorporate considerable analytic and physical redundancy into nearly any flight control system C R

A82-39081 # Handling qualities criteria for flight path control of V/STOL aircraft. M B Tischler and R H Hoh (Systems Technology, Inc , Hawthorne, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1292* 10 p 14 refs Contract No N62269-80-C-0290

Tentative handling qualities criteria for V/STOL path control have been developed based on a study of bandwidth requirements and lower-order equivalent system representations This work extends the equivalent system concept from singleloop to multiloop applications Numerical results show the significant influence of inter-axis coupling on maximum attainable piloted bandwidth Preliminary fixed-base simulation results verify the expected trends and correlate well with the analytically derived boundaries proposed in this paper (Author)

A82-39082 * # Piloted simulator evaluation of a relaxed static stability fighter at high angle-of-attack. M Lapins, R W Klein, R P Martorella, J Cangelosi (Grumman Aerospace Corp , Bethpage, NY), and W R Neely, Jr (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1295* 19 p 10 refs

A piloted simulator evaluation of the stability and control characteristics of a relaxed static stability fighter aircraft was conducted using a differential maneuvering simulator The primary purpose of the simulation was to evaluate the effectiveness of the limiters in preventing departure from controlled flight The simulation was conducted in two phases, the first consisting of open-loop point stability evaluations over a range of subsonic flight conditions, the second concentrating on closed-loop tracking of a preprogrammed target in low speed, high angle-of-attack air combat maneuvering The command limiters were effective in preventing departure from controlled flight while permitting competent levels of sustained maneuvering Parametric variations during the study included the effects of pitch control power and wing-body static margin Stability and control issues were clearly shown to impact the configuration design C D

A82-39083 # In-Flight investigation of large airplane flying qualities for approach and landing. N C Weingarten and C R Chalk (Calspan Advanced Technology Center, Buffalo, NY) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1296* 13 p 9 refs Contract No F33615-79-C-3618

A study of the handling qualities of large airplanes in the approach and landing Flight Phase was performed utilizing the USAF-AFWAL/Calspan Total In-Flight Simulator A one-million pound statically unstable airplane model was used as a baseline about which variations were made The primary variables were relative pilot position with respect to center of rotation, command path time delays and phase shifts, augmentation schemes and levels of augmentation The results indicate that the approach and landing task with very large airplanes is a fairly low bandwidth task Low equivalent short-period frequencies and relatively long time delays can be tolerated As the pilot position is moved aft towards and then behind the center of rotation, pilot ratings are degraded (Author)

A82-39084 * # Development and flight test evaluation of a pitch stability augmentation system for a relaxed stability L-1011. J J Rising (Lockheed-California Co, Burbank, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1297* 10 p 5 refs Contract No NAS1-15326

The L-1011 has been flight tested to demonstrate the relaxed static stability concept as a means of obtaining significant drag benefits to achieve a more energy efficient transport Satisfactory handling qualities were maintained with the design of an active control horizontal tail for stability and control augmentation to allow operation of the L-1011 at centers of gravity close to the neutral point Prior to flight test, a motion base visual flight simulator program was performed to optimize the augmentation system The system was successfully demonstrated in a test program totaling forty-eight actual flight hours (Author)

A82-39085 # Supersonic missile aerodynamic and performance relationships for low observables mission profiles. R J Krieger (McDonnell Douglas Astronautics Co, St Louis, MO) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1298* 11 p 8 refs

Closed-form analytical relationships are developed between supersonic missile aerodynamic characteristics such as lift, zero-lift drag and drag due-to-lift and performance parameters such as range, velocity, specific range, flight path angle and maneuver load factor These relationships apply to low observable missile flight profiles for long range cruise and glide missions The analytical relationships are developed for climb, cruise, glide, dive, and run-in segments The results include equations for use in closed-form performance estimates and guiding configuration development (Author)

A82-39090 * # Applications of parameter estimation in the study of spinning airplanes. L W Taylor, Jr (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1309* 7 p 12 refs

Spinning airplanes offer challenges to estimating dynamic parameters because of the nonlinear nature of the dynamics In this paper, parameter estimation techniques are applied tc spin flight test data for estimating the error in measuring post-stall angles of attack, deriving Euler angles from angular velocity data, and estimating nonlinear aerodynamic characteristics The value of the scale factor for post-stall angles of attack agrees closely with that obtained from special wind-tunnel tests The independently derived Euler angles are seen to be valid in spite of steep pitch angles Estimates of flight derived nonlinear aerodynamic parameters are evaluate, in terms of the expected fit error (Author)

A82-39091 * # Analysis of general-aviation accidents using ATC radar records. R C Wingrove and R E Bach, Jr (NASA, Ames Research Center, Moffett Field, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1310* 8 p 12 refs

It is pointed out that general aviation aircraft usually do not carry flight recorders, and in accident investigations the only available data may come from the Air Traffic Control (ATC) records A description is presented of a technique for deriving time-histories of aircraft motions from ATC radar records The employed procedure involves a smoothing of the raw radar data The smoothed results, in combination with other available information (meteorological data and aircraft aerodynamic data) are used to derive the expanded set of motion time-histories Applications of the considered analytical methods are related to different types of aircraft, such as light piston-props, executive jets, and commuter turboprops, as well as different accident situations, such as takeoff, climb-out, icing, and deep stall G R

A82-39092 * # An estimation of aerodynamic forces and moments on an airplane model under steady state spin conditions. B N Pamadi and L W Taylor, Jr (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1311* 14 p 21 refs

The problem of estimating the aerodynamic characteristics of a wing body configuration of a spinning airplane at extreme angles of attack and spin rates is approached by the application of strip theory Semiempirical methods are used to estimate the aerodynamic force distributions over each component using static, nonrotational wind-tunnel test data To these predictions, corrections are applied to account for the primary rotational flow effects which are significant at large spin rates The results of this modified strip theory are shown to be in good agreement with spin tunnel rotary balance test data (Author)

A82-39093 * # A simple, low cost application of a flight test parameter identification system. R Clarke and J Roskam (Kansas, University, Lawrence, KS) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1312* 8 p 9 refs Grant No NsG-4019

The flight test system combines state-of-the-art microprocessor technology and high accuracy instrumentation with parameter identification technology which minimize data and flight time requirements The system was designed to avoid permanent modifications of the test airplane and allow quick installation It is capable of longitudinal and lateral-directional stability and control derivative estimation This paper presents details of this system, calibration and flight test procedures, and the results of the Cessna 172 flight test program The system has proven easy to install, simple to operate, and capable of accurate estimation of stability and control parameters in the Cessna 172 flight tests (Author)

A82-39094 # Parameter estimation applied to general aviation aircraft - A case study. W R Wells (Wright State University, Dayton, OH) and V Klein (George Washington University, Washington, DC, Joint Institute for Advancement of Flight Sciences, Hampton, VA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1313* 12 p 27 refs

NASA is currently involved in extensive general aviation stall-spin studies In undertaking the stall-spin research, the aircraft dynamics in pre and post stall regimes must be understood A case study is presented of the application of parameter estimation methods to problems of general aviation aircraft The research areas considered are related to control input selection, data compatibility, identification algorithms, unsteady aerodynamic modeling, and model structure determination Several recent advances in the application of systems identification are summarized using the aircraft as subject These advances are concerned with such techniques as stepwise regression algorithms, design of optimal control selection for parameter estimation, use of Kalman filtering in data compatibility checks, frequency domain identification algorithms, and high angle of attack formulation It is shown that the discipline of systems identification can be quite effective in improving the knowledge of the flight mechanics of general aviation aircraft G R

A82-39098 * # Dynamic load measurements with delta wings undergoing self-induced roll-oscillations. D Levin and J Katz (Technion-Israel Institute of Technology, Haifa, Israel) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1320* 11 p 11 refs Grant No NAGW-00218

The aerodynamic forces acting on a delta wing, mounted on a free-to-roll sting-balance apparatus, were measured Two wing planforms having leading edge sweeps of 76 and 80 deg were tested, but only the wing with the 80 deg sweep would undergo periodic self-induced roll oscillation The time dependent forces and roll angles for this wing were then recorded for various test conditions In these tests a considerable drop in the average normal force of the free-to-roll wing was measured, relative to the normal force obtained in the static tests Also, the helium-bubble flow visualization technique was used to gain some insight into the periodic motion of the separated leading edge vortices (Author)

A82-39099 * # High angle-of-attack characteristics of a forward-swept wing fighter configuration. S B Grafton, W P Gilber, M A Croom, and D G Murri (NASA, Langley Research Center, Hampton, VA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1322* 19 p 13 refs

The NASA-Langley Research Center is currently investigating the high angle-of-attack characteristics of a forward-swept wing fighter technology demonstrator in a cooperative program with the Defense Advanced Research Projects Agency The program includes static and dynamic wind-tunnel force tests, free-flight model tests, spin-tunnel tests, and piloted simulation Particular emphasis is placed on identifying the contributions of the forward-swept wing to the configuration aerodynamics at high angles of attack Results are presented to illustrate the wing contributions in terms of aerodynamic stability, flow visualization, and observation of free-flight characteristics (Author)

A82-39100 # The use of small strakes to reduce interference drag of a low wing, twin engine airplane. T E Wallis, D R Ellis (Cessna Aircraft Co, Wichita, KS), and W H Wentz, Jr (Wichita State University, Wichita, KS) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1323* 13 p 5 refs

This paper discusses the effect of small strakes on the interference drag of a low wing, twin engine airplane The strakes, highly swept delta wing semi-spans with a root chord 18 percent of the wing MAC, provide a strong streamwise vortex at high angles of attack They are placed on the fuselage and nacelles at the wing leading edge Both full scale and wind tunnel tests are discussed The strakes, in the proper location, provide a reduction in interference drag, increases in maximum lift coefficient and lift to drag ratio at high angles of attack, a broader range of high lift coefficients, and less abrupt stall characteristics (Author)

A82-39102 * # Dynamic stability of flexible forward swept wing aircraft. T A Weisshaar and T A Zeiler (Purdue University, West Lafayette, IN) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1325* 12 p 25 refs Grant No NAG1-157

This paper describes potential vehicle instability modes for forward swept wing aircraft and other divergence prone aircraft Examples show that either body-freedom flutter or aircraft aeroelastic divergence may occur depending upon the airplane planform geometry and mass distribution These vehicle instabilities may occur at speeds very different than the clamped wing aeroelastic divergence speed (Author)

A82-39103 # Optimal three-dimensional turning performance of supersonic aircraft. C -F Lin (Wisconsin, University, Madison, WI) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1326* 10 p 17 refs

This paper discusses real-time, on-line three-dimensional turning maneuvers of supersonic aircraft with emphasis on the problems of minimum-time and minimum-fuel turns The minimum-time problem is completely solved For the minimum-fuel case, the problem of minimum-fuel turn to a line is solved while suggestions for further research on minimum-fuel turn in three dimensions are presented Two mathematical models of the aerodynamic and engine characteristics are designed to facilitate the application of the optimal control theory to analyze a wide range of flight programs One such model is a typical lightweight, high thrust-to-weight ratio fighter used for the computation of minimum-time problem The other is a rocket-powered aircraft used for the computation of the minimum-fuel problem (Author)

A82-39105 # The correlation of flight test and analytic M-on-N air combat exchange ratios. D S Hague (Aerophysics Research Corp , Bellevue, WA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1328* 6 p Contract No F33615-80-C-3003

This paper compares analytic and flight test predictions of Many-on-Many air combat performance capability It is shown that stochastic effects dominate air combat encounter outcomes and that air combat performance estimates should be based on a large sample of encounters Overall exchange ratios, the number of red losses per blue loss, predicted by flight test and analysis are within 5% of each other Trends in exchange ratio with force size obtained by the two methods are also similar Finally, it is shown that air combat performance is sensitive to both force size ratio and the total number of aircraft engaged and that differences in performance between aircraft types may diminish with increasing aircraft numbers (Author)

A82-39106 * # Unique flight characteristics of the AD-1 oblique-wing research airplane. R E Curry and A G Sim (NASA, Flight Research Center, Edwards, CA) *American Institute of Aeronautics and Astronautics Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11 1982, Paper 82-1329* 8 p 9 refs

Flight characteristics associated with an oblique-wing airplane have been studied with limited scope and complexity using the AD-1 research vehicle The AD-1 is a low-speed, low-cost, manned airplane with an aeroelastically tailored wing that can be pivoted 0 to 60 deg asymmetrically Results of the flight tests include aerodynamic parameter extraction, verification of the aeroelastic wing design criteria, trim requirements, stall characteristics, and an evaluation of the handling qualities and basic control system requirements Some of the unique characteristics of these results that pertain to the oblique-wing design are presented (Author)

A82-39107 * # Analysis of in-trail following dynamics of CDTI-equipped aircraft. J A Sorensen and T Goka (Analytical Mechanics Associates, Inc , Mountain View, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1330* 10 p 14 refs Contract No NAS1-16135

In connection with the necessity to provide greater terminal area capacity, attention is given to approaches in which the required increase in capacity will be obtained by making use of more automation and by involving the pilot to a larger degree in the air traffic control (ATC) process It was recommended that NASA should make extensive use of its research aircraft and cockpit simulators to assist the FAA in examining the capabilities and limitations of cockpit displays of traffic information (CDTI) A program was organized which utilizes FAA ATC (ground-based) simulators and NASA aircraft and associated cockpit simulators in a research project which explores applications of the CDTI system The present investigation is concerned with several questions related to the CDTI-based terminal area traffic tactical control concepts Attention is given to longitudinal separation criteria, a longitudinal following model, longitudinal capture, combined longitudinal/vertical control, and lateral control G R

A82-39117 * # Flight dynamics of rotorcraft in steep high-g turns. R T N Chen (NASA, Ames Research Center, Moffett Field, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1345* 16 p 21 refs

An analyticl procedure developed to permit a systematic examination of rotorcraft flight dynamics in steep high-g turns is presented The procedure is used in a numerical investigation of a tilt-rotor aircraft and three single-rotor helicopters that have different types of main rotor systems The results indicate (1) that strong coupling in longitudinal and lateral-directional motions exists for these rotorcraft in high-g turns, (2) that for single-rotor helicopters, the direction of turn has a significant influence on flight dynamics, and (3) that a stability and control augmentation system that is designed on the basis of standard small-disturbance equations of motion from steady straight and level flight and that otherwise performs satisfactorily in operations near 1 g, becomes significantly degraded in steep turning flight (Author)

A82-39118 * # A ground-simulation investigation of helicopter decelerating instrument approaches J V Lebacqz (NASA, Ames Research Center, Moffett Field, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1346* 11 p 24 refs

In connection with the expansion of civil helicopter operations in the current era, the effect of helicopter flight and control characteristics on the flying qualities for instrument flight rules (IFR) flight have become a factor of concern, and a research program has been initiated to investigate IFR certification criteria A description is presented of an experiment which is the sixth in a series of ground- and flight-simulation investigations This piloted-simulator experiment was conducted to examine the influence of stability-control augmentation, display information format, and approach-task effects on helicopter flying qualities for terminal-area operations incorporating a deceleration in instrument meteorological conditions Simulated test configurations were evaluated for precision approaches with an instrument deceleration from 60 to about 15 knots in both calm air and simulated moderate turbulence and wind shear G R

A82-39119 # Maneuver stability of a vehicle with a towed body. B L Nagabhushan (Goodyear Aerospace Corp , Defense Systems Div , Akron, OH) and E M Cliff (Virginia Polytechnic Institute and State University, Blacksburg, VA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1347* 9 p 8 refs Research supported by the Virginia Polytechnic Institute and State University

Nonlinear equations of motion are derived and subsequently linearized to describe the coupled dynamics of a vehicle with a towed body Using these stability of an aircraft with a sling load has been determined for simple maneuvers where the vehicle is maintaining a straight and level flight path or performing a steady turn The effect of orienting the corresponding thrust vector of the aircraft on the system stability is examined by considering the thrust (1) fixed in inertial space, (2) fixed with respect to the vehicle relative wind Typically, towing cable length, towed body to vehicle mass ratio, and load factor in a turn have been found to affect stability of the aircraft and its sling load These results are illustrated here with an example of a maneuvering helicopter with a sling load (Author)

A82-39120 # Application of multivariable model following method to flight controller. K Kanai (Defense Academy, Yokosuka, Japan), P N Nikiforuk (Saskatchewan, University, Saskatoon, Canada), S Uchikado, and N Hori *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1349* 7 p

The present investigation is concerned with the problem of designing a model following control system for a multivariable linear plant, taking into account an application to the synthesis of a multiinput multioutput flight controller Attention is given to a problem statement, the construction of a model following system via state feedback plus input dynamics, and the synthesis of a Control Configured Vehicle (CCV) controller It is found that the construction of a model following system via state feedback with input dynamics compensator becomes possible even for the case of the singular control matrix Using the proposed method, CCV modes, such as desirable precision maneuvers, independent velocity, and altitude changes, are achieved G R

A82-39121 # Design and analysis of a multivariable control system for a CCV-type fighter aircraft. D B Ridgely, S S Banda (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH), and J T Silverthorn (USAF, Wright Aeronautical Laboratories and Institute of Technology, Wright-Patterson AFB, OH) *American Institute of Aeronautics and Astronautics Atmospheric Flight Mechanics Conference, 9th, San Diego, CA Aug 9-11 1982 Paper 82-1350* 8 p 10 refs

The theory of high-gain, error-actuated feedback control was applied to the design of a longitudinal decoupling flight control system for an advanced fighter aircraft Because of the structure of the system, measurement variables different from the outputs are necessary to apply this method This paper describes how entire eigenstructure assignment can be used to determine appropriate measurement equations by assigning their corresponding transmission zeros A singular value decomposition was used to choose the eigenvectors from their permissible subspaces Proper selection of eigenvalues/eigenvectors was shown to be crucial to the successful application of this theory (Author)

A82-39122 # An MLS with computer aided landing approach. M N Wagdi (Riyadh, University, Riyadh, Saudi Arabia) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1352* 9 p 5 refs

A computerized landing approach path definition that utilizes the MLS radio navigational aid is presented An algorithm is developed which identifies the minimum time path that connects the initial MLS engage point to the touch down point Such path is generally composed of two segments. The first segment begins at the MLS engage point and ends at the beginning of the straight glide slope The second segment starts at the beginning of the straight glide slope and ends at the touch down point The MLS azimuth and elevation and DME signals are processed by an on board computer that displays on a CRT the aircraft position relative to the ideal position of the optimal computed landing pattern The present technique allows the initiation of landing approaches from wide range of headings and elevations, thus resulting into more efficient terminal area traffic control Also it is suitable for low visibility landing approaches (Author)

A82-39123 # Perspectives of the flying qualities specification. S G Fuller and D J Moorhouse (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1354* 9 p 24 refs

A combined flying qualities and flight controls conference was held to discuss proposed changes to MIL-F-8785C and MIL-F-9490D These changes were primarily due to the new MIL-Standard and Handbook format being developed A summary is presented of the formal and informal presentations and the discussions related to flying qualities topics Included are organization of the requirements, equivalent systems, alternate criteria, atmospheric disturbance effects and the relationship of the flying qualities and flight control system requirements In recent years the flying qualities specification has lost credibility Results of this credibility loss and the solutions for the future are discussed (Author)

A82-39124 # Guidance for the use of equivalent systems with MIL-F-8785C. T A Gentry (USAF, Flight Dynamic Laboratory, Wright-Patterson AFB, OH) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1355* 11 p 20 refs

It is pointed out that handling qualities requirements for military conventional aircraft are specified in MIL-F-8785C, Military Specifications - Flying Qualities of Piloted Airplanes' This specification places requirements on the characteristics of the overall aircraft system as perceived by the pilot during piloted control An application of the specification in the case of conventional aircraft presents no difficulties However, there may be problems with more complex flight control systems In order to compare future augmented aircraft systems to MIL-F-8785C the equivalent system approach has been suggested The present investigation provides guidance in the application of the equivalent system approach to augmented aircraft longitudinal dynamics and similar application to lateral-directional dynamics where appropriate The equivalent of an augmented system is actually produced by matching the actual high-order system with an equivalent low-order system G R

A82-39125 * # A modern approach to pilot/vehicle analysis and the Neal-Smith criteria. B J Bacon and D K Schmidt (Purdue University, West Lafayette, IN) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1357* 10 p Grant No NAG4-1

The present investigation is concerned with the development of a better pilot modelling technique via optimal control theory, taking into account concepts concerning 'pilot rating' considered by Neal and Smith (1970) The investigation conducted by Neal and Smith had the objective to provide data on the effects of Flight Control System dynamics and to develop a design criterion capable of pinpointing pilot problem areas encountered in performing a given task Neal and Smith devised a 'pilot-in-the-loop' analysis capable of showing problem areas in pitch attitude tracking Unfortunately the employed method has some drawbacks The current investigation attempts, therefore, to provide an alternate approach which makes use of an optimal-control pilot model An optimal control model (OCM) had been discussed by Kleinman et al (1970) It is shown that the alternate approach, based on the OCM, offers some distinct advantages G R

A82-39128 # Analysis and wind tunnel tests of a probe used to sense altitude through measurement of static pressure. K D Tillotson (General Dynamics Corp, Pomona, CA) and A E Fuhs (U S Naval Postgraduate School, Monterey, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1361* 10 p 8 refs Navy-supported research

A static pressure probe was tested to determine the feasibility of using the probe, as an integral part of a missile nose, to sense missile altitude Experiments were conducted at Mach 2 0 and at Mach 1 51 At Mach 2 0, the static pressure probe will perform within altitude specifications of 25,000 feet + or - 2,000 feet at angles-of-attack ranging from - 8 to + 8 degrees At Mach 2 0, within an angle-of-attack ranging from 0 to 6 degrees, the probe will measure free stream static pressure within 4 percent, a 4 percent error in measurement is equivalent to an altitude error of 900 feet The missile nose shock will remain downstream of the probe pressure ports for flight Mach numbers above 1 5 (Author)

A82-39129 # Use of rotary balance and forced oscillation test data in six degrees of freedom simulation. J Kalviste (Northrop Corp, Hawthorne, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1364* 11 p

New analysis techniques are presented that will blend the data from the rotary balance test, forced oscillation test and computed dynamic derivatives for a nonlinear 6 DOF simulation A component of the rotation vector about the velocity vector is used with the rotary balance test data The other components of the rotation vector are used with the forced oscillation test data and computed derivatives The problem of separating the pure rotational and acceleration terms of the forced oscillation test data is resolved Recommendations are made in the data reduction procedure for forced oscillation testing to make the results more usable for aircraft motion simulation (Author)

A82-39132 # Close-coupled canard-wing vortex interaction and Reynolds stress acquisition. W Calarese (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1368* 12 p 7 refs

The present experiment investigates the interaction of canard and wing vortices and their effect on the lifting wing's flow field turbulence and Reynolds stresses Spanwise wing blowing was used to enhance the leading edge vortex and alter the vortex trajectory in an effort to keep it locked to the wing's leading edge for lift enhancement The turbulence intensity and Reynolds stresses were obtained by using hot film anemometers Air blowing enhances the circulation over the wing, preventing extensive flow separation Reynolds stresses, mean velocity, and turbulence intensity values illustrate the vortex structure (Author)

A82-39134 # Analysis of an airplane windshield anti-icing system. P Ross (Ross Aviation Associates, Sedgwick, KS) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1372* 8 p

This report documents the analysis methods developed to predict the performance of the windshield hot air anti-icing system on a business jet airplane Flight data gathered from dry air and natural icing tests are used to develop and verify the accuracy of a procedure that will predict the windshield surface temperature for either wet or dry air It is shown that windshield surface temperatures can be estimated to an accuracy of + or - 5% for a wide range of aircraft conditions It is demonstrated that the method is somewhat conservative for all conditions (Author)

A82-39135 * # NASA Dryden's experience in parameter estimation and its uses in flight test. K W Iliff and R E Maine (NASA, Flight Research Center, Edwards, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1373* 16 p 17 refs

An explanation of the parameter estimation method used at the Dryden Flight Research Facility is presented, and an overview is provided of experience related to the employment of this method, taking into account the utilization of this experience in flight tests According to a definition of the aircraft parameter estimation problem, the system investigated is asumed to be modeled by a set of dynamic equations containing unknown parameters To determine the values of the unknown parameters, the system is excited by a suitable input, and the input and actual system response are measured The values of the unknown parameters are then inferred, based on the requirement that the model response to the given input match the actual system response Examples of parameter estimation in flight test are discussed, giving attention to the F-14 fighter, the HiMAT (high maneuverable aircraft technology) vehicle, and the Space Shuttle G R

A82-39141 * # Effects of vortex breakdown on longitudinal and lateral-directional aerodynamics of slender wings by the suction analogy. C E Lan and C -H Hsu (Kansas, University, Lawrence, KS) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th,* San Diego, CA, Aug 9-11, 1982, Paper 82-1385 17 p 30 refs Grant No NAG1-134

A semi-empirical method based on the suction analogy is developed to predict longitudinal aerodynamics and lateral-directional characteristics of slender wings at high angles of attack, including effects of vortex breakdown The latter is based on a correlation parameter derived from the predicted leading-edge suction distribution in the attached flow Empirical formulas, derived from a least-square analysis of data, for the vortex-breakdown angle of attack at the trailing edge, the progression rate of breakdown points and the vortex lift recovery factor in the breakdown region are given Comparison of predicted results with data in longitudinal aerodynamics and lateral-directional characteristics for wings exhibiting strong vortex flow shows that the present method is reasonably accurate Explanation for peculiar lateral-directional characteristics is given (Author)

A82-39142 * # **Lateral aerodynamics of delta wings with leading edge separation.** J Katz (Technion - Israel Institute of Technology, Haifa, Israel) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1386* 12 p 23 refs Grant No NAGW-00218

An unsteady vortex lattice method is presented for the calculation of the aerodynamic forces acting on lifting surfaces undergoing complex three dimensional motion For the present case the nonsymmetric motion of a slender delta wing was considered and the resulting lateral characteristics were calculated The flow separation line was specified along the wing leading edge and the emanating vortex sheet shape and rollup was then calculated Numerical results are presented for the combined high angle of attack and side slip condition and for the wing constant roll and coning motions (Author)

A82-39143 # **Analytic extrapolation to full scale aircraft dynamics.** L E Ericsson and J P Reding (Lockheed Missiles and Space Co , Inc , Sunnyvale, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1387* 13 p 57 refs

It is pointed out that the extrapolation from subscale wind tunnel data to full scale flight becomes an especially serious problem at subsonic speeds when stall is involved and at high subsonic and transonic speeds where shock-boundary layer interaction can dominate the aerodynamics In the case of dynamic testing, valid subscale simulation is often impossible A description is presented of an approach which provides a solution to this preliminary design dilemma The approach makes it possible to obtain a prediction of the full scale aircraft dynamics on the basis of an analytical extrapolation from subscale test data The considered procedure establishes analytic relationships between dynamic and static aerodynamic characteristics induced by viscous flow effects The veracity of the analytic method is proved by predicting dynamic test results using corresponding static test data at the same subscale flow conditions Finally, the procedure provides the input necessary for extrapolation to full scale G R

A82-39190 **Fixed pattern noise correction for staring arrays in guidance systems.** D T Whinray (British Aerospace Public, Ltd , Co , Dynamics Group, Hatfield, Herts , England) In Advanced infrared detectors and systems, Proceedings of the Symposium, London, England, October 29, 30, 1981 (A82-39176 19-35) London, Institution of Electrical Engineers, 1981, p 97-101

Infrared guided missiles of the next generation are expected to show significant advances in performance over those in current service These advances are partly related to an employment of focal plane arrays A size advantage is gained by the removal of the traditional scanning mirror and drive systems The introduction of an electronic scanned array provides speed and reliability advantages and also the potential of increased sensitivity On the other hand, focal plane arrays do present their own set of problems in the areas of testing and operation The present investigation is concerned with some of the aspects of testing and systems implementation of charge-coupled device (CCD) readout IR focal plane arrays which operate in the long wavelength atmospheric IR window A description is presented of the principles of operation, and hardware techniques, which have been successfully used to achieve fixed pattern noise compensation at the high speeds necessary for focal plane arrays working in the long infrared waveband G R

A82-39191 **Algorithm development for infra-red air-to-air guidance systems.** P D Allen and J Northfield (British Aerospace Public, Ltd , Co , Dynamics Group, Hatfield, Herts , England) In Advanced infrared detectors and systems, Proceedings of the Symposium, London, England, October 29, 30, 1981 (A82-39176 19-35) London, Institution of Electrical Engineers, 1981, p 102-111

General algorithms for the overall guidance of air-to-air infra-red missiles through the acquisition, tracking and terminal phases are described Special attention is given to the vital area of initial target detection Two 3 x 3 spatial operators are described and their response against naturally occurring cluttered sky images is reported An assessment of the performance of each of these operators as discriminators of simulated targets against cluttered backgrounds has been made and is reported The surprising result that point enhancement operators give impressive results even against large targets is discussed and qualified (Author)

A82-39194 **Target tracking using area correlation.** R M B Jackson (EMI Electronics, Ltd , Hayes, Middx , England) *(NATO, AGARD, Conference on Image and Sensor Data Processing for Target Acquisition and Recognition, Aalborg, Denmark, Sept 8-12, 1980)* In Advanced infrared detectors and systems, Proceedings of the Symposium, London, England, October 29, 30, 1981 (A82-39176 19-35) London, Institution of Electrical Engineers, 1981, p 124-130

With the increasing use of electrooptical imagers in weapon systems for aircraft, there is a need to provide an automatic track of targets of interest to relieve the operation - who may be the pilot - of this task A description is presented of a tracking system, based on the area correlator technique, which can provide a stable and accurate track of targets for use in airborne systems in conjunction with Forward Looking Infrared Radar (FLIR) or TV imagers It is of small size and can be built into standard format packages for installation in military aircraft The tracking system can handle targets with a wide range of characteristics, and it can adapt automatically to magnification and target aspect changes G R

A82-39245 **The system of 'objective control' (Das System der 'Objektiven Kontrolle').** K -D Grätzsch (Interflug Gesellschaft fur Internationalen Flugverkehr mbH, Berlin, East Germany) *Technisch-ökonomische Information der zivilen Luftfahrt,* vol 18, no 1, 1982, p 1, 2 In German

The concept of 'objective control' was originally developed as a control procedure in connection with the failure of components and systems of aviation equipment However, it was soon recognized that this control method could also be employed for an evaluation of flight activities which is independent of subjective considerations This advantage and the possibility to analyze flights, on a routine basis and in a manner which cannot be foreseen by the involved persons, has considerable educational significance The system of 'objective control' in the case of a supervision of flight activities is based on the collection of information regarding the flight with the aid of onboard and ground-based equipment This system makes it possible to initiate corrective action as soon as shortcomings with respect to the activities of the flying personnel are recognized G R

A82-39246 **Rationalization of the maintenance process for helicopter Ka-26 (Rationalisierung des Instandhaltungsprozesses für Hubschrauber Ka-26).** K Janeczek (Interflug Gesellschaft für Internationalen Flugverkehr mbH, Leipzig, East Germany) *Technisch-ökonomische Information der zivilen Luftfahrt,* vol 18, no 1, 1982, p 3-7 In German

Since 1970, the helicopter Ka-26 has been employed in the mountainous areas of the German Democratic Republic for agricultural applications The maintenance program is a vital part of the utilization of the helicopter The information obtained in connection with the use of the helicopter provided an indispensable basis for an efficient, cost-effective organization of the maintenance procedures The enhancement of the efficiency of maintenance operations made it possible to increase the performance provided by the helicopter and to improve its reliability Attention is given to the conventional maintenance system for helicopter Ka-26, the requirements for an optimization of maintenance procedures for the helicopter in agricultural applications, the development of an optimal maintenance system, and the introduction of suitable control procedures G R

A82-39247 **Minimization of the total costs incurred in the employment of passenger jet aircraft (Minimierung der Gesamtkosten beim Einsatz von Strahlverkehrsflugzeugen).** J Wilde (Interflug Gesellschaft fur Internationalen Flugverkehr mbH, Leipzig, East Germany) *Technisch-okonomische Information der zivilen Luftfahrt,* vol 18, no 1, 1982, p 8-14 In German

A description is presented of a procedure which makes it possible to minimize the total costs for the flight of a jet airliner The procedure makes use of an optimization method which attempts to take into consideration all factors that affect the costs of a flight The optimization problem is discussed, taking into account the various factors which affect fuel consumption and flight time, the determination of the Mach number which will provide a cost minimum, the consideration of meteorological factors and flight path characteristics, and the computation of fuel consumption An investigation regarding the accuracy of the optimization calculation is also conducted After the completion of a calculation including an optimization, it is possible to determine fuel consumption, flight times, and total costs for arbitrary Mach numbers by making use of the data stored in the computer as a result of the preceding calculation Possible cost reductions for the operation of Interflug airliners are discussed, taking into account also the price for fuel at specific airports G R

A82-39248 **Instrument landing systems /ILS/ at airports of the German Democratic Republic (Instrumentenlandesysteme /ILS/ auf DDR-Flughäfen).** W Trempler (Interflug Gesellschaft für Internationalen Flugverkehr mbH, Leipzig, East Germany) *Technisch-ökonomische Information der zivilen Luftfahrt,* vol 18, no 1, 1982, p 15-20 In German

The introduction of a new generation of landing systems of the type ILS SP-70

(System Posadki-70), provided by the Soviet industry, began with the installation of the first system of the considered type at the airport Berlin-Schönefeld in 1978 Up to March 1981, three more ILS SP-70 were installed at airports of the German Democratic Republic The utilization of the new SP-70 systems in Berlin and Leipzig has led to an improvement of aspects of flight safety for all arriving aircraft particularly under conditions of bad weather The SP-70 is suited for automatic approaches according to the standards of the ICAO Details concerning the ILS principles are discussed along with the characteristics of the ILS SP-70 The ILS SP-70 utilizes the most modern technology to satisfy Category III requirements Attention is given to ground installations, functional descriptions of system components, and antenna diagrams G R

A82-39263 † The effect of hybrid composite materials on the dynamic characteristics of helicopter rotor blades (Vliianie gibridnykh kompozitnykh materialov na dinamicheskie kharakteristiki lopastei vertoletov). E G Pak, V N Stekol'nikov, Iu P Ganiushkin, R V Ivannikova, and V N Kestel'man *Mekhanika Kompozitnykh Materialov,* May-June 1982, p 475-479 7 refs In Russian

It is shown that changes in the relationship between the rigidity and mass characteristics of helicopter rotor blades can be effected by varying the modulus of elasticity of the structural material of the spar Hybrid composite materials make it possible to achieve this by combining in one matrix several reinforcing fillers with different physical and mechanical properties The optimal combination is that of glass and carbon fibers The carbon-and-glass-reinforced plastic makes it possible to increase the rigidity of the spar without changing the mass characteristics as well as to increase the fatigue strength B J

A82-39275 Application of an optical data link in the airborne scanning system. M J Green (Wisconsin, University, Madison, WI) *Review of Scientific Instruments,* vol 53, Aug 1982, p 1278-1280

A scanning thermal IR radiometer has been used in the acquisition and digital processing of thermal imagery In connection with plans for a study of oceanic thermal fronts, attention has been given to the possibility to employ the scanner in a system for mapping sea surface temperature which could be used with the Navy P-3 patrol aircraft The main obstacle to such an employment is that, since the aircraft are to be used on an 'aircraft-of-opportunity' basis, no modifications to the aircraft would be permitted The scanner is comprised of two principal subsystems, including the scanner head itself and a power supply/signal conditioning chassis These two units are normally connected by a 39-conductor cable As the requirements regarding the Navy application do not permit an employment of the normal connection, an optical data link has been fabricated which can replace the hard-wired connections between scanner head and power supply G R

A82-39279 † Primary-data devices (Pribory pervichnoi informatsii). V A Bodner Moscow, Izdatel'stvo Mashinostroenie, 1981 344 p 29 refs In Russian

The work examines the theoretical principles, design, and analysis of primary-data devices, i e , sensors that are used to acquire information necessary for the control and monitoring of flight vehicles Particular consideration is given to advanced measurement techniques (pulse-time and frequency output devices, correlation devices, etc), the computer-aided design of the devices with allowance for complex optimization, the use of microprocessors, and automatic error compensation Attention is given to sensors for measuring pressure, temperature, fuel consumption, flight speed and altitude, and acceleration B J

A82-39295 † The operation of aircraft and helicopters in difficult meteorological and environmental conditions (Ekspluatatsiia samoletov i vertoletov v uslozhnennykh prirodnykh usloviiakh). A M Volodko Moscow, Izdatel'stvo Transport, 1981 158 p 48 refs In Russian

The effects of such adverse phenomena as turbulence, ice formation and hail, wind shear, and lightning on the operation of aircraft are considered Attention is also given to the effects of high and low air temperatures, dust in the air, and air moisture Biological damage (from microorganisms, insects, and birds) is also considered along with conditions of helicopter flight in mountain areas and clouds B J

A82-39321 Flight management computers (Calculateurs de gestion du vol). J Grossin (Société Nationale Industrielle Aérospatiale, Toulouse, France) *L'Onde Electrique,* vol 62, June-July 1982, p 59-66 11 refs In French

Flight management computers (FMC) and their role in reducing fuel consumption in commercial aircraft are examined Research to offset rising fuel costs is concentrating on improving engine efficiency and the aerodynamic performance of the aircraft, and in flight control computers which automate control of flight and systems to the most efficient levels Implementation of FMC with the Airbus is described, including the retrofit to provide accurate navigation and economical ascent and descent Flight time at low speed and altitudes is minimized, and systems surveillance and fuel flow are automated Block diagrams are presented of the systems interconnections with the FMC and the control strategy Flight plans fed into the FMC yield an optimized flight strategy based on a plan involving lowest cost The flight is categorized into ascent, cruise, and descent phases Constraints which can alter the plan consist of changes in altitude to maintain proper cruise speed, the tempo of the flight in reaching fixed ground reference points, and operational limits of the aircraft M S K

A82-39322 Electronic stabilization of an aircraft (Stabilisation d'un avion par l'électronique). A Chadeau (Ministère de la Défense, Service Technique des Télécommunications et des Equipements Aéronautiques, Paris, France) *L'Onde Electrique,* vol 62, June-July 1982, p 67-71 In French

The applications of electronic flight control systems (EFC) to the amelioration of engine troubles and to automatic pilot systems are reviewed Nominal instabilities are automatically corrected in-flight through commands implemented by electrohydraulic servocontrols responding to preset tolerances for the flight envelope parameters, including airspeed, altitude, pitch, route, and landing functions EFC systems permit the use of aircraft configurations which experience instabilities which could not be handled by a human pilot, but can be electronically altered so that control of the aircraft appears similar to simple mechanical linkage Digitized control of a modern aircraft is noted to require over 400,000 operations/sec, with control decisions being weighted toward safety through calculations of the probability of occurrence of destabilizing events and an assessment of the total effect a command decision will have on the aircraft It is concluded that progress toward introducing new control stragegies is slow, in order to maintain the accuracy and operability of preexisting systems M S K

A82-39323 Air-air collision avoidance systems (Systèmes d'anticollision air-air). A Michel (Direction Generale de l'Aviation Civile, Service Technique de la Navigation Aérienne, Paris, France) *L'Onde Electrique,* vol 62, June-July 1982, p 72-82 10 refs In French

Methods of improving air-to-air collision avoidance through ground based actions are asserted to reside in flow control, by restricting the number of flights to levels which can be handled by available controller personnel aided by computers and radar An on-board collision avoidance system is offered as a means to ameliorate the workload on the ground The systems tested thus far have operated between 1520-1620 MHz and work multilaterally, obtaining identification of nearby aircraft, their relative distance, altitudes, and characterizing their approach paths Attention is given to various systems developed as prototypes for operational systems, noting that the FAA is requiring that any system used be compatible with ATC Characteristics of the Discrete Address Beacon System introduced in 1980 are presented, including methods for the suppression of erroneous data Problems in perfecting the control logic for the detection systems are discussed M S K

A82-39358 # The unsteady motion of a wing traveling at subsonic speed above a plane (Neustanovivsheesia dvizhenie kryla s dozvukovoi skorost'iu nad ploskost'iu). E A Krasil'shchikova *Revue Roumaine de Mathématiques Pures et Appliquées,* vol 27, no 3, 1982, p 363-370 In Russian

An analysis is presented of the plane-parallel flow of a compressible fluid excited by a thin wing moving at subsonic speed above a plane, the motion of the wing taken to begin from a state of rest The aerodynamic problem is viewed as a combination of boundary value problems with a moving boundary for the two-dimensional wave equation Each of these problems is solved by the method of integral equations in characteristic coordinates The velocity potential is represented in recursive formulas, which make it possible to analyze the interaction of the wing and plane for arbitrary moments of time B J

A82-39359 # The rectangular wing with semiinfinite span in nonlinear theory (Der rechteckige flugel halbunendlicher spannweite in der nichtlinearen theorie). S Turbatu (Bucuresti, Universitatea, Bucharest, Rumania) *Revue Roumaine de Mathématiques Pures et Appliquées,* vol 27, no 3, 1982, p 419-422 10 refs In German

In an investigation of unsteady flow, use is made of an approach considered by Teipel (1964), Hosokawa (1964), and Ruo (1974) It is assumed that unsteady effects are superimposed on steady flow, taking into account a consideration of these effects in the first order The concepts employed in connection with the solution of the nonlinear differential equation are similar to those used by Oswatitsch and Keune (1955) for the steady flowfield A boundary-value problem in two parts regarding the potential of a rectangular wing with semiinfinite span in a state of harmonic oscillations is also solved, taking into consideration the case of unsteady transonic flow in a nonlinearized treatment G R

A82-39374 Optimal control application in supersonic aircraft performance. C -F Lin (Michigan, University, Ann Arbor, MI) *IEE Proceedings, Part D - Control Theory and Applications,* vol 129, pt D, no 4, July 1982, p 113-117

In the present investigation, the aerodynamic and engine characteristics of a typical lightweight high thrust/weight ratio fighter are modelled as continuous functions of a state variable, the Mach number This approach provides the possibility for a smooth application of optimal control theory By introducing a set of dimensionless variables, general results are obtained for an entire class of vehicles with similar physical characteristics Numerical solutions are presented to show the characteristics of the optimal trajectory, taking into account the optimal control features for guiding the aircraft along a particular trajectory A description is presented of the general properties of optimal trajectories These properties are used to solve any particular optimal trajectory which depends on the terminal conditions and the physical constraints G R

A82-39399 † **Application of the sequential optimization method to the tuning of the natural frequencies of gas-turbine engine compressor blades (Primenenie metoda posledovatel'noi optimizatsii k ostroike chastot sobstvennykh kolebanii lopatok kompressora GTD).** A B Roitman, V P Afanas'ev, T F Mikhailova, and S P Omel'chenko *Problemy Prochnosti*, July 1982, p 86-89 5 refs In Russian

The optimum tuning of the natural frequencies away from the dangerous resonance range is carried out for laterally oscillating turbine blades using the maximum blade profile thickness as the control function The control range is limited by the tolerance on the blade geometry A quality functional is obtained which provides a way to tune the natural frequencies with allowance for the constraints involved V L

A82-39403 † **Problems in the simulation of correlation-extremal navigation systems (Problemy modelirovaniia korreliatsionno-ekstremal'nykh sistem navigatsii).** V I Alekseev and V P Tarasenko (Tomskii Institut Avtomatizirovannykh Sistem Upravleniia i Radioelektroniki, Tomsk, USSR) *Elektronnoe Modelirovanie*, vol 4, July-Aug 1982, p 80-83 9 refs In Russian

A general scheme for the simulation of correlation-extremal navigation systems is described, and problems of the synthesis and analysis of these systems which can be implemented through hybrid computers are examined Applied programs developed for the simulation of correlation-extremal navigation systems are briefly characterized B J

A82-39404 † **Simulation of correlation-extremal receivers of signals from sampling-phase radio-navigation systems (Modelirovanie korreliatsionno-ekstremal'nogo priemnika signalov impul'sno-fazovykh radionavigatsionnykh sistem).** I M Egorov and A M Korikov (Tomskii Gosudarstvennyi Universitet, Tomsk, USSR) *Elektronnoe Modelirovanie*, vol 4, July-Aug 1982, p 84-89 6 refs In Russian

The paper examines the simulation of correlation-extremal navigation systems according to radio fields created by sampling-phase radio-navigation systems Particular attention is given to the simulation software, and the synthesis of a correlation-extremal receiver is considered for a Loran-C type system B J

A82-39467 † **The use of analog computers in solutions of inverse problems of heat conduction for the identification of boundary conditions on the surfaces of gas-turbine-engine parts on the basis of temperature-measurement results (Ispol'zovanie AVM v resheniiakh obratnykh zadach teploprovodnosti dlia identifikatsii granichnykh uslovii na poverkhnostiakh detalei GTU po rezul'tatam ikh termometrirovaniia).** B D Bileka, V N Klimenko, and S M Chepaskina (Akademiia Nauk Ukrainskoi SSR, Institut Tekhnicheskoi Teplofiziki, Kiev, Ukrainian SSR) *Promyshlennaia Teplotekhnika*, vol 4, July-Aug 1982, p 53-59 5 refs In Russian

Methodological features and computational results are considered for two types of inverse problems of heat conduction without heat removal in the inner zone and with heat removal The first case is illustrated by the nonstationary problem of determining convective heat transfer from the gas to the stator above moving blades and to noncooled moving blades, while the second case is illustrated by the stationary problem of determining convective heat transfer from the gas to cooled nozzle blades These two problems are treated by analog computation on the basis of the finite difference method, an implicit scheme using the Liebman method is applied to the nonstationary problem Errors arising in the use of this approach to solve inverse heat-conduction problems are examined B J

A82-39482 † **Turbulent boundary layer on a porous surface with injection at various angles to the wall *(Turbulentnyi pogranichnyi sloi na poristykh poverkhnostiakh pri vduvakh pod raznymi uglami k stenke).*** V M Eroshenko, A A Klimov, and L S Ianovskii *Akademiia Nauk SSSR, Izvestiia, Mekhanika Zhidkosti i Gaza*, May-June 1982, p 59-64 13 refs In Russian

Experimental results are presented on turbulent boundary layers on porous plates in the case of uniform injection directed at various angles to the wall (15, 25, 40, 75, and 90 deg) The data disclose the influence of the intensity and angle of injection on the profiles of averaged and fluctuating velocities, characteristic thicknesses, surface friction, and turbulent shear stresses in the boundary layer It is shown that moderate injections at angles to the flow are more effective in terms of protecting the surface than the commonly used normal-incidence injection B J

A82-39539 **'Listening' systems to increase aircraft structural safety and reduce costs.** C D Bailey and W M Pless (Lockheed-Georgia Co, Marietta, GA) *Lockheed Horizons*, Summer 1982, p 17-22

Applications of acoustic emissions (AE) techniques to in-flight monitoring of fatigue stresses leading to parts failure is discussed Due to inherent difficulties in designing all flows out of an aircraft, the deficiencies present in visual inspection, and the existence of many hard-to-reach critical areas, the use of AE for lifetime surveillance of potential fatigue-prone components of aircraft is offered as an effective means to prevent failure Piezoelectric or capacitive devices are employed to detect AE originating from corrosion, stress-corrosion cracking, and *crystal dislocation movements The sensors are tuned to ranges outside of normal* structural vibration and situated in areas known for potential flaws, sometimes in arrays which serve to locate a flaw through triangulation Performance on board the KC-135 aircraft is cited as evidence for the cost-effectiveness of AE stress monitoring M S K

A82-39540 **The fourth dimension.** R L Heimbold and M F Leffler (Lockheed-California Co, Burbank, CA) *Lockheed Horizons*, Summer 1982, p 24-30

Problems and solutions for introduction of the Lockheed four-dimensional (4-D) flight management system (FMS) into regular airline traffic are explored The 4-D system is operated totally by the flight management computer, which directs the plane to appropriate altitudes and speeds for minimum fuel consumption over the entire flight The altitude is increased as fuel is consumed and the aircraft becomes lighter Integration of the system into current air traffic involves including accurate wind data, initial estimates of arrival time and options for the flight path, a sufficient capacity for ATC control metering and spacing procedures, and accuracy of high enough order to reduce ATC workloads Flow integration proceeds 100 mi from the airport and the necessity for a holding pattern results in a revectoring for approach once a go-around has been completed It is noted that NWS forecasts are inadequate in terms of accuracy of available wind data M S K

A82-39718 **The technological aspects of titanium application in the TU-144 aircraft structure.** S A Vigdortchik and A N Tupolev In Titanium and titanium alloys Scientific and technological aspects Volume 3 (A82-39626 19-26) New York, Plenum Press, 1982, p 2181-2193

The development of techniques leading to the construction of significant portions of the TU-144 aircraft with titanium alloys is reviewed Statistical data from experiments indicated that hydrogenation of the structural material and subsequent slow-rate failures could be controlled by vacuum low-temperature annealing, in addition to chemical milling combined with refining The relationship of nitrogen and oxygen surface content introduced by heating, cutting, and multilayer welding to fatigue, slow-rate failure, and creep were also established statistically Automatic inert-gas welding in sealed chambers was found to control the failure-producing elemental contents Carbon contamination of surface layers was reduced by chemically etching and removing 0 2-0 5 mm of the surface Finally, salt-stress corrosion was determined to be minimal in the expected operating temperatures of the titanium materials M S K

