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AERONAUTICAL ENGINEERING

A SPECIAL BIBLIOGRAPHY WITH INDEXES

Supplement 13

JANUARY 1972

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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AERONAUTICAL ENGINEERING

A Special Bibliography

Supplement 13

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in December 1971 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.

This supplement to *Aeronautical Engineering—A Special Bibliography* (NASA SP-7037) lists 283 reports, journal articles, and other documents originally announced in December 1971 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. For previous bibliographies in this series, see inside of front cover.

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

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

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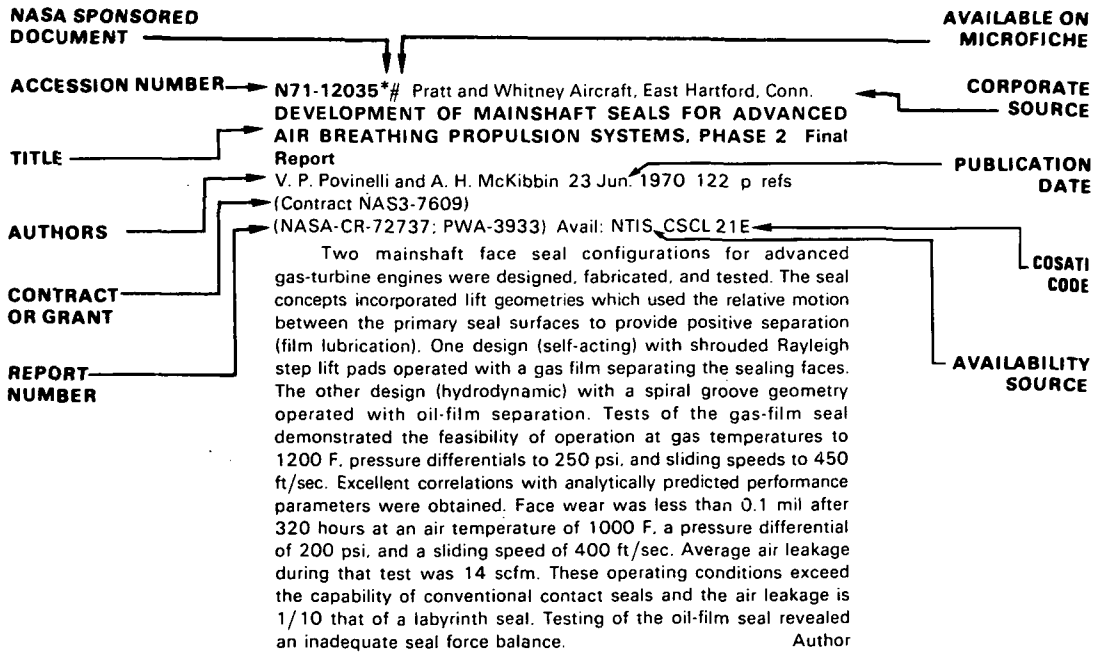

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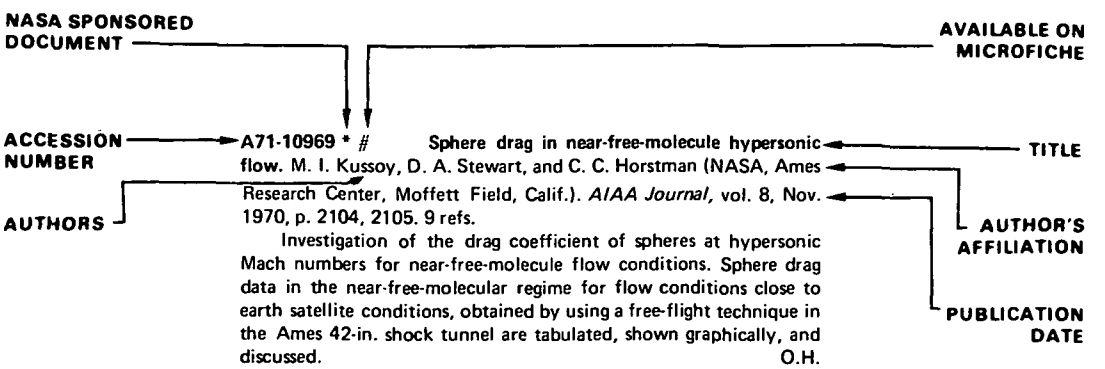

AERONAUTICAL ENGINEERING

A Special Bibliography (Suppl. 13) JANUARY 1972

IAA ENTRIES

A71-42921 **Fluidics.** Robert O. McDonald (Honeywell, Inc., Commercial Div., Minneapolis, Minn.). *(Institute of Electrical and Electronics Engineers, Textile Industry Technical Conference, Charlotte, N.C., May 1, 2, 1969, Paper 70-TP-120-IGA.) IEEE Transactions on Industry and General Applications,* vol. IGA-7, May-June 1971, p. 367-373.

A rapid resumé of the basic theory of fluidic devices including wall attachment amplifiers, turbulence amplifiers, and vortex amplifiers is presented. The basic fluidic devices are then treated in their application as sensors of temperature and pressure, and there is a review of fluidic indicators and associated relays. Current application of these fluidic devices and fluidic systems for chemical industry inspection, and rejection, fluidic systems for the ammunition industry, and fluidic systems for jet aircraft controls are discussed. The discussion covers the operational benefits of the fluidic systems under actual operating field experience. (Author)

A71-42922 # **FAA flight test research approach to the SST airworthiness standards.** R. F. LeSuer, R. Abrams, and R. D. Forrest (FAA, Flight Standards Service, Washington, D.C.). *(Flight Test Symposium, Montreal, Canada, Feb. 8, 1971.) Canadian Aeronautics and Space Journal,* vol. 17, Sept. 1971, p. 271-274.

A test program in which several proposed takeoff requirements were evaluated using an F-102A. Particular attention was given to takeoff speeds, expected operational takeoff speed abuses and their effects on safe performance, and minimum speed determination methods. Handling qualities and performance trends were evaluated on a six-degree-of-freedom flight simulator. The aircraft simulated include a reference subsonic design, a generalized SST design, and a specific model of the Concorde prototype. V.P.

A71-42923 # **On the variation of intensity of aircraft 'permanent' magnetic fields.** P. Charlton (Canadian Armed Forces, Directorate of Aeronautical Engineering, Toronto, Canada). *Canadian Aeronautics and Space Journal,* vol. 17, Sept. 1971, p. 275-277.

The performance of Magnetic Anomaly Detection (MAD) equipment is dependent upon the signal-to-noise ratio achieved. The amount of noise, in turn, is a function of the strength of the aircraft's magnetic field and the degree to which it is affected by aircraft movements relative to the earth's field. Nulling out, or compensating, the aircraft's field reduces the effective aircraft field strength and hence the maneuver noise. However, after compensation the aircraft permanent field strength has been found to change, apparently due to the earth's field inducing magnetism into components of the aircraft structure. These changes in the so-called permanent field degrade MAD equipment performance but tests have shown that they can be predicted, measured and, to some degree, alleviated by selective parking of the aircraft relative to the local earth's field direction. (Author)

A71-42926 # **Mi-12 - A new dimension in helicopter design (Mi-12 - Eine neue Dimension im Hubschrauberbau).** Karl-Heinz Eyermann. *Technisch-ökonomische Informationen der zivilen Luftfahrt,* vol. 7, no. 8, 1971, p. 345-354. In German.

The design concepts for the Mi-12 have been significantly influenced by the specific economic and geographic conditions of the northern and eastern territories of the USSR. The Mi-12 is well suited for the transportation of heavy equipment needed for the production of oil and for other industrial developments. One of the most difficult problems which had to be solved during the design of the aircraft was the connection between the two pairs of gas turbines by a rigid shaft of 30 m length. The potential of the helicopter for the transportation of heavy loads was demonstrated in a flight in which the Mi-12 reached an altitude of 2951 m with a payload weighing 31,030 kg. In another flight the aircraft rose with a payload of 40,204.50 kg to an altitude of 2255 m. G.R.

A71-42927 # **The control system of the Tu-154 (Steuerungssystem der Tu-154).** F. Woloschin. (*Grazhdanskaia Aviatsiia,* no. 5, 1971.) *Technisch-ökonomische Informationen der zivilen Luftfahrt,* vol. 7, no. 8, 1971, p. 355-374. 17 refs. In German.

The Tu-154 has a cruising speed of about 0.9 Mach at altitudes of 11,000 m. Compressibility effects of the air under those conditions affect the stability and control characteristics of the aircraft. A dependence on manual control is only justified at flight speeds up to 0.85 Mach. The Tu-154 employs, therefore, a nonreversible hydraulic control system, making use of four hydraulic pumps. Details of a suitable design of the control system are discussed, giving attention to the maintenance of aircraft control in case of an emergency due to failure of a component. G.R.

A71-43088 * **Radar observations of the convective process in the clear air - A review. II.** T. G. Konrad and J. S. Brennan (Johns Hopkins University, Silver Spring, Md.). *Aero-Revue,* Sept. 1971, p. 487-489. 12 refs. USAF-NASA-supported research.

Cells often have turreted tops. Contour tracings of the same cell taken from a PPI sequence are presented. The cell growth is shown by the time sequence at several altitudes covering roughly 20 min. At the lower altitudes the cell appears singular and its pattern becomes progressively more unrecognizable with time as the top of the cell grows to higher levels. At higher elevations the cell appears two-headed. Aspects of cell drift, growth, and distribution are discussed. G.R.

A71-43089 **The application of high lift devices to competition gliders.** Nicholas Goodhart. *Aero-Revue,* Sept. 1971, p. 489-491.

The theoretical benefits to be obtained from high lift devices are examined, giving particular attention to Sigma high performance gliders. It is generally accepted that competition gliders will normally operate by climbing in circling flight in thermals and making distance in straight gliding flight between thermals. The merit of various design possibilities for the conflicting climb/cruise requirements are investigated. G.R.

A71-43090 # Optimal autorotation landing parameters for a helicopter (Optymalne parametry autorotacyjnego lądowania śmigłowca). Kazimierz Szumański. *Instytut Lotnictwa, Prace,* no. 45, 1971, p. 3-18. 5 refs. In Polish.

Theoretical analysis of factors governing the autorotation-mode helicopter landing process. A method is described for delineating domains within which the landing parameters can be varied while ensuring touchdown in a given area at zero sinking speed. A limitation is imposed on the rotor speed due to flow separation on the blades. Numerical examples are given for the Mi-2 helicopter. T.M.

A71-43197 # Repair or throwaway - Graphic screening techniques help supply the answer. James K. Segar (Lockheed-California Co., Burbank, Calif.). *Logistics Spectrum,* vol. 5, Fall 1971, p. 18-25.

It has been estimated that an overall saving as great as 30% may be realized if each spare part assembly is subjected to an economic analysis of the desirability of repairing the assembly. A technique is presented for making repair-throwaway decisions which minimize costs over life cycle. The technique indicates those cases where a clear-cut decision cannot be made because of imprecise knowledge of costs and failure rates. It is pointed out that the repair-throwaway analysis should be considered for each part as early as possible in the development stage of an aircraft because potential economic savings are greatest then. G.R.

A71-43226 Annual Corporate Aircraft Safety Seminar, 16th, Washington, D.C., April 19, 20, 1971, Proceedings. Seminar sponsored by the Flight Safety Foundation. Arlington, Va., Flight Safety Foundation, Inc., 1971. 117 p. $6.00.

An approach to safety problems is discussed together with corporate accident statistics, the determination of the causes of aircraft skidding accidents, Lufthansa pilot training programs, aircraft wake turbulence, the airport certification program, and corporate flight operations in the Japan area. Other subjects considered include ditching and survival, aviation fuels and their safety aspects, the significance of circadian rhythm for pilots, in-flight monitoring and engine reliability, and aircraft modifications. G.R.

A71-43227 # 1970 corporate accident statistics. C. A. McKinnon (Flight Safety Foundation, Inc., Arlington, Va.). In: Annual Corporate Aircraft Safety Seminar, 16th, Washington, D.C., April 19, 20, 1971, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1971, p. 9-15.

The data presented are based on preliminary data furnished through the courtesy of the National Transportation Safety Board and the Federal Aviation Administration. In an analysis of the data it is found that 70% of the Corporate/Executive fatal accidents occurred on ferry flights. There is a lack of discipline in some corporate flying that becomes acute on flights without passengers. It is pointed out that corporations should be able to improve their safety record with more careful selection, training, and supervision of pilots. This is particularly true of smaller organizations with single pilot operations. G.R.

A71-43228 * # Determining causation of aircraft skidding accidents or incidents. Walter B. Horne and Upshur T. Joyner (NASA, Langley Research Center, Hampton, Va.). In: Annual Corporate Aircraft Safety Seminar, 16th, Washington, D.C., April 19, 20, 1971, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1971, p. 16-29.

Accident investigators have been especially hampered by the lack of reliable means to establish the actual slipperiness of the runway for a given accident situation to aid in their determinations. Slipperiness measurements obtained with a NASA test vehicle are discussed. Computations of aircraft stopping distance using test vehicle stopping distance measurements are compared to FAR wet field length requirements. The investigations of the causes of two aircraft accidents/incidents have shown reasonable agreement between calculated airplane stopping distance on a specific wet runway and the observed aircraft stopping distance. G.R.

A71-43229 # Ditching and survival. Norman C. Seebach (Flight Safety Foundation, Inc., Arlington, Va.). In: Annual Corporate Aircraft Safety Seminar, 16th, Washington, D.C., April 19, 20, 1971, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1971, p. 30-36.

The ditching of a DC-9 jet in the Caribbean in May 1970 is briefly reviewed. Twenty-three passengers lost their lives in the incident. The Coast Guard estimated the swells to be from 8 to 10 feet. Problems were experienced with the life vests both in the aircraft and in the water. The lessons to be learned from the accident are discussed. The importance of passenger-briefing is emphasized, and suggestions for such a briefing are made. It is recommended that each crewmember's jacket be equipped with a small battery-operated VHF transceiver to coordinate rescue operations with aircraft overhead. G.R.

A71-43231 # Aviation fuels and their safety aspects. Alexander R. Ogston. In: Annual Corporate Aircraft Safety Seminar, 16th, Washington, D.C., April 19, 20, 1971, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1971, p. 45-54.

Hazards caused by the use of the highly volatile and flammable gasoline during the early days of aviation are reviewed. A special gasoline called 'Safety Fuel' was produced prior to World War II. Unfortunately there were certain problems which at the time defied practical solution. The advent of the jet engine, which can use low volatility fuel, represented a major contribution to flight safety. Various currently used fuels are discussed together with properties related to safety aspects of a fuel. In conclusion it is pointed out that there appears to be a well-justified case for prohibiting by regulatory action the use of JP-4 or Jet B type fuel in commercial passenger-carrying aircraft. G.R.

A71-43233 # In-flight monitoring and engine reliability. W. K. Russell (Dallas Airmotive, Inc., Dallas, Tex.). In: Annual Corporate Aircraft Safety Seminar, 16th, Washington, D.C., April 19, 20, 1971, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1971, p. 65-70.

An original and unique system of turbine engine operational surveillance has been developed. The program is computer-oriented in order to achieve consistency plus rapid response time and particularly to store and correlate pertinent operational data from the time of the manufacturer's green test run-up to today's flight. The method permits performance-monitoring starting at any time of the engine's life. It is attempted to determine deterioration from the time of the profile, and not on the basis of a comparison of engine data with a 'theory engine.' To establish the preliminary profile, the operator has to accumulate 25 to 30 recordings of selected readings during established cruise conditions. G.R.

A71-43234 * # Aircraft wake turbulence progress and plans. William A. McGowan and Mason T. Charak (NASA, Washington, D.C.). In: Annual Corporate Aircraft Safety Seminar, 16th,

Washington, D.C., April 19, 20, 1971, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1971, p. 71-87. 22 refs.

Analytical and flight test data are used to establish the inflight hazards associated with trailing vortex encounters. Techniques are suggested for avoiding the damaging manifestations of aircraft wake turbulence, taking into account various flight regimes. The comprehensive aircraft wake turbulence research program supported by NASA is outlined. Flight and model tests and instrument development for remote wind sensing are used to improve understanding of the aircraft wake turbulence generated by heavy transport aircraft. Other studies are conducted for uncovering ways to prevent the trailing vortices from forming or to induce early dissipation of dangerous winds. G.R.

A71-43235 # **Don't call them air carrier airports.** James C. Pope (FAA, Airport Certification Branch, Washington, D.C.). In: Annual Corporate Aircraft Safety Seminar, 16th, Washington, D.C., April 19, 20, 1971, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1971, p. 88-100.

In 1970 Congress enacted the Airport and Airway Development Act of 1970 which provides for mandatory minimum safety standards, airport certification, and improved air navigation facilities. The act includes provisions for issuance of airport operating certificates to airports serving air carriers certificated by the Civil Aeronautics Board. As a result of a comprehensive evaluation of all related factors, a two-phase certification program has been developed. The regulations regarding airport operating certificates are presented, and the tasks that lie ahead are analyzed. G.R.

A71-43312 # **Lifting line theory of a wing in uniform shear flow.** Kuninobu Morita. *JSME, Bulletin*, vol. 14, June 1971, p. 550-558; Discussion, p. 558-560; Author's Closure, p. 560-563. 9 refs.

Analysis of the characteristics of a finite large aspect ratio wing in a uniform shear flow with velocity variations along the wing span. A singularity approach different from the one used by Kármán and Tsien (1943) is applied to determine the characteristics of various wings of this type in discrete form. Also studied is the different behavior of large aspect wing characteristics in a uniform shear flow and in a uniform potential flow. Analytical expressions are given for a planar wing and for aerodynamic forces providing minimum drag. V.Z.

A71-43347 # **Nitrous oxide - A natural source of stratospheric NO.** Michael B. McElroy and John C. McConnell (Harvard University, Cambridge, Mass.). *Journal of the Atmospheric Sciences*, vol. 28, Sept. 1971, p. 1095-1098. 33 refs. NSF Grant No. GP-13982.

Investigation of an important natural source of NO, the reaction O(super 1D) + N2O yields 2NO, and comparison of the natural source with estimates for the source due to a fleet of 500 planes cruising for an average of 7 hr a day. The natural and artificial inputs above 15 km are of comparable magnitude. The natural source corresponds to a net production of NO, averaged over the globe, of about 2 x 10 to the 7th molecules sq cm/sec, and offers a yardstick for judging the possible significance of any artificial input. Additional sources of stratospheric NO, due to downward diffusion from the ionosphere and upward transport from the earth's surface, are discussed but are not quantitatively estimated. (Author)

A71-43357 Comparative study of two-dimensional and three-dimensional wakes in supersonic and hypersonic rarefied-gas flows (Etude comparative des sillages bidimensionnels et tridimensionnels dans des écoulements supersoniques et hypersoniques de gaz raréfié). Jean Allègre, Christian Matrand, and Michel Raffin (CNRS, Laboratoire d'Aérothermique, Meudon, Hauts-de-Seine, France). *Académie des Sciences (Paris), Comptes Rendus, Série A - Sciences Mathématiques*, vol. 273, no. 11, Sept. 13, 1971, p. 467-469. In French. Direction des Recherches et Moyens d'Essais Contract No. 525-68.

Results of an experimental study of the wakes of two- and three-dimensional bodies in rarefied-gas wind tunnels at various Mach and Reynolds numbers. Some remarks are made concerning the wake configuration of a dihedron in a high-speed rarefied-gas flow. A comparison is made between the wakes of a cone and a dihedron placed at a 12-deg angle of attack in a Mach 4 flow, showing a larger opening in the case of the two-dimensional wake and a lower pressure recorded on the axis of the two-dimensional wake downstream from the base. A.B.K.

A71-43379 Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Seminar sponsored by the Flight Safety Foundation. Arlington, Va., Flight Safety Foundation, Inc., 1970. 140 p. $5.00.

General aspects of aviation developments are discussed, and corporate aircraft accident statistics are examined. Factors related to the aircraft accidents and their prevention are considered including aircraft vortex wakes, accelerate-stop criteria, rescue operations in case of crash or fire, physical fitness and fatigue in aircrew members, and corporate pilot training programs. Questions of adequately functioning instrumentation as an important factor in avoiding accidents are covered by giving attention to altitude indicating devices and the advantages of Angle of Attack Instrumentation. G.R.

A71-43380 # **Another look at accelerate-stop criteria.** T. G. Foxworth and H. F. Marthinsen (Air Line Pilots Association, Washington, D.C.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 28 p. 74 refs.

Accelerate-stop criteria developed prior to the introduction of the jet transport are reviewed in light of operational experience. Reaction times presently used by the manufacturers in accelerate-stop calculations are examined from the human engineering standpoint. Results of a flight simulator study showing pilot reaction times for transition to the rejected take-off configuration are presented. Each pilot subject in the study was unexpectedly confronted with a simultaneous fire warning bell and light at some specified time increment prior to attaining V sub 1 during a simulated take-off. The resulting times for transition to the full braking configuration and the associated overspeeds above the critical engine failure speed, V sub 1, are compared to the certification performance and show a need for revision to the present criteria. (Author)

A71-43381 * # **Aircraft vortex wakes.** Robert W. Boswinkle, Jr. (NASA, Langley Research Center, Hampton, Va.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 8 p. 8 refs.

An aircraft which is producing lift leaves a rotating flow field behind each wing as it flies forward. There is usually one pair of oppositely rotating flow fields, or vortices, extending downstream from each wing tip and moving downward. Each vortex has a core region in which the rotational velocities build up from zero in the center to some maximum velocity at the edge of the core. If another aircraft crosses laterally through the core of each vortex, it will be subjected to an up-flow, a down-flow, and then another up-flow. Hazards connected with these air motions for a light aircraft are discussed. G.R.

A71-43382 # **Operational considerations of angle of attack.** W. Lange (Teledyne Avionics, Charlottesville, Va.). In: Annual

Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 9 p.

Technology has now provided a new addition to instrumentation used for the evaluation and control of a certain aspect of total aircraft performance. This addition is called Angle of Attack Instrumentation. Various parameters and relations which are involved in the lift performance of an aircraft are examined. The importance of the angle of attack in connection with lift performance is discussed, together with aspects regarding the occurrence of a phugoid oscillation. G.R.

A71-43383 # **Altitude awareness.** Fred Illston (American Airlines, Inc., New York, N.Y.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 16 p.

The development of the altitude instrumentation for the aircraft pilot is discussed. The first instruments, based on the variation of the air pressure with altitude, were improved to allow for barometric adjustments. Weaknesses of the three-pointer Altimeter led to the Servo-Altimeter, a drum-pointer configuration, and to direct readout of the altitude on a digital counter. Other approaches discussed include the radar Altimeter with the 'Altitude Alert' system, and automatic altitude reporting systems. G.R.

A71-43384 # **Altitude . . . or pressure.** John J. Carroll (National Transportation Safety Board, Bureau of Aviation Safety, Washington, D.C.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 6 p.

Several years ago, government agency studies concluded that regardless of barometric altimetry system inadequacies, there was nothing better to go to. After the rash of catastrophic air carrier approach and landing accidents during December 1968 and January 1969, the Safety Board released a series of recommendations to the FAA intended to prevent recurrences of such accidents. Among other things it was pointed out that 'the reassessment of altimetry systems with particular regard to their susceptibility to insidious interference by forms of precipitation needs to be the subject of attention by the highest level of aeronautical research facilities and personnel.' G.R.

A71-43385 # **Pressure instruments - Their use and misuse.** James W. Angus (Kollsman Instrument Corp., Syosset, N.Y.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 10 p.

The pressure altimeter, sensitive airspeed and vertical velocity instruments are a very important aid during the landing and takeoff phases of flight. There are six key points to be considered which will allow the pilot to obtain proper performance from his instruments. These points include the selection of the right instruments, careful instrument installation, the pilot's ability to recognize the normal from the abnormal conditions of operation, the identification of a problem for the repairman, the selection of a suitable repair shop, and familiarity with a number of altimeter characteristics. G.R.

A71-43386 # **Trust your altimeter.** James L. Hemingway (FAA, Washington, D.C.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 4 p.

In the case of a test program conducted in 1963 involving 152 general aviation aircraft it was found that not a single altimeter was within the tolerance now specified in the rules. A subsequently adopted regulation requires all general aviation aircraft to have an altimeter and static system test before being flown in IFR. Possible problems with altimeters are discussed along with suggestions for remedial action. G.R.

A71-43387 # **Pitot static systems.** J. A. Sevart (Swearingen Aircraft, San Antonio, Tex.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 3 p.

A number of aspects of pitot-static systems are discussed, giving attention to the various components involved. It is pointed out that a removable drain plug which is easily accessible for inspection shall be located at all low points where water may collect. Problems of line installation are considered, together with the location of the manifolds, and the design of the alternate static system. G.R.

A71-43388 # **Corporate training.** E. L. Hutcheson (Flight Safety Foundation, Inc., Arlington, Va.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 12 p.

It is pointed out that in aviation the group with the most stringent training requirements for pilots has percentagewise the smallest number of accidents caused by pilots. Examples of accident causes involving pilot errors are considered. A training program for pilots is suggested, giving attention to a ground and a flight training phase. Flight Check Records are recommended to determine any area that needs specific stress during this training. G.R.

A71-43389 # **The challenge of aircraft crash fire rescue.** Earl W. Keegan (Flight Safety Foundation, Inc., Arlington, Va.). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 7 p. 9 refs.

This paper provides a review of the current airport fire-fighting equipment and requirements. Statistics are offered concerning the inadequacies of such equipment at many airports served by air carriers and suggestions are made for improving the situation. The latest available fire-fighting equipment and fire-fighting agents are detailed as well as that equipment programmed by manufacturers for future use. The author also offers ideas and concepts on fire-fighting tactics that could be employed today, and those to meet future airport needs. (Author)

A71-43391 # **Corporate operations in Latin America.** Harold Curtis (National Distillers). In: Annual Corporate Aircraft Safety Seminar, 15th, San Antonio, Tex., May 11-13, 1970, Proceedings. Arlington, Va., Flight Safety Foundation, Inc., 1970. 9 p.

It is assumed that multiengine pressurized turbine-powered aircraft are used. Standard vhf communication and navigation in duplicate is essential, and dual ADF is suggested. The use of hf is recommended as the only means to maintain communication in certain areas. Various details regarding flight operations in Latin America are discussed including the amount of fuel to be carried, the paper work, problems of navigation, food, vaccinations, and weather. G.R.

A71-43448 **On combustion generated noise.** Warren C. Strahle (Georgia Institute of Technology, Atlanta, Ga.). *Journal of Fluid Mechanics*, vol. 49, Sept. 29, 1971, p. 399-414. 21 refs.

Upon review of past experimental results and theoretical efforts it is apparent that the mechanism by which combustion noise is generated is not well understood. A theory of combustion noise is developed in this paper which follows rigorously from the principles

of fluid mechanics. Lighthill's approach, used in his studies of aerodynamic noise, is closely followed in the present work. The sound radiated from open, turbulent flames is found to depend strongly upon the structure of such flames; at present their structure is not well known. However, meaningful bounds and scaling rules for the sound power output and spectral content are derived based upon the present limited knowledge. A framework is developed which explains past experimental work and the origin of combustion noise. (Author)

A71-43487 # The integral equation of the supporting rectangular plane in symmetric flow (Zur Integralgleichung der tragenden Rechteckfläche bei symmetrischer Anströmung). H. Schubert and W. Wittig (Halle, Universität, Halle, East Germany). *Zeitschrift für angewandte Mathematik und Mechanik,* vol. 51, Aug. 1971, p. 345-352. 10 refs. In German.

A rectangular thin airfoil in a flow orthogonal to the leading edge is considered, taking into account the case of a small angle of attack. The flow around the airfoil is analyzed by making use of two components, the fundamental flow and the perturbation flow. Assumptions needed for obtaining a singular integral equation for calculating the circulation density are discussed. The singular integral equation is transformed into the form reported by Weissinger (1949). G.R.

A71-43554 # Experimental study of the operation of axial-flow compressors during rotation of the guide vanes (Eksperimental'noe issledovanie raboty osevykh kompressorov pri povorote napravliaiushchikh lopatok). V. I. Titenskii and V. G. Karpov. *Energomashinostroenie,* vol. 17, July 1971, p. 43-46. 5 refs. In Russian.

Study of the possibilities of a method of expanding the range of stable operation of axial-flow compressors by regulating the rotating guide vanes on two four-stage model compressors with degrees of reactivity of 0.5 and 1, respectively. It is shown that regulation of rotating guide vanes may be successfully used for compressors with both degrees of reactivity. It is further shown that Titenskii and Shirokov's (1967) method of calculating the characteristics of the stages and flow area of an axial-flow compressor during rotation of the guide vanes gives results which are in satisfactory agreement with experimental results. A.B.K.

A71-43586 Société Internationale de Photogrammétrie, Symposium on Photogrammetry of Moving Objects, Saint-Mandé, Val-de-Marne, France, September 21, 22, 1970, Proceedings. Part 2 (Société Internationale de Photogrammétrie, Symposium sur la Photogrammétrie des Objets en Mouvement, Saint-Mandé, Val-de-Marne, France, September 21, 22, 1970, Proceedings. Part 2). *Société Française de Photogrammétrie, Bulletin,* Jan. 1971. 63 p. In French, English, and German.

The papers deal with developments in the field of photogrammetry, including photo-optical calibration of radio-navigation aids, photogrammetry in traffic merging studies and photogrammetric analysis of an airfoil. V.P.

A71-43587 Photo-optical calibration of aeronautics radio navigation aids. Gabor Remetey-Fülöpp (VIZITERV, Budapest, Hungary). *(Société Internationale de Photogrammétrie, Symposium sur la Photogrammétrie des Objets en Mouvement, Saint-Mandé, Val-de-Marne, France, Sept. 21, 22, 1970.) Société Française de Photogrammétrie, Bulletin,* Jan. 1971, p. 19-26. 5 refs.