A82-39727 **Remotely piloted vehicles; International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers and Supplementary Papers.** Conference sponsored by the Royal Aeronautical Society and University of Bristol Bristol, England, University of Bristol, 1982 Conference papers, 172 p, Supplementary papers, 57 p (For individual items see A82-39728 to A82-39750)

Advances in system components, performance, and sensor systems of remotely piloted vehicles and unmanned vehicles are reported The impacts and applications of RPVs on combat situations and costs are discussed, along with the various configurations of fixed wing and helicopter platforms, and Canadian, British, and U S efforts in RPV developmental programs Attention is given to the various sensors which an RPV may carry, including radar, TV cameras, IR scanners, radiometers, and dead reckoning guidance systems The design of algorithms for terrain following systems is described, as are sensor stabilization requirements and images received from remote sensors Attention is given to the use of radio controlled aircraft in pollution studies, propulsion systems for RPVs, and image orientation for RPV ground station crew members M S K

A82-39728 # **Unmanned aircraft in future combat.** W D Simpson (British Aerospace Public, Ltd, Co, Dynamics Group, Stevenage, Herts, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 2 1-2 5

An assessment of the total effect of unmanned vehicles on armed forces is presented The U S Army Aquila is noted to provide reconnaissance capability in a fixed wing aircraft form, while tethered helicopter platforms and drone dirigibles show promise of fulfilling the same needs at lower cost Explosives delivery to targets at a distance have reached the level of cruise missiles, which are completely dependent on internal sensors and processors once launched Similar autonomous vehicles, piston engined, can be used to jam radar, dispense chaff, and are called harassment drones Production costs increase with the degree of sophistication of the system, including addition of IR sensors, jam-free radio, and personnel training required for control and retrieval The autonomous systems are nominally used in large numbers and fly at high altitudes to retain line-of-sight communications MSK

A82-39729 # Horses for courses in RPV operations. R G Austin and C J Roberts (ML Aviation Co, Ltd, Bristol, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 3.1-3 18

Different configurations and capacities, the increase of cost with complexity, and examples of RPVs are examined The highest cost savings engendered by use of RPVs is noted to be the stationing of the pilot in a relatively benign environment, while additional benefits are gained from civilian applications such as crop spraying and pollution monitoring, a smaller target in combat situations, and the reduction in support crew necessary for military applications Although the range is generally limited to a quarter mile from the controller, repeated flights may be made for photographic purposes Operation and components of a minimal system are described, and means of extending the range, addition of a TV camera, uses of helicopter-type vehicles, and retrieval by netting are reviewed Attention is also given to equipping RPVs for flight in severe weather, reduction of noise, shielding the RPV IR emissions, and standards for the production of RPVs MSK

A82-39730 # Short range tactical RPH system. M J Breward (Westland Helicopters, Ltd, Yeovil, Somerset, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 4 1-4 12 5 refs

Design features of a remotely piloted helicopter (RPH) for use in surveillance and as an observation post are discussed The RPH is intended for use in the forward combat zone and needs high mobility, rapid deployment, flexibility of response, and rapid response Performance requirements include all weather operation, 24-hr capability, a 10-km radius of action, a response time less than 10 min, and real time data flow Attention is given to the sensor system with look-up ability, using low-light TV or IR scanner The characteristics of the Wisp and Wideye RPHs are described, including payloads of 30 and 25 kg, respectively, and all up weights of 125 and 85 kg Command links are achieved with low frequency transmissions lasting short periods, with 30-60 sec intervals of silence Dead reckoning with meteorological input alone is recommended for overcoming the dangers of ECM MSK

A82-39731 # Canadair rotary wing technology development. A S Clark (Canadair, Ltd, Montreal, Canada) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 5 1-5 13

Design, performance, and operational features of the Canadair CL-227 rotary wing RPV are detailed The CL-227 is intended as a surveillance and target acquisition system transmitting in real time, operating in the short-to-medium range battlefield locations, and controlled by mobile units A rotary winged configuration permits take-off from unprepared ground and hovering over target areas The vehicle is modular in design, comprising power, rotor, and control units A Wankel engine has been successfully employed during testing, and rotor blades are made of Kevlar with a foam core The control module contains sensor and telemetry equipment for microwave relay and operation with four degrees of freedom Attention is given to the development of a transfer function suitable for maintaining the aerodynamic stability of the vehicle A total of 300 flights had been performed by 1980, and test procedures are described MSK

A82-39732 # U.S. Army remotely piloted vehicle program. J K Marstiller (U S Army, Aviation Research and Development Command, St Louis, MO) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 6 1-6 5

The U S Army full scale engineering development program for the Aquila RPV is described Aquila is intended as an artillery aid to provide target acquisition, permit first round fire for effect, allow artillery adjustment, and provide designation for laser guided projectiles out to maximum artillery range The entire system comprises the air vehicle, a ground control station, remote ground terminal, a hydraulic catapult launcher, a net type recovery subsystem, and support equipment Aquila is launched 10-15 km on the friendly side of combat lines and flight is governed by preprogrammed internal commands covering waypoints, with loiter or jinking modes available by remote control, received in burst form The vehicle carries a stabilized TV sensor with laser rangefinder/designator, and is constructed to survive in nuclear, ballistic, and chemical environments, and in worldwide climatic conditions Operational testing is scheduled for 1982 MSK

A82-39733 # Stabileye. R Stephenson (British Aerospace Public, Ltd, Co, Dynamics Group, Bristol, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 7 1-7 12 6 refs

Performance, design, and materials characteristics of the Stabileye RPV, which is used to define applications of RPVs, are detailed The Stabileye has progressed through three versions, each featuring a twin-boom pusher engine layout, with the most recent, the MK 3, carrying a maximum payload of 25 kg, a 50 m/sec or less top speed, and flight duration of one hour The MK 3 was constructed to examine the effectiveness of glass reinforced plastics and honeycomb core material for the fuselage, bulkheads, nose and rear body fairings, and the top lid, which conceals the payload and recovery parachute The wing is a NACA 4415 profile made of hot-wire cut polystyrene foam with multiple hardwood spars and wood veneer/glass reinforced plastic skins A two-cylinder, 7-hp power plant is interfaced with a pulse code modulated system The primary sensor is a vertical gyroscope, with flight control electronics, a yaw rate gyro, and a telemetry encoder MSK

A82-39734 # The national dynamics 'observer' mini-RPV for tropical operation. M Reed (Natal, University, Durban, Republic of South Africa) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 9 1-9 9 7 refs

Results of testing program of a mini-RPV for civil and military applications in South Africa are reported The airframe was fabricated using epoxy resin/fiberglass and fire-retard low density styrofoam A two-stroke engine was chosen, developing 22 6 hp at 7200 rpm and a four-bladed propeller for reasons of maintaining engine speed Launch is from the roof of a car and power for servo-units is derived from nickel-cadmium battery packs Program goals for additional development of a rhombic-wing mini-RPV are outlined MSK

A82-39735 # MACHAN - A unmanned aircraft flight research facility. T G Hamill (Marconi Avionics, Ltd, Rochester, Kent, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 10 1-10 8 Research supported by the Ministry of Defence (Procurement Executive)

The purpose of this paper is to introduce the MACHAN programme, or to give it it's full name, 'the provision of an unmanned aircraft flight research facility' This programme is funded by MOD(PE) with a substantial PV input from Marconi Avionics The 3 aspects of the programme covered are the aircraft itself, the supporting facilities and, here, specifically the ground station, and the programme of experimental flying and payload trials as it is currently envisaged (Author)

A82-39736 # Mini-RPV propulsion. L A Kolbo (Kolbo Corp, Anaheim, CA) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 13 1-13 4

Mini-RPV propulsion systems which can deliver flight durations of four hours at speeds between 100 and 200 kn are reviewed The reciprocating internal combustion engine is the favored choice because of fuel density, noise, heat signature, and fuel consumption characteristics A two-cylinder configuration is the most satisfactory choice due to lightness, carburation, and simplicity The engine components are preferably made of aluminum, chromium, and aluminum-magnesium alloys to preserve weight-saving design goals and heat-tolerant properties It is recommended that mini-RPVs have a specific fuel consumption of 0 8, with an aneroid barometer-equipped carburetor in order to adjust fuel-air mixtures for height automatically An ignition system which delivers 40,000 V open circuit is described, and features of propellers are discussed in terms of performance and material considerations MSK

A82-39737 # The application of small propellers to RPV propulsion. A C Roberts (British Aerospace Public, Ltd, Co, Dynamics Group, Bristol, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 14 1-14 10

Progress in the development of a data base for construction of propellers for increasing the range and performance of small unmanned aircraft is assessed Compromises are necessary in design of propellers due to different requirements during climb and dash flight modes, and options for areas to explore include diameter and number of blades Restrictions include resulting size of the radar target produced, the effect on forward looking sensors, recovery method, and noise Small RPV propellers operate in the middle of the critical Reynolds number flow regime, encountering both laminar and turbulent flows while turning at 6000-8000 rpm A numerical model is developed for optimizing propeller efficiency and a computer program is outlined for predicting performance Wind tunnel tests of 0 5 m diam fixed-pitch 2-blade propellers showed that current predictions degrade in accuracy with increases in forward speed MSK

A82-39738 # The control and guidance unit for MACHAN. I F Cooper and J A Birkenshaw (Marconi Avionics, Ltd, Rochester, Kent, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April

6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 16 1-16 11 Research supported by the Ministry of Defence (Procurement Executive)

Details of the MACHAN development program for evaluating the unmanned aircraft guidance achievable by a dead reckoning system aided by other systems and sensors are presented An attitude and heading reference (AHRS) system was concluded to require a vertical reference within 0 5 deg and a heading reference of not more than 4 deg/hr, provide pitch, roll, and yaw rates for the autopilot, operate digitally, possess navigation capability and update, operate within various mission profiles, and be amenable to mass production The AHRS system constructed featured three single axis gyros, three accelerometers, a dedicated real time microprocessor, and attitude recognition by reference to gravity and initial data supplementary sensors, such as a single degree of freedom rate integrating gyro and accelerometer, pass data through the microprocessor where magnetic heading and Doppler velocity data are also considered M S K

A82-39739 # U S. Army remotely piloted vehicle supporting technology program. T D Gossett (U S Army, Research and Technology Laboratory, Moffett Field, CA) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 18 1-18 10 10 refs

Details of the U S Army full scale engineering development program for the RPV Aquila are described The system includes the air vehicle, a recovery system, an air vehicle handler, a remote ground terminal, a ground control station, a launcher subsystem, and a maintenance shelter With attention focused on the propulsion and antijam data link developments, it is noted that the data link includes a command uplink, telemetry downlink, video downlink, and navigation of the air vehicle relative to the remote ground terminal Components of the antijam modular integrated communication and navigation system comprise an analog null steerer, modems with chopped chirp waveforms, a direct pseudonoise spread modem, and a phased array Ducted propellers were determined to offer higher takeoff, and quieter performance and efficiency than open propellers Finally, operational features of the 20 hp test engines and the FLIR sensor are provided M S K

A82-39740 # A terrain following system, an algorithm and a sensor. E Skarman (Saab-Scania AB, Linkoping, Sweden) and U Rehammar (Telefonaktiebolaget L M Ericsson, Molndal, Sweden) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 19 1-19 15

The development of a control logic for terrain following RPVs using radar and laser sensors to detect possible obstacles at least 1300 m in advance is described analytically Limitations in the theory of linear dyn ic systems are discussed in terms of filtering an input command with a low pass filter to avoid exceeding the mechanical environment stress limits of all vehicle subsystems The odeling of a dynamic system comprises two states of the kinematics, vertical speed and altitude, the two states pitch of the vehicle dynamics, the flight control system, which is an acceleration feedback system, and the low pass filter The system is shown to have one input and seven functions with simple asymptotes and control is confined to operating at height to height from time to time Inputs to the command filter are developed along with decision rules, and two- and three-dimensional simulation algorithms are outlined M S K

A82-39741 # Sensor stabilisation requirements of RPV's - A simulation study. K G Narayanan, M Madhuranath, S K Bhat, and G Elangovan (Aeronautical Development Establishment, Bangalore, India) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 21 1-21 8 6 refs

The application of pilot simulator video displays to the development of sensors for the stabilization of TV carrying RPVs is described Either films with servo-induced roll, yaw, and jitter or numerically generated images can be displayed to the RPV TV sensor Particular attention is given to scaled geometric presentations which produce out-the-window views to pilots Requirements for the simulation include accurate representations of objects, reflectance/radiance and contrast, RPV sensor accounting for resolution, sensitivity, FOV, look angle, slewing rate, image smear/lag, platform speed, direction, altitude, attitude, and maneuvers The data link is limited by the range of operation, bandwidth, and noise, and terrains are chosen for the appropriate mission Block diagrams are provided of the RPV sensor simulator and improvements necessary for the system to be operational M S K

A82-39742 # Radars for UMA. M Scorer (Marconi Avionics, Ltd , Research Laboratory, Rochester, Kent, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Conference Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 22 1-22 6

The implementation of lightweight radar systems in unmanned aircraft (UMA) is discussed Attention is given to the application of UMA to air defense as a passive receiver system, carrying radiometers as a passive detector, and microwave, millimeter wave, and laser radars for target detection and ranging The necessity of developing laser radars which operate at eyesafe wavelengths, such as 10 micron CO2 lasers, which are currently too heavy for UMA, is noted Data gathered by a UMA radar system is gained by means of a transmitter and a receiver, then relayed along a ground link Millimeter wave radars permit the use of 20 cm antennas on UMAs while maintaining an image resolution of 25 m at 1 5 km, operating at 100 GHz Flat plate printed circuit antennas several millimeters thick have been fabricated, permitting placement of the receiver on the same substrate as the antenna Employing magnetrons for high power gain is outlined M S K

A82-39744 # Electric propulsion for a mini RPV system. G R Seemann and G L Harris (Developmental Sciences, Inc , City of Industry, CA) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Supplementary Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 12 1-12 6 Contract No F33657-79-C-0508

The advantages of electric propulsion, such as reliable instant-start, enhanced survivability, possible higher performance and improved storability, have merited further investigation Advances in the development of the lithium battery have increased the payload performance to 200-300 Wh/lb with the battery being the prime factor of the propulsion system concept A point design system of the mini-RPV is described based on predictions after a strawman mission, and studies of current and advanced concepts of an electric propulsion system are discussed in terms of the components of the system Temperature control is studied, and performance estimates of the mini-RPV are outlined such as a speed range of 60-150 kts, a climb rate of 600 ft/min and an endurance of five hours The system's potential use as an expendable vehicle to conduct surveillance, jamming or kamikaze missions is foreseen R K R

A82-39745 # Flight control systems for aerial targets. A W Bargery and K W Rosenberg (Marconi Avionics, Ltd , Rochester, England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Supplementary Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 17 1-17 18 Research supported by the Ministry of Defence (Procurement Executive)

Aerial targets, a class of unmanned aircraft (UMA), present constraints different from other classes of UMA The control system design is partially determined by data link, tracking facilities, and range location The flight control systems of two targets, the Jindivik, in operation for 25 years, and the Sea Vixen, soon to be in operation, are described The Advanced Subsonic Aerial Target (ASAT) flight control system is under development, and its design approach, which anticipates a more expendable target vehicle, is described The ground station for the ASAT requires a high initial investment, but the air vehicle requires a minimal cost A comparison of each of these three systems is presented The Jindivik has high operating skills, the Sea Vixen has medium skills, and the ASAT has low skills, while the Jindivik and the Sea Vixen require large crews and the ASAT requires a small crew Block diagrams of each UMA are included R K R

A82-39746 The design of a viewing system for near real time stereo images from a UMA borne linescan sensor J A C Beattie (Royal Aircraft Establishment, Farnborough, Hants , England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Supplementary Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 20 1-20 3

Laboratory trials demonstrate a display of stereoscopic images, received in data streams with a bandwidth of 512 kHz (-3 dB) The sensing and presentation of the data are described An optical system consisting of a German television lens of 10 2 mm focal length and an F number of 1 8 is used The image plane is divided in two by a right angle splitting prism with each half falling on a separate linear array angled 7 5 degrees from the optical axis The two linear arrays provide data alternately, which is converted to form a pair of visible images The demultiplexing system is explained, as well as various methods of storing the data The effect of cardboarding is less severe with this system as it has an effective back drop The viewing system is described with its main problem being that a 90 degree twist in the image path is necessary for correct viewing The proposed air vehicle BAe (Filton) Stabileye MkII is discussed In addition, it is shown that excessive movement may cause severe blurring, leading to difficulties in the fusion of the stereo pairs Fifty lines of horizontal disparity and 12 lines of vertical disparity can be tolerated with a good stereo viewing facility Two 4-bit images have been successfully stored and extracted using look up table methods R K R

A82-39747 # Opto-electronical push-broom scanners for navigation, reconnaissance and generation of digital data bases. O Hofmann and P M W Navé (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Supplementary Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 20A 1-20A 3

A82-39750 # The design of a RPV ground station simulator. J Ford and P G Thomasson (Cranfield Institute of Technology, Cranfield, Beds , England) In Remotely piloted vehicles, International Conference, 2nd, Bristol, England, April 6-8, 1981, Supplementary Papers (A82-39727 19-01) Bristol, England, University of Bristol, 1982, p 26 1-26 7 Research supported by the Ministry of Defence (Procurement Executive)

A simulator complex has been designed representing the ground station environment of a remotely piloted vehicle (RPV) system, in order to evaluate the human factors of a ground control station such as the work load of the crew The design requirements of the simulator are described, and the reasons for using a multicomputer design are explained The primary requirement of the simulator is that it operate in real time, and a second requirement is that it be flexible in order to accommodate specification changes in the system An example of the flexibility of the system is that the memory requirement of the system has increased from 24 K bytes to 128 K bytes with no need to modify the framework or computing capacity The goals in creating a ground control station are that it be able to preplan missions for the RPV, to control and replan missions while the RPV is airborne, and to interpret real time imagery Various diagrams are included R K R

A82-39836 # Aerodynamic aspects of aircraft dynamics at high angles of attack /AGARD Lecture/. K J Orlik-Ruckemann (National Aeronautical Establishment, Ottawa, Canada) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1363* 22 p 37 refs

This paper presents a review of some of the fluid dynamics phenomena that are associated with the oscillatory flight at high angles of attack, with particular emphasis on asymmetric shedding of forebody vortices, asymmetric breakdown of leading edge vortices, the oscillatory motion of such vortices, and the time lag between the motion of the vortices and that of the aircraft These phenomena cause a number of important effects on the dynamic stability parameters at high angles of attack (high alpha), such as strong nonlinearities with alpha, significant static and dynamic aerodynamic cross-coupling, large time-dependent and hysteresis effects, and a strong configuration dependence The need to consider all the aerodynamic reactions in their vectorial form is emphasized, and the importance of the abovementioned effects on our prediction capabilities of aircraft behavior at high alpha is discussed Development of adequate mathematical models is advocated and requirements for advanced wind tunnel techniques for performing the necessary oscillatory experiments are described The oral presentation is illustrated by movie films showing flow visualization on oscillating models (Author)

A82-39882 On the state of technology and trends in composite materials in the United States. J R Vinson (Delaware, University, Newark, DE) In Composite materials Mechanics, mechanical properties and fabrication, Proceedings of the Japan-U S Conference, Tokyo, Japan, January 12-14, 1981 (A82-39851 19-39) Barking, Essex, England, Applied Science Publishers, 1982, p 353-361 16 refs

In connection with the ongoing NASA Aircraft Energy Efficiency Composite Primary Aircraft Program a number of composite material structural components have been installed on commercial aircraft and are in service today The composite components involved include rudder, vertical fin, ailerons, elevators, and horizontal tail Attention is given to the use of graphite composites in commercial and military aircraft, F100 afterburner nozzle flaps made of carbon-polyimide composite, the graphite-epoxy airframe of the Learfan 2100, the use of Kevlar in helicopters, the employment of Kevlar composites in sailplanes, the fabrication of the fifty foot long booms of the Space Shuttle from graphite epoxy, and the use of Kevlar-epoxy in the design of many rocket motor cases Unfortunately, cost and confidence are still major obstacles toward more use of composites in the auto industry G R

A82-39890 Tests of CFRP spar/rib models with corrugated web. Y Tada, T Ishikawa, and E Nakai (National Aerospace Laboratory, Chofu, Tokyo, Japan) In Composite materials Mechanics, mechanical properties and fabrication, Proceedings of the Japan-U S Conference, Tokyo, Japan, January 12-14, 1981 (A82-39851 19-39) Barking, Essex, England, Applied Science Publishers, 1982, p 461-470 5 refs

Static strength tests are conducted on cantilever beams with corrugated web, models of spars and ribs used in aircraft structures, which are fabricated from carbon fiber reinforced plastics The shear strength of the corrugated web, the strain distributions, and the failure modes are evaluated for three types of models having different corrugation depths and laminate constructions Results show that the ultimate strengths of the webs are approximately equivalent to the shear strength of flat specimens of the same laminate construction In addition, the depth of the corrugation does not crucially change the strain distribution and the static bending strengths, but does effect the failure mode Strengthened layers of the flange-web connections have little effect on the web strength The critical state of the webs can be identified by observing the magnitude of the surface strains, not by the displacements N B

A82-39892 Evaluation of CFRP prototype structures for aircraft. Y Noritake, T Kohda, Y Abe, F Yamauchi, S Toyohira, K Mogami, H Arai, and N Arata (Japan Defense Agency, Technical Research and Development Institute, Tachikawa, Tokyo, Japan) In Composite materials Mechanics, mechanical properties and fabrication, Proceedings of the Japan-U S Conference, Tokyo, Japan, January 12-14, 1981 (A82-39851 19-39) Barking, Essex, England, Applied Science Publishers, 1982, p 478-486

The results of flight test programs to test the suitability of CFRP advanced composites for aircraft structures are presented The CFRP components tested included a rudder and rear nose landing gear door of a supersonic trainer, ground spoilers of a C-1 transport, and the outer leading edge slat rails of an antisubmarine patrol seaboat Proof load tests were performed on the ground to affirm that the CFRP parts were as strong as conventional materials The flight tests covered stresses from velocity, altitude, angle of attack, and load factor of the aircraft and stress on the composite components Two and one-half years of flight data, with inspections every 200 hours and 9 months, were combined with coin tapping tests for external structural elements No rigidity degradations were observed on the spoilers or the slat rails and all test components were evaluated as remaining in satisfactory condition M S K

A82-39893 Developments on graphite/epoxy T-2 nose landing gear door. K Mogami, F Yamauchi (Japan Defense Agency, Technical Research and Development Institute, Tachikawa, Tokyo, Japan), Y Sakatani, and Y Yamaguchi (Mitsubishi Heavy Industries, Ltd , Nagoya Aircraft Works, Nagoya, Japan) In Composite materials Mechanics, mechanical properties and fabrication, Proceedings of the Japan-U S Conference, Tokyo, Japan, January 12-14, 1981 (A82-39851 19-39) Barking, Essex, England, Applied Science Publishers, 1982, p 487-493

Attention is given to the material systems and processing specially developed for the graphite/epoxy composite door, among them unidirectional tapes, fabrics, chopped fiber materials, and semi-cocuring techniques To evaluate the durability of the graphite/epoxy skin laminates, water absorption tests and fatigue tests are performed at low, high, and room temperatures for the design required The all-graphite/epoxy beam-fittings were fabricated using the hot-pressing technique and tested to verify the bearing and bending strength according to design requirements The saving in weight came to 25% C R

A82-39894 Design, fabrication and qualification of the T-2 composite rudder. F Yamauchi, K Mogami (Japan Defense Agency, Technical Research and Development Institute, Tachikawa, Tokyo, Japan), T Fukui, and T Sato (Fuji Heavy Industries, Ltd , Aircraft Engineering Div , Utsunomiya, Tochigi, Japan) In Composite materials Mechanics, mechanical properties and fabrication, Proceedings of the Japan-U S Conference, Tokyo, Japan, January 12-14, 1981 (A82-39851 19-39) Barking, Essex, England, Applied Science Publishers, 1982, p 494-503

It is pointed out that this is the first primary control surface to be flight tested in Japan The rudder has a span of 1 53 m, a 0 71-m chord at the midspan, and an area of 1 05 sq m The design involves a single-spar, full depth honeycomb sandwich structure Graphite/epoxy is used for the skins, spar, upper and lower closure ribs, and leading edge ribs The graphite/epoxy parts make up approximately 40% of the total weight The spar and closure ribs are precured and bonded to the sandwich assembly after the skins are cured Nine precured leading edge ribs are attached with cherry-lock fasteners in addition to normal adhesive bonding It is noted that a conservative design approach was used and that the primary objectives were to obtain actual production experience and in-service operational experience for a composite primary control surface C R

A82-39895 Development of the advanced composite ground spoiler for C-1 medium transport aircraft. F Yamauchi, K Mogami (Japan Defense Agency, Technical Research and Development Institute, Tachikawa, Tokyo, Japan), H Masaeda, and T Shirata (Kawasaki Heavy Industries, Ltd , Aircraft Div , Kagamihara, Gifu, Japan) In Composite materials Mechanics, mechanical properties and fabrication, Proceedings of the Japan-U S Conference, Tokyo, Japan, January 12-14, 1981 (A82-39851 19-39) Barking, Essex, England, Applied Science Publishers, 1982, p 504-512

The research and development program for the graphite/epoxy ground spoiler for the C-1 medium transport aircraft is discussed The design requirement was that the spoiler provide strength and rigidity not less than the baseline spoiler in addition to interchangeability The design analysis was done by finite element method and the detail design configurations of major structural components were evaluated by trade-off tests in the initial design phase, showing that the components met design requirements Successful environmental characteristic tests were also conducted The scattering characteristic of the Gr/E for static and fatigue strength were obtained and found to be significantly superior to that of aluminum alloy Full scale verification tests were also passed C D

A82-39896 Fabrication of CFRP prototype structure for aircraft horizontal tail leading edge slat rail F Yamauchi, K Mogami (Japan Defense Agency, Technical Research and Development Institute, Tochikawa, Tokyo, Japan), K Suzuki, T Kiho, and T Ikuyama (Shin Meiwa Industry Co , Ltd , Kobe, Japan) In Composite materials Mechanics, mechanical properties and fabrication, Proceedings of the Japan-U S Conference, Tokyo, Japan, January 12-14, 1981 (A82-39851 19-39) Barking, Essex, England, Applied Science Publishers, 1982, p 513-520

Results of a fabrication study and materials properties tests of an advanced composite horizontal tail leading edge slat rail for the Japanese PS-1 STOL antisubmarine warfare seaplane are presented The slat rail was fabricated of carbon fiber satin cloth and a bisphenolic epoxy resin matrix, with co-curing by vacuum injection Static tests were performed to 100 and 180% of the design load limit and satisfactory results were obtained Coating the slat rail with silicon grease resulted in good resistance to salt spray, although stiffness was reduced 5% after 24,000 cycles High and low temperature environmental tests produced no degradation in the material The composite slat rails had been flown for 1000 hr in flight tests by 1978 and performed to specification M S K

A82-39897 Development status of a composite vertical stabilizer for a jet trainer. K Takagi and S Idei (Fuji Heavy Industries, Ltd , Aircraft Engineering Div , Utsunomiya, Tochigi, Japan) In Composite materials Mechanics, mechanical properties and fabrication, Proceedings of the Japan-U.S Conference, Tokyo, Japan, January 12-14, 1981 (A82-39851 19-39) Barking, Essex, England, Applied Science Publishers, 1982, p 521-528

Progress in a program to develop a composite materials vertical stabilizer for the next generation Japanese transonic military jet trainer is described Focusing on graphite/epoxy materials, the tests to date cover small elements, components, and full scale main box trials The stabilizer is about 2 4 m long with an area of 1 0 sq m, containing a two-spar multirib structure All component parts are graphite/epoxy except the ribs and root fittings, which are aluminum Tests have been run to examine the moisture temperature effects, rigidity, strain, and static loading to failure Results have indicated no inherent difficulty in accepting a composite stabilizer on the trainer M S K.

A82-39929 Fasteners for composite structures. R T Cole, E J Bateh (Lockheed-Georgia, Co , Marietta, GA), and J Potter (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) *(Symposium on Jointing in Fibre-Reinforced Plastics, London, England, July 13, 14, 1982) Composites,* vol 13, July 1982, p 233-240 16 refs

The four basic problems with fasteners for composites - galvanic corrosion, galling, installation damage, and low pull-through strength - are identified Seven special fastener systems for use in composites - bigfoots, semi-tubular rivets, Cherry Buck rivets, stress-wave rivet systems, groove proportioned lockbolts, composite fasteners, and self-tapping screws are described Survey results are shown indicating that flush, low-load transfer, composite-to-composite joints are the most common in current composite structures The rationale for selecting the flush head configuration as the modification considered is presented Test results indicate that 100 deg tension countersink fasteners are the best for sheet thicknesses in excess of the head height (Author)

A82-39930 On the bearing strengths of CFRP laminates. T A Collings (Royal Aircraft Establishment, Structures Dept , Farnborough, Hants , England) *(Symposium on Jointing in Fibre-Reinforced Plastics, London, England, July 13, 14, 1982) Composites,* vol 13, July 1982, p 241-252 12 refs

Bearing strength measurements have been made on zero, + and - 45, zero, 90 deg and 90 + and - 45 deg carbon fiber reinforced plastic (CFRP) laminates made from three different fibre/resin systems, HTS/914, XAS/914 and HTS/HC 3501 Equations have been derived for predicting the ultimate bearing strengths of constrained pin-loaded holes using a semiempirical approach, and considering the physical conditions governing failure at the hole edge Experimental results are presented and these show good agreement with those predicted for each of the laminate configurations and fibre/resin systems used (Author)

A82-39996 † Numerical solution of a problem concerning transonic flow past a wing-fuselage configuration (Chislennoe reshenie zadachi ob okolozvukovom obtekanii kryla s fiuzeliazhem). V I Savitskii (Tsentral'nyi Aerogidrodinamicheskii Institut, Moscow, USSR) *Gidromekhanika,* no 46, 1982, p 41-47 8 refs In Russian

Nonviscous transonic flow past an arbitrary wing-fuselage configuration is analyzed within the framework of the small-perturbation theory A relaxation method is used in conjunction with a finite-difference scheme Finite-difference approximations for the relaxation equation and boundary conditions are selected by using nonstationary analogy To illustrate the method, calculations are carried out for several different wing-fuselage configurations V L

A82-40051 Noise pollution and airport regulation. J L Helms (FAA, Washington, DC) *Journal of Air Law and Commerce,* vol 47, Spring 1982, p 405-412

Methods are proposed of reversing the trend of curfews and other limitations on airport use that have been adopted across the U S in the name of noise reduction or environmental protection The economic problems caused by airport restrictions are discussed along with the drawbacks of various types of restrictions The situation in White Plains, New York is used as an example of the progress that can be made by holding litigation against restrictions in abeyance and cooperating with the FAA to bring about quick improvements An example of a beneficial rule is allowing the quietest planes to operate at night rather than banning night flights altogether, as was the case in White Plains The litigation route is briefly discussed, and the remedy of seeking systematic solutions is proposed, one combining legislation with FAA review C D

A82-40052 O'Hare International Airport - Impervious to proposed state efforts to limit airport noise. M J Pavlicek (Schaffenegger, Watson and Peterson, Ltd , Chicago, IL) *Journal of Air Law and Commerce,* vol 47, Spring 1982, p 413-448 199 refs

The complexity of formulating a legally valid, technologically feasible, and economically reasonable state regulation that effectively abates noise at O'Hare International Airport is demonstrated The federal responsibility for airport noise, federal preemption and the role of the airport proprietor, and the Illinois Pollution Control Board's jurisdiction over the airport noise proposal before it is briefly discussed, while the proposal itself is dealt with in detail Particular attention is given to the variance procedure which mandates that the airport proprietor consider certain noise abatement methods which are under the control of another authority Noise abatement activities that can be directly implemented by the proprietor, those that require federal approval, and those that are controlled by local zoning authorities are discussed C D

A82-40057 Touchdown technology. J Moxon *Flight International,* vol 122, July 24, 1982, p 215-217

The introduction of widebodied jets brought on a need for modifications in tires, brakes, and wheels to accommodate for weight Radial tires are being tested as they offer a 15-20% weight reduction Also, tires made of Guayule, a wild desert plant found in the southern United States and Mexico, are being tested The evolution of brakes is discussed, with the most recent development being the use of carbon disks as they absorb more kinetic energy than steel without overheating Carbon also offers weight reduction and long life, but a more cost efficient production method is being investigated Variations in wheel production have been minimal and the current focus is on safety improvements and the use of titanium and aluminum alloys NASA is studying a new landing method which involves the active control of landing gear so that forces transmitted to the airframe are reduced R K R

A82-40124 Two-dimensional model studies of the impact of aircraft exhaust emissions on tropospheric ozone. R G Derwent (Atomic Energy Research Establishment, Harwell, Oxon, England) *Atmospheric Environment,* vol 16, no 8, 1982, p 1997-2007 38 refs Research sponsored by the Department of Environment

The potential effects of aircraft operations in the troposphere were investigated with a two-dimensional (latitude-altitude) transport-kinetics model There appears to be reasonable agreement between the present and previous studies that aircraft operations may have already increased ozone concentrations in the upper troposphere by up to a few per cent or so The corresponding increases in the total ozone column amount to a few tenths of a per cent and may well have partially offset any decrease due to the release of chlorofluorocarbons 11 and 12 (Author)

A82-40276 # Flying quality requirements for V/STOL transition. C G Carpenter, J Hodgkinson (McDonnell Aircraft Co , St Louis, MO), R H Hoh (Systems Technology, Inc , Hawthorne, CA), and J W Clark, Jr (U S Naval Material Command, Naval Air Development Center, Warminster, PA) American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1293 *8 p 7 refs*

A landing approach criterion showed excellent correlation of heave damping and pitch-to-path coupling effects Blending schemes for transition from approach dynamics to hover dynamics, and vice versa, correlated well with earlier NASA results A time response criterion discriminated well between attitude and rate systems in low speed and hover Pilot's command gain has a strong effect on piloting charactersitics in all phases of transition (Author)

A82-40287 # Flying qualities requirements for roll CAS systems. D G Mitchell and R H Hoh (Systems Technology, Inc , Hawthorne, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1356* 9 p 8 refs Contract No. F33615-80-C-3604

Command augmentation systems (CAS) are becoming essential components for modern fighters A roll rate CAS utilizes an effective feedforward so that pilot control inputs are compared directly to actual roll response Such CASs, as they are used today, can be limited in authority with parallel direct links, or full-authority with high command gains The latter are the more interesting from a handling qualities standpoint Attention is given to gradient shaping, roll responses for conventional aircraft, roll CAS gradients, roll ratcheting, implications for the handling qualities standard, roll performance, linearity, the roll mode time constant, and aspects of sensitivity G R

A82-40290 * # **Flight-determined correction terms for angle of attack and sideslip.** M F Shafer (NASA, Flight Research Center, Edwards, CA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1374* 11 p

The effects of local flow, upwash, and sidewash on angle of attack and sideslip (measured with boom-mounted vanes) were determined for subsonic, transonic, and supersonic flight using a maximum likelihood estimator The correction terms accounting for these effects were determined using a series of maneuvers flown at a large number of flight conditions in both augmented and unaugmented control modes The correction terms provide improved angle-of-attack and sideslip values for use in the estimation of stability and control derivatives In addition to detailing the procedure used to determine these correction terms, this paper discusses various effects, such as those related to Mach number, on the correction terms The use of maneuvers flown in augmented and unaugmented control modes is also discussed (Author)

A82-40294 * # **The use of linearized-aerodynamics and vortex-flow methods in aircraft design /Invited paper/.** J E Lamar (NASA, Langley Research Center, Transonic Aerodynamics Div, Hampton, VA) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1384* 17 p 41 refs

This paper deals with selected linearized-aerodynamic and vortex-flow methods as applied to aircraft design problems at high subsonic speeds In particular, the NASA Vortex Lattice and Modified Multhopp methods are the linearized techniques employed, and the suction analogy is used to provide estimates associated with vortex-flow aerodynamics Many examples are given as to how researchers at Langley have used these methods to design the high subsonic, wing-mean-camber shapes for various configurations such as a supersonic transport, high-aspect-ratio transport, trapezoidal fighter wing, strake wing, tandem wing, joined wing, delta wing, and slender cranked wing Many of these have been built, tested, and have had their data compared with theory In addition, a technique for defining efficiently performing strake planforms for use in strake-wing combinations is discussed, and further improvements in wing design are outlined The latter may be obtained by using higher-ordered linear panel methods as well as nonlinear-transonic methods (Author)

A82-40348 **Boeing's new 767 eases crew workload.** R R Ropelewski *Aviation Week and Space Technology,* vol 117, Aug 23, 1982, p 40, 41, 43 (3 ff)

Details of the cockpit avionics and control switches and their operations in the Boeing 767 aircraft are described Automation of the control and monitoring of most aircraft functions has permitted elimination of the flight engineer's station, and all controls are now within reach of the pilot and copilot Each pilot is furnished electronic attitude director and horizontal situation indicators and flight management system control display units, in addition to sharing two centrally located 6 x 7 in electronic displays giving engine indication and crew alerts Standard electromechanical gages remain as a redundant feature, while checklist procedures are reduced to a short time Flight paths and travel times are currently being programmed for easy access loading into the flight computer for automated guidance, with the computer tuning to navigations aids stationed along the flight path M S K

A82-40395 # **Summary of sting interference effects for cone, missile, and aircraft configurations as determined by dynamic and static measurements.** B L Uselton and D R Haberman (Calspan Field Services, Inc, Arnold Air Force Station, TN) *American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, 9th, San Diego, CA, Aug 9-11, 1982, Paper 82-1366* 16 p 21 refs

A summary of an AEDC technology program of sting effects on aerodynamic measurements is presented Four different configurations - a 7-deg cone, 6-deg sliced-base cone, missile and an aircraft - were tested in the wind tunnel Interference effects were obtained by measurements of damping derivatives, static data, surface pressures, and base pressures from subsonic to hypersonic Mach numbers The critical sting limits were investigated as a function of frequency of oscillation, model boundary layer, type of measurement, angle of attack, Mach number, and configuration Comparisons of wind tunnel and ballistic range data are presented for the missile and aircraft configurations Critical sting length was found to be dependent on the parameter selected as the interference indicator (Author)

A82-40417 * # **NASA research in supersonic propulsion - A decade of progress.** L H Fishbach, L E Stitt, J R Stone, and J B Whitlow, Jr (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1048* 23 p
(Previously announced in STAR as N82-26300)

A82-40418 * # **Propulsion opportunities for future commuter aircraft.** W C Strack (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1049* 26 p 9 refs
(Previously announced in STAR as N82-26298)

A82-40419 * # **Summary and recent results from the NASA advanced high-speed propeller research program.** G A Mitchell and D C Mikkelson (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1119* 34 p 37 refs
(Previously announced in STAR as N82-26219)

A82-40420 * # **Performance of a 2D-CD nonaxisymmetric exhaust nozzle on a turbojet engine at altitude.** D M Straight and R R Cullom (NASA, Lewis Research Center, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1137* 27 p 14 refs
(Previously announced in STAR as N82-26241)

A82-40422 * # **Comparison of experimental and analytic performance for contoured endwall stators.** R J Boyle (NASA, Lewis Research Center, Cleveland, OH) and J E Haas (U S Army, Propulsion Laboratory, Cleveland, OH) *AIAA, SAE, and ASME, Joint Propulsion Conference, 18th, Cleveland, OH, June 21-23, 1982, AIAA Paper 82-1286* 14 p 18 refs
(Previously announced in STAR as N82-26299)

A82-40428 # **Terrain following/terrain avoidance system concept development.** G D Young, Jr, W W Harrington, R L Overdorf, and E Rachovitsky (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) *American Institute of Aeronautics and Astronautics, Guidance and Control Conference, San Diego, CA, Aug 9-11, 1982, Paper 82-1518* 8 p 6 refs Grant No F33615-80-C-3617

The development of a real-time simulation of a terrain following/terrain avoidance (TF/TA) system algorithm for use with an operating AFTI/F-16 simulator is described The simulator is equippped with a control feel system, a single seat cockpit, an earth/sky and a target/terrain projection system, and motion and g-force provisions A 5000 1 scale scenario of western Europe was chosen with night, dusk, and daylight capability in addition to cloud cover and weather configurations The TF/TA control system is considered in terms of a preplanned ground track, with the mission proceeding from waypoint to waypoint, a computed flight path, for optimized aircraft performance on trajectories within the mission path, and aircraft control to follow the actual flight path A feasible directions algorithm for obtaining the computed flight path is presented and operations are described Further developments to complete the pilot-in-the loop strategies are discussed M S K

A82-40429 * # **Flight experience with a backup flight-control system for the HiMAT research vehicle.** R W Kempel (NASA, Flight Research Center, Edwards, CA) *American Institute of Aeronautics and Astronautics, Guidance and Control Conference, San Diego, CA, Aug 9-11, 1982, Paper 82-1541* 20 p

The NASA Dryden Flight Research Facility is conducting flight tests of two remotely piloted, subscale, advanced fighter configurations, the tests are part of the Highly Maneuverable Aircraft Technology (HiMAT) project Closed-loop primary flight control is performed from a ground-based cockpit and digital computer in conjunction with an up/down telemetry link A significant feature of these vehicles is an on-board, digitally active, backup control system designed to recover the vehicle in the event of a transfer from primary control Automatic transfers occur upon certain critical ground or airborne system malfunctions Control modes are provided that enable a ground or airborne controller to guide the vehicle to a safe landing This paper describes the features, operational development, and flight evaluation of the HiMAT backup flight control system (Author)

A82-40434 # **Analytical design and validation of digital flight control system structure.** D B Mulcare, W G Ness, and R M Davis (Lockheed-Georgia Co, Marietta, GA) *American Institute of Aeronautics and Astronautics, Guidance and Control Conference, San Diego, CA, Aug 9-11, 1982, Paper 82-1626* 11 p 17 refs

Flight controls applications continue to be a dominant driver of applied digital technology, especially in the areas of fault-tolerant computer subsystems and flight-critical assurance methods The present investigation is concerned with two of the major digital flight system technology needs, taking into account system validation technology and integrated methodology Attention is given to the integration of assurance activities or provisions into the design process The problem at hand is to formulate, develop, and validate an analytically based methodology which can dependably yield a readily validatable and maintainable digital flight control system Questions of basic strategy are considered along with the technical approach, the control of complexity, a design description, aspects of system validation, and questions of development methodology G R

A82-40483 † **Sport aircraft (Sportivnye samolety).** S A Iakovlev Moscow, Izdatel'stvo DOSAAF SSSR, 1981 72 p In Russian

The development and character of sport aviation in the Soviet Union are discussed, with attention given to the historical background and the line of Yak light aircraft Non-Soviet sport aircraft are also considered Many color drawings of sport aircraft are presented B J

A82-40505 **American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings.** Washington, DC, American Helicopter Society, 1982 537 p (For individual items see A82-40506 to A82-40556)

Among the topics discussed are the aerodynamics, structural dynamics, propulsion, design, avionics, product assurance, structures and materials, testing, and acoustics of helicopters The papers presented cover optimum airloads of rotors in hover and forward flight, the evaluation of vertical drag and ground effect, helicopter vibration reduction by rotor blade modal shaping, the finite element analysis of bearingless rotor blade aeroelasticity, adaptive fuel controls, digital full authority engine controls, helicopter autorotation assist concepts, and the conceptual design of an integrated cockpit Also presented are papers on the demonstration of radar reflector detection, avionics systems for helicopter integration, the adaptation of pultrusion to the manufacture of helicopter components, composite main rotor blades, optimum structural design, the in-plane shear testing of thin panels, error minimization in ground vibration testing, and the prediction of helicopter rotor discrete frequency noise O C

A82-40506 # **Theory and application of optimum airloads to rotors in hover and forward flight.** R C Moffitt and J R Bissell (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 1-12 (For individual items see A82-40506 to A82-40556)

A method is derived and applied that predicts optimum lift distribution for rotors in hover and forward flight A key feature of the method is that it is formulated in terms of a matrix equation that gives a direct solution when wake geometry is fixed An evaluation of the Theodorsen optimum static propeller theory, conducted with the analysis, indicates that the theory is not rigorous It is shown that the torque differential term omitted in that analysis is both finite and significant With this term included, the optimum static propeller wake displacement velocity is not constant An optimized Black Hawk twist distribution in hover is shown to closely approximate the classic inverse radius pitch distribution predicted by strip momentum theory The resulting downwash, however, is constant only over the inner 75% of the radius and substantial reductions occur in the tip region Predicted improvements in Black Hawk forward flight performance with optimized azimuthally varying twist are significant but the associated variable twist is complex (Author)

A82-40507 # **A new Transonic Airfoil Design Method and its application to helicopter rotor airfoil design.** J C Narramore and J G Yen (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 13-23 28 refs

A new Transonic Airfoil Design Method has recently been developed which can produce airfoils with desired aerodynamic, dynamic, and geometric characteristics This new method is based on fundamental principles and utilizes efficient techniques to provide a practical airfoil design tool Compressibility and shock wave terms are included in the method which evaluates families of velocity distributions and selects the best one which will satisfy the design objectives This pressure distribution is used as input to a transonic inverse routine which calculates the coordinates of the section that will produce the desired velocity Using this approach, sections can be produced that will provide desired levels of lift, drag, and pitching moment at the design operating conditions This technology is applied to the design of an aeroelastically compliant rotor (ACR) by designing airfoils which produce favorable pitching moment and performance at design Mach number and Reynolds number conditions (Author)

A82-40508 # **Recent advances in rotor technology at Boeing Vertol.** M A McVeigh and F J McHugh (Boeing Vertol Co , Philadelphia, PA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 24-33

Results of a wind tunnel test on advanced rotor configurations present an assessment of the benefits of advanced airfoils, tip shape, blade chord, and blade number A CH-47D model rotor with VR-7/8 airfoils was tested as a reference rotor The advanced rotors, incorporating recently-developed VR-12/15 high speed airfoils, were tested to 231 knots in the wind tunnel and demonstrated an improvement of 6 0% in figure of merit and 25% in cruise lift-to-effective-drag ratio over a rotor with VR-7/8 airfoils The advanced airfoils show significant improvements in stall inception limits, flying qualities boundaries and rotor noise Improved blade tip shapes provide additional benefits in rotor noise and do not reduce the stall inception boundary (Author)

A82-40509 * # **Evaluation of an asymptotic method for helicopter rotor airloads.** A R Vaidyanathan and G A Pierce (Georgia Institute of Technology, Atlanta, GA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 34-42 21 refs Contracts No NAS1-16222, No NAS1-16817
(Previously announced in STAR as N82-21156)

A82-40510 * # **An evaluation of vertical drag and ground effect using the RSRA rotor balance system.** R J Flemming (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) and R E Erickson (NASA, Ames Research Center, Moffett Field, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 43-54 12 refs

A flight test program utilizing the Rotor Systems Research Aircraft (RSRA) main rotor balance system was conducted to obtain data for the helicopter configuration The test program is discussed along with the employed data reduction methods, and the results NASA 740, the RSRA used for the vertical drag test, was in the standard helicopter configuration The 31-foot radius blades have a linear twist of eight degrees and NACA 0012 airfoil sections Aspects of instrumentation are considered, taking into account the data recording system, the static calibration facility, and aspects of data calibration and processing Attention is given to the test procedure, data analysis methods, balance measurements, the ground effect, and vertical drag It is found that the RSRA rotor balance system is capable of providing high quality performance data The vertical drag of the RSRA is 4%, compared to 2 9% predicted G R

A82-40511 * # **Effect of tip vanes on the performance and flow field of a rotor in hover.** H R Velkoff and T W Parker (Ohio State University, Columbus, OH) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 55-64 7 refs NASA-sponsored research

Tests run with a single bladed model rotor with a vane located at the tip of the blade indicated significantly increased performance under certain test conditions Data reveal that a figure of merit increase of over one third occurred in hover Flow visualization using smoke revealed that a pair of vortices sprung from the blade tip and the vane tip The vane tip vortex tended to roll up and over the primary vortex The vortices in the wake became much less well defined with the tip vane configurations (Author)

A82-40512 # **An experimental investigation of a bearingless model rotor in hover.** S Dawson (U S Army, Aeromechanics Laboratory, Moffett Field, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 65-79 6 refs

A 1 79-m diameter model rotor was used to investigate the aeroelastic stability of an isolated bearingless rotor blade in hover, and the results were compared with theory Configurations tested included (1) an uncoupled configuration with a leading and trailing edge pitch link, (2) a cantilever pitch arm configuration with a single pitch link on the trailing edge of the blade (three pitch link radial locations were studied), (3) a cantilever pitch arm configuration with a single trailing edge pitch link (again three radial locations were studied), (4) a trailing edge pitch link location with -2 5 deg droop, and (5) a trailing edge pitch link location with 2 5 deg precone Lead-lag damping was heavily dependent on pitch link radial location at higher pitch angles for the cantilever pitch arm configurations studied Theoretical predictions show stability trends quite well in almost all cases but show discernible differences in damping at higher pitch angles (Author)

A82-40513 # **Whirl mode stability of the main rotor of the YAH-64 Advanced Attack Helicopter.** L J Silverthorn (Hughes Helicopters, Inc , Culver City, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 80-89

The selection of the main rotor configuration for the YAH-64 helicopter was based on the very favorable experience with the combat-proven rotor system of the OH-6A Light Observation Helicopter Results of an analysis conducted to investigate the main rotor cyclic modes have shown an instability at the advancing whirl mode frequency of 15 hertz The whirl mode instability was eliminated in connection with design changes It is pointed out that the whirl mode instability is an aeroelastic phenomenon strongly dependent on coupling between hub motion and blade pitch change motion Rotor support structure stiffening proved to be effective in increasing whirl model stability boundaries G R

A82-40514 # **Helicopter vibration reduction by rotor blade modal shaping.** R B Taylor (United Technologies Research Center, East Hartford, CT) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 90-101

The general vibration design criteria currently used in helicopter rotor blade design is placement of natural frequencies removed from integer frequencies of rotor rotation In this paper, a theoretical approach is presented which demonstrates that design consideration of blade mode shapes can be as important as consideration of natural frequencies for vibration transmitted to the helicopter fuselage A Modal Shaping Parameter is derived from the theoretical approach that is a measure of blade modal vibration susceptibility A baseline blade design is then revised in accordance with minimizing the value of the Modal Shaping Parameter A comparison of hub vibration predicted by a fully coupled aeroelastic analysis for the baseline and revised blade design shows a 70 percent reduction in the contribution of the flatwise modes to vertical hub vibration as well as a 20-30 percent reduction in blade fatigue loading It is demonstrated that the large reductions in vibration resulted directly from desensitizing certain blade modes to aerodynamic loading as predicted by the modal shaping approach (Author)

A82-40515 # Correlation of predicted vibrations and test data for a wind tunnel helicopter model. R Sopher and S B R Kottapalli (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 102-113 9 refs

The desirability to reduce helicopter vibrations has motivated the development of a substructure vibration analysis The computer program involved is designed to serve as a predictive and design tool for designing helicopters for low vibrations The substructure analysis, (SIMVIB - Simplified Vibration Analysis) embodies features which are necessary for vibration prediction Little is known about the validity and sensitivity of the conducted analysis A description is presented of the results of a limited correlation study performed at model scale to examine the method The correlations of fuselage vibrations and blade moments are presented and discussed Sensitivities of analytical predictions to changes in dynamic properties of the fuselage are shown In addition, a study is conducted of the correlation of analysis and theory when higher harmonic control is applied to the rotor to minimize fuselage vibrations G R

A82-40516 # Wind tunnel modeling of rotor vibratory loads. R Gabel, M Sheffler, F Tarzanin, and D Hodder (Boeing Vertol Co , Philadelphia, PA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 114-124

A tandem rotor dynamic model has been designed, manufactured and tested at the Boeing Vertol 20 x 20 ft V/STOL Wind Tunnel The model measures vibratory hub loads with five independent measuring systems on each rotor This four-bladed model was flown at full scale tip speeds through a wide envelope of airspeeds and thrusts, achieving a maximum speed of 200 knots The various measurement systems are discussed, calibration activities are reviewed and test results are presented (Author)

A82-40517 * # Finite element analysis for bearingless rotor blade aeroelasticity. N T Sivaneri and I Chopra (NASA, Stanford Joint Institute for Aeronautics and Acoustics, Stanford, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 125-139 18 refs Grant No NCC2-13

A conventional articulated rotor blade has mechanical flap and lag hinges, a lag damper, and a pitch bearing In connection with an interest in designs of greater mechanical simplicity and increased maintainability, hingeless and bearingless rotors have been developed A hingeless blade lacks the hinges and is cantilevered at the hub It does have a pitch bearing for pitch control A bearingless design eliminates the hinges and the pitch bearing as well In the present investigation of bearingless rotor blade characteristics, finite element analysis has been successfully applied to determine the solutions of the nonlinear trim equations and the linearized flutter equations of multiple-load-path blades The employed formulation is based on Hamilton's principle The spatial dependence of the equations of motion is discretized by dividing the flexbeams, the torque tube, and the outboard into a number of elements G R

A82-40518 * # Civil helicopter propulsion system reliability and engine monitoring technology assessments. J A Murphy (Bell Helicopter Textron, Fort Worth, TX) and J Zuk (NASA, Ames Research Center, Moffett Field, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 140-149 16 refs NASA-supported research

A study to reduce operating costs of helicopters, particularly directed at the maintenance of the propulsion subsystem, is presented The tasks of the study consisted of problem definition refinement, technology solutions, diagnostic system concepts, and emergency power augmentation Quantifiable benefits (reduced fuel consumption, on-condition engine maintenance, extended drive system overhaul periods, and longer oil change intervals) would increase the initial cost by $43,000, but the benefit of $24 46 per hour would result in breakeven at 1758 hours Other benefits not capable of being quantified but perhaps more important include improved aircraft avilability due to reduced maintenance time, potential for increased operating limits due to continuous automatic monitoring of gages, and less time and fuel required to make engine power checks The most important improvement is the on-condition maintenance program, which will require the development of algorithms, equipment, and procedures compatible with all operating environments R K R

A82-40519 # Adaptive fuel control feasibility investigation. R L Bolton (U S Army, Applied Technology Laboratory, Fort Eustis, VA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 150-155

Responsive, stable power control has been an important design objective since the advent of the helicopter Many helicopters flying today, however, suffer from less than desirable power response because of the difficulty in designing a system which is rapid in rotor speed control over the entire operating envelope An optimization regarding the response of engine power for all flight regimes would be particularly important in the case of a combat helicopter A description is presented of an on-going program of investigation of adaptive fuel control concepts utilizing existing full authority electronic systems capability The concepts developed in this program are being analyzed by use of a full dynamic computer simulation of the engine/fuel control/airframe It was found that fuel consumption can be reduced as much as 10% by variation of rotor speed for very specific cruise conditions, i e , high speed, high altitude, and heavy load G R

A82-40520 # 800 Shaft Horsepower Advanced Technology Demonstrator Engine (ATDE) status update. D B Cale (U S Army, Applied Technology Laboratory, Fort Eustis, VA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 156-162

The objectives, engine design features, accomplishments and current status of the ATDE program are presented More than 1000 hours of engine and gas generator testing have been accumulated, including performance, environmental and durability testing, and objectives are being demonstrated and problems discovered More than 1500 hours of aerodynamic component testing and 4000 hours of fuel system and mechanical component testing have also been done In particular, the durability demonstration was considered successful, but certain redesign efforts, such as inlet separator performance and producibility, compressor durability, and bearing durability, are necessary and are being considered R K R

A82-40521 * # TF34 Convertible Engine System Technology Program. K L Abdalla (NASA, Lewis Research Center, Cleveland, OH) and A Brooks (General Electric Co , Lynn, MA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 163-165 8 refs

The ability of the helicopter to function efficiently at zero flight speed is counterbalanced by a limitation to rather low forward flight speeds An ability to fly efficiently at high speed would provide very significant improvements in rotorcraft productivity and economics The implementation of such improvements would require the development of a suitable integrated power plant for both the vertical and horizontal flight modes The engine should be a shaft output engine in the vertical flight mode In the horizontal mode, the propulsor can be fan or propeller A description is presented of a program concerned with the demonstration of a convertible turbofan/turboshaft engine The program is nominally directed toward the demonstration of a propulsion system for an X-wing aircraft However, the principles being investigated are applicable to any convertible turbofan/turboshaft engine application At the current early stage of the program, no barrier problems have become apparent, and interesting possibilities for high speed rotorcraft flight are envisaged G R

A82-40522 # Digital full authority controls for helicopter engines. E S Eccles (Dowty and Smiths Industries Controls, Ltd , Cheltenham, Glos , England) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 170-180 5 refs Research supported by the Ministry of Defence /Procurement Executive/

The paper reviews the benefits that accrue to the aircraft, the operator and the crew from using full authority digital electronic engine controls They are discussed as performance benefits, mission effectiveness benefits, cost benefits and maintainability benefits The paper discusses the use of redundancy and its effects on the operation of aircraft, particularly commercial operation The paper concludes that digital controls, and particularly dual redundant controls offer some very significant cost benefits to many helicopter operators (Author)

A82-40523 # Tandem rotor helicopter characteristics in a continuous icing environment. P J Dunford (Boeing Vertol Co , Philadelphia, PA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 181-193 9 refs

In connection with the growing need for Instrument Flight Rule (IFR) operations in both military and commercial applications, considerable emphasis has been placed on helicopter utilization in adverse weather conditions As a corollary to this requirement, investigations have been conducted with the aim to permit the operation of helicopters under icing conditions Attention is given to test results, a natural icing performance analysis, the need for a deicing system, and icing certification criteria It is found that the impracticality and expense involved in testing helicopters to the full extent of the requirements of FAR Part 25 makes the need for LIMITED icing releases a real one Recognition of specific helicopter attributes and shortcomings is highly desirable for this type of certification G R

A82-40524 # **An evaluation of helicopter autorotation assist concepts.** G T White (U S Army, Applied Technology Laboratory, Fort Eustis, VA), A H Logan, and J D Graves (Hughes Helicopters, Inc , Culver City, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 194-216 11 refs Grant No DAAK51-80-C-0011

The unique autorotation capability of the helicopter is an inherent safety feature which is heavily relied upon during power failure emergencies However, the autorotation maneuver places great demands on pilot skill An analytical study was conducted of autorotation improvement devices These devices were evaluated using both weight and preliminary performance analyses The three most promising concepts were carried through preliminary design It was found that no significant gain in autorotation performance can be achieved by only the management of available baseline energy Supplemental energy must be supplied The use of a simple Autorotative Index is a good tool for the initial determination of the auxiliary power level required for good autorotative characteristics The autorotative characteristics of a single-engine scout helicopter can be substantially improved with the combination of a MIL-STD-1290 type landing gear and either a Tip Jet, Flywheel or Auxiliary Turbine system G R

A82-40525 # **Predesign study for an advanced flight research rotor.** R H Blackwell, T G Campbell (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT), and R B Taylor (United Technologies Research Center, East Hartford, CT) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 217-234 11 refs

A flight research rotor program aimed at demonstrating significant improvements in aerodynamic performance and reductions in vibration and noise is outlined The benefits and practical design considerations of approximately a dozen advanced rotor concepts were considered and three concepts were chosen for inclusion in the flight research program Detailed design of a blade permitting experimental study of tip shape, a tuned trailing edge tab system and blade mass distribution is presented The design issues addressed in connection with the research blade are shown to have general applicability Finally the total program required to develop these concepts including further analysis, model test, ground tests and flight test is outlined (Author)

A82-40526 # **Sikorsky ACAP preliminary design.** B F Kay (United Technologies Corp , Sikorsky Aircraft Div., Stratford, CT). In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-4050520-01) Washington, DC, American Helicopter Society, 1982, p 235-238A

Sikorsky Aircraft is currently under contract to the U S Army to conduct an Advanced Composite Airframe Program (ACAP) The basic objectives of the ACAP are to demonstrate the weight and cost saving potential of advanced composite materials when used to the maximum extent possible in an airframe designed to meet stringent military requirements This paper will describe Sikorsky's ACAP helicopter and the approaches used to minimize weight, reduce manufacturing costs and achieve high levels of crashworthiness, survivability, reliability, and maintainability (Author)

A82-40527 # **Conceptual design of the LHX integrated cockpit.** R R Pruyn and R E Domenic (Boeing Vertol Co , Philadelphia, PA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 239-246 9 refs

The present investigation is concerned with the application of computer-based technology to the next generation of Army tactical aircraft Attention is given to missions which drive cockpit design, the potential benefits of improved displays, developments in automation, questions regarding the merits of displays versus windows, mockups to develop design, aspects of display capability and flight safety, concepts in image processing, crew workload studies, assumptions for workload analysis, workload methodology, and the results of workload analysis It is concluded that with the anticipated automation, controls, and displays, one crewman can efficiently perform all of the desired tactical scout and attack tasks For next-generation aircraft a wide-field-of-view panel or helmet-mounted display is needed since it reduces pilot workload and improves mission performance and flight safety G R

A82-40528 # **The YAH-64 empennage and tail rotor - A technical history.** R W Prouty and K B Amer (Hughes Helicopters, Inc , Culver City, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 247-261

The development of a helicopter from drawing board to production line is still very much a learning process The lessons learned in connection with the development of the Army YAH-64 Advanced Attack Helicopter should, therefore, be sufficiently valuable to future designers to warrant a detailed review Attention is given to the changes to the empennage and tail rotor as the designers sought the best compromise between good performance and flying qualities on the one hand and low weight, low cost, and simplicity on the other The considered helicopter has been developed primarily as a tank hunter and killer capable of flying and fighting at night or in bad weather The primary weapons are wingmounted Hellfire guided missiles The work discussed primarily deals with solutions to problems in the basic aircraft as they were discovered during its flight test G R

A82-40529 # **Future helicopter cockpit design.** S D Roy (Westland Helicopters, Ltd , Yeovil, Somerset, England) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 262-273 5 refs

The influence of the use of electronic display systems on the helicopter cockpit is examined Color CRT's are decidedly essential when proposed as complete replacements for conventional instruments, and two sizes of display are being considered (5 inches x 5 inches and 8 inches x 8 inches) Lighter displays, using flat panel technology, should be considered for the long term, but with careful consideration of pilot error due to misselection Other technologies considered are data entry and extraction techniques, and direct voice control systems The data technique is considered in terms of class of task, access, time constraints, and space availability, and a design approach for a voice system capable of continuous speech recognition is presented The cockpit design implications of these modifications are considered R K R

A82-40530 # **Concept demonstration of automatic subsystem parameter monitoring.** M S Randolph (General Electric Co , Aerospace Control Systems Dept , Binghamton, NY) and R V Kurowsky (U S Army, Fort Monmouth, NY) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 274-286 Grant No DAAK80-79-C-0270

A feasibility demonstration model of an Electronic Master Monitor and Advisory Display System (EMMADS) has been developed as part of the Army's efforts to reduce aircrew workload, integrate cockpit instrumentation, and enhance aircraft maintenance capability The feasibility demonstration hardware is considered along with aspects of system operation, taking into account the philosophy of operation, the types of operation, manually commanded operations, and fault commanded operations Under a follow on development effort currently in progress, the capabilities of the current feasibility hardware will be expanded to include fault logic for all CH-47D model subsystems G R

A82-40531 * # **Flight test evaluation of a video tracker for enhanced offshore airborne radar approach capability.** G R Clary (NASA, Ames Research Center, Moffett Field, CA) and P G Cooper (Cooper Avionics, Inc , Montara, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 287-297 7 refs

As a part of NASA's Rotorcraft All-Weather Operations Research Program, advanced airborne radar approach (ARA) concepts are being investigated Since data from previous NASA/FAA flight tests showed significant ARA limitations, a research program was initiated at NASA Ames Research Center to determine the benefit that could be derived by automating certain radar functions and superimposing course display data on the radar display To evaluate these concepts, a newly developed video tracking system which interfaces with weather radar was acquired After the pilot designates a destination target, the system tracks the target video as it moves on the radar indicator Using a small, efficient microprocessor, the autotracker presents valuable approach data on the radar screen and automatically adjusts the radar gain and tilt Results of a limited flight test evaluation of the autotracker show that the course display concept, combined with automated gain and tilt functions, is effective for improving ARA's and reducing radar operator workload (Author)

A82-40532 * # **Demonstration of radar reflector detection and ground clutter suppression using airborne weather and mapping radar.** D J Anderson, J S Bull (NASA, Ames Research Center, Moffett Field, CA), and J P Chisholm (Nevada, University, Reno, NV) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 298-305

A navigation system which utilizes minimum ground-based equipment is especially advantageous to helicopters, which can make off-airport landings Research has been conducted in the use of weather and mapping radar to detect large radar reflectors overland for navigation purposes As initial studies have not been successful, investigations were conducted regarding a new concept for the detection of ground-based radar reflectors and eliminating ground clutter, using a device called an echo processor (EP) A description is presented of the problems associated with detecting radar reflectors overland, taking into account the EP concept and the results of ground- and flight-test investigations The echo processor concept was successfully demonstrated in detecting radar reflectors overland in a high-clutter environment A radar reflector target size of 55 dBsm was found to be adequate for detection in an urban environment G R

A82-40533 # Micro-heads-up display. J R Goodman and H W Upton (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 306-311

A revolutionary microsized heads-up display (micro-HUD), which weighs only a few ounces and can be worn as a pair of conventional eyeglasses, is described A microsize optical system makes the display possible An advanced state-of-the-art visible light-emitting diode (VLED) array and a vibrating fiber ribbon generate the image The system uses a microprocessor display generator that produces a dynamic image with 128 x 128 elements of resolution This gives the micro-HUD the capability of presenting the same information as a standard heads-up display Development of the custom-designed linear array of light-emitting diodes along with the specially fabricated fiber-optic scanner is also described Results of laboratory and flight tests are discussed Potential improvements such as higher resolution and multicolor versions of the display are described Finally, the possible applications and future of the system is discussed (Author)

A82-40534 # Avionics systems for helicopter integration. D R Nelson (Rockwell International Corp , Collins Government Avionics Div , Cedar Rapids, IA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 312-321

Attention is given to a 'core system' which provides a common set of equipments that is, with appropriate software, applicable to a wide variety of helicopter missions The basic core system is the core of the Coast Guard (USCG) HH-65A system It has been proposed for civil and military helicopter programs with requirements ranging from covert 'behind-the-lines' operations to resupply of oil rigs Particular elements of the core avionics systems include the Cockpit Management System (CMS), the Multi-purpose Video Display System, the Mission Computer, a dual redundant multiplex data bus control system, and a four-axis autopilot/flight director capable of hands-off flight in all regimes including transition to hover Attention is given to system capability requirements, aspects of system functional allocation, the automatic flight control system, and the mission processor G R

A82-40535 * # NASA/FAA Helicopter ATC simulation investigation of RNAV/MLS instrument approaches. L L Peach, Jr , L Tobias, and H Q Lee (NASA, Ames Research Center, Moffett Field, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 322-336 6 refs

The NASA/FAA Helicopter Air Traffic Control (ATC) simulation investigations to determine the feasibility of simultaneous, independent instrument approach procedures for helicopters at major terminal areas, using Area Navigation/Microwave Landing System (RNAV/MLS) guidance, was conducted at several levels of helicopter display sophistication, up to that of a Cockpit Display of Traffic Information (CDTI) system Test objectives included the determination of pilot acceptability and the tracking performance of the RNAV/MLS's noninterfering rotorcraft approach path structure, along with the evaluation of the effect on controller workload of multiroute structures combining conventional and rotorcraft approaches at various arrival rates and traffic separations The utility of electronic area maps and CDTI displays was also investigated Participating pilots flew 127 simulated instrument approaches in an ATC simulation laboratory O C

A82-40537 # Adaptation of pultrusion to the manufacture of helicopter components. E E Blake (Bell Helicopter Textron, Fort Worth, TX) and N J Tessier (U S Army, Army Materials and Mechanics Research Center, Watertown, MA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 346-351

A fabrication technique is described in which pultruded epoxy/glass stock with a complex crossection is postformed and cured to produce a curved UH-1 helicopter door track During pultrusion, prepreg roving is overwrapped with adhesive prepreg glass cloth for transverse strength The 'B' stage stock is postformed and autoclave cured in a glass/epoxy tool The resulting door track retains the crossection of the pultrusion after developing the sweep and twist designed into the present aluminum part Wear and load testing were performed on the composite door track along with an economic analysis comparing it with hand layup and the present aluminum track The results demonstrate that it is feasible to produce complex helicopter components from pultrusions by means of postforming (Author)

A82-40538 # In-motion radiography of titanium spar tube welds. R J Milne (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 352-358

The application of titanium to a helicopter rotor blade spar was developed during the 1960's However, the initially contemplated manfacturing method did not prove to be economical, and a new manufacturing procedure involving the use of a plasma arc welding technique was developed The verification of weld integrity by means of a typical static X-ray test was found to be too time consuming, and the employment of in-motion radiography was considered By using an in-motion radiographic system, it was possible to reduce significantly the time required to radiograph spar tube welds without sacrificing detail sensitivity G R

A82-40539 # Development of the Sea King composite main rotor blade. R Sanders (Westland Helicopters, Ltd , Yeovil, Somerset, England) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 359-370

The Sea King composite main rotor blade has been designed to satisfy ruggedness requirements for the 1980's, and will soon be ready for flight testing Composite materials with a replacable metal erosion shield have been chosen to improve the life of the blade, and a carbon and glass fiber mixture satisfies stiffness and weight requirements A bolted root end design was chosen for this retrofit blade in order to ease automation, without degrading fatigue advantages of the composite construction Technical problems and achievements encountered in the development process are discussed in terms of materials used, blade root design, manufacturing process, serviceability, and quality and safety control A plant has been constructed to satisfy future production requirements, with an anticipated product availability date of late 1984 R K R

A82-40540 # Computer aided coordinate measuring systems. J W Nastri (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 371-376

Sikorsky's computer-aided inspection system and equipment utilized to assure that manufactured parts meet drawing tolerance specifications are discussed An overview of the system is given, and the software is described, including the monitor console routine and commands and the language commands The system's three coordinate measuring machines are discussed, and the part inspection methods are described in stepwise fashion System benefits and time savings items are detailed, including quick and accurate measurement of parts difficult to inspect by conventional methods, significant reduction in inspection time, a consistent baseline that highlights variances, and the use of personnel with lower skill levels to effectively inspect critical parts C D

A82-40541 # Support of the HH-65A - The impact of advanced technology of VTOL systems upon existing product support. R E Walkup (Aerospatiale Helicopter Corp , Grand Prairie, TX) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 377-382

The Coast Guard (USCG) will begin to replace the HH-52 Helicopters with the HH-65A in 1982 The HH-65A is equipped with a state-of-the-art digital avionics system As the HH-52 has only vacuum tube avionics equipment, the new establishment of a complete support capability for solid state digital avionics will be necessary in connection with the introduction of the HH-65A Other technological advances utilized in the HH-65A are related to turbine engines of modular design and the employment of composite materials in the aircraft structure The HH-52 will continue in operation until all USCG stations will have received their HH-65A's To provide support for simultaneous operation of both helicopters without an increase in support personnel will necessitate careful planning during the transitional period Attention is given to the HH-65A avionics system, modular engine maintenance, aspects of corrosion control and the USCG mission, and the allocation and repair of spare components G R

A82-40542 # A roadmap toward a fatigue qualification process for modern technology helicopters. S T-T Chiu and R W Arden (U S Army, Directorate for Development and Qualification, St Louis, MO) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 383-397 30 refs

The helicopter fatigue qualification process is critically reviewed to establish a roadmap, providing specific directions for a more efficient and unified qualification process Specific improvements, various alternatives, and suggested unified approaches are discussed in terms of supporing rationales in the areas of coupon

S-N data utilization, S-N curve reduction factor and curve shape, cycle counting method, structure classification, fatigue test requirement and in-service monitoring Current status and an overview are presented of a parallel AGARD effort to compile a 'Helicopter Fatigue Design Guide' (Author)

A82-40543 # **Optimum structural design.** R L Bennett (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 398-407 12 refs

Four typical helicopter engineering analyses have been combined with a nonlinear programming (NLP) algorithm to produce closed loop design-oriented analyses The resulting models are shown to be very effective in supporting detailed design by eliminating the existing external man-in-the-loop iterative process The nonlinear programming problem and how it relates to the engineering design process is described, along with typical NLP algorithms and how they are combined with conventional engineering analyses C D

A82-40544 # **Design and fabrication of a composite rear fuselage for the UH-60 /Black Hawk/.** D G Orlino (U S Army, Applied Technology Laboratory, Fort Eustis, VA) and B F Kay (United Technologies Corp , Sikorsky Aircraft Div , Stratford, CT) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 408-416

The primary objective of the program to design a composite rear fuselage (CRF) is fabrication cost reduction, and other concerns are a 10% weight savings, improved reliability and maintainability, and increased ballistic survivability The CRF design comprises a stiffened skin, with five major panels, bulkheads, and frames A modular repair concept resulted in reduced life-cycle cost, introducing reliability and maintainability into the design In order to prevent fuel fires on impact with high explosive incendiary projectiles, rigid ballistic foam was used to fill the fuel cell Visual inspection as well as destructive tests were completed, and necessary tooling changes were implemented Objectives being met, a full-scale static test article is being produced R K R

A82-40545 # **In-plane shear test of thin panels.** G L Farley and D J Baker (U S Army, Structures Laboratory, Hampton, VA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 417-425 5 refs

Efficient application of thin gage composite materials to helicopter fuselage structures necessitates that the materials be designed to operate at loads several times higher than initial buckling load Methods are required to accurately measure and predict the response of thin gage composites when subjected to these loads This paper presents the results of an analytical and experimental study of the behavior of thin gage composite panels subjected to in-plane shear loads Finite element stress analyses were used to aid in the design of an improved shear fixture that minimizes adverse corner stresses and tearing and crimping failure modes characteristic of commonly used shear fixtures Tests of thick buckle resistant aluminum panels and thin aluminum and composite panels were conducted to verify the fixture design Results of finite element stress and buckling analyses and diagonal tension theory predictions are presented Correlation of experimental data with analysis indicated that diagonal tension theory can be used to predict the load-strain response of thin composite panels (Author)

A82-40546 # **A summary of weight savings data for composite VSTOL structure.** R L Foye (U S Army, Research and Technology Laboratory, Moffett Field, CA) and R Arden (U S Army, Aviation Research and Development Command, St Louis, MO) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 426-437 96 refs

This paper summarizes the weight savings that have been obtained over the last ten years through the application of advanced composite materials to each of the major structural weight groups of a VSTOL airframe The data has been drawn from journal articles, published papers, R&D reports, and personal communications Helicopter, VSTOL, and fixed wing applications of composites have been included The data is not comprehensive but represents a significant sampling of all recent composite airframe designs (Author)

A82-40547 # **Structural design of a crashworthy landing gear for the AH-64 Attack Helicopter.** J M McDermott (Hughes Helicopters, Inc , Culver City, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 438-450

Requirements for the design of a landing gear for helicopters are considered In the case of the AH-64 Attack Helicopter, an additional consideration is related to air transportability requirements of the helicopter, necessitating a kneeling requirement in the landing gear configuration in order to reduce the height of the helicopter to fit into the cabin of the cargo aircraft transporting it This kneeling requirement was also utilized to provide a high degree of crash protection According to specification, protection of the crew has to be provided for conditions involving a vertical impact velocity of as high as 42 ft/sec In order to meet this requirement, it was necessary to use the landing gear to absorb as high a proportion of the vertical kinetic energy as was feasible before the fuselage contacted the ground Attention is given to the configuration of the landing gear for the AH-64, the design criteria, details of impact energy absorption, the integration of the landing gear into the airframe, and static structural testing G R

A82-40548 # **Ringfin augmentation effects.** H E Lemont (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 451-460

The ringfin concept has been developed since 1975 as a potential remedy for a number of concerns experienced in connection with the operation of single main totor/tail rotor helicopters This concept involves the use of a thrust ring around the tail rotor The ring acts as fin, and generates lift force (antitorque) The present investigation is concerned with the measured augmentation effects in ground running, in hover and side flight, in forward translation, and mixing of the rotor wakes The investigation shows that under static thrust conditions the tail rotor flow generates an induced positive force on the ring The rotor tip vortices are dissipated with downstream flow motion, and an expanding slowed-velocity wake is created G R

A82-40549 * # **Performance of the Rotor Systems Research Aircraft calibrated rotor loads measurement system.** C W Acree, Jr (NASA, Ames Research Center, Moffett Field, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 461-473 6 refs

The compound Rotor Systems Research Aircraft (RSRA) is designed to make high accuracy, simultaneous measurements of all rotor forces and moments in flight Physical calibration of the rotor force- and moment-measurement system when installed in the aircraft is required to account for any errors and to ensure that measurement system accuracy is traceable to the National Bureau of Standards The first static calibration and associated analysis has been completed with good results Hysteresis was a potential cause of static calibration errors, but was found to be negligible in flight, and analytical methods have been devised to eliminate its effects on calibration data Flight tests confirmed that the calibrated rotor loads measurement system performs as expected in flight, and that it can dependably make direct measurements of fuselage vertical drag in hover (Author)

A82-40550 # **Error minimization in ground vibration testing.** E J Nagy (Kaman Aerospace Corp , Bloomfield, CT) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 474-480 5 refs

The Ground Vibration Testing (GVT) of a U S Army AH-1G helicopter airframe has been successfully completed New methods have been developed to identify and minimize the errors in GVT These methods can be utilized in future programs The new approaches make effective use of a digital signal analyzer as a 'working tool' Examples are presented to demonstrate the use of the digital signal analyzer in connection with a number of applications Attention is given to methods for the determination of the linear range, the location and identification of structural modes, the selection of narrow band sweeps, the selection of driving points, the local mode effect, driving point acceleration mobility checks for positive imaginary components, strain mobilities, the power method, and the number of averages G R

A82-40551 # **Results of the AH-64 Structural Demonstration.** K R Spreuer (Hughes Helicopters, Inc , Carlsbad, CA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 481-489

This paper presents the results of the Structural Demonstration of the AH-64 Attack Helicopter The paper presents graphical data that shows the techniques used to attain the extreme points that define the flight envelope The areas of the flight envelope that most challenge the various components of the helicopter are discussed The methods used to assure flight safety during the program are also presented Finally, the most highly loaded components are identified and the conditions and causes of the loads are presented The Structural Demonstration was conducted successfully and all required maneuvers were performed without exceeding limit loads on any components (Author)

A82-40552 # **Evaluation of an automatic subsystem parameter monitor.** R V Kurowsky and A S Santanelli (U S Army, Fort Monmouth, NJ) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 490-496

It is pointed out that the workload of the pilot of an aircraft is not necessarily reduced by making available to the pilot a new type of avionics system architecture, if the pilot is still required to perform all the tasks he has traditionally performed To achieve such a reduction in workload, the pilot should be used primarily as a decision maker with the ability to reprogram and command his machine in flight The Electronic Master Monitor and Advisory Display System (EMMADS) is an information transfer system which will relieve the pilot of certain functions he has traditionally performed, such as monitoring aircraft subsystems A description is presented of the test procedures which will be used to evaluate the operator/control/display interface of the EMMADS Advanced Development Model G R

A82-40553 * # The prediction of helicopter rotor discrete frequency noise. F Farassat (NASA, Langley Research Center, Hampton, VA) and G P Succi (Bolt Beranek and Newman, Inc , Cambridge, MA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 497-507 23 refs

An accurate prediction of the noise produced by helicopters requires a good understanding of the noise generating mechanisms involved Such an understanding can lead to controlling the noise of existing helicopters by avoiding noisy regimes of flight or by redesigning the main and tail rotors The present investigation is concerned with approaches which are suitable for the calculation of discrete frequency noise of helicopter rotors The governing differential equation of acoustics used in a consideration of acoustic formulations is the Ffowcs Williams-Hawkings (FW-H) equation Attention is given to a method reported by Farassat (1981), a method developed by Succi (1979), and a procedure discussed by Woan and Gregorek (1978) G R

A82-40554 # A semiempirical high-speed rotor noise prediction technique. K R Shenoy (Bell Helicopter Textron, Fort Worth, TX) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 508-516 14 refs

A semiempirical technique to predict high-speed noise of helicopter main rotors is discussed This technique uses an existing data base, the properties of the equations governing the flow field, and empirical relationships to account for the changes in gross weight, blade chord and the blade rotational tip Mach number The technique is verified through an application to full-scale flyover noise data and full-scale in-flight noise data Hover test results for a model rotor are used to predict the noise levels for forward flight and are compared with wind tunnel test data In addition, results of flow field investigations to study the effects of blade design parameters on high-speed noise and to extend the prediction technique are presented These results are based on the flow field calculations made by using a three-dimensional, quasi-steady, full potential transonic analysis developed by NASA (Author)

A82-40555 * # Dynamic surface measurements on a model helicopter rotor during blade slap at high angles of attack. J E Hubbard, Jr and W L Harris (MIT, Cambridge, MA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 517-527 16 refs Research supported by the Massachusetts Institute of Technology, Grant No NsG-1583

The modern helicopter offers a unique operational capability to both the public and private sectors However, the use of the helicopter may become severely limited due to the radiated noise generated by the rotor system A description is presented of some of the experimental results obtained with a model helicopter rotor in an anechoic wind tunnel with regard to blade stall as a source mechanism of blade slap Attention is given to dynamic rotor blade surface phenomena and the resulting far field impulsive noise from the model helicopter rotor at high angles of attack and low tip speed The results of the investigation strongly implicates the boundary layer as playing an important role in blade slap due to blade/vortex interaction (BVI) in a highly loaded rotor Intermittent stall cannot be ruled out as a possible source mechanism for blade slap This implies that blade surface characteristics, airfoil shape and local Reynolds number may now be used as tools to reduce the resultant far-field sound pressure levels in helicopters G R

A82-40556 # Helicopter model scale results of blade-vortex interaction impulsive noise as affected by blade planform. D A Conner and D R Hoad (U S Army, Structures Laboratory, Hampton, VA) In American Helicopter Society, Annual Forum, 38th, Anaheim, CA, May 4-7, 1982, Proceedings. (A82-40505 20-01) Washington, DC, American Helicopter Society, 1982, p 528-537 21 refs

An experimental investigation of the blade-vortex interaction impulsive noise characteristics of an advanced main rotor system for the UH-1 helicopter has been conducted Models of both the advanced main rotor system and the standard UH-1 main rotor system were tested at one-quarter scale in the Langley 4- by 7-Meter (V/STOL) Tunnel using the General Rotor Model System (GRMS) Tests were conducted over a range of descent angles which bracketed the blade-vortex interaction phenomenon at a range of simulated flight speeds The tunnel was operated in the open-throat configuration with acoustic treatment to improve the acoustic characteristics of the test chamber The model data indicated that the advanced rotor system has increased the flight-scaled, LA noise produced by the UH-1 at all descent angles except where the blade-vortex interaction phenomenon was most intense for the standard UH-1 main rotor system (Author)

A82-40561 # Research on the behavior of a turbojet engine during internal and external disturbances with respect to early recognition of damage (Untersuchungen über das Verhalten eines Turbostrahltriebwerks bei inneren und äusseren Störungen im Hinblick auf die Schadensfrüherkennung). H Tönskötter Aachen, Rheinisch-Westfälische Technische Hochschule, Fakultät fur Maschinenwesen, Dr -Ing Dissertation, 1980 215 p 41 refs In German

The results of a theoretical and experimental study on the behavior of a single-wave turbojet engine during disturbances are presented The simulated disturbances are categorized as either external or internal The former influence flow relationships in the engine and vary their behavior, but entail no consequences for the engine parts Damage and structural changes in the engine components are called internal disturbances Experimentally obtained thermodynamic parameter changes are presented as volume divisions and average values A program to calculate the stationary and dynamic operating behavior in turbojet engines is used to determine the extent to which the experimental results coincide with a one-dimensional computational procedure, and whether monitoring of operating behavior can be useful for early detection of damage C D

A82-40562 # Research on an adaptive Kalman filter for solving the radar tracking problem (Untersuchung adaptiver Kalman-Filter zur Lösung des Radar-Zielverfolgungsproblems). W Schumacher Berlin, Technische Universität, Fachbereich Verfahrenstechnik, Dr -Ing Dissertation, 1979 126 p 44 refs In German Research supported by the Deutsche Forschungsgemeinschaft

The use of Kalman filters in automated air traffic control for failsafe measurement of local coordinates and speeds is discussed Continuous and time-discrete models are constructed and an optimal filter is investigated A sensitivity analysis is presented, followed by the design and simulation of an adaptive filter Tracking at a one-level trajectory is discussed, and the design of an adaptive procedure is analyzed for different filter levels C D

A82-40569 # Design and construction of a flexible autonomic electronic display device (Entwurf und Aufbau eines flexiblen autonomen elektronischen Anzeigegerätes). R Frieling Braunschweig, Technische Universität, Fakultät für Maschinenbau und Elektrotechnik, Dr -Ing Dissertation, 1980 166 p 40 refs In German

A compact, autonomic display device for presenting synthetic graphic images is needed for research work in the area of flight control The device should also be suited for the presentation of dynamic processes A device with the desired characteristics is currently not commercially available The present investigation is concerned with the essential design criteria for the development and the construction of a display device which satisfies the considered requirements The envisaged device consists of a microcomputer and an image element generator which contains digital differential analyzer (DDA) circuits A detailed mathematical description of the generation of conic sections as image elements and the linear transformation of the elements provides the basis for universal employment possibilities of the device The performance characteristics of the display device are illustrated with the aid of two examples, including an interpolation problem, and the display of data for flight control applications G R

A82-40876 International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings. Volumes 1 & 2. Edited by B Laschka and R Staufenbiel, New York, American Institute of Aeronautics and Astronautics, 1982 Vol 1, 821 p , vol 2, 721 p Members, $75 , nonmembers, $90 In English and French (For individual items see A82-40877 to A82-41025)

Topics in aeronautical and aerodynamics research, development, implementation, and future directions are considered The development and applications of Space Transportation Systems are described, and attention is also given to development programs for transport aircraft and military combat aircraft Theoretical studies in flowfields, crew station design, and power plant materials and design are presented, along with investigations of aerodynamics, computational aerodynamics, control systems, and materials fatigue and tolerance The uses of simulators for Orbiter pilot training, swept wings for efficient flight, and computer-controlled flight management systems are described, and examinations of vortex flows, structural dynamics, applications of composite structures, and canards are reported M S K

A82-40878 # Engineering aspects of international collaboration on Tornado. B O Heath (British Aerospace Public, Ltd , Co , Aircraft Group, Preston, Lancs , England) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 8-22 11 refs

Design features, engineering goals, and the performance envelope of the Tornado combat aircraft are described The fighter was developed to perform air-to-ground, interdictor/strike, naval strike, reconnaissance, air superiority, interception, and training missions The distribution of responsibilities and management authority among the organizations of the three nations which participated in the development program are outlined, along with decisions in the evolution of the design A new engine was developed as a cost-saving measure, and the aircraft was built to ensure that no single failure would endanger flightworthiness Easy access was also added to the Tornado systems in order to hold down repair time and costs M S K

A82-40879 # **Advanced aerodynamic design for future combat aircraft.** B R A Burns (British Aerospace Public, Ltd , Co , Preston, Lancs , England) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 23-33

Progress in aerodynamic design features to enhance the effectiveness and performance of combat aircraft are reviewed Higher turning performance at subsonic and transonic speeds has been achieved through improvements in the lift/drag ratio by providing for attached flow on the upper part of the wings The effects of wing root leading edge strakes and aeroelastic tailoring on flight performance are discussed, and methods of augmenting the turning performance by adding wing interference to the jet exhaust are considered Pilot workload has been lowered by active flight controls, which allow full exploitation of modern aircraft flight and maneuvering envelopes, while gust alleviation has ensured stable flight during high speed, low altitude flight Intake duct geometry has been configured to permit operation at high angles of attack and in sideslip, while an underfuselage carriage scheme has been developed which greatly reduces interference drag compared with conventional underwing carriage M S K

A82-40880 # **Some aerodynamic/flightmechanic aspects for the design of future combat aircraft.** P Mangold (Dornier GmbH, Friedrichshafen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 34-43 6 refs

At an early project state of a future combat aircraft, designed with negative static stability, it is necessary to go through an optimization process in order to minimize the complexity and cost for the control system by avoiding undesirable aerodynamic characteristics A careful refinement of certain parts of the configuration gives the chance to stay within the limits and to meet the criteria and goals for the desired longitudinal and lateral basic behavior General trends, evaluated from many wind tunnel tests, are presented which show the influence of changing LEX size, shape of fuselage nose, slats, vertical tails etc Concerning maximum attainable negative static margin one limit is set by the time to double amplitude after a gust disturbance Looking at some typical existing and projected combat aircraft the paper discusses the fact and the consequences that the same Time To Double leads to different (attainable) static margins (Author)

A82-40881 # **Gust load alleviation on Airbus A 300.** O Sensburg, J Becker, H Lusebrink, and F Weiss (Messerschmitt-Bölkow-Blohm GmbH, Munich and Hamburg, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 44-58 15 refs

An active gust load alleviation system for an Airbus A 300 with a 10% wing span increase is described, along with passive maneuver load alleviation The introduction of active control systems is intended to minimize the incremental structural dynamic loads caused by span expansion or increased wing loading, especially due to gusts The gust magnitude is assayed by a vane or differential pressure sensor in the front fuselage, weighted with a time delay for the vane to wing transit Actuator transfer functions are introduced into the existing active flight controls to compensate fo, unsteady aerodynamic effects A block diagram of the closed loop gust alleviation system is provided, along with linearized equations of motion of elastic aircraft with closed or open loop systems Finally, further studies are indicated in unsteady effects in order to implement passive maneuver load alleviation M S K

A82-40882 # **Calculations of transonic steady state aeroelastic effects for a canard airplane.** N Agrell and S G Hedman (Flygtekniska Forsoksanstalten, Bromma, Sweden) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 59-66 5 refs Forsvarets Materielverk *Contracts No AU-1540,* No AU-1691

A transonic small perturbation potential method for calculation of the aeroelastic effects on aircraft with a canard is presented, and comparisons are made with results of earlier calculations The equation for the disturbance potential is defined and the velocity potential is transformed into a finite difference form Boundary conditions are formulated for subsonic and supersonic regimes and methods of treating steady state aeroelastic effects are discussed A numerical mesh is devised using the SAAB 37 Viggen as an example and solution procedures at sub- and supersonic speeds are presented, covering the speed range of Mach 0 9-1 1 Aeroelastic deformation is calculated by balancing aerodynamic loads against interior forces M S K

A82-40883 # **Computer-aided derivation of equations of motion for rotary-wing aeroelastic problems.** F Kiessling (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Aeroelastik, Göttingen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 67-77 13 refs

A general computer-algebra system has been applied to derive literal equations of motion for the aeroelastic behavior of rotary-wings Inertia, elastic, structural damping, aerodynamic, and gravitational contributions are considered Modal degrees of freedom are provided to represent elastic rotor blades The program input comprises mainly a kinematic description of the system A weighting scheme is used to obtain the most important terms in a consistent manner Multiblade coordinate transformation is applied to reduce or to eliminate periodic coefficients As output, matrices are written in FORTRAN code, which reflect the mathematical model and can be used for further numerical calculations As an example, the suggested procedure is applied to a model of a two-bladed wind turbine mounted on an elastic tower (Author)

A82-40884 # **HAJIF-II - A program system for the dynamic analysis of aeronautical structures.** G -G Liu and J -J Li (Chinese Aeronautical Establishment, Beijing, People's Republic of China) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 78-82 17 refs

HAJIF-II is a program system developed for the calculation of modal parameters of aircraft structures as well as flutter and gust response analyses with active control systems taken into consideration Ninety-nine substructures, each with 7000 degrees of freedom, can be used in the calculation of modal parameters and 50 modes for the flutter and gust response analyses Some new techniques, such as a revised hypermatrix technique, an improved algorithm of simultaneous iteration, and new methods of modal synthesis etc , were developed to improve the efficiency of the system Typical aircraft structures were analyzed and good results were obtained (Author)

A82-40886 # **A practical approach to the incorporation of technical advances in avionics.** J D Bannister and D Roughton (British Aerospace Public, Ltd , Co , Aircraft Group, Brough, North Humberside, England) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 97-107

Features of a program to design, develop, and construct an avionic system demonstrator rig for the next generation of tactical combat aircraft while taking advantage of advances in VLSI hardware are described The VLSI-based architecture permits shared communication and displays, in addition to sensor-dedicated microprocessors Military standard data busses can currently handle up to 31 subsystems through a common transmission line, and further determinations are needed to identify the effects of common mode failures, limitations on the amount of traffic on a bus, the effects of transmission delays, and particular links which cannot be routed through a data bus Details of the functional aspects of pilot, system control, mission, navaids, and aircraft groups to define problem areas, goals, and method to allow an acceptable transition to VLSI-based avionics are discussed M S K

A82-40887 # **Applying advanced technology to flight station design.** W R Paden, Jr and G A Sexton (Lockheed-Georgia Co , Marietta, GA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 108-117

Efforts by Lockheed to develop a flight simulation research facility are described, including the construction of a functional pilot's desk flight station, aircraft systems, and controls expected to be in use in the 1990s Simulators are being constructed to accommodate high resolution CRT color graphics, flat panel displays, touch panel controls, voice command and response systems, head-up displays, and electronic flight and thrust controllers Stages in the realization process are outlined, noting current status in the design and fabrication of the simulator hardware and software Systems under study are an appropriate color format, display formats, and advisory, caution, and warning system and cockpit display of traffic information format Further research on the effects of introduction of the new equipment on pilot performance and on air traffic control are indicated M S K

A82-40888 # The evolution of display formats for advanced fighters using multimode color CRT displays. N M Lefritz, J H Tuttle, Jr (Rockwell International Corp , El Segundo, CA), and M J Forte (Bendix Corp , Teterboro, NJ) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 118-131 Research supported by the Rockwell Independent Research and Development Fund

Efforts to combine electromechanical indicators, instruments, and displays onto multimode, time-shared CRT displays (MMD) in advanced cockpit configurations for military aircraft are described A cockpit configuration is presented in which the stick controller is situated to the right of the pilot, while the center console contains three MMDs Color formatting was guided by goals to minimize electromechanical displays, provide the pilot with information relevant solely to a given mode of operation, have all data available at the pilot's option, use color and formats already implemented by the military, replace symbolic information with pictorial information, and employ the CRT for checklists Procedures for completing an electronic preflight checklist are detailed, in addition to take-off, climb to cruise, emergency conditions, and landing sequences M S K

A82-40889 # Application of advanced exhaust nozzles for tactical aircraft. D L Bowers and J A Laughrey (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 132-141 39 refs

Advanced exhaust nozzles play an important role in the system design for advanced tactical aircraft and offer attractive design options which contribute to total aircraft performance These exhaust nozzles can improve aircraft cruise performance if integrated carefully Thrust vectoring attainable with these exhaust nozzles adds significantly to aircraft maneuver performance STOL performance is obtained by thrust reversing or a combination of thrust reversing and thrust vectoring The significant aircraft performance improvements which lie in advanced exhaust nozzle technology will be determined by past, ongoing and future programs investigating the best application of advanced exhaust nozzles for tactical aircraft (Author)

A82-40890 # Optimized 10 ton class commercial aircraft engine. R Laurens (SNECMA, Moissy-Cramayel, Seine-et-Marne, France) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 142-145

The development program goals and methods for the CFM56 series engines for powering aircraft of 110 to 200 passengers into the 1990s are reviewed The CFM56, in the 20,000 lb class, began with the F101 core Derivatives of the engine are currently used in the DC8-60, the KC-135 tanker, and the 737 Compression ratios have been raised from 25-30 1 to 35-40 1, and the core features a low clearance compressor with rotor temperature control, variable stators on the first four stages, a high speed HP turbine, active clearance cooling in the turbine, and close turning clearances High energy X rays are being employed to improve the clearances and survey the temperature map and cooling system A commonality of 60% has been maintained between generations of the engine M S K

A82-40891 # Recent advances in the performance of high bypass ratio fans. D J Nicholas and C Freeman (Rolls-Royce, Ltd , Derby, England) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 146-158 7 refs Research supported by the Ministry of Defence (Procurement Executive)

Theoretical and experimental techniques employed to improve the efficiency of the high tip speed fan jet engine are reviewed, Design features of high bypass ratio fans, including arrangement of the fan diffusion factors induced by the placement of the outlet guide vanes and the splitter are discussed Overall design parameters of the RB211-22 fan are described, including factors influencing the spanwise work distribution, the outlet guide configuration, and techniques for characterizing the airflow It was found that an optimum tip speed existed for each level of design pressure ratio Performance tests on scale model rigs to determine the spanwise distribution, the blade element performance, and airfoil losses, were compared with actual engine operation It is noted that laser holography, anemometry, and two- and three-dimensional numerical models were employed to identify and define the flow in test rig conditions M S K

A82-40892 # Axisymmetric approach and landing thrust reverser impacts on usage and LCC. J P Blackman, P B Stumbo (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH), and M F Eigenmann (McDonnell Aircraft Co , St Louis, MO) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 159-167 7 refs

The effects on the performance of the F15-C and advanced fighters by the installation of three different types of approach and landing thrust reversers (ALTR) are reported, including projected impacts on thy life cycle costs (LCC) The aircraft were tested in mission configurations comprising a 350 nm subsonic cruise and 200 nm supersonic dash at high altitude, along with appropriate defensive maneuvers The ALTR concepts examined included a rotating vane upstream of the nozzle throat, a translating shroud ALTR downstream of the throat, and a three-door ALTR downstream of the nozzle throat of the advanced air-to-surface vehicle Effects were evaluated in terms of the resultant engine hot time, and cycles of use of the ALTRs in a variety of mission modes The F15-C LCC was estimated to cost 3 8% more using the ALTR, while advanced vehicle LCCs increased 2 4-3 8%, with smallest increases occurring with'downstream ALTR placement M S K