The advantages of photogrammetric techniques for calibrating and checking airport ILS systems are outlined. In the photogrammetric method, the aircraft is made to circle or to perform radial flights, with lights flashing up at an appropriate pointer position of the cockpit voltmeter, or at a relative minimum or maximum field intensity measured by the board voltmeter. Colored lights may be used to distinguish between flashing signals referring to relative minimum or maximum position. The ground equipment incorporates a phototheodolite or digitized theodolite fitted with a technical camera, and an electronic range meter for determining the Y-base distances. V.P.

A71-43588 Photogrammetric analysis of the aerodynamics of a rotating airfoil (Analyse photogrammétrique de l'aérodynamique d'une voilure tournante). A.-J. Brandenberger (Université Laval, Quebec, Canada). *(Société Internationale de Photogrammétrie, Symposium sur la Photogrammétrie des Objets en Mouvement, Saint-Mandé, Val-de-Marne, France, Sept. 21, 22, 1970.) Société Française de Photogrammétrie, Bulletin,* Jan. 1971, p. 27-31. In French.

A wind tunnel investigation is described in which the aerodynamics effects produced by a helicopter rotor were recorded photogrammetrically with the aid of smoke visualization techniques. The observed effects are plotted. The equipment and procedure employed are described, and the precision of the technique is assessed. V.P.

A71-43592 * # Compressible flow across shaft face seals. John Zuk, Lawrence P. Ludwig, and Robert L. Johnson (NASA, Lewis Research Center, Cleveland, Ohio). *British Hydromechanics Research Association, International Conference on Fluid Sealing, 5th, University of Warwick, Coventry, England, Mar. 30-Apr. 2, 1971, Paper.* 44 p. 20 refs.

An analysis is presented for compressible fluid flow across shaft face seals and narrow slots. The analysis includes fluid inertia, viscous friction and entrance losses. Subsonic and choked flow conditions can be predicted and analyzed. The model is valid for both laminar and turbulent flows. Results agree with experiment and with solutions which are more limited in applicability. Results show that a parallel film can have a positive film stiffness under choked flow conditions. (Author)

A71-43599 * # Inlet-engine-nozzle wind tunnel test techniques. D. N. Bowditch (NASA, Lewis Research Center, Cleveland, Ohio). *NATO, AGARD, Meeting of the Propulsion and Energetics Panel, 38th, Sandeford, Norway, Sept. 13-17, 1971, Paper.* 29 p. 20 refs.

Experimental investigation of the inlet, engine, and exhaust nozzle of a supersonic propulsion system. Wind-tunnel and flight-test exhaust nozzle results are compared, and the accuracy of flight measurements is assessed. Comparisons are also presented for nozzle performance obtained with a cold jet, a powered turbojet simulator, and a solid jet boundary simulator. The effect of the local boundary layer on nozzle performance is discussed, and the need for good dynamic measurements during inlet-engine testing is illustrated for transients such as inlet unstart and engine stall. Also, the transient nature of inlet distortion and its effect on the engine are described for two different operating conditions. T.M.

A71-43600 * # Effect of operating variables on pollutant emissions from aircraft turbine engine combustors. Jack Grobman (NASA, Lewis Research Center, Cleveland, Ohio). *General Motors Corp., Symposium, Warren, Mich., Sept. 27, 28, 1971, Paper.* 40 p. 29 refs.

The purpose of this paper is to review NASA-Lewis combustor research aimed at reducing exhaust emissions from jet aircraft engines. Experimental results of tests performed on both conventional and experimental combustors over a range of inlet total pressure, inlet total temperature, reference velocity, and fuel-air ratio are presented to demonstrate the effect of operating variables on pollutant emissions. Combustor design techniques to reduce emissions are discussed. Improving fuel atomization by using an air-assist fuel nozzle has been shown to significantly reduce hydrocarbon and carbon monoxide emissions during idle. A short-length

annular swirl-can combustor has demonstrated a significant reduction in nitric oxide emissions compared to a conventional combustor operating at similar conditions. The use of diffuser wall bleed to provide variable control of combustor airflow distribution may enable the achievement of reduced emissions without compromising combustor performance. (Author)

A71-43878 Low frequency air navigation in Southeast Asia. Bruce E. Gearhart (USAF, Washington, D.C.). *Signal,* vol. 26, Nov. 1971, p. 20-24.

The discussion is concerned primarily with the AN/MRN-13 set, while a brief comparison with the AN/GRN-6 set is conducted to show planning differences. Both sets were deployed to Khe Sanh and Kham Due for tactical air support. The AN/MRN-13 is a mobile, air conditioned beacon which utilizes the NA/URN-5 transmitter. The URN-5 operates from an unattended V-83 van, with power adjustable from 25 watts to 400 watts. The URN-5 can be preset to any frequency within 200 to 800 kHz. Experience with the equipment is discussed, giving attention also to certain operation and maintenance problems. G.R.

A71-43887 Test report: Acrostar Mk. II (Test: Acrostar Mk. II). Walter Wolfrum. *Flugrevue/Flugwelt International,* Oct. 1971, p. 30-33. In German.

The history and technical characteristics of an all-wood single-seat high-performance acrobatic light-weight aircraft. The aircraft is designed for stresses ranging from +8 g to -8 g and for long periods of inverted flight. The aircraft profile is almost symmetrical, which means that the aerodynamic characteristics hardly differ in normal and inverted flight. The Hartzell constant speed propeller is driven by 220 hp Franklin 6A-350-Cl six-cylinder air-cooled engine. The landing gear is not retractable. Extensive tests performed with the aircraft are described in detail. V.R.

A71-43888 A step toward automatic air traffic control. (Der automatischen Flugsicherung einen Schritt näher). Wilfried E. Zuschlag (Internationale Büro-Maschinen Gesellschaft mbH, Sindelfingen, West Germany). *Flugrevue/Flugwelt International,* Oct. 1971, p. 35-38, 43, 44. In German.

The application of the IBM 9020 multiprocessing computer system to air traffic control is examined. The computer system and its operation are described, and the control sectors for inflight control at air route traffic control centers are discussed. An operational malfunction-analysis program is outlined, and the modes of operation of the polymorphic IBM 9020 computer system are examined. V.P.

A71-43889 Laser technique for determining the meteorological visibility range at airports (Lasertechnik zur Bestimmung der meteorologischen Sicht auf Flugplätzen). Roland Ziegler. *Flugrevue/Flugwelt International,* Oct. 1971, p. 45, 46. In German.

Methods and equipments currently used at airports to determine the runway visibility range (RVR), the slant visibility range (SVR), the lower cloud boundary, and the atmospheric damping coefficient are reviewed. The advantages of using lasers as light sources and using lidars for determining the relationship between reflected light and the state of the atmosphere are outlined. V.P.

A71-43897 Principles of automated checking of the operational capability of aircraft engines and the systems functionally connected to them. G. P. Shibanov. (*Avtometriia,* Sept.-Oct. 1970, p. 111-117.) *Automatic Monitoring and Measuring,* Sept.-Oct. 1970, p. 476-481. Translation.

Consideration of certain enumerated principles from the point of view of Boolean algebra and the algebra of events and states in an attempt to formulate these principles relative to their realization with an automatic monitoring system (AMS) designed on the basis of digital technology. An algorithm is derived which establishes the connection between the separate states of the AMS and the operating regimes of the monitored object, and may be used for automatic association of the states of the AMS to the cyclogram for checking the operational capability of different types of aircraft engines and the systems functionally connected with them. F.R.L.

A71-44071 # Selecting the geometry of a two-dimensional variable-geometry nozzle for a supersonic wind tunnel (O vybore geometrii ploskogo reguliruemogo sopla sverkhzvukovoi aerodinamicheskoi truby). L. P. Kozhenkova. *Akademiia Nauk Latviiskoi SSR, Izvestiia, Seriia Fizicheskikh i Tekhnicheskikh Nauk,* no. 4, 1971, p. 45-48. In Russian.

Formulas are derived, using which the principal geometrical parameters of a two-dimensional supersonic variable-area nozzle can be calculated as a function of the Mach number. The advantages of varying the rigid portion of the nozzle with respect to the Mach number in the case of a wide range of Mach numbers are demonstrated. V.P.

A71-44077 Minimum order state reconstruction filters for constant plants. Lee Gregor Hofmann (Systems Technology, Inc., Princeton, N.J.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 22-30. 21 refs. Contract No. AF 33(615)-69-C-1359.

Optimal control laws and decoupling control laws usually require the complete plant state. However, only a limited number of measurements are usually available in practice. Procedures are developed for obtaining the equations for a minimum order filter which can reconstruct the state from the given measurements when the rank of the augmented control effectiveness matrix is equal to the number of measurements and when a certain matrix constructed from the plant matrices is nonsingular. If m is the number of measurements for an n-th order plant, this filter requires a total of (n-m) integrations and differentiations for realization in general. For the case of practical interest where no differentiations are required, the filter requires (n-m) integrations for realization. An application to a significant multiple control-point problem in aircraft flight control illustrates the use of the theory. T.M.

A71-44089 Identification of aircraft states and parameters. W. H. Kroy, Jr. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 302a, 302b. 6 refs.

The utilization is discussed of available flight test measurements for improved estimates of parameters characterizing new aircraft. The example cited involves estimating the aerodynamic parameters associated with the equations of motion of a large aircraft, such as the DC-10, in the lateral mode when nonperfect measurements of the state and nonperfect measurements of some of the derivatives of the state are available. The total number of states and parameters to be identified is 26. A modified version of the Kopp/Oxford form of the relinearized Kalman filter was developed and used to identify the augmented state vector. Good starting estimates reduced the level of biased errors appreciably. The ability of the filter to estimate the states was very good, with errors in the fraction of one percent. M.V.E.

A71-44093 A nonvarying-C* control scheme for aircraft. Edward R. Rang (Honeywell, Inc., Hopkins, Minn.; U.S. Naval

Postgraduate School, Monterey, Calif.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 369-374. 14 refs.

Evaluation of the concept that a sum of normal acceleration and pitch rate appears to be the best variable to use to control aircraft in the longitudinal axis. The C*-Criterion specifies that the time response of this quantity must fall in a prescribed envelope for all speeds and altitudes. The control scheme is based on the observation that this is equivalent to controlling the system so that the coefficients of a certain equation which describes the aircraft's short-period motion are held fixed. This is done by using feedbacks with variable gains, the gain-changing mechanism being found by using gradient techniques. The system was shown to be practical by analog simulation. It was found to be tolerant of instrument noise, elevator hysteresis, and other complications not accounted for in the analytic derivations. F.R.L.

A71-44104 An application of stochastic optimal control theory to the optimal rescheduling of airplanes. R. S. Ellis and R. W. Rishel (Bell Telephone Laboratories, Inc., Whippany, N.J.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 527-535. 5 refs.

A model for the air traffic flow between two airports subject to random constraints on the take-off and landing capacities is set up. A dynamic programming algorithm for computation of optimal landing and take-off rules is established. For a simple case the algorithm is used to compute the optimal solutions explicitly. The methods used will generalize to problems of optimal control of linear systems subject to random constraints. The specific case discussed illustrates the problems that will be encountered in computing optimal feedback control laws for these types of systems. (Author)

A71-44105 An approach to semiautomated optimal scheduling and holding strategies for air traffic control. Michael Athans and Lynn W. Porter (MIT, Cambridge, Mass.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 536-545. 5 refs.

Consideration of the problem of coordinating the traffic flow and holding patterns of N aircraft which desire to land on a single runway. A distance separation is to be enforced over the outer marker. It is shown that this problem can be attacked as a variation of a linear-quadratic optimal control problem. The solution of this optimization problem can be used to indicate which aircraft can accomplish headway corrections by velocity control, and which ones must undergo path stretching or holding maneuvers. The gradual implementation of these strategies in current and evolutionary ATC systems is discussed. F.R.L.

A71-44106 Active flutter control - Flight test system synthesis. Robert P. Johannes (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 599-607.

Discussion of the synthesis of a flutter mode control system for flight test, with summary of a study to determine the feasibility of an actual flutter control demonstration as part of the Control Configured Vehicles (CCV) Advanced Development Program. The analytical study shows that it is quite practical to artificially destabilize a symmetrical wing flutter mode through adverse mass balancing, and then provide active flutter control of the mode and those modes directly associated with that unstable mode for flight demonstration on the Load Alleviation and Mode Stabilization (LAMS) test vehicle. F.R.L.

A71-44107 Active flutter suppression - An emerging technology. G. O. Thompson and G. J. Kass (Boeing Co., Wichita, Kan.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 608-616. 40 refs.

Consideration of the control of aircraft elastic modes as a result of studies made over the past decade. Flight demonstration of Stability Augmentation Systems on the B-52 and XB-70 aircraft have demonstrated the value of suppressing stable structural modes. These programs and others which provide the basis to proceed with confidence to active control of unstable modes are discussed. Attention is also given to the limited analytical studies accomplished on unstable or flutter modes, with suggestion of future areas of research which can bring this emerging technology to fruition. F.R.L.

A71-44108 Potential performance gains by use of a flutter suppression system. L. J. Topp (Boeing Co., Seattle, Wash.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 617-623.

Discussion of the potential gains which can be achieved by using an active flutter suppression system (FSS) in lieu of conventional means of flutter speed improvement. Analyses show that an FSS, using a dedicated control surface, may impose a smaller weight penalty on an aircraft than mass balancing, an increase in stiffness, or geometry changes. The amount of flutter speed improvement with the FSS is shown to be a function of the location of applied force, the type of sensor or sensors and their locations, and the control system transfer function. Results indicate that adequate margins in gain and phase, as well as the required modal damping, can be achieved. F.R.L.

A71-44109 A feasibility study of active wing/store flutter control. W. E. Triplett (McDonnell Aircraft Co., St. Louis, Mo.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 624-632. 12 refs.

Analytical investigations of active feedback flutter control for fighter type aircraft, specifically with respect to wing/store flutter control, show promise of significant benefits for both contemporary and future aircraft. The F-4 Phantom aircraft with an external store is idealized for a flutter critical configuration. Computer programs, based on both frequency and time domains, are used with conventional control system design techniques to generate feedback compensation for active control of flutter for this configuration. Results of linear analyses indicate the possibility of expanding the permissible flight envelope by 150 knots using the existing aileron control surfaces and establish preliminary requirements for control system hardware. (Author)

A71-44111 Adaptive guaranteed cost control of systems with uncertain parameters. S. S. L. Chang and T. K. C. Peng (New York, State University, Stony Brook, N.Y.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 686-694. 15 refs. NSF Grant No. GK-16017; Grant No. AF AFOSR 70-1890.

Discussion of guaranteed cost control, a method of synthesizing a closed-loop system in which the controlled plant has large parameter uncertainty. The basic theoretical development of guaranteed cost control is given, and it is shown how it can be incorporated into an adaptive system. The uncertainty in system parameters is reduced first by either on-line measurement and evaluation, or prior knowledge of the parametric dependence of a certain easily measured situation parameter. Guaranteed cost control is then used to take up the residual uncertainty. It is shown that the

uncertainty in system parameters introduces an additional term in the Riccati equation. A FORTRAN program for computing the guaranteed cost matrix and control law is developed and applied to an air frame control problem with large parameter variations. F.R.L.

A71-44113 ***Parameter and model identification of nonlinear dynamical systems using a suboptimal fixed-point smoothing algorithm.*** Robert T. N. Chen and Bernard J. Eulrich (Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y.). In: Joint Automatic Control Conference, 12th, Washington University, St. Louis, Mo., August 11-13, 1971, Preprints of Technical Papers. New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 731-740. 22 refs. Contract No. N 00019-69-0534.

This paper presents a suboptimal fixed-point nonlinear data smoothing algorithm for parameter and initial state estimation of nonlinear dynamic systems having a large number of parameters and unknown forcing inputs. Also presented in the paper is a method for estimating the unknown forcing inputs or modeling errors. A start-up procedure for the fixed-point smoothing algorithm and an improved computational algorithm for the variances of the fixed-point smoothed estimates are also proposed. Application of the proposed methods to the identification of V/STOL aircraft parameters is given. (Author)

A71-44189 **R & D in Soviet aviation.** Arthur J. Alexander (RAND Corp., Santa Monica, Calif.). *Instruments and Control Systems,* vol. 44, Oct. 1971, p. 37-40.

Research institutes, design bureaus, and manufacturing plants are administratively autonomous organizations coordinated under the Ministry of Aviation. A prominent feature of the Soviet aircraft industry is the absence of small contractors. Emphasis on the use of handbooks permits the research institutes to control aerodynamic structures and manufacturing techniques. A proposal for a new aircraft is submitted to several independent design bureaus. The building of the prototype is discussed together with the manufacture of the product, and approaches responsible for technological innovations. G.R.

A71-44271 # **Imai-Lamla's approximation method for the circular profile with a normal jet (Metoda de approximare a lui Imai-Lamla pentru profilul circular cu jet normal).** A. Bársony-Nagy (Academia Română, Institutul de Matematică, Bucharest, Rumania). *Studii şi Cercetări Matematice,* vol. 23, no. 9, 1971, p. 1339-1352. In Rumanian.

Brief discussion of the principle of Imai-Lamla's approximation method for subsonic flows in the presence of a steady current to infinity, parallel to the Ox axis, described by Bársony-Nagy (1969, 1971). An attempt is made to obtain the complex potential of the flow of the compressible fluid, in second approximation, under the same conditions. This problem is reduced to a Volterra problem with two given singularities, and by applying the Kutta-Joukowski theorem, the resultant of the aerodynamic forces is calculated, with an example. M.M.

A71-44273 **Solid-state airborne weather radar fully satisfying ARINC and TSO specifications.** Atsushi Kurokawa, Yoshitaka Sueishi, and Toshio Hakoda (Tokyo Shibaura Electric Co., Ltd., Tokyo, Japan). *Toshiba Review,* June 1971, p. 19-23. 8 refs.

Description of the technical status and future prospects of an airborne weather radar now being used in civilian aviation. A second-generation radar of solid-state design has been completed and is ready for commercial production. The solid-state design has made possible a weight reduction of about 30%, and a reduction in power requirement by half as compared with the vacuum tube design. F.R.L.

A71-44342 **Circling performance of sailplanes.** D. J. Marsden (Alberta, University, Edmonton, Alberta, Canada). *Aero-Revue,* Oct. 1971, p. 549-552. 10 refs.

Proposal of variable geometry in the form of high lift flaps as a means of increasing the overall cross-country speed of a sailplane by providing a better compromise between cruise and climb performance. The circling performance of a sailplane with high lift flaps is analyzed, keeping the main design parameters in the range dictated by operational considerations of straight glide performance and the characteristics of thermals encountered. The results show that a substantial increase in both climb performance and effective cross-country speed can be expected. F.R.L.

A71-44346 **A study of the stability of a plate-like load towed beneath a helicopter.** D. F. Sheldon (Royal Military College of Science, Swindon, Wilts., England). *Journal of Mechanical Engineering Science,* vol. 13, Oct. 1971, p. 330-343. 14 refs. Research supported by the Science Research Council.

Recent experience has shown that a plate-like load suspended beneath a helicopter moving in horizontal forward flight has unstable characteristics at both low and high forward speeds. These findings have prompted a theoretical analysis to determine the longitudinal and lateral dynamic stability of a suspended pallet. Only the longitudinal stability is considered here. Although it is strictly a nonlinear problem, the usual assumptions have been made to obtain linearized equations of motion. The aerodynamic derivative data required for these equations have been obtained, where possible, for the appropriate ranges of Reynolds and Strouhal number by means of static and dynamic wind tunnel testing. The resulting stability equations (with full aerodynamic derivative information) have been set up and solved, on a digital computer, to give direct indication of a stable or unstable system for a combination of physical parameters. These results have indicated a longitudinal unstable mode for all practical forward speeds. Simultaneously the important stability derivatives were found for this instability and modifications were made subsequently in the suspension system to eliminate the instabilities in the longitudinal sense. Throughout this paper, all metric dimensions are given approximately. (Author)

A71-44347 **Streamline curvature analysis of compressible and high Mach number cascade flows.** J. P. Bindon (Natal, University, Durban, Natal, Republic of South Africa) and A. D. Carmichael (MIT, Cambridge, Mass.). *Journal of Mechanical Engineering Science,* vol. 13, Oct. 1971, p. 344-357. 24 refs. Research supported by the South African Council for Scientific and Industrial Research.

A blade to blade design tool for analysing the subsonic, transonic and supersonic flows in axial turbine blades is presented using the streamline curvature method. The work includes a numerical convergence analysis which produced convergence of the digital computer programme for all cases attempted. Computed results are compared with experiment and other theory. Comparisons for turbine type cascades up to Mach 1.0 show a satisfactory agreement and techniques introduced give improved leading edge results and allow the Kutta-Joukowski condition to be applied at the trailing edge for the accurate determination of the velocity distribution and the cascade deviation. Predictions for convergent-divergent supersonic wind tunnel type nozzles agree closely with experiment and with other theories. Numerical difficulties are found to be more acute for subsonic/supersonic turbine cascades and experimental agreement, while acceptable, is inferior to that obtained for subsonic cascades. (Author)

A71-44352 **Supersonic transport aviation and air traffic control (L'aviation de transport supersonique et le controle du trafic aérien).** Jean Maigret. *Navigation* (Paris), vol. 19, Oct. 1971, p. 405-416. In French.

Results of studies conducted for more than five years by the work group formed by the German, British, and French Institutes of

Navigation concerning supersonic transport. Taxiing, takeoff, and landing maneuvers are discussed, as well as operations in terminal areas (climb and descent below Flight Level 250). Subsonic cruise and acceleration to supersonic cruise, the termination of cruise, and deceleration and descent to lower airspace are considered. Aspects of the role of ATC above ocean regions are outlined. F.R.L.

A71-44353 **Integrated system of control and operation of aircraft (Système intégré de controle et de commande des avions).** M. J. Jullien and J. C. Peigney (Thomson - CSF, Paris, France). *Navigation* (Paris), vol. 19, Oct. 1971, p. 417-431. In French.

Exposition of the major operational components and techniques of apparatus for visualization and manual control suitable for assembling, and for best presentation of, all useful information in each phase of a commercial or military flight. New concepts of the instrument panel to respond to old and new requirements, and new techniques and developments are described. Attention is given to the interconnections of the integrated system with the other on-board electronic equipment. F.R.L.

A71-44365 **Liquid hydrogen as a fuel for the future.** Lawrence W. Jones (Michigan, University, Ann Arbor, Mich.). *Science*, vol. 174, Oct. 22, 1971, p. 367-370. 13 refs.

The use of liquid hydrogen as a long-term replacement for hydrocarbon fuel for land and air transportation seems technically feasible. It is an ideal fuel from the standpoint of a completely cyclic system, serving as a 'working substance' in a closed chemical and thermodynamic cycle. The energy-per-unit-weight advantage over gasoline or any other hydrocarbon fuel makes liquid hydrogen particularly advantageous for aircraft and long-range land transport. As a pollution-free fuel, it must be seriously considered as the logical replacement for hydrocarbons in the 21st century. G.R.

A71-44393 # **An algorithm for search of compromise control in static hierarchical systems (Pro odin algoritm poshuku kompromisnogo keruvannia u statichnikh ierarkhichnikh sistemakh).** V. L. Volkovich and M. F. Radoms'kii. *Avtomatika*, vol. 16, July-Aug. 1971, p. 42-51. 12 refs. In Ukrainian.

It is shown that two compromise-control search problems arise for each subsystem of the inner level in a multilevel static hierarchical system. Several types of interactions between the subsystems are possible, depending on the relationships among periods of commands applied to the subsystems. In the case of simultaneous interaction among all the subsystems, the search for compromise control is reduced to a nonlinear programming problem. The results are illustrated by the example of automatic air traffic control of a number of aircraft over a given territory. T.M.

A71-44454 **Automatic flight - An introduction.** *Interavia*, vol. 26, Oct. 1971, p. 1141-1144.

Brief history of automatic flight control system development in the U.K. and the U.S., together with a description of various flight control systems and the current state of these programs. In the American approach, the pilot is retained in the control loop, while some Europeans consider that the pilot should evolve into a systems manager. Progress at the Blind Landing Experimental Unit (BLEU) is discussed. F.R.L.

A71-44455 **Automatic flight - The American view.** *Interavia*, vol. 26, Oct. 1971, p. 1145-1147.

Review of American developments in automatic flight and their application. The American philosophy on automatic landing has always included a requirement that the pilot must at all times be aware of what is going on and must supervise it. The requirements established by the FAA are outlined, and American interest in visibility enhancement as an aid to the pilot is discussed. F.R.L.

A71-44456 **Triplex and simplex - The Trident and the Caravelle.** *Interavia*, vol. 26, Oct. 1971, p. 1148-1150.

Review of two major European programs to develop automatic flight control systems that would eventually permit the aircraft to which they were fitted to carry out automatic landings in Category IIIA conditions. These were the Smiths Industries SEP5 triplex system for the de Havilland (Hawker Siddeley) Trident and the Lear Siegler-Sud Aviation AWLS simplex system for the Sud Aviation (Aérospatiale) Caravelle. The Trident made the first autoflare with fare paying passengers aboard, and the Caravelle made the first automatic landing in scheduled service in Category IIIA conditions. More experience has been gained with these aircraft than with any other type of civil aircraft. F.R.L.

A71-44558 **The effects of an oscillating flap and an acoustic resonance on vortex shedding.** J. M. R. Graham and D. J. Maull (Cambridge University, Cambridge, England). *Journal of Sound and Vibration*, vol. 18, Oct. 8, 1971, p. 371-380. 8 refs.

Vortex shedding from the blunt trailing edge of a flat plate spanning a wind tunnel under two kinds of periodic excitation is described. The conditions under which these two forms of excitation, an oscillating flap and an acoustic resonance, cause the vortex shedding to be in phase along the span are compared. Particular attention is paid to cases when the natural shedding frequency and either the flap frequency or the center frequency of the acoustic resonance, respectively, are not quite coincident. (Author)

A71-44559 **Interpolation of aerodynamic damping of lifting rotors in forward flight from measured response variance.** G. H. Gaonkar (Washington University, St. Louis, Mo.). *Journal of Sound and Vibration*, vol. 18, Oct. 8, 1971, p. 381-389. 12 refs.

Description of methods for the direct computation of the blade response variance matrix up to high rotor advance ratios for a series of inertia numbers. Numerical results refer to a rigid blade flapping model with an elastically restrained flapping hinge at the rotor center. Different combinations of the advance ratio, tip-loss factor, flapping restraint parameter and inertia number are included. The white noise excitation is treated without and with input modulation, the latter case including azimuthwise blade input variation. The mean square response study of the model shows that up to an advance ratio of the order of 0.3 and at conventional values of the inertia number the perturbation approach is satisfactory. The numerical scheme, in addition to solving directly the response variance equations which are similar in structure to the original blade dynamic equations, uses the fact that the variable part of system parameter functions are independent of the inertia number. M.M.

A71-44560 **A note on the acoustic output from round and interfering jets.** D. Middleton (Nottingham University, Nottingham, England). *Journal of Sound and Vibration*, vol. 18, Oct. 8, 1971, p. 417-421. 12 refs.

A model is presented for estimating the acoustic output per unit slice in the adjustment region of a round subsonic jet, and the deduced contributions of the annular, adjustment and fully-developed regions are found to be approximately in the proportions 25:24:1. The method is extended to the case when two similar adjacent parallel round jets interfere, the estimated reduction in total acoustic output being up to 2 dB. An approach to the calculation of the attenuation of suppressor nozzles is also given. (Author)

A71-44572 # **The shape of a supersonic aircraft (Kształt samolotu naddźwiękowego).** Kazimierz Gilewski. *Technika Lotnicza i Astronautyczna*, vol. 26, Sept. 1971, p. 7-10, 29. 5 refs. In Polish.

It is shown that the dissemination of shock waves from a supersonic body can be minimized by employing an aerodynamic shape corresponding to a channel with a converging inlet section and a diverging outlet section. Air compressed at the inlet moves through the channel to fill the outlet region evacuated by the forward motion

of the body. A specific aircraft design is proposed which employs a rectangular channel containing the propulsion system. The bottom wall of the channel is used to provide some of the required lift. T.M.

A71-44574 # **Damage of aircraft parts by corrosion (Uszkodzenia części lotniczych przez korozję).** Emil Gruszczyński and Edward Sychowicz. *Technika Lotnicza i Astronautyczna,* vol. 26, Sept. 1971, p. 16-20. 10 refs. In Polish.

Examples of actual corrosive damage of aircraft parts, occasioned by friction forces, intercrystalline attack, and hot gases. A worn universal joint is used to demonstrate the oxidation of a surface exposed to friction loading. Corrosive damage along grain boundaries is described in terms of effects resulting in service, and mechanisms responsible for blade damage in gas turbines are explained. T.M.

A71-44577 * # **Aerodynamics of lift fan V/STOL aircraft.** Jerry V. Kirk, Leo P. Hall, and Brent K. Hodder (NASA, Ames Research Center, Moffett Field, Calif.; U.S. Army, Air Mobility Research and Development Laboratory). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-981.* 9 p. 11 refs. Members, $1.50; nonmembers, $2.00.

Lift fans have been shown to be effective for providing direct lift for V/STOL aircraft. Recent efforts at Ames Research Center have been directed toward determining the aerodynamic characteristics of podded lift fans located fore and aft of the wing to allow higher wing loading and reduce constraints on wing design. Most existing design studies in which lift fans were used for direct lift show that a fan pressure ratio of about 1.3 is optimum while an augmentation ratio of 2.5 is maintained. For this reason an investigation was made of the aerodynamic characteristics of a 1.3 pressure ratio lift fan. Results show that podded lift-fan configurations can produce induced lift approaching the magnitude of the better fan-in-wing configurations while reducing significantly the variation of pitching moment with forward speed. The 1.3 pressure ratio lift fan performs well in crossflow and research is being conducted to reduce lift-fan noise. (Author)

A71-44578 # **Canada's STOL program - A progress report.** C. C. Halton (Ministry of Transport, Ottawa, Canada). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-982.* 14 p. Members, $1.50; nonmembers, $2.00.

Evaluation of the opportunity for STOL aircraft to supplement and complement conventional air transportation in Canada. In Canada air traffic accounts for 30% of passenger traffic in the Quebec-Windsor corridor, and 60% of the common carrier traffic. It is emphasized that a STOL system that will fulfill the various roles that can be seen for it must be capable of landings and takeoffs that are short, steep, and quiet. F.R.L.

A71-44579 # **The trends of the STOL system.** M. Avramito (Société Nationale Industrielle Aérospatiale, Paris, France). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-983.* 6 p. Members, $1.50; nonmembers, $2.00.

The STOL system is necessary to increase the productivity of air transport in short-haul traffic. It comprises ground installations with short runways, three-dimensional area navigational aids and well-adapted and quiet aircraft. It will deal with the traffic problems of under-developed countries, areas of difficult access, secondary cities and especially interurban travel. The type and capacity of the future aircraft depend on the date of their commercial entry into service. Aérospatiale is developing a new concept of STOL aircraft which will be ready by the end of the 70's. M.M.

A71-44582 # **The design and analysis of a fully-flexible ram-air inflated parawing.** Basil S. Papadales, Jr. (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-986.* 10 p. 5 refs. Members, $1.50; nonmembers, $2.00.

Based on previous research, tests were conducted to determine an optimum method of inflating a keel or leading-edge section of a parawing in hopes of increasing stability. Several small parawings were constructed and tested at low velocities. Increased stability and reliability were noted. The final parawing design had a ram-air inflated keel and leading-edge. An approximation method for determining the inflated wing shape was derived. It was concluded, that the use of semirigid members in a parawing is beneficial to stability characteristics. (Author)

A71-44585 # **Performance prediction and evaluation of propulsion-augmented high lift systems for STOL aircraft.** R. L. Gielow (Lockheed-Georgia Co., Marietta, Ga.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-990.* 9 p. 6 refs. Members, $1.50; nonmembers, $2.00.

A technique has been developed for predicting the aerodynamic forces of powered-lift systems. Theoretically generated powered section data are distributed spanwise along a lifting line to produce three-dimensional characteristics which exhibit good correlation with experimental results. Employing this technique, baseline-configured aircraft are sized to perform a military STOL mission for field lengths of 1500 to 2500 feet. The lift system concepts include the internally and externally blown jet flaps, BLC, and pure thrust deflection. Direct lift engines are also considered. The sizing process recognizes differences in lift system weight and aerodynamic performance. A comparison of the optimally-sized aircraft produces some interesting conclusions concerning the tradeoff between sophisticated systems and their associated weight penalties. (Author)

A71-44586 # **A comparison of outflows from a helicopter, tilt wing and jet lift hovering aircraft.** Odd E. Michaelsen (Canadair, Ltd., Montreal, Canada). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-992.* 13 p. Members, $1.50; nonmembers, $2.00.

The objectives of the flight test measurements discussed were to assess the suitability of the CL-84 and the Harrier as hover rescue vehicles compared to helicopters. The data shows that, near the downwash impingement area, the vertical variation of the outflow velocity is appreciably different for the three vehicles. While the helicopter velocity-height profile is nearly uniform, the higher disk loading vehicles show higher velocities near the ground and lower velocities at head height. These differences reduce rapidly with radial distance. The measured results were in good agreement with analytically predicted velocity-height profiles. (Author)

A71-44588 # **Prediction of flow angularity near a supersonic fuselage forebody with arbitrary cross-section.** Jerome A. Forner (USAF, Aeronautical Systems Div., Wright-Patterson AFB, Ohio). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-996.* 11 p. 12 refs. Members, $1.50; nonmembers, $2.00.

A simple method was developed to predict flow angularity around the side of a typical uncambered fuselage forebody at supersonic speeds with zero sideslip. The method falls within the class of slender body solutions in small perturbation theory. The body cross-section at any axial location is analytically described by a truncated cosine series, whose coefficients vary with axial position as the body cross-section changes. A disturbance velocity potential is found, which is made up of axial and crossflow components due to an equivalent body of revolution, plus axial and crossflow com-

ponents which adjust for the body asymmetry. The potential is made to satisfy the approximate boundary conditions of flow tangency on the body. A computer solution provides plots which compare the theoretical crossflow around a fuselage forebody for which experimental data was available. Comparisons were made at Mach 2.5 with angles of attack of -7.5, 7.5, and 12.5 degrees and Mach 2.2 at 8.3 degrees. Agreement of flow angularity is generally good. Surface static pressures were also compared at Mach 2.2 and agreement was unsatisfactory. Recommendations for possible improvements to the method are made. (Author)

A71-44591 # **Trends in the field of automatic control in the last two decades (Von Kármán Lecture).** I. Flügge-Lotz (Stanford University, Stanford, Calif.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-1001.* 32 p. 22 refs. Members, $1.50; nonmembers, $2.00.

Discussion of the essential events which occurred in the controls field in the last two decades with the intent of giving the aeronautical engineer some aspects which have attracted great attention. Essential trends of the solution possibilities for optimal control problems are indicated. It is stressed that one aspect of optimal controls has really not gained enough attention. It has been pointed out what enormous role the chosen performance criterion plays. However, it is not always clear which of several performance criteria is the most important one for a specific design. M.M.

A71-44594 # **The impact of future transportation technology.** Robert L. Maxwell (U.S. Department of Transportation, Office of Systems Engineering, Washington, D.C.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-1010.* 10 p. 6 refs. Members, $1.50; nonmembers, $2.00.

Discussion of the necessity for new approaches to evaluation criteria of new system design for future transportation technology. An example of this is cited in the approach taken by the CARD (Civil Aviation Research and Development) Policy Study of the problem of aircraft noise. It is pointed out that mass transit systems such as personal rapid transit, dial-a-ride, dual mode and dynamic traffic control are expected to make a positive contribution. Transportation technology, guided by these new evaluation criteria, is expected to have a dominant effect on our future civilization while minimizing the negative impact to a much more satisfactory degree than has been achieved in the past. M.M.

A71-44596 # **STOL, VTOL, and V/STOL - Where do they fit in.** *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-1015.* 6 p. Members, $1.50; nonmembers, $2.00.

Synopsis of broad comments from AIAA members on various aspects of the merits and developments, present and future, of the STOL, VTOL, and V/STOL family of aircraft. The aspects covered include: the current situation, the background and current status of each of these aircraft varieties, the military role, the worth of pursuing the development of a V/STOL aircraft (i.e., a transport that has the combined capabilities of the STOL and VTOL aircraft and can operate in any mode, including the conventional), the implementation problem, and implementation suggestions. M.V.E.

A71-44597 # **Technology and the environment - Friends or foes.** Glenn Larson (U.S. Department of Transportation, Transportation Systems Center, Cambridge, Mass.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-1016.* 16 p. Members, $1.50; nonmembers, $2.00.

Background material taken from current literature is presented, giving the diverse views that concerned people have on the subject of environmental impact. Some equate environmental degradation directly to the misuse of technology. Others would admit of a less direct relationship but see our survival directly dependent upon the proper use of technology. A shift in values appears to be underway with a corresponding shift in emphasis between first-order effects and side effects. Views on how this shift in emphasis can be achieved in our society are explored, again by quoting from a number of statements in the current literature. (Author)

A71-44600 # **Commercial air transportation - What's the prognosis.** *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-1022.* 18 p. Members, $1.50; nonmembers, $2.00.

Current trends in the industry of commercial air transportation are reviewed, and the requirements of optimal planning for the future are examined. Key issues discussed include airline economic viability, industry regulation, public service, and environmental compatibility. Options and considerations are presented rather than 'pat' solutions, for optimum solutions to many of the problems are clearly not evident. Only joint industry/government dialogues are likely to start an effective search for sound principles and 'good' objectives. M.V.E.

A71-44602 * # **The CARD Study - What is its impact.** C. A. Syvertson (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-1024.* 10 p. Members, $1.50; nonmembers, $2.00.

The nature and magnitude of the three major problems confronting civil aviation are discussed in the light of the Civil Aviation Research and Development (CARD) Policy Study, along with CARD Study's key recommendations for each problem. The highest priority belongs to the problem of aircraft noise abatement for it affects the solutions to other problems. The most urgent recommendation asks that time-phased research goals be established calling for noise reductions at the generating source of about 10 to 15 dB per decade. Congestion, the next on the priority list, is a complex problem whose solution involves an organized effort directed at the combination of air traffic control, runway capacity, and airport development. The third major problem of low-density, short-haul service is important to civil aviation's ability to contribute to the goals of the nation, particularly in regard to future regional development. A government-sponsored determination of market sensitivities to changes in service, fare, frequency, and equipment, as well as government-funding of studies for the design and analysis of appropriate vehicles, is recommended. M.V.E.

A71-44604 # **Adiabatic laminar boundary-layer/shock-wave interactions on flared axisymmetric bodies.** Harry P. Horton (Von Kármán Institute for Fluid Dynamics, Rhode-Saint-Genèse, Belgium). *AIAA Journal*, vol. 9, Nov. 1971, p. 2141-2148. 27 refs.

A method is described for calculating the over-all properties of flare-induced laminar boundary-layer/shock-wave interactions on axisymmetric bodies at zero incidence in supersonic flow, under adiabatic conditions. The method consists of an extension to axisymmetric flow of the two-dimensional integral method of Lees and Reeves, as recently improved by Klineberg. The relationship between the local slope and Mach number of the external inviscid stream is calculated by a suitable inversion of the second-order shock-expansion method of Syvertson and Dennis. Satisfactory agreement is demonstrated between the theory and measurements on hollow cylinder-flare models at Mach numbers of 2.2 and 4.0. (Author)

A71-44613 # **Downwash-velocity potential method for lifting surfaces.** John Kenneth Haviland (Virginia, University, Charlottesville, Va.). *AIAA Journal*, vol. 9, Nov. 1971, p. 2268, 2269. 6 refs.

It is demonstrated in the steady-state case that the method is capable of achieving 5% accuracy with moderate array sizes, involving 16 points or less, and with wake of less than 5 chord lengths. Further, it is shown that the accuracy improves as these numbers increase. Future work will investigate the applicability of an extended method to the oscillating case with arbitrary planforms. G.R.

A71-44620 # **Transonic flows by coordinate transformation.** P. O. Baronti, S. Elzweig (Advanced Technology Laboratories, Inc., Jericho, N.Y.), and R. Vaglio-Laurin (New York University, New York, N.Y.). *AIAA Journal*, vol. 9, Nov. 1971, p. 2280. Contract No. N 00014-71-C-0197.

It is pointed out that a problem regarding the periodical recalculation of far field boundary conditions in the method used by Murman and Cole (1971) can be avoided by a new approach. This approach involves the transformation of the infinite domain around the airfoil into a finite domain by coordinate transformation. A typical numerical solution for a nonlifting circular arc airfoil at a freestream Mach number of 0.8 is presented. G.R.

A71-44621 # **Aerodynamic characteristics of slender wedge-wings in hypersonic strong interaction flows.** C. M. Rodkiewicz and T. K. Chattopadhyay. *AIAA Journal*, vol. 9, Nov. 1971, p. 2280-2282.

The investigation discussed is based on the results obtained by Chattopadhyay and Rodkiewicz (1971). A formula for the shear stress on the wall is obtained, and expressions for the different forces acting on the wedge are presented. Effects of parameter changes on the lift/drag ratio of a 2 deg wedge and of a flat plate are determined. G.R.

A71-44624 * # **Approximate analytic solution for the position and strength of shock waves about cones in supersonic flow.** Sanford S. Davis (NASA, Ames Research Center, Aerodynamics Branch, Moffett Field, Calif.). *AIAA Journal*, vol. 9, Nov. 1971, p. 2287-2289.

The equations derived are valid for higher Mach numbers and/or larger cone semiangles than the equations obtained previously by Lighthill (1948) and Whitham (1952). Both the Whitham procedure for calculating a uniformly valid first-order solution, and the simplification afforded by the conical symmetry of the flow are utilized in the derivation. Only the details of the second order characteristics are used in order to obtain a solution. The expressions found for the pressure rise across the shock wave and for the angle that the conical shock wave makes with the linearized Mach cone differ from the results of Lighthill and Whitham by the appearance of an additional factor in the denominators. G.R.

A71-44692 # **Use of a correlation system of equations for accuracy analysis in flight dynamics problems (Primenenie korreliatsionnoi sistemy uravnenii dlia analiza tochnosti v zadachakh dinamiki poleta).** I. O. Mel'ts, T. A. Pykhova, and G. V. Uskov. In: Nonlinear and optimal systems. Moscow, Izdatel'stvo Nauka, 1971, p. 246-263; Discussion, p. 263. 10 refs. In Russian.

Development of methods of calculating the mathematical expectations of typical functions encountered in various flight dynamics problems. An effective method of calculating the right members of the correlation system (a system of equations for mathematical expectations and correlation moments of phase coordinates) for various problems of flight vehicle dynamics is developed, and the required tables are compiled. The development of methods which make it possible to take into account nonlinear couplings and the discrete-continuous nature of the control in obtaining the correlation system is also considered. A.B.K.

A71-44761 **Some new results of flight dynamics. II (Quelques résultats nouveaux de la mécanique du vol. II).** Werner Schulz (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Porz-Wahn, West Germany) and Peter Hamel (Messerschmitt-Bölkow-Blohm GmbH, Hamburg, West Germany). *(Association Française des Ingénieurs et Techniciens de l'Aéronautique et de l'Espace and Deutsche Gesellschaft für Luft- und Raumfahrt, Journée Otto Lilienthal, 11th, Paris, France, Dec. 16, 1970.) L'Aéronautique et l'Astronautique,* no. 30, 1971, p. 13-18. 34 refs. In French.

After appreciating the methodical change of theoretical considerations and experimental investigations, with which Lilienthal tried to approach the solution of the problem of the free flight of man, three topics are discussed, to the treatment of which flight dynamics can be useful: the problem of flight noise, the decrease of the influence of gusts on aircraft, and the problem of dynamics stability of parachute-load systems. A reduction of noise annoyance on the ground, particularly after the take-off of V/STOL aircraft, may be obtained by the determination of noise optimal flight profiles. For gust decrease, the method of 'tuned lift control,' the lift due to automatic control attacking in the neutral point of the aircraft, proves to be the most advantageous. The analytical treatment of the greatly nonlinear problem of dynamic stability of parachute-load systems succeeds well by employing the theory of describing function, as comparisons with results obtained by numerical integration show. (Author)

A71-44763 **Measurements of velocities in a subsonic wind tunnel (0.10 less than V less than 20 m/sec) (Mesures des vitesses en soufflerie subsonique 0.10 less than V less than 20 m/s).** J. Moinard and C. Froger (Centre d'Etudes et Recherches des Charbonnages de France, Verneuil-en-Halatte, Oise, France). *L'Aéronautique et l'Astronautique,* no. 30, 1971, p. 31-37. In French.

Review of low speed wind tunnel studies carried out at the Centre d'Etudes et Recherches des Charbonnages de France (CERCHAR), which show that at very low speeds the sound waves due mainly to the noise of the fan which ensures air circulation in the wind tunnel are propagated in all directions. In this range of velocities the acoustic pressure variations in the testing section have about the same magnitude as the dynamic pressures to be measured. To overcome this difficulty the aerodynamic study was complemented by an acoustic one on a model, and corrections were applied to the full scale tunnel. F.R.L.

A71-44765 **Maintenance and reliability of civil transport aircraft (Maintenance et fiabilité des avions de transport civils).** J. Emery (Société Nationale Industrielle Aérospatiale, Toulouse, France). *L'Aéronautique et l'Astronautique,* no. 30, 1971, p. 56-64. In French.

General discussion of aircraft and equipment maintenance and reliability problems. Modern methods of satisfactory solutions with best time, cost, and weight compromises are described. Aircraft availability involves systems reliability, redundancy, supervision and preventive maintenance, and flight under specific limitations. The cost of maintenance involves working hours and spare parts, tools, and standardization. F.R.L.

A71-44766 **The multi-purpose military aircraft Panavia 200 (MRCA Program) (L'avion militaire polyvalent Panavia 200 /Programme M.R.C.A./).** Georges Bruner (Centre de Documentation de l'Armement, Paris, France). *L'Aéronautique et l'Astronautique,* no. 30, 1971, p. 65-70. In French.

Designed and built jointly by Western Germany, United Kingdom and Italy, the military aircraft Panavia 200 will be a

multipurpose aircraft capable of performing three main tasks: close air support, air superiority and interdiction/strike. The sometimes conflicting requirements resulting from the performance of these three missions could be conciliated owing to a variable geometry conception. The main characteristics of the plane are recalled and some details are given on the engines, the armament and the electronics of this aircraft, the first flight of which is planned for end 1973. (Author)

A71-44975 **Folding sidewall aircraft tires.** Paul M. Wagner (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). *Shell Aviation News,* no. 399, 1971, p. 18-21.

Development of the folding sidewall tire and its flight demonstration. This tire can be folded in flight for compact storage and expanded again for normal usage upon gear extension. On a retrofit basis it would provide present aircraft with the capability to employ larger tires, thereby improving ground flotation. The tire offers improved performance at high deflection, and run-flat emergency operational capability. An inflation/deflation system, however, reduces the reliability of an aircraft. Results of tests on ten tires exhibited excellent tread wear qualities. F.R.L.

A71-44982 # **Planning a program for assessing the possibility that SST aircraft might modify climate.** Robert H. Cannon, Jr. (U.S. Department of Transportation, Washington, D.C.). *(American Meteorological Society, Annual Meeting, 51st, San Francisco, Calif., Jan. 12, 1971.) American Meteorological Society, Bulletin,* vol. 52, Sept. 1971, p. 836-842.

Description of the characteristics of projected SST fleet operations, followed by review of some pertinent aspects of the nature of the atmosphere, the ways that have been suggested that it might be affected by SST operations, and what is still to be learned. The preliminary planning of a program to gain the necessary additional knowledge, and the way it is proposed to carry out the program are discussed. The possible effects of carbon dioxide, water vapor, contrails, particulates, nitrogen oxides, and carbon monoxide are considered. The assessment program will involve study of engine emissions, atmospheric modeling, and photochemistry. F.R.L.

A71-44983 # **The effect of weather on the operations and economics of air transportation today.** W. Boynton Beckwith (United Air Lines, Inc., Chicago, Ill.). *(American Meteorological Society, Annual Meeting, 51st, San Francisco, Calif., Jan. 12, 1971.) American Meteorological Society, Bulletin,* vol. 52, Sept. 1971, p. 863-868.

Review of technical improvements in aircraft and navigational and aircraft aids which have eliminated most of the problems of adverse weather which the air transportation industry faced 30 years ago. In spite of the this progress, nature is still capable of setting up hostile environments for aircraft operations. Such elements as thunderstorms, fog, turbulence, snowstorms, heavy rain, and high winds can close airports, divert flights, and cause disservice to passengers. Using typical cases, the full effects of weather interruptions are discussed and related to the present-day U.S. fleet of 2400 transport aircraft and to their control. Recent economic studies provide a basis for assessing the cost of several weather factors which interfere with scheduled air transportation. F.R.L.

A71-44986 **Airborne laser profiling of the Arctic pack ice.** Robert D. Ketchum, Jr. (U.S. Naval Oceanographic Office, Ocean Science Dept., Washington, D.C.). *Remote Sensing of Environment,* vol. 2, Oct. 1971, p. 41-52.

Description of the results of an analysis of laser terrain profile data obtained with coincident photography from an altitude of 1000 ft over the sea ice fields of the Beaufort Sea in April 1968. Analysis of the data reveals that sea ice surface roughness and the nature of the roughness as well as relative surface reflectivities, which are both manifested in the laser terrain profile, can be used to interpret the categorical stages of ice development. The laser terrain profiler seemingly detected, with acceptable accuracy, all ice features traversed; however, ice pressure ridges, ice hummocks, or ice blocks could not be distinguished from each other on the record because the measurement is only two-dimensional. These features were always detectable even when occurring in rapid succession. Cracks are very discernible on the laser terrain profile record. M.M.

A71-45004 # **Retardation of condensate particle crystallization in a jet engine nozzle (O zaderzhke kristallizatsii chastits kondensata v sople reaktivnogo dvigatelia).** A. P. Tishin, V. A. Khudiakov, and V. N. Kostin. *Aviatsionnaia Tekhnika,* vol. 14, no. 2, 1971, p. 24-31. 5 refs. In Russian.

The influence of retardation of crystallization on the energy characteristics of a jet engine is analyzed. Approximate estimates of the influence of crystallization on the flow rate are obtained. The expansion process in the engine is shown to occur at a prescribed area ratio of the nozzle exit section, and it is shown that in the absence of crystallization in the nozzle, the pressure at the nozzle exit section can differ appreciably from the pressure calculated for equilibrium expansion. A more accurate approach, therefore, is to compare the processes with and without crystallization (rather than for a constant outlet pressure). The relative effectiveness of the expansion process in the absence of crystallization is assessed on the basis of special thermodynamic calculations for two compositions with 7 and 15% aluminum and for a BeH2 + H2O2 fuel. Nonequilibrium flows of two-phase combustion products are calculated for studying the influence of the heat transfer rate between the particles and the gas during the crystallization process. V.P.

A71-45011 # **Profiling the temperature field along the radius in front of a turbine stage (O profilirovanii polia temperatur po radiusu pered turbinnoi stupen'iu).** A. M. Toptunov. *Aviatsionnaia Tekhnika,* vol. 14, no. 2, 1971, p. 76-83. 8 refs. In Russian.

A method is proposed for determining the optimal temperature field along the radius in front of a gas-turbine stage. The possibility of obtaining a radially nonuniform temperature field with a bypass turbine of special design is studied, and the applicability of this approach to regeneratively cooled turbine engines is demonstrated. V.P.

A71-45012 # **Applicability of statistical methods to the analysis of the characteristics of sheet joints in aircraft structures (K primeneniiu statisticheskikh metodov dlia analiza kharakteristik listovykh soedinenii aviakonstruktsii).** V. P. Burmistrov. *Aviatsionnaia Tekhnika,* vol. 14, no. 2, 1971, p. 84-90. 9 refs. In Russian.

The possibility of using statistical methods for analyzing the observed spread of the principal characteristics of sheet joints is discussed. Problems involved in the determination of the distribution laws of breaking loads and numerical characteristics are examined. The influence of the spread of the parameters of a joint is evaluated, and the minimum strength of a spot-welded joint is determined. The interrelation between random parameters is studied on the basis of statistics characterizing the relationship between random quantities. All results are obtained for spot-welded and adhesive joints of high-strength aluminum alloy sheet. V.P.

A71-45016 # **Determination of transient functions and impulse transient functions for an aircraft in its unsteady motion by the method of Laplace-Carson integral transforms (K voprosu o nakhozhdenii perekhodnykh i impul'snykh perekhodnykh funktsii samoleta pri ego neustanovivshemsia dvizhenii metodom integral'nogo preobrazovaniia Laplasa-Karsona).** V. A. Sannikov. *Aviatsionnaia Tekhnika,* vol. 14, no. 2, 1971, p. 102-108. In Russian.

An approximate method is proposed for analyzing the intrinsic dynamic characteristics of an aircraft under unsteady flight conditions. The method consists of integrating approximately the linear

differential equation of perturbed motion of the aircraft over a finite interval of time. A solution over the entire interval under consideration is obtained by consecutively passing from one approximation interval to the next. V.P.

A71-45018 # Influence of fuselage strains on the work of a small-aspect-ratio wing (O vliianii deformatsii fiuzeliazha na rabotu kryla malogo nadlineniia). E. A. Ivanova and V. A. Komarov. *Aviatsionnaia Tekhnika,* vol. 14, no. 2, 1971, p. 112-114. In Russian.

Some aspects of the calculation of a small-aspect-ratio wing with allowance for the fuselage strains are examined. The strong influence of fuselage strains, particularly in the case of antisymmetric loading, on the work of the wing is demonstrated on the basis of extensive calculations performed for a delta wing. V.P.

A71-45022 # Substantiation of the constraints placed on the overall excess air ratio (K obosnovaniiu ogranichenii, nakladyvaemykh na summarnyi koeffitsient izbytka vozdukha). A. M. Akhmedzianov, B. N. Chizhov, and V. P. Alatortsev. *Aviatsionnaia Tekhnika,* vol. 14, no. 2, 1971, p. 132-136. In Russian.

The permissible deviations of the overall excess air ratio in test-bed engine studies are analyzed with a view toward obtaining excess air ratio values that correspond to technical specifications for various modes of engine operation. A diagram for calculating the constraints placed on the excess-air ratio is proposed. V.P.

A71-45160 # Integration of the kinematic equations of an astatic gyroscope (Ob integrirovanii kinematicheskikh uravnenii astaticheskogo giroskopa). L. A. Motyl'kov (Leningradskii Korablestroitel'nyi Institut, Leningrad, USSR). *Priborostroenie,* vol. 14, no. 7, 1971, p. 94-98. 6 refs. In Russian.

Analysis of an astatic gyroscope mounted on an aircraft that moves in an arbitrary fashion near the earth's surface. The rotor axis is close to vertical at the initial moment. Integrals of the kinematic equations are obtained without imposing any restrictions on the rotation of the gimbals or on aircraft motion. Many special cases of gyroscope motion follow from these integrals. T.M.

A71-45180 # Expression for the ideal weight of shell fuselages (Su una espressione del peso ideale delle fusoliere a guscio). Giuseppe Gabrielli. *Torino, Accademia delle Scienze, Classe di Scienze Fisiche, Matematiche e Naturali, Atti,* vol. 105, Mar.-Apr. 1971, p. 227-231. In Italian.

Derivation of an expression for the ideal weight of fuselages with the shape of a body of revolution with a straight axis to which can be likened the shapes adopted in modern aircraft, particularly passenger transports. From this expression, which takes into account stressed loads and their distribution as well as cabin pressurization, is derived a general formula to which can be conveniently reduced, by the adoption of suitable coefficients, empirical formulas which give the real weight of fuselages on the basis of data measured statistically. M.M.

A71-45280 # The detection of hot corrosion-sulfidation in Navy aircraft turbine engines. James E. Newhart (U.S. Navy, Naval Air Propulsion Test Center, Trenton, N.J.). *American Society for Nondestructive Testing, National Fall Conference, 31st, Detroit, Mich., Oct. 18-21, 1971, Paper.* 9 p. 5 refs.

Study of the catastrophic deterioration of vanes and blades in the hot section of an aircraft powerplant, caused by operation in an environment containing varying amounts of sea salts. The condition is termed hot corrosion or, more commonly, sulfidation. Current procedures for the repair of nozzle guide vanes exhibiting hot corrosion attack call for the removal of the corrosion by grinding, blending of the surface, and then recoating the ground area. Several nondestructive methods for rapid detection are discussed. F.R.L.

A71-45295 * # The reduction of VTOL operational noise through flight trajectory management. F. H. Schmitz (U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.) and W. Z. Stepniewski (Boeing Co., Philadelphia, Pa.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-991.* 16 p. 14 refs. Members, $1.50; nonmembers, $2.00. NASA-Army-supported research.

The concept of altering the flight path of VTOL aircraft to reduce ground noise levels in communities adjacent to the landing site is explored. Two classes of VTOLs are considered: prop-rotor and lift-fan aircraft. Theoretical performance and acoustic models are developed and then mathematically flown to yield representative takeoff and landing flight profiles. Proposed noise abatement profiles are compared with minimum time and fuel trajectories to assess the possible annoyance reduction through flight path control. Significant annoyance reductions are feasible if a nearly vertical takeoff flight path is flown near the landing site. However, the time expended and fuel consumed increase. A procedure is also suggested which assesses the overall community annoyance to VTOL operations. Several noise abatement trajectories of both types of aircraft are evaluated to determine which flight paths are most acceptable to the VTOL port's neighboring community. (Author)

A71-45296 # The heavy lift helicopter program - An advanced technology solution to transportation problems. Ben Tencer and J. P. Cosgrove (Boeing Co., Philadelphia, Pa.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-994.* 9 p. 6 refs. Members, $1.50; nonmembers, $2.00.

Description of the advanced technology developments in rotor and drive, flight controls, and cargo handling systems areas of the Heavy Lift Helicopter System (HLHS). The system was conceived to expedite the loading and offloading of containerized cargo from ships. The shift to containerization, coupled with the projected availability of a vertical lift system, has provided the opportunity for significant improvement in the logistics support to both military and commercial customers. Commercial applications of the HLHS will also be feasible and profitable in areas such as power line construction, forestry, and bridge building. F.R.L.

A71-45297 # Factors in STOL flight control configuration. William P. A. Harris (Boeing Co., Seattle, Wash.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 8th, Washington, D.C., Oct. 25-28, 1971, Paper 71-993.* 17 p. 8 refs. Members, $1.50; nonmembers, $2.00.

The STOL flight control problem is discussed in relationship to its unique operational requirements. A survey is made of the historic growth of control system techniques, and their implementation, in order to put into perspective the STOL position. The danger of regarding STOL control as a simple extension of CTOL technique is discussed, and in contrast, the concept of task orientation and configuration is developed as pertinent to the STOL problem. Reference is made to current control system technology and analytical tools, and thoughts are presented on future trends. The need for a composite approach to control implementation is emphasized. (Author)

A71-45325 # Additives to fuels for jet-propelled aircraft (Survey) (Prisadki k toplivam dlia reaktivnoi aviatsii /Obzor/). Ia. B. Chertkov. *Khimiia i Tekhnologiia Topliv i Masel,* vol. 16, no. 8, 1971, p. 59-61. 21 refs. In Russian.

A review is presented of typical additives that are being used or recommended for use in aircraft fuels. The following types of additives are considered: antioxidant; metal deactivating; anticorrosive; antiwear; preventing ice crystal formation; preventing accumulation of static electricity; coagulating; thickening; stabilizing; biocide; and antismoke. O.H.