A82-40893 * # Observations and implications of natural laminar flow on practical airplane surfaces. B J Holmes (NASA, Langley Research Center, Hampton, VA) and C J Obara (Kentron Technical Center, Hampton, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 168-181 48 refs

The results of natural laminar flow (NLF) experiments conducted by NASA to determine if modern aircraft structures can benefit from NLF as do sailplanes are presented Seven aircraft, ranging from a Cessna 210 to a Learjet 28/29, with relatively stiff skins were flown in production configurations with no modifications Measurements were made of the boundary-layer laminar to turbulent transition locations on various aerodynamic surfaces, the effect of a total loss of laminar flow, the effect of the propeller slipstream on the wing boundary-layer transition and the boundary-layer profiles, the wing section profile drag, the effect of flight through clouds, and insect debris contamination effects Favorable pressure gradients for NLF were concluded to be feasible up to a transition Reynolds number of 11 million Laminar flows were observed in propeller slipstreams, and insects were found to cause transition 1/4 of the time M S K

A82-40894 # Aerodynamic development of laminar flow control on swept wings using distributed suction through porous surfaces. J A Thelander, J B Allen, and H R Welge (Douglas Aircraft Co , Long Beach, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 182-189 8 refs

Development of a laminar flow control system utilizing distributed suction through porous strips is reviewed Recent improvements in electron beam perforation technology have greatly enhanced the potential for practical LFC application The design of airfoil shapes compatible with LFC on swept wings is outlined Boundary layer stability analysis results and determination of suction distributions are reviewed Considerations for an operational system for protection from ice and insect contamination are noted Results of a swept wing model test and plans for a LFC leading edge glove flight test program are reviewed (Author)

A82-40895 # External aerodynamic design for a laminar flow control glove on a Lockheed JetStar wing. J A Bennett and L B Brandt (Lockheed-Georgia Co , Marietta, GA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 190-202 34 refs

A recent study contract for a subsonic laminar flow control (LFC) transport with a supercritical wing and recent Lockheed research are discussed as background information leading to the design of a JetStar part-span LFC glove to be flight-tested The special design requirements needed to develop the glove and some of the problems encountered during the process are presented The following topics are discussed a method of simulating the interference effects of the body/pylons/nacelles on wing pressures when using an isolated-wing code, wind-tunnel testing of a JetStar model with a wing glove and correlation with theoretical glove pressures, and suction requirements for maintaining a laminar boundary layer (Author)

A82-40896 * # NASA research on viscous drag reduction. R H Petersen and D V Maddalon (NASA, Langley Research Center, Hampton, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p. 203-213 42 refs

Current NASA research points toward exciting opportunities for large reductions in viscous drag Research is underway on natural laminar flow, laminar flow control by suction, and turbulent drag reduction Preliminary results suggest that a significant amount of natural laminar flow can be achieved on small, straight-wing airplanes On larger, swept-wing aircraft, laminar flow control by distributed suction is expected to result in significant fuel savings The area over which laminar flow control is applied depends on tradeoffs involving structural complexity, maintenance, and cost Several methods of reducing turbulent skin friction by altering the turbulence structure itself have shown promise in exploratory testing This paper reviews the status of these technologies and indicates the benefits of applying them to future aircraft (Author)

A82-40897 # **Viscous transonic airfoil flow simulation.** J Longo, W Schmidt (Dornier GmbH, Friedrichshafen, West Germany), and A Jameson (Dornier GmbH, Friedrichshafen, West Germany, Princeton, University, Princeton, NJ) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 214-223 19 refs

The present paper describes a method for the calculation of subsonic and transonic viscous flow over airfoils using the displacement surface concept This modelling technique uses a fast multigrid solver for the full potential equation and laminar and turbulent boundary layer integral methods In addition, special models for transition, laminar or turbulent separation bubbles and trailing edge treatment have been selected However, the flow is limited to small parts of trailing edge-type separation The present paper deals with some theoretical features in a short description and shows computed results compared with experimental data and other methods (Author)

A82-40898 # **Computation of supersonic flow around three-dimensional wings.** B G Arlinger (Saab-Scania AB, Linkoping, Sweden) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 224-232 16 refs

As part of the development of a program for supersonic flow around realistic aircraft configurations a method is presented for the computation of strictly supersonic flow around single wings or two-wing configurations of arbitrary shape The method is based on the steady Euler equations which are solved in a streamwise marching procedure using a shock-capturing finite volume formulation As solution algorithm an explicit predictor-corrector scheme of MacCormack type is used A variety of numerical applications of the method is presented including canard configuration cases, and comparisons are made with other theories and test data confirming versatility and reliability of the method (Author)

A82-40899 # **Transonic small disturbance code for body-wing configuration coupled with full potential code for wing alone.** A Luntz (Israel Aircraft Industries, Ltd , Lod, Israel) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 233-237 7 refs

A transonic small disturbance approximation code TSD was designed, for potential flow around a body-wing configuration This code is based on the embedded fine grid concept elaborated by Ch Boppe Improvements are introduced into the boundary condition representation, including the body boundary condition, the wing boundary condition and the interface between the fine grid box and the coarse grid computation Only cartesian coordinate grids are used The code provides good prediction of the position of the shock on the wing surface, using a comparatively small number (about 20) of grid points along the wing section cord The TSD code is coupled with a modified (no crossflow at the wing root plane) in FL022, is replaced with the crossflow values computed by the TSD code This new boundary condition, at the wing root, contains all information of the body influence needed for the wing pressure computation The coupling allows detailed analysis of the body-wing interference effects in the flow (Author)

A82-40900 # **Advanced fighter technology integration program AFTI/F-16.** A J Bianco and F R Swortzel (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 238-246

The AFTI/F-16 Advanced Development Program is developing and flight validating advanced technologies which improve fighter lethality and survivability The capability is achieved by the integration of mission task-tailored, digital flight controls with a director-type fire control system, and advanced target sensor/-trackers The Digital Flight Control System is the core technology Integration of the systems forms the capability for automated maneuvering attack Evaluation of automation, with respect to the weapon delivery task, is a key program thrust Use is made of nonconventional aircraft control modes to achieve improved maneuverability and weapon line pointing Careful attention is given to pilot/vehicle interface provisions The AFTI/F-16 is now undergoing an extensive test program to provide the confidence necessary to transition the technologies for use on current and future fighter aircraft (Author)

A82-40901 # **Tail versus canard configuration - An aerodynamic comparison with regard to the suitability for future tactical combat aircraft.** G Wedekind (Dornier GmbH, Friedrichshafen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 247-254

Extensive experimental and theoretical research work on tail and canard configurations has recently been done at Dornier, considering the requirements for a future tactical combat aircraft Tail and canard configurations, which were designed for the same tactical requirements, are compared This comparison leads to the conclusion that the canard configuration cannot be regarded superior to the tail configuration, neither with regard to zero-lift drag at supersonic speeds nor with regard to lift-dependent drag at subsonic and supersonic speeds Furthermore, severe problems must be expected regarding lateral and directional stability at high angles-of-attack for a canard configuration It turns out that those problems do not occur or are easier to handle with tail configurations (Author)

A82-40902 # **Material and process developments on the Boeing 767.** J T Quinlivan and D T Lovell (Boeing Commercial Airplane Co , Seattle, WA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 255-261

The design goal of the 767 is an economic service life of 20 years with minimum unscheduled maintenance Materials, material processing, and assembly methods employed on the 767 play a key role in the achievement of this design goal Materials and processes also are key in maintaining weight within design limits for fuel efficiency The 767 uses a wealth of new and improved materials, processing methods, and assembly techniques Some of the innovations are subtle and involve minor changes to previous technology, such as the reduction of certain fastener head diameters Others are more dramatic, such as the use of new aluminum alloys for wing skins or advanced composites for primary flight-control surfaces Corrosion resistance is achieved through material selection, attention to design details, and proper finishing and sealing methods For the most part, the materials selected for the passenger cabin interior are new and are selected for their flame resistance and lack of smoke and toxicant emission during combustion A review of major structural and nonstructural material and process developments on the 767 will be summarized in this paper (Author)

A82-40903 # **The promise of laminated metals in aircraft design.** D H Petersen, L E Sloter, II, W A Poindexter, J L Maris, and G E Kuhn (Vought Corp , Dallas, TX) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 262-269 8 refs

The relative merits of monolithic metals, adhesively bonded sheet metal and a new family of metallurgically bonded laminated alloys are presented and discussed in light of the U S Air Force's laminated metal technology demonstration Advanced Technology Wing program A wing section was designed and constructed whose lower skin consisted of adhesively bonded aluminum layers having no fastener penetrations The elimination of lower wing skin fasteners precludes both corrosion intrusion sites and locations for structural cracking, and in addition reduces manufacturing and assembly costs The wing suffered no damage during two lifetimes of spectrum fatigue testing, as well as an additional 1 8 lifetimes of damage tolerance testing which included exposure to sump water and JP-4 fuel O C

A82-40904 # **Design of compensated flutter suppression systems.** M Lanz and P Mantegazza (Milano, Politecnico, Milan, Italy) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 270-279 37 refs Consiglio Nazionale delle Ricerche *Contract No 81,02536,07*

The paper presents a method to design compensated flutter suppression systems by eigenvalue assignment The compensator is designed as a state observer by paralleling the Luenberger approach The eigenvalues of the aeroelastic system and compensator are obtained by imposing a stationary value to a suitable norm of the gains, under the constraint of satisfying the aeroelastic eigensystem for assigned stable eigensolutions, and without any problem on the modelling of the unsteady aerodynamic forces The compensator can be used not only to reconstruct lacking states, but also to insure insensitivity to different flight conditions A method is presented to mechanize, and possibly to reduce in order, the aeroelastic observer Some simple examples illustrate the use of the method along with comments on the stabilization of an aeroelastic system by eigenvalue assignment techniques (Author)

A82-40905 # Design and experience with a low-cost digital fly-by-wire system in the SAAB JA37 Viggen A/C. K Folkesson, P O Elgerona, and R Haglund (Saab-Scania AB, Linkoping, Sweden) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 280-288 Research supported by the Forsvaret Materielverk

A digital Fly-By-Wire system has been designed built and evaluated as a rig system and as a flight system installed in a JA37 Viggen test aircraft Headlines for definition of the system have been low complexity and low production cost, met by trading off complexity against safety and reliability margins System characteristics are minimized servo hardware, minimized channel interconnections and maximum replacement of hardware by software including servo loop closures Functional development areas are application of optimal control technique for multimode laws and for servo loop computations The paper will present system definition, system mechanization in test aircraft, ground test and flight test information (Author)

A82-40906 * # Design and flight testing of a digital optimal control general aviation autopilot. J R Broussard (Information and Control Systems, Inc , Hampton, VA), D R Downing (Kansas, University, Lawrence, KS), and W H Bryant (NASA, Langley Research Center, Flight Control Systems Div , Hampton, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 289-298 12 refs Contract No NAS1-16303

This paper presents the designs of Proportional-Integral-Filter (PIF) autopilots for a General Aviation (NAVION) aircraft The PIF autopilots use modern control theory to determine heading select and altitude select and hold autopilot modes The PIF control law uses typical General Aviation sensors for state feedback, command error integration for command tracking, digital complimentary filtering and analog prefiltering for sensor noise suppression, a control filter for computation delay accommodation, and the incremental form to eliminate trim values in implementation Theoretical developments for the control law are described which combine the sampled-data regulator with command generator tracking for use as a digital flight control system The digital PIF autopilots are evaluated using closed-loop eigenvalues and simulations Successful flight test results for the PIF autopilots are presented for different turbulence conditions and quadratic weights (Author)

A82-40907 # Preliminary design of an advanced integrated power and avionics information system. G L Dunn, P Leong (Boeing Military Airplane Co , Seattle, WA), and D Fox (USAF, Aero Propulsion Laboratory, Wright-Patterson AFB, OH) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 299-305 Contract No F33615-80-C-2004

An advanced aircraft electrical system is described which meets the requirements for a 1990 time frame two-engine tactical aircraft with multimission capability It features modular design and use of intelligent electrical load management centers with solid state power controllers, resulting in a greatly enhanced aircraft electrical system over that currently available The power generation and distribution, electrical power control, multiplex data bus characteristics, power system processor, electrical load management center, generator control unit, and electrical system software are discussed and diagrammed C D

A82-40908 * # Inlet and airframe compatibility for a V/STOL fighter/attack aircraft with top-mounted inlets. D A Durston and D B Smeltzer (NASA, Ames Research Center, Moffett Field, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 305/a-305/i 9 refs

Aerodynamic force and inlet-pressure data were obtained for 9 5% force and pressure models of a V/STOL fighter/attack aircraft configuration with top-mounted twin inlets Data are presented from wind tunnel tests conducted at Mach numbers of 0 6, 0 9, and 1 2 at angles of attack up to 27-deg and angles of sideslip up to 12-deg Trimmed aerodynamic characteristics and inlet performance were compared for three different leading-edge extension (LEX) configurations The effects of wing leading- and trailing-edge flaps on the inlet were also determined Maneuver performance was calculated from combined force and inlet-pressure data The largest of the three LEX sizes tested gave the best airplane maneuver performance Wing flap deflections improved inlet recovery at all Mach numbers (Author)

A82-40909 # Investigation of the unsteady airloads on a transport aircraft type airfoil with two interchangeable oscillating trailing edge flaps, at transonic speed and high Reynolds numbers. H Triebstein (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Gottingen, West Germany), R Destuynder (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France), and H Hansen (Messerschmitt-Bölkow-Blohm GmbH, Hamburg, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 306-315 8 refs Research supported by the Bundesministerium für Forschung und Technologie

Investigations in unsteady aerodynamics were conducted in order to study the potential of active control technology for transport aircraft wings Wind tunnel tests were carried out using a large two-dimensional model with two interchangeable, fast moving, trailing edge control surfaces of different relative chord The subsonic and supercritical pressure distributions were studied, and the unsteady aerodynamic coefficients were analyzed It is found that in subsonic flow trailing edge separation causes considerable reduction in steady lift, but there is far less influence on the magnitude of the unsteady lift generated by an oscillating control surface Only the corresponding phase angle changes dramatically In transonic flow the development of the supersonic region and the shock strength and location demonstrate a predominant influence on steady as well as unsteady pressure distributions The properties of the supersonic regions and the shocks change considerably with all parameters investigated C D

A82-40910 # Determination of the efficiency of a trailing edge flap in unsteady three-dimensional flow (Determination de l'efficacité d'un volet de bord de fuite en écoulement tridimensionnel instationnaire). H Consigny (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 316-328 18 refs In French Research supported by the Direction des Recherches, Etudes et Techniques and Ministère de la Défense

A study was carried out in order to improve understanding of the three-dimensional unsteady effects of an oscillating part-span trailing-edge flap The experiments were performed on a constant chord and constant thickness supercritical wing mounted on the sidewall of a transonic wind tunnel The model was fitted with some 238 static pressure taps and 136 small unsteady pressure transducers located on several spanwise stations The measurements made for different geometric configurations provided extensive information on the influence of various parameters on both steady and unsteady chordwise pressure distributions and aerodynamic coefficients The experimental results were compared with those obtained by theoretical methods based on the solution of the full potential equation in steady flow and on the classical transonic small disturbances equation in unsteady flow Quasi-steady pressure distributions were also compared to preliminary computational results, including viscous effects C D

A82-40911 * # An investigation of scale model testing of VTOL aircraft in hover. W G Hill, Jr , R C Jenkins (Grumman Aerospace Corp , Bethpage, NY), and M R Dudley (NASA, Ames Research Center, Moffett Field, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 329-335 6 refs Contract No NAS2-10645

Utilizing the unique opportunity created by full scale hover testing of the twin-jet Grumman Design 698 VTOL aircraft in the NASA-Ames Hover Facility, a series of experiments was conducted to evaluate the effectivness of scale model testing in predicting full scale behavior Interference forces were found to be sensitive to aircraft lower surface geometry, but when the geometry was modeled accurately the small scale results matched full scale forces quite well The interference forces were found to be insensitive to core nozzle temperature and fan nozzle pressure ratio The results clearly demonstrate that small scale models can be reliably utilized for aircraft and technology development when the appropriate sensitivities are recognized (Author)

A82-40912 # Optimization of flight with tilt wings (Optimisation du vol à aile battante. P Contensou (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 336-341 In French

Within a structure of simplifying assumptions, a complete solution is presented for the problem of optimizing a tilted flying surface by establishing the law of motion relative to a mobile wing and determining the functions of lift and propulsion for a heavy and inertial body The solutions are compared both with bird flight and mechanical flight C D

A82-40915 * # **Advanced technologies applied to reduce the operating costs of small commuter transport aircraft.** O Masefield, A Turi, and M Reinicke (Pilatus Aircraft, Ltd , Stans, Switzerland) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 352-358 NASA-supported research

The application of new aerodynamic, structural, and propulsion technologies to a specified baseline commuter aircraft is studied The assessment models can be used on a desktop calculator and include a sizing program, operating cost program, and passenger ride qualities model Evaluation is done with a step-by-step approach and is applied to range, number and type of engines, structure, wing selection, and configuration A 40 percent direct operating cost saving is anticipated compared to current well established commuter aircraft C D

A82-40917 # **Design and experimental verification of the USB-flap structucture for NAL STOL aircraft.** M Sano (National Aerospace Laboratory, Tokyo, Japan), Y Fujimori (National Space Development Agency, Tokyo, Japan), and S Maekawa (Kawasaki, Heavy Industries, Ltd , Gifu, Japan) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 370-375 6 refs

In order to verify the safety of the USB flap structure of the NAL STOL experimental aircraft, tests were carried out on structural models, including a test to detect thermal buckling temperature, vibration tests, and an acoustic fatigue test at elevated and room temperature The USB flap structure, the acoustic fatigue design, the structure and static and dynamic characteristics of the test panel are discussed, including the resonant frequency, mode shape and damping coefficient, static thermal response, and dynamic response It was found that thermal buckling occurred on test panels, that resonant frequencies of the flat test panels fall in the range between those of clamped and those of simply supported plates, and that through the prescribed fatigue test period, all structural models proved themselves to be strong enough to resist both acoustic and thermal loading C D

A82-40921 * # **A summary of V/STOL inlet analysis methods.** D P Hwang and J M Abbott (NASA, Lewis Research Center, Cleveland, OH) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 402-409 24 refs

The methods used to analyze the aerodynamic performance of V/STOL inlets at the NASA Lewis Research Center are briefly described Recent extensions and applications of the method are emphasized They include the specification of the Kutta condition for a slotted inlet, the calculation of suction and tangential blowing for boundary layer control, and the analysis of auxiliary inlet geometries A comparison is made with experiment for the slotted inlet and also for tangential blowing Finally, an optimum inlet diffuser velocity distribution is developed (Author)

A82-40925 * # **A unique flight test facility - Description and results.** R R Meyer, Jr (NASA, Flight Research Center, Edwards, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 433-448 13 refs

The Dryden Flight Research Facility has developed a unique research facility for conducting aerodynamic and fluid mechanics experiments in flight A low aspect ratio fin, referred to as the flight test fixture (FTF), is mounted on the underside of the fuselage of an F-104G aircraft The F-104/FTF facility is described, and the capabilities are discussed The capabilities include (1) a large Mach number envelope (0 4 to 2 0), including the region through Mach 1 0, (2) the potential ability to test articles larger than those that can be tested in wind tunnels, (3) the large chord Reynolds number envelope (greater than 40 million), and (4) the ability to define small increments in friction drag between two test surfaces Data are presented from experiments that demonstrate some of the capabilities of the FTF, including the shuttle thermal protection system airload tests, instrument development, and base drag studies Proposed skin friction experiments and instrument evaluation studies are also discussed (Author)

A82-40928 * # **Determination of airplane aerodynamic parameters from flight data at high angles of attack.** V Klein (Joint Institute for Advancement of Flight Sciences, Hampton, VA) and J G Batterson (NASA, Langley Research Center, Hampton, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 467-474 8 refs

The problem of determining airplane aerodynamic model equations and estimating the associated parameters from flight data taken at high angles of attack is addressed Two representations of the aerodynamic function based on the polynomial and spline representations are given Then the technique of building an adequate model using a stepwise regression is presented with examples demonstrating the construction of the model and various approaches to model verification (Author)

A82-40930 * # **Computational and experimental studies of light twin aerodynamic interference.** W G Thomson, W H Wentz, Jr , and C Ostowari (Wichita State University, Wichita, KS) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1, (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 489-495 Research supported by the Beech Aircraft Co and NASA

The results of an analytical and experimental study of aerodynamic interference effects for a light twin aircraft are presented Both the influence of a body (either fuselage or nacelle) on a wing and the influence of a wing on a body are studied The wing studied uses a new natural laminar flow airfoil with variable camber movable trailing edge A three-dimensional panel method program utilizing surface source and surface doublet singularities was used to design wing-nacelle and wing-fuselage fairings Experiments were conducted using a 1/6 scale reflection plane model Forces, pressures, and surface flow visualization results are presented Results indicate that potential flow analysis is useful to guide the design of intersection fairings, but experimental tuning is still required While the study specifically addressed a light twin aircraft, the methods are applicable to a wide variety of aircraft (Author)

A82-40931 * # **Dual wing, swept forward swept rearward wing, and single wing design optimization for high performance business airplanes.** M D Rhodes and B P Selberg (Missouri-Rolla, University, Rolla, MO) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 496-511 32 refs Grant No NAG1-26

An investigation was performed to compare closely coupled dual wing and swept forward swept rearward wing aircraft to corresponding single wing 'baseline' designs to judge the advantages offered by aircraft designed with multiple wing systems The optimum multiple wing geometry used on the multiple wing designs was determined in an analytic study which investigated the two- and three-dimensional aerodynamic behavior of a wide range of multiple wing configurations in order to find the wing geometry that created the minimum cruise drag This analysis used a multi-element inviscid vortex panel program coupled to a momentum integral boundary layer analysis program to account for the aerodynamic coupling between the wings and to provide the two-dimensional aerodynamic data, which was then used as input for a three-dimensional vortex lattice program, which calculated the three-dimensional aerodynamic data The low drag of the multiple wing configurations is due to a combination of two dimensional drag reductions, tailoring the three dimensional drag for the swept forward swept rearward design, and the structural advantages of the two wings that because of the structural connections permitted higher aspect ratios (Author)

A82-40932 * # **Assessment of advanced technologies for high performance single-engine business airplanes.** D L Kohlman (Kohlman Aviation Corp , Lawrence, KS) and B J Holmes (NASA, Langley Research Center, Hampton, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 512-563 24 refs

The prospects for significantly increasing the fuel efficiency and mission capability of single engine business aircraft through the incorporation of advanced propulsion, aerodynamics and materials technologies are explored It is found that turbine engines cannot match the fuel economy of the heavier rotary, diesel and advanced spark reciprocating engines The rotary engine yields the lightest and smallest aircraft for a given mission requirement, and also offers greater simplicity and a multifuel capability Great promise is also seen in the use of composite material primary structures in conjunction with laminar flow wing surfaces, a pusher propeller and conventional wing-tail configuration This study was conducted with the General Aviation Synthesis Program, which can furnish the most accurate mission performance calculations yet obtained O C

A82-40933 * # **The design integration of wingtip devices for light general aviation aircraft.** R V Gifford (NASA, Langley Research Center, Hampton, VA) and C P van Dam (Kansas, University, Lawrence, KS) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings

Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 564-569 21 refs

An investigation was conducted to determine the load carrying capabilities and structural design requirements for wingtip devices on general aviation aircraft Winglets were designed and analyzed as part of a research program involving a typical agricultural aircraft This effort involved analytical load prediction for the winglets, structural design for both the winglets and aircraft installation, structural load testing and flight test verification Conclusions from this program are believed to be applicable to the use of wingtip devices on light-weight general aviation aircraft (Author)

A82-40934 # **Operation V10F - Development of a composite material wing.** G Hellard (Société Nationale Industrielle Aérospatiale, Toulouse, France) and D Chaumette (Avions Marcel Dassault - Breguet Aviation, Vaucresson, Hauts-de-Seine, France) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 570-578

The design development and detailed structural and fabrication method features of the Falcon 10 business jet aircraft carbon fiber reinforced plastic composite wing are described, with emphasis on the design and testing of individual wing structure components such as stiffened ribs and integrally stiffened upper and lower surface panels The testing of laminate composite wing structure element properties included transverse loading, thermal and mechanical fatigue, shear, combined shear and bending, fuel pressure, tension, and compression The delamination and lightning strike behavior of the wing components were also assessed Finally, all structural elements were assembled and tested for static loads and fatigue The composite wing represents a 20 3 percent weight saving over the metallic wing it replaces O C

A82-40935 # **A one-shot autoclave manufacturing process for carbon epoxy components.** M Kaitatzidis, R Renz (Dornier GmbH, Friedrichshafen, West Germany), and D Wurzel (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 579-585

For the Alpha-Jet aircraft Dornier has developed and fabricated a carbon-/epoxy horizontal stabilizer, which has already successfully completed its qualification tests This paper presents the requirements and goals of this development and describes the structural design of the horizontal stabilizer For its leading and trailing edges a new one-shot manufacturing technique has been developed The toolings are described, weight and cost savings are reported This technique is now being applied for series production of ailerons for the Do 228 Commuter Aircraft A brief presentation of the results of the qualification tests under various environmental conditions (humidity and temperature) is given (Author)

A82-40936 # **Non-honeycomb F-16 horizontal stabilizer structural design.** D N Butcher (General Dynamics Corp, Fort Worth, TX) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 586-592

A description is given of the F-16 fighter's horizontal stabilizer structural design and fabrication methods The primary components of the stabilizer are graphite/epoxy composite skins, which are mechanically fastened with countersunk rivets to a one-piece sheet aluminum corrugated substructure and a machined aluminum pivot fitting The skins and substructure are tooled to a common inside mold-line surface to facilitate assembly Weight, construction and maintenance costs comparisons are made with the full depth-bonded honeycomb stabilizer design which the present one will replace Despite a weight of 165 9 lb, by comparison to 157 8, the new stabilizer represents a 50% fabrication cost reduction at the 600th stabilizer produced Lower maintenance costs are expected, in view of the long-term service problems associated with the honeycomb fabrication alternative O C

A82-40937 # **Material identification for the design of composite rotary wings.** V Giavotto, C Caprile, M De Capitani, L Salvioni (Milano, Politecnico, Milan, Italy), V Caramaschi, G C Maffioli, and F Mussi (Costruzioni Aeronautiche Giovanni Agusta S p A, Gallarate, Italy) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 593-606 15 refs

Among the developments that appear to be absolutely needed for the design of advanced composite rotary wings there are material models, to be supported by substantial experimentation and to be capable of an accurate modeling of the behavior of multilayer FRPs, complete of failure criteria regarding all possible failure modes This paper reports an experimental activity carried on by Aerospace Department of Politecnico of Milano in cooperation with Costruzioni Aeronautiche G Augusta The most relevant part of such activity has been a fairly large campaign on tubular specimens in biaxial stress states and plane specimens in uniaxial stress states All tests have been run statically, measuring stresses and strains up to failure The results of such measurements have been so far worked out to verify existing material models and failure criteria No one existing failure criteria seems to be completely adequate to the whose stress domain explored (Author)

A82-40939 # **Dynamic energy transfer between wind and aircraft.** G Schänzer (Braunschweig, Technische Universität, Brunswick, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 615-621 6 refs

The energy effect of vertical wind on glider aircraft is studied The theoretical basis of maximum dynamic energy transfer is discussed, and the energy transfer problem is investigated using a glider with up and downdrafts varying in space The response of the aircraft is calculated with a nonlinear simulation program on a digital computer Maneuvering that produces optimal energy transfer is connected with a high kinetic energy level of the aircraft and high load factors which depend on vertical wind velocities Energy-optimal flight maneuvers significantly increase the average groundspeed of a glider aircraft compared to the procedure described by Nickel and McCready (1949) C D

A82-40940 # **Digital computer simulation of modern aeronautical digital communication systems.** S Chow (Nanjing Aeronautical Institute, Nanjing, People's Republic of China) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 622-629 11 refs

A Monte Carlo simulation method for modern aeronautical digital communication systems is described Its relationship to various parameters is studied, including filtering, limiting, carrier frequency offset, bit time jitter, and multipath effects in A/G and A/A communications (Author)

A82-40941 # **Flight simulation studies on the feasibility of laterally segmented approaches in an MLS environment.** L J J Erkelens (Nationaal Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 630-641 5 refs

On the moving base flight simulator of the NLR an investigation was carried out to establish a number of minimum approach parameters concerning laterally segmented approach paths, assuming that guidance was provided by an MLS facility Seven laterally segmented approach paths with different turn angles and final intercept altitudes were flown manually with a simulated heavy transport aircraft in the final approach configuration Results were obtained in terms of tracking accuracy, pilot effort ratings and pilot responses to a questionnaire A subsequent simulation program was carried out recently, in which as new items were introduced a more realistic simulation of the MLS environment (MLS coverage area and signal noise), implementation of aircraft configuration changes (flaps, landing gear) A third simulation program is prepared in which the interaction is emphasized between the air traffic controller and the flight crew The pilot is vectored to a point within MLS coverage, from which he is expected to intercept a laterally segmented approach path using MLS-guided intercept procedures (Author)

A82-40942 # **A concept for 4D-guidance of transport aircraft in the TMA.** V Adam and W Lechner (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Brunswick, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 642-653 18 refs

The four dimensional (4D) guidance of aircraft in the TMA allows for precise control of the minimum separation and thus efficient use of the available approach capacity of the airport A concept for the 4D-guidance of transport aircraft has been developed and a corresponding control mode has been integrated in an automatic flight control system for transport aircraft The 4D mode is based on the usual radar vector guidance technique of air traffic control and, therefore, is characterized by a succession of flight sections with constant values for indicated airspeed, heading and descent rate The time of arrival is controlled by altering the path via a delay fan The algorithm for the calculation of the commanded 4D flight path takes into account suitable wind models updated by actual wind data In the paper the 4D mode is described and first flight test results are discussed (Author)

A82-40943 # **Optimal open-loop aircraft control for go-around maneuvers under wind shear influence.** H G Jacob (Braunschweig, Technische Universität, Brunswick, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 654-664 24 refs

The optimization procedure is based on the representation of time dependent command inputs by analytical functions The coefficients of these functions are iterated by a static search algorithm to values optimizing the behavior of the process The longitudinal motion in heavy tail wind shear of the Airbus A 300 aircraft is described by a system of nonlinear equations of 4th order bounded by numerous design, safety and comfort constraints The quality criterion is defined in a way to maximize the minimal distance between aircraft and ground as well as the area between flight path and ground For these studies a very simple optimization program has been used which allows to consider boundaries and which comprises less than 100 FORTRAN-statements The optimal input functions and other interesting variables are shown and discussed for the particular case that full power is available and for half power (Author)

A82-40944 # **The nonsynchronous whirls of the turbine rotor in aerojet engines.** J -L Gu and P -Z Ren (Northwestern Polytechnical University, Xian, Shaanxi, People's Republic of China) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 665-673 12 refs

Several factors involved in the stability analyses of the supercritical overhung-rotor-bearing system of a specific type of aircraft engine are discussed The phenomenon of 1/2 order subharmonic vibration within aerojet engines and its causes are assessed, and mathematical expressions for destabilizing forces are worked out The latter include the unbalanced torque force due to circumferential variations of blade tip clearances, the frictional moment within splined coupling, and the aeroelasticity of labyrinth seals Mathematical expressions for parametric excitation are found for the nonlinear stiffness of single-row deep-grooved ball bearings and for the nonlinear stiffness of the back support Equations of motion of the high-speed overhung turbine rotor are derived C D

A82-40945 # **Fluctuating forces and rotor noise due to distorted inflow.** G Neuwerth, R Staufenbiel, A Kellner, and J Schreier (Aachen, Rheinisch-Westfälische Technische Hochschule, Aachen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 674-688 14 refs

The influence of inflow distortions on the rotor blade forces and on their increased radiated noise is theoretically and experimentally investigated Two types of distortions are considered, one involving a ducted rotor whose inflow is distorted by wakes, the other involving a helicopter tail rotor cutting the tip vortices of the main rotor Fluctuations in the direction and magnitude of the flow relative to the blades is Fourier analyzed and the unsteady blade forces and pressures are computed on the basis of two and three-dimensional theories The Fourier coefficients of these forces are used to compute the additional rotor noise emission due to the inflow distortions Measurements of the unsteady blade pressures and the radiated noise power spectrum are in reasonable agreement with the theoretical results C D

A82-40946 # **An experimental and numerical study of 3-D rotor wakes in hovering flight.** M Nsi Mba, D Favier, and C Maresca (Aix-Marseille I, Université, Marseille, France) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 689-699 12 refs Direction des Recherches, Etudes et Techniques *Contract No 78-456*

Results of comparison between experimental and numerical studies on the 3-D wake of a hovering rotor are presented The wind-tunnel investigation is conducted by means of X-hot wires and laser Doppler anemometry procedures to measure the 3-D velocity field under the rotor and to determine the tip vortex paths for several rotor configurations Additional flow visualizations and rotor airloads coefficients are also carried out The prediction model is based on the classical vortex theory with an empirically prescribed geometry of the wake From the blade circulation distribution the rotor wake is represented by vortex lines which are allowed to freely adapt until a converged wake geometry is obtained Then a new estimate of the blade circulation repartition can be deduced The procedure is repeated, iterating until the compatibility between the adapted wake geometry and the blade circulation repartition is obtained The validity range of the calculation model is deduced from comparison with experimental data obtained on instantaneous velocities and tip vortex paths, for different rotor parameters including solidy, number of blades, pitch angle, blade twist, and tip shape (Author)

A82-40947 * # **Aerodynamic interactions between a 1/6-scale helicopter rotor and a body of revolution.** M D Betzina (NASA, Ames Research Center, Moffett Field, CA) and P Shinoda (U S Army, Aeromechanics Laboratory, Moffett Field, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 700-711 6 refs

A wind-tunnel investigation was conducted in which independent, steady-state aerodynamic forces and moments were measured on a 2 24-m-diam, two-bladed helicopter rotor and a body of revolution The objective was to determine the interaction of the body on the rotor performance and the effect of the rotor on the body aerodynamics for variations in velocity, thrust, tip-path-plane angle of attack, rotor/body position, and body nose geometry Results show that a body of revolution near the rotor can produce significant favorable or unfavorable effects on rotor performance, depending on the operating condition Body longitudinal aerodynamic characteristics are significantly modified by the presence of an operating rotor and hub (Author)

A82-40948 # **The prediction of propeller/wing interaction effects.** A S Aljabri (Lockheed-Georgia Co , Marietta, GA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 712-719

An analytical technique has been developed which predicts the influence of a propeller slipstream on a nacelle/wing combination This is achieved by coupling a slipstream code with a complex configuration potential flow analysis code The slipstream code is based on the vortex theory of propellers and predicts the slipstream in terms of its shape induced velocities and swirl angle To verify the slipstream code two experiments with different model propellers were carried out The wake immediately behind these propellers was surveyed and results compared with predictions Good correlation is obtained The coupling of the slipstream code with the panel code allows analysis of propeller slipstream/-nacelle/wing combinations Results comparing the wing spanwise loading with and without slipstream are presented The computational results are found to be in good agreement with experimental data (Author)

A82-40949 # **Wind-tunnel testing of V/STOL configurations at high lift.** W R Sears (Arizona, University, Tucson, AZ) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 720-730 12 refs Contract No N00014-79-C-0010

The results of a study of the problem of the large airstream deflections involved in wind-tunnel testing of V/STOL configurations are reported The concept of adaptive wind-tunnel walls is utilized to eliminate, along with boundary interference, the inaccuracies of the usual tunnel calibration Some numerical models of adaptive-wall tunnels are described and it is shown that the undisturbed stream direction and magnitude, arbitrarily chosen, are achieved by the iterative process of such a tunnel The use of this type of tunnel in an extreme case is demonstrated by constructing and model testing an approximate panel representation of a jet-flap wing of finite span The demonstration is completely sucessful, suggesting that the new tunnel would solve the recurring problem of V/STOL testing C D

A82-40950 # **Estimation of simulation errors in the European Transonic Wind Tunnel /ETW/.** B Wagner (Dornier GmbH, Friedrichshafen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 731-740 22 refs Bundesministerium fur Forschung und Technologie *Contract No LVW-7901, European Transonic Wind Tunnel* Contract No 79/01/68730/143963

Simulation errors in cryogenic wind tunnels caused by real gas effects, changes in viscosity and heat conductivity characteristics at low temperatures, heat transfer, and local condensation are estimated theoretically For this purpose viscous effects and heat transfer influences in transonic high Reynolds number turbulent flows are calculated by solving numerically the full Navier-Stokes equations for shock wave boundary layer interactions and by calculating boundary layers on airfoils, real gas equations of state and non-adiabatic walls being included in both procedures Equilibrium condensation approximating the case of heterogeneous nucleation is investigated in transonic airfoil flows by means of numerical solutions of the full inviscid Euler equations The separation behavior is shown not to be sensitive to real gas effects and small amounts of heat transfer The condensation influence is primarily seen by a considerable drag increase (Author)

A82-40953 # **Prediction of high alpha flight characteristics utilizing rotary balance data.** W Bihrle, Jr (Bihrle Applied Research, Inc , Jericho, NY) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 761-768

Rotational flow aerodynamic data, as measured by a rotary balance at low Reynolds number, are used to analytically predict steady spin modes and post-stall motions The excellent agreement obtained between predicted and full-scale flight results would indicate that use of low Reynolds number rotary balance data is sufficient for calculating steady-spin modes for military configurations and general aviation configurations not having large wing leading-edge radii Considerations, however, in the application of these low Reynolds number data to steady-state spin analysis, as well as large angle, six degree-of-freedom high alpha studies, are discussed Also, the procedure for developing a configuration highly resistant to spins is illustrated (Author)

A82-40955 # Experimental and theoretical studies of three-dimensional turbulent boundary layers on an empennage of a typical transport airplane. H C Seetharam, N J Pfeiffer, M Ohmura, and J D McLean (Boeing Commercial Airplane Co , Seattle, WA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 1 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 784-795 6 refs

This paper describes experiments conducted to measure the three-dimensional incompressible turbulent boundary layers on the horizontal and vertical tails of a 1/5 scale model of a transport airplane empennage The boundary layer measurements were made with a V-shaped anemometer with a high precision traversing mechanism Variations of angle of attack and Reynolds number were included in the tests Measurements were also made with small elevator and rudder deflections The data includes extensive pressure distributions, and detailed analyses of three-dimensional boundary layer data Comparison of the experimental data with a three-dimensional boundary layer code taking into account viscous-inviscid interaction is shown Details of the test theory comparison and the need for a better turbulence model are discussed (Author)

A82-40956 # Requirements and trends in fuel consumption in transport mission with aircraft and surface vehicles. G Gabrielli In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 796-799

A discussion is presented of the energy utilization factor, f, which relates the payload product of a vehicle, yielded by weight and route distance, to the mechanical energy used Values of f are presented which have been derived from several hundred sea, land and air vehicles of 15 different types in view of their customary missions It is demonstrated that turboprop aircraft, and to an even greater degree turbojet aircraft, are the only types of vehicles which offer higher transport speeds without a corresponding reduction in the energy utilization factor O C

A82-40957 # Aerodynamic concepts for fuel-efficient transport aircraft. G Krenz and R Hilbig (Vereinigte Flugtechnische Werke GmbH, Bremen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 800-810 8 refs

The rapid inflation of jet fuel prices in the last decade contributes largely to the growing operating expenses of the airlines and to a disproportionate share of the Direct Operating Costs (D O C) as well, wherein the fuel share is already dominant This report describes the influence of the increasing fuel costs on the aircraft design and explains the manner in which the lift/drag ratio as design parameter is steadily increasing in importance compared to the weight The evaluation of the fundamentals for a new fuel efficient aircraft is a challenge for both, designer and aeronautical research On the other hand there still exist potentials for performance improvements in terms of L/D for most of the current aircraft in service, as they were generally designed for minimum weight performance This paper gives examples for aircraft modifications for performance improvement and shows potentials for future designs in the field of aerodynamics (Author)

A82-40958 # Progress at Douglas on laminar flow control applied to commercial transport aircraft. W E Pearce (Douglas Aircraft Co , Long Beach, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 811-817

Design studies, development efforts and testing related to laminar flow control for subsonic commercial transport aircraft are described in this paper The paper covers selection of a suitable suction surface, integration of the suction system, and results of LFC aircraft design studies Current programs which include wind tunnel testing and flight testing are discussed as well as proposed future LFC activities (Author)

A82-40959 # Cracks interacting with contact forces - A finite element study on loaded holes. H Ansell and B Fredriksson (Saab-Scania AB, Linkoping, Sweden) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 818-825 17 refs Research supported by the Forsvaret Materielverk

A computerized method for the simultaneous solution of the contact and stress intensity factor problem has been developed The solution is based upon the finite element method using virtual crack extension method for stress intensity factor calculations The method is generally applicable to both two- and three-dimensional problems and both through- and part-through cracks could be studied The method has been applied to a lug with pressfitted sleeve and shaft. Both single- and doublesided cracks are studied Contact pressures and stress intensity factors during crack propagating are presented The stress intensity factors are compared with experimental results The importance of the simultaneous solution of the contact and crack problem is demonstrated (Author)

A82-40961 # A crack growth model under spectrum loading. B -X Yang (Beijing Institute of Aeronautics and Astronautics, Beijing, People's Republic of China) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 837-843 12 refs

In the present study, based on the mechanisms of delayed retardation of overload retardation effect, an analytical equation for predicting the delayed retardation parameter is presented Further, a model for predicting the retardation under tensile overloads and tensile-compressive overloads is proposed, and it can be used to predict the fatigue crack growth rate and fatigue life under complex spectrum loading And as an example, the retardation effects of some materials under different loading conditions are predicted The fatigue life of stiffened panel of wing and landing gear of aircraft under complex spectrum loadings are predicted Predictions agree very well with experimental results (Author)

A82-40962 # Age exploration in naval aviation. A D Williams (U S Navy, Naval Aviation Logistics Center, Patuxent River, MD) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 844-850

In this paper, an overview of the United States Navy's newly developed aviation age exploration process is given As age exploration is a subset of the Reliability-Centered Maintenance (RCM) program, the underlying concepts of age exploration, RCM, and their relationship to each other, are explored Age exploration is depicted as a multi-faceted analyzation, marrying diverse types of information with maintenance engineering logic and statistical formulation Specific applications of the age exploration process, in the Navy's aviation community are presented It is shown how the knowledge gained from age exploration enables the designer of the RCM requirements to effect maximum uptime of the equipment at the lowest cost within the bounds of safety (Author)

A82-40963 # Logistics research program in the United States Air Force. J C Reynolds and P E Davidson (USAF, Coordinating Office for Logistics Research, Wright-Patterson AFB, OH) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 851-853

An assessment is given of the factors which contribute to the lack of interest and investment of resources in logistics research and development, with emphasis on the need to integrate the consideration of logistics into research and development activities, and attention to the program developed toward that end by the U S Air Force USAF program results demonstrate that any agency with logistics responsibilities can improve its technical capabilities and operational methods through management attention and the cooperation of the logistics and research and development communities O C

A82-40964 # Third generation turbo fans. J F Coplin (Rolls-Royce, Ltd , Derby, England) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 867-878

The modular design concept of the RB211 family of turbofan aircraft engines has allowed the progressive improvement of fuel efficiency through refinement of the design of individual components, resulting in gradual increases of optimum pressure and bypass and temperature ratios The RB211-535E4, which is the latest engine derived from the basic RB211 design and is destined for use by the 757 airliner, incorporates inherent precision tip clearance control, thermal barrier coatings, creep-resistant titanium alloys, supercritical airfoil designs, a single nozzle exhaust, a single stage, wide chord clapperless fan, and three-dimensional core compressor and core turbine designs Attention is given to the basic research conducted on component efficiency, which involved the use of laser holography and laser anemometry techniques for observing and measuring aerodynamic flow O C

A82-40965 # Turboprop design - Now and the future. B S Gatzen (United Technologies Corp , Hamilton Standard Div , Windsor Locks, CT) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 879-903 92 refs

After an account of the development history of turboprop rotor technology during the 1960s for V/STOL applications, the development status and design and performance characteristics of commuter aircraft turboprop and high speed propeller fan rotor technologies are considered The commuter aircraft propeller family incorporates composite shell and aluminum spar blades with a double-acting pitch change system and a pitch-lock feature, resulting in weight reduction, greater safety, improved durability, and a near-ideal aerodynamic performance in the Mach 0 4-0 65 range that assures low cabin noise levels and meets far field noise certification requirements The propeller fan incorporates 8-10 blades with swept blade tips for the Mach 0 65-0 8 range cruise speeds of 80-160 passenger transports and military cargo and ASW aircraft The propeller fan will result in fuel consumption reductions of 20% and 40% for commercial and military aircraft, respectively O C

A82-40966 # Inflated wings. A Roselli In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 904-910

The design principles and possible uses of both statically and dynamically inflated wings are considered, on the basis of their inherently high strength/weight ratios, economy of construction, and ease of storage and deployment It is noted that the upper surface of a large statically inflated wing acts as a greenhouse-effect solar trap which may be harnessed to provide both static buoyancy, as in a hot air balloon, and energy for propulsion Attractive uses of these large, kite-like wings include auxiliary power for ships, seed, fertilizer and insecticide-spraying platforms for agriculture, and military parachutes O C

A82-40967 # Design and tests of airfoils for sailplanes with an application to the ASW-19B. L M M Boermans and H J W Selen (Delft, Technische Hogeschool, Delft, Netherlands) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 911-921 14 refs

The paper describes the considerations, tests and results of an investigation aimed at designing some improved airfoils for sailplane applications The following preliminary studies are discussed Windtunnel experiments on two actual wing segments of a Standard Class sailplane ASW-19B are described The characteristics of some modern airfoils for sailplanes are analyzed Results of flight and windtunnel experiments with respect to leading edge contamination by insects are presented The effectiveness of pneumatic turbulators, applied to decrease the airfoil drag by avoiding laminar separation bubbles, is demonstrated Based on the experience gained in these studies, some airfoils were designed and, after windtunnel verification, applied to the wing of an ASW-19B Flight performance measurements before and after the wing modification showed an improvement of 5% in glide ratio over the entire practical flight speed range (Author)

A82-40968 # Variable geometry aerofoils as applied to the Beatty B-5 and B-6 sailplanes. R A Streather (Atlas Aircraft Corp , Johannesburg, Republic of South Africa) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 922-930 11 refs

Two variable-geometry aerofoils using flexible surfaces have been developed by Beatty for his B-5 and B-6 sailplanes The B-5 has a basic Eppler 1001 section with a flexible upper surface which is raised to form a thick, high-camber profile for thermalling The B-6 uses a Wortman FX 05-H-126 section with flexible upper and lower surfaces over the rear 40% of the chord Predictions for the polars of the two sections using the Eppler and NASA viscous, two-dimensional computer programs are presented Predictions for the overall aircraft polars are compared with flight-test measurements obtained by conventional methods and by using a prototype glide-angle indicator (Author)

A82-40969 # Development of the Circulation Control Wing-Upper Surface Blowing powered-lift system for STOL aircraft. M J Harris, J H Nichols, Jr , R J Englar, and G G Huson (David W Taylor Naval Ship Research and Development Center, Bethesda, MD) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 931-939 10 refs

The design characteristics and performance levels attained in static, wind tunnel and test aircraft operation of the Circulation Control Wing/Upper Surface Blowing (CCW/USB) powered lift system for STOL aircraft are described The configuration of the system places turbofan engine exhausts above the upper surface of a Coanda-effect trailing edge circulation-control wing, so that the exhaust gases scrub the wing upper surface In addition to controlling effective wing camber with circulation control blowing, propulsion-induced lift is generated through the downward deflection of turbofan exhaust over the trailing edge of the wing to a degree which is controlled pneumatically by the momentum of the circulation-control jet sheet It is experimentally demonstrated that the mechanically simple CCW/USB pneumatic system can generate high lift as effectively as the heavier and more complex mechanical flap systems O C

A82-40970 # Ejector powered propulsion and high lift subsonic wing. R A Squyers, J L Porter (Vought Advanced Technology Center, Dallas, TX), K S Nagaraja (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH), and G F Cudahy (Fairchild Republic Co , Farmingdale, NY) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 940-950 8 refs Contract No F33615-79-C-3017

A high performance ejector wing is designed by means of methodologies based on three-dimensional vortex lattice and lifting line theories and two-dimensional analog techniques, in conjunction with viscous flow predictions and empirically based ejector augmentor design and performance procedures The initial analytical consideration of various ejector wing configurations established the superior lift and thrust performance at high angles of attack of a configuration consisting of a constant pressure mixing ejector with a wing lower surface inlet and an upper wing trailing edge exhaust flow Test results for a swept planform, four-ejector bay wing configuration indicate maximum lift/drag ratio improvements over a conventional wing of up to 27%, and an angle of attack increase of more than 10 deg without stall A thrust augmentation factor of 1 06 was achieved at a freestream Mach number of 0 294, in keeping with predictions O C

A82-40971 # Development of an advanced no-moving-parts high-lift airfoil. R J Englar (David W Taylor Naval Ship Research and Development Center, Bethesda, MD) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 951-959 15 refs

An advanced Circulation Control Wing (CCW) airfoil has been developed by incorporating a very small radius blown trailing edge into the aft profile of an existing supercritical airfoil This combined no-moving-parts configuration generates the same high lift as the already flight-proven large-radius CCW airfoils (section lift coefficient near 7), yet produces negligible unblown drag penalty due to leaving the device deployed for cruise flight The large leading edge radius of the supercritical airfoil allows high-lift operation without mechanical deflection Experimental results presented by the paper imply the feasibility of an efficient mono-element cruise and high-lift airfoil, with transition between the two modes accomplished by merely initiating blowing from the fixed trailing edge slot Comparisons to existing blown and unblown high lift systems are made, and possible applications are discussed (Author)

A82-40972 # Design integration of CCW/USB for a sea-based aircraft. H S D Yang (Lockheed-California Co , Burbank, CA) and J H Nichols, Jr (David W Taylor Naval Ship Research and Development Center, Bethesda, MD) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 960-968 8 refs

A design study is being conducted to apply the technologies of Circulation Control Wing with Upper Surface Blowing (CCW/USB) engine installation to a Navy/Lockheed sea based aircraft Research and development in the CCW and USB concepts indicate that the application of the combined technologies may achieve a goal of operating the S-3 type aircraft from a ship deck without the catapult The design emphasizes the integration of the propulsion system with a simple installation to obtain high lift or drag when required Attention is also being directed to the cruise efficiency and the optimum design approach for stability and control (Author)

A82-40973 # Aircraft design for fuel efficiency. L O Lehman, D Woll, and C Lampart (U S Naval Material Command, Naval Air Development Center Warminster, PA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle WA August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York American Institute of Aeronautics and Astronautics, 1982, p 969-979 6 refs

U S Navy Aircraft Energy Conservation Research, Development Test and

Evaluation Program recommendations to date are presented, with emphasis on those aircraft design approaches which promise the greatest fuel savings for a given level of investment In addition to design modifications which reduce aerodynamic drag or aircraft weight, attention is given to efficiency-enhancing propulsion system concepts, Flight Performance Advisory/Management Systems which improve mission fuel utilization, and mission planning and training techniques which improve operational effectiveness The study results cover fighter, attack and patrol aircraft, and includes recommendations for such year 2000 air vehicles as nuclear aircraft and advanced lighter-than-air vehicles O C

A82-40974 * # Performance characteristics of a buoyant quad-rotor research aircraft. B L Nagabhushan, P P Jacobs, C E Belknap (Goodyear Aerospace Corp , Defense Systems Div , Akron, OH), and D A Euler (Hughes Helicopters, Inc , Commercial Engineering Div , Culver City, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 980-989 Contract No NAS2-10777

Performance characteristics of a buoyant, quadrotor research aircraft, which represents a hybrid airship concept for heavy lift application, are described Ceiling altitude and endurance for hovering at typical power levels, including partial power failure, are predicted Climb performance at various altitude and gross weight conditions have been examined Forward flight performance of this vehicle is illustrated in terms of typical performance parameters such as maximum speed, maximum range, and endurance, over the full range of its payload capability Optimum payload weights have been identified which result in maximum range at sea level density altitude and constant endurance at various altitudes, both during hover and cruise flights (Author)

A82-40975 # Application of a new hybrid material /ARALL/ in aircraft structures. J W Gunnink, L B Vogelesang, and J Schijve (Delft, Technische Hogeschool, Delft, Netherlands) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 990-1000 18 refs

An aircraft structural material produced by the bonding of thin aluminum alloy sheets with an aramid fiber-reinforced adhesive, designated Aramid-Reinforced Aluminum Laminate (ARALL), is described ARALL exhibits superior fatigue crack growth properties, and has a high tensile strength which may be maximized through the introduction of suitable residual stresses into laminates having optimized aluminum sheet thicknesses Monolithic material test results are used as reference in comparative tensile strength and fatigue tests for notched and centrally cracked ARALL specimens, bolted and riveted joints, and lugs Buckling test results are compared with calculations for both aluminum alloy and ARALL compression panels Attention is given to the weight savings obtainable in pressurized cabins representative of various existing aircraft through the use of ARALL O C

A82-40976 # The behavior of composite thin-walled structures in dynamic buckling under impact. J Ari-Gur, J Singer (Technion-Israel Institute of Technology, Haifa, Israel), and H Röhrle (Dornier GmbH, Friedrichshafen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1001-1010 12 refs

The influence of material properties, and in particular those of composites, on response and behavior of columns under axial impact is studied An extensive experimental investigation has been carried out on specimens made of graphite/epoxy, glass/epoxy and Kevlar/epoxy laminates with different layups Dynamic buckling and failure are compared with those of metal columns and the relative advantages and disadvantages of the composite materials are discussed In general, composite columns show improved dynamic buckling properties, and, with several exceptions, they may replace metal ones efficiently and reliably (Author)

A82-40977 # Nondestructive testing in aircraft construction using holographic methods. K Wanders (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Cologne, West Germany) and H Steinbichler (Laboratory Dr H Steinbichler, Endorf, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1011-1017 10 refs

The application of high power laser-based holographic interferometry to aircraft structure nondestructive testing is described The techniques covered include real time holography, which denotes structural deformation through the dark bands of destructive interference, the double exposure method, in which structural stresses applied between exposures are manifested as interference fringes among odd multiples of one-half wavelength, and time-average holography, which reconstructs wavefront interference between two virtual images of a vibrating structure The concrete examples given are of a glass fiber-reinforced plastic tube, a helicopter rotor blade, the running surface of a tire, a turbine rotor, and a thermally deformed antenna, as well as exhaust nozzle jets O C

A82-40978 # Design and fabrication of cocured composite hat-stiffened panels. G D Peddie and E E Spier (General Dynamics Corp , Convair Div , San Diego, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1018-1031 7 refs

Design/analysis study established cocured graphite-epoxy hat-stiffened panels of high compressive structural integrity for development and demonstration by mechanized methods Both flat and curved-crown hats were involved in the design/analysis study, but only the flat-crown concept was included in the manufacturing study It was found that manufacture of the curved-crown hat would not result in added complexity Post-buckling structural integrity was assumed to be directly related to the summation of classical local bifurcation buckling strengths of panel elements Parts were built in stages with the final panel being 18 feet long Mechanization and tooling procedures were proven to be valid for the manufacturyof long panels Test panels were not fabricated in time for correlation with analysis, but testing will be performed in the near future (Author)

A82-40979 # Spin behaviour of the Pilatus PC-7 Turbor Trainer. P Wittwer and O Masefield (Pilatus Flugzeugwerke AG, Stans, Switzerland) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1032-1039

Experience gained during the development of the PC-7 Turbo Trainer aircraft suggests that while spin tunnel tests are helpful in determining the critical points of a design's spin characteristics, an exhaustive and accurate forecast of spin behavior is not attainable The spin tunnel test model used for the PC-7 had a generally steeper nose-down attitude, and was faster turning, than the prototype aircraft Recovery turns were, however, accurately represented Attention is given to the differences in spin behavior resulting from a series of modifications to the prototype aircraft in the course of its spin test program O C

A82-40982 # Models for the motor state of VSCF aircraft electrical power system. X Qiu, Y Yan, and Y Hu (Nanjing Aeronautical Institute, Nanjing, People's Republic of China) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1061-1071

Mathematical models for the motor state of an AC-AC variable speed constant frequency (VSCF) power system are established in this paper Two computing methods, of which the first is a method for finding the analytic solution of the state transition matrix with a computer and the second is a combination of the 0 618-optimization method and the Runge-Kutta method, are proposed These methods reduce computation time (Author)

A82-40983 # The effect of intake flow disturbances on APU compressor blade high cycle fatigue in the Airbus A300. K W Lotter and J Jörg (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1072-1081 7 refs

Premature compressor failures of the APU in the Airbus A300, related to high cycle fatigue, led to a detailed investigation of the relevant intake/engine parameters Relatively high total pressure distortion and excessive flow angularity have been determined to be the cause of high alternating blade loads and, in combination with the chosen material of the compressor disk and blades, surface fretting In systematic test steps intake modifications were developed to improve the intake flow quality It is shown that only relatively minor intake modifications were required to achieve a substantial improvement in total pressure distortion and swirl In addition, a suitable modification at the compressor blade dove-tails was initiated to increase the blades' fatigue strength (Author)

A82-40984 # Engine controls for the 1980s and 1990s. V A Fisher (Rolls-Royce, Ltd , Bristol, England) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1082-1087

After a brief developmental history of full-authority electronic engine control systems, with attention to that employed by the Olympus 593 engines of the Concorde SST, consideration is given to the developmental prospects for such systems in the near future in view of the increasing power of microprocessors

The fault tolerance characteristics, transducer systems, high integrity software and reliability/maintainability of the projected full authority digital electronic control (FADEC) system are described, with attention to fault identification and flight crew notification procedures The RB211-535C turbofan engine will be equipped with such a FADEC system O C

A82-40985 # **Advanced aerodynamic wing design for commercial transports - Review of a technology program in the Netherlands.** N Voogt (Fokker, Amsterdam, Netherlands) and J W Slooff (National Lucht- en Ruimtevaartlaboratorium, Amsterdam, Netherlands) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1088-1098 16 refs

An aerodynamic technology development program is described, whose main objectives are the formulation and validation of a computational procedure for the aerodynamic design of high aspect ratio wings for the transonic regime of short-/medium range commercial aircraft, as well as the establishment of a transonic technology base An inverse procedure has been formulated for the wing design task which allows the excercise of explicit control over wing geometry while approaching the target pressure distribution as closely as possible Experience has been gained in relating target pressure distributions to off-design conditions through two-dimensional airfoil and three-dimensional wing studies, together with wind tunnel verifications that included the assessment of high Reynolds number characteristics A wing-body configuration computational analysis capability for drag minimization studies has also been achieved by the program O C

A82-40986 # **Recent airfoil developments at DFVLR.** H Körner and G Redeker (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Entwurfs-Aerodynamik, Brunswick, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1099-1114 37 refs

New airfoils may bring a substantial improvement in the aerodynamic efficiency of airborne vehicles A number of new airfoils based on transonic and laminar concept have been designed and investigated at DFVLR With theoretical design methods and facilities for experimental verification at hand, airfoils for subsonic transports, sail-planes, propellers, helicopter rotors and combat aircraft have been developed (Author)

A82-40987 # **Wing-tip jets aerodynamic performance.** J M Wu, A Vakili, and Z. L Chen (Tennessee, University, Tullahoma, TN) In. International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2. (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1115-1121 32 refs. Contract No F33615-81-K-3034

This paper presents the preliminary study of wing-tip jets blowing techniques to achieve improvements in the wings aerodynamics performance The feasibility of utilizing wing-tip jets to reduce the currently popular winglets has been conducted The idea is to study the potential of replacing solid winglets by more flexible wing-tip jets to suit changing flight conditions The wing-tip jets modify the flow-field near the wing tip and could achieve better aerodynamic performance of the wing A first order calculation has been made to check the air-jet advantage versus the disadvantage in degrading the jet-engine performance by bleed-off of compressed air The result indicate that the power (or thrust) saved is significant enough to encourage us to explore this new concept Munk's minimum induced drag criterion has been extended to formulate the split branched wing-tips by utilizing multi-ports jet Moreover, it is also conceived that an added jet swirling effect may induce a circulatory motion. The induced local downwash could alter the new wing-tip flow and thus suppress the main wing-tip-roll-up vortex For this purpose, wind-tunnel tests with a half-wing model have been conducted to verify this concept This is done by controlling the jet blowing direction and magnitude (Author)

A82-40988 # **An experimental investigation of leading-edge spanwise blowing.** W Su, M Liu, B Zhou, C Qiu, and S Xiong (Beijing Institute of Aeronautics and Astronautics, Beijing, People's Republic of China) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1122-1132 13 refs

Oil flow visualizations and pressure measurements on a 30-deg swept trapezoidal wing were conducted to investigate leading edge spanwise blowing (LE SWB), which is very near the leading edge and along it The LE SWB can provide a higher maximum lift coefficient than conventional SWB It can generate a more stable jet leading edge vortex above the inboard wing, and the outboard wing leading edge vortex can also be enhanced The flow patterns of the wing with LE SWB are similar to those of a strake-wing configuration (Author)

A82-40989 # **Vortex formation over double-delta wings.** U Brennenstuhl and D Hummel (Braunschweig, Technische Universtät, Brunswick, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1133-1146 20 refs

Low speed wind tunnel tests have been carried out on a series of double-delta wings The effects of variations in leading edge kink angle and in kink position have been investigated by mens of three-component pressure distribution and flow-field measurements, as well as by flow visualization at a Reynolds number value of 1 3 million At small angles of attack two primary vortices exist on each side of the wing, originating from the apex and from the leading-edge kink At moderate kink angles these two vortices join each other with increasing angle of attack The junction process is analysed in detail and is intrepreted as a 'potential flow effect' At very large angles of attack vortex breakdown occurs within the jointed vortices, which leads to the limitation of the aerodynamic coefficients (Author)

A82-40990 # **CATIA - A computer aided design and manufacturing tridimensional system.** F Bernard (Avions Marcel Dassault-Breguet Aviation, Suresnes, Hauts-de-Seine, France) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1147-1154

A properietary computer graphics-aided, three-dimensional interactive application (CATIA) design system is described CATIA employs approximately 100 graphics displays, which are used by some 500 persons engaged in the definition of aircraft structures, structural strength analyses, the kinematic analysis of mobile elements, aerodynamic calculations, the choice of tooling in the machining of aircraft elements, and the programming of robotics CATIA covers these diverse fields with a single data base After a description of salient aspects of the system's hardware and software, graphics examples are given of the definition of curves, surfaces, complex volumes, and analytical tasks O C

A82-40991 # **CDS-the designer's media, the analyst's model.** D P Raymer (Rockwell International Corp, Los Angeles, CA) and S K Albrecht (Rockwell International Corp, Space Transportation and Systems Group, Downey, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1155-1163 6 refs

A proprietary Configuration Development System (CDS) is described which incorporates both a flexible interactive graphics program for the conceptual design of aerospace vehicles and a three-dimensional geometric data base which may be used by analysis programs Experience to date with the CDS has demonstrated substantial productivity improvements, although, as noted by Sandusky' (1978), such gains are more pronounced in the conduct of iteration procedures than in the reduction of throughtime Nevertheless, optimal results are reached at an earlier stage of the design process Graphics examples are given from CDS work on the FDL-5 and FDL-8 lifting body manned orbital vehicles O C

A82-40992 * # **Aircraft geometry verification with enhanced computer-generated displays.** J V Cozzolongo (NASA, Ames Research Center, Moffett Field, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1163/a-1163/j 11 refs

A method for visual verification of aerodynamic geometries using computer-generated, color-shaded images is described The mathematical models representing aircraft geometries are created for use in theoretical aerodynamic analyses and in computer-aided manufacturing The aerodynamic shapes are defined using parametric bi-cubic splined patches This mathematical representation is then used as input to an algorithm that generates a color-shaded image of the geometry A discussion of the techniques used in the mathematical representation of the geometry and in the rendering of the color-shaded display is presented The results include examples of color-shaded displays, which are contrasted with wire-frame-type displays The examples also show the use of mapped surface pressures in terms of color-shaded images of V/STOL fighter-/attack aircraft and advanced turboprop aircraft (Author)

A82-40993 # **Technical and economic comparison of carbon fiber tape and woven fabric applications.** G Hilaire and G Briens (Société Nationale Industrielle Aérospatiale, Laboratoire Central, Suresnes, Hauts-de-Seine, France) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1164-1172

A comparative study is made of the structural performance characteristics of various types of carbon fiber fabrics and unidirectional filament prepreg tapes, in view of the relative equality of the importance, in recent applications of carbon fiber composites, of weight reduction, strength maximization, and reductions in manufacturing costs The comparisons are between a 3000-filament (3 K) tow, T 300 carbon fiber, 5 H satin weave cloth weighing 285 g/sq m when dry, and a 3 K T 300 tape Both are impregnated with 5208 resin and in that state represent 60 percent fiber volume composites The performance charactersitics considered are interlaminar shear, notched and unnotched tensile strength, and compressive strength The consequences of each alternative for manufacturing are assessed for the cases of manual and automated lay-up, machining and cut trimming

O C

A82-40994 # **Application of composite materials and new design concepts for future transport aircraft.** R H Lange and J W Moore (Lockheed-Georgia Co , Marietta, GA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1173-1181 30 refs

The application of advanced technologies and the use of innovative aircraft design concepts show the potential for significant improvement in the fuel efficiency of future transport aircraft envisioned for operation in the mid to late-1990s This paper reviews recent preliminary design system studies of transport aircraft featuring cost/benefit analyses of advanced technology and new vehicle design concepts Emphasis is directed toward the use of graphite epoxy composite materials in the primary and secondary structures of transport aircraft The data on aircraft design concepts include preliminary design studies of Advanced Civil/Military Aircraft (ACMA) aircraft and innovative configurations The aircraft design parameters include cruise Mach numbers of 0 75 to 0 80, design payloads from 330,000 to 772,000 lbs, and range from 3,500 to 4,000 nautical miles

(Author)

A82-40995 # **Sliced disc design - A composite conform concept for a turbo engine axial compressor.** R Kochendorfer (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Bauweisen- und Konstruktionsforschung, Stuttgart, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1182-1191 5 refs

For an 800 kW turbo engine demonstrator an axial compressor concept in composite technology was developed The aim was a reduction of mass and moment of inertia compared to a titanium design The geometry and the blade spacing required a single-blade attachment concept To minimize the problems in the shear loading area, the 'compressor rotor' was divided into individual segments, made of aluminum alloy Each of the Al-segments represents the root part of a B/Al blade In the leading and trailing edge areas these segments are shrunk together by composite hoops, which also sustain the centrifugal loads As long as the shrinkage pressure is present, the segmented disk exhibits a similar behavior as an unsliced disk This sliced disk concept was successfully proof-tested in cold spin tests up to the design level of 47,600 rpm, corresponding to a maximum blade tip speed of 420 m/sec (Author)

A82-40996 # **Comparison of HP turbine 'deep blade design' effects in turbofan engine gas generators with different bearing structure configurations.** D Rist (Munchen, Technische Universität, Munich, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1192-1202 5 refs

Two different types of gas generator bearing structure configurations have been investigated for a projected turbofan engine based on the deep blade design concept Mechanical analyses are carried out for defined operation and load cases to estimate the required mass increase for the main components It is shown that when the HP turbine rotor blade chord length is increased by 50%, the mass of the turbofan engine core increases by about 7 and 11% for the two configurations investigated V L

A82-40998 # **Redundant control unit for an advanced multispool engine.** G Dahl (Bodenseewerk Gerätetechnik GmbH, Uberlingen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1214-1221

The advantages and disadvantages of the use of digital technology for the control of modern multispool engines are discussed with reference to a newly developed redundant digital engine control unit The controller structure is discussed with emphasis on software design and software verification methods It is shown that the many advantages resulting from the introduction of digital technology, such as increased reliability, improved maintainability, and internal controller intelligence, make up for the inevitable disadvantages associated with the sampling process and computer delay time V L

A82-40999 # **Test results of chordwise and spanwise blowing for low-speed lift augmentation.** G A Howell (General Dynamics Corp , Fort Worth, TX) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1222-1234 11 refs

Low-speed wind tunnel tests were conducted on a large-scale and a small-scale powered model of a STOL wing/canard concept with engines mounted over the wing In a basic configuration, both models exhausted the entire nozzle-flow momentum over vectoring flaps In an alternate configuration, both models exhausted a portion of the flow from spanwise nozzles in the outer nacelle wall to obtain wing-leading-edge vortex augmentation Force and pressure data were obtained for the small-scale model powered by compressed air Pressure and thermal data were obtained for the large-scale model powered by two turbojet tengines Chordwise blowing decreased the pressures over the entire wing upper surface and even on the canard at high angles of attack The power-induced lift coefficients were moderate for chordwise blowing Spanwise blowing increased the strength of the wing leading-edge vortex and reduced the pressure on the wing upper surface beneath the path of the vortex (Author)

A82-41000 # **Aerodynamic research applications at Boeing.** A L Nagel (Boeing Commercial Airplane Co , Seattle, WA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1235-1242 24 refs

This paper shows by several recent examples how aerodynamic research tools and methods have been applied to the design of subsonic commercial transport airplanes Examples include wing modifications, nacelle integration, vortex generators, and cab design Some recent high Reynolds number tests in the NASA 0 3-meter Transonic Cryogenic Tunnel are also described (Author)

A82-41001 # **Wind tunnel test and aerodynamic analysis of three aeroelastically tailored wings.** W W Braymen, W A Rogers (General Dynamics Corp , Fort Worth, TX), and M H Shirk (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1243-1255 11 refs USAF-sponsored research

Aeroelastic tailoring of composite lifting surfaces was validated in a program that involved design, fabrication, and transonic wind tunnel testing of three static aeroelastic wings in addition to a set of steel wings Each aeroelastic wing had unique design objectives The test featured aeroelastic shape documentation through the use of photogrammetry along with the simultaneous acquisition of forces and pressures Highlights of the aerodynamic test results are presented, with emphasis placed on test-to-theory comparisons The strong points as well as areas of needed improvement in the aerodynamic design methods are discussed The investigation demonstrates that the design of composite lifting surfaces should include consideration of aerodynamic benefits available through tailoring (Author)

A82-41002 * # **Upper Vortex Flap - A versatile surface for highly swept wings.** D M Rao (Vigyan Research Associates, Inc , Hampton, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1256-1266 9 refs NASA-supported research

The Upper Vortex Flap (UVF) is a multipurpose surface concept to improve the subsonic aerodynamics of highly swept delta wings Hinged along the leading edges and deployed from the wing upper surface, the UVF generates a vortex inboard on the wing in addition to the leading-edge vortex acting on the flap The relative suction levels on the wing and on the flap surface, governed by the flap angle and angle of attack, lead to a variety of functional applications viz lift increment, drag modulation, lift/drag improvement and roll augmentation This paper presents wind tunnel force and pressure measurements on a 74-deg flat plate delta to define the UVF-related vortex effects and to assess its potential as a versatile control surface in different angle-of-attack regimes (Author)

A82-41003 * # **Analytical study of vortex flaps on highly swept delta wings.** N T Frink (NASA, Langley Research Center, Hampton, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1267-1275 25 refs

This paper highlights some current results from ongoing analytical studies of vortex flaps on highly swept delta wings A brief discussion of the vortex flow analysis tools is given along with comparisons of the theories to vortex flap force and pressure data Theoretical trends in surface pressure distribution for both angle-of-attack variation and flap deflection are correctly predicted by Free Vortex Sheet theory Also shown are some interesting calculations for attached-flow and vortex-flow flap hinge moments that indicate flaps utilizing vortex flow may generate less hinge moment than attached flow flaps Finally, trailing-edge flap effects on leading-edge flap thrust potential are investigated and theory-experiment comparisons made (Author)

A82-41004 * # Wind-tunnel investigation of vortex flaps on a highly swept interceptor configuration. W E Schoonover, Jr (NASA, Langley Research Center, Hampton, VA) and W E Ohlson (Boeing Military Airplane Co, Seattle, WA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1276-1290 15 refs

A subsonic wind-tunnel investigation of the application of vortex flaps to a supersonic interceptor configuration is described Experimental results are presented which indicate the aerodynamic effects of vortex-flap deflection, trailing-edge flap deflection, vortex flap chord and span, vertical stabilizers, and a highly cambered leading edge designed for attached flow Data presented include longitudinal forces and moments, upper-surface pressure distributions, and oil- and smoke-flow visualization photographs It is concluded that a full-span deployable vortex flap can provide a substantial performance improvement for this and other similar configurations (Author)

A82-41005 # Spanwise distribution of vortex drag and leading-edge suction in subsonic flow. S N Wagner (München, Hochschule der Bundeswehr, Neubiberg, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1291-1301 12 refs

The spanwise distribution of the leading-edge suction force of wings with arbitrary planforms is calculated on the basis of a linear subsonic thin-wing theory and a study by Carlson and Mack (1980) on two-dimensional airfoil sections The approach makes it possible to account for the effects of Mach number, Reynolds number, and wing parameters, including local thickness to chord ratio, location of the maximum wing section thickness, local leading-edge radius, and leading-edge sweep Results obtained by the proposed method are found to be in good agreement with experimental data V L

A82-41006 # Fuselage effects in leading edge vortex flap aerodynamics. J F Marchman, III and M L Hollins (Virginia Polytechnic Institute and State University, Blacksburg, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1302-1309 8 refs

Wind tunnel tests were conducted to determine the influence of a fuselage on the aerodynamic behavior of a 60 deg delta wing with leading edge vortex flaps The results showed that at some combinations of angle of attack and yaw, the fuselage had a stabilizing effect on the leading edge vortices and that maximum lift is increased due to fuselage lift and added vortex stability The fuselage did not affect the ability of vortex flaps to significantly increase the L/D of the wings (Author)

A82-41007 # New technology for the next generation of commercial transports - Real or imaginary. I S Macdonald In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1310-1320

Economical, technical, financial, and legal implications associated with the needed replacement of technically and economically obsolete fleets of old commercial aircraft are examined The discussion includes a brief review of the factors necessitating changes in aircraft fleets, a review of what aircraft and engine manufacturers have done to respond to the needs of the airlines to upgrade their fleets, new developments which will make it possible to increase the safety, efficiency, and profitability of commercial aircraft, and possible deterrents to the successful and useful implementation of new technology V L

A82-41008 * # An initial look at the supersonic aerodynamics of twin-fuselage aircraft concepts. R M Wood, S M Dollyhigh, and D S Miller (NASA, Langley Research Center, Hampton, VA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1320/a-1320/h 15 refs

Results of two studies into the supersonic aerodynamics of twin-fuselage aircraft configurations are summarized In the first study, a set of experimental data was obtained on a simple rectangular-wing twin-fuselage wind-tunnel model, this data was then used to evaluate prediction methods, assess favorable interference effects, and identify any unexpected or unpredictable aerodynamic phenomena Results are presented which show that significant reductions in wave drag are possible through optimum body positioning and that existing aerodynamic prediction methods are adequate for making preliminary aerodynamic estimates Several configuration concepts were theoretically explored in the second study, and results are presented which indicate the sensitivity of the twin-fuselage concept to various methods of integrating the aircraft components (Author)

A82-41009 # Reduced nonlinear flight dynamic model of elastic structure aircraft. J Jankovic (Beograd, Univerzitet, Belgrade, Yugoslavia) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1321-1329 11 refs

A flight dynamics model defined by equations of motion for the case of an unconstrained deformable body subjected to aerodynamic forces, thrust load and aircraft weight is presented, with a deformable structure represented by the finite element method A reducing method based on the small energy and large damping characteristics of very fast modes is introduced which involves the determination of the generalized coordinate nonlinear vector transformation which can turn the basic nonlinear model to a linear one The method of decoupling linear systems to subsystems of slow and fast models makes it possible to extract fast structural modes and find a linear dependence between generalized, transformed coordinates A criterion for neglecting these modes is also presented It is, finally, necessary to find the nonlinear dependence between basic generalized coordinates which leads to the reduced nonlinear model of the system O C

A82-41010 # Determination of load spectra and their application for keeping the operational life proof of sporting airplanes. H J Kossira (Braunschweig, Technische Universität, Brunswick, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1330-1338

Modern load spectrum determination techniques are applied to glass fiber-reinforced plastic (GFRP) sailplanes, with attention to the estimation of aircraft structure service life The use of such methods in the case of sailplanes is demanded by their combined gust and maneuver load environments The preparation of data gathered during a limited time interval by means of computers, using Markov transition matrix storage and extrapolation to the total lifetime of the sailplanes, is demonstrated O C

A82-41011 # The role of the scale parameter in service load assessment and simulation. J Gedeon (Budapesti Muszaki Egyetem, Budapest, Hungary) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1339-1349 23 refs

The integral scale L, which is a universal parameter for stationary stochastic processes and complementary to the standard deviation, sigma, must be used in conjunction with sigma and one or two other parameters which are unique to the process being described in order to compose autocorrelation and power-spectral density functions The conversion from measured to theoretical standard deviation and vice versa in the case of atmospheric turbulence measurement and evaluation, which is restricted to a finite frequency bandwidth, is feasible by means of the dimensionless parameter comprising L and the low frequency cutoff wavenumber L may also be used for the direct calculation of time spectra from space spectra, and it facilitates the accurate treatment of stochastic transients O C

A82-41013 # Theoretical and experimental investigation of joint-structural damping interaction for airplane construction. I N Krivosic (Beograd, Univerzitet, Belgrade, Yugoslavia) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1358-1367 14 refs

After considering previously published joint structural damping interaction studies and possible physical models for this phenomenon, experimental results for the case of typical aircraft structures are treated by employing the same geometrical model with different types of joints between the skin, stringers and transverse elements Separate analyses are given for rivet, bolt and adhesive joints, and the corresponding mutual influence of the amplitude on structural damping is analyzed in light of the experimental results O C

A82-41014 # Optimizing aerospace structures for manufacturing cost. B R Noton (Battelle Memorial Institute, Columbus, OH) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings

Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1368-1385

The evolution of design/manufacturing interaction reveals the need for design methodologies to reduce aerospace systems cost Cost-driver identification related to performance, design, materials, and manufacturing emphasizes the importance of the preliminary design phase Data are required on designer-influenced cost elements, for example, with composites these are, hybrids, ply count, curing method, and quality requirements A 'Manufacturing Cost/Design Guide' (MC/DG) for composite and metallic airframes, and also electronics, is discussed Using examples of components and fuselage panels, the utilization of designer-oriented formats for relative and quantitative costs of manufacturing processes in trade-studies involving structural performance is shown The MC/DC will also indicate potential cost savings of emerging technologies which accelerate technology transfer (Author)

A82-41015 # **Composite structures repair.** H Wicker (Grumman Aerospace Corp, Bethpage, NY) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1386-1392

This paper concerns itself with the repair of composite materials on modern aircraft with particular emphasis on repair techniques and equipment for field use The high strength to weight ratio of composites make them ideal to meet the demand for increasing the performance of military aircraft However, with the increasing use of composite materials, a need has been created for unique repair methods To meet the need to simultaneously apply pressure and a uniform temperature to the patch, a composite repair console and integral vacuum/-heater blanket was developed by Grumman (Author)

A82-41016 # **Principles of achieving damage tolerance with flexible maintenance programs for new and aging aircraft.** J Hall and U G Goranson (Boeing Commercial Airplane Co, Seattle, WA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1393-1405

Boeing has developed new technology and procedures for determining flexible structural maintenance programs that meet damage tolerance regulations Rating systems, based on past maintenance, are used to develop inspection programs to ensure timely detection of structural damage from environmental deterioration (EDR), accident (ADR), or fatigue (DTR) The inspection program consists of two phases Initially, the program is based on evaluations for detecting corrosion, stress corrosion, and accidental damage using the EDR and ADR systems As the fleet matures, inspection tasks for detecting fatigue damage, based on the DTR evaluations are incorporated into the program (Author)

A82-41018 # **Intake swirl - A major disturbance parameter in engine/intake compatibility.** F Aulehla (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1415-1424 10 refs

Based on theoretical considerations and primarily on experiment it is shown that all supersonic intakes of present combat aircraft produce essentially two types of swirl components of varying magnitude i e bulk and twin swirl Depending on the sensitivity of the engine towards such disturbances serious engine/intake compatibility problems may arise, as for example engine surge and fan vibration The remedial measures to overcome this problem are described and the solution of fenced intakes selected for Tornado is discussed It is expected that this intake modification may also be of advantage for other high performance combat aircraft having similar intake configurations Finally the relevance of dynamic total pressure distortion as prime compatibility parameter is questioned and a proposal for an improved intake disturbance simulation in engine bench tests is made (Author)

A82-41019 . # **An improved propulsion system simulation technique for scaled wind tunnel model testing of advanced fighters.** M F Eigenmann, P A Devereaux (McDonnell Aircraft Co, St Louis, MO), and C D Wagenknecht (General Electric Co, Cincinnati, OH) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1425-1436 10 refs

In the interest of accurately evaluating interactions between inlet and nozzle flowfields and between a propulsion system and aerodynamic surfaces, in advanced fighter aircraft having highly integrated and closely coupled propulsion systems, a supersonic propulsion simulator for wind tunnel models has been developed A digital control console system was also developed in order to match model engine operational and control requirements that approximate those of a full scale engine Attention is given to simulator engine components and wind tunnel model installation details, along with the efficient use of the simulator test technique in the various phases of a supersonic aircraft configuration's development program The thrust/drag accounting system employing the simulator model for studies of basic aerodynamic performance and throttle-dependent effects is flowcharted, and the corrections necessary in each case are assessed O C

A82-41020 # **Low-speed characteristics of a fighter-type configuration at high angles-of-attack and sideslip.** K Huenecke (Vereinigte Flugtechnische Werke GmbH, Bremen, West Germany) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1437-1444

Force measurements and flow observations were conducted on a fighter-type configuration as an aid to understanding the complex flow phenomena occuring at high angles-of-attack, with an, without sideslip The configuration typically was provided with a cranked delta wing of aspect ratio 2 5, leading-edge sweep of 56 deg, wing-mounted vertical tails, and all-moving canard surfaces The results indicate that certain configurational changes, such as vertical tailplane strakes, are sufficient to eliminate an otherwise unstable roll and yaw behavior occuring at around 22 deg angle-of-attack (Author)

A82-41021 # **Wing design for supersonic cruise/transonic maneuver aircraft.** P B Gingrich and E Bonner (Rockwell International Corp, El Segundo, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1445-1453 9 refs

An approach to multiple-design-point tactical aircraft wing development is discussed Requirements for proposed tactical aircraft include both efficient supersonic cruise an, acceleration and enhanced transonic maneuvering performance A computational approach was developed to address the conflicting requirements of these conditions The approach consists of developing two point designs a transonic maneuver configuration with weak shocks and nearly attached flow and an optimum supersonic cruise design A compromise is then developed in an iterative cycle which seeks to approach the point design flow quality through the use of variable camber Computational results for representative tactical aircraft are presented to illustrate the process Test experience is discussed to indicate the performance achieved with compromise designs relative to point-design configurations (Author)

A82-41022 # **Analysis of jet transport wings with deflected control surfaces by using a combination of 2- and 3-D methods.** N J Pfeiffer (Boeing Commercial Airplane Co, Seattle, WA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1454-1458 6 refs

A computational technique has been developed which analyzes transport wings with deflected spoilers or ailerons It uses 2-D separated flow analysis results in a 'strip theory' fashion to provide inputs for a 3-D lifting surface method Wing body lift and pitching moments are quantitatively predicted and calculated spanloads qualitatively match experimental results The method is accurate and economical enough to be useful in the basic design of control systems (Author)

A82-41023 # **Optimization of canard configurations - An integrated approach and practical drag estimation method.** I M Kroo and T McGeer (Stanford University, Stanford, CA) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1459-1469 16 refs

A fundamental analysis of subsonic canard configurations illustrates some of the problems associated with such designs and difficulties encountered in their optimization A general solution for minimum induced drag as a function of span ratio, vertical gap, and relative surface lifts is presented Stability and trim requirements, together with the system geometry then determine the total induced drag and practical conclusions follow when structural weight and stalling speed constrains are added Required chord and twist distributions are determined, illustrating the problems associated with multiple design points Unlike conventional configurations, the canards' geometric variables associated with optimal solutions to each of the above problems vary widely, showing great sensitivity to constraints and off-design operation (Author)

A82-41024 * # **Wind-tunnel investigation of a full-scale canard-configured general aviation aircraft.** L P Yip and P F Coy (NASA, Langley Research Center, Hampton, VA) In International Council of the Aeronautical

Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 22 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1470-1488 11 refs

As part of a broad research program to provide a data base on advanced airplane configurations, a wind-tunnel investigation was conducted in the Langley 30-by 60-Foot Wind Tunnel to determine the aerodynamic cha5 axeristics of an advanced canard-configured general aviation airplane The investigation included measurements of forces and moments of the complete configuratio , isolated canard loads, and pressure distributions on the wing, winglet, and canard Flow visualization was obtained by using surface tufts to determine regions of flow separation and by using a chemical sublimation technique to determine boundary-layer transition locations Additionally, other tests were conducted to determine simulated rain effects on boundary layer transition Investigation of configuration effects included variations of canard locations, canard airfoil sec on, winglet size, and use of a leading-edge droop on the out-board section of the wing (Author)

A82-41025 # Wind tunnel measurements of longitudinal stability and control characteristics of primary and secondary wing configurations. H L Chevalier (Texas A & M University, College Station, TX) In International Council of the Aeronautical Sciences, Congress, 13th and AIAA Aircraft Systems and Technology Conference, Seattle, WA, August 22-27, 1982, Proceedings Volume 2 (A82-40876 20-01) New York, American Institute of Aeronautics and Astronautics, 1982, p 1489-1494

Low speed wind tunnel measurements of the variations in pitching moment coefficient with angle of attack are described for primary and secondary wing configurations, wing-canard combinations Experimental results are shown for various vertical and horizontal distances between the surfaces, canard incidence angles and canard flap angles These experimental results show that the stability is nonlinear with both angle of attack and incidence angle and as a consequence the pitching moment coefficient at zero lift is an important parameter affecting the stability at trim conditions At high angles of attack, above canard stall, the change in pitching moment coefficients with canard incidence angle and flap angle is reduced and for some configurations the change is reversed Results also show that wind tunnel tests, at the appropriate Reynolds Number, are needed to determine longitudinal stability and control characteristics of wing-canard combinations (Author)

A82-41055 Monopole antenna patterns on finite size composite ground planes. C A Balanis (West Virginia University, Morgantown, WV) and D DeCarlo (Naval Air Systems Command, Naval Air Test Center, Patuxent River, MD) *IEEE Transactions on Antennas and Propagation,* vol AP-30, July 1982, p 764-768 9 refs

The geometrical theory of diffraction methods is used to develop models and to predict the patterns of communications, navigation, and identification (CNI) blade antennas mounted on finite size composite ground planes The computed patterns are found to agree extremely well with measurements It is shown, both analytically and experimentally, that very minor differences between patterns of antennas mounted on perfectly conducting and composite ground planes appear for conductivities equal to 10,000 s/m The anisotropy effect of the composite material on the antenna patterns is thought to be undetectable, at least within the system measuring accuracy Therefore, perfectly conducting models can be used to analytically investigate the electromagnetic scattering properties of composite materials with conductivities equal to or greater than 10,000 s/m C R

A82-41075 Heat release rate calorimetry of engineering plastics. A L Bridgman and G L Nelson (General Electric Co , Pittsfield, MA) *Journal of Fire and Flammability,* vol 13, Apr 1982, p 114-134 27 refs

The Ohio State University Heat Release Rate Calorimeter (OSUHRRC) is examined as a means of defining the fire characteristics of engineering plastics under closely controlled and defined conditions of exposure to incident thermal radiation The principles and operation of the OSUHRRC are described, and examples of tests are presented utilizing engineering thermographics A typical test is described in detail, and the factors affecting the results, including reproducibility, external heat flux, and sample thickness, are examined The improvement in fire retardancy resulting from the incorporation of flame retardants into test specimens is documented for polycarbonates Comparisons of the results with large-scale foam box tests show the same relative rankings with respect to both temperature and smoke performance C D

A82-41114 # Design of a longitudinal ride-control system by Zakian's method of inequalities. T R Crossley (Salford, University, Salford, England) and A M Dahshan (Military Technical College, Cairo, Egypt) *Journal of Aircraft,* vol 19, Sept 1982, p 730-738 36 refs

In this paper, Zakian's method of inequalities is applied to the design of a ride-control system for a STOL aircraft The purpose of the controller is to reduce the normal acceleration experienced by both passengers and crew The method is based on the synthesis of a controller such that a set of performance specifications and constraints is satisfied Controllers are designed on the basis of the characteristics of both the closed-loop step response and the closed-loop error response It is shown that the design of a single-input, single-output controller by the method of inequalities is straightforward, and can be achieved by using a sequence of formulations until the designer is satisfied that no further improvement is necessary (Author)

A82-41115 # Fatigue behavior of weldbonded joints. G V Scarich and G R Chanani (Northrop Corp , Aircraft Div , Hawthorne, CA) *Journal of Aircraft,* vol 19, Sept 1982, p 773-780 7 refs Contract No F33615-76-C-5412

The effects of material and process variables on fatigue behavior were determined for a newly developed, low-cost weldbonding process for the assembly of durable aircraft structures The weldbonding process involves spot-welding components through a previously applied adhesive, and then oven-curing the assembly to achieve a bonded structure Both low-load and high-load transfer specimen geometries with each of two alloy combinations (7075-T6/7075-T6 and 2024-T3 alclad/7075-T6) were evaluated Fatigue behavior of weldbonded specimens with different nugget sizes and different manufacturing defects was compared with that of riveted and adhesive-bonded specimens In low-load transfer fatigue, weldbonding was better than riveting, but not as good as adhesive bonding, while in high-load transfer fatigue, weldbonding was equal to or better than riveting and adhesive bonding (Author)

A82-41116 # Minimum induced drag of canard configurations. I M Kroo *Journal of Aircraft,* vol 19, Sept 1982, p 792-794 10 refs

Drag estimations are made for an elliptically loaded wing on an aircraft equipped with canards An analysis of Prandtl's biplane equation, along with Monk's stagger theorem (1921), shows that a minimum induced drag occurs when the total loading is elliptical over the wing span, with lift transferred toward the outboard section of the wings The section lift of the wing is represented as a Fourier series and a resulting lift distribution defines a minimum induced drag Prandtl's interference factor is calculated and a nonelliptic interference factor is defined and is used to demonstrate that a substantial reduction in induced drag is possible in comparison with the elliptically loaded case M S K

A82-41117 # Estimation of the number of in-flight aircraft on instrument flight rules. N Myerhoff and J Garlitz (U S Department of Transportation, Office of Air and Marine Systems, Cambridge, MA) *Journal of Aircraft,* vol 19, Sept 1982, p 794-796 FAA-supported research

Mathematical models for estimating the instantaneous aircount (IAC) of aircraft on instrument flight rules flying over the U S at any moment are described The data is gathered from the Official Airline Guide for scheduled great circle paths and projections are made for the location of aircraft at any time of day The estimates are made independent of radar target reports and cover the regions monitored by each of the 20 air route traffic control centers on the continent Noting that arrivals and departures are approximately equal from individual centers' jurisdiction at any moment, probabilities are generated for the presence of an aircraft in any given time interval, and a standard profile is employed in regions where a specific flight profile is unknown Accuracy has been shown to be within 10% during peak hours M S K

A82-41140 Recommended practice for a demonstration of Nondestructive Evaluation /NDE/ reliability on aircraft production parts - Introduction to the guidelines. W D Rummel (Martin Marietta Aerospace, Denver, CO) *Materials Evaluation,* vol 40, Aug 1982, p 922-932

Guidelines for a demonstration of Nondestructive Evaluation (NDE) reliability on aircraft production parts have been compiled in order to promulgate recommended practices for the development of repeatable data in fracture mechanics applications Such practices are designed to demonstrate the capabilities of various NDE methods for the detection of flaws in specific materials or parts under routine production inspection conditions The intent of the guidelines is to define the limiting flaw size which can be detected within a given probability of detection and with a given percent of confidence in that probability The outline presented encompasses operational requirements, the acquisition and reduction of data, and requalification procedures O C

A82-41141 Evaluation of heat damage to aluminum aircraft structures. D J Hagemaier (Douglas Aircraft Co , Long Beach, CA) *Materials Evaluation,* vol 40, Aug 1982, p 962-969 15 refs

Examinations of heated surface discoloration or distortion, eddy current conductivity comparison tests and hardness tests are used to evaluate the degree of heat damage incurred by aluminum alloy aircraft structures Data from articles and reports on the exposure of 7075-T6 and 2024-T3/T4 aluminum alloy sheet materials to elevated temperatures for extended periods of time are considered, and portable hardness and eddy current test equipment for damage assessment are described with attention to significant variables affecting conductivity readings The data presented suffice for the substantiation of a direct relationship between conductivity, hardness and strength which will allow the evaluation of heat or fire damage in heat-treatable aluminum alloys O C

A82-41447 # **Visual scene simulation concerning the landing of sporting aircraft in connection with investigations regarding the control and learning behavior of the pilot (Sichtsimulation der Landung von Sportflugzeugen im Hinblick auf Untersuchungen zum Regler- und Lernverhalten des Piloten).** W Heumann Darmstadt, Technische Hochschule, Fachbereich Regelungs- und Datentechnik, Dr -Ing Dissertation, 1980 268 p 89 refs In German Research supported by the Deutsche Forschungsgemeinschaft

The present investigation is concerned with the behavior of man as controller in a technical system The object of the studies, which were conducted with the aid of a simulator providing a visual scene presentation, is the control of the longitudinal motion of a sporting aircraft during the last phases of a landing under visual flight conditions Attention is given to the behavior of flying students, taking into account differences in the behavior of students and experienced pilots Changes in the behavior of the student in connection with advances related to the learning process are examined The landing simulation system employed provides a presentation of the visual environment of the pilot during the landing procedure, and, in addition, also a lateral view of the landing aircraft This approach has certain advantages for the student from a didactic point of view The analysis of the flight path with the aid of the simulator makes it possible to develop a basic model which is typical for a landing performed by an experienced pilot G R

A82-41453 # **Investigations concerned with shifting pilot activities to a higher hierarchical stage of flight control (Untersuchungen zur Verlagerung der Pilotentätigkeit auf eine höhere hierarchische Stufe der Flugführung).** P Sundermeyer Braunschweig, Technische Universität, Fakultät für Maschinenbau und Elektrotechnik, Dr -Ing Dissertation, 1980 120 p 26 refs In German

Advantages and drawbacks of the automation of flight control systems are discussed, taking into account various hierarchical planes The result of this system analysis is the concept of an aircraft guidance computer for the onboard four-dimensional flight path calculation and generation The developed computer system becomes a component of an integrated flight guidance system The computer makes it possible to conduct studies by which the activities to be performed by the pilot are raised to a higher level, involving the solution of coordination problems The computer calculates possible alternatives regarding the flight path for the aircraft The pilot makes the final decision on the basis of the information provided by the computer In addition to performing a calculation of the flight path, the computer provides a representation of the flight path on a map display, time control information, and flight guidance activities (four-dimensional) with respect to different stages of automatization G R

A82-41575 † **High-sensitivity holographic plates PL-3M (Vysokochuvstitel'nye gologroficheskie plastinki PL-3M).** L Ia Kaplun, E F Klimzo, and E N Sergeeva (Vsesoiuznyi Gosudarstvennyi Nauchno-Issledovatel'skii i Proektnyi Institut Khimiko-Fotograficheskoi Promyshlennosti, Moscow, USSR) *Zhurnal Nauchnoi i Prikladnoi Fotografii i Kinematografii,* vol 27, July-Aug 1982, p 293-295 8 refs In Russian

High-sensitivity holographic plates have been obtained by using spectrally sensitized ultrafine-grained emulsion with pAg = 6 8 The plates, designated PL-3M, have a light sensitivity of 100 erg/sq cm and a diffraction efficiency of 4 3% The high-sensitivity holographic plates are currently used in research concerned with holographic interferometry of aircraft structures, development of holographic memory devices, stress and strain analysis of structures and materials, lens testing, and optical recording of analog information V L

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STAR ENTRIES

N82-28243*# Lockheed-California Co, Burbank
ELECTRONIC/ELECTRIC TECHNOLOGY BENEFITS STUDY Report, Aug. 1980 - Jan. 1982
W W Howison and M J Cronin May 1982 226 p
(Contract NAS1-16199)
(NASA-CR-165890, NAS 1 26 165890, LR-30079) Avail NTIS HC A11/MF A01 CSCL 01B

The benefits and payoffs of advanced electronic/electric technologies were investigated for three types of aircraft The technologies, evaluated in each of the three airplanes, included advanced flight controls, advanced secondary power advanced avionic complements, new cockpit displays, and advanced air traffic control techniques For the advanced flight controls, the near term considered relaxed static stability (RSS) with mechanical backup The far term considered an advanced fly by wire system for a longitudinally unstable airplane In the case of the secondary power systems, trades were made in two steps in the near term, engine bleed was eliminated, in the far term bleed air, air plus hydraulics were eliminated Using three commercial aircraft, in the 150, 350, and 700 passenger range, the technology value and pay-offs were quantified, with emphasis on the fiscal benefits Weight reductions deriving from fuel saving and other system improvements were identified and the weight savings were cycled for their impact on TOGW (takeoff gross weight) and upon the performance of the airframes/engines Maintenance, reliability and logistic support were the other criteria Author