A71-45380 # **Possible modes of operation of a centripetal stage (O vozmozhnykh rezhimakh radial'no-osevoi stupeni).** M. V. Adler and G. S. Solov'eva. *Energomashinostroenie,* vol. 17, Aug. 1971, p. 20-22. In Russian.

The universal characteristics of a centripetal stage are examined. The influence of the rate of airflow and the pressure ratio on the power is demonstrated, and the velocity triangles of a centripetal stage are examined for two types of compressor and two types of turbine. V.P.

A71-45381 # **Analytical design of a transonic airfoil cascade (Analiticheskoe postroenie transzvukovoi reshetki profilei).** E. E. Drozd and E. G. Lazarenko. *Energomashinostroenie,* vol. 17, Aug. 1971, p. 38, 39. In Russian.

A simple and time-saving method is proposed for designing a transonic airfoil cascade, and evaluating quantitatively its efficiency from the velocity distribution, without recourse to experimental tests. It is shown how an airfoil lattice with an infinite chord can be reduced to one with a finite chord. V.P.

A71-45383 **The lubricating quality of aviation fuels.** R. T. Aird (Lucas Group Research Centre, Birmingham, England) and S. L. Forgham (Lucas Gas Turbine Equipment, Ltd., Birmingham, England). *(Institute of Mechanical Engineers and Royal Institute of Chemistry, Joint Conference on Chemical Effects at Bearing Surfaces, Swansea, Wales, Jan. 6-8, 1971.) Wear,* vol. 18, Nov. 1971, p. 361-380. 17 refs. Research supported by the Ministry of Technology.

Aviation fuels from different sources have shown marked differences in their ability to lubricate load bearing surfaces in aircraft fuel pumps. Over the years there have been changes in the methods used in the refining of aviation fuels. An investigation was conducted to determine what differences existed in the lubricating ability of these fuels. Aviation fuels are produced to conform with comprehensive national specifications but there is no section which relates specifically to lubricating properties. Permitted variations in fuel specification tests, for example, distillation characteristics and viscosity, have failed to relate to service performance. A test has been developed based on the assumption that the resistance to breakdown of the boundary lubricating film depends upon the tenacity of certain fuel constituents adsorbed on the bearing surfaces. G.R.

STAR ENTRIES

N71-36398*# Translation Consultants, Ltd., Arlington, Va.
RELATION BETWEEN STRATOSPHERE TURBULENCE CAUSING AIRCRAFT BUFFETING AND THE VERTICLE DISTRIBUTION OF METEOROLOGICAL PARAMETERS [SVYAZ TURBULENTNOSTI V STRATOSFERE, VYZYVAY-USHCHEY BOLTANKU SAMOLETOV, S VERTIKALNYM PASPREDELENIYEM METEOROLOGICHESKIKH PARA-METROV]
G. S. Buldovskiy Washington NASA Oct. 1971 18 p refs Transl. into ENGLISH from Gidrometeoizdat (USSR), no. 70 1970 p 79-92
(Contract NASw-2038)
(NASA-TT-F-13981) Avail: NTIS CSCL 01A

The relation between aircraft buffeting of various intensities and the vertical distribution of meteorological parameters calculated from radiosonde data is determined. In this case the main problem reduces to finding the critical values of these parameters, which optimally characterize the successfulness of a diagnosis of the presence or absence of aircraft buffeting. It is found that the successfulness of such diagnosis is optimally characterized by the vertical wind vector shear, the Richardson number, and the change in thermal stability from the underlying to the overlying layer (a change which characterizes the boundaries of the baroclinic layers). On the basis of a graph of the dependence of aircraft buffeting on a combination of two of these factors, a buffeting parameter is obtained in terms of which a condition governing the presence or absence of buffeting is expressed. Author

N71-36399# Aeronautical Research Labs., Melbourne (Australia).
ON THE FICTION OF LEADING EDGE SUCTION
A. E. Billington Jan. 1971 7 p refs
(ARL/SM-Note-360) Avail: NTIS

It is shown that the so-called leading edge suction of thin aerofoil theory is a misnomer. It results from misinterpreting the meaning of the leading edge singularity. Author

N71-36400# Advisory Group for Aerospace Research and Development, Paris (France). Ad Hoc Committee.
ENGINE-AIRPLANE INTERFERENCE AND WALL CORRECTIONS IN TRANSONIC WIND TUNNEL TESTS
Aug. 1971 143 p refs
(AGARD-AR-36-71) Avail: NTIS

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1. CONCLUSIONS AND RECOMMENDATIONS ON ENGINE AIRPLANE INTERFERENCE AND WALL CORRECTIONS IN TRANSONIC WIND TUNNEL TESTS A. Ferri 5 p

2. ENGINE-AIRPLANE INTERFERENCE IN TRANSONIC TESTS F. Jaarsma 117 p refs

3. WALL CORRECTIONS FOR AIRPLANES WITH LIFT IN TRANSONIC WIND TUNNEL TESTS R. Monti 15 p refs

N71-36401# Advisory Group for Aerospace Research and Development, Paris (France).
CONCLUSIONS AND RECOMMENDATIONS ON ENGINE AIRPLANE INTERFERENCE AND WALL CORRECTIONS IN TRANSONIC WIND TUNNEL TESTS
Antonio Ferri (New York Univ., N. Y.) *In its* Eng.-Airplane Interference and Wall Corrections in Transonic Wind Tunnel Tests Aug. 1971 5 p
Avail: NTIS

The conclusions and recommendations are presented concerning the correct representation in wind tunnel tests of the interaction between engine flow and airplane characteristics, and wall interference at high lift. A review of experimental methods in use for determining engine-airplane interference in transonic tests includes the following topics: (1) inlet airplane interference, (2) engine thrust with airplane drag and nozzle characteristics, (3) exhaust flow and airplane interference, and (4) determination of interference of the engine flow on the aerodynamic characteristics of the complete configuration. It is concluded that all of the approaches have important unknowns and shortcomings; action is required by research groups to develop new techniques, and improve existing ones. F.O.S.

N71-36402# Advisory Group for Aerospace Research and Development, Paris (France).
ENGINE-AIRPLANE INTERFERENCE IN TRANSONIC TESTS
F. Jaarsma (Natl. Aero- and Astronaut. Res. Inst.) *In its* Eng.-Airplane Interference and Wall Corrections in Transonic Wind Tunnel Tests Aug. 1971 117 p refs
Avail: NTIS

A compilation is presented of the response to a distributed questionnaire on engine-airframe interference in transonic tests among aeronautical laboratories operating transonic wind tunnels, aircraft manufacturers, engine companies, and airplane users in the AGARD countries. The experimental techniques, correction procedures, advantages and limitations of inlet, nozzle/afterbody, complete model testing, and engine thrust determination are discussed in a technical order. Author

N71-36403# Advisory Group for Aerospace Research and Development, Paris (France).
WALL CORRECTIONS FOR AIRPLANES WITH LIFT IN TRANSONIC WIND TUNNEL TESTS
R. Monti (Univ. Degli Studi, Naples, Italy) *In its* Eng.-Airplane Interference and Wall Corrections in Transonic Wind Tunnel Tests Aug. 1971 15 p refs
Avail: NTIS

The technical information supplied by the Ad Hoc Committee is summarized. After some preliminary remarks on wall interference corrections in transonic tests, the different answers to the AGARD questionnaire are presented together with the main points made by the committee members as representatives of the different countries. A number of general agreements among the committee members are stated which indicate the state-of-the-art of transonic wind tunnel corrections. The discussions and the conclusions of the committee are presented on the problems which appear to be most important for future research. Problems are briefly reviewed and research areas are indicated for which the committee agreed an international program will be most profitable. A list of references is provided which includes the works referenced by all the different groups participating in the committee. Author

N71-36404*# United Aircraft Corp., East Hartford, Conn.
ANALYTICAL INVESTIGATION OF THE EFFECTS OF BLADE FLEXIBILITY, UNSTEADY AERODYNAMICS, AND VARIABLE INFLOW ON HELICOPTER ROTOR STALL CHARACTERISTICS
E. D. Bellinger Washington NASA Sep. 1971 114 p refs
(Contract NAS1-8350)
(NASA-CR-1769) Avail: NTIS CSCL 01C

An analytical study was conducted to investigate systematically the relative importance of blade flexibility,

unsteady aerodynamics, and variable inflow (with and without wake distortions) in determining predicted helicopter rotor stall characteristics. The theoretical results of this study were compared with a corresponding full scale wind tunnel results for the H-34 rotor system. The classical theory (rigid blades, steady aerodynamics, and constant inflow) produced good correlation at nominally unstalled operating conditions. However, rotor lifts significantly lower than the test values were predicted at high blade angles of attack. The use of unsteady airfoil data provided the most significant improvement in correlation by allowing higher section lift coefficients to be reached due to the stall delay phenomenon associated with unsteady operating conditions. The primary effect of blade flexibility was due to blade torsional deflections, which, as with blade pitch changes, had a direct effect on performance. Variable inflow, although producing significant changes in the angle of attack distribution over the disc, did not appreciably affect rotor performance.
Author

N71-36405# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing
ANALYTICAL AND NUMERICAL STUDIES OF DOWNWASH OVER RECTANGULAR PLANFORMS
H. C. Garner (RAE) and G. F. Miller May 1971 28 p refs
(NPL-MA-99) Avail: NTIS

The distribution of downwash at the surface of rectangular planforms with prescribed subsonic aerodynamic loading is considered. Three separate aspects of the problem are treated analytically, the results of each being tested against those derived from an accurate numerical procedure. Asymptotic expressions for large and small aspect ratio are formulated and shown to apply over a wide range of aspect ratio. Downwash routines from certain existing lifting-surface methods are studied, and their patterns of convergence are illustrated and compared. A logarithmic singularity near the leading tip corner is identified, but it is observed that this can exist without serious detriment to the lifting-surface methods. Author (ESRO)

N71-36406# Rochester Applied Science Associates, Inc., N.Y.
AN EXPERIMENTAL STUDY OF TIP VORTEX MODIFICATION BY MASS FLOW INJECTION Final Technical Report, 1 Feb. 1969 - 31 Jan. 1971
Stephen A. Rinehart, John C. Balcerak, and Richard P. White, Jr. Jan. 1971 85 p refs
(Contract N00014-69-C-1069)
(AD-726736; RASA-71-01) Avail: NTIS CSCL 20/4

An experimental program was conducted to investigate the modifications of a tip vortex which could be obtained by injecting the core of a tip vortex with a stream of air. Wind tunnel tests of an airfoil model were conducted. The results obtained from flow-visualization studies, balance data, and vortex-meter measurements show how the strength of the tip vortex can be reduced significantly by the injection of a linear mass flow of air into the core of the tip vortex. The reduction in drag obtained with injection is important since it allows the recovery of power required to inject the tip vortex core with mass flow. Author (GRA)

N71-36407# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
CALCULATION OF LIFT INTERFERENCE CORRECTIONS DUE TO WIND TUNNEL TEST SECTION BOUNDARIES BY THE VORTEX LATTICE METHOD Annual Report, 1 Apr. 1970 - 31 Mar. 1971
E. Wasserstrom, Y. Borovik, D. Hazanovsky, and J. Rom Apr. 1971 44 p refs
(TAE-124; Rept-160-088) Avail: NTIS

The vortex lattice numerical method is used to calculate lift interference corrections due to wind tunnel test-section boundaries. Various test-section geometrical shapes are considered, such as square, rectangular and circular. The calculations were carried out for closed, partially open and completely open (free-jet) test sections respectively. The model is represented mathematically by a simple horseshoe vortex. Spanwise as well as longitudinal variations of the normal induced velocity at the model are determined. The resulting interference parameters agree with available exact theoretical calculations. Author

N71-36408# ARO, Inc., Arnold Air Force Station, Tenn.
TESTS CONDUCTED IN THE AEDC 16-ft TRANSONIC TUNNEL ON A 0.0226-SCALE MODEL OF THE C-5A AIRCRAFT FOR DATA CORRELATION BETWEEN THREE TRANSONIC WIND TUNNELS Final Report, 30 Dec. 1969 - 20 Jan. 1970
J. A. Black AEDC Jul. 1971 64 p refs
(Contract F40600-72-C-0003)
(AD-727006; AEDC-TR-71-105; ARO-PWT-TR-71-68) Avail: NTIS CSCL 14/2

Tests were conducted on two configurations of a 0.0226-scale model of the C-5A aircraft for the purpose of data correlation with other major transonic test facilities. The results reported herein were obtained at Mach numbers from 0.600 to 0.825 and Reynolds numbers from 2.1 million to 4.2 million and represent the AEDC contribution to the correlation study.
Author (GRA)

N71-36409# Texas Univ., Austin. Applied Mechanics Research Lab.
SUPERSONIC AIRFOILS OF MINIMUM TOTAL DRAG
Don James Hull Dec. 1970 35 p refs
(Grant AF-AFOSR-1744-69)
(AD-726767; TR-1020; AFOSR-71-1956-TR) Avail: NTIS CSCL 20/4

Minimum drag airfoil shapes in supersonic flow for a given chord length are considered. The shapes are assumed to be two-dimensional and symmetric. In order to relate the drag of the airfoil to its geometry, it is assumed that the airfoil is slender. The boundary layer is specified to be entirely turbulent. Two cases are solved: (a) minimum drag shape for a given chord and (b) minimum drag shape for a given chord and heat transfer rate. For each case, the minimal shape is obtained by employing the calculus of variations in one independent and dependent variable to the drag expression. Author (GRA)

N71-36410# National Research Council of Canada, Ottawa (Ontario).
COMPARISON OF THIN PLATE AND THICK AEROFOIL BLADES IN A CENTRIFUGAL FAN
H. S. Fowler Aug. 1971 33 p refs
(ME-238; NRC-12166) Avail: NTIS

The patterns and stability of the airflow in the rotor of a centrifugal fan have been studied, with thin plate blading and with thick aerofoil blades. Specifications of the blading are presented, and a detailed comparison is made of the visualized flow patterns in the channels, exit velocity profiles, flow characteristic curves, and operating range. It is concluded that the aerofoil blading has a wider operating range, and some explanations of this are derived from study of the flow patterns.
Author

N71-36411*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR CALCULATING THE AERODYNAMIC LOADING ON WING-BODY COMBINATIONS AT SMALL ANGLES OF ATTACK IN SUPERSONIC FLOW
Charlie M. Jackson, Jr. and Wallace C. Sawyer Oct. 1971 32 p refs
(NASA-TN-D-6441; L-7822) Avail: NTIS CSCL 20D

This report describes a theoretical method for estimating the aerodynamic loading on a wing-body configuration. In order to provide a basis for evaluation of the method, experimental

measurements of surface pressures, forces, and moments were made on a series of basic wing-body configurations over a Mach number range from 2.5 to 4.5. Comparison of the theoretical estimates with these experimental data generally indicated good agreement for the entire range of configurations and test conditions. Author

N71-36412*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE OF CLOSELY SPACED TWIN-JET AFTERBODIES WITH DIFFERENT INBOARD-OUTBOARD FAIRING AND NOZZLE SHAPES
Edwin E. Lee, Jr. and Jack F. Runckel Washington Sep. 1971 151 p refs
(NASA-TM-X-2329; L-7759) Avail: NTIS CSCL 01A

Thrust-minus-drag forces and pressure distributions were obtained on the afterbody and nozzle sections of various fuselage closures at Mach numbers from 0.60 to 2.01. Four interfairing contours were investigated: a circular-arc; an elliptical; and a blunt configuration, all ending at the nozzle attachment station; and one blunt-based type extending between the nozzles. Also, limited data were obtained with tail booms of circular or oval cross section extending from the sides of the afterbody past the nozzles. Propulsive nozzle shapes represented variable geometry iris and convergent-divergent types with circular arc and conical boattailing, respectively. Each was configured for minimum and maximum throat area (dry and augmented power) and operated with compressed air at pressure ratios up to 20, depending on Mach number. Author

N71-36413*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN IMPROVED METHOD FOR CALCULATING SUPERSONIC PRESSURE FIELDS ABOUT BODIES OF REVOLUTION
Robert J. Mack Washington Oct. 1971 34 p refs
(NASA-TN-D-6508; L-7873) Avail: NTIS CSCL 01A

An improved near-field method for determining supersonic-flow-field properties about a body of revolution is presented and discussed. Comparisons between the improved method, Whitham's theory, and wind-tunnel results are shown for four bodies of revolution - three closed-nose bodies and one ducted body. At Mach numbers of 2.96, 3.83, and 4.63 and ratios of radial distance to body length of 1.0, 2.0 and 5.0, results show that the improved method does reasonably well in predicting flow-field pressure signatures and represents a definite improvement over existing near-field theory. It is also shown that the simple area balancing shock prediction technique works reasonably well for bodies with pointed nose sections provided the improved method is used to locate the body flow-field disturbances more exactly. Author

N71-36414*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF A LOW REYNOLDS NUMBER PARTIAL ADMISSION SINGLE STAGE SUPERSONIC TURBINE
Louis J. Goldman Washington Oct. 1971 22 p refs
(NASA-TM-X-2382; E-6380) Avail: NTIS CSCL 01A

Turbine performance characteristics were obtained for a single stage partial-admission supersonic turbine operating at low Reynolds numbers. The turbine was tested over a range of pressure ratios from 20 to 150 and equivalent speeds from 20 to 100 percent of design. Author

N71-36415*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL AERODYNAMIC CHARACTERISTICS AT MACH 1.50 TO 4.63 OF A MISSILE MODEL EMPLOYING VARIOUS CANARDS AND A TRAILING EDGE FLAP CONTROL
Charles D. Trescot, Jr. Washington Oct. 1971 113 p refs
(NASA-TM-X-2367; L-6163) Avail: NTIS CSCL 01A

An investigation was made in a unitary plan wind tunnel to determine the static longitudinal stability and control characteristics of a missile configuration with cruciform delta wings and various horizontal canards. The controls consisted of three different trapezoidal canards and a wing trailing-edge flap located on the horizontal wings only. The tests were made at Mach numbers from 1.50 to 4.63, through an angle-of-attack range from about -4 to 30 deg, at an angle of sideslip of 0 deg, and at a Reynolds number of 8,200,000 per meter. The results are summarized in the form of various pertinent aerodynamic parameters as a function of Mach number. Although no detailed analysis of the results was made, the summary of results is useful in demonstrating the importance of certain parameters and should be useful in providing a source of systematic experimental data for correlation with analytical techniques. Author

N71-36416*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CALCULATED PRESSURE DISTRIBUTIONS AND COMPONENTS OF TOTAL-DRAG COEFFICIENTS FOR 18 CONSTANT-VOLUME, SLENDER BODIES OF REVOLUTION AT ZERO INCIDENCE FOR MACH NUMBERS FROM 2.0 TO 12.0, WITH EXPERIMENTAL AERODYNAMIC CHARACTERISTICS FOR THREE OF THE BODIES
Louis S. Stivers, Jr. Washington Oct. 1971 99 p refs
(NASA-TN-D-6536; A-4005) Avail: NTIS CSCL 20D

The pressure distributions and drag coefficients of 18 constant length and volume, slender bodies of revolution at zero incidence were calculated for Mach numbers 2.0 to 12.0. Four bodies were selected from each of four families of profiles: the Sears-Haack, the parabolic arc, the Von Karman, and one of Miele's. A 3/4-power body and a cone body were included to complete the group. Experimental aerodynamic characteristics for two Sears-Haack bodies and the 3/4-power body were obtained from tests in the Ames 3.5-foot hypersonic wind tunnel at Mach numbers of 5.4, 7.4, and 10.5. The calculations showed that the Sears-Haack bodies generally provided the least drag throughout the range of Mach numbers from 2.0 to 12.0. The experimental aerodynamic characteristics of the three bodies showed that the overall lift and drag characteristics did not differ markedly, but that the minimum-drag coefficients were the least for the Sears-Haack bodies. The centers of pressure for the three bodies were roughly approximated by the centers of projected plan area of the bodies. Author

N71-36418*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF CENTERLINE SHOCK-LAYER THICKNESS AND PRESSURE DISTRIBUTION ON DELTA WING-BODY CONFIGURATIONS
George E. Kaatari Washington Oct. 1971 22 p refs
(NASA-TN-D-6550; A-4013) Avail: NTIS CSCL 20D

Methods are presented to calculate both the shock inclination angle and the surface pressure coefficient in the vertical plane of symmetry of bodies at angle of attack. The methods are applicable over an angle-of-attack range from 0 deg to a maximum angle that depends on the body slenderness ratio; for very slender bodies, this maximum angle of attack approaches 90 deg. The methods apply to configurations of elliptical cross section and of rectangular cross section with rounded corners. Author

N71-36419# Air Force Academy, Colo. Frank J. Seiler Research Lab.
THE RAM-WING SURFACE EFFECT VEHICLE COMPARISON OF ONE DIMESIONAL THEORY WITH WIND TUNNEL AND FREE FLIGHT RESULTS
Roger W. Gallington, Mark K. Miller, and Woodrow D. Smith 29 Oct. 1971 38 p refs

(AD-727774; SRL-TR-71-0012) Avail: NTIS CSCL 01/3

The one-dimensional channel flow theory with leakage is described. Using this theory lift and drag laws for low aspect ratio ram-wings with side plates are derived. The one-dimensional channel flow theory is corroborated by wind tunnel tests of two ram-wings of significantly different geometry. Lift/drag ratios far superior to existing surface effect vehicles were measured. A series of successful free flight model tests show that complete vehicles designed from the one-dimensional channel flow theory can be statically and dynamically stable over a ground clearance range from zero to infinity. Author (GRA)

N71-36421*# Aeronautical Research Associates of Princeton, Inc., N.J.

SINGLE-DEGREE-OF-FREEDOM ROLL RESPONSE DUE TO TWO-DIMENSIONAL VERTICAL GUSTS

John C. Houbolt and Asim Sen Jul. 1971 17 p refs

(Contract NAS1-9200)

(NASA-CR-111966; ARAP-160) Avail: NTIS CSCL 01A

The single-degree-of-freedom of roll response due to encountering vertical gusts which are random in the spanwise direction as well as the flight direction is studied. Cross spectral functions associated with the von Karman spectral function are used to evaluate the roll response. Results analogous to the results that apply in the case of vertical motion response only are found. It is shown that the wing tip acceleration due to roll for the two-dimensional turbulence case can be greater than the vertical acceleration that is found for the vertical motion reference case. An interesting possible means for evaluation of gust severity sigma sub w and turbulence scale L from vertical and rolling accelerations only is developed. Author

N71-36422*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

AERODYNAMIC SOUND RADIATION FROM LIFTING SURFACES WITH AND WITHOUT LEADING-EDGE SERRATIONS

Alan S. Hersh and Richard E. Hayden [1971] 101 p refs

(Contract NAS2-5974)

(NASA-CR-114370) Avail: NTIS CSCL 01A

A series of fundamental studies were conducted to understand how lifting surfaces radiate sound in both smooth and turbulent flow. The application of leading edge serrations as a device for reducing the sound radiated from these surfaces was studied for the case of smooth inflow. The directivity pattern radiated by a small airfoil in flow was compared with that predicted by Curle's point dipole sound theory, and was found to be sufficient to present a partial check on that aspect of his theory. A theoretical model predicting the sound radiated from a small airfoil in turbulent flow shows good agreement with experiment over a wide speed range. The good agreement between theory and experiment suggests that for small airfoils in turbulent flow, most of the radiated sound is generated by the time derivative of the fluctuating lift induced by the turbulent flow. Author

N71-36424*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY TESTS OF THE MIXER NOZZLE CONCEPT FOR REDUCING BLOWN FLAP NOISE

Jack H. Goodykoontz, William A. Olsen, and Robert G. Dorsch [1971] 11 p

(NASA-TM-X-67938; E-6617) Avail: NTIS CSCL 01A

Noise measurements were made with a small scale external blown flap model using the mixing nozzle concept to reduce the velocity impingment at the flaps. To simplify the apparatus the mixer nozzle was simulated by a multi-lobed orifice plate. A comparison was made of the data obtained with a single orifice and an eight lobe orifice, both having the same total area of discharge. Results show that noise was reduced about 6 db below the wing when the flaps were blown with the multi-element orifice. Author

N71-36425# Cranfield Inst. of Technology (England). Coll. of Aeronautics.

THE FEASIBILITY OF THE LARGE FREIGHT AIRSHIP

D. Howe Mar. 1971 49 p refs

(Rept-5) Avail: NTIS

The reasons for the current interest in airships are analyzed and certain proposals critically examined. Some indication of the performance requirements for a large freight airship are given and the optimum speed for maximum work capacity is established. A discussion of the likely design features of the craft is concluded by selection of a particular example for numerical comparison. This is a 1000 ton gross displacement airship which in one version employs a novel method for overall control of displacement. Author

N71-36426*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SUBSONIC CHARACTERISTICS OF A TWIN-JET SWEPT-WING FIGHTER MODEL WITH LEADING EDGE KRUEGER FLAPS

Edward J. Ray and Julian G. Carmichael, Jr. (McDonnell Douglas Corp., St. Louis, Mo.) Washington Oct. 1971 69 p refs

(NASA-TM-X-2325; L-7804) Avail: NTIS CSCL 01C

An investigation has been conducted at Mach numbers of 0.60 and 0.90 to determine the effects of various combinations of leading-edge Krueger flaps, inboard plain flaps, and out-board slats on the static aerodynamic characteristics of a twin-jet, swept-wing fighter-airplane model. The angle-of-attack range was varied from -2 deg to 24 deg and the angle-of-sideslip range was varied from about 4 deg to -15 deg. The results of the investigation indicated that the addition of Krueger flaps caused significant improvements in maximum lift coefficient and in drag coefficient at high lift coefficients. Author

N71-36427# Sandia Labs., Albuquerque, N.Mex.

ANALOG SIMULATION OF A GUIDED PARACHUTE-PAYLOAD SYSTEM

R. Vaughn, G. E. Reis, and J. A. Stark May 1971 38 p refs

(SC-DR-710097) Avail: NTIS

A description is given of a device to complement field trials in training pilots in the maneuvering of a remotely controlled steerable parachute-payload system and to study the behavior of such a system when under the control of a pilot. The device consists of roll and glide controls operated by the pilot which are coupled to an analog computer that synthesizes the flight behavior of the parachute-payload system. A stylized picture of a ground target as seen by a camera on board the payload and generated in the computer is presented on an oscilloscope. This picture is viewed by the pilot who manipulates the controls and attempts to impact the parachute and payload on the target. Author

N71-36429# Army Foreign Science and Technology Center, Charlottesville, Va.

HELICOPTER AERODYNAMICS

D. I. Bazov 14 May 1971 224 p refs Transl. into ENGLISH of the mono. "Aerodinamika Vertoletov" Moscow, Transport Publ. House, 1969 p 1-196

(AD-726841; FSTC-HT-23-549-71; ACSI-J-9360) Avail: NTIS CSCL 01/1

The book contains the principles of helicopter flight, special characteristics of the main rotor and its function in autorotation axial and oblique flow, regimes of vertical and horizontal flight, climb and descent, takeoff and landing, balance, stability and control of the helicopter and their acting aerodynamic forces. Author (GRA)

N71-36430# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.

DEVELOPMENT AND EVALUATION OF AIRCRAFT CLOCKS INSENSITIVE TO HIGH INTENSITY MAGNETIC FIELDS Final Report

Lloyd G. Blades 8 Jul. 1971 15 p
(AD-726700; NADC-AM-7123) Avail: NTIS CSCL 01/3

Aircraft mechanical clocks and battery-operated clocks designed to be resistant to high intensity magnetic fields were developed. Author (GRA)

N71-36431*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF BREAKING PERFORMANCE OF A LIGHT, TWIN-ENGINE AIRPLANE ON GROOVED AND UNGROOVED PAVEMENTS
Thomas J. Yager, W. Pelham Phillips, and Perry L. Deal Washington Oct. 1971 35 p refs
(NASA-TN-D-6444; L-7643) Avail: NTIS CSCL 01A

The braking performance of a nine-place, light, twin-engine airplane was evaluated on comparative grooved and ungrooved surfaces of a landing research runway. The test airplane was equipped with manual braking on the main wheels of the tricycle landing gear, and its weight varied from (7500 to 8000 lb). The test results indicate that pavement grooving significantly improves aircraft braking and directional control on wet runways. Measurements and observations of airplane tire treads made during this test program showed no indication of unusual wear and/or damage attributable to grooved surfaces. Comparative braking data obtained with a jet fighter and a civil and a military jet transport are also presented. Author

N71-36432# Nortronics, Palos Verdes Peninsula, Calif. Electronics Div.
CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS) Interim Report
Apr. 1971 349 p refs
(Contract DAAJ01-71-C-0503)
(AD-726951; NORT-71-209-1; USAAVSCOM-TR-72-1; IR-1) Avail: NTIS CSCL 01/3

The report represents the first formally documented submittal prepared as part of the concept formulation study for Automatic Inspection, Diagnostic and Prognostic Systems (AIDAPS) for Army aircraft. The principal objective of this phase A effort is to establish that only basic engineering, rather than experimental effort, is required to proceed with engineering development of AIDAP systems. Confirmation of this fact is presented by in-depth discussions of the availability of applicable AIDAPS technology thereby demonstrating categorically the feasibility of proceeding with development and deployment of AIDAP systems without further research effort. In the process of accomplishing this objective, several subsidiary tasks were performed that provide a base of information from which phases B and C can proceed. Author (GRA)

N71-36433# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, SUPPLEMENTAL ISSUE, 1969 ACCIDENTS
Jul. 1971 63 p
(NTSB-BA-71-2) Avail: NTIS

Reports of 108 aircraft accidents are presented as a supplement for 1969. The accident reports included were *delayed pending supplemental data, additional study, or because* of difficult areas in the investigation. Twenty-seven of the reports cover foreign registered aircraft accidents that occurred in the United States or its possessions. Author

N71-36434# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT PRELIMINARY REPORT: ALASKA AIRLINES, INCORPORATED, BOEING 727, N2969G, JUNEAU, ALASKA, 4 SEPTEMBER 1971
12 Oct. 1971 10 p
(SB-71-87) Avail: NTIS

The facts, circumstances, and conditions surrounding the fatal crash of the Alaska Airline, Inc., Flight 1866 on September 4, 1971 are presented. No concrete causes were established for the accident. E.H.W.

N71-36435*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STABILITY AND CONTROL CHARACTERISTICS OF A LARGE SCALE DEFLECTED SLIPSTEAM STOL MODEL WITH A WING OF 5.7 ASPECT RATIO
V. Robert Page and Thomas N. Aiken Washington Oct. 1971 66 p refs
(NASA-TN-D-6393; A-3342) Avail: NTIS CSCL 01B

A wind tunnel investigation was conducted to determine the stability and control characteristics of a large scale model representative of a propeller-driven STOL transport. Longitudinal and lateral directional characteristics were obtained for a four-engine configuration having a wing of 5.7 aspect ratio fully immersed in the propeller slipstream. Configuration variables included an aileron, a spoiler, a slot-lip aileron, a spanwise variation of propeller thrust, and two vertical heights of the horizontal tail. Author

N71-36436*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE-SCALE WIND-TUNNEL TESTS OF A PROPELLER-DRIVEN DEFLECTED SLIPSTREAM STOL MODEL IN GROUND EFFECT
V. Robert Page and Thomas N. Aiken Washington Oct. 1971 42 p refs
(NASA-TM-X-2313; A-3927) Avail: NTIS CSCL 01A

A wind-tunnel investigation was conducted to determine the *longitude and lateral-directional characteristics of a large-scale* STOL transport model in ground effect. Test configurations included three wing spans (aspect ratios, 5.71, 6.52, and 8.06), with and without full-span triple-slotted trailing-edge flaps, horizontal tail on and off, spanwise variation of propeller thrust (to vary the span loading and descent capability), differential propeller pitch for yaw control, and spoiler and slot-lip aileron for roll control. Author

N71-36437# National Transportation Safety Board, Washington, D.C.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA: US AIR CARRIER OPERATIONS, CALENDAR YEAR 1969
18 Aug. 1971 119 p
(NTSB-ARC-71-1) Avail: NTIS

Statistical, cause/factor and injury tables, accident rates, and the briefs of accidents involving U.S. air carriers are reported for 1969. An analysis of the operation and safety record of these carriers by type of power and class of carrier is included. Author

N71-36438# Federal Aviation Administration, Washington, D.C. Flight Standards Service.
MULTIENGINE AIRPLANE CLASS OR TYPE RATING
1971 29 p Revised
(FAA-AC-61-4C) Avail: NTIS; SOD $0.25

A guide was developed to assist applicants for multiengine rating in preparing for his certification or rating flight test. The guide provides explanations of the procedures, maneuvers, and the acceptable performance necessary to pass such a test according to Federal Aviation Regulations. The test is given in three phases: (1) oral operational test, (2) basic piloting techniques, and (3) multiengine emergency procedures. The failure of any required item constitutes the failure of the phase involved and of the flight test. E.H.W.

N71-36439# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.
MATHEMATICAL MODELING OF F8-E WAVE-OFF

TRAJECTORIES FOR TSP (TERMINAL STATE PREDICTOR) Phase Report
David B. Bailey 1 Jul. 1971 26 p ref
(AD-727121; NADC-AM-7119) Avail: NTIS CSCL 01/2

F-8E wave-off trajectories are mathematically modeled for the terminal state predictor systems. A carrier-approach critical state identifier, using nonlinear range and altitude equations, is discussed. GRA

N71-36548*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Engineering.
DOPPLER RADAR SIMULATION STUDIES
William D. Stanley Washington NASA Oct. 1971 121 p refs
(Grant NGR-47-003-015)
(NASA-CR-1776) Avail: NTIS CSCL 17I

A study of digital simulation and possible implementation techniques for Doppler radar altimeter signal processing is presented. A technique is described for generating simulated Doppler signals by employing a random number generator and a digital filter. Representative Doppler spectra are presented and are used in studying the measurement techniques considered. The development of a digital phase-locked concept is given. The simulation of such system on a digital computer is developed, and suggestions for possible implementation are presented. A study of processing Doppler signals with a fast Fourier transform spectrum processor is presented. Results of a computer simulation of a processor are discussed, and representative processed Doppler spectra are included. Author

N71-36672*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
MOTION CUE AND SIMULATION FIDELITY ASPECTS OF THE VALIDATION OF A GENERAL PURPOSE AIRBORNE SIMULATOR
Kenneth J. Szalai Washington Oct. 1971 36 p refs
(NASA-TN-D-6432; H-648) Avail: NTIS CSCL 14B

In the validation of the general purpose airborne simulator, certain motion and visual cues could not be duplicated because the airborne simulator could not be independently controlled in six degrees of freedom. According to pilot opinion, however, the XB-70 airplane at two flight conditions has been simulated satisfactorily. Because of the dependence of simulation results on simulator configuration, two areas were investigated after the validation program was completed. The first was the effect of mismatched cues on observed handling qualities. Experiments which varied lateral acceleration at the pilot's location and yaw rate, while keeping constant the lateral-directional dynamics displayed on the pilot's instruments, showed pilot sensitivity to directional motion cues to be different for the simulation of two XB-70 flight conditions. A technique for allowing consecutive evaluations of moving- and fixed-base configurations in flight was used successfully to determine motion cue effects. The second area investigated was the measurement and description of simulation fidelity. In-flight frequency-response measurements of the model-following system were taken to examine model-following fidelity for directly matched variables such as sideslip and roll rate as well as uncontrolled parameters such as lateral acceleration. Author

N71-36674# Cincinnati Univ., Ohio. Design Research Collaborative.
ADVANCED LIGHTWEIGHT PORTABLE STRUCTURAL CONCEPTS FOR SHELTERS, HANGARS AND MAINTENANCE DOCKS Final Technical Report, 21 Apr. 1969 - 30 Sep. 1970
W. Randall Wakefield, James M. Alexander, Karl H. Merkel, and Jack R. Farrah Wright-Patterson, Ohio ASD 1971 356 p refs
(Contract F33615-69-C-1719)
(AD-727056; ASD-TR-71-34) Avail: NTIS HC $6.00/MF $0.95 CSCL 13/13

A lightweight, high-mobility structural concept for shelters used primarily for general purposes. Hangars used for temporary aircraft storage, and maintenance docks for support of aircraft maintenance crews is presented. Five shelter concepts are described. Several offer modular growth patterns. Four hangar concepts are described. Six maintenance dock concepts are described. The designs are both the aircraft-enclosing type and the access-platform type. One universal panel and beam shelter capable of various spans and shapes is discussed. Models were built of twelve of the concepts for design evaluation. Structural design feasibility analyses were performed and are included as an appendix. Author

N71-36675*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RAPID ESTIMATION OF WIND-TUNNEL CORRECTIONS WITH APPLICATION TO WIND-TUNNEL AND MODEL DESIGN
Harry H. Heyson Washington Sep. 1971 370 p refs
(NASA-TN-D-6416; L-7793) Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

A chart method is developed for the rapid estimation of wind tunnel interference in closed and closed-on-bottom-only tunnels. In addition, testing limit charts, based on varying degrees of correction, are developed. Applications of these results indicate very powerful effects of wing sweep and the degree of correction on the usable testing range of wind tunnels. Author

N71-36677*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
PREDICTION OF IN-FLIGHT FLUCTUATING PRESSURE ENVIRONMENTS INCLUDING PROTUBERANCE INDUCED FLOW
J. E. Robertson Mar. 1971 96 p refs
(Contract NAS8-25700)
(NASA-CR-119947; WR-71-10) Avail: NTIS CSCL 20D

An investigation of the transonic fluctuating pressure environments is presented. Based on test results from many sources, prediction methods for various unsteady flow environments are formulated. In particular, prediction methods are proposed for basic fluctuating pressure phenomena which occur on virtually all aerospace vehicles during some phase of launch and protuberance induced fluctuating pressure phenomena which are typical of three-dimensional protuberances attached to the external surfaces of a vehicle. The prediction methods for the basic fluctuating pressure phenomena were developed for two-dimensional and axisymmetric configurations; however, the conclusions are of fairly general application. The prediction of overall levels, spectra and cross-spectra for both basic and protuberance induced fluctuating pressure phenomena are compared to show characteristics unique to the particular unsteady flow condition. Author

N71-36679*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TIP VORTICES: VELOCITY DISTRIBUTIONS
N. A. Chigier and V. R. Corsiglia Sep. 1971 14 p refs
Presented at the 27th Ann. Natl. Forum of the Am. Helicopter Soc., May 1971
(NASA-TM-X-62087) Avail: NTIS CSCL 20D

Detailed measurements of velocity distributions have been made in vortices generated at the tip of a square-tip, 18-inch-chord, 48-inch semispan blade mounted in the NASA-Ames 7-by 10-foot wind tunnel. Time-mean-average velocity components were measured using a triple sensor hot wire probe operated by three separate anemometers. With the blade at an angle of attack of 12 deg, traverses were made through the vortex centers at six axial stations, x/c = -0.75, -0.50, -0.25, 0.0, 2.0, and 4.0, where x/c = 0 is the trailing edge. The dimensions of the vortex increase with distance downstream over the blade surface, and at x/c = 4 the vortex core radius is 1.7% of the span. Maximum circumferential

velocity of 42% of mainstream velocity was measured at x/c = -0.50, over the wing surface, followed by decay to 24.0% of mainstream velocity at x/c = 4. Axial velocity in excess of free stream velocity was measured in the vortex core with maximum axial velocity of 140% of free stream velocity at x/c = -0.25.
Author

N71-36688# Sandia Corp., Albuquerque, N.Mex.
MAGNUS DATA ON THE STANDARD 10 DEG CONE CALIBRATION MODEL
Warren H. Curry, James F. Reed, and William C. Ragsdale (NOL, White Oak, Md.) Mar. 1971 24 p refs Presented at 35th Meeting of the Supersonic Tunnel Assoc., Dallas, 8-9 Mar. 1971
(SC-DC-71-3821; Conf-710306-1) Avail: NTIS

The standard 10 deg cone calibration model was run in a supersonic wind tunnel to obtain Magnus force and moment data at Mach numbers of 1.76, 2.02, and 3.02, at respective Reynolds numbers of 2.74, 2.44, and 1.79 million based on model length. The angle of attack was varied from zero to 12 degrees and the spin helix angle ranged from zero to approximately 0.25 radians. Boundary layer transition occurred on the model at all finite angles of attack. As expected, these results were not in agreement with the theoretical predictions for the all laminar boundary layer condition. Author (NSA)

N71-36695# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
AN INVESTIGATION OF THE FLOW AROUND RECTANGULAR CYLINDERS
P. W. Bearman and D. M. Trueman Jun. 1971 25 p refs
(IC-Aero-71-15) Avail: NTIS

Measurements are presented of the base pressure coefficients, drag coefficient and Strouhal number of rectangular cylinders. The results confirm a finding in Japan that the drag coefficient rises to nearly 3 when the depth of the section is just over half the width. The flow around the sections is found to be strongly influenced by the presence of the trailing edge corners.
Author

N71-36697*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF NONLINEAR CONICAL FLOWS BY THE METHOD OF LINES
E. B. Klunker, Jerry C. South, Jr., and Ruby M. Davis Washington Oct. 1971 82 p refs
(NASA-TR-R-374; L-7813) Avail: NTIS CSCL 20D

A computational technique, called the method of lines, is developed for computing the flow field about conical configurations at incidence in a supersonic flow. The method, which makes use of the self-similarity property, is developed for the nonlinear flow equations. The method has proved to be an efficient and versatile procedure for constructing the numerical solutions to conical flow problems. It has been successful in computing the flow about circular and elliptic cones at conditions where small regions of supersonic cross flow develop and for the conical delta wings where the region of supersonic cross flow is extensive. The calculations made for circular and elliptic cones as well as for the compression side of various conical delta wings are in good agreement with experiment except in regions where viscous effects become important.
Author

N71-36704 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFICIENCY OF SINGLE-ROW IMPULSE STAGES ON THE BASIS OF SOVIET TEST DATA
V. D. Pshenichny [1970] 10 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), v. 16, no. 6, Jun. 1970 p 9-11
(NLL-CE-Trans-5631-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Test data obtained by determining the internal efficiency of single-row impulse stages are presented. The maximum internal efficiency of a single impulse stage is plotted against the parameters of the nozzle cascade and the leakages in the tip section are examined. It is found that the efficiency values obtained in all the experiments are in good agreement if they are reduced to the same test conditions. Author

N71-36720*# Aeronautical Research Associates of Princeton, Inc., N.J.
COMPUTING DISPERSAL OF ATMOSPHERIC POLLUTANTS NEAR AIRPORTS
Coleman duP. Donaldson and Glenn R. Hilst Jul. 1971 36 p refs
(Contract NAS1-10192)
(NASA-CR-111962; ARAP-162) Avail: NTIS CSCL 04A

The basic rationale of invariant modeling is demonstrated and verified in specifying the structure of atmospheric turbulence near the ground. A model capable of predicting the dispersal of inert airborne pollutants emanating from arbitrary source configurations was constructed and tested. This model depends upon the turbulence model for inputs of turbulence structure and, when the source configuration is specified, predicts the distribution of pollutant concentration downstream. E.M.C.

N71-36748# Air Force Cambridge Research Labs., Bedford, Mass.
A REMOTE-SENSING INVESTIGATION OF FOUR MOJAVE PLAYAS. ENVIRONMENTAL RESEARCH PAPERS
Carlton E. Molineux, Emmanuel E. Bliamptis, and James T. Neal 16 Apr. 1971 73 p refs
(AD-727031; AFCRL-71-0235; AFCRL-ERP-352) Avail: NTIS CSCL 08/6

Dry lakebeds (playas) in the Mojave Desert are often hard and flat enough to serve as natural landing areas for aircraft. However, the surface physical properties of moisture, strength, and microrelief can vary with seasonal or local conditions. It is desirable to develop methods for determining and monitoring these properties and their variations. Airborne remote sensing enables collection of data on the reflectance, temperature, and emissivity of these surfaces that can be correlated with soil parameters. Four playas in the Mojave Desert that have a variety of surface properties were investigated. Airborne spectrophotography and thermal infrared imagery were obtained by overflights. Ground photometry and measurements of surface properties were obtained. Moisture-sensitive dyes were applied to one lakebed surface to evaluate the feasibility of monitoring its dryness through color changes apparent on the aerial photography. The report describes the results of the remote-sensing investigations and the correlation of photographic and imagery interpretation with actual surface conditions.
Author (GRA)

N71-36770*# California Univ., Berkeley. Forestry Remote Sensing Lab.
REMOTE SENSING APPLICATIONS IN FORESTRY. THE DEVELOPMENT OF AN EARTH RESOURCES INFORMATION SYSTEM USING AERIAL PHOTOGRAPHS AND DIGITAL COMPUTERS PHOTOGRAPHS AND DIGITAL COMPUTERS Annual Progress Report
Philip G. Langley, Jan Van Roessel, David A. Sharpnack, and Robert M. Russel 30 Sep. 1970 33 p refs Sponsored in part by Dept. of Agr.
(NASA Order W-12996)
(NASA-CR-122922) Avail: NTIS CSCL 14B

Work continued: (1) to develop an operating earth resources information system oriented toward wildland application; (2) to provide techniques for scanning and interpreting aerial photographs automatically to provide inputs to the information system; and (3) to develop sampling designs which optimally utilize the information system and supplementary remote sensor and ground data for resource inventory and analysis. A systems analysis has been completed specifying the equipment and software packages needed to build the wildland information system and programs have been written for data input. Several image matching procedures for automatic mapping of forest

resources using digitized stereopairs of aerial photographs have been tested. A program package for simulating scanned aerial photographs in various orientations has been written. Development of a linear discriminate function (LDF) to automatically classify forest types on panchromatic prints continued. A large scale test of a five-stage forest inventory procedure using Apollo 9 and aerial photographs was conducted on 10 million acres with a sampling error of only 13 percent on an estimate of 2.2 billion cubic feet of timber growing on 5 million acres. Author

N71-36776# Advisory Group for Aerospace Research and Development, Paris (France).
RELIABILITY OF AVIONICS SYSTEMS
Jul. 1971 191 p refs Mostly in ENGLISH; partly in FRENCH Conf. held in Rome, 16-17 Sep. 1971 and London, 20-21 Sep. 1971; Sponsored by Avionics Panel and Exchange Programme of AGARD *Its* Lecture Series No. 47
(AGARD-LS-47-71) Avail: NTIS

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2. TECHNIQUES OF SYSTEM RELIABILITY ESTIMATION, INCLUDING FAILURE EFFECT ANALYSIS (FAILURE CONSEQUENCE) W. T. Sumerlin (McDonnell Aircraft Co., St. Louis, Mo.) 29 p refs
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8. METHODS OF SPECIFYING AND CONTROLLING DESIGN RELIABILITY J. J. Bussolini (Grumman Aerospace Corp.) 19 p refs
9. RELATIONSHIPS BETWEEN PROGRAM TEST AND USER SUPPORT COSTS M. M. Tall (RCA, Moorestown, N. J.) 9 p refs
9. RELATIONSHIPS BETWEEN PROGRAM TEST AND USER SUPPORT COSTS M. M. Tall (RCA, Moorestown, N. J.) 9 p refs
10. SYSTEM OPERATIONAL CONSIDERATIONS AND THEIR RELATIONSHIP TO THE TEST PROCESS W. T. Sumerlin (McDonnell Aircraft, St. Louis, Mo.) 8 p refs
11. TECHNIQUES OF ANALYZING ACCELERATION P. Blanquart (Centre Natl. d'Etudes des Telecommunication, Lannion, France) 8 p
12. THE BENEFITS OF A TOTALLY INTEGRATED RELIABILITY TEST PROGRAM J. J. Bussolini (Grumman Aerospace Corp.) 21 p refs
13. OPERATIONAL CONSIDERATIONS AND SYSTEMS RELIABILITY B. E. Baker (Royal Air Force, High Wycombe, England) 7 p

N71-36777# McDonnell Aircraft Corp., St. Louis, Mo. Engineering Reliability.
TECHNIQUES OF SYSTEM RELIABILITY ESTIMATION, INCLUDING FAILURE EFFECT ANALYSIS (FAILURE CONSEQUENCE) **c15**
W. T. Sumerlin *In* AGARD Reliability of Avionics Systems Jul. 1971 29 p refs
Avail: NTIS
The reliability estimation of an avionic system, which includes gross estimates, rapid estimates, and detailed estimates is discussed. Probability of attainment is then studied by selective reliability allocation among subsystems, followed by feasibility estimates based on experience, complexity, failure rate summations and/or other effective techniques. Constraints including allowable degradation, alternative mode operation, environment, operator effectiveness, and excellence of maintenance will permit improved estimates. Failure mode and effect analyses serves to guide conceptual design decisions so as to eliminate single point failures and identify areas for judicious application of redundancy, requirements for high reliability parts, special environmental control, and beneficial choice of operating profile. Author

N71-36779# McDonnell Aircraft Corp., St. Louis, Mo. Engineering Reliability.
EFFECTIVENESS OF RELIABILITY PROGRAM ELEMENTS **c15**
W. T. Sumerlin *In* AGARD Reliability of Avionics Systems Jul. 1971 9 p
Avail: NTIS
An opinion is given of the probable relative importance of reliablity program elements including reliability requirement evaluation and allocation, proof of attainment, parts control, design surveillance, failure analysis and design correction, and reliability progress measurement. Author

N71-36780# Radio Corp. of America, Moorestown, N.J.
COST EFFECTIVENESS OF BUILT-IN TEST PROVISIONS **c15**
M. M. Tall *In* AGARD Reliability of Avionics Systems Jul. 1971 8 p refs
Avail: NTIS
The feasibility of using built in test provisions (BIT) as a means of improving operational effectiveness of aircraft is discussed. The primary purpose of BIT is to indicate to the user if the prime equipment is operating satisfactorily. It provides information upon which a decision to abort, modify, or continue a mission may be based. Bit may also be applied to passive devices. In highly complex equipment BIT may indicate degrade performance of portions of the equipment as well as catastrophic failure, and indicate the use of any alternate mode of operations. The cost effectiveness of BIT is also discussed. E.H.W.

N71-36784# Radio Corp. of America, Moorestown, N.J.
RELATIONSHIPS BETWEEN PROGRAM TEST AND USER SUPPORT COSTS **c15**
M. M. Tall *In* AGARD Reliability of Avionics Systems Jul. 1971 9 p refs
Avail: NTIS
The significant factors that should be included in a cost ownership analysis of avionic equipments are discussed. The value of reliability improvement efforts, including AGREE type test programs, are assessed. Author

N71-36801# Joint Publications Research Service, Washington, D.C.
USE OF INFRARED DEVICES IN OBSERVATIONS OF ICE CONDITIONS
F. I. Melkov et al 30 Sep. 1971 15 p refs Transl. into ENGLISH from the publ. "Primeniye Radiofizicheskikh Metodov v Okeanograficheskikh i Ledovykh Issledovaniyakh" Leningrad, 1965 p 95-106
(JPRS-54162) Avail: NTIS
Observations of ice conditions from an airplane by photography, by the use of television, or by using passive or active radio-locating devices, infrared techniques, and other devices operating on the principle of receiving radiated or reflected electromagnetic waves are discussed. All of these devices have their advantages and disadvantages. Photography and television assure a high resolution capability but their use requires sufficient illumination and the absence of cloud and fog. Radio location equipment in the centimeter range can be used

for ice prospecting even in the presence of clouds and fog, but with extremely poor resolution. A complete solution of the problems of ice prospecting can be accomplished only with the use of a combination of devices operating in various parts of the electromagnetic wave spectrum. The use of a combination of various apparatus smooths out the disadvantages of any one system and reinforces their positive values. Author

N71-36830*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF SELF-ACTING-LIFT-PAD CHARACTERISTICS FOR MAIN-SHAFT SEAL APPLICATIONS
William F. Hady and Lawrence P. Ludwig Washington Oct. 1971 21 p refs
(NASA-TN-D-6384; E-6186) Avail: NTIS CSCL 11A

Experimental studies on four acting lift geometries (shrouded step pads) for maintaining positive separation of seal surfaces are compared with theoretical calculations. Load capacities at measured film thicknesses were lower than those predicted by theory for parallel surfaces. Sufficient gas (air) film stiffness was generated so that dynamic tracking of the seal seat face runout was maintained. Seal seat runouts to (0.0035 in.) were accommodated. Tracking, however, is inhibited during startup under light loads when seal seat runouts exceed 0.0025 cm (0.001 in.). Author

N71-36845# ARO, Inc., Arnold Air Force Station, Tenn.
LASER DOPPLER VELOCIMETER DUAL SCATTER PROBE VOLUME Final Report, Jul. - Oct. 1970
W. H. Goethert AEDC Jul. 1971 40 p refs
(Contract F40600-72-C-0003)
(AD-727005; AEDC-TR-71-85; ARO-OMD-TR-71-24) Avail: NTIS CSCL 14/2

A further clarification of the volume from which data originate in the dual scatter laser Doppler velocimeter is presented. Several factors are noted that specify the primary dimensions of the probe volume which in some cases are totally specified by the collector optics. It was found experimentally that the lens aperture of the light collecting optics has a primary effect on the volume from which data originate. An equation is derived for reducing this data volume for both the on-axis and off-axis cases. Experimental verification is presented and compared to the derived equation. Author (GRA)

N71-36930# Midwest Research Inst., Kansas City, Mo.
THE VISCOSITY OF SYNTHETIC TURBINE ENGINE LUBRICANTS FROM 100 F TO 700 F Technical Report, Jul. 1969 - Jan. 1971
Ronald D. Butler Wright-Patterson AFB, Ohio AFAPL Jun. 1971 79 p refs
(Contract F33615-69-C-1265)
(AD-727060; AFAPL-TR-71-35) Avail: NTIS CSCL 11/8

The report describes a technique for the experimental determination of fluid viscosity over the temperature range 100 deg - 700 deg. The method incorporates standard procedures, and meets accepted specifications for data precision and for temperature control and measurement over the entire temperature range. Reliable data of high precision can be obtained for subsequent analysis and prediction of lubricant performance in operating turbine aircraft engines. Complete viscosity data are presented for 30 synthetic lubricants. The following fluid types were included in this study: MIL-L-7808, MIL-L-23699, MIL-L-27502, poly(phenyl ether), and silicone formulations. Statistical analysis of the data indicates that a logarithmic relationship accurately describes the variation of kinematic viscosity with temperature over the entire temperature range. Appropriate equation can be used to calculate fluid viscosity at any desired temperature up to 500 F (or 700 F for thermally stable lubricants) with an average error less than 2%. Author (GRA)

N71-36985# Environmental Science Services Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
AN AIRBORNE PYROTECHNIC CLOUD SEEDING SYSTEM AND ITS USE
Joanne Simpson, William L. Woodley, Howard A. Friedman, Thomas W. Slusher (Olin Mathieson Chem. Corp.), R. S. Scheffee (Atlantic Res. Corp.) et al *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 47 p refs
(ESSA-TM-ERLTM-APCL-5) Avail: SOD $3.75

The development, testing, and use of an airborne pyrotechnic cloud seeding system is described. Pyrotechnic flares producing 50 g of silver iodide smoke each were developed and tested for nucleation effectiveness in a cloud chamber. Night flight tests were made of the delivery rack and firing system reliability, burn time, and flare trajectory. A randomized seeding scheme was used on 19 supercooled cumuli, of which 14 were seeded and 5 were controls. Of the 14 seeded clouds, 13 grew explosively. Seeded clouds grew 10,900 ft higher than the controls, with the difference significant at better than the 1/2 percent level. Rainfall from seeded and control clouds were compared by means of calibrated ground radars. Large increases in rainfall were found from seeded clouds, but not at a satisfactory level. Author

N71-36990# Society of Motion Picture and Television Engineers, Inc., New York.
CLOUD PHOTOGRAMMETRY FROM AIRBORNE TIME LAPSE PHOTOGRAPHY c14
Luis M. H. Cantilo (Miami Univ.) and William L. Woodley (Miami Univ.) *In* Atlantic Oceanog. and Meteorol. Labs. Collected Reprints, 1969, Vol. 2 Sep. 1970 11 p refs Presented at 105th Tech. Conf., 20-25 Apr. 1969 Sponsored by ESSA Its Preprint No. 105-52
Avail: SOD $3.75

The technique used to analyze the aerial cloud photographs, process the Doppler navigational information, and obtain the desired measurements of the clouds is described. The various problems inherent in this method are considered, and results of its application are presented. Author

N71-37038# National Aviation Facilities Experimental Center, Atlantic City, N.J.
MEASUREMENT AND ANALYSIS OF EN ROUTE ATC DIGITAL RADAR SYSTEM ERRORS Interim Report, Jul. 1970 - Mar. 1971
Clifford Chapman Sep. 1971 27 p refs
(FAA-NA-71-16) Avail: NTIS

Prior to the conduct of tests pertinent to radar separation standards, a review of previous efforts was accomplished to ascertain the application of existing data towards the establishment of separation criteria within the en route Air Traffic Control National Airspace System, Model 1 complex at Jacksonville, Florida. Data analyses and presentation were directed towards the range and azimuth resolution characteristics and aircraft separation measurement capability of the secondary radar/digitizer subsystem. Author

N71-37041# Civil Aeromedical Inst., Oklahoma City, Okla.
ATTITUDES AND MOTIVATIONAL FACTORS IN TERMINAL AREA AIR TRAFFIC CONTROL WORK
Roger C. Smith, Bart B. Cobb, and William E. Collins Jul. 1971 30 p refs
(FAA-AM-71-30) Avail: NTIS

A sample of 614 journeymen terminal ATCSs at 17 high-density IFR airports, and 514 ATC trainees were administered a questionnaire which asked them to list what they liked best and what they liked least about ATC work in general; in addition, ATCSs made similar lists for work at their assigned facilities. Responses were surveyed for clusters, and nine response categories were established. The frequency of responses within each category was tabulated. With minor variations the pattern of responses from ATCSs was highly similar from one facility to another. The categories of job

challenge, job tasks, career characteristics, and salary contained the most positive responses about ATC work, while the categories of management, work schedule, career characteristics, and job tasks had the most negative responses. Trainee attitude patterns were similar. Author

N71-37042# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN AIRBORNE TRAFFIC SITUATION DISPLAY SYSTEM
Richard W. Bush, Howard Blatt, and Francis X. Brady 29 Oct. 1971 19 p
(Contract F19628-70-C-0230)
(AD-727769; TN-1971-19; ESD-TR-71-194) Avail: NTIS CSCL 17/7

An airborne traffic situation display system which could be used as an adjunct to the evolving National Airspace System/Automatic Radar Control Terminal System (NAS/ARTS) is described. In the proposed system, a contemporary realization of an old concept, the NAS/ARTS data are broadcast. A small digital computer in an aircraft then selects from the message stream the data on its own aircraft, nearby aircraft, and a local map. These data, plus aircraft heading data from a directional gyro, are used to generate a situation display that can be aircraft-centered and heading-oriented. Author (GRA)

N71-37113# Defence Research Establishment Toronto, Downsview (Ontario).
NOISE SURVEY: A TURBOSHAFT POWER PLANT COUPLED TO A MOBILE TEST BED
R. A. Stong Mar. 1971 7 p refs
(DRET-TM-788) Avail: NTIS

Measurements were made of the overall sound pressure levels and spectra of the noise generated by a turboshaft power plant coupled to a mobile engine test trailer and operated outdoors. Running at maximum power the system produced overall sound pressure levels as high as 125 dB with the significant sound energy distributed between 300 and 8000 Hz, equivalent to an ISO noise hazard rating of 125. Author