N82-28244# Federal Aviation Administration, Washington, D C *Office of Management Systems*
GENERAL AVIATION ACTIVITY AND AVIONICS SURVEY Annual Report
Judith C Schwenk Dec 1981 205 p refs
(AD-A112924, FAA-MS-81-5) Avail NTIS HC A10/MF A01 CSCL 01/2

This report presents the results and a description of the 1980 General Aviation Activity and Avionics Survey The survey was conducted during 1981 by the FAA to obtain information on the activity and avionics of the United States registered general aviation aircraft fleet, the dominant component of civil aviation in the U S The survey was based on statistically selected sample of about 14 0 percent of the general aviation fleet and obtained a response rate of 65 percent Survey results are based upon responses but are expanded upward to represent the total population Survey results revealed that during 1980 an estimated 41 0 million hours of flying time were logged by the 211,045 active general aviation aircraft in the U S fleet, yielding a mean annual flight time per aircraft of 190 5 hours The active aircraft represented about 83 percent of the registered general aviation fleet The report contains breakdowns of these and other statistics by manufacturer/model group, aircraft type, state and region of based aircraft, and primary use Also included are fuel consumption, lifetime airframe hours, avionics, and engine hours estimates Author (GRA)

N82-28245# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div
INTERNATIONAL AVIATION (SELECTED ARTICLES)
12 Apr 1982 23 p Transl into ENGLISH from Guoji Hangkong (Communist China), no 224, Oct 1981 p 2-9, 49
(AD-A114422, FTD-ID(RS)T-0027-82) Avail NTIS HC A02/MF A01 CSCL 21/5

Chinese made goods were exhibited, including aeronautical forgings, castings, forging dies, casting molds, powder metallurgical products, and titanium alloys and products These goods symbolize China's production capability and technical level of aeronautical forgings and castings, with excellent qualities of these products S L

N82-28249*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
A SUMMARY OF V/STOL INLET ANALYSIS METHODS
Danny P Hwang and John M Abbott 1982 17 p refs To be presented at the 13th Congr of the Intern Council of the Aeronautical Sci and Aircraft Systems and Technol Conf, Seattle, 22-27 Aug 1982, sponsored by the American Inst of Aeronautics and Astronautics Previously announced in IAA as A82-16902
(NASA-TM-82885 E-1263, NAS 1 15 82885) Avail NTIS HC A02/MF A01 CSCL 01A

For abstract see A82-16902

N82-28252*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AERODYNAMIC INTERACTIONS BETWEEN A 1/6 SCALE HELICOPTER ROTOR AND A BODY OF REVOLUTION
Mark D Betzina and Patrick Shinoda Jun 1982 15 p refs Prepared in cooperation with Army Research and Technology Labs, Moffett Field, Calif
(NASA-TM-84247 A-8940 NAS 1 15 84247) Avail NTIS HC A02/MF A01 CSCL 01A

A wind-tunnel investigation was conducted in which independent, steady state aerodynamic forces and moments were measured on a 2 24-m-diam, two bladed helicopter rotor and a body of revolution The objective was to determine the interaction of the body on the rotor performance and the effect of the rotor on the body aerodynamics for variations in velocity thrust, tip-path-plane angle of attack, body angle of attack, rotor/body position, and body nose geometry Results show that a body of revolution near the rotor can produce significant favorable or unfavorable effects on rotor performance, depending on the operating condition Body longitudinal aerodynamic characteristics are significantly modified by the presence of an operating rotor and hub Author

N82-28260# Systems Research Labs, Inc Dayton, Ohio
WIND-TUNNEL EVALUATION OF AN AEROELASTICALLY CONFORMABLE ROTOR Final Report
Lawrence R Sutton Richard P White, Jr, and Robert L Marker Mar 1982 87 p refs
(DA Proj 1L2-62209-AH-76)
(AD-A114384, USAAVRADCOM-TR-81-D-43) Avail NTIS HC A05/MF A01 CSCL 01/3

This report summarizes the theoretical and experimental investigations that were conducted to evaluate the potential of aeroelastic and mass-elastic couplings in an aerolastic conformable rotor (ACR) that will improve the performance and vibratory characteristics of helicopter rotor systems without creating instabilities ACR parameters were identified and a baseline rotor system was selected An ACR blade concept was investigated by altering the characteristics of the baseline and using automated analysis techniques GRA

N82-28261# Army Aviation Research and Development Command, St Louis Mo Applied Technology Lab
NATIONAL TRANSONIC FACILITY (NTF) PROTOTYPE FAN BLADE FATIGUE TEST Progress Report, Jan. - Mar 1981
E H Dean, A J Gustafson and D M Saylor Mar 1982 18 p
(DA Proj 1L1-62209-AH-76)
(AD-A114405 USAAVRADCOM-TR-82-D-5) Avail NTIS HC A02/MF A01 CSCL 14/2

The Applied Technology Laboratory conducted fatigue tests on a composite fan blade designed for use in the new NTF wind tunnel being constructed at NASA-Langley The tests were performed by the Structures Technical Area using the root end fatigue machine (REFM) which was modified for ground air ground testing Simulated centrifugal and aerodynamic (bending) load tests were performed The fan blade successfully withstood 6000 cycles at 360 rpm and 600 rpm load conditions for the cyclic rate tests These tests simulated the starting and stopping cycles of the fan Static load tests to 57 000 pounds design load were also successfully performed on the blade specimen Author (GRA)

N82-28262# National Aerospace Lab Amsterdam (Netherlands) Fluid Dynamics Div
EVALUATION OF AN EXPERIMENTAL TECHNIQUE TO INVESTIGATE THE EFFECTS OF THE ENGINE POSITION ON ENGINE/PYLON/WING INTERFERENCE
J A J vanEngelen B Munniksma, and A Elsenaar 28 Apr 1981 16 p refs Presented at AGARD Symp on Aerodyn of Power Plant Installation Toulouse 11-14 May 1981
(NLR-MP-81020-U) Avail NTIS HC A02 MF A01

Free flow and blown nacelle wind tunnel testing of engine airframe integration are compared and the magnitude of the parasitic interference of an additional strut and engine inlet fairing is examined A semispan model, typical of a transport aircraft with a supercritical wing was tested A 3/4 fan cowl high bypass engine was located at six positions underneath the wing Measurements included pressure and balance force It is shown that while accurate simulation of engine nozzle geometry is of prime importance, tests on free flow nacelles are useful for selecting engine position Interference forces derived from pressure integration are only useful for determining trends in interference effects for flexible initial tests Author (ESA)

N82-28263# National Aerospace Lab, Amsterdam (Netherlands) Informatics Div

A FINITE DIFFERENCE METHOD FOR THE CALCULATION OF TRANSONIC FLOW ABOUT A WING, BASED ON SMALL PERTURBATION THEORY

J vanderVooren, G H Huizing and A vanEssen 5 Mar 1981 103 p refs
(Contract NIVR-1739)
(NLR-TR-81031-U) Avail NTIS HC A06/MF A01

A calculation method for the transonic flow about a semiwing based on transonic small perturbation theory, is presented The influence of a body can be simulated by prescribing appropriate transverse velocities in a vertical plane through the wing root The wing should be thin and have little dihedral, camber and twist and a not too blunt leading edge The body should be slender The angle of incidence must be small However, highly swept wings are allowed A fully finite difference scheme is implemented for a correct shock capture Line relaxation is used to solve the corresponding nonlinear equations It is indicated that too much artificial viscosity leads to an unrepresentative calculation, and too little can lead to instabilities Author (ESA)

N82-28264# General Accounting Office, Washington, D C Accounting and Financial Management Div

COMPUTER OUTAGES AT AIR TERMINAL FACILITIES AND THEIR CORRELATION TO NEAR MISS MID-AIR COLLISIONS (AFMD-82-43)

16 Feb 1982 17 p refs
(B-206064) HC A02/MF A01

The frequency of computer failures at terminal facilities and the extent of correlation between these failures and near mid-at collisions were investigated in a survey of nine terminal facilities No direct correlation between the computer outages and reported mid-air collisions or the safety related incidents was found RJF

N82-28265# Aeronautical Research Labs, Melbourne (Australia)

A STUDY OF WIND SHEAR EFFECTS ON AIRCRAFT OPERATIONS AND SAFETY IN AUSTRALIA

K W Anderson and B A J Clark Mar 1981 84 p refs
(ARL-Sys-Rept-24 AR-002-271) Avail NTIS HC A05/MF A01

The ergonomics aspects of aircraft operation in conditions of local variations of wind were studied Questionnaires were analyzed for subject understanding, detection of wind difficulties, frequency of wind shear and downdraft situations, pilot techniques, and forewarning methods Pilots often found terrain-induced downdrafts and thunderstorm wind shears troublesome Operations in irregular terrain away from major aerodromes were frequently cited for wind shear hazards Pilot judgements on the most susceptible aircraft types were not readily explicable in terms of size, landing speed or wing loading Pilots and ATCs indicated that currently used cues in wind shear conditions include visual estimates of glideslope departures precision approach radar observations and aircraft-based measurements of wind or ground speed Ground-based remote sensing equipment for detecting stable wind shear is considered A synopsis of wind-involved airliner crashes and a summary of meteorological conditions for the occurrence of local wind variations are included Author

N82-28266*# Villanova Univ Pa

GUST RESPONSE OF COMMERCIAL JET AIRCRAFT INCLUDING EFFECTS OF AUTOPILOT OPERATION Final Report

Joseph H Goldberg Jun 1982 125 p refs
(Contract NAS1-16095)
(NASA-CR-165919) Avail NTIS HC A06/MF A01 CSCL 01C

A simplified theory of aircraft vertical acceleration gust response based on a model including pitch, vertical displacement and control motions due to autopilot operation is presented High-order autopilot transfer functions are utilized for improved accuracy in the determination of the overall response characteristics Four representative commercial jet aircraft were studied over a wide range of operating conditions and comparisons of individual responses are given It is shown that autopilot operation relative to the controls fixed case causes response attenuation of from 10 percent to approximately 25 percent depending on flight condition and increases in crossing number up to 30 percent, with variations between aircraft of from 5 percent to 10 percent, in general, reflecting the differences in autopilot design A detailed computer program description and listing of the calculation procedure suitable for the general application of the theory to any airplane autopilot combination is also included Author

N82-28267# Aerospace Medical Research Labs, Wright-Patterson AFB, Ohio Biomechanical Protection Branch

COMPARATIVE VERTICAL IMPACT TESTING OF THE F/FB-111 CREW RESTRAINT SYSTEM AND A PROPOSED MODIFICATION

Bernard F Hearon, James W Brinkley James H Raddin Jr, Lawrence A McGowan and Joseph M Powers Mar 1982 312 p refs
(AF Proj 7231)
(AD-A113957 AFAMRL-TR-82-13) Avail NTIS HC A13/MF A01 CSCL 01/3

An impact test program was conducted to evaluate the operational F/FB-111 crew seat and restraint system and a proposed modification A primary objective of the program was to compare human response to vertical impacts in the two restraint harnessess A total of 67 human impact tests were performed on the Vertical Deceleration Tower up to 10 G peak 26 ft/sec Subjects were exposed to comparable impacts at different seat elevations in both harnesses to allow parametric analysis of the test results Measured data included seat acceleration and velocity head and chest translational acceleration components, triaxial forces acting on the seat and footrest, forces acting at the restraint harness, attachment and deplacements of various body segments The resultant head and chest accelerations were significantly greater in the modified harness than in the operational harness, regardless of seat elevation On the basis of this comparison, the proposed modification to the F/FB-111 crew seat and restraint is not recommended for implementation Future restraint harness modification proposals should be based on careful evaluation of all unconventional design features of the operational harness and should address all mechanisms by which adverse loads may be imposed on the seat occupant In addition future redesign efforts of the F/FB-111 escape system should provide improved landing impact attenuation GRA

N82-28268# Air Force Engineering and Services Center Tyndall AFB, Fla Engineering and Services Lab

SMOKE ABATEMENT SYSTEM FOR CRASH RESCUE/FIRE TRAINING FACILITIES Final Report, Sep. 1979 - Sep. 1981

Anthony J Kwan and John A Hamre Sep 1981 33 p
(AF Proj 2505)
(AD-A114380 AFESC/ESL-TR-81-43) Avail NTIS HC A03/MF A01 CSCL 13/2

This report provides the design for a smoke-abated aircraft crash/rescue trainer The design is for a 75-ft diameter fire area suitable for operation in freezing and nonfreezing climates With this system liquid petroleum fuels can be burned with little or no smoke by injecting a fine water spray near the surface of the burning fuel This method of smoke abatement is being applied at military fire fighting training facilities The report includes all equipment necessary for the smoke abatement function and provides detailed step-by-step operating procedures Author (GRA)

N82-28269*# Analytical Mechanics Associates, Inc, Hampton, Va

TERMINAL AREA AUTOMATIC NAVIGATION, GUIDANCE, AND CONTROL RESEARCH USING THE MICROWAVE LANDING SYSTEM (MLS). PART 4 TRANSITION PATH RECONSTRUCTION ALONG A STRAIGHT LINE PATH CONTAINING A GLIDESLOPE CHANGE WAYPOINT Final Report

Samuel Pines Washington NASA Jun 1982 40 p refs
(Contract NAS1-15116)

(NASA-CR-3574-Pt-4 NAS 1 26 3574 AMA-81-37) Avail NTIS HC A03/MF A01 CSCL 17G

The necessary algorithms to reconstruct the glideslope change waypoint along a straight line in the event the aircraft encounters a valid MLS update and transition in the terminal approach area are presented Results of a simulation of the Langley B737 aircraft utilizing these algorithms are presented The method is shown to reconstruct the necessary flight path during MLS transition resulting in zero cross track error, zero track angle error, and zero altitude error, thus requiring minimal aircraft response T M

N82-28270# Radio Technical Commission for Aeronautics, Washington, D C

MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR AUTOMATIC DIRECTION FINDING (ADF) EQUIPMENT

13 May 1982 53 p Supersedes RTCA/DO-137
(RTCA/DO-179 RTCA/DO-137) Avail NTIS HC A04/MF A01

Minimum operational performance standards are set forth for automatic direction finding equipment Incorporated in these standards are system characteristics that will benefit users of the system as well as designers, manufacturers, and installers Compliance with these standards is recommended as a means of assuring that the equipment will satisfactorily perform its intended function under all conditions normally encountered

L F M

N82-28274# Arinc Research Corp, Annapolis, Md

COST ANALYSIS OF THE DISCRETE ADDRESS BEACON SYSTEM FOR THE LOW-PERFORMANCE GENERAL AVIATION AIRCRAFT COMMUNITY Final Report

S Kowalski, K Peter, A Schust, D Swann, and P Young Sep 1981 364 p
(Contract DOT-FA76WA-3788)
(AD-A112957, Rept-1326-01-15-2529, FAA-RD-81-61) Avail NTIS HC A16/MF A01 CSCL 17/7

This report presents the results of cost analysis of various Discrete Address Beacon System (DABS) configurations that may be implemented for the low-performance general aviation aircraft community The DABS designs considered in this analysis were developed by ARINC Research Corporation using state-of-the-art technology GRA

N82-28276# National Aerospace Lab, Amsterdam (Netherlands) Informatics Div

IMPROVED 243 MHz HOMING ANTENNA SYSTEM FOR USE ON HELICOPTERS

F Klinker 23 Apr 1981 24 p refs Presented at Intern IEEE/AP-s Symp, Los Angeles, 16-19 Jun 1981
(NLR-MP-81022-U) Avail NTIS HC A02/MF A01

The principles of azimuthal homing systems used in SAR search and rescue helicopters are outlined In current SAR systems the homing signal is represented by the intersection of the radiation from two vertical dipoles Intersections at 0 and 180 deg with respect to a center line are desired, but those at 120, 140, and 200 deg must be eliminated Pattern distortion, which results in spurious intersections, is caused by mutual coupling between antennas, electromagnetic interaction coupling through the beam forming network, and attenuation and reflection of the received signal by the helicopter fuselage The design uses reflectors on the antennas to reduce fuselage influence, and increases separation between radiation patterns to prevent intersections arising from mutual coupling No homing ambiguities are reported in flight tests of a helicopter using the redesigned system Author (ESA)

N82-28277# National Transportation Safety Board, Washington, D C Bureau of Accident Investigation

SPECIAL INVESTIGATION REPORT: AIR TRAFFIC CONTROL SYSTEM

8 Dec 1981 60 p
(PB82-136276, NTSB-SIR-81-7) Avail NTIS HC A04/MF A01 CSCL 05A

The air traffic control system was investigated following a strike of the air traffic controllers which resulted in the walkout of about 11,400 of the 17,275 controller workforce The investigation included an analysis of ATC data, the ability of the FAA to meet staffing requirements, the qualifications of the controller workforce, training for new controllers, the effect of stress and fatigue, facility supervision and management, the control of the capacity of the system, and computer and equipment reliability No basic ATC procedures were changed or compromised in order to keep the ATC system in operation, and the high level of ATC safety required is possible within the present system GRA

N82-28278*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

FLIGHT EVALUATION OF LORAN-C IN THE STATE OF VERMONT Final Report, Jul. 1979 - May 1981

F D Mackenzie (Transportation Systems Center, Cambridge, Mass) and C D Lytle Sep 1981 162 p refs
(NASA-TM-84711, NAS 1 15 84711, PB82-138603, DOT-TSC-RSPA-81-10) Avail NTIS HC A08/MF A01 CSCL 17G

A flight evaluation of LORAN C as a supplement to existing navigation aids for general aviation aircraft, particularly in mountainous regions of the United States and where VOR coverage is limited was conducted Flights, initiated in the summer months, extend through four seasons and practically all weather conditions typical of northeastern U S operations Assessment of all the data available indicates that LORAN C signals are suitable as a means of navigation during enroute terminal and nonprecision approach operations and the performance exceeds the minimum accuracy criteria GRA

N82-28279* National Aeronautics and Space Administration Langley Research Center, Hampton, Va

MEANS FOR CONTROLLING AERODYNAMICALLY INDUCED TWIST Patent

Wolf Elber, inventor (to NASA) Issued 18 May 1982 4 p Filed 28 Sep 1979 Supersedes N80-16055 (18 - 07, p 0821)
(NASA-Case-LAR-12175-1, US-Patent-4,330,100 US-Patent-Appl-SN-079913, US-Patent-Class-244-48) Avail US Patent and Trademark Office CSCL 01C

A control mechanism which provides active compensation for aerodynamically induced twist deformation of high aspect ratio wings consists of a torque tube, internal to each wing and rigidly attached near the tip of each wing, which is moved by an actuator located in the aircraft fuselage As changes in the aerodynamic loads on the wings occur the torque tube is rotated to compensate for the induced wing twist

Official Gazette of the U S Patent and Trademark Office

N82-28280*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

DESIGN CONSIDERATIONS AND EXPERIENCES IN THE USE OF COMPOSITE MATERIAL FOR AN AEROELASTIC RESEARCH WING

Clinton V Eckstrom and Charles V Spain (Kentron International, Inc, Hampton, Va) May 1982 11 p refs Presented at 23rd AIAA/ASME/ASCH/AHS Structures, Structural Dyn and Mater Conf, New Orleans, 10-12 May 1982
(NASA-TM-83291, NAS 1 15 83291, AIAA-82-0678) Avail NTIS HC A02/MF A01 CSCL 01C

Experiences in using composite skin material on an aeroelastic research wing used in flight flutter testing are described Significant variations in skin shear modulus due to stress and temperature were encountered with the original fiberglass laminate skin designed to minimize wing torsional stiffness These variations along with the sensitivity of wing torsional stiffness to the skin-to-frame attachment method complicated the structural model vibration mode predictions A wing skin redesign with different fiber orientation and a reduction in the amount of skin-to-frame bonding resulted in more predictable model characteristics without sacrificing design objectives Design and modeling considerations for future applications are discussed Author

N82-28282*# Georgia Inst of Tech, Atlanta School of Aerospace Engineering

HELICOPTER VIBRATION SUPPRESSION USING SIMPLE PENDULUM ABSORBERS ON THE ROTOR BLADE Final Report

G Alvin Pierce and M-Nabil H Hanouva [1982] 140 p refs
(Grant NsG-1592)
(NASA-CR-169131, NAS 1 26 169131) Avail NTIS HC A07/MF A01 CSCL 01C

A comprehensive analytical design procedure for the installation of simple pendulums on the blades of a helicopter rotor to suppress the root reactions is presented A frequency response analysis is conducted of typical rotor blades excited by a harmonic variation of spanwise airload distributions as well as a concentrated load at the tip The results presented included the effect of pendulum tuning on the minimization of the hub reactions It is found that a properly designed flapping pendulum attenuates the root out-of-plane force and moment whereas the optimum designed lead-lag pendulum attenuates the root in-plane reactions For optimum pendulum tuning the parameters to be determined are the pendulum uncoupled natural frequency, the pendulum spanwise location and its mass It is found that the optimum pendulum frequency is in the vicinity of the excitation frequency For the optimum pendulum a parametric study is conducted The parameters varied include prepitch, pretwist, precone and pendulum hinge offset Author

N82-28283# Rockwell International Corp, Cedar Rapids, Iowa
DELTA ELECTRICAL LOAD ANALYSIS C-141B JACC/CP AIRCRAFT
G R Taylor 10 Mar 1982 9 p
(Contracts F09603-80-C-0602 F09603-81-C-1953)
(AD-A113761) Avail NTIS HC A02/MF A01 CSCL 01/3
The installation of the provisions to accept the JACC/CP Capsule in the C-141B Aircraft causes a change to the electrical loads within the present aircraft power distribution system The purpose of this report is to furnish a tabulation of the changes to the aircraft power system caused by this installation GRA

N82-28284# Boeing Military Airplane Development, Seattle, Wash
ADVANCED AIRCRAFT ELECTRICAL SYSTEM CONTROL TECHNOLOGY DEMONSTRATOR PHASE 1. ANALYSIS AND PRELIMINARY DESIGN Interim Report, 1 Mar - 30 Sep. 1981
T R Boldt, G L Dunn D E Hankins, P J Leong, and I S Mehdi Wright-Patterson AFB, Ohio AFWAL Jan 1982 134 p refs
(Contract F33615-80-C-2004, AF Proj 3145)
(AD-A113633 D180-25927-3 AFWAL-TR-81-2128) Avail NTIS HC A07/MF A01 CSCL 10/2
This report summarizes Task 1-Requirements Analysis and Task 2-Conceptual Design and documents the results of Task 3, Phase I of this two-phase program Task 3 is the preliminary design of an advanced aircraft electrical system (AAES) The AAES is designed to meet the requirements of a 1990 time frame two-engine tactical aircraft with multi-mission capability The AAES performs the functions of power generation distribution and control of power to loads, system protection, and load management Key characteristics of the AAES are Integrated avionics and power data bus configuration consisting of Digital Avionics Information System (DAIS) standard elements (MIL-STD-1750 processor, MIL-STD-1553B data bus, controls and displays, and remote terminals (RT)) Intelligent Electrical Load Management Centers (ELMC) capable of controlling power to loads, Built-in-test (BIT) capability to isolate faults to the module level BIT includes both circuit and data monitoring checks Solid State Power Controllers (SSPC) to replace circuit breakers and power control switches SSPCs are turned on/off via computer control Generator control, protection and status monitoring by a Generator Control Unit (GCU) compatible with DAIS hardware and software Multimission data information system through programmable system processors, ELMCs and standard DAIS elements Automatic load management for increased aircraft survivability and probability of mission completion GRA

N82-28285# National Research Council of Canada Ottawa (Ontario) Flight Research Lab
EVALUATIONS OF HELICOPTER INSTRUMENT-FLIGHT HANDLING QUALITIES
S R M Sinclair and S Kereliuk Jan 1982 49 p refs In ENGLISH FRENCH summary
(AD-A114004 NRCC-LR-608) Avail NTIS HC A03/MF A01 CSCL 01/2
The NAE Airborne Simulator, a modified and suitably equipped Bell 205A helicopter, was used in experiments to provide background information on the handling qualities requirements for helicopter instrument flight This investigation was in support of a regulatory review undertaken by the U S Federal Aviation Administration as part of an overall assessment of the helicopter certification process The results illustrate the inter-dependence of the various stability and control characteristics which contribute to safe instrument flight handling qualities, and underline the importance of good mission simulation in conducting certification-related experiments Author (GRA)

N82-28286# McDonnell Aircraft Co, St Louis, Mo
ADVANCED TRENDING ANALYSIS/EDS DATA PROGRAM Final Report, May 1979 - Sep. 1981
David C Perryman Wright-Patterson AFB, Ohio AFWAL Jan 1982 181 p refs
(Contract F33615-78-C-2070, AF Proj 3066)
(AD-A113511, AFWAL-TR-81-2125) Avail NTIS HC A09/MF A01 CSCL 09/2
Ground, flight, and maintenance data was collected during the F-15/F100 Engine Diagnostic System (EDS) Flight Evaluation and provided to the Air Force Aero-Propulsion Laboratory (AFWAL/POTC) This data was used by the Air Force, in a concurrent program, to verify a gas turbine engine fault detection/isolation and health trending algorithm employing gas path analysis In addition, the EDS Flight Evaluation served as a demonstration vehicle for a prototype Maintenance Information Management System (MIMS) Independent assessments of the gas path analysis algorithm and of the prototype MIMS were performed and the results are presented Several lessons learned about the automatic recording of in-flight trending data for high performance gas turbine engines in modern tactical aircraft are also presented Author (GRA)

N82-28287# Ballistic Research Labs, Aberdeen Proving Ground, Md
KINEMATIC INVESTIGATION HUGHES HELICOPTER 7.62mm CHAIN GUN
R P Kaste Feb 1982 48 p refs
(DA Proj 1L1-62617-AH-19)
(AD-A113114 AD-F300017, ARBRL-MR-03157) Avail NTIS HC A03/MF A01 CSCL 19/6
A kinematic study of the Hughes Helicopter 7 62mm Chain Gun was performed to determine the power required to operate the weapon and loads on the stud roller due to the various components of the weapon Using a 24-volt battery system the gun drew up to 60 amperes to start and operated on 22 amperes The stud roller carries a load up to 497 Newtons GRA

N82-28288# General Dynamics/Fort Worth, Tex
RESEARCH MODEL WING/TAIL FABRICATION Technical Report, 17 Aug. 1981 - 18 Jan. 1982
Ronald A Cox Mar 1982 9 p
(Contract N00014-81-C-0680)
(AD-A114101, FZA-535) Avail NTIS HC A02/MF A01 CSCL 14/2
The design and construction of a transonic wind-tunnel model has been completed The 1/7 5-scale model can be equipped with an all-flying low- mid-, or T-tail A baseline, linear element wing and an alternate wing of identical planform, but with chordwise airfoil sections optimized for transonic cruise, have been manufactured One row of pressures is located on each wing and on the horizontal tail Author (GRA)

N82-28289# Army Aviation Engineering Flight Activity, Edwards AFB, Calif Directorate for Development and Qualification
HISS CALIBRATION, ICE PHOBICS AND FAA R/D EVALUATIONS Final Report, Jan. - Mar. 1981
John C Henderson, Ralph Woratschek, and Loran A Haworth Aug 1981 62 p refs
(AD-A114435, USAAEFA-80-13) Avail NTIS HC A04/MF A01 CSCL 01/3
Artificial and natural icing tests of a JUH-1H helicopter were flown in the vicinity of St Paul, Minnesota, during the three month period of January through March 1981 Productive flight time totaled 15 4 hours in the artificial icing environment behind the Helicopter Icing Spray System (HISS) and 3 2 hours in natural icing Test conditions ranged from -5 C to -20 C and 0 25 to 1 0 gram per cubic meter liquid water content (LWC) for the artificial testing and -6 C to -9 C and 0 1 to 0 5 gram per cubic meter LWC for the natural testing Tests in the artificial icing environment behind the HISS were flown to define the nature of the HISS cloud in terms of LWC, cloud particle size and distribution, and to quantitatively determine the effects of an ice phobic coating on the capability of the UH-1H to fly in

icing conditions The ice phobic coating did not significantly affect the capability of the UH-1H to fly in icing conditions GRA

N82-28290# Army Aviation Research and Development Command, St Louis, Mo
HISTORICAL RESEARCH AND DEVELOPMENT INFLATION INDICES FOR ARMY FIXED AND ROTOR WINGED AIRCRAFT Annual Report
Charles W Lines, Jr and William J Waymire Jan 1982 37 p refs
(AD-A114368, USAAVRADCOM-TR-82-F-3) Avail NTIS HC A03/MF A01 CSCL 05/1

This Technical Memorandum is a continuation of previous efforts to develop the necessary rationale and methodology needed in order to construct historical inflation indices, in the Research and Development (R&D) area, relative to Army aircraft The R&D historical indices, and the sub-indices from which they are derived, are presented in the appendices to this report for the period FY68 through FY81 These indices are appropriate for updating statistical reports that formerly utilized the OSD forecasting indices, for initial use in bringing a cost in prior years to a present-year dollar value, and for evaluating inflation actually experienced A computer program is utilized to make the necessary mathematical calculations Data sources for this report were the Office of Personnel Management (OPM) and the Bureau of Labor Statistics (BLS) OPM supplied data on government salaries BLS furnished data on industry salaries and thirteen different materials The computer program prints the R&D historical inflation indices and subindices by fiscal year as shown in Appendices C through G of this report GRA

N82-28291# INCOSYM, Inc, Westlake Village, Calif
LOW COST DEVELOPMENT OF INS SENSORS FOR EXPENDABLE RPV CONTROL AND NAVIGATION Final Report, Apr 1979 - May 1981
D G Kim and James G Russell Wright-Patterson AFB, Ohio AFWAL Aug 1981 71 p
(Contract F33615-79-C-3616)
(AD-A112691, AFWAL-TR-81-3086) Avail NTIS HC A04/MF A01 CSCL 01/3

A two year development effort has resulted in the design, fabrication and test of a feasibility model 3-axis vibrating beam accelerometer and a brassboard cycloidal magnetic vector sensor The cycloidal magnetic vector sensor is based on a rotating coil technique which eliminates slip rings It performed as expected, and demonstrated an accuracy of approximately 0 25 degrees The 3-axis vibrating beam accelerometer is based on the principle that a vibrating beam will change its frequency as a function of the applied tension Using six beams, two per sensing axis, connected to a common mass, a 3-axis accelerometer can be designed Such a design measures acceleration, by a change in beam vibration frequency, as a function of applied acceleration to the mass The accelerometer, at first, demonstrated an insensitivity due to frequency lock between the beams This effect was eliminated, but the necessary change in design caused an unstable bias and non-linearity of the scale factor A solution to these problems was also conceived, and hardware changes made However, to fully demonstrate the concept requires a computer and software, which is outside the scope of this program Author (GRA)

N82-28292# Environmental Research Inst of Michigan, Ann Arbor Radar and Optics Div
DESIGN STUDY FOR A LOW-DISTORTION HOLOGRAPHIC HUD Final Technical Report, Jul. 1980 - Aug. 1981
W S Colburn and R C Fairchild Wright-Patterson AFB, Ohio AFWAL Jan 1982 104 p refs
(Contract F33615-80-C-1077)
(AD-A113982 AFWAL-TR-81-1263, ERIM-150800-29-F) Avail NTIS HC A06/MF A01 CSCL 14/5

A low distortion holographic HUD optical system was examined Distortion correction was based on the use of a holographic combiner made with analytically defined construction wavefronts, wavefronts for which the phase at the hologram is described by mathematical expressions Such wavefronts are designed subsequent to the hologram design, and offer great design flexibility as their realization is based in part on the use of computer generated holograms A method for designing the construction wavefronts of a holographic optical element based on minimizing the mean squared wavefront error while satisfying the Bragg condition is described A holographic HUD optical system was designed for the F-16 cockpit in which distortion was corrected optically through simultaneous optimization of combiner and relay lens parameters Both construction wavefronts of the combiner were described in terms of Legendre polynomial series The implementation of construction beams required to form the combiner construction wavefronts is discussed Author (GRA)

N82-28293# Federal Aviation Administration Atlantic City N J
A COMPENDIUM OF LIGHTNING EFFECTS ON FUTURE AIRCRAFT ELECTRONIC SYSTEMS Final Report
Nickolus O Rasch Feb 1982 257 p refs Proc of Conf held at Hampton, Va, 4-6 Nov 1981
(AD-A114117, DOT-FAA-CT-82-30) Avail NTIS HC A12/MF A01 CSCL 01/3

This publication is a composite of presentations given at the NASA-Langley Research Center/FAA Technical Center 'Lightning Effects on Future Aircraft Systems Workshop held on November 4-6, 1981, at the NASA-Langley Research Center Facility The presentations encompassed the full spectrum of lightning research from lightning phenomonology lightning modeling, electromagnetic issues associated with composite materials, to the lightning/aircraft electromagnetic interaction analysis Also included are a total of five presentations assessing the Digital System upset phenomena Author (GRA)

N82-28294# Grumman Aerospace Corp, Bethpage, N Y
HYDRAULIC UNIVERSAL DISPLAY PROCESSOR SYSTEM (HUDPS) Final Report, 1 Apr. - 1 Sep. 1981
John J Duzich and Herman L Dreksler Warminster Pa Naval Air Development Center 21 Nov 1981 66 p refs
(Contract N62269-81-C-0243)
(AD-A114428, NADC-82053-60) Avail NTIS HC A04/MF A01 CSCL 01/3

This six month study effort explored methods of display fault indication to ground support personnel and optimize microprocession circuitry for universal aircraft application Task I was established the maximum number of sensors required for a complex, comprehensive diagnostic system for the F14A as 150 Inputs could be either analog or digital For comparison purposes, an A6E system was considered Fault display methods were investigated with emphasis on smart alphanumeric devices in Task II Volatile and non-volatile memory components were utilized along with the Intel 8748 microprocessor and associated EPROMS The use of National Semiconductor ADC0816 data acquisition chips consisting of a 16 input multiplexer, an 8 bit A/D converter and an 8 bit tri-state buffered output facilitates the many inputs Power consumption for a complete system was estimated as 5 watts while airborne On the ground, 15 watts at 5 volts is required for display requirements Display envelope would measure 8x7x6 and would contain approximately 6 circuit boards In Task III a universal display processor system was formulated A Block Diagram and several flow diagrams were generated Multiplexer schematics were established for analog and discrete inputs An electrical component parts list was generated for a typical system Author (GRA)

N82-28295*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
STATIC NOISE TESTS ON MODIFIED AUGMENTOR WING JET STOL RESEARCH AIRCRAFT
G R Cook and B F Lilley (deHavilland Aircraft of Canada, Ltd, Downsview, Ontario) Feb 1981 58 p refs
(NASA-TM-81231, NAS 1 15 81231) Avail NTIS HC A04/MF A01 CSCL 21E

Noise measurements were made to determine if recent modifications made to the bifurcated jetpipe to increase engine thrust had at the same time reduced the noise level The noise field was measured by a 6-microphone array positioned on a 30 5m (100 ft) sideline between 90 and 150 degrees from the left engine inlet Noise levels were recorded at three flap angles over a range of engine thrust settings from flight idle to emergency power and plotted in one-third octave band spectra Little attenuation was observed at maximum power, but significant attenuation was achieved at approach and cruise power levels TM

N82-28296*# Pratt and Whitney Aircraft Group, East Hartford Conn Commercial Products Div
B747/JT9D FLIGHT LOADS AND THEIR EFFECT ON

ENGINE RUNNING CLEARANCES AND PERFORMANCE DETERIORATION; BCAC NAIL/P AND WA JT9D ENGINE DIAGNOSTICS PROGRAMS
W J Olsson and R L Martin 19 Feb 1982 74 p refs
Prepared in cooperation with Boeing Commercial Airplane Co, Seattle
(Contracts NAS3-20632 NAS1-15325)
(NASA-CR-165573, NAS 1 26 165573 PWA-5512-88) Avail NTIS HC A04/MF A01 CSCL 21E

Flight loads on the 747 propulsion system and resulting JT9D blade to outer airseal running clearances during representative acceptance flight and revenue flight sequences were measured The resulting rub induced clearance changes, and engine performance changes were then analyzed to validate and refine the JT9D-7A short term performance deterioration model
Author

N82-28297*# General Electric Co, Cincinnati, Ohio Aircraft Engine Group
CF6 JET ENGINE PERFORMANCE IMPROVEMENT: HIGH PRESSURE TURBINE ACTIVE CLEARANCE CONTROL
S E Rich and W A Fasching Jun 1982 136 p refs
(Contract NAS3-20629)
(NASA-CR-165556, NAS 1 26 165556, R82AEB198) Avail NTIS HC A07/MF A01 CSCL 21E

An active clearance control system was developed which reduces fuel consumption and performance degradation This system utilizes compressor discharge air during takeoff and fan discharge air during cruise to impinge on the shroud structure to improve the thermal response The system was evaluated in component and engine tests The test results demonstrated a performance improvement of 0 7 percent in cruise SFC S L

N82-28298*# Bolt, Beranek and Newman, Inc, Cambridge, Mass
ANALYTICAL AND SIMULATOR STUDY OF ADVANCED TRANSPORT Final Report
William H Levison and William W Rickard (Douglas Aircraft Co, Long Beach Calif) Washington NASA Jun 1982 86 p refs
(Contract NAS1-16410)
(NASA-CR-3572, NAS 1 26 3572, Rept-4778) Avail NTIS HC A05/MF A01 CSCL 01C

An analytic methodology, based on the optimal-control pilot model was demonstrated for assessing longitudinal-axis handling qualities of transport aircraft in final approach Calibration of the methodology is largely in terms of closed-loop performance requirements, rather than specific vehicle response characteristics, and is based on a combination of published criteria, pilot preferences, physical limitations, and engineering judgment Six longitudinal-axis approach configurations were studied covering a range of handling qualities problems, including the presence of flexible aircraft modes The analytical procedure was used to obtain predictions of Cooper-Harper ratings, a solar quadratic performance index, and rms excursions of important system variables T M

N82-28299*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va
METHODOLOGY FOR DETERMINING ELEVON DEFLECTIONS TO TRIM AND MANEUVER THE DAST VEHICLE WITH NEGATIVE STATIC MARGIN
Boyd Perry, III May 1982 50 p refs
(NASA-TM-84499 NAS 1 15 84499) Avail NTIS HC A03/MF A01 CSCL 01C

The relationships between elevon deflection and static margin using elements from static and dynamic stability and control and from classical control theory are emphasized Expressions are derived and presented for calculating elevon deflections required to trim the vehicle in lg straight-and-level flight and to perform specified longitudinal and lateral maneuvers Applications of this methodology are made at several flight conditions for the ARW-2 wing On the basis of these applications it appears possible to trim and maneuver the vehicle with the existing elevons at -15% static margin Author

N82-28301# Virginia Univ, Charlottesville Dept of Mechanical and Aerospace Engineering
LIMITING PERFORMANCE OF NONLINEAR SYSTEMS WITH APPLICATIONS TO HELICOPTER VIBRATION CONTROL PROBLEMS Final Report
Walter D Pilkey 1982 26 p refs
(Grant DAAG29-79-G-0015)
(AD-A113239, UVA/525098-MAE-82/10, ARO-16091 5-E) Avail NTIS HC A03/MF A01 CSCL 20/11

This report summarizes the accomplishments of a study exploring new methods for the vibration control of helicopters Reanalysis methodology permits a variety of vibration control problems to be solved efficiently Both analytical and experimental studies have been conducted Author (GRA)

N82-28302# Air Force Human Resources Lab, Brooks AFB, Tex
MANUAL REVERSION FLIGHT CONTROL SYSTEM FOR A-10 AIRCRAFT: PILOT PERFORMANCE AND SIMULATOR CUE EFFECTS Final Report
Thomas H Gray Mar 1982 31 p refs
(AF Proj 1123)
(AD-A113463, AFHRL-TR-81-53) Avail NTIS HC A03/MF A01 CSCL 14/2

The A-10 aircraft incorporates an emergency backup control mode, the Manual Reversion Flight Control System (MRFCS) Maintaining effective control in this mode is a demanding pilot task, but it is not practiced in the flying training syllabus Because current plans call for training this skill using simulation, information was needed on simulator cue requirements Accordingly, the research objective was to determine the effectiveness of selected simulator visual and force cues used by experienced A-10 pilots to maintain aircraft control and to land when in the MRFCS mode The study found that (1) a large field of view enhanced the pilot's control of the aircraft, (2) platform motion had no influence upon aircraft control, (3) aircraft control was more difficult in the MRFCS mode than in the simple single engine failure state, (4) point of failure was a significant variable reliably affecting pilot control of the aircraft, and (5) pilot performance improved as a function of practice (trials)
Author (GRA)

N82-28303# National Aerospace Lab, Amsterdam (Netherlands) Structures and Materials Div
THE DETERMINATION OF GUST LOADS ON NONLINEAR AIRCRAFT USING A POWER SPECTRAL DENSITY APPROACH
R Noback and C Laauboder 17 Dec 1980 80 p refs
(Contract NIVR-RB-1854)
(NLR-TR-80123-U) Avail NTIS HC A05/MF A01

Since the power spectral density method cannot determine the exceedance of the output over the input in the nonlinear equations which describe an aircraft subjected to atmospheric turbulence, methods which approximate the exceedance curve were developed One method is analogous to the classical expression for the equivalent gain Another is analogous to the equivalent gain based on minimum error in energy In both, the maximum value (mu zy) of the cross correlation function between output and input to the nonlinearity is used A reasonable estimate of the exceedance curve, for systems for which mu zy is not known, can be obtained if the correlation between the input to the nonlinearity (z) and the system output (y) is high The ratio of the standard deviations of z and y can then be used Design loads based on mission analysis can be established once the load exceedance curve due to constant standard deviation of the input is known A definition for the design load of nonlinear aircraft using the design envelope method is proposed
Author (ESA)

N82-28306# Seville Research Corp, Pensacola, Fla
OPERATIONAL TEST AND EVALUATION HANDBOOK FOR AIRCREW TRAINING DEVICES. VOLUME 3: OPERATIONAL SUITABILITY EVALUATION Final Report
William V Hagin, Stephen R Osborne, Roik L Hockenberger, James P Smith, and Thomas H Gray (Operations Training Div, Williams AFB, Ariz) AFHRL Brooks AFB, Tex Feb 1982 128 p refs
(Contract F33615-78-C-0063, AF Proj 1123)
(AD-A112569, AFHRL-TR-81-44-Vol-3) Avail NTIS HC A07/MF A01 CSCL 05/9

The Handbook is comprised of three volumes and is intended to provide guidelines and procedures appropriate for Air Force Operational Test and Evaluation (OT&E) personnel to use in planning, conducting and reporting the results of simulator assessment efforts Although of value to all test personnel, it is primarily for the typical novice test manager/director - a person who has subject matter expertise (e g , a qualified pilot or operator), but who may have little or no previous OT&E experience The Handbook provides detailed coverage on OT&E planning and management with special emphasis on measuring device operational effectiveness and suitability In accord with its objectives, the Handbook was prepared to serve as a supplement to Air Force Manual 55-43 'Management of Operational Test and Evaluation, but providing those specific additional evaluation concepts and techniques necessary for aircrew training device test and evaluation GRA

N82-28307# Strategic Air Command, Offutt AFB, Nebr Aircraft Engineering Div

ALERT AIRCRAFT ROLL OVER CHOCKS Final Engineering Report

John M Connolly 14 Aug 1981 53 p
(AD-A107456, SAC/LGME-ER-P-372) Avail NTIS HC A04/MF A01 CSCL 01/5

The feasibility of restraining a parked alert aircraft with chocks which could be safely taxied over was studied Chocks were designed and then evaluated during SAC Giant Match II exercise The chocks successfully restrained a parked aircraft and allowed a heavy weight aircraft to safely taxi over when the chocks were placed on a rough surface Roll-over chock use was expanded command wide for B-52G and KC-135 alert aircraft except on icy surfaces Three ice gripping surface designs were evaluated All three designs performed successfully Author

N82-28309# Naval Training Equipment Center, Orlando, Fla Advanced Simulation Concepts Lab

COMPUTER PROGRAM FOR ANALYSIS OF SPHERICAL SCREEN DISTORTION Technical Report, Oct. 1980 - Feb. 1981

Richard C Hebb Mar 1982 71 p refs
(AD-A113136, NAVTRAEQUIPC-IH-332) Avail NTIS HC A04/MF A01 CSCL 05/9

In visual simulation, the distortion of imagery in wide-angle display systems is a major concern Effective flight training requires that the imagery presented to a trainee provide a proper perspective view of his simulated environment without distortion Use of spherical screens (domes) introduces perspective and geometrical distortion into these wide-angle displays Use of video projection systems with Computer Image Generation (CIG) offers the options of raster shaping or computer remapping for distortion correction The method is to correct the imagery before projection in order to provide a non-distorted scene to a trainee This report is documentation of a computer program for analysis of the required raster correction for specific projector/viewpoint positioning within a spherical screen The programs and report were initiated to provide input to the F-18 simulator (Device 2E7) being developed by Hughes Aircraft Author (GRA)

N82-28310# Aeronautical Research Labs , Melbourne (Australia)

PROGRAMS FOR THE TRANSONIC WIND TUNNEL DATA PROCESSING INSTALLATION. PART 8. PROGRAMS FOR PROCESSING DATA ON THE CENTRAL SITE COMPUTER

B D Fairlie Sep 1980 32 p refs
(AD-A112900, ARL/AERO-TM-324-Pt-8) Avail NTIS HC A03/MF A01 CSCL 09/2

Three programs which run on the central site computer (PDP-10) are described The first, PLT8 complements and extends the tunnel installation six-component force data plotting system The second, INTEG integrates aerofoil surface pressure measurements The third, PLTALL plots these surface pressure data Author (GRA)

N82-28311# Aeronautical Research Labs , Melbourne (Australia)

DESIGN BASIS FOR A NEW TRANSONIC WIND TUNNEL

J B Willis and N Pollock Jan 1982 27 p refs
(AD-A112899, ARL/Aero-TM-335, AR-002-326) Avail NTIS HC A03/MF A01 CSCL 14/2

The existing ARL Transonic Wind Tunnel, which is the largest such tunnel in Australia, has severely limited testing capabilities due to a low test Reynolds number and an inadequate test section size These deficiencies are becoming more acute as military aircraft performance capabilities increase For current fighter aircraft, the ratio of tunnel test to flight Reynolds number is about 1 100 and the extrapolation of tunnel data to flight carries a high risk of serious error and for some conditions is not possible at all The small test section size limits the scale of the models which can be tested The difficulty of machining small models to the required accuracy produces excessive manufacturing times Moreover, it is not possible to incorporate remotely adjusted control surfaces These two factors severely restrict tunnel productivity Given adequate support, it should be possible to build and commission a suitable new wind tunnel in about five years, at a cost substantially less than that of a single military fighter aircraft GRA

N82-28364# Messerschmitt-Boelkow-Blohm G m b H , Ottobrunn (West Germany) Information und Dokumentation

CARBON FIBER REINFORCED COMPOSITE STRUCTURES PROTECTED WITH METAL SURFACES AGAINST LIGHTNING STRIKE DAMAGE

C M Heckert, H P Wentzel (Vereinigte Flugtechnische Werke GmbH), and G Boes (Tech Univ , Hanover) 1982 9 p Presented at Intern Aerospace Conf on Lightning and Static Elec , Culham, England, 23-25 Mar 1982
(MBB-UD-340-82-O/E) Avail Issuing Activity

Lightning protection for carbon fiber reinforced composite (CFC) structures, typical of parts mainly located on the surface of aircraft, was investigated Only direct structural, effects of a lightning strike on a component were considered As protective materials, flame sprayed aluminum, aluminum mesh, aluminum foil, and aluminum/glass hybrid fabrics were tested Three specimen geometries were studied (1) solid CFC plates 2 and 3 mm thick, (2) sandwich plates with CFC facing of different thickness and with different core material (aluminum and Nomex) 10 mm through, and (3) electrically bonded test specimen composed of a solid CFC plate and metal substructure The test rig for simulating lightning discharges is described Results consist of damage diagrams showing specimen type, applied electrical discharge, and damaged area on protective surface and composite structure Author (ESA)

N82-28365# Messerschmitt-Boelkow-Blohm G m b H , Ottobrunn (West Germany) Information und Dokumentation

DEVELOPMENT OF MATERIALS AND MANUFACTURING TECHNOLOGY OVER THE NEXT 20 YEARS: COMPOSITE MATERIALS [ENTWICKLUNG DER WERKSTOFF- UND FERTIGUNGSTECHNIK IN DEN NAECHSTEN 20 JAHREN - VERBUNDWERKSTOFFE]

C M Heckert 1982 17 p In GERMAN Presented at Wehrtech Symp Entwicklung der Werkstoffe- u Fertigungstech in den naechsten 20 Jahren, Mannheim, West Germany, 17 Dec 1981, sponsored by Bundesakademie fuer Wehrverwaltung und Wehrtechnik, Mannheim, West Germany
(MBB-UD-341-82-O) Avail Issuing Activity

The development of reinforced plastics and their application in various manufacturing processes are reviewed The choice of CFRP or glass fiber reinforced plastic in military and commercial aircraft design is justified by higher specific strength and stiffness properties than alternative metals Other applications are found in automobiles, railway cars, and helicopters Size and mass reduction in parts as well as production cost savings are mentioned Influence on manufacturing of component geometry (rod, plate, complex) is considered The interrelationship of manufacturing capability with composite materials development is stressed through examples from industry Author (ESA)

N82-28462# Suntech, Inc Marcus Hook, Pa

AN EXPLORATORY RESEARCH AND DEVELOPMENT PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL FROM WHOLE CRUDE SHALE OIL PART 1 PRELIMINARY PROCESS ANALYSES Interim Report, 2 Jan - 1 Jul. 1979

H E Reif, J P Schwedock and A Schneider Wright-Patterson AFB, Ohio AFWAL Sep 1981 48 p refs 3 Vol
(Contract F33615-78-C-2024, AF Proj 3048)
(AD-A112681 AFWAL-TR-81-2087-Pt-1) Avail NTIS HC A03/MF A01 CSCL 21/4

Preliminary process analyses of three different technically feasible processing schemes proposed by SUN TECH, INC for converting 100,000 BPCD of raw Paraho shale oil into military turbine fuels was investigated Each processing scheme is based on very limited, but pertinent, data generated by SUN TECH plus literature sources The base processing scheme consists of severe hydrotreating followed by sulfuric acid extraction, the two alternate cases utilize moderate hydrotreating plus extraction for nitrogen removal and hydrocracking Screening-type process designs and costs estimates were prepared for each case using the economic basis specified Results indicate that shale oil fuels refineries are more capital intensive than a comparable size petroleum refinery No attempt was made at optimization Author (GRA)

N82-28463# Suntech, Inc, Marcus Hook, Pa

AN EXPLORATORY RESEARCH AND DEVELOPMENT PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL FROM WHOLE CRUDE SHALE OIL. PART 2 PROCESS VARIABLE ANALYSES AND LABORATORY SAMPLE PRODUCTION Interim Report, Jul 1979 - 1 Nov. 1980

H E Reif, J P Schwedock, and A Schneider Wright-Patterson AFB, Ohio AFWAL Sep 1981 61 p refs 3 Vol
(Contract F33615-78-C-2024, AF Proj 2480)
(AD-A112682 AFWAL-TR-81-2087-Pt-2) Avail NTIS HC A04/MF A01 CSCL 21/4

Pilot plant process data have been incorporated in three design bases for manufacturing military fuels from raw Occidental shale oil Processing schemes for 90,000 BPCD refineries to maximize either JP-4 JP-8 or to produce JP-4 plus other military fuels are presented The processing sequence comprises moderate severity hydrotreating, fractionation, anhydrous HCl extraction and hydrocarcking Plant capacities and product yields were not optimized Investments for the three refinery options considered are 1 5 to 2 0 times as much as a comparable size petroleum fuels refinery At maximum JP-4 or JP-8 production the yields are about 87 and 53 volume % of total refinery energy input, respectively Overall, refinery thermal efficiency is > or = 75% Inspection data are presented for five samples of specification aviation turbine fuels prepared from pilot plant operations GRA

N82-28464# Suntech, Inc Marcus Hook Pa

AN EXPLORATORY RESEARCH AND DEVELOPMENT PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL FROM WHOLE CRUDE SHALE OIL. PART 3: PRODUCTION OF SPECIFICATION OF JP-4 FUEL FROM GEOKINETICS SHALE OIL Interim Report, 1 Jan - 1 Apr 1980

H E Reif, J P Schwedock, and A Schneider Wright-Patterson AFB Ohio AFWAL Oct 1981 45 p refs 3 Vol
(Contract F33615-78-C-2024, AF Proj 2480)
(AD-A112683, AFWAL-TR-81-2087-Pt-3) Avail NTIS HC A03/MF A01 CSCL 21/4

270 Barrels of specification JP-4 jet fuel were produced by hydrorefining 890 barrels of raw Geokinetics shale oil under severe operating conditions in a continuous process development unit On a once thru basis the yield of JP-4 off the hydrotreater was about 35 volume % of the feed Preliminary estimates of plant investments and economics indicate that for the combination severe hydrorefining and hydrocracking an 85 volume % yield can be attained based on total refinery energy input Capital investments and manufacturing costs do not appear to be excessive for a shale oil refinery GRA

N82-28470# California Univ, Livermore Lawrence Livermore Lab

LABORATORY-SCALE SIMULATION OF UNDERGROUND COAL GASIFICATION EXPERIMENT AND THEORY

J R Creighton and C B Thorsness 28 Aug 1981 26 p refs Presented at the Western States Sect Meeting of the Combust Inst Tempe, Ariz, 19-20 Oct 1981
(Contract W-7405-eng-48)
(DE82-001063, UCRL-86473, CONF-811041-2) Avail NTIS HC A03/MF A01

Laboratory-scale experiments simulating underground coal gasification are described A 1 cm borehole is drilled through a block of coal which is cut to fit in a 55 gallon oil drum Inlet gas may be air or oxygen/steam mixture at various ratios The blocks are burned for a period of several hours at a prescribed flow schedule, with appropriate instrumentation Gas quality is found to be relatively independent of coal type for the range of sub-bituminous coals tested After the burn the blocks of coal are cut open to examine the cavity A mathematical modeling effort supports these experiments The models are restricted to pure carbon, to simplify the chemistry in the model When plug flow is assumed in the cavity the model predicts reasonable cavity shape downstream, but an incorrect shape upstream When aerodynamic flow including viscosity and vortex formation, is calculated in the cavity reasonable cavity shapes are obtained DOE

N82-28486# Vereinigte Flugtechnische Werke G m b H, Bremen (West Germany) Materials and Processes Development Dept

ADVANCED CASTING: TODAY AND TOMORROW

Dietmar Mietrach 1982 20 p refs Presented at AGARD Meeting on Adv Casting Technol, Brussels 4-9 Apr 1982
Avail NTIS HC A02/MF A01

The state of aluminum casting technology in terms of processes, component sizes design and material-scientific data as well as mechanical characteristics was established during visits to foundries in the USA, Canada, France Italy, Great Britain and the Federal Republic of Germany Components of the primary structure of Tornado and ALPHA aircraft, (pylon, intake floor) classified according to the degree of difficulty during casting, were used to compare existing designs (riveted sheet metal and machined parts) and cast versions with regard to cost reduction and technical reliability Visual inspection, dimensional checks, chemical composition analysis, penetrant tests X-ray tests, metallographic investigations, and tensile tests were carried out Cost savings of 25% and weight savings of 20% can be achieved by using castings Author (ESA)

N82-28523# TRW Defense and Space Systems Group, Redondo Beach, Calif

MULTIFUNCTION MULTIBAND AIRBORNE RADIO ARCHITECTURE STUDY Final Report, Apr. 1978 - Jan 1980

L N Ma, S K Ogi, M Y Huang, L L Bodnar, and P Martin Wright-Patterson AFB, Ohio AFWAL Jan 1982 379 p refs
(Contract F33615-77-C-1172, AF Proj 2003)
(AD-A114427, AFWAL-TR-81-1113) Avail NTIS HC A17/MF A01 CSCL 17/2

The demands of modern military avionic communication, radio navigation, and cooperative identification (CNI) equipment has been greatly expanded as the result of the need for antijam (AJ), low probability of intercept (LPI), higher navigation accuracy, and increased volume of information transfer These demands are verified in programs such as GPS, JTIDS, SEEK TALK, SINCGARS and AFSAT I and II The cost of this additional capability has severely hampered the ability of the Government to procure new CNI systems and equipment with desired performance capabilities The problem is further compounded by the lack of available space in the tactical aircraft, the transition of new equipment into the inventory, and the retention of many current systems The multifunction multiband airborne radio system (MFBARS) program is formulated to explore the feasibility of producing a modern CNI system at an affordable life cycle cost (LCC) and within real estate requirements A cost effective system approach was developed that revolved around high technology RF-LSI analog components that are in the development stage high speed digital pre-processor elements and a programmable signal processor all under control of a host processor configuration This design trades the ultimate gain in volume, weight and life cycle cost against a reasonable risk for the mid 1980's development Author (GRA)

N82-28552# Boeing Aerospace Co, Seattle, Wash

FEASIBILITY STUDY OF A 270V dc FLAT CABLE AIRCRAFT ELECTRICAL POWER DISTRIBUTED SYSTEM Final Report, Dec. 1980 - Jan. 1982

M J Musga and R J Rinehart Jan 1982 272 p refs
(Contract N62269-81-C-0231)
(AD-A114026, D182-10816-1, NADC-82023-60) Avail NTIS HC A12/MF A01 CSCL 10/2

This report documents the efforts of a one man-year feasibility study to evaluate the usage of flat conductors in place of conventional round wires for a 270 volt direct current aircraft power distribution system This study consisted of designing electrically equivalent power distribution harnesses in flat conductor configurations for a currently operational military aircraft Harness designs were established for installation in aircraft airframes which are (1) All metal, or (2) All composite, or (3) a mixture of both Flat cables have greater surface areas for heat transfer allowing higher current densities and therefore lighter weight conductors, than with round wires Flat cables are less susceptible to electromagnetic effects However, these positive factors are partially offset by installation and maintenance difficulties This study concludes that the extent of these difficulties can be adequately limited with appropriate modification to present installation and maintenance practices A comparative analysis of the flat and the round conductor power distribution harnesses was made for weight, cost, maintenance and reliability The knowledge gained from the design and comparative analysis phases was used to generate design criteria for flat power cable harnesses and to identify and prioritize flat cable harness components and associated production tooling which require development GRA

N82-28571# Aeronautical Research Inst of Sweden, Stockholm
MEASURING THE FLOW PROPERTIES OF SLOTTED TEST-SECTION WALLS
Sune B Berndt May 1982 15 p refs
(FFA-135) Avail NTIS HC A02/MF A01

By measuring pressure distributions at two levels near a slotted wall it is possible to deduce simultaneous values of normal and longitudinal velocities Such measurements require, for their proper interpretation, a basic understanding of the flow in the neighborhood of the wall An analysis of the problems involved is provided Author

N82-28624# Rose Engineering and Research, Inc, Incline Village, Nev
NEARFIELD AERODYNAMICS AND OPTICAL PROPAGATION CHARACTERISTICS OF A LARGE-SCALE TURRET MODEL Final Report
William C Rose, James E Craig (Spectron Development Lab, Inc), and K R Raman (Raman Aeronautics, Inc) Kirtland AFB, N Mex AFWL Feb 1982 100 p refs
(Contract F29601-79-C-0011, AF Proj 317J)
(AD-A113910, AFWL-TR-81-28) Avail NTIS HC A05/MF A01 CSCL 20/6

Measurements of the unsteady flow field affecting optical propagation quality have been made with both aerodynamic and direct optical instrumentation Properties affecting degradation of coherent radiation beams propagated from within the turret have been investigated These properties include both the magnitude and scale sizes of the fluctuating index-of-refraction field present in the turbulent shear layers and separation regions of the turret flow field Direct optical degradation information was obtained by holographic interferometry and quantified through techniques presented here Aerodynamic measurements were made with hot-wire anemometry and multiple-port probes Comparisons between the aerodynamically and optically deduced data are presented These data can be used directly to estimate trends in expected loss of optical quality of a coherent beam for various flight speeds, altitudes, wavelengths and azimuthal turret angles More data are now available for estimating the effects of unsteady aerodynamic flow fields on optical propagation quality Data were obtained for Reynolds numbers near those occurring at full-scale flight conditions over a range of Mach number from 0 55 to 0 75 Investigation results generally agree with those obtained previously on smaller scale models and indicate that severe optical degradation can be present at aft-looking azimuth angles Author (GRA)

N82-28643*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
RELIABILITY MODEL FOR PLANETARY GEAR
Michael Savage (Akron Univ), Charles A Paridon (Hewlett Packard Co, Sunnyvale, California), and John J Coy (Army Aviation Research and Development Command, Cleveland Ohio) 1982 22 p refs Proposed for Presentation at Design Engr Tech Conf Washington D C, 12-15 Sep 1982 sponsored by ASME Prepared in cooperation with Army Aviation Research and Development Command
(NASA-TM-82859 NAS 1 15 82859 AVRADCOM-TR-82-C-6) Avail NTIS HC A02/MF A01 CSCL 13I

A reliability model is presented for planetary gear trains in which the ring gear is fixed, the Sun gear is the input, and the planet arm is the output The input and output shafts are coaxial and the input and output torques are assumed to be coaxial with these shafts Thrust and side loading are neglected This type of gear train is commonly used in main rotor transmissions for helicopters and in other applications which require high reductions in speed The reliability model is based on the Weibull distribution of the individual reliabilities of the transmission components The transmission's basic dynamic capacity is defined as the input torque which may be applied for one million input rotations of the Sun gear Load and life are related by a power law The load life exponent and basic dynamic capacity are developed as functions of the component capacities Author

N82-28644*# National Aeronautics and Space Administration Lewis Research Center Cleveland Ohio
ADVANCES IN HIGH-SPEED ROLLING-ELEMENT BEARINGS
Erwin V Zaretsky 1982 29 p refs Presented at the 16th Ann Israel Conf on Mechan Engr Haifa Israel 12-14 Jul 1982 sponsored by Technion - Israel Inst of Tech
(NASA-TM-82910 E-1295 NAS 1 15 82910) Avail NTIS HC A03/MF A01 CSCL 13I

Aircraft engine and transmission rolling-element bearing state-of-the-art is summarized Author

N82-28676# Alabama Univ Huntsville Dept of Mechanical Engineering
RECENT DEVELOPMENTS IN HYGROTHERMOVISCOELASTIC ANALYSIS OF COMPOSITES
T J Chung *In* Shock and Vibration Information Center The Shock and Vibration Digest Vol 14, No 4 Apr 1982 p 33-40 refs (For primary document see N82-28673 19-39)
Avail SVIC, Code 5804, Naval Research Lab Washington D C 20375, $20 00/set CSCL 20/11

Constitutive theories of hygrothermomechanical behavior of viscoelastic composites are reviewed Author

N82-28685# National Aerospace Lab Amsterdam (Netherlands) Structures and Materials Div
PREDICTION OF FATIGUE CRACK GROWTH RATES UNDER VARIABLE LOADING USING A SIMPLE CRACK CLOSURE MODEL
A U deKoning and H H vanderLinden Apr 1980 45 p refs Presented at 11th ICAF Symp Noordwijkerhout, Netherlands 20-22 May 1981
(Contracts NIVR-1777 NIVR-1822, NIVR-1823)
(NLR-MP-81023-U) Avail NTIS HC A03/MF A01

A model which predicts fatigue crack growth rates in aluminum alloys subjected to flight service loading is presented The model is based on an approximate description of the crack opening behavior and was applied successfully in an analysis of effects of crack growth acceleration and retardation observed experimentally under variable amplitude loading The model describes effects of the plane strain to plane stress transition and of relatively high overloads on crack growth rate of the crack Author (ESA)

N82-28690*# National Aeronautics and Space Administration Wallops Flight Center, Wallops Island Va
BASELINE MONITORING USING AIRCRAFT LASER RANGING
W B Krabill, F E Hoge and C F Martin Jun 1982 28 p refs
(NASA-TM-73298 NAS 1 15 73298) Avail NTIS HC A03/MF A01 CSCL 08B

The use of aircraft laser ranging for the determination of baselines between ground based retroreflectors was investigated via simulations and with tests at Wallops Flight Center using the Airborne Oceanographic Lidar (AOL) on the Wallops C-54 aircraft ranging to a reflector array deployed around one of the Wallops runways The aircraft altitude and reflector spacing were chosen on the basis of scaled down modeling of spacecraft tracking from 1000 km of reflectors separated by some 52 km or of high altitude (10 km) aircraft tracking of reflectors separated by some 500 m Aircraft altitudes flown for different passes across the runway reflector array varied from 800 m to 1350 m, with 32 reflectors deployed over an approximately 300 m x 500 m ground pattern The AOL transmitted 400 pulses/sec with a scan rate of 5/sec in a near circular pattern so that the majority of the pulses were reflected by the runway surface or its environs rather than by retroreflectors The return pulse characteristics clearly showed the high reflectivity of portions of the runway with several returns indistinguishable in amplitude from reflector returns For each pass across the reflector field typically six to ten reflector hits were identified consistent with that predicted by simulations and the observed transmitted elliptical pulse size Author

N82-28715*# National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt Md
SCANNER IMAGING SYSTEMS, AIRCRAFT
Stephen G Ungar *In* JPL Proc of the NASA Workshop on Registration and Rectification 1 Jun 1982 p 138-152 (For primary document see N82-28699 19-43)
Avail NTIS HC A23/MF A01 CSCL 08B

The causes and effects of distortion in aircraft scanner data are reviewed and an approach to reduce distortions by modelling the effect of aircraft motion on the scanner scene is discussed With the advent of advanced satellite borne scanner systems, the geometric and radiometric correction of aircraft scanner data has become increasingly important Corrections are needed to reliably simulate observations obtained by such systems for purposes of evaluation It is found that if sufficient navigational information is available, aircraft scanner coordinates may be related very precisely to planimetric ground coordinates However, the potential for a multivalue remapping transformation (i e, scan lines crossing each other) adds an inherent uncertainty, to any radiometric resampling scheme which is dependent on the precise geometry of the scan and ground pattern EAK

N82-28841# Aerospace Medical Research Labs, Wright-Patterson AFB Ohio Biodynamics and Bioengineering Div

FIELD STUDIES OF THE AIR FORCE PROCEDURES (NOISECHECK) FOR MEASURING COMMUNITY NOISE EXPOSURE FROM AIRCRAFT OPERATIONS Final Report

R A Lee Mar 1982 130 p
(AF Proj 7231)
(AD-A113672, AFAMRL-TR-82-12) Avail NTIS HC A07/MF A01 CSCL 20/1

This report describes the results of noise measurements at Laughlin AFB and Homestead AFB to field test the NOISECHECK equipment and procedures developed under contract by Bolt, Beranek and Newman, Inc and Digital Acoustics Inc NOISECHECK is the equipment and procedures used by the Air Force to spot check or validate the long term noise exposure predicted by NOISEMAP the Air Force computer program for predicting community noise exposure from aircraft operations The total noise exposure level at a specified location has an uncertainty associated with it whether the level is predicted or measured The purpose of NOISECHECK is to determine the total noise exposure in terms of the Day-Night Level (DNL) metric for a specified ground location from direct measurements NOISEMAP predicts DNL values for yearly-averaged 'busy days' aircraft operations Therefore, the direct DNL measurements need to be normalized to this busy day DNL The NOISECHECK Procedures lead you through these normalizations in a straightforward step-by-step method The results of the Laughlin and Homestead tests show that, with the proper data collection, the NOISECHECK procedures can validate the long-term noise exposure and explain any differences between the NOISEMAP predicted DNL values and the short term measurement DNL values Author (GRA)

N82-28842# California Univ, Riverside Statewide Air Pollution Research Center

ATMOSPHERIC CHEMISTRY OF HYDROCARBON FUELS. VOLUME 2 OUTDOOR CHAMBER DATA TABULATIONS, PART 1 Final Report, Mar 1980 - Sep 1981

William P L Carter, Paul S Ripley, Cecil G Smith, and James N Pitts, Jr Tyndall AFB, Fla AF Engineering and Services Center Nov 1981 336 p 2 Vol
(Contract F08635-80-C-0086, AF Proj 1900)
(AD-A113665 AFESC/ESL-TR-81-53-V-2-P-1) Avail NTIS HC A15/MF A01 CSCL 04/1

A total of 132 single- and multi-day outdoor environmental chamber experiments were conducted, involving nine different aviation and automotive fuels These included the petroleum-derived JP-4 and JP-8 military aviation fuels their shale-oil derived analogues, unleaded gasoline, diesel No 2 fuel, and the experimental high-energy cruise-missile fuels JP-10 RJ-4, and RJ-5 The program was conducted to assess the potential of these fuels to adversely affect air quality Author

N82-28881*# Tennessee Univ Space Inst Tullahoma

ANALYSIS OF VIBRATION INDUCED ERROR IN TURBULENCE VELOCITY MEASUREMENTS FROM AN AIRCRAFT WING TIP BOOM Final Report

Safwan H Akkari and Walter Frost Washington NASA Jun 1982 77 p refs
(Contract NAS8-34627)
(NASA-CR-3571 NAS 1 26 3571) Avail NTIS HC A05/MF A01 CSCL 04B

The effect of rolling motion of a wing on the magnitude of error induced due to the wing vibration when measuring atmospheric turbulence with a wind probe mounted on the wing tip was investigated The wing considered had characteristics similar to that of a B-57 Cambera aircraft and Von Karman s cross spectrum function was used to estimate the cross-correlation of atmospheric turbulence Although the error calculated was found to be less than that calculated when only elastic bendings and vertical motions of the wing are considered, it is still relatively large in the frequency s range close to the natural frequencies of the wing Therefore it is concluded that accelerometers mounted on the wing tip are needed to correct for this error, or the atmospheric velocity data must be appropriately filtered Author

N82-29022*# Research Triangle Inst, Research Triangle Park, N C Systems and Measurements Div

PROBLEMS RELATED TO THE INTEGRATION OF FAULT TOLERANT AIRCRAFT ELECTRONIC SYSTEMS

J A Bannister, V Adlakha, K Triyedi, and T A Alspaugh, Jr Jun 1982 167 p refs
(Contract NAS1-16489)
(NASA-CR-165926, NAS 1 26 165926, RTI/2094/02-02F) Avail NTIS HC A08/MF A01 CSCL 09B

Problems related to the design of the hardware for an integrated aircraft electronic system are considered Taxonomies of concurrent systems are reviewed and a new taxonomy is proposed. An informal methodology intended to identify feasible regions of the taxonomic design space is described Specific tools are recommended for use in the methodology Based on the methodology, a preliminary strawman integrated fault tolerant aircraft electronic system is proposed Next, problems related to the programming and control of inegrated aircraft electronic systems are discussed Issues of system resource management, including the scheduling and allocation of real time periodic tasks in a multiprocessor environment, are treated in detail The role of software design in integrated fault tolerant aircraft electronic systems is discussed Conclusions and recommendations for further work are included M G

N82-29111*# Stanford Univ, Calif Joint Inst for Aeronautics and Acoustics

THE EFFECT OF BARRIERS ON WAVE PROPAGATION PHENOMENA WITH APPLICATION FOR AIRCRAFT NOISE SHIELDING

C V M Mgana and I-Dee Chang May 1982 142 p refs
(Contract NCC2-76)
(NASA-CR-169128, NAS 1 26 169128) Avail NTIS HC A07/MF A01 CSCL 20A

The frequency spectrum was divided into high and low frequency regimes and two separate methods were developed and applied to account for physical factors associated with flight conditions For long wave propagation the acoustic filed due to a point source near a solid obstacle was treated in terms of an inner region which where the fluid motion is essentially incompressible, and an outer region which is a linear acoustic field generated by hydrodynamic disturbances in the inner region This method was applied to a case of a finite slotted plate modelled to represent a wing extended flap for both stationary and moving media Ray acoustics, the Kirchhoff integral formulation, and the stationary phase approximation were combined to study short wave length propagation in many limiting cases as well as in the case of a semi-infinite plate in a uniform flow velocity with a point source above the plate and embedded in a different flow velocity to simulate an engine exhaust jet stream surrounding the source ARH

N82-29116# Technische Physische Dienst TNO-TH, Delft (Netherlands)

USE OF THE CAVITATION TUNNEL AT THE DUTCH NAVAL EXPERIMENT STATION (NSP), WAGENINGEN FOR THE DETERMINATION OF THE ACOUSTIC SOURCE STRENGTH OF PROPELLER CAVITATION [HET GEBRUIK VAN DE CAVITATIETUNNEL VAN HET NSP TE WAGENINGEN VOOR DE BEPALING VAN DE AKOESTISCHE BRONSTERKTE VAN SCHROEFCAVITATIE]

K Verhulst 18 Aug 1981 44 p refs In DUTCH
(Contract A72/KM/007)
(TPD-908-720 TDCK-75536) Avail NTIS HC A03/MF A01

Experiments were performed using a five blade model propeller in order to investigate the possibilities of using the large NSP cavitation tunnel in the acoustical study of propeller cavitation The influence of the hydrodynamic characteristics in the tunnel on the sound transmission to the tunnel wall was investigated The transfer functions fluctuate strongly, even at a given water velocity or static pressure, probably due to poor acoustic damping in the tunnel circuit For a turning propeller the acoustic response of the tunnel wall due to propeller cavitation is very stable since the degree of turbulence in the water and thus the absorption, are very high Author (ESA)

N82-29118# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany)

SOME COMMENTS ON THE PREDICTION OF FORWARD FLIGHT EFFECTS ON JET NOISE

Frank Obermeier Dec 1981 37 p refs
(MPIS-20/1981 ISSN-0436-1199) Avail NTIS HC A03/MF A01 Fachinformationszentrum, Karlsruhe, West Germany DM 8,55

How aeroacoustic sound generation in turbulent jet flow is affected by a coflowing stream is considered Experiment shows that simply allowing for Doppler effects, applied to the sound field of a static jet which is assumed to be known, does not yield convincing results The effects of a coaxial stream on the aerodynamics of jet flow, i e, the effects on its characteristic length and velocity, found experimentally, are critically reviewed through the literature Results lead to a prediction scheme for in-flight effects on jet noise A comparison of this method with test data exhibits good agreement Author (ESA)

N82-29261# Federal Aviation Administration Washington D C Planning Analysis Div

FAA AVIATION FORECASTS-FISCAL YEARS 1982-1993

Feb 1982 72 p
(AD-A114696 FAA-APO-82-2) Avail NTIS HC A04/MF A01 CSCL 01/2

This report contains the Fiscal Years 1982 to 1993 Federal Aviation Administration (FAA) forecasts of aviation activity at FAA facilities These include airports with FAA control towers air route traffic control centers, and flight service stations Detailed forecasts were made for the four major users of the national aviation system air carriers, air taxi/commuters, general aviation and the military The forecasts have been prepared to meet the budget and planning needs of the constituent units of the FAA and to provide information that can be used by state and local authorities by the aviation industry and the general public GRA

N82-29263# Aeronautical Research Inst of Sweden Stockholm Aerodynamics Dept

ON EMBEDDED FLOW CHARACTERISTICS OF SHARP EDGED RECTANGULAR WINGS

Erik S Larson 21 Apr 1982 19 p refs Backup Document for AIAA Synoptic scheduled for publication in the Journal of Aircraft Feb or Mar 1983
(Log-C4712) Avail NTIS HC A02/MF A01

The semiempirical analytic expressions for steady, symmetric flow characteristics on thin rectangular wings at transonic speed are investigated Semiempirical expressions representing aerodynamic characteristics of sharp edged rectangular wings are reported The basic coefficients correlated very well with panel method results for Mach number of the free stream $<$ or $=$ 1 the intended domain of applicability S L

N82-29267*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

AERODYNAMICS OF AN AIRFOIL WITH A JET ISSUING FROM ITS SURFACE

D A Tavella and K Karamcheti May 1982 93 p refs
(Contract NCC2-74)
(NASA-TM-84825 NAS 1 15 84825 SU-JIAA-TR-44) Avail NTIS HC A05/MF A01 CSCL 01A

A simple, two dimensional, incompressible and inviscid model for the problem posed by a two dimensional wing with a jet issuing from its lower surface is considered and a parametric analysis is carried out to observe how the aerodynamic characteristics depend on the different parameter The mathematical problem constitutes a boundary value problem where the position of part of the boundary is not known a priori A nonlinear optimization approach was used to solve the problem, and the analysis reveals interesting characteristics that may help to better understand the physics involved in more complex situations in connection with high lift systems Author

N82-29268*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

AIRCRAFT GEOMETRY VERIFICATION WITH ENHANCED COMPUTER GENERATED DISPLAYS

J V Cozzolongo Jun 1982 13 p refs
(NASA-TM-84254, NAS 1 15 84254) Avail NTIS HC A02/MF A01 CSCL 01A

A method for visual verification of aerodynamic geometries using computer generated, color shaded images is described The mathematical models representing aircraft geometries are created for use in theoretical aerodynamic analyses and in computer aided manufacturing The aerodynamic shapes are defined using parametric bi-cubic splined patches This mathematical representation is then used as input to an algorithm that generates a color shaded image of the geometry A discussion of the techniques used in the mathematical representation of the geometry and in the rendering of the color shaded display is presented The results include examples of color shaded displays, which are contrasted with wire frame type displays The examples also show the use of mapped surface pressures in terms of color shaded images of V/STOL fighter/attack aircraft and advanced turboprop aircraft Author

N82-29271*# Boeing Vertol Co, Philadelphia, Pa

INVESTIGATION OF A ROTOR SYSTEM INCORPORATING A CONSTANT LIFT TIP Final Contractor Report

M A McVeigh, H Rosenstein, K Bartie and F J McHugh Oct 1981 326 p refs
(Contract NAS2-10769)
(NASA-CR-166261, NAS 1 26 166261) Avail NTIS HC A15/MF A01 CSCL 01A

A wind tunnel test of a 16 8 ft model of a rotor having passively controlled pivotable tips is described Performance and vibratory hub load data are presented which compare the performance of the rotor with the tips free and fixed. A brief analysis of the experimental findings is included S L

N82-29274# Federal Aviation Administration Washington, D C Office of Aviation Medicine

FLIGHT ATTENDANT INJURIES 1971-1976

Donell W Pollard, Earl D Folk, and Richard F Chandler Jan 1982 60 p refs
(AD-A114909 FAA-AM-82-8) Avail NTIS HC A04/MF A01 CSCL 01/2

Data from 206 reports of 377 flight attendant injuries occurring from 1971 through 1976 are summarized These data were obtained from the Cabin Safety Data Bank of the Civil Aeromedical Institute, and are based on Federal Aviation Administration and National Transportation Safety Board accident/incident reports Information relating to the severity and location of the injury is provided when available from original reports Data relating to the flight condition and location in the aircraft where the injury occurred are provided Summaries of each reported injury are included in the appendices Author (GRA)

N82-29275# Federal Aviation Administration, Washington, D C Office of Aviation Medicine

CRASHWORTHINESS STUDIES CABIN, SEAT, RESTRAINT, AND INJURY FINDINGS IN SELECTED GENERAL AVIATION ACCIDENTS

William R Kirkham, S Marlene Wicks and Donald Lee Lowrey Mar 1982 24 p refs
(AD-A114878, FAA-AM-82-7) Avail NTIS HC A02/MF A01 CSCL 01/2

This report reviews 47 survivable or partly survivable accidents investigated since 1973 by personnel from the Civil Aeromedical Institute The accidents were reviewed for a number of features of crashworthiness and, in particular for injuries to occupants in relation to the severity of the impact and the performance of cabin and restraint systems Opinions were rendered by trained crash injury investigators as to the role or expected role in seats and upper torso restraints in adding to or lessening the injuries The data support the general concepts that nonoccupiable portions of the aircraft receive greater physical damage than occupiable areas The greatest damage to the occupiable area is to the forward portion of cockpit/cabin and the occupants have a greater chance of survival if the cockpit/cabin remains reasonably intact Occupants seated forward in the cockpit/cabin receive greater injuries than those seated more rearward Further the findings suggest tha seat placement or seat failure to one degree or another intensified injuries (as compared to more optimum crashworthy seats) to occupants in at least

30 percent of the accidents reviewed Upper torso restraints, in the few instances used, were beneficial, and had they been used by all occupants, would have significantly reduced the injuries The report discusses the relation of the occupant to the seat and restraint system and the apparent benefit to be derived from a well-designed impact attenuating seat and, in particular, use of an upper torso restraint Author (GRA)

N82-29276# Federal Aviation Administration, Atlantic City, N J
REDUCTION AND ANALYSIS OF MODE C ALTITUDE DATA COLLECTED AT HIGH ALTITUDES OVER THE CONTINENTAL UNITED STATES Final Report, Sep. 1977 - Apr. 1978
Robert Rigolizzo Mar 1982 101 p refs
(AD-A114655, DOT/FAA/CT-81/53, DOT/FAA/EM-82/9)
Avail NTIS HC A06/MF A01 CSCL 01/2

This report describes the reduction and analysis of mode C altitude data collected over the en route centers of Cleveland, Ohio, Memphis, Tennessee, and Albuquerque, New Mexico The data were gathered under the aegis of the separation standards program primarily for the study of lateral navigation performance over the continental United States at high altitudes This study provides a procedure for estimating the vertical flight technical error as evidenced from mode C altitude data recorded at the en route centers It does not account for basic altimeter system error or flight technical error biases and/or fluctuations that are not observable in the ground-derived mode C reported altitude The data are fitted to six different analytical distributional forms The effect that data quantization has on the estimation of the parameters of the distributions is examined Then statistical tests are performed to evaluate the appropriateness of each distributional model in representing the histogram of the mode C deviations A preliminary analysis is conducted to investigate the association between mode C altitude and aircraft environmental performance characteristics commonly utilized in evaluating separation criteria as well as identifying aircraft attributes that are of major interest when evaluating vertical flight technical error Author (GRA)

N82-29277# Clemson Univ, S C Dept of Industrial Management
MAXIMIZING SOUTH CAROLINA'S AVIATION RESOURCES IDENTIFYING POTENTIALLY PROFITABLE COMMUTER AIRLINE ROUTES, VOLUME 2
Clinton H Whitehurst, Jr, Mark A McKnew, Michael W Broadway, and Gayle H Taylor Oct 1981 168 p refs
(Grant EDA-04-06-03042-40)
(PB82-139353, EDA-81-0132) Avail NTIS HC A08/MF A01 CSCL 01B

The commuter airline routes within South Carolina were analyzed It is concluded there are, in fact, a number of potentially profitable commuter airline routes between communities within South Carolina and interstate routes tying some communities in the State to medium and large hub airports There is however, still work to be done As communities grow in size and should air service to the State by trunk carriers decline further, it would be well worth it for a community to reevaluate its potential to support commuter service in terms of the profitability criteria outlined in this study GRA

N82-29278# National Transportation Safety Board, Washington, D C Bureau of Technology
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA. US GENERAL AVIATION CALENDAR YEAR 1979
5 Nov 1981 213 p
(PB82-136250 NTSB-ARG-81-1) Avail NTIS HC A10/MF A01 CSCL 01B

Aircraft accidents which occurred in U S general aviation operations during the calendar year 1979 are summarized It includes an analysis of accident data involving an overview, types of accidents, accidental causal factors, kind of flying, and conclusions a statistical compilation of accident information presented in the form of accident and rate tables, analytic tables, injury tables and cause/factor tables These statistical data are divided into sections pertaining to all operations, small fixed-wing aircraft, large fixed-wing aircraft, rotorcraft, gliders, and collisions between aircraft In 1979, there were 4,023 total general aviation accidents, 678 of which were fatal Included in the total number of accidents are 40 collisions between aircraft Author

N82-29279# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
AIRCRAFT FIRE SAFETY
May 1982 174 p refs Presented at AGARD Lecture Series, Oslo, 7-8 Jun 1982 and London, 10-11 Jun 1982 and Washington, 15-16 Jun 1982
(AGARD-LS-123, ISBN-92-835-1424-6) Avail NTIS HC A09/MF A01

Progress in aerospace science and technology, especially pertaining to aircraft safety was reported The goals of the international organization are to strengthen common defense posture, improve international cooperation in research and development, provide scientific and technical advance to NATO in aerospace R&D, increase scientific and technical potential and recommend effective use of R&D capabilities The following topics are discussed aircraft fire mishap experience/crash fire scenario quantitation, human response to fire aviation fuels, future outlook and impact on aircraft fire threat, fuel system protection methods, fireworthiness of transport aircraft interior systems, the development and application of a full scale wide body test article to study the behavior of interior materials during a postcrash fuel fire, aircraft postcrash fire reduction/survivability enhancement from a manufacturer's viewpoint, and aircraft postcrash fire fighting/rescue For individual titles, see N82-29280 through N82-29287

N82-29280# Federal Aviation Administration, Washington, D C Engineering Analysis Branch
AIRCRAFT FIRE MISHAP EXPERIENCE/CRASH FIRE SCENARIO QUANTITATION
Thomas G Horeff *In* AGARD Aircraft Fire Safety May 1982 6 p refs (For primary document see N82-29279 20-03)
Avail NTIS HC A09/MF A01

Civil and military turbine aircraft accidents were reviewed It was confirmed that the major postcrash fire hazard was caused by ignition of fuel released from wing separation failured during impact survivable accidents General scenarios for postcrash fire hazards are described and heat flux levels and cabin airflow rates based on fuselage postcrash fire tests are suggested Fire fatalities to fire tests are suggested Fire fatalities to fire scenarios and fire experience data base through 1979 are related It is concluded that the reduction of postcrash fire gives the greatest potential for improved crashworthiness and increased occupant survivability E A K

N82-29281# Army Aeromedical Research Lab, Fort Rucker, Ala
HUMAN RESPONSE TO FIRE
Stanley C Knapp and Francis S Knox, III *In* AGARD Aircraft Fire Safety May 1982 19 p (For primary document see N82-29279 20-03)
Avail NTIS HC A09/MF A01

Human survival in aircraft fire was investigated Aircraft fires and human survival in thermophysical dimensions and aircraft fire properties, chemical and toxic nature of fibres, the concept of worst credible environment, and survival time dimension derived from ground and airborne fire suppression are discussed The epidemiology of human fire morbidity and mortality are divided into (1) no personal protection, no prevention of fire, (2) inadequate protection, no prevention of fire and (3) prevention of fire and good protection Assessment techniques to select fabric for protective clothing are examined Physical and biomedical bases to formulated strategies for the development of aircraft fire prevention and personal protection which leads to increased human survival is constructed E A K

N82-29282# Air Force Wright Aeronautical Labs, Wright-Patterson AFB, Ohio Aero Propulsion Lab
AVIATION FUELS-FUTURE OUTLOOK AND IMPACT ON AIRCRAFT FIRE THREAT
A V Churchill *In* AGARD Aircraft Fire Safety May 1982 17 p refs (For primary document see N82-29279 20-03)
Avail NTIS HC A09/MF A01

The properties of aviation turbine fuels with respect to aircraft fire safety are described It is indicated that projections of the availability of petroleum crudes specifications for aviation turbine fuels may have to be modified to use fuels produced from shale oil, heavy oils and coal Projections of the chemical and physical properties of future aviation fuels produced from these alternative sources are discussed and compared with present fuels Progress on programs to develop fire safe fuels through the use of antimisting additives is also described E A K

N82-29283# Royal Aircraft Establishment Farnborough (England) Engineering Physics Dept
FUEL SYSTEM PROTECTION METHODS
H W G Wyeth *In* AGARD Aircraft Fire Safety May 1982 16 p refs (For primary document see N82-29279 20-03)
Avail NTIS HC A09/MF A01

A fuel system protection equipment for military aircraft and helicopters, to reduce fires and explosions which occur under combat conditions was developed Equipments are available for fitment to civil transport for survivability enhancement It is recommended that aircraft fire safety and crash resistance in the initial design and appropriate safety precautions taken to minimize the risk of fire and explosion both in flight and on the ground should be considered It is concluded that fuel containment systems and antimisting fuels can reduce dynamic fuel spillage and improve occupant survivability in postcrash fire EAK

N82-29284*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
FIREWORTHINESS OF TRANSPORT AIRCRAFT INTERIOR SYSTEMS
John A Parker and D A Kourtides *In* AGARD Aircraft Fire Safety May 1982 17 p refs (For primary document see N82-29279 20-03)
Avail NTIS HC A09/MF A01

The fire worthiness of air transport interiors was evaluated The effect of interior systems on the survival of passengers and crew in an uncontrolled transport aircraft fire is addressed Modification of aircraft interior subsystem components which provide improvements in aircraft fire safety are examined Three specific subsystem components, interior panels, seats and windows offer the most immediate and highest payoff by modifying interior materials of existing aircrafts It is shown that the new materials modifications reduce the fire hazards because of significant reduction in their characteristic flame spread, heat release, and smoke and toxic gas emissions EAK

N82-29285# Federal Aviation Administration, Atlantic City, N J Fire Safety Branch
THE DEVELOPMENT AND APPLICATIONS OF A FULL-SCALE WIDE BODY TEST ARTICLE TO STUDY THE BEHAVIOR OF INTERIOR MATERIALS DURING A POST-CRASH FUEL FIRE
Constantine P Sarkos, Richard G Hill, and Wayne D Howell *In* AGARD Aircraft Fire Safety May 1982 21 p refs (For primary document see N82-29279 20-03)
Avail NTIS HC A09/MF A01

The full scale, wide body test article was developed to study postcrash cabin fires Applications of the C-133 article are described as follows (1) capabilities and instrumentation (2) derivation of fuel fire test conditions based on physical modeling and fire tests, (3) characterization of cabin fire hazards which result from exposure of wide body interior materials to external fuel fire, and (5) evaluation of effectiveness of urethane seat cushion fire blocking layers and improved cushioning materials It is shown that cabin hazards and parameters associated with postcrash fire can be realized by use of improved materials EAK

N82-29286# British Aerospace Aircraft Group Bristol (England) Fire Precautions Engineering Dept
AIRCRAFT POST CRASH FIRE REDUCTION/SURVIVABILITY ENHANCEMENT FROM A MANUFACTURER'S VIEWPOINT
T Madgwick *In* AGARD Aircraft Fire Safety May 1982 23 p refs (For primary document see N82-29279 20-03)
Avail NTIS HC A09/MF A01

The importance of achieving a balanced level of overall safety for flight and crash situations are outlined Research and development in the area of external fire effects and occupant escape is evaluated The crashworthiness requirements developed for the SST and the means of compliance are outlined Cabin interior material combustion hazards are discussed Visibility tests in a smoke filled cabin and the relative importance of toxicity effects in hindering escape are assessed EAK

N82-29287# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt Cologne (West Germany) Inst fuer Antriebstechnik
AIRCRAFT POST-CRASH FIRE FIGHTING/RESCUE
R Fiala *In* AGARD Aircraft Fire Safety May 1982 27 p refs (For primary document see N82-29279 20-03)
Avail NTIS HC A09/MF A01

The correlation between specific extinguishing time and the size of the burning fuel area was calculated The influence of fuel properties the boiling temperature and viscosity on extinguishing efficiency of foams is described An extinguishing technique which considers the dependence of extinguishing efficiency on the foam properties is presented The requirements for foam monitors are shown The break up of foam jets produced by foam monitors is discussed The extinguishing efficiency with the combined application of dry powder halon and foam and the advantages of a combined use when there is only a pool fire are outlined EAK

N82-29288*# Princeton Univ N J Flight Research Lab
DEVELOPMENT OF FLYING QUALITIES CRITERIA FOR SINGLE PILOT INSTRUMENT FLIGHT OPERATIONS Interim Report, Sep. 1979 - May 1981
Aharon Bar-Gill, W Barry Nixon and George E Miller Jun 1982 167 p refs
(Contract NAS1-15764)
(NASA-CR-165932, NAS 1 26 165932 MAE-1528) Avail NTIS HC A08/MF A01 CSCL 17G

Flying qualities criteria for Single Pilot Instrument Flight Rule (SPIFR) operations were investigated The ARA aircraft was modified and adapted for SPIFR operations Aircraft configurations to be flight-tested were chosen and matched on the ARA in-flight simulator, implementing modern control theory algorithms Mission planning and experimental matrix design were completed Microprocessor software for the onboard data acquisition system was debugged and flight-tested Flight-path reconstruction procedure and the associated FORTRAN program were developed Algorithms associated with the statistical analysis of flight test results and the SPIFR flying qualities criteria deduction are discussed NW

N82-29290# Federal Aviation Administration, Washington D C Office of Aviation Medicine
EFFECTS OF APPROACH LIGHTING AND VARIATION IN VISIBLE RUNWAY LENGTH ON PERCEPTION OF APPROACH ANGLE IN SIMULATED NIGHT LANDINGS
Henry W Mertens and Mark F Lewis Feb 1982 21 p refs
(AD-A114742 FAA-AM-82-6) Avail NTIS HC A02/MF A01 CSCL 01/2

Previous experiments have demonstrated illusions due to variations in both length and width of runways in nighttime 'black hole approaches Even though approach lighting is not designed to provide vertical guidance, it is possible that cues from approach lights could interact with cues from runway lighting to reduce illusions due to variation in runway size Two experiments were conducted to evaluate the effect of approach lighting on perception of approach angle in simulated night approaches In the first experiment, 40 pilots made simulated visual approaches to a 150- by 6,000-ft runway with and without a 3,000-ft approach light system (ALSF-2) Pilots controlled a moving runway model to produce a constant 'normal' angle of approach over the distance range of 23,000 ft to 8,000 ft from threshold In the second experiment 24 pilots made simulated approaches to a 150- by 6,000-ft runway which was either fully visible or which had lights of the upwind half occluded In addition, a 1,400-ft abbreviated approach light system (SSALS) was used at three intensities Decreasing the visible length of the runway by occulting lights of the far half increased mean generated approach angles from 2 2 deg to 2 7 deg in agreement with results of a previous experiment involving similar lengths of runways Neither the presence of equal intensity approach lights nor uncomfortable glare from approach lights 20 times brighter than runway lights had an effect of practical significance on responses These findings reinforce previous experimental demonstrations of the importance of runway size cues related to varying runway length, and also show that potential size cues provided by approach lights do not prevent illusions due to variations in runway size GRA

N82-29291# SRI International Corp Menlo Park, Calif
TERMINAL INFORMATION DISPLAY SYSTEM BENEFITS AND COSTS Final Report
Waheed Siddiqee, Janet Tornow, and Mina Chan Washington FAA Mar 1982 79 p refs
(Contract DOT-FA-79-WA-4344)
(AD-A114937, FAA-APO-82-4) Avail NTIS HC A05/MF A01 CSCL 17/7

Benefits and costs expected to accrue from a terminal information display system (TIDS) are analyzed TIDS is an electronic data processing system intended to replace (1) present flight data entry and printing equipment and (2) several devices currently used to display meteorological and operational information within towers and terminal radar control facilities A description of the terminal information display system is presented Major sources of both quantifiable and nonquantifiable benefits are discussed It is shown that the installation of TIDS would improve terminal controller productivity by ten to fifteen percent and would result in a substantial reduction in maintenance costs Information in present value (1981) dollars for the equipment life cycle is presented Over the twenty year service life of TIDS, the analysis indicates that the benefit/cost ratio is 1 74 and the net present value of savings by installing TIDS at thirty major terminal facilities is about $26 million GRA

N82-29292# Applied Geophysics, Inc, Salt Lake City, Utah
GEOPHYSICAL FLIGHT LINE FLYING AND FLIGHT PATH RECOVERY UTILIZING THE LITTON LTN-76 INERTIAL NAVIGATION SYSTEM
A F Mitkus, Dwight Cater, Patrick F Farmer, and S Parker Gay, Jr Nov 1981 177 p refs Prepared for High Life Helicopter, Inc
(Contract DE-AC13-79GJ-01692)
(DE82-005555, GJBX-363-81) Avail NTIS HC A09/MF A01
The Litton LTN-76 Inertial Navigation Systems (INS) with Inertial Track guidance system software is geared toward the airborne survey industry This report is a summary of tests performed with the LTN-76 designed to fly an airborne geophysical survey as well as to recover the subsequent flight path utilizing INS derived coordinates DOE

N82-29293# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
HUMAN FACTORS IN AIR TRAFFIC CONTROL
V David Hopkin (Royal Air Force Inst of Aviation Medicine) Apr 1982 187 p refs
(AGARD-AG-275, ISBN-92-835-1421-1) Avail NTIS HC A09/MF A01
Human factors are related to air traffic control, air traffic control systems the physical surroundings, equipment, and operation of the system, and the selection, development, training and evaluation of air traffic controllers For individual titles, see N82-29294 through N82-29310

N82-29294# Advisory Group for Aerospace Research and Development Neuilly-Sur-Seine (France)
THE AIR TRAFFIC CONTROL SYSTEM
In its Human Factors in Air Traffic Control Apr 1982 p 3-9 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
Principles and practices of air traffic control are described The information influencing the air traffic control system and the information available to the controller are summarized and defined The users of air traffic control, whether commercial, military, or general aviation traffic is considered, are categorized, and their responsibilities discussed Interactions between air traffic control and the pilot are considered National and regional variations in the problems and practices of air traffic control are described J D

N82-29295# Advisory Group for Aerospace Research and Development Neuilly-Sur-Seine (France)
HUMAN FACTORS CONTRIBUTIONS TO AIR TRAFFIC CONTROL SYSTEMS
In its Human Factors in Air Traffic Control Apr 1982 p 10-21 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
The role of the human factors specialist in air traffic control systems operations and planning is analyzed Man-machine interactions the contribution of human factors engineering to system design the implementation and testing of air traffic control systems and tasks, and the evolution of air traffic control systems and the educational role of human factors specialists as applied to air traffic control are considered J D