N71-37369# Anheuser-Busch, Inc., St. Louis, Mo.
CHEMICAL AND PHYSICAL STUDY OF FUELS GELLED WITH CARBOHYDRATE RESINS Final Report, 22 Jun. 1970 - 2 Feb. 1971
James Teng and James M. Lucas Sep. 1971 90 p refs
(Contract DOT-FA70NA-497)
(FAA-NA-71-18; FAA-RD-71-43) Avail: NTIS

A carbohydrate derivative was designed as a gelling agent for turbine fuel. The gelling agent is effective in reducing the fire hazard of the fuel. The free flowing gelled fuel could be adapted readily to existing fuel systems. The rheological profile of this gelled fuel was established over a range of conditions by means of a rotating viscometer, equipped with special measuring heads. Among the rheological parameters which were measured, the viscoelasticity of the gelled fuel appears likely to be a major factor in contributing to the crash-safe character of the fuel. Pertinent physical properties and microbiological data were also compiled to demonstrate that the fuel gelled with the carbohydrate based gelling agent is compatible with present aircraft fuel systems. Author

N71-37373*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF COMPRESSOR END SEALS STATOR INTERSTAGE SEALS, AND STATOR PIVOT SEALS IN ADVANCED AIR BREATHING PROPULSION SYSTEMS. PART 2: EXPERIMENTAL DATA AND ANALYSIS Final Report, 26 Jun. 1965 - 23 Oct. 1970
R. M. Hawkins and A. H. McKibbin 24 Nov. 1970 185 p refs
(Contract NAS3-7605)
(NASA-CR-72887; PWA-4059-Pt-2) Avail: NTIS CSCL 21E

The design and development of 28-inch diameter rotating seals for air breathing propulsion systems is discussed. The results of testing the compressor seals, an analysis of two improved self-acting compressor seal designs, and the performance tests of stator pivot seals are presented. Numerical analyses and graphs are used to further substantiate the test results. Author

N71-37378*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PEAK AXIAL-VELOCITY DECAY WITH MIXER-TYPE EXHAUST NOZZLES
D. Groesbeck, R. Huff, and U. von Glahn Sep. 1971 27 p refs
(NASA-TM-X-67934; E-6609) Avail: NTIS CSCL 21E

Preliminary results of an experimental study on the peak axial-velocity decay obtained with circular and non-circular nozzles and several mixer-type nozzles is summarized. Prime applications of nozzles having a rapid axial velocity decay are for: (1) reduction of jet exhaust-deflected flap interaction noise associated with STOL aircraft using an externally blown flap lift augmentation system; (2) VTOL downwash suppression resulting from vertically oriented exhaust nozzles; and (3) conventional exhaust noise suppressors with and without ejectors. With a multi-element nozzle, the velocity of the individual small jets decays rapidly by mixing with the surrounding air. At some distance downstream of the nozzle exit plane, the individual jets coalesce sufficiently to form a large diameter coalescing core and a very slow peak-velocity degradation occurs. Once the coalesced core has fully formed, rapid mixing again occurs with an associated rapid velocity degradation. Author

N71-37381# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN AND EXPERIMENTAL EVALUATION OF A HIGH-TEMPERATURE RADIAL TURBINE, PHASE 2 Final Report, 18 Jul. 1967 - 31 Aug. 1970
Glenn S. Calvert, Stephen C. Beck, and Uelo Okapuu Ft. Eustis, Va. Army Air Mobility Research and Development Lab. May 1971 223 p refs
(Contract DAAJ02-68-C-0003)
(AD-726466; PWA-FR-4058; USAAMESL-TR-71-20) Avail: NTIS CSCL 21/5

The report describes the design, fabrication and test of a radial turbine designed to produce 219.6 Btu/lb stage work at 87.5% efficiency, with a 5:1 stage pressure ratio. Turbine inlet gas conditions at design point were 257.5 psia and 2300 F. The resulting turbine configuration consisted of an air-cooled, 12-bladed rotor designed for 67,000 rpm, and a 20-vaned air-cooled nozzle section of a reflex-type (supersonic) design. Both parts were designed as IN100 (PWA 658) investment castings. As part of the preliminary design effort, a fabrication study was conducted to evaluate feasible methods of casting the turbine nozzle and rotor. Results showed that the nozzle section could be cast as an integral assembly, but fabrication of the rotor as an integral casting was much more difficult. Bicasting was evaluated as an alternate method of fabricating the rotor, and results showed substantial advantages for the bicasting technique. However, neither method could produce designed rotor properties, and testing was conducted with structurally limited rotors. A test rig was designed and fabricated by the contractor. The test rig consisted of a supercharged gas generator, which had the capability of controlling the turbine load by varying the compressor flow rate. Burner testing preceded turbine testing. Author (GRA)

N71-37384*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE CHARACTERISTICS OF A SINGLE-ENGINE FIGHTER MODEL FITTED WITH AN IN-FLIGHT THRUST REVERSER
Donald L. Maiden and Charles E. Mercer Washington Sep. 1971 130 p refs
(NASA-TN-D-6460; L-7824) Avail: NTIS CSCL 21E

The investigation was conducted at the Langley 16-foot transonic tunnel at Mach numbers up to 1.30. The purpose of the investigation was to establish changes in thrust-minus-drag performance as well as longitudinal and directional stability and control characteristics attributable to an in-flight thrust reverser. The performance results and the effects of the thrust reverser on local surface temperatures and pressures are presented in this report. Test conditions simulated landing-approach conditions as well as high-speed maneuvering such as may be required for combat or steep descent from altitude. The results indicate that the developed thrust control unit will produce reverse thrust up to 52 percent of forward thrust at static conditions and that reverse-thrust effectiveness increased with an increase in Mach number over the speed range investigated. Secondary cooling during reverse thrust and local tail temperatures may require further design considerations. Author

N71-37387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AIRCRAFT ENGINES (SELECTED ARTICLES)
Yu. A. Bordovitsyn et al 7 May 1971 88 p refs Transl. into ENGLISH from Tr. Inst. Aviats. (USSR), no. 110, 1969 p 11-15, 27-46, 56-66, 74-92
(AD-727175; FTD-MT-24-18-71) Avail: NTIS CSCL 21/2

Content: The effect of the form of an active gas jet on the characteristics of a gas ejector with short mixing chamber; calculation of the maxium degree of compression of an ejector; the rational method of selecting parameters and calculating single-stage gas turbines; a generalization of the results of measurements of the fineness of fuel atomization of mechanical and at air-mechanical injectors of the pressure-jet type; calculation of temperature field in a cooled turbine blade with longitudinal cooling channels; turbulence in the zone of interplay of jetstreams with the flow. GRA

N71-37524# Aeronautical Research Labs., Melbourne (Australia).
A SURVEY OF FATIGUE LIFE VARIABILITY IN ALUMINUM ALLOY AIRCRAFT STRUCTURES
G. S. Jost and F. E. Verinder Feb. 1971 25 p refs
(ARL/SM-report-329) Avail: NTIS

The variability, or scatter, in the fatigue lives of aluminium alloy aircraft structures was tested under both symmetric and asymmetric variable amplitude loading spectra and programmed and random loading sequences. Physically and statistically compatible data have been pooled to increase the precision of scatter estimates and this has clarified the influence of loading conditions on scatter. It has been found that, although loading sequence is of little importance, the symmetry of the loading spectrum has a major influence on scatter. Author

N71-37540# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE REDUCTION OF RESONANT VIBRATIONS IN INTEGRALLY STIFFENED SKIN STRINGER PANELS USING VISCO-ELASTIC MATERIALS Final Report, 15 Feb. 1968 - 14 Feb. 1970
Fernando Cicci Wright-Patterson AFB, Ohio AFML 29 Oct. 1971 243 p refs
(Contract F61052-68-C-0027)
(AD-727773; AFML-TR-71-1) Avail: NTIS CSCL 01/3

The vibration characteristics of integrally stiffened skin-stringer panels have been investigated theoretically and experimentally. This type of structure was found to have mode shapes similar to those of flat plates due to the relatively low values of stringeri bending stiffness. The experimental measurements were made by means of strain gauges and accelerometers, with the typical panel excited acoustically by travelling waves at approximately grazing incidence. Methods of damping the resonant vibrations were also investigated theoretically and experimentally. Predictions were verified using a beam taken from the cross section of an integrally stiffened panel. It was found that an extremely efficient method was one in which a damper was attached to the free edges of the stringers. This damper could be either a strip of viscoelastic material or a shear system made up of metal skins and a viscoelastic shear layer. Author (GRA)

N71-37643 Stanford Univ., Calif.
IMPACT ON PLATES ON ELASTIC FOUNDATIONS
Arthur Gates Ware, III (Ph.D. Thesis) 1970 104 p
Avail: Univ. Microfilms Order No. 70-18501

The equations of motion for a plate-foundation system under a dynamic load are presented. By assuming that the load can be broken into the product of a space-dependent function and a time-dependent function two approaches are followed to separate the basic partial differential equations for the infinite plate. The final solutions are applied to the landing of an aircraft and numerical examples are carried out to illustrate the effect of the various parameters. The results show that the responses of plates on elastic foundations are almost identical whenever the bending rigidity of the plate is greater than that of the model. However, for plates possessing less bending rigidity than the foundation, the continuity of the foundation begins to assert itself. The concluding part of the work describes the cases of dual and multiple wheel assemblies and possible extensions of the investigation are outlined. Dissert. Abstr.

N71-37563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROCEDURE FOR SCALING OF EXPERIMENTAL TURBINE VANE AIRFOIL TEMPERATURES FROM LOW TO HIGH GAS TEMPERATURES
Herbert J. Gladden and John N. B. Livingood Washington Sep. 1971 28 p refs
(NASA-TN-D-6510; E-6250) Avail: NTIS CSCL 20M

A procedure was developed based on conditions of similarity whereby cooled turbine vane airfoil temperatures measured at low levels of gas temperature can be used to accurately represent both the local and average airfoil temperatures that would be expected at a much higher level of gas temperature. The feasibility of this scaling procedure was verified experimentally in a four-vane cascade capable of operation at gas temperatures and pressures up to 1645 K (2500 F) and 103.4 newtons per square centimeter (150 psia), respectively. A comparison of these scaled airfoil temperatures with experimentally measured airfoil temperatures for the same high temperature conditions is presented. Author

N71-37690# Committee on Foreign Relations (U. S. Senate).
CONVENTION FOR THE SUPPRESSION OF UNLAWFUL SEIZURE OF AIRCRAFT
Richard Nixon Washington GPO 1971 19 p
Avail: US Capitol, Senate Document Room

The convention for the suppression of unlawful seizure of aircraft, signed at the Hague on 16 December 1970 is presented with an article by article analysis. J.M.

N71-37593*# Scientific Translation Service, Santa Barbara, Calif.
REVIEW OF TESTING TECHNIQUES FOR TRANSONIC AIRFOILS [CRITIQUE DES TECHNIQUES D'ESSAIS DE PROFILS TRANSSONIQUES]
M. Bazin et al Washington NASA Oct. 1971 49 p refs Transl. into ENGLISH from ONERA preprint of conf. paper Presented to 7th Colloq. on Appl. Aerodyn. Rhone, France, 4-6 Nov. 1970: sponsored by Assoc. Franc. Des Ingr. et Technicien de l'Aeronaut. et de l'Espace
(Contract NASW-2035)
(NASA-TT-F-13988) Avail: NTIS CSCL 01A

The testing of airfoils in two-dimensional flow in two types of wind tunnels is discussed. One apparatus makes it possible to

carry out tests on large models over a wide range of Reynolds numbers. The study of helicopter blade elements with chords identical to those of rotor blades tested in a similar wind tunnel makes comparisons possible. The systematic study of wall interactions was carried out in the second wind tunnel, which is well adapted for basic research at high Reynolds numbers. Preliminary results indicate corrections which are applicable to test conditions in the latter wind tunnel. Author

N71-37594*# Lockheed-California Co., Van Nuys. Rotary Wing Div.
TRIM, CONTROL, AND STABILITY OF A GYRO-STABILIZED HINGELESS ROTOR AT HIGH ADVANCE RATIO AND LOW ROTOR SPEED
G. A. Watts, R. J. London, and R. J. Snoddy May 1971 312 p refs
(Contract NAS2-5168)
(NASA-CR-114362) Avail: NTIS CSCL 01B

Methods are developed for predicting the behavior of hingeless rotors with stiff blades, at high advance ratios and low rotor speeds. The methods are simple and expository in nature, and are developed for the purposes of: (1) providing insight into the influences of various rotor and control parameters on rotor system behavior, (2) examining the suitability of existing methods which contain more comprehensive analytic descriptions for predicting behavior of hingeless rotors at high advance ratios at low rotor speeds, and (3) providing analysis techniques which are flexible enough to be useful in preliminary design studies.

N71-37596# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
AERODYNAMIC TESTS ON A CENTRIFUGAL FAN IMPELLER MODEL WITH SWEPT-BACK BLADES
H. S. Fowler May 1971 64 p refs
(NRC-12020; ME-237) Avail: NTIS

A low speed centrifugal compressor rig was used to test a 58 1/2 inch diameter model of a fan impeller with highly swept-back vanes. The impeller was run over a range of speeds and throttle settings to explore the whole operating field. The flow was measured at inlet and impeller exit by hot-wire anemometer traverses, and motion pictures of the flow were made using smoke visualisation. The flow through the impeller is described in detail, and is compared with that in other impellers investigated on the same test rig. A comparison is also made with the flow in a geometrically similar impeller tested in a water tunnel. The correspondence between the flows seen in these two experiments is shown to be very close. Author

N71-37597# Douglas Aircraft Co., Inc., Long Beach, Calif.
CALCULATION OF POTENTIAL FLOW ABOUT ARBITRARY THREE DIMENSIONAL LIFTING BODIES Final Report, Dec. 1969 - Oct. 1970
John L. Hess Oct. 1970 46 p refs
(Contract N00019-70-C-0100)
(AD-727628; MDC-J0971-01) Avail: NTIS CSCL 01/3

The report describes work accomplished during the second phase of a projected three-phase effort to develop a computer program to calculate potential flow about arbitrary three-dimensional lifting bodies. The main task of this phase was programming and checking-out logic that had been developed previously. Evaluation of the method by numerical experimentation has just begun, and the few results obtained so far comprise the body of this report. Simple wings of rectangular planform are considered. Preliminary results indicate that surface pressures are insensitive to wake shape but sensitive to the means of applying the Kutta condition. For some situations there is an anomaly in the surface dipole distribution, which fortunately does not affect the surface pressures. GRA

N71-37598*# Pennsylvania State Univ., University Park.
EXPERIMENTAL STUDY OF ROTOR UNSTEADY AIRLOADS DUE TO BLADE-VORTEX INTERACTION
Raghuveera Padakannaya Washington NASA Nov. 1971 37 p ref
(Grant NGR-39-009-111)
(NASA-CR-1909; PSU-AERSP-71-1) Avail: NTIS CSCL 01A

Measurements of unsteady, rotor-blade airloads and their time derivatives are presented for a rotor blade intersecting a completely rolled-up vortex. These results, taken at the blade spanwise station of 0.9R, 0.85R, and 0.75R, complement measurements previously reported for the 0.95R station in CR-1573. Incremental values in the section lift coefficient as high as 1.17 were obtained at the 0.75R station. Generally, these values decreased with increasing radius. Author

N71-37600*# Techtran Corp., Glen Burnie, Md.
DEPENDENCE OF AIRCRAFT BUFFETING IN THE STRATOSPHERE ON HORIZONTAL TEMPERATURE AND WIND DISTRIBUTION [ZAVISIMOST BOLTANKI SAMOLETOV V STRATOSFERE OT GORIZONTALNOGO RASPREDELENIYA TEMPERATURY I VETRA]
G. S. Buldovskiy Washington NASA Oct. 1971 15 p refs Transl. into ENGLISH from Russian report
(Contract NASw-2037)
(NASA-TT-F-13978) Avail: NTIS CSCL 01B

The relationship between buffeting of aircraft in the stratosphere and horizontal temperature and wind distributions is analyzed on the basis of data collected in previous studies and results of instrument measurements of stratospheric turbulence, done in a special aircraft laboratory at altitudes of 10 to 18-19 km. The task was to determine the critical values of the horizontal parameters that would insure the most successful diagnosis of buffeting. Of all examined parameters considering the horizontal temperature and wind distributions, horizontal wind shears along and across the stream are best for diagnosing stratospheric buffeting. Author

N71-37601*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE REDUCTION BY MEANS OF VARIABLE-GEOMETRY INLET GUIDE VANES IN A CASCADE APPARATUS
David Chestnut and Lorenzo R. Clark Washington Oct. 1971 24 p refs
(NASA-TM-X-2392; L-7852) Avail: NTIS CSCL 01C

Noise reduction studies involving variable geometry inlet guide vanes for choking have been made by using a two-sector cascade apparatus with three different inlet configurations: a rotating offset inlet guide vane (IGV), a translating wave IGV, and a stationary uncambered IGV. All three configurations were operated in both the choked and unchoked modes for a range of airflows. The acoustic and aerodynamic performances were found to be dependent on the geometry of the test configurations. Choking in an uncambered IGV resulted in a noise reduction of 49 dB for the fundamental frequency. Choking in the offset IGV and in the wave IGV resulted in noise reductions of 21 dB and 34 dB, respectively. The total-pressure recovery for the uncambered IGV was 0.94 out of 1.00, whereas total-pressure recoveries in the choked mode for the offset IGV and the wave IGV were 0.57 and 0.66, respectively. Author

N71-37602# Air Force Systems Command, Wright-Patterson AFB, Ohio.
FLIGHT DYNAMICS; AIRCRAFT TRAJECTORIES
I. V. Ostoslavskii et al 7 Jun. 1971 693 p refs Transl. into ENGLISH from the book "Dinamika Poleta. Trayektorii Letatelnykh Apparatov" Moscow, Mashgiz., 2d edition, revised and enlarged, 1969 p 5-294 and 299-499
(AD-727474; FTD-HC-23-637-70) Avail: NTIS CSCL 01/2

The book presents methods of calctlating flight trajectories of various aircraft and spacecraft. Equations of motion in inertial and noninertial reference systems are derived, along with fundamental laws of flight dynamics and background information on the mathematics of investigation of flight trajectories. Quasi-steady and unsteady motion are examined in relation to

additional kinematic couplings, along with general and variational methods of solving problems in flight dynamics. Methods of calculating elements of trajectories, and takeoff and landing characteristics of aircraft, including ballistic rockets, orbital aircraft, artificial satellites, and spacecraft are given. Methods of calculating the trajectory of ballistic rockets over powered and passive phases is given, along with methods of calculating the trajectory of motion of artificial satellites when injected into orbit. Methods of optixal control of spacecraft are examined briefly. Author (GRA)

N71-37603*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPLORATORY WIND-TUNNEL INVESTIGATION OF DEPLOYABLE FLEXIBLE VENTRAL FINS FOR USE AS AN EMERGENCY SPIN-RECOVERY DEVICE
Sanger M. Burk, Jr. Washington Oct. 1971 33 p refs Film Supplement Number L-1103 to this report is available on loan from NASA, Langley Research Center
(NASA-TN-D-6509; L-7877) Avail: NTIS CSCL 01A

Spin-tunnel tests have been conducted on dynamic models of two fighter airplanes to explore the feasibility of using deployable flexible ventral fins as an emergency spin-recovery device. Various fin configurations, deflections, and locations were tested. The results indicated that the fins provided satisfactory spin recoveries for the models tested. Author

N71-37604# Coordinating Research Council, Inc., New York. Aviation, Fuel, Lubricant and Equipment Research Committee.
THE 1969 CRC AVIATION EMISSION-TREATMENT TECHNIQUE EVALUATION
Mar. 1970 58 p ref
(Rept-430) Avail: NTIS

Methods for sampling, handling, and measuring emissions from aircraft gas turbine engines were evaluated. Agreement among three particulate methods in measuring carbonaceous materials was fairly good. Flame ionization detectors were quite satisfactory for measuring hydrocarbon concentrations in the range of 200 to 300 ppm by volume. The Fisher partitioner and the nondispersive infrared aborption (NDIR) analyzer were well suited for measuring carbon monoxide and carbon dioxide. The phenol disulphonic acid method for measuring nitrogen oxides and the NDIR analyzer for measuring nitric oxide performed well. The 3-methyl 2-benzothiazolinone hydrazone hydrochloride method gave fair results when the engine was operated at low rpm and concentrations of oxygenated materials were in the range of 10 ppm. Traverses of the tail pipe plane showed significant variations in emissions among sampling points. The length of sample hydrocarbon sample line was unimportant, but the use of Teflon rather than stainless steel as line material, high line temperature, and high sample flow rate were all judged desirable. Author

N71-37605# Federal Aviation Administration, Washington, D.C.
STOL: THE AGONY AND THE ECSTASY
Ronald W. Pulling Jun. 1971 31 p refs Presented at the Greater Miami Chamber of Com. V/STOL Conf. Workshop, Miami, Fla., Feb. 1971
(WRCN-2; AV71-2) Avail: NTIS

The nature of intercity travel is discussed, and the historical growth of air transportation is reviewed. Some of the significant factors concerning the air transportation penetration into the intercity travel market are presented and discussed. As a result of this penetration, air transportation now accounts for the majority of commercial passenger miles traveled. Commercial air transportation is short-haul oriented with half of all scheduled flights covering distances of 500 miles or less. Commercial air transportation is also oriented toward areas of high population density, with 11 communities accounting for half of all passenger enplanements. The growth in air transportation has resulted in many acute problem areas such as noise, pollution, and traffic congestion. The population increase and the resulting increase in travel demand over the next 10 years will cause a corresponding increase in the severity of these problems. Author

N71-37606# Royal Aircraft Establishment, Farnborough (England).
CATEGORY 2: A SIMULATION STUDY OF APPROACHES AND LANDINGS AT NIGHT
A. D. Brown Jun. 1970 81 p refs
(RAE-TM-Avionics-59(bleu)) Avail: NTIS

The design, execution and preliminary results of a flight simulator experiment to investigate the problems of aircraft operating in Category 2 conditions are described. Both military and airline pilots participated and over 500 approaches were performed. The effects of decision height, contact time, lateral offset, visual sequence and visual segment on the approach success (ratio of landings to approaches) are examined and a curve relating this parameter to visual segment, the predominant factor, is determined. The influence of different visual sequences on pilot performance during the approach and landing is also considered and some observations are made about the crew techniques employed during the experiment which appeared to have certain deficiencies. A full analysis of the flight path performance and pilot comments was omitted. Author

N71-37607# Tippetts-Abbett-McCarthy-Stratton, Washington, D.C.
AIRCRAFT GROUND OPERATIONS SIMULATION
Peter C. Sih Mar. 1971 24 p Presented at 4th Ann. Simulation Symp., Tampa, Fla., 10-12 Mar. 1971
Avail: NTIS

A description is given of an aircraft ground operations simulation program coded in GPSS/360. The physical elements of the airfield are described in terms of GPSS entities and inputted through GPSS matrix savevalues. The aircraft transactions are generated into the model through deterministic flight schedules projected for the simulated target years. The program logic is related to GPSS block actions. Indirect addressing is used extensively to give the program a flexible structure. Supplementary output to standard utilization statistics includes a computer produced movie film. Author

N71-37608# McDonnell Aircraft Corp., St. Louis, Mo.
SURVIVABLE FLIGHT CONTROL SYSTEM. STUDIES, ANALYSES AND APPROACH. SUPPLEMENT FOR HYDRAULIC POWER AND ACTUATION STUDIES Interim Report, Jul. 1969 - May 1971
Gerald E. Amies, Cecil Clark, Charles L. Jones, and M. Sheppard Smyth Wright-Patterson AFB, Ohio AFFDL 29 Oct. 1971 268 p refs.
(Contract F33615-69-C-1827)
(AD-727763; AFFDL-TR-71-20-Suppl-3; IR-1) Avail: NTIS CSCL 13/7

The Survivable Flight Control System (SFCS) Program is an advanced development program of which the principal objective is the development and flight test demonstration of an SFCS utilizing Fly-By-Wire and Integrated Actuator Package techniques. The studies and analyses conducted to date have sufficiently defined the system requirements to provide a definition of an approach to the implementation of the SFCS. The results of these studies and the definition of the approach are presented in the basic report. The details of the Control Criteria and Control Law Development studies are presented in report supplements 1 and 2, respectively. The details of the Hydraulic Power and Actuation studies are reported in this supplement 3.
Author (GRA)

N71-37609# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
FEASIBILITY STUDY OF A COMBINED LAMINAR AND TURBULENT BOUNDARY LAYER CONTROL SYSTEM

USING DISTRIBUTED SUCTION Final Report, May 1969 - Jan. 1971
Lawrence J. Mertaugh Wright-Patterson AFB, Ohio AFFDL 29 Oct. 1971 83 p refs
(Contract F33615-69-C-1582)
(AD-727767; AASE-71-42; AFFDL-TR-71-47) Avail: NTIS CSCL 20/4

The objective of the investigation was to determine the feasibility of a combined low-drag, high-lift boundary layer control system intended for use in the XV-11A aircraft. The XV-11A is a low-speed aerodynamic research aircraft constructed entirely of glass reinforced plastic. The combined boundary layer control system to provide full chord laminar flow over the wing surfaces in cruise flight and prevent separation of the turbulent boundary layer under conditions of high lift coefficients in the approach configuration will utilize distributed suction over the wing surfaces with the porosity provided by rows of closely spaced suction holes. The evaluation of the laminar system was accomplished on a glove section installed on the wing of a TG-3 glider. GRA

N71-37610# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
PENNSYLVANIA-PRINCETON ARMY AVIONICS RESEARCH PROGRAM: FORMATION FLIGHT
Kenneth A. Fegley Jun. 1971 214 p refs
(Contract DA-28-043-AMC-02411-E)
(AD-727635; ECOM-02411-21) Avail: NTIS CSCL 01/2

The report summarizes the results of a task whose objective was to determine the problems and functional requirements associated with the non-visual formation flight of helicopters. It also gives the requirements of the stationkeeping system required for non-visual formation flight. Author (GRA)

N71-37611# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AUTO PILOT Final Report
10 Jun. 1971 18 p
(AD-727789; MTP-6-3-121) Avail: NTIS CSCL 01/4

Procedures are given for service testing automatic pilots used for control of rotary and fixed wing aircraft. Author (GRA)

N71-37612# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMICS OF THE TU-134
T. I. Ligum et al 29 Jan. 1971 434 p Transl. into ENGLISH from the monograph "Aerodinamika Samoleta Tu-134" Moscow, 1969 p 1-304
(AD-727196; FTD-MT-24-138-70) Avail: NTIS CSCL 01/3

The book states the practical aerodynamics of the new passenger aircraft Tu-134. Construction and aerodynamic peculiarities are described of the aircraft and power plant with D-30 engines. Basic flight conditions during take-off, climb, horizontal flight and landing stability and maneuverability of the aircraft; special cases in flight; loads acting on the aircraft and its strength are discussed. Author (GRA)

N71-37613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNICAL AVIATION HANDBOOK
V. G. Aleksandrov et al 7 Apr. 1971 798 p Transl. into ENGLISH from the monograph "Aviatsionnyi Tekhnicheskii Spravochnik" Moscow, 1969 p 1-495
(AD-727195; FTD-MT-24-126-70) Avail: NTIS CSCL 01/2

The material in this handbook is generalized, systematized and set forth with respect to the following questions: practical aerodynamics; technical operation and maintenance of aircraft (helicopter) airframes, their systems, gas-turbine and piston engines, oxygen and high-altitude equipment, instrument-flying navigation devices; electronic equipment; lubricants employed in the operation and repair of the aviation equipment; wear of components, subassemblies and mechanisms, repair and routine maintenance operations; maintenance of the components and systems of the aircraft, gas-turbine and piston engines, inspection and checking operations, anticorrosive treatments; aviation materials being employed, fuels, lubricants and working fluids; article defects and strength of materials. This handbook is intended for flight and technical-engineering personnel of all branches of aviation, the aviation industry, scientific institutions, students of the higher and intermediate aviation educational institutions. Author (GRA)

N71-37614# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
IMPACT LOADS ON WARPED PLANING SURFACES LANDING ON SMOOTH AND ROUGH WATER Final Report
John A. Mercier Mar. 1971 53 p refs
(Contract N00600-69-C-1072)
(AD-727753; SIT-DL-71-1514) Avail: NTIS CSCL 01/3

The impact of planing surfaces on waves is analyzed according to an extension of the theory for smooth-water impacts in a way that takes account of the influence of wave kinematics. Impacts of the type incurred by seaplanes, in which the weight of the craft is sustained by wing lift, are studied. Data for planing, which is a special case of impact, are used to obtain the needed relationship between virtual mass and hull geometry. Impact tests with two models having different amounts of warp, or longitudinal variation of deadrise, are compared with theoretical calculations. Observations are made concerning the influence of trim, deadrise, beam loading, glide path, warp rate and waves on the initial stages of the impact, when the vertical velocity is practically uniform, on the basis of the derived differential equation of motion. Author (GRA)

N71-37615# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VARIABLE SWEEP. CHAPTERS 1-5
S. Yu. Skripnichenko 25 Feb. 1971 79 p Transl. into ENGLISH from the book "Izmenyayemaya Strelovidnost" Moscow, Izd-vo Min. Oborony SSSR, 1969 p 1-72
(AD-727210; FTD-MT-24-264-70) Avail: NTIS CSCL 01/3

Contents: the aerodynamics of variable-sweep wing; the stability and control of variable-sweep wing; variety of operating conditions - a feature of variable-sweep; flight at low altitudes; short take-off and landing of variable-sweep wing. Author (GRA)

N71-37616# McDonnell Aircraft Corp., St. Louis, Mo.
SURVIVABLE FLIGHT CONTROL SYSTEM. STUDIES, ANALYSES AND APPROACH. SUPPLEMENT FOR CONTROL CRITERIA STUDIES Interim Report, Jul. 1969 - May 1971
Robert L. Kisslinger and Michael J. Wendl Wright-Patterson AFB, Ohio AFFDL May 1971 201 p refs See also Supplement 3; AD-727763
(Contract F33615-69-C-1827)
(AD-727762; AFFDL-TR-71-20-Suppl-1; ir-1) Avail: NTIS CSCL 01/3

The Survival Flight Control System (SFCS) Program is an advanced development program of which the principal objective is the development and flight test demonstration of an SFCS utilizing fly-by-wire and integrated actuator package techniques. The studies and analyses conducted to date have sufficiently defined the system requirements to provide a definition of an approach to the implementation of the SFCS. The results of these studies and the definition of the approach are presented in the basic report. Details of the Control Law Development, and Hydraulic Power Actuation studies are presented in report supplements 2 and 3, respectively. The results of the Control Criteria studies are presented in this supplement. Author (GRA)

N71-37617# School of Aerospace Medicine, Brooks AFB, Tex.
PILOTS, TAKE HEED OF BIRDS

V. S. Lavrik et al 1971 101 p refs Transl. into ENGLISH of the book "Letchik, Vnimaniye-Ptitsyl" Moscow, 1970
(AD-727881; SAM-TT-R-1093-0771) Avail: NTIS CSCL 01/2

Contents: analysis of statistical data on cases of collision of aircraft with birds; analysis of physical discoveries, observed when aircraft and birds collide, and basic types of damage to aviation equipment; measures for preventing collisions of aircraft with birds. GRA

N71-37618# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROCKET CARRYING AVIATION (SELECTED CHAPTERS)
A. N. Ponomarev 2 Mar. 1971 281 p refs Transl. into ENGLISH from the book "Raketsonosnaya Aviatsiya" Moscow, Izd-vo Ministerstva, 1964 p 1-23; 99-340
(AD-727860; FTD-MT-24-258-70) Avail: NTIS CSCL 19/7

Contents: aircraft; air navigation and takeoff and landing aids; flight support at high altitudes and equipment for rescuing the pilot (crew member) in an emergency situation. GRA

N71-37619# Naval Air Development Center, Johnsville, Pa. Aero structures Dept.
STRUCTURAL INTEGRITY INVESTIGATION OF REWORKED S-2 CORRUGATED WING SKIN PANELS
H. Lystad and Louis Berman 1 Apr. 1971 40 p refs
(AD-728009; NADC-ST-7107) Avail: NTIS CSCL 01/3

Laboratory fatigue tests were performed on reworked S-2 corrugated wing skin panels to determine the effect on the structural integrity of skin material removal due to corrosion damage. Reworking of the S-2 aircraft corrugated wing skin panels, as performed by the Naval Air Rework Facilities, to remove corrosion damaged material, does not adversely affect the structural integrity of the panels. Author (GRA)

N71-37621# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF DAZZLE ON ELECTRONIC DISPLAY [EINFLUSS DER BLENDUNG AUF DAS ERKENNEN ELEKTRONISCHER ANZEIGEN IN KANZELN MODERNER HOCHLEISTUNGSFLUGZEUGE: KURZFASSUNG]
P. Jainski Mar. 1971 27 p Transl. into ENGLISH of Ger. Federal Min. of Defence report T-808-I-203
(RAE-Lib-Trans-1545; T-808-I-203) Avail: NTIS

The performance of pilots in testing electronic head-up and head-down display systems is discussed. Measurements were made of the dazzle effect in the cockpit of high performance aircraft during daylight conditions. The measuring criteria include wength of display from subject, color used on symbols, and intensity of light. Results indicate red to be particularly suitable for recognition of display symbols and that the head-down display is favored over the head-up display. E.H.W.

N71-37682# Civil Aeromedical Inst., Oklahoma City, Okla.
AURAL GLIDE SLOPE CUES: THEIR EFFECT ON PILOT PERFORMANCE DURING IN-FLIGHT SIMULATED ILS INSTRUMENT APPROACHES
A. Howard Hasbrook and Paul G. Rasmussen May 1971 27 p refs
(FAA-AM-71-24) Avail: NTIS

Forty instrument rated commercial and ATR pilots with 250 to 12,271 flight hours each flew ten simulated ILS approaches in a single engine, general aviation aircraft. Divided into five groups, each group used a different glide slope cue display in combination with a modified T instrument panel configuration. Two types of aural glide slope cue displays were utilized: (1) voice, and (2) Morse code signals. No significant differences were found among the five groups relative to accuracy in glide slope tracking. There was no apparent improvement with practice. The presence of aural glide slope cues resulted in the aircraft being flown slightly higher across the middle maker than when only the conventional visual display was utilized. Localizer performance showed a slight but significant initial decrease in the presence of aural glide slope cues with respect to only one performance measure. Transition from the conventional visual cross-pointer display to the aural (voice) glide slope cues was achieved with a minimum of familiarization and with no apparent difficulty. Author

N71-37707# Naval Research Lab., Washington, D.C.
A VERSATILE C BAND RADAR TRANSMITTER
W. T. Davis, N. R. Mills, and J. A. Weston Jun. 1971 38 p
(AD-727086; NRL-MR-2278) Avail: NTIS CSCL 17/9

The C band transmitter is one of the four radar transmitters which are included in the Four-Frequency Radar System. The Four-Frequency Radar in its entirety is an airborne system capable of measuring target characteristics and terrain backscatter, and has been used in the synthetic aperture mode to map sea ice, waterborne oil pollution, and land and sea surfaces. The four radar transmitters operate at P/UHF (428 MHz), L band (1228 MHz), C band (4455 MHz), and X band (8910 MHz). Previous attempts to produce the required power and versatility at C band netted only partial success, and in due course, it was decided to replace and update the C band transmitter. A new transmitter has been produced by NRL and installed as a part of the airborne Four-Frequency Radar System. The new transmitter uses an electrostatic focused Klystron and meets its design goals while having approximately one-half the weight and cubic displacement of the older transmitter. The Four-Frequency Radar is a valuable research tool and the addition of a stable dependable transmitter in the C band region gives it the balance and continuity envisioned in its inception. Author (GRA)

N71-37712# National Resource Analysis Center, Washington, D.C. Information Systems Div.
ALTERNATIVE ATC CO-CHANNEL SEPARATION CRITERIA BASED ON PROBABILITY-OF-INTERFERENCE CONSIDERATIONS
Richard H. Wilcox and Marvin E. Hoepken Aug. 1970 26 p refs
(IST-101) Avail: NTIS

Current air traffic control standards for separation between locations using the same frequency are discussed. Two aspects are considered: relative signal strength differential between interfering signals, and conditions under which this differential is applied to determine acceptable ground transmitter separations. The general geometrical relationships among controlled aircraft and their respective ground transmitters are considered in order to permit analysis of the probability of interference occurring which exceeds the differential specified. High altitude enroute control is used as a vehicle for developing specific analysis procedures and resulting quantitative results. It appears that use of probability-of-interference criteria, instead of worst case, would permit reductions in co-channel RCAG separations sufficient for a minimum increase of 50 percent in use of any given frequency; if lesser signal strength differentials were accepted and normal sector traffic were considered, improvement by a factor of six might be possible for high altitude enroute service. Extension of the method to other classes of ATC service should be straightforward. Substitution of probability-of-interference criteria for separation standards represents a desirable approach to improvement because safety is not compromised. Author

N71-37723# Scope Electronics, Inc., Reston, Va.
VOICE INITIATED COCKPIT CONTROL AND INTERROGATION (VICCI) SYSTEM TEST FOR ENVIRONMENTAL FACTORS Final Report, 16 Feb. 1970 - 30 Apr. 1971
James W. Glenn, Ronald N. Gordon, and Gabriel Moschetti 30 Apr. 1971 112 p refs
(Contract N00019-70-C-0426)
(AD-727574) Avail: NTIS CSCL 17/2

The objectives of the contract were to investigate the effects of the pilot's acoustic environment, optimize system

parameters for operation in the cockpit environment, provide system performance statistics, and investigate the availability of on-board computing systems which may be utilized. Voice data were recorded in aircraft cockpits and in an altitude test chamber. These data were analyzed to determine the effects of the environment and of physiological stresses experienced by the speakers. The results of the analyses determined modifications to be made to a simulated voice control system. The recorded data were then processed by the simulated system to obtain performance statistics. Lack of positive control over environmental variables and the inability to provide an immediate indication of system response to the speaker resulted in a data base inadequate to support statistically significant results. However it was noted that the main sources of interference to reliable speech recognition in the cockpit environment are sounds made by the pilot's oxygen supply equipment and his own breathing sounds. Methods for accommodating such sources ar suggested. Author (GRA)

N71-37742# Information Processing Association of Israel, Jerusalem.
PROCEEDINGS OF THE NATIONAL CONFERENCE ON DATA PROCESSING
Asa Kasher, ed. (Bar-Ilan Univ.) 1970 478 p refs Partly in ENGLISH; partly in HEBREW Conf. held in Tel-Aviv, 12 Oct. 1970

Avail: NTIS HC $6.00/MF $0.95

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N71-37744# Eurosystem, Paris (France).
MADAP: A COMPUTERIZED AIR-TRAFFIC CONTROL SYSTEM c21
Leon Borocin *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E19-E33

Avail: NTIS HC $6.00/MF $0.95
MADAP - Maastricht Automatic Data Processing and Display System in a real time system intended to facilitate the air traffic control in the upper airspace of a region covering Belgium, Luxemburg, the Netherlands and the Federal Republic of Germany. The goal as the system is to help the human controller in memorizing all the elements of the situation, to present synthetic information for quick decision making, and to initiate a warning when a decision has to be made. The system uses for input flight plans, radar data, meteorological data, and radio links with aircrafts. Its subfunctions are divided in such a way that each corresponds to a programming module of three to four thousand instructions. An extension of the system is projected by replacing older computers with newer hardware having strong storage facilities. G.G.

N71-37765# Naval Air Systems Command, Washington, D.C.
ADVANCED AVIONIC DIGITAL COMPUTER DEVELOPMENT PROGRAM Progress Report
Ronald S. Entner 1 Jul. 1971 108 p refs
(AD-727607; PR-8) Avail: NTIS CSCL 09/2
The report contains the following: Preliminary statement of work for an analytical study to establish the feasibility of a tactical interactive programming facility; Summary sheets of AADC program review; Papers entitled, the programmer as a computer designer; AADC status report; Storage technology and advanced computer architecture; Agenda of the advanced digital technology conference. GRA

N71-37766# Naval Air Systems Command, Washington, D.C.
ADVANCED AVIONIC DIGITAL COMPUTER DEVELOPMENT PROGRAM Progress Report
Ronald S. Entner 4 Feb. 1971 52 p refs
(AD-727605; PR-7) Avail: NTIS CSCL 09/2
Contents: AADC bibliography; Preliminary statement of work for a high level programming language development; On software modularity. GRA

N71-37772# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONVERSION OF SEVERAL COMPUTATIONAL ALGORITHMS FOR DECREASING THE LENGTH OF THE WORD FORM AT OF CONTROL COMPUTERS FOR AIRCRAFT
I. N. Kornet et al 3 Mar. 1971 9 p Transl. into ENGLISH from Samoletostr. Tekhk. Vozdush. Flota (USSR), no. 14, 1969 p 21-24
(AD-727917; FTD-HC-23-865-70) Avail: NTIS CSCL 09/2
The report discusses the transformation of certain computational algorithms to a form convenient for computer adaptation. It is shown that, by reducing an algorithm to a form that makes it possible to obtain the values of a function from its increments, the length of the digital network of the computer can be shortened with a very small accuracy penalty. This is of particular importance in the case of aircraft computers, as it simplifies their structure and reduces the speed requirements. Author (GRA)

N71-37774# Royal Aircraft Establishment, Farnborough (England).
TUT-3: A COMPUTER PROGRAM FOR SIMULATING THE ATTACK OF LOW FLYING AIRCRAFT BY ANTI-AIRCRAFT MISSILES [MASKINPROGRAM FOER SIMULERING AV LV-ROBOT MOT LAGT FLYGANDE FLYPAN]
J. Palme et al May 1971 17 p refs Transl. into ENGLISH from FOA-P rept., C 8188-13, 1968
(RAE-Lib-Trans-1578) Avail: NTIS
Intervisibility distances are distances along the aircraft's flight course where there exists alternately a line of sight and no line of sight. The means by which these distances are obtained are described in a separate report. The computer program to be described in this paper uses these intervisibility distances, obtaining them either from magnetic tape, or alternately generating them from a built in Monte Carlo type subroutine. TUT-3 computer program simulates an anti-aircraft defence with the aircraft flying along a course divided into intervisibility distance. Results are given in the form of average number of engagements per shot. In the simulation, the aircraft is assumed to be flying at constant speed along a straight-line course. The missile is assumed to fly on an intercept path, i.e. towards a point ahead of the aircraft. The missile acceleration can if necessary be varied

in the time of flight. The time for a relaunch after an interception, or after a line of sight interruption may be fed in as a constant or as a probability with some time distribution.
Author

N71-37792# Westinghouse Research Labs., Pittsburgh, Pa. Astronuclear Lab.
HIGH TEMPERATURE ELECTRONICS Final Technical Report, 11 Nov. 1969 - 15 May 1971
R. B. Campbell, H. S. Berman, W. D. Loftus, and C. E. Hardies Jul. 1971 80 p refs
(Contract F33615-70-C-1053)
(AD-727761; AFAPL-TR-71-46) Avail: NTIS CSCL 09/5

The fabrication of a silicon carbide (SiC) junction field effect transistor (J-FET) was shown practicable. Several amplifier designs were breadboarded with silicon devices to study the required parameters. A simplified building block amplifier was constructed and tested. Author (GRA)

N71-37820# *Federal Aviation Administration, Washington, D.C.*
MEASUREMENT OF RUNWAY FRICTION Minutes of Meeting
15 Apr. 1971 189 p refs Conf. held in Washington, D. C., 2-3 Feb. 1971
(FS-160-65-68-2) Avail: NTIS

Four basic problems associated with wet, icy, and slush or snow covered runways were identified as aircraft stopping distance, aircraft directional control in a crosswind, engine ingestion effects, and slush drag effects. The first two of these problems were treated in detail. Nine influences on aircraft stopping distance and seven influences on directional control were listed and the effects of each were discussed. Statistics were presented on veer-off and overrun accidents for the 1967 to 1969 period. Traction test data were presented to illustrate the effect of rubber deposits on slipperiness of normal, grooved, and sealed runways. The procedings are summarized and the minutes of the discussion session are included. J.G.M.

N71-37821# Naval Ordnance Lab., White Oak, Md.
NOL HYPERVELOCITY WIND TUNNEL. REPORT NO. 2: NOZZLE DESIGN
Walter J. Glowacki 30 Apr. 1971 129 p refs
(AD-727591; NOLTR-71-6; Rept-2) Avail: NTIS CSCL 14/2

The NOL hypervelocity wind tunnel will provide a high Reynolds number turbulent flow simulation in the Mach number range 10 to 20. This facility, much needed for large-scale testing of hypersonic vehicles, will be operational late in 1972. This report presents the detailed procedure used to design three nozzles for the facility. Pressure and temperature effects on the thermodynamic properties of nitrogen are taken into account in both the inviscid core and the boundary layer calculations. The supersonic portion of the inviscid core is calculated by the method of characteristics and the subsonic portion is approximated as a one-dimensional flow. The boundary layer calculation procedure is based on an integral moment of momentum equation and is valid for thick as well as thin boundary layers.
GRA

N71-37823*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
VALIDATION OF A GENERAL PURPOSE AIRBORNE SIMULATOR FOR SIMULATION OF LARGE TRANSPORT AIRCRAFT HANDLING QUALITIES
Kenneth J. Szalai Washington Oct. 1971 73 p refs
(NASA-TN-D-6431; H-591) Avail: NTIS CSCL 14B

A flight simulation program was conducted to validate the general purpose airborne simulator (GPAS) for handling-qualities studies of large transport aircraft in cruise. Pilots compared flying qualities of the XB-70-1 with those simulated on the GPAS during consecutive flights of the two vehicles. In addition, various handling-qualities parameters and time histories for the XB-70 and the airborne simulator were compared to assess simulator fidelity. The GPAS was shown to be capable of accurate and realistic simulation of the XB-70 at two flight conditions (Mach 1.2 at 12,200 meters (40,000 feet) altitude and Mach 2.35 at 16,800 meters (55,000 feet) altitude). In-flight changes to the programed model were required to obtain a satisfactory simulation from the pilot's point of view. In most instances, these changes were necessary to improve model representation of the XB-70 rather than to correct for possible simulator-introduced distortions. Author

N71-37824# Federal Aviation Administration, Washington, D.C.
NATIONAL TRANSPORTATION PLANNING MANUAL (1970 - 1990). MANUAL D: AIRPORTS AND OTHER INTERCITY TERMINALS
Apr. 1971 121 p
(OMB-04-S71002) Avail: NTIS

General instructions relating this manual to the 1972 National Transportation Needs study are presented as well as instructions for the preparation of information related to airports and other intercity terminals. Needs estimates for 1970 to 1990 and capital improvement programs for fiscal years 1974 to 1978 and 1979 to 1990 are discussed. The development of airport needs estimates, capital improvement programs, and reporting requirements are included. Terminal issues and the development of needs estimates and capital improvement programs for other intercity terminals are also covered. Author

N71-37826# *National Aviation Facilities Experimental Center, Atlantic City, N.J.*
DALLAS-FORT WORTH TOWER CAB DESIGN EVALUATION Final Report, Jul. 1970 - May 1971
J. Roy Bradley, Jr. Nov. 1971 19 p
(FAA-NA-71-37; FAA-RD-71-77) Avail: NTIS

The design concept and operational feasibility of an undecagon (11-sided) control tower cab for the new Dallas-Fort Worth Regional Airport are discussed. A report was made on position and equipment arrangements, tower console design, and operational factors resulting from the study. A full-scale plywood mockup of the tower cab and consoles was constructed. After installation of equipments and displays, a 30-day evaluation was conducted. Results indicate that the design concept of the 11-sided tower cab for the Dallas-Fort Worth Regional Airport is valid and that it is highly feasible from an operational aspect. Position arrangements and the console design are considered excellent. An improved equipment arrangement was developed and recommended. Author

N71-37827# Boeing Scientific Research Labs., Seattle, Wash. Aerospace Group.
DESIGN AND OPERATION OF THE BSRL WATER TUNNEL
John N. Olsen Sep. 1971 28 p refs
(D180-14130-1) Avail: NTIS

The design, construction, and performance of a water tunnel for two-dimensional testing of pitching airfoils is described. The test section is 4.5 inches x 12 inches x 36 inches long. The tunnel can run at 40 feet/second, but cavitation may even occur at lower speeds depending on the pressure coefficients on the model. A practical limit for say an NACA 0012 airfoil is 20 feet/second if cavitation is to be avoided. The velocity profile is uniform within at least 1% and the turbulence level is below .15%. Author

N71-37835*# Hamilton Standard, Windsor Locks, Conn.
DEVELOPMENT OF ATMOSPHERIC GUST CRITERIA FOR SUPERSONIC INLET DESIGN Final Report
Frank W. Barry Dec. 1968 205 p refs
(Contract NAS2-4515)
(NASA-CR-114372; HSER-5195) Avail: NTIS CSCL 20D

A method was developed for relating transient tolerances in inlet throat Mach number and shock position to the frequency of unstarts of a supersonic inlet due to atmospheric disturbances.

Data on high-altitude atmospheric turbulence was collected and evaluated. A general linear analytical model was developed to compute changes in inlet throat Mach number and shock position. The relation of inlet transient tolerances to propulsion system performance is presented. A stepwise procedure for relating frequency of inlet unstarts to transient tolerances is given and applied to a representative example. Author

N71-37836*# Pratt and Whitney Aircraft, East Hartford, Conn.
SINGLE STAGE EVALUATION OF HIGHLY LOADED HIGH MACH NUMBER COMPRESSOR STAGES. 4: DATA AND PERFORMANCE OF HUB SLIT SUCTION STATOR
G. D. Burger and G. Bogardus 10 Nov. 1971 133 p refs
(Contract NAS3-10482)
(NASA-CR-120802; PWA-4186) Avail: NTIS CSCL 20D

A single stage compressor with a rotor tip speed of 1600 fps and 0.5 hub/tip ratio was used to demonstrate the effects of boundary layer suction through slits at the intersection of the stator suction surface and the hub wall. No efficiency benefit was obtained at design speed; 1.5 percentage points improvement was obtained at part speed. Maximum design speed stage efficiency of 82.7 percent was obtained at a pressure ratio of 1.935. Accounting for rotor work on the flow bled through the stator hub slit decreases this efficiency 0.5 percent. Author

N71-37850# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A WEAKLY SUPERSONIC FLOW AROUND THIN BODIES
S. V. Falkovich et al 12 Mar. 1971 21 p refs Transl. into ENGLISH from Transzvukovye Tech. Gaza (USSR), 1964 p 9-21
(AD-727854; FTD-HT-23-31-71) Avail: NTIS CSCL 20/4

A two-dimensional steady gas flow past a thin symmetrical body is studied under the assumption that the mach number at infinity is close to unity. The continuous nature of shock-wave formation during transition from sonic to supersonic flow is established mathematically. This solution also explains the 'bursts' in the values of the current function calculated by Vincenti and Wagoner. As a result of the numerical calculations, the first 20 coefficients are found and the transition to plane (x,y) is made. GRA

N71-37851# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
USE OF A REFINED BOUNDARY-LAYER CALCULATION METHOD TO CALIBRATE A SIMPLE ONE
P. Bradshaw Oct. 1971 12 p refs
(IC/71/23) Avail: NTIS

A technique is described which enables refined standards of accuracy to be obtained from a simple boundary layer calculation method, over a small range of pressure distributions near the one used for calibration. The technique can be applied to multi-run problems such as parametric studies or the iterative calculation of aerofoil pressure distribution with allowance for viscous effects. Author

N71-37853# Aircraft Research Association, Ltd., Bedford (England).
SOME MEASUREMENTS OF POROUS TUNNEL WALL INTERFERENCE IN THE ARA 8 FOOT BY 9 FOOT TUNNEL
E. C. Carter Sep. 1971 28 p refs
(ARA-19) Avail: NTIS

Results are presented of measurements made in a 8ft x 9ft transonic tunnel to determine the constraint and blockage corrections at subsonic Mach numbers. Corrections were determined initially for a transport type of model at Mach numbers up to 0.88. These indicate the existence of a simple upwash constraint factor invariant with Mach number and equal to 50% of the open tunnel value, a zero blockage correction, and a blockage buoyancy correction equal to 50% of the theoretical value calculated for the wall characteristics giving zero blockage. This latter 50% factor is associated with the graded porosity opposite the forward part of the model. These corrections were applied to results in the porous section obtained on a very different type of model - a large canard configuration with low drag-rise Mach number. These corrected results were compared with tests on the model in the tunnel with closed walls. Agreement in lift and drag is generally very good. Author

N71-37862*# Michigan Univ., Ann Arbor. Infrared and Optics Lab.
WATER-DEPTH MEASUREMENT BY WAVE REFRACTION AND MULTISPECTRAL TECHNIQUES Technical Report, 1 Jul. 1969 - 30 Sep. 1970
W. L. Brown, F. C. Polcyn, A. N. Sellman, and S. R. Stewart Aug. 1971 49 p refs
(Contract NAS9-9784)
(NASA-CR-123194; WRL-31650-31-T) Avail: NTIS CSCL 20F

Two remote sensing techniques which measure water depth were investigated. One technique involves photographic observation of wave refraction phenomena and of wave length changes measured in Fourier transforms. The transforms were obtained by optical processing. Test sites near Puerto Rico and Barbadoes were used to study wave changes which occur near nonuniform bottom profiles of shallow reefs. The second technique makes use of multispectral scanner to measure radiation reflected from the ocean floor. Measurement occurs in several spectral intervals in the visible region. The depth is calculated when the ratio of signals in pairs of spectral bands is taken. The technique was tested for sloping sandy beach gradients, as well as for coral reef areas which contained a variety of materials of different reflectances. Examples of computer-generated depth maps are included. Author

N71-37896# Deutsche Lufthansa Aktiengesellschaft, Hamburg (West Germany).
PROBLEMS OF AIR NAVIGATION c21
J. P. Hach *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 6 p

Avail: NTIS HC $6.00/MF $0.95

Problems in air navigation from the airline operations point of view are presented. Aids to final approach and landing, short distance aids, and long distance aids are also discussed. ESRO

N71-37922# Nova Univ., Dania, Fla. Physical Oceanographic Lab.
DEVELOPMENT OF AN OPERATIONAL SYSTEM FOR MEASURING OCEAN SURFACE CURRENT FROM AIRCRAFT Final Report
William S. Richardson May 1971 17 p
(Contract DOT-CG-10737-A)
(AD-726568) Avail: NTIS CSCL 08/3

The report contains the development of an operational system which permits surface current measurements (and, incidentally, volume transport measurements per unit width) to be made in the ocean from aircraft. It is assumed that this method will have applications to the Coast Guard's efforts in search and rescue and in pollution monitoring. An inexpensive, expendable probe is launched from the airplane and, on conzacting the sea surface, a dye package separates and floats on the surface. The remainder of the probe is carried to the bottom by its weight and from its fixed location on the bottom releases two floats at separate, predetermined times. The floats return to the surface under their own buoyancy. At the surface the three parts (surface marker and two floats) emit florescent dye which can be photographed or otherwise relatively positioned. Author (GRA)

N71-37924# Florida Atlantic Univ., Boca Raton. Remote Sensing and Interpretation Lab.
TIDEWATER SHORELINES IN BROWARD AND PALM

BEACH COUNTIES, FLORIDA: AN ANALYSIS OF CHARACTERISTICS AND CHANGES INTERPRETED FROM COLOR, COLOR INFRARED AND THERMAL AERIAL IMAGERY
L. Alan Eyre Jun. 1971 30 p ref
(Contracts N00014-67-A-0320-0003; Nonr-4761(00))
(AD-727630; TR-11) Avail: NTIS CSCL 14/5

In South Florida, pressures to extend and modify tidewater shorelines are very strong. These modifications include canal excavations, dredging and filling, bulkheading, erection of sea walls, and dock construction. Access to tidewater is much coveted and competition for such access is keen. Using color infrared aerial photography flown at 5000 ft., eight types of tidal shorelines are distinguished in a portion of NASA Test Site 164. Comparisons are made with other imagery, including high-altitude (60,000 ft.) photography and that from the Reconafax and Bendix Thermal Infrared sensor systems; and the degree to which these shoreline types are observable is noted. Some changes over time are also indicated, in particular the extent of additional modifications during a period of approximately one year. Author (GRA)

N71-37928*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME CONSIDERATIONS IN THE SELECTION OF AIRCRAFT FOR EARTH RESOURCE OBSERVATIONS
Roger D. Arno and Jerry M. Deerwester Washington Oct. 1971 18 p refs
(NASA-TM-X-2418; A-4046) Avail: NTIS CSCL 08G

The logistics problems and cost aspects of earth resource surveys using various types of aircraft are discussed. Eight categories of aircraft (from piston engine to large jet) as well as commercial air carriers are examined on the basis of quantity needed, coverage afforded, and annual program cost. Independent parameters in the analysis include (1) the requirements of a typical group of resource features, (2) number and location of bases, (3) cloud cover uncertainty, and (4) aircraft cost and the parametric influence of payload associated costs. The results obtained in this analysis show an advantage in cost and rate of coverage for a special fleet of twin engine turbojets over all other aircraft options. Special fleets of turboprop, large turbojet, piston engine planes and commercial air carriers were found to be inferior, principally because of the greater number of aircraft required to achieve comparable coverage. To illustrate, to cover 45 to 95 percent of the resources considered about every two weeks, the special fleet of twin-engine jets requires 6 to 30 aircraft, while the commercial air carrier numbers range from 36 to 180 for coverage ranging from 40 to 80 percent. Annual progjam operating costs would appear to run between $2 and $10 million plus the costs associated with payload and data handling. Total costs might average between $10 and $100 million annually. Author

N71-38013# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
COMPARISON OF INFORMATION CONTENT OF SPACE PHOTOGRAPHY AND LOW ALTITUDE AERIAL PHOTOGRAPHY Final Report
Lewis H. Shapiro Jun. 1971 47 p refs
(Contract Di-14-08-001-12682)
(IR-USGS-229; USGS-DO-71-012) Avail: NTIS

Three problems are discussed. First it is shown, through the use of information theory, that the capability of space photography to transmit information compares favorably to that of conventional aerial photography. Secondly, results indicate that there is a *significant overlap between the size of the smallest features* which can be identified on the space photography and the larger features which can be identified on low altitude photography at scales of less than 1:15,000. Last is the determination of the geologic information content of space and conventional aerial photography. Author

N71-38022*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF MAINSHAFT SEALS FOR ADVANCED AIR BREATHING PROPULSION SYSTEMS, PHASE 3 Final Report
V. P. Povinelli and A. H. McKibbin 25 Jul. 1971 111 p refs
(Contract NAS3-7609)
(NASA-CR-72987; PWA-4263) Avail: NTIS CSCL 11A

Five self-acting gas-film face seals for advanced gas-turbine engines were analyzed and four were tested. All five seal designs incorporated shrouded Rayleigh step lift pads at the primary seal surfaces to provide the gas-film lubrication. The wide pad and revised narrow pad seal were successfully operated at seal sliding speeds up to 500 ft/sec(17,300 rpm), pressure differential up to 300 psi, and gas temperatures up to 1200 F. The air leakages for both seals were in good agreement with calculated values and were about 1/10 of leakages expected from labyrinth seals at comparable conditions. The operating range of the narrow pad seal was limited due to insufficient film thickness. The ceramic seal suffered damage due to chipping during testing. Author