N82-29296# Advisory Group for Aerospace Research and Development Neuilly-Sur-Seine (France)
MAN AS A SYSTEM COMPONENT
In its Human Factors in Air Traffic Control Apr 1982 p 22-30 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
The air traffic controller is considered as a component of a man-machine system Limitations of this approach are considered The allocation of functions the effects of automation and computer assistance, the man-machine interface and human reliability are discussed J D

N82-29297# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
HUMAN CAPABILITIES AND LIMITATIONS IN SYSTEMS
In its Human Factors in Air Traffic Control Apr 1982 p 31-46 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
Human capabilities and limitations which restrict the development of air traffic control systems are discussed Sensory factors, perception, learning, memory, capacity for attention, information processing, understanding, problem solving, decision making, and motivation are considered Common mismatches of system requirements with human capabilities are described J D

N82-29298# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
JOBS AND TASKS IN AIR TRAFFIC CONTROL
In its Human Factors in Air Traffic Control Apr 1982 p 47-52 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
Jobs and tasks are discussed The required content of job descriptions and their application to allocation of jobs is considered Task analysis and task synthesis, task grouping interactions between tasks, and workloads are described J D

N82-29299# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
THE WORK ENVIRONMENT
In its Human Factors in Air Traffic Control Apr 1982 p 53-62 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
The work environment for all traffic control tasks is considered Principles of workspace design are discussed The physical environment, suites and consoles, air traffic control centers and control rooms, and air traffic control towers are described J D

N82-29300# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
DISPLAYS
In its Human Factors in Air Traffic Control Apr 1982 p 63-78 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
Factors affecting interactions between visual displays and their users are discussed The physical dimensions of the display, the layout of the display and of information within the display, the information content of the display, visual codings and color codings, the legibility and readability of displays, the relation between displays, and the quality of displayed information are considered New display technology is summarized J D

N82-29301# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
CONTROLS
In its Human Factors in Air Traffic Control Apr 1982 p 79-84 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
The location, type, sensitivity, and interactions of the controls used by the human to convey information to the air traffic control system are discussed The relationships between controls and visual displays are considered J D

N82-29302# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)
COMMUNICATIONS
In its Human Factors in Air Traffic Control Apr 1982 p 85-93 (For primary document see N82-29293 20-04)
Avail NTIS HC A09/MF A01
The human factor terms of communication in air traffic control are examined The effects of known specified variables in communications on controller performance or system efficiency were measured The importance of speech and the use of computers in the man machine systems as a means of dialogue and information transmission is emphasized The following topics

are discussed transmission of information between air and ground, speech as a medium of communication qualitative attributes of speech, automated speech recognition and automated speech synthesis, coordination and liaison, language and terminology of air traffic control, air traffic phrasing and message formats, information quantification and redundancy in air traffic control messages EAK

N82-29309# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)

ADDITIONAL FUNCTIONS WITHIN THE AIR TRAFFIC CONTROL SYSTEM

In its Human Factors in Air Traffic Control Apr 1982 p 150-153 (For primary document see N82-29293 20-04)

Avail NTIS HC A09/MF A01

The application of human factors engineering to other job functions existing within the air traffic control system is discussed Personnel involved in data gathering, maintenance of system integrity, fault finding, supervision, and traffic control assistance are considered JD

N82-29310# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)

FUTURE TRENDS AND PROBLEMS

In its Human Factors in Air Traffic Control Apr 1982 p 154-155 (For primary document see N82-29293 20-04)

Avail NTIS HC A09/MF A01

Anticipated developments and problems occurring in the application of human factors engineering to air traffic control systems, particularly in the light of technological advances in hardware and software, are summarized JD

N82-29311*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

ESTABLISHMENT OF A ROTOR MODEL BASIS

R E McFarland Jun 1982 93 p refs *Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif*

(NASA-TP-2026, A-8605, NAS 1 60 2026, AVRADCOM-TR-81-A-14) Avail NTIS HC A05/MF A01 CSCL 01C

Radial-dimension computations in the RSRA's blade-element model are modified for both the acquisition of extensive baseline data and for real-time simulation use The baseline data, which are for the evaluation of model changes, use very small increments and are of high quality The modifications to the real-time simulation model are for accuracy improvement, especially when a minimal number of blade segments is required for real-time synchronization An accurate technique for handling tip loss in discrete blade models is developed The mathematical consistency and convergence properties of summation algorithms for blade forces and moments are examined and generalized integration coefficients are applied to equal-annuli midpoint spacing Rotor conditions identified as 'constrained' and balanced' are used and the propagation of error is analyzed Author

N82-29312*# Cincinnati Univ, Ohio Dept of Aerospace Engineering and Applied Mechanics

FLAP-LAG-TORSIONAL DYNAMICS OF EXTENSIONAL AND INEXTENSIONAL ROTOR BLADES IN HOVER AND IN FORWARD FLIGHT Semiannual Progress Report, Jan - Jun. 1982

Crespo DaSilva Jun 1982 72 p refs

(Grant NAG2-38)

(NASA-CR-169159, NAS 1 26 169159) Avail NTIS HC A04/MF A01 CSCL 01C

The reduction of the O(cu epsilon) integro differential equations to ordinary differential equations using a set of orthogonal functions is described Attention was focused on the hover flight condition The set of Galerkin integrals that appear in the reduced equations was evaluated by making use of nonrotating beam modes Although a large amount of computer time was needed to accomplish this task, the Galerkin integrals so evaluated were stored on tape on a permanent basis Several of the coefficients were also obtained in closed form in order to check the accuracy of the numerical computations The equilibrium solution to the set of 3n equations obtained was determined as the solution to a minimization problem SL

N82-29313*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

THE FEASIBILITY OF A HIGH-ALTITUDE AIRCRAFT PLATFORM WITH CONSIDERATION OF TECHNOLOGICAL AND SOCIETAL CONSTRAINTS Thesis - Kansas Univ

Ernald B Graves Jun 1982 250 p refs

(NASA-TM-84508 NAS 1 15 84508) Avail NTIS HC A15/MF A01 CSCL 01C

The feasibility of remotely piloted aircraft performing year around missions at an altitude of 70 000 feet is determined Blimp and airplane type vehicles employing solar-voltaic, microwave, or nuclear propulsion systems were considered A payload weighing 100 pounds and requiring 1000 watts of continuous power was assumed for analysis purposes Results indicate that a solar powered aircraft requires more solar cell area than is available on conventional aircraft configurations if designed for the short days and high wind speeds associated with the winter season A conventionally shaped blimp that uses solar power appears feasible if maximum airspeed is limited to about 100 ft/s No viable airplane configuration that uses solar power and designed to withstand the winter environment was found Both a conventionally shaped blimp and airplane appear feasible using microwave power Nuclear powered aircraft of these type are also feasible Societal attitudes toward the use of solar power in high altitude aircraft appear favorable The use of microwave power for this purpose is controversial, even though the ground station required would transmit power at levels comparable to existing satellite communications stations SL

N82-29315*# Bell Helicopter Co, Fort Worth, Tex

INVESTIGATION OF CORRELATION BETWEEN FULL-SCALE AND FIFTH-SCALE WIND TUNNEL TESTS OF A BELL HELICOPTER TEXTRON MODEL 222 Final Report

Patrick K Squires Jun 1982 401 p refs

(Contract NAS2-10773)

(NASA-CR-166362, NAS 1 26 166362) Avail NTIS HC A18/MF A01 CSCL 01C

Reasons for lack of correlation between data from a fifth-scale wind tunnel test of the Bell Helicopter Textron Model 222 and a full-scale test of the model 222 prototype in the NASA Ames 40-by 80-foot tunnel were investigated This investigation centered around a carefully designed fifth-scale wind tunnel test of an accurately contoured model of the Model 222 prototype mounted on a replica of the full-scale mounting system The improvement in correlation for drag characteristics in pitch and yaw with the fifth-scale model mounted on the replica system is shown Interference between the model and mounting system was identified as a significant effect and was concluded to be a primary cause of the lack of correlation in the earlier tests Author

N82-29316*# Massachusetts Inst of Tech, Cambridge Flight Transportation Lab

THE COST OF NOISE REDUCTION FOR DEPARTURE AND ARRIVAL OPERATIONS OF COMMERCIAL TILT ROTOR AIRCRAFT

Henry B Faulkner and William M Swan Jun 1976 118 p refs

(Contract NAS2-7620)

(NASA-CR-137803 NAS 1 26 137803) Avail NTIS HC A06/MF A01 CSCL 01C

The relationship between direct operating cost (DOC) and noise annoyance due to a departure and an arrival operation was developed for commercial tilt rotor aircraft This was accomplished by generating a series of tilt rotor aircraft designs to meet various noise goals at minimum DOC These vehicles ranged across the spectrum of possible noise levels from completely unconstrained to the quietest vehicles that could be designed within the study ground rules Optimization parameters were varied to find the minimum DOC This basic variation was then extended to different aircraft sizes and technology time frames Author

N82-29317*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

AUTOMATED OPTIMUM DESIGN OF WING STRUCTURES DETERMINISTIC AND PROBABILISTIC APPROACHES

S S Rao Aug 1982 47 p refs

(NASA-TM-84475, L-15169, NAS 1 15 84475) Avail NTIS HC A03/MF A01 CSCL 01C

The automated optimum design of airplane wing structures subjected to multiple behavior constraints is described The structural mass of the wing is considered the objective function

The maximum stress, wing tip deflection, root angle of attack, and flutter velocity during the pull up maneuver (static load), the natural frequencies of the wing structure and the stresses induced in the wing structure due to landing and gust loads are suitably constrained Both deterministic and probabilistic approaches are used for finding the stresses induced in the airplane wing structure due to landing and gust loads A wing design is represented by a uniform beam with a cross section in the form of a hollow symmetric double wedge The airfoil thickness and chord length are the design variables, and a graphical procedure is used to find the optimum solutions A supersonic wing design is represented by finite elements The thicknesses of the skin and the web and the cross sectional areas of the flanges are the design variables, and nonlinear programming techniques are used to find the optimum solution S L

N82-29318# Aeronautical Research Labs , Melbourne (Australia)
A DISCUSSION OF THE FLYING QUALITY REQUIREMENTS OF A BASIC TRAINING AIRCRAFT
C A Martin Mar 1982 16 p refs
(AD-A114805, ARL/AERO-TM-337) Avail NTIS HC A02/MF A01 CSCL 01/3

This Memo aims to identify flying qualities of importance in a basic training aircraft and also to suggest interpretations of particular military specifications The proposition is developed that flying qualities which are considered good for an operational aircraft are not necessarily desirable for a training aircraft GRA

N82-29319*# National Aeronautics and Space Administration Langley Research Center Hampton, Va
HEADS UP DISPLAY Patent Application
H Douglas Garner and William E Howell, inventors (to NASA) Filed 28 May 1982 12 p
(NASA-Case-LAR-12630-1 US-Patent-Appl-SN-383384) Avail NTIS HC A02/MF A01 CSCL 01D

A heads up aircraft display which allows the pilot to view the display without diverting his attention from the scene ahead is disclosed The display is designed for use on propeller driven aircraft comprised of a radially disposed row of lamps embedded in the rear surface of a propeller Measurements of flight data are made by conventional means and converted into digital signals These digital signals are applied to graphic generators which control lamp drivers which in turn control lamps through slip rings The lamps are lit at the appropriate times during each revolution of the propeller to display the flight data in graphic form to the pilot The combination of graphic generators and radially disposed lamps embedded in an aircraft propeller enables the pilot to view the display without diverting his attention from the scene ahead NASA

N82-29321# National Center for Atmospheric Research, Boulder, Colo Atmospheric Technology Div
AN EVALUATION OF THE ROSEMOUNT ICE DETECTOR FOR CLOUD WATER CONTENT MEASUREMENTS
E N Brown Oct 1981 19 p refs
(Grant NSF ATM-77-23757)
(PB82-158833, NCAR/TN-183) Avail NTIS HC A02/MF A01 CSCL 14B

A Rosemount ice detector was installed on a Research Aviation Facility Queen Air for evaluation It was used during a winter stratus cloud experiment at Muskegon Michigan (1978) and also during a cumulus cloud experiment (HIPLEX) in 1980 at Big Spring, Texas Results indicate that the detector is an extremely sensitive instrument with a reasonable dynamic range The instrument provides a measurement of icing severity and valid computed water content values only for conditions of small water content and/or low temperature GRA

N82-29322# Aeronautical Research Labs , Melbourne (Australia)
RESULTS OF T56 ENGINE PERFORMANCE MONITORING TRIAL IN HERCULES AIRCRAFT, FEBRUARY - JULY 1977
D E Glenny Apr 1981 37 p refs
(ARL-MECH-Eng-TECH-MEMO-409 AR-002-277) Avail NTIS HC A03/MF A01

An engine performance monitoring trial was carried out on the Hercules aircraft The engine monitoring procedures were developed as an aid to the flight engineer and the maintenance section so that the performance of the Allison T56 engines were monitored more closely than was specified in operating procedures, thus enabling engine operation and maintenance action to be carried out more effectively The trial was conducted on Hercules aircraft, and the initial analysis of results was carried out by personnel who are responsible for maintenance of these aircrafts Operating instructions for aircrew and maintenance personnel and the results of the trial are presented Details of the rationale behind the monitoring procedures and overall conclusions on the trial are given S L

N82-29323*# Teledyne CAE, Toledo, Ohio
COOLED VARIABLE NOZZLE RADIAL TURBINE FOR ROTOR CRAFT APPLICATIONS
C Rogo Mar 1981 205 p refs
(Contract NAS3-22005, DA Proj 1L1-62209-AH-76)
(NASA-CR-165397 NAS 1 26 165397 Rept-1759) Avail NTIS HC A10/MF A01 CSCL 21E

An advanced, small 2 27 kb/sec (5 lbs/sec), high temperature, variable area radial turbine was studied for a rotor craft application Variable capacity cycles including single-shaft and free-turbine engine configurations were analyzed to define an optimum engine design configuration Parametric optimizations were made on cooled and uncooled rotor configurations A detailed structural and heat transfer analysis was conducted to provide a 4000-hour life HP turbine with material properties of the 1988 time frame A pivoted vane and a moveable sidewall geometry were analyzed Cooling and variable geometry penalties were included in the cycle analysis A variable geometry free-turbine engine configuration with a design 1477 K (2200 F) inlet temperature and a compressor pressure ratio of 16 1 was selected An uncooled HP radial turbine rotor with a moveable sidewall nozzle showed the highest performance potential for a time weighted duty cycle Author

N82-29324*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
QCSEE OVER-THE-WING ENGINE ACOUSTIC DATA
Harry E Bloomer and Irvin J Loeffler May 1982 28 p refs
(NASA-TM-82708 E-990 NAS 1 15 82708) Avail NTIS HC A03/MF A01 CSCL 21E

The over the wing (OTW) Quiet, Clean, Short Haul Experimental Engine (QCSEE) was tested at the NASA Lewis Engine Noise Test Facility A boilerplate (nonflight weight), high throat Mach number acoustically treated inlet and a D shaped OTW exhaust nozzle with variable position side doors were used in the tests along with wing and flap segments to simulate an installation on a short haul transport aircraft All of the acoustic test data from 10 configurations are documented in tabular form Some selected narrowband and 1/3 octave band plots of sound pressure level are presented Author

N82-29325# Exotech Proprietary Ltd , Monterey, Calif
MULTISTAGE AXIAL COMPRESSOR PROGRAM ON TIP CLEARANCE EFFECTS Contractor Report, May 1979 - Aug. 1981
I Moyle Aug 1981 49 p refs
(Contract N62271-80-M-2504)
(AD-A107445, NPS67-81-01CR) Avail NTIS HC A03/MF A01 CSCL 21/5

Tip clearance has long been known to be a source of losses in axial compressors with cantilevered blades The reasons for the losses, however, are not well understood and current practice in engine design still requires extensive effort to maintain constant minimal operating clearances over a wide range of conditions The emphasis on clearance control may be appreciated by the typical observation that a ten percent change in peak static pressure rise in a compressor stage may occur for a fifty percent change in clearance Clearances are typically in the one to five percent of major passage dimension range, and thus a small change in passage dimensions represents a large change in clearance It is clear that, in general, it would be desirable that blading performance be less sensitive to changes in clearance Less sensitivity would allow a general relaxation of the mechanical tolerances on a compressor assembly and provide more consistent transient performance The aerodynamics of achieving such a situation are a challenge as the underlying requirement is improved performance at larger clearances Work toward understanding the basic mechanisms of tip clearance effects with an emphasis on designing for clearance has been commenced at the Naval Postgraduate School Turbopropulsion Laboratory (NPS/TPL) This report summarizes the preliminary work on the Multistage Compressor (MSC) facility at the Laboratory GRA

N82-29326# Purdue Univ, Lafayette, Ind School of Mechanical Engineering

WATER INGESTION INTO AXIAL FLOW COMPRESSORS. PART 3: EXPERIMENTAL RESULTS AND DISCUSSION Final Report, 15 Dec. 1977 - 30 Jun. 1981

T Tsuchiya, S N B Murthy, C M Ehresman, and D Richards Wright-Patterson AFB Ohio AFWAL Oct 1981 268 p refs
(Contract F33615-78-C-2401, AF Proj 3066)
(AD-A114830, AFWAL-TR-80-2090-Pt-3) Avail NTIS HC A13/MF A01 CSCL 21/5

The subject of air-water mixture flow in axial compressors of jet engines is of practical interest in two contexts of water ingestion during take-off from rough runways with puddles of water and during flight through rain storms The change in the compressor performance in turn produces changes in the performance of other components and of the engine as a whole During the current investigation, (1) an analysis of the effects of water ingestion into a compressor has been carried out leading to the development of a predictive code, the PURDU-WICSTK program and (2) a series of tests have been carried out on a small test compressor with mixtures of gases (containing methane gas to simulate steam) and with air-water droplet mixtures The experimental results have been compared with predictions It is concluded that the basic effects of water ingestion into compressors arise through (1) blockage, (2) distortion and (3) heat and mass transfer processes, the changes in blade aerodynamic performance being relatively small In the case of a compressor of small mass flow and pressure ratio and high operating speed, increased quantities of water ingestion give rise to large quantities of water in the tip region GRA

N82-29327# Purdue Univ, Lafayette, Ind School of Mechanical Engineering

EFFECT OF WATER ON AXIAL FLOW COMPRESSORS. PART 2: COMPUTATIONAL PROGRAM Final Report, 15 Dec. 1977 - 30 Sep. 1980

T Tsuchiya and S N B Murthy Wright-Patterson AFB, Ohio AFWAL Jun 1981 425 p refs
(Contract F33615-78-C-2401, AF Proj 3066)
(AD-A114831, AFWAL-TR-80-2090-Pt-2) Avail NTIS HC A18/MF A01 CSCL 21/5

An analysis of the performance of an axial flow compressor operating with mixtures of gases and air-water droplet mixtures was performed In the case of mixtures of gases, account was taken of the changes in molecular weight and ratio of specific heats In the case of two phase flow, the major processes of interest are (1) droplet blade interaction, (2) droplet heating, (3) droplet centrifuging, and (4) droplet break up The PURDU-WICSTK program developed for the prediction of compressor performance was utilized to obtain the performance of a test compressor A three dimensional stream line computer code the UD-0300, was also modified and exercised in the case of compressor operation with mixtures of gases Water ingestion into the compressor of an aircraft gas turbine engine affects the performance of the engine, and a preliminary analysis of the nature of the effects was also conducted M G

N82-29328# Iowa State Univ of Science and Technology, Ames Turbomachinery Components Research Lab

AERODYNAMICS OF ADVANCED AXIAL-FLOW TURBOMACHINERY Annual Report, 1 Oct. 1980 - 30 Sep. 1981

George K Serovy, Patrick Kavanagh, and Theodore H Okiishi Dec 1981 82 p refs
(Grant AF-AFOSR-0004-80, AF Proj 2307)
(AD-A114911 ISU-ERI-AMES-82108 TCRL-22, AFOSR-82-0201TR) Avail NTIS HC A05/MF A01 CSCL 21/5

A multi-task research program on the aerodynamics of advanced axial-flow turbomachinery is continuing at Iowa State University Program components are intended to result in direct contributions to the improvement of axial-flow fan, compressor, and turbine design procedures A detailed experimental investigation of intrapassage flow in a large-scale, curved, rectangular cross section channel representative of turbomachinery passages is in progress Author (GRA)

N82-29329*# National Aeronautics and Space Administration Langley Research Center, Hampton, Va

AGRICULTURAL AIRPLANE MISSION TIME STRUCTURE CHARACTERISTICS

Joseph W Jewel, Jr Jul 1982 44 p refs
(NASA-TM-84470, L-15125, NAS 1 15 84470) Avail NTIS HC A03/MF A01 CSCL 01C

The time structure characteristics of agricultural airplane missions were studied by using records from NASA VGH flight recorders Flight times varied from less than 3 minutes to more than 103 minutes There was a significant reduction in turning time between spreading runs as pilot experience in the airplane type increased Spreading runs accounted for only 25 to 29 percent of the flight time of an agricultural airplane Lowering the longitudinal stick force appeared to reduce both the turning time between spreading runs and pilot fatigue at the end of a working day Author

N82-29330* National Aeronautics and Space Administration John F Kennedy Space Center, Cocoa Beach, Fla

METHOD FOR REFURBISHING AND PROCESSING PARACHUTES Patent

Russell T Crowell, inventor (to NASA) Issued 2 Feb 1982 7 p Filed 30 May 1980 Supersedes N81-14967 (19 - 06, p 0706) Division of US Patent Appl SN-862878, filed 12 Dec 1977, US Patent-4,244,810
(NASA-Case-KSC-11042-1, US-Patent-4,313,291, US-Patent-4,244 810 US-Patent-Appl-SN-154663 US-Patent-Appl-SN-862878 US-Patent-Class-53-429, US-Patent-Class-8-150) Avail US Patent and Trademark Office CSCL 14B

A system and method for refurbishing and processing parachutes is discussed including an overhead monorail conveyor system on which the parachute is suspended for horizontal conveyance The parachute is first suspended in partially open tented configuration wherein open inspection of the canopy is permitted to remove debris and inspect all areas Following inspection, the parachute is transported by the monorail conveyor to a washing and drying station with the parachute canopy mounted on the conveyor ina systematic arrangement which permits water and air to pass through the ribbonlike material of the canopy Following drying of the parachute the parachute is conveyed into an interior space where it is finally inspected and removed from the monorail conveyor and laid upon a table for folding Official Gazette of the U S Patent and Trademark Office

N82-29331*# National Aeronautics and Space Administration John F Kennedy Space Center Cocoa Beach, Fla

INFLIGHT IFR PROCEDURES SIMULATOR Patent Application

Lloyd C Parker inventor (to NASA) Filed 11 Jun 1982 22 p
(NASA-Case-KSC-11218-1 US-Patent-Appl-SN-387649) Avail NTIS HC A02/MF A01 CSCL 14B

An in-flight trainer designed to train students in a conventional aircraft is disclosed The trainer generates simulated signals and commands to conventional instruments provided in the aircraft that correspond to the normal signals a pilot receives during instrument flight rule (IFR) flights and landing and departure procedures Results of studies conducted using apparatus which demonstrated the concept indicate that the concept is feasible Also students trained using only the In-flight IFR Simulator were more proficient in skills development than those trained using table-top simulators and in aircraft in the conventional manner J M S

N82-29332# Seville Research Corp Pensacola Fla

OPERATIONAL TEST AND EVALUATION HANDBOOK FOR AIRCRAFT TRAINING DEVICES VOLUME 1 PLANNING AND MANAGEMENT Final Report

Thomas H Gray, Stephen R Osborne Roik I Hockenberger and James P Smith Williams AFB Ariz Air Force Human Resources Lab Feb 1982 72 p refs
(Contract F33615-78-C-0063 AF Proj 1123)
(AD-A112498 AFHRL-TR-81-44-Vol-1) Avail NTIS HC A04/MF A01 CSCL 05/9

The handbook comprised of three volumes is intended to provide guidelines and procedures appropriate for Air Force Operational Test and Evaluation (OT/E) personnel to use in planning conducting and reporting the results of simulator assessment efforts Although of value of all test personnel it is primarily for the typical novice test manager/director-a person who has subject matter expertise (e g a qualified pilot or operator) but who may have little or no previous OT/E experience The handbook provides detailed coverage on OT/E planning and management with special emphasis on measuring device operational effectiveness and suitability In accord with its objectives the handbook was prepared to serve as a supplement to Air Force Manual 55 43 Management of Operational Test and Evaluation', by providing those specific additional evaluation concepts and techniques necessary for aircrew training device (ATD) test and evaluation Volume 1 is concerned first with describing both general and specific ATD OT/E planning and management considerations and links those events which occur early in the ATD acquisition process to later ATD OT/E planning and management activities It defines the various evaluation concepts germane to understanding ATD OT/E, and describes the two major ATD OT/E activities--Initial/Qualification OT/E and Follow-on OT/E matters of ATD value and worth to the Air Force The acquisition and life cycle costs associated with modern ATDs make such concerns important GRA

N82-29333# Calspan Field Services Inc, Arnold Air Force Station, Tenn

THE USE OF A MULTI-DEGREE-OF-FREEDOM DUAL BALANCE SYSTEM TO MEASURE CROSS AND CROSS-COUPLING DERIVATIVES Final Report, 1 Oct. - 1 Nov. 1981

D R Haberman AEDC Apr 1982 92 p refs Sponsored by Air Force

(AD-A114813, AEDC-TR-81-34) Avail NTIS HC A05/MF A01 CSCL 12/1

The equations of motion are derived for two existing dual balance systems used at the Arnold Engineering Development Center (AEDC) to obtain measurements of aerodynamic cross and cross-coupling derivatives The complete equations of motion presented include the effects of sting motion Each system incorporates a dynamic cross flexure balance and a five-component static balance The primary deflection modes of the balances were confirmed using a holographic interferometry measurement technique Both laboratory and wind tunnel data are presented to illustrate dynamic effects Author (GRA)

N82-29334# Advisory Group for Aerospace Research and Development Neuilly-Sur-Seine (France) Fluid Dynamics Panel

WINDTUNNEL CAPABILITY RELATED TO TEST SECTIONS, CRYOGENICS, AND COMPUTER-WINDTUNNEL INTEGRATION

Apr 1982 64 p refs

(AGARD-AR-174, ISBN-92-835-1420-3) Avail NTIS HC A04/MF A01

The roles of computational fluid dynamics and wind tunnels, and their growing interdependence are considered Transonic test sections, cryogenic testing technology, and integration of computer and wind tunnel testing are discussed S L

N82-29343# Sandia Labs, Albuquerque, N Mex Aerodynamic Simulation Div

USER'S MANUAL FOR THE AMEER FLIGHT PATH-TRAJECTORY SIMULATION CODE

Eugene J Meyer Oct 1981 187 p refs

(Contract DEOAC04-76DP-00789)

(DE82-007004 SAND-80-2056) Avail NTIS HC A09/MF A01

A guide to the use of the AMEER (Aero-Mechanical Equations Evaluation Routines) flight path-trajectory simulation code is presented The input data requirements, computed output data available, code control features, and code flow logic are described for a rigid-body six-degree-of-freedom or point mass simulation DOE

N82-29347# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)

PRELAUNCH ESTIMATES OF NEAR EARTH SATELLITE LIFETIMES USING QUASI-DYNAMIC ATMOSPHERE MODELS - APPLICATION TO A PROPOSED BRAZILIAN SATELLITE

Nellore S Venkataraman and Kondapalli Rama Rao Feb 1982 22 p refs Submitted for publication

(INPE-2325-PRE/080) Avail NTIS HC A02/MF A01

A rapid prelaunch estimate of near Earth satellite lifetimes using the small perturbation theory is calculated A quasi-dynamic atmospheric model is used employing a different exospheric temperature every three months The drag coefficient is calculated using kinetic theory S L

N82-29393# Ellis (George S), Chardon, Ohio

ETHANOL PRODUCTION BY VAPOR COMPRESSION DISTILLATION Final Report

George S Ellis 1981 9 p

(Contract DE-FG02-80R5-10240)

(DE82-004892, DOE/R5-10240/2) Avail NTIS HC A02/MF A01

It was the goal of the project to develop and demonstrate a one (1) gallon per hour vapor compression distillation unit for fuel ethanol production that could be profitably manufactured and economically operated by individual family units The unit constructed was originally built for strictly ambient temperature operation, but later modified to permit elevated temperature operation It successfully separated ethanol from a dilute solution, but only at a very low production rate The initial configuration had the compressor located outside of the distillation vessel and was losing excessive energy to the environment Therefore, it would not be possible to operate that design at elevated temperature Thus, the compressor was moved inside the distillation vessel DOE

N82-29464# Brookhaven National Lab Upton, N Y

WATER-COMPATIBLE POLYMER CONCRETE MATERIALS FOR USE IN RAPID REPAIR SYSTEMS FOR AIRPORT RUNWAYS Final Report, Mar. 1980 - Feb. 1981

T Sugama and L E Kukacka Mar 1981 128 p refs

(Contracts AFOSR ISSA 80-00027, DE-AC02-76CH-00016, AF Proj 2307)

(DE82-010994, BNL-51390, AFOSR-81-0589TR) Avail NTIS HC A07/MF A01

Water-compatible polymer concrete (PC) formulations were developed which appear to have potential for use in all-weather rapid repair procedures for bomb-damaged runways Formulations consisting of furfuryl alcohol, water-saturated aggregate, dry silica flour, promoters, and catalysts produced composites with properties suitable for repair purposes when mixed and polymerized at temperatures from -200 to 300 C Calcium-unsaturated polyester complexed PC also produced excellent properties However, the early strength criteria [2000 psi (13 78 MPa) at 1 h] and other requirements such as compatibility of the formulation with water and practical working times could be attained only at temperatures > 200 C This system can be polymerized under water Studies of the polymerization reaction mechanisms, materials properties, costs, and potential placement methods were performed DOE

N82-29476# UOP Inc, Des Plaines, Ill

UNITED STATES AIR FORCE SHALE OIL TO FUELS, PHASE 2 Interim Technical Report, 1 Apr. 1979 - 30 Sep. 1980

J R Wilcox, J G Sikonia, T G Board, and F J Riedl Wright-Patterson AFB, Ohio AFWAL Nov 1981 295 p refs

(Contract F33615-78-C-2079)

(AD-A114531, AFWAL-TR-81-2116) Avail NTIS HC A13/MF A01 CSCL 21/4

Phase II of this project was conducted to demonstrate innovative technology to reduce the cost of converting shale oil to high yields of aviation turbine fuels To carry out this program, UOP selected a processing scheme involving hydrocracking as the primary conversion unit The Phase II program included pilot plant processing, fouling studies and economic analysis The pilot plant operations performed during Phase II involved four specific processing steps feed preparation, low pressure hydrotreating, high pressure hydrotreating, and hydrocracking Two shale oil feedstocks were utilized for each processing step shale oil derived from Occidental Modified In-Situ retort and shale oil obtained from the Paraho direct-heated retort Using data generated from the pilot plant operations and the study basis provided by the USAF, economic analyses were performed to find the cost of production of jet fuel, and total liquid product at a 15% discounted cash flow rate of return (DCFRR) on investment GRA

N82-29510*# Draper (Charles Stark) Lab, Inc, Cambridge, Mass

SYSTEM DATA COMMUNICATION STRUCTURES FOR ACTIVE-CONTROL TRANSPORT AIRCRAFT, VOLUME 1 Final Report

A L Hopkins, J H Martin, L D Brock, D G Jansson, S Serben, T B Smith, and L D Hanley Jun 1981 236 p refs 2 Vol

(Contract NAS1-15359)

(NASA-CR-165773-Vol-1, NAS 1 26 165773-Vol-1, R-1469-Vol-1) Avail NTIS HC A11/MF A01 CSCL 17B

Candidate data communication techniques are identified, including dedicated links, local buses, broadcast buses, multiplex buses, and mesh networks The design methodology for mesh networks is then discussed, including network topology and node architecture Several concepts of power distribution are reviewed, including current limiting and mesh networks for power The technology issues of packaging, transmission media, and lightning are addressed, and, finally, the analysis tools developed to aid in the communication design process are described There are special tools to analyze the reliability and connectivity of networks and more general reliability analysis tools for all types of systems S L

N82-29511*# Draper (Charles Stark) Lab, Inc, Cambridge, Mass

SYSTEM DATA COMMUNICATION STRUCTURES FOR ACTIVE-CONTROL TRANSPORT AIRCRAFT, VOLUME 2 Final Report

A L Hopkins, J H Martin, L D Brock, D G Jansson, S Serben, T B Smith, and L D Hanley Jun 1981 156 p refs 2 Vol

(Contract NAS1-15359)

(NASA-CR-165773-Vol-2, NAS 1 26 165773-Vol-2, R-1469-Vol-2) Avail NTIS HC A08/MF A01 CSCL 17B

The application of communication structures to advanced transport aircraft are addressed First, a set of avionic functional requirements is established, and a baseline set of avionics equipment is defined that will meet the requirements Three alternative configurations for this equipment are then identified that represent the evolution toward more dispersed systems Candidate communication structures are proposed for each system configuration, and these are compared using trade off analyses, these analyses emphasize reliability but also address complexity Multiplex buses are recognized as the likely near term choice with mesh networks being desirable for advanced, highly dispersed systems S L

N82-29520# Lincoln Lab, Mass Inst of Tech, Lexington

MOVING TARGET DETECTOR (MOD 2)

David Karp and John R Anderson 3 Nov 1981 159 p refs

(Contracts DOT-FATQ-WAI-679, F19628-80-C-0002)

(AD-A114709, ATC-95, FAA-RD-80-77) Avail NTIS HC A08/MF A01 CSCL 17/9

Under FAA sponsorship, MIT/Lincoln Laboratory has developed a second generation, field operable Moving Target Detection System (MTD-II) which has been tested at operational FAA terminal and enroute radar sites, and serves as the basis for the ASR-9 MTD technical performance specifications This summary report covers the period October, 1976 through September, 1979 in which design, development, field testing and system performance evaluation were carried out Report No FAA-RD-76-190, ATC-69, 'Description and Performance Evaluation of the Moving Target Detector' dated 8 March 1977, serves as the technical foundation of this work MTD-processing design modifications were effected to handle conditions of excessive ground clutter and moving ground traffic The rationale for the modified algorithms is provided, and measured performance characteristics at several FAA field sites are discussed Author (GRA)

N82-29527# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France)

ELECTROMAGNETIC PROPAGATION PROBLEMS IN THE TACTICAL ENVIRONMENT

Apr 1982 155 p refs Lecture Series held in Munich, 3-4 May 1982 and Paris, 6-7 May 1982

(AGARD-LS-120, ISBN-92-835-1419-X) Avail NTIS HC A08/MF A01

Propagation criteria affecting the performance of electronic equipment under battlefield conditions are discussed For individual titles, see N82-29528 through N82-29537

N82-29535# Royal Aircraft Establishment, Farnborough (England)

PROPAGATION PROBLEMS ASSOCIATED WITH AIRCRAFT COMMUNICATIONS SYSTEMS

B Burgess *In* AGARD Electromagnetic Propagation Probl in the Tactical Environ Apr 1982 10 p refs (For primary document see N82-29527 20-32)

Avail NTIS HC A08/MF A01

Communications with mobiles is assuming increasing importance in a military context, with the advances in technology enabling not only greater amounts of information to be transferred, but also fostering a much harsher electromagnetic environment The trend towards digital communications systems coupled with the possible demand for the wider bandwidths means that the propagation medium characteristics that influence the performance of these links are somewhat different from those that need to be addressed for narrowband analogue modulation transmissions The various types of communications systems that are used with aeromobile platforms are reviewed and the various propagation problems that arise in achieving systems with good overall performance discussed The links are conveniently divided into two types beyond line of sight and line of sight systems, and span the frequency range from LF through to microwaves Author

N82-29555# Syracuse Univ N Y Dept of Physics

COMPUTER ENHANCED ANALYSIS OF A JET IN A CROSS-STREAM

John W Trischka and Nancy J Birkenheuer (Midwest Research Inst, Golden, Colo) 22 Feb 1982 41 p refs Backup document for AIAA synoptic scheduled for publication in the AIAA Journal, Feb 1983

Avail NTIS HC A03/MF A01

Previously analyzed velocity data for a jet in a wind tunnel cross stream was used in a computer analysis which, through interpolation and extrapolation, produced velocity and vorticity fields on a uniform three dimensional grid Microfilm output from the computer displayed isopleths on sets of planes in three orthogonal directions Improved determinations were made of the jet center line of the center lines of the bound vortices and of the jet boundaries Stationary waves were discovered in the mixing region on the upstream side of the jet An explanation for these waves is proposed The angle between vorticity and velocity is used to compare the flow with complex lamellar and Beltrami flows A convergence feature in the jet wake is noted Author

N82-29556*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

CORRELATION OF PRESTON-TUBE DATA WITH LAMINAR SKIN FRICTION (LOG NO. J12984)

T D Reed (Oklahoma State Univ, Stillwater), A Abu-Mostafa (Oklahoma State Univ, Stillwater), and F W Steinle, Jr 18 Jan 1982 37 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Feb 1983

(Grants NSG-2396, NAG2-76)

(NASA-TM-84827 NAS 1 15 84827, Log-J12984) Avail NTIS HC A03/MF A01 CSCL 20D

Preston tube data within laminar boundary layers obtained on a sharp ten-degree cone in the NASA Ames eleven-foot transonic wind tunnel are correlated with the corresponding values of theoretical skin friction Data were obtained over a Mach number range of 0 30 to 0 95 and unit Reynolds numbers of 9 84, 13 1, and 16 4 million per meter The rms scatter of skin friction coefficient about the correlation is of the order of one percent, which is comparable to the reported accuracy for calibrations of Preston tubes in incompressible pipe flows In contrast to previous works on Preston tube/skin friction correlations, which are based on the physical height of the probe's face, this satisfactory correlation for compressible boundary layer flows is achieved by accounting for the effects of a variable 'effective height of the probe The coefficients, which appear in the correlation, are dependent on the particular tunnel environment The general procedure can be used to define correlations for other wind tunnels Author

N82-29800# Electro Magnetic Applications, Inc, Denver, Colo

ATMOSPHERIC ELECTRICITY HAZARDS ANALYTICAL MODEL DEVELOPMENT AND APPLICATION. VOLUME 1. LIGHTNING ENVIRONMENT MODELING Final Report, Aug. 1979 - Jun. 1982

Martin A Uman (Lightning Location and Protection Inc) and E Philip Krider (Lightning Location and Protection, Inc) Wright-Patterson AFB, Ohio AFWAL Aug 1981 172 p refs 3 Vol

(Contract F33615-79-C-3412, AF Proj 2402)

(AD-A114015, EMA-81-R-21-Vol-1, AFWAL-TR-81-3084-Vol-1) Avail NTIS HC A08/MF A01 CSCL 04/1

The state of the art of lightning phenomenology and its electromagnetic environment is reviewed All aspects and phases are discussed A model is chosen for each phase which best describes what is currently known and understood Computer models for predicting the electromagnetic environment for several of the processes are given, along with numerical predictions A comprehensive bibliography is also provided Author

N82-29801# Lightning and Transients Research Inst, Melbourne, Fla

ATMOSPHERIC ELECTRICITY HAZARDS ANALYTICAL MODEL DEVELOPMENT AND APPLICATION. VOLUME 2: SIMULATION OF THE LIGHTNING/AIRCRAFT INTERACTION EVENT Final Report, Aug. 1979 - Jun. 1981

John D Robb Wright-Patterson AFB, Ohio AFWAL Jun 1981 59 p refs 3 Vol

(Contract F33615-79-C-3412, AF Proj 2402)

(AD-A114016, EMA-81-R-21-Vol-2, AFWAL-TR-81-3084-Vol-2) Avail NTIS HC A04/MF A01 CSCL 04/1

A review of currently used lightning test techniques for aircraft is given The requirements for lightning simulation are given and discussed Finally, a new approch for simulating the lightning/aircraft interaction is presented, and is based on nuclear electromagnetic pulse (NEMP) technology GRA

N82-29802# Electro Magnetic Applications, Inc, Denver, Colo

ATMOSPHERIC ELECTRICITY HAZARDS ANALYTICAL MODEL DEVELOPMENT AND APPLICATION. VOLUME 3: ELECTROMAGNETIC COUPLING MODELING OF THE LIGHTNING/AIRCRAFT INTERACTION EVENT Final Report, Aug. 1979 - Jun 1981

F J Eriksen, T H Rudolph, and Rodney Perala Wright-Patterson AFB, Ohio AFWAL Jun 1981 330 p refs 3 Vol

(Contract F33615-79-C-3412, AF Proj 2402)

(AD-A114017, EMA-81-R-21-Vol-3, AFWAL-TR-81-3084-Vol-3) Avail NTIS HC A15/MF A01 CSCL 04/1

The state of the art of coupling of electromagnetic fields to aircraft is reviewed Assessing the electromagnetic interaction of lightning with aircraft is considered The coupling process is explained and the modeling requirements implied by the lightning environment are discussed The description of models selected and implemented is given Author

N82-29996# Systems Control, Inc, Palo Alto, Calif

SYSTEM IDENTIFICATION OF NONLINEAR AERODYNAMIC MODELS

T L Trankle, J H Vincent, and S N Franklin *In* AGARD Advan in the Tech and Technol of the Appl of Nonlinear Filters and Kalman Filters Mar 1982 26 p refs (For primary document see N82-29989 20-64)

Avail NTIS HC A23/MF A01

System identification, a technology for determining a mathematical model of a dynamic system from observations of its response to inputs is discussed Identification technology is used for the determination of nonlinear aerodynamic models for aircraft maneuvering at high angles of attack The method outlined here (equation error, output error, and maximum likelihood algorithms) can directly nonlinear aerodynamic coefficients in table look-up or multivariable spline formats For application to nonlinear problems, the basic algorithms are enhanced by recent techniques for evaluation of partial derivatives of the likelihood function, calculation of parameter estimation uncertainties, and by the use of multidimensional splines as a generic model structure An example application of these methods to the identification of F-4S fighter aircraft high angle of attack aerodynamics is illustrated B W

N82-30013*# National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif

APPLICATIONS TO AERONAUTICS OF THE THEORY OF TRANSFORMATIONS OF NONLINEAR SYSTEMS

George Meyer, Renjeng Su, and L R Hunt May 1982 13 p refs

(Contract N00014-76-C-1136)

(NASA-TM-84249, NAS 1 15 84249 A-8943) Avail NTIS HC A02/MF A01 CSCL 12B

The development of the transformation theory is discussed Results and applications concerning the use of this design technique for automatic flight control of aircraft are presented The theory examines the transformation of nonlinear systems to linear systems The tracking of linear models by nonlinear plants is discussed Results of manned simulation are also presented B W

N82-30029# Federal Aviation Administration, Washington, D C

ESTIMATED AIRPLANE NOISE LEVELS IN A-WEIGHED DECIBELS

11 Feb 1981 19 p refs

(AC-36-3B) Avail NTIS HC A02/MF A01

Listings of estimated airplane noise levels in units of A-Weighted Sound Level in decibels (dBA) are provided N W

N82-30030*# General Electric Co, Cincinnati, Ohio Aircraft Engine Group

FORWARD VELOCITY EFFECTS ON FAN NOISE AND THE SUPPRESSION CHARACTERISTICS OF ADVANCED INLETS AS MEASURED IN THE NASA-AMES 40 BY 80 FOOT WIND TUNNEL Final Report

Michael T Moore May 1980 161 p refs

(Contract NAS2-8675)

(NASA-CR-152328, NAS 1 26 152328, R79AEG626) Avail NTIS HC A08/MF A01 CSCL 20A

Forward velocity effects on the forward radiated fan noise and on the suppression characteristics of three advanced inlets relative to a baseline cylindrical inlet were measured in the NASA Ames Research Center 40 x 80 foot Wind Tunnel A modified JT15D turbofan engine in a quiet nacelle was the source of fan noise, the advanced inlets were a Conventional Takeoff/Landing (CTOL) hybrid inlet, a Short Takeoff/Landing (STOL) hybrid inlet, and a treated deflector inlet Also measured were the static to flight effects on the fan noise of canting the baseline inlet 4 deg downward to simulate typical wing mounted turbofan engines The CTOL hybrid inlet suppressed the high tip speed fan noise as much as 18 PNdB on a 61 m (200 ft) sideline scaled to a CF6 size engine while the STOL hybrid inlet suppressed the low tip speed fan noise as much as 13 PNdB on a 61 m (200 ft) sideline scaled to a OCSEE size engine The deflector inlet suppressed the high tip speed fan noise as much as 13 PNdB at 61 m (200 ft) overhead scaled to a CF6 size engine No significant changes in fan noise suppression for the CTOL and STOL hybrid inlets occurred for forward velocity changes above 21 m/s (68 ft/s) or for angle of attack changes up to 15 deg However, changes in both forward velocity and angle of attack changed the deflector inlet noise unpredictably due to the asymmetry of the inlet flow field into the fan Author

N82-30031# Aerospace Medical Research Labs, Wright-Patterson AFB, Ohio

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 148 T-37B IN-FLIGHT CREW NOISE

Harald K Hille Nov 1981 15 p

(AF Proj 7231)

(AD-A114943 AMRL-TR-75-50-Vol-148) Avail NTIS HC A02/MF A01 CSCL 01/2

The T-37B is a USAF two-seat primary trainer aircraft This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this aircraft during normal flight operations Data are reported at one location for 19 different flight conditions and psychoacoustic measures overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors GRA

N82-30032# Aerospace Medical Research Labs, Wright-Patterson AFB, Ohio

FAR-FIELD ACOUSTIC DATA FOR THE TEXAS ASE, INC HUSH HOUSE

Robert A Lee Apr 1982 287 p refs

(AF Proj 7231)

(AD-A114564, AFAMRL-TR-81-148) Avail NTIS HC A13/MF A01 CSCL 01/2

This report supplements AFAMRL-TR-73-110, which describes the data base (NOISEFILE) used in the computer program (NOISEMAP) to predict the community noise exposure resulting from military aircraft operations The results of field test measurements to define the single-event noise produced on the ground by military aircraft/engines operating in the Texas ASE Inc hush-house are presented as a function of angle (0 deg to 180 deg from the front of the hush-house) and distance (200 ft to 2500 ft) in various acoustic metrics All the data are normalized to standard acoustic reference conditions of 59 F temperature and 70% relative humidity Refer to Volume I of the AFAMRL-TR-73-110 report for discussion of the scope limitations, and definitions needed to understand and use the data in this report GRA

N82-30261# Office National d'Etudes et de Recherches *Aerospatiales, Paris (France)*
WIND TUNNEL STUDIES OF STORE SEPARATION WITH LOAD FACTOR. FREEDROPS AND CAPTIVE TRAJECTORIES c02
J Coste and J Leynaert *In its* La Rech Aerospatiale, Bi-monthly Bull no 1982-1, Jan-Feb 1982 (ESA-TT-755) May 1982 p 1-9 refs Transl into ENGLISH from La Rech Aerospatiale, Bull Bimestriel (Paris), No 1982-1, Jan-Feb 1982 (For primary document see N82-30260 20-99)
Avail NTIS HC A02/MF A01, original report in FRENCH available at ONERA, Paris FF 55

Techniques used to study separation trajectories of stores dropped from under an aircraft are described In dropping tests, light, heavy and intermediate scaling laws which respect the Mach number are studied The captive trajectory tests use a six degrees of freedom system which moves the model step by step in the aerodynamic field of the aircraft Aerodynamic forces acting on the store are measured by an internal balance This method does not take into account the relative speed of store and aircraft Arrangements used to compensate for this defect are shown When the stores are inert, have perturbed trajectories, high initial separation speeds, or are incompatible with an external mount and an internal balance, the freedrop method is preferable, particularly for short trajectories In the contrary cases, or when the store is propelled, the captive trajectory method is essential For long trajectories, with several phases, the two methods are used in conjunction Author (ESA)

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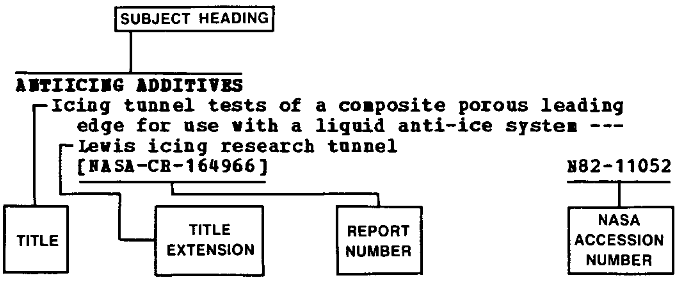

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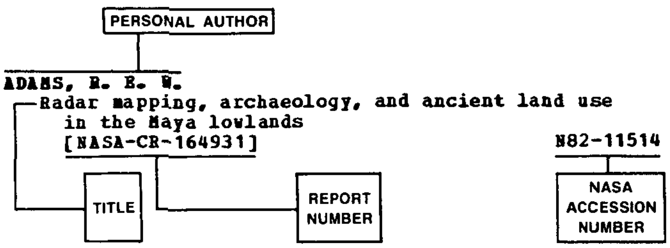

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