N71-38032# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN OF COMPRESSORS: AERODYNAMIC CALCULATIONS
A. N. Sherstyuk 26 May 1971 337 p refs Transl. into ENGLISH from the book "Osevye Kompressory: Aerodinamicheskii Raschet" 1955 p 1-250
(AD-727191; FTD-HC-23-781-70) Avail: NTIS CSCL 13/7

The book sets forth the foundations of the theory and design of axial compressors. Particular attention is devoted to compressors of stationary installations. The book is intended for engineers who design axial compressors. In addition, the book can be used by students in higher technical training institutions. GRA

N71-38132# Dow Chemical Co., Midland, Mich.
LATEX MODIFICATION OF FAST-FIX C-1 CEMENT FOR THE RAPID REPAIR OF BOMB-DAMAGED RUNWAYS Report for 16 Apr. 1970 - 12 May 1971
R. Eash and G. M. Hart May 1971 204 p refs
(Contract DACA39-70-C-0022)
(AD-727728; AEWES-TR-C-71-1) Avail: NTIS CSCL 11/3

The report consists, essentially, of two parts: a state-of-the-art review and laboratory testing of the effects of adding two Dow polymeric latexes to Fast-Fix C-1. The state-of-the-art review covers several basic studies in which many materials, both organic and inorganic, were investigated. The study was then focused on the study of fast-setting inorganic cements and methods to obtain high strength concrete, silicate concrete, and cementitious ceramic materials, are also covered. The state-of-the-art review also has a section indicating areas in which *fast-setting cements can serve and the requirements* placed on this service. Topics covered are runway design, pavement requirements, pavement evaluation, surface repair, and cold weather construction. In the lab study, two polymeric latexes, Dow Latex 460 and Dow Latex 464, were incorporated at selected concentrations in Fast-Fix C-1 mortars. Tests were conducted to determine freeze-thaw durability, tensile strength, compressive strength, flexural strength, and shear bond. All latex concentrations improved bond strength and freeze-thaw durability and decreased 24-hour water absorption. All concentrations tended to retard set and early strength gain. Low concentrations (4%) of Latex 464 produced a modest improvement in compressive and flexural strengths, but no change in the elastic modulus. Author (GRA)

N71-38133# Southern Research Inst., Birmingham, Ala.
DEVELOPMENT OF RAIN-EROSION-RESISTANT COATINGS FOR HIGH SPEED AIRCRAFT Final Report, 15 Jan. 1970 - 14 Jan. 1971
A. C. Tanquary, Robert E. Burks, Jr., and M. Virginia Jackson Mar. 1971 41 p *refs*
(Contract N00019-70-C-0330)
(AD-727750; A-579-2406-6) Avail: NTIS CSCL 11/3

A polymer prepared as a prospective rain-erosion-resistant coating from hexafluoroacetone, propylene, and bis(dimethylamino)-dimethylsilane had a glass-transition temperature of -50C, and it had good resistance to heat and aliphatic or aromatic hydrocarbons. However, it was not successfully cured to an elastomer. A polymer prepared from 1,4-bis(dimethylhydroxysilyl) benzene and bis(dimethylamino)dimethylsilane had a glass-transition temperature of -62C, excellent thermal stability, but less resistance to hydrocarbons than the fluoropolymer. It was cured to a tough elastomer at room temperature. The coating otained when this elastomer was sprayed onto air-foil test specimens was found to have much greater resistance to simulated rain erosion at ordinary temperatures than a silicone coating and slightly less than neoprene. It suffered no degradation on being heated 4 hours at 250C, as indicated by sand-erosion tests. Author (GRA)

N71-38149# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SMALL SCALE FIRE TESTS OF HIGH TEMPERATURE CABIN PRESSURE SEALANT AND INSULATING MATERIALS Final Report, 1970 - 1971
Constantine P. Sarkos Nov. 1971 37 p refs
(FAA-NA-71-22; FAA-RD-71-67) Avail: NTIS

A 2 sq ft stainless steel panel was constructed with the same dimensions between the fuselage skin and cabin wall as those of a titanium fuselage previously exposed to an external fuel fire. The panel was subjected to a 2 gal/hr kerosene burner which simulates the heat flux and temperature from a large JP-4 fuel fire. Testing of the panel utilizing the same materials found in the titanium fuselage caused phenomena and temperature distribution very similar to those observed during the full-scale test, thus giving credence to the test method as being representative of what would occur to a titanium or stainless-steel aircraft during a post-crash fire. Two commercially available high-temperature insulations tested without any sealant maintained survivable conditions for at least 15 minutes. Viton, a hydrofluorocarbon elastomer, was found not to flame or cause a flash-fire under conditions which silicone did. The propensity of the formation of a flash-fire was strongly influenced by the compactness of the insulation and the presence of any voids or passageways between the fuselage skin and cabin wall interface. Author

N71-38210# Royal Aircraft Establishment, Farnborough (England).
SEVENTH MEETING OF THE NAT SYSTEMS PLANNING (SPANISH DELEGATION)
Apr. 1971 88 p Transl. into ENGLISH from the Spanish report (RAE-LIB-TRANS-1580) Avail: NTIS

Details are given of the aircraft traffic over the North Atlantic for the years 1966 to 1969. An estimation of the minimum time routes to North America is made together with a comparative study of flights at various Mach numbers and below level 310. Penalties are given for deviations of 2 deg in latitude from these minimum time routes. In a mathematical study, the numbers of tracks necessary for the period 1970 to 1980 are worked out, leading to work on track compensation and the establishment of the NAT structure for each characteristic meteorological situation, with particular emphasis on an equable distribution of penalties between users from various geographical regions. Author

N71-38211# National Bureau of Standards, Washington, D.C. Signal Lighting Group.
DEVELOPMENT, TESTING, AND EVALUATION OF VISUAL LANDING AIDS Consolidated Progress Report, 1 Jan. - 31 Mar. 1971
1 Jul. 1971 12 p refs Sponsored by the Navy and FAA
(NBS-10604) Avail: NTIS

Continuing research of visual landing aids is reported and includes the results of studies on: (1) visibility meters and their application, and (2) airfield lighting and marking. The operational performance of two models of backscatter visibility meters is described, and modifications made to enhance their performance are discussed. Another research effort involved an analysis of sky luminance measurements as a consideration of factors affecting the visual range of runway lights. An investigation was made to determine the performance characteristics of selected organic coatings for use on panels of control tower consoles. The coatings systems were tested for abrasion resistance, adhesion, and stain resistance. Tables are presented of the results obtained. In another study, the performance of a narrow-beam deck floodlight using a 400-watt high pressure sodium lamp was evaluated. The characteristics of the lamp as compared to those of incandescent fixtures is discussed. D.L.G.

N71-38213# Federal Aviation Administration, Washington, D.C. Office of Aviation Economics.
FAA PROGRAM EFFECTIVENESS AND FACILITY CRITERIA. AN ANALYSIS OF THE COSTS AND EFFECTIVENESS OF AIR TRAFFIC CONTROL TOWERS
James Gansle Apr. 1971 92 p
Avail: NTIS

Analytical data was developed on the effectiveness of VFR control towers. The results of a research effort which was conducted as a special issue study are presented. The analytical substance is included, as well as summaries of two interim reports prepared earlier and a summary of a draft report by the National Bureau of Standards. The major finding, based on statistical analysis, is that for airports with low and medium amounts of annual traffic, those airports with VFR control towers have a significantly lesser rate of aircraft accidents than airports without towers. Another finding indicates that VFR towers can help to reduce aircraft time in approach and landing at airports. Author

N71-38214# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
SRDS PROGRAM: GOALS, ACHIEVEMENTS, TRENDS, 1 APRIL 1970 - 31 MARCH 1971
31 Mar. 1971 159 p refs
Avail: NTIS

The material is presented in separate chapters for each of the SRDS technical development divisions: Air Traffic Control, Communications, Navigation, Frequency Management, Systems Analysis, and Aircraft. Subprograms are listed in sequential numeric order along with key descriptive words on each effort. Author

N71-38215 Air Traffic Control Evaluation Unit, Bournemouth (England).
AN EVALUATION OF THE AUTOMATIC FLIGHT PROGRESS STRIP CUTTER AND LOADER
A. E. Windebank and T. Anderson Jun. 1971 17 p
(ACTEU-330) Avail: Issuing Activity

The results are presented of performance evaluation tests conducted on the strip cutter and loader machine to determine its acceptibility for use at air traffic control centers. The function of the machine is to cut and load flight progress strips in page form, and it was designed to load into special plastic strip holders which were modified to work with the machine. The evaluation tests consisted of an anlaysis of the percentage of misloaded strips and strips not loaded in comparison with the total number of loads. In addition, cutter wear and the noise level of the machine were assessed. Based on the results, the machine was judged to be acceptable for operational use. D.L.G.

N71-38277*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE NUCLEAR-POWERED SUBSONIC AIRCRAFT FOR TRANSOCEANIC COMMERCE
Frank E. Rom and Charles C. Masser Washington Nov. 1971 47 p refs

(NASA-TM-X-2386; E-6271) Avail: NTIS CSCL 21F

Large subsonic aircraft, greater than 905 metric tons (1000 tons) gross weight, have the potential for hauling transoceanic cargo at rates in the range of $0.008 to $0.036 per metric ton-kilometer ($0.01 to $0.06/ton-n mi) at speeds of 740 to 925 kilometers per hour (400 to 500 knots). It theoretically would take a fleet of 500 such aircraft to handle 1 percent of the forecast world ocean trade in 1980. For gross weights of 3620 metric tons (4000 tons) the cargo rate would be reduced to less than $0.012 per metric ton-kilometer ($0.02/ton mi). It theoretically would take a fleet of over 1000 such aircraft to carry 8 percent of the world transoceanic trade projected for 1980 or 4 percent of the projected trade in 1995. Aircraft with a gross weight of 3620 metric tons (4000 tons) using compact lightweight nuclear reactors show better performance than chemical aircraft for ranges greater than 5565 kilometers (3000 n mi). Nuclear aircraft performance is less sensitive than that of chemical aircraft to the operating and cost assumptions used. Relatively large variations in any of the important assumptions have a relatively small effect on nuclear aircraft performance.
Author

N71-38283*# Hamilton Standard, Windsor Locks, Conn.
RESULTS OF PROP-FAN/STOL WING ACOUSTICS TESTS
T. G. Ganger 29 Jul. 1971 79 p
(Contract NAS1-11019)
(NASA-CR-111956; HSER-5910) Avail: NTIS CSCL 20A

The results of a test conducted to determine the noise characteristics of a STOL wing with externally blown flaps in the vicinity of an aircraft propulsor are summarized. The STOL wing used for these tests was a 0.43 scale model with 60 deg and 0 deg flap capabilities; however, this wing system was not an optimum configuration, nor was it representative of all STOL wing/flap systems. The propulsor used was a low tip speed, high bypass ratio, low pressure ratio, variable pitch prop-fan model. Far field noise data and directional character were determined for a 60 deg and 0 deg flap configuration. In addition, the noise character of the 21 inch diameter prop-fan model without the STOL wing was evaluated.
Author

N71-38530# Dynamic Science, Irvine, Calif.
SUPERSONIC COMBUSTION CHEMISTRY AND MIXING OF HIGH ENERGY DENSITY FUELS RELATED TO ADVANCED AIR-BREATHING ENGINE DESIGN Final Report
Stuart Hersh 30 Apr. 1971 45 p refs
(Contract F44620-70-C-0061)
(AD-727782; SN-209) Avail: NTIS CSCL 21/2

The program is directed towards answering the following question. Given a boron combustible particle of known initial size and composition moving at a high relative velocity in a gaseous medium, how are the combustion behavior and particle dynamics influenced by the particle/gas relative velocity, gas composition, temperature, and pressure anticipated in operational combustors? The role of the shock tube in answering this question is discussed. An 'ideal' experiment is postulated and several possible practical experimental techniques are assessed relative to this standard. To aid in the assessment of the practicality of an experimental technique, a computer program was developed to compute particle trajectories for shock tube flows. Some preliminary experiments aimed at establishing the applicability of a reflected shock technique to the measurement of burning particle drag coefficients were carried out. The results of these experiments yielded very high values of the drag coefficient. At the present time, it is not known if this result was due to the roughness of the particles, static charge effects, the effect of combustion or the preliminary nature of the experiments. In all probability a combination of the above factors is involved.
Author (GRA)

N71-38531# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION FUELS, LUBRICANTS AND SPECIAL LIQUIDS
A. F. Aksenov 14 May 1971 367 p refs Transl. into ENGLISH of the book "Aviatsionnye Topliva, Smazochnye Materialy i Spetsialnye Zhidkosti" Moscow, Izd-vo Transport, 1970 p 1-255
(AD-727199; FTD-MT-24-07-71) Avail: NTIS CSCL 21/4

The report presents the methods of obtaining, the chemical composition of the operational properties, and the methods of controlling the applicable fuels, lubricants, and special liquids. Main attention is paid to the heat of combustion of fuels; to the stability of fuels, oils, of lubricants, and liquids under various operating conditions; to the pumpability of fuels and oils, the corrosion, antiwear, and antiseizing properties. Attention is also paid to fuels for supersonic aviation, promising lubricating materials, including solid lubricants, and promising liquids. The book is intended as a textbook for students of aviation higher educational institutions.
Author (GRA)

N71-38535*# Scientific Translation Service, Santa Barbara, Calif.
REMARKS ON THE PAPER OF M. D. C. WHITTLEY (PAPER NO. 13): SOME ASPECTS OF PROPULSION FOR THE AUGMENTOR WING CONCEPT [SUITE A LA COMMUNICATION DE M. D. C. WHITTLEY (PAPER NO. 13)]
M. H. Schmitt Washington NASA Oct. 1971 10 p Transl. into ENGLISH from Paper Presented at 38th Meeting of AGARD Propulsion and Energetics Panel, Inlet and Nozzles for Aerospace Engines, Sep. 1971 p 1-8
(Contract NASW-2035)
(NASA-TT-F-14005) Avail: NTIS CSCL 21E

A summary of the work in Europe on dilution systems is given which falls into the category of the propulsive wing. The first application was the aircraft ARADO 232 in Germany in 1943. After that, the ONERA in France took on the development of a combined suction and blowing system, beginning with its inception in 1945. Finally, the BERTIN Society in 1959 proposed the false wing system. New techniques of dilution, which have become available, seem to indicate that considerable improvements can be made.
Author

N71-38538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN AND OPERATION OF AIRCRAFT GAS TURBINE ENGINES
N. A. Sherlygin et al 27 May 1971 484 p refs Transl. into ENGLISH of the book "Konstruktsiya i Ekspluatatsiya Aviatsionnykh Gazoturbinnykh Dvigatelei" Moscow, 1969 p 1-371
(AD-727188; FTD-HC-23-519-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 21/5

The textbook presents an analysis of the designs of modern gas turbine engines. It discusses forces acting on the essential units, and their dependence on the operating regimes of the engine and the flight conditions. The construction and the operation of the engine components and parts are described. Methods of calculating safety factors for the most heavily loaded parts are given. Problems of vibration and methods of computing the vibrational load factors for engines are discussed. The operation and construction of the lubrication, fuel supply, start-up, and automatic engine control systems are examined. Brief data are given on the servicing of the engines when in operation.
Author (GRA)

N71-38541# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS TURBINE ENGINES FOR HELICOPTERS
M. M. Maslennikov et al 24 Jun. 1971 488 p refs Transl. into ENGLISH of the publ. "Gazoturbinnyye Dvigateli dlya Vertoletov" Moscow, Mashinostr., 1969 p 1-380
(AD-727959; FTD-MT-24-141-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 21/5

The first part, basically, elucidates questions connected with the use of gas turbine engines with a free power turbine for helicopters: the characteristics of thermal calculation and the

calculation of characteristics, conditions of synchronizing the operation of the engine and the rotor, the means of adjustment, and the design. Briefly, mainly for purposes of comparison with engines with a free turbine, single shaft engines are also considered. The operating conditions of gas turbine engines on helicopters in service are elucidated. In the second part, questions are considered regarding the use of a jet drive of the rotor of a helicopter both by means of turbojet engines mounted on the blade tips and also by means of turbojet engines mounted on the blade tips and also by means of supplying compressed gas to jet nozzles on the blade tips. This book is intended for technical engineering workers who are engaged in designing and operation of helicopters and helicopter engines. It may also be useful for teachers and students of the respective specialities in aviation technical schools. Author (GRA)

N71-38542# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBUSTION CHAMBERS OF GAS TURBINE ENGINES
Yu. M. Pchelkin 6 May 1971 274 p refs Transl. into ENGLISH of the publ. "Kamery Sgoraniya Gazoturbinnykh Dvigateley" Moscow, Mashinosfro, 1967 p 1-207
(AD-727960; FTD-MT-24-306-70) Avail: NTIS CSCL 21/2

The report is a textbook for students studying power-engineering and machine building and it may also be useful to technical and engineering personnel and to advanced aeronautical engineering students. The book deals with gas-turbine fuels, fuel production, processing properties, and characteristics, combustion, combustion theory and products, combustion-chamber design, construction, and operation. GRA

N71-38552# California Univ., Berkeley. Lawrence Radiation Lab.
AN EXPERIMENTAL MEASUREMENT OF GALACTIC COSMIC RADIATION DOSE IN CONVENTIONAL AIRCRAFT BETWEEN SAN FRANCISCO AND LONDON COMPARED TO THEORETICAL VALUES FOR CONVENTIONAL AND SUPERSONIC AIRCRAFT
Roger Wallace and Michael F. Boyer 25 Feb. 1971 23 p refs Presented at the Symp. on Natural and Manmade Radiation in Space, Las Vegas, Nev., 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20209; Conf-710304-11) Avail: NTIS

By utilizing beta-gamma and NTA photographic emulsions and thermoluminescent dosimeters, measurements of radiation dose were made in conventional jet aircraft. These direct measurements were in fair agreement with computations made using a program that takes into consideration both basic cosmic ray atmospheric physics and the focusing effect of the earth's magnetic field. These measurements also agreed with those made at supersonic jet aircraft altitudes in RB-57 aircraft. It was concluded that both experiments and theory show that the doses received at conventional jet aircraft altitudes are slightly higher than those encountered in supersonic flights at much higher altitudes, when the long time of exposure at the lower altitudes is taken into consideration. Author (NSA)

N71-38626# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 APRIL - 30 JUNE 1971
Jun. 1971 113 p refs
(DME/NAE-1971(2)) Avail: NTIS

CONTENTS:

1. LOW SPEED AERODYNAMICS AND THE SCIENCE COUNCIL'S NATIONAL GOALS R. J. Templin (Natl. Aeron. Estab., Ottawa, Ontario) p 1-20 refs
2. EXPERIMENTS WITH AN ON-LINE PICTURE LANGUAGE T. Kasvand p 21-56 refs
3. THE UNBOUNDED TURBULENT JET AS A TRANSDUCER ELEMENT J. W. Tanney (Natl. Aeron. Estab., Ottawa, Ontario) p 57-87 refs
4. CURRENT PROJECTS p 89-111

N71-38627# National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.
LOW SPEED AERODYNAMICS AND THE SCIENCE COUNCIL'S NATIONAL GOALS c01
R. J. Templin *In* NRC of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1971 Jun. 1971 p 1-20 refs
Avail: NTIS

A simple version of the so-called relevance tree forecasting method was used to relate the Science Council's list of National Goals to relevant research gaps in low speed aerodynamics. The exercise was performed mainly out of curisoity, partly as to the nature of the method itself, and partly as to the results it can produce. The numerical results of the relevance marking system used appear to be sensitive to individual judgment, and may merely indicate which bandwagon the scorer prefers. On the other hand, the relevance tree provides a simple graphic display of the possible connections between specific research areas, and broad national goals. Author

N71-38668*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC HEATING TO THE GRUMMAN SPACE SHUTTLE ORBITERS (ROS-NB1 AND ROS-WB1) AT MACH NUMBER 8.0
A. D'Errico (Grumman Aerospace Corp.) Jul. 1971 78 p
(Contract NAS8-4016)
(NASA-CR-119984; DMS-DR-1154) Avail: NTIS CSCL 22B

The results are presented for a heat transfer wind tunnel test conducted on 0.0067 scale models utilizing the phase-change paint technique. Two delta wing orbiter configurations were investigated. One configuration was tested with a ventral fin on selected runs. Data were obtained for an angle of attack range from 0 to 50 degrees. The test was conducted in a hypersonic wind tunnel at a Mach number of 8.0 and nominal Reynolds numbers per foot of 5 x 10 to the fifth power, 7 x 10 to the fifth power, and 2.0 x 10 to the sixth power. Author

N71-38734*# AiResearch Mfg. Co., Los Angeles, Calif.
LOW-CYCLE FATIGUE EVALUATION FOR REGENERATIVELY COOLED PANELS
C. E. Richard, J. D. Duncan, C. Demogenes, and W. G. Flieder Washington NASA Oct. 1971 72 p refs
(Contract NAS1-50024)
(NASA-CR-1884; Rept-68-4313) Avail: NTIS CSCL 20K

Results of low cycle fatigue evaluations at room and elevated temperatures of Inconel 625 and Hastelloy X, brazed, plate-fin sandwiches suitable for regeneratively cooled structural panel applications are presented and compared with available theory. Also presented are results of supplemental parent metal tensile and fatigue tests. Author

N71-38758*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC HEATING AT MACH 8 OF ATTACHED INFLATABLE DECELERATOR CONFIGURATIONS
Theodore R. Creel, Jr. and Robert Miserentino Washington Oct. 1971 78 p refs
(NASA-TM-X-2355; L-7864) Avail: NTIS CSCL 20M

Heat transfer coefficients on four attached inflatable decelerator (AID) configurations were obtained in a Mach 8 variable-density tunnel at angles of attack of 0, 5, and 10 deg for a Reynolds number range of 220,000 to 1,230,000 in air. A fusible-temperature-indicator technique which employs a temperature-sensitive material that changes from an opaque solid to a clear liquid at a known temperature was used to obtain these coefficients. The results of this investigation indicate

that the heat transfer coefficients on the ram-air inlets and the burble fence are up to five times larger than the coefficients at identical locations on a smooth AID body. Moving the ram-air inlets rearward reduces the heating rates immediately behind the aft row of inlets. This placement of the inlets also increases the heating rate on the burble fence. Increasing Reynolds number resulted in an increase in heat transfer coefficient primarily on the burble fence. Author

N71-38760# Curtiss-Wright Corp., Wood-Ridge, N.J.
EXPLORATORY DEVELOPMENT PROGRAM ON THE ROTATING COMBUSTION ENGINE USING THE RC1-90 TEST RIG
C. Jones, H. Lamping, and H. R. Corwin Jan. 1971 15 p refs
(Contract N00019-70-C-0371)
(AD-727745; CW-WR-70-052.S) Avail: NTIS CSCL 21/2

The report covers additional testing of the stratified charge RC-90 engine to explore its exhaust emission characteristics plus a brief evaluation of the Texaco ignition system. Author (GRA)

N71-38767*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A MODULAR COMBUSTOR DESIGNED FOR A VTOL TIP-TURBINE LIFT FAN
Nicholas R. Marchionna Washington Nov. 1971 18 p refs
(NASA-TN-D-6542; E-6441) Avail: NTIS CSCL 20M

An array of 16 swirl-can modules was tested with liquid ASTM A-1 fuel in a 10.75-in. diameter circular duct at conditions simulating the design operating point of a combustor for a 10,000-lbf thrust VTOL lift engine with an inlet air temperature of 600 F, an inlet total pressure of 111 psia, and a reference velocity of 165 ft/sec. Performance of flat plate and conical flame holders were compared for combustion efficiency, total pressure loss, and pattern factor. At the design operating point requiring an exhaust gas temperature of 1440 F, combustion efficiency was close to 100 percent for all models tested. The flat plate flame holders gave better exhaust gas temperature profile characteristics than the conical flame holders. With a burning length of 18 in., the pattern factor was 0.36 and the total-pressure loss was 5.1 percent. Author

N71-38789# Air Force Systems Command, Washington, D.C.
AIR FORCE RESEARCH REVIEW. NO. 2, MARCH APRIL 197
Ethel Gamer Apr. 1971 31 p refs
(AD-727338; AFSCRP-80-2) Avail: NTIS CSCL 20/12

Contents: Vortex interactions in modern aerodynamics; Methods of eliminating phased array blind spots; Signal processing with elastic surface waves; Rare earth cobalt magnets; A new vacuum microbalance; Vuilleumier cycle cryogenic coolers demonstrate a new era in aircraft reliability; Laser research; Irradiation defects and the electrical quality of ion implanted silicon; High resolution chemical ionization mass spectroscopy; Design and synthesis of materials for lasers; Geodetic application of long base interferometry; A model for evaluating the utility of forecasting natural environmental phenomena; Research advances; Research needs. GRA

N71-38792# Federal Aviation Administration, Washington, D.C. *Office of Environmental Quality.*
FEDERAL POLICY AND PLANNING ON THE AIRCRAFT ENVIRONMENT
John O. Powers 1 Apr. 1971 22 p
Avail: NTIS

The impact of man's activity on the environment is discussed. A short history of federal environmental legislation is presented. The activity of the FAA in environmental studies is outlined, with particular stress on the influence of aircraft and related factors. A position paper is being prepared utilizing a systematic interdisciplinary approach which integrates the use of the natural and social sciences and the environmental design arts. Author

N71-38793# Civil Aeronautics Board, Washington, D.C.
FORECAST OF SCHEDULED DOMESTIC AIR CARGO FOR THE 50 STATES, 1971 - 1975
Irving Saginor and David B. Richards Feb. 1971 30 p
Avail: NTIS

Forecasts are presented for domestic air cargo for the next five years. The forecasts are in terms of revenue ton-miles and are summations of freight (including express) and mail revenue ton-miles forecast over this period. Domestic cargo includes freight, express, and mail flown in scheduled service. These forecasts are based on a statistical analysis of historical data for the domestic operations of the carriers. The analysis indicated that the gross national product (GNP) and the levels of rates were the most important factors associated with the growth of express and freight traffic and that the GNP is the most important factor associated with mail ton-miles. The forecasts include a projection of mail ton-miles and projections of freight plus express ton-miles. This division was necessary due to the different growth pattern exhibited by express and freight on the one hand and mail on the other. Author

N71-38794# Civil Aeronautics Board, Washington, D.C. Bureau *of International Affairs.*
US INTERNATIONAL AIR CARGO MARKETS, 1970
Mary Irene Pett Apr. 1971 23 p refs
Avail: NTIS

Tables covering the growth in U.S. air cargo markets in 1970 as compared to prior years and the U.S. carries participation in these markets are given. E.H.W.

N71-38795# Federal Aviation Administration, Washington, D.C. Office of Aviation Economics.
DOMESTIC AIR PASSENGER TRIP LENGTH
[1971] 24 p
Avail: NTIS

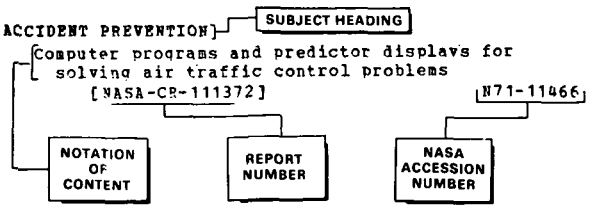
An analysis of the distances traveled by domestic air passengers is submitted which is a significant characteristic of the air commerce traffic pattern. The study is a planning tool showing the extent to which domestic air travel is short, medium, or long distance. In addition to providing a basis for estimating future passenger traffic by length of trip, the data presented indicate in broad terms the size of the national market potentially available to various passenger aircraft types such as V/STOL aircraft which are economically of technically efficient over particular stage lengths. These surveys include statistics on the number of passengers, passenger-miles, and city pairs by passenger length of trip intervals. Author

N71-38798# Federal Aviation Administration, Washington, D.C.
A POLICY PAPER GUIDELINES FOR NATIONAL AVIATION SYSTEM PLANNING AND R AND D POLICY Final Report
Benjamin F. L. Darden, Thomas P. Messier, and Milton B. Meisner Jun. 1971 109 p refs
(FAA-AV-71-2; FAA-AV-100) Avail: NTIS

In most long range aviation system planning, a singleness of purpose is missing. The proposed Goals Approach method of aviation system planning gives clear direction for system development. Aviation system goals should relate to broad societal needs as well as internal system requirements. Levels of research and development strongly affect rate of goal achievement. Industry and government program information indicates FAA research expenditures are appropriate at an annual expenditure rate of $100-200 million. Author

SUBJECT INDEX

Typical Subject Index Listing



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Mathematical modeling of F-8 aircraft wave off trajectories for aircraft carrier approaches
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A71-43234

ACCURACY
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Vortex shedding from blunt trailing edge of flat plate spanning wind tunnel under oscillating flap and acoustic resonance excitations
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Acoustic noise output from round interfering subsonic jets, considering suppressor nozzle attenuation
A71-44560

ACOUSTIC PROPAGATION
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A71-44763

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Acrostar Mk II all wood single seat acrobatic light weight aircraft designed for plus/minus 8g and inverted flight
A71-43887

ACTUATORS
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[IR-USGS-229] N71-38013

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Active flutter mode control system synthesis for flight test, showing mass balancing as possible artificial symmetrical wing destabilization
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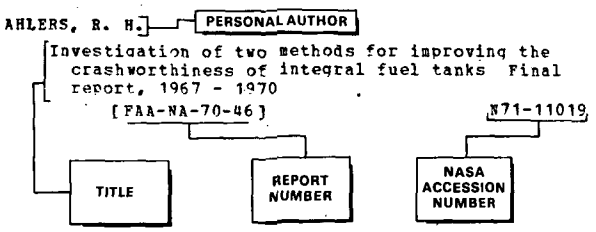

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National Aeronautics and Space Administration Washington, D. C. 20546	13. Type of Report and Period Covered
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15. Supplementary Notes

16. Abstract

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