AERONAUTICAL ENGINEERING

A SPECIAL BIBLIOGRAPHY WITH INDEXES

Supplement 38

DECEMBER 1973

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges:

IAA (A-10000 Series)	A73-39915—A73-43190
STAR (N-10000 Series)	N73-29993—N73-31924

This bibliography was prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through July 1, 1974.

1. Report No. NASA SP-7037 (38)	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AERONAUTICAL ENGINEERING A Special Bibliography (Supplement 38)		5. Report Date December 1973 6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D. C. 20546		10. Work Unit No. 11. Contract or Grant No.
12. Sponsoring Agency Name and Address		13. Type of Report and Period Covered 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This special bibliography lists 473 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1973.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Aerodynamics Aeronautical Engineering Aeronautics Bibliographies	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	145	

*For sale by the National Technical Information Service, Springfield, Virginia 22151

NASA SP-7037 (38)

AERONAUTICAL ENGINEERING

A Special Bibliography

Supplement 38

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 November 1973 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

Scientific and Technical Information Office
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
DECEMBER 1973
Washington, D.C.

This Supplement is available from the National Technical Information Service (NTIS), Springfield, Virginia 22151, for $3.00. For copies mailed to addresses outside the United States, add $2.50 per copy for handling and postage.

INTRODUCTION

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

This supplement to *Aeronautical Engineering—A Special Bibliography* (NASA SP-7037) lists 473 reports, journal articles, and other documents originally announced in November 1973 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*.

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

Each entry in the bibliography consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections, *IAA Entries* and *STAR Entries*, in that order. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* 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.

Three indexes—subject, personal author, and contract number—are included.

An annual cumulative index will be published.

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A73-10000 Series)

All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc., (AIAA), as follows: Paper copies are available at $5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche [1] are available at the rate of $1.00 per microfiche for documents identified by the # symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is $1.00. Please refer to the accession number, e.g., A73-10468, when requesting publications.

STAR ENTRIES (N73-10000 Series)

A source from which a publication abstracted in this Section is available to the public is ordinarily given on the last line of the citation, e.g., Avail: NTIS. The following are the most commonly indicated sources (full addresses of these organizations are listed at the end of this introduction):

Avail: NTIS. Sold by the National Technical Information Service at the price shown in the citation. If no price is shown in a current *STAR* citation, it may be ascertained by referring to *Government Reports Announcements* or to NTIS. Beginning with documents announced in Issue 21, 1973, "stocked" reports, such as printed NASA reports are priced on a step schedule ranging irregularly from $2.75 for a 1-to-25 page report to $10.75 for 576 to 600 pages, plus $2.00 for each additional 100-page increment. Demand print reports (those for which a facsimile reproduction will be made to fill orders) are priced at $3.00 for the first 20 pages plus 25 cents for each five pages or portions thereof. These prices are not applied retroactively; i.e., reports previously announced at a certain price continue to be sold at that price. If "Avail: NTIS" without a price appeared in the citation of a NASA report (asterisked) it is sold at $3.00 whether printed copy or facsimile is supplied. Because of price changes and possible surcharges, it is recommended that for any document announced in *STAR* before July 1970, NTIS be queried as to the price. Document prices are subject to change without notice. See "Avail: SOD" below for documents available from both the Superintendent of Documents and NTIS.

Microfiche. Microfiche is available from NTIS at a standard price of $1.45 (regardless of age) for those documents identified by the # sign following the accession number (e.g., N73-10281#) and having an NTIS availability shown in the citation. Standing orders for microfiche of (1) the full collection of NTIS-available documents announced in *STAR* with the # symbol, (2) NASA reports only (identified by an asterisk (*)), (3) NASA-accessioned non-NASA reports only (for those who wish to maintain an integrated microfiche file of aerospace documents by the "N" accession number), or (4) any of these classes within one or more *STAR* categories, also may be placed with NTIS at greatly reduced prices per title (e.g., 38 cents) over individual requests. Inquiries concerning NTIS Selective Categories

(1) A microfiche is a transparent sheet of film, 105 x 148 mm in size, containing as many as 60 to 98 pages of information reduced to micro images (not to exceed 24:1 reduction).

in Microfiche should be addressed to the Subscription Unit, National Technical Information Service.

Deposit Accounts and Customers Outside U.S. NTIS encourages its customers to open deposit accounts to facilitate the purchase of its documents now that prices vary so greatly.

NTIS customers outside the United States are reminded that they should add the following handling and postage charges to the standard or announced prices: hard (paper) copy, $2.50 each document; microfiche, $1.50 each document. For subscribers outside the United States who receive microfiche through the Selective Categories in Microfiche program, NTIS will add 15 cents for each title shipped.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The price is given following the availability line. (An order received by NTIS for one of these documents will be filled at the SOD price if hard copy is requested. NTIS will also fill microfiche requests, at the standard $1.45 price, for those documents identified by a # symbol.)

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration, Public Documents Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the Mississippi Test Facility, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: NASA Scientific and Technical Information Office. Documents with this availability are usually news releases or informational brochures available without charge in paper copy.

Avail: AEC Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of U.S. Atomic Energy Commission reports, usually in microfiche form, are listed in *Nuclear Science Abstracts*. Services available from the USAEC and its depositories are described in a booklet, *Science Information Available from the Atomic Energy Commission* (TID-4550), which may be obtained without charge from the USAEC Technical Information Center.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from *Dissertation Abstracts*, and are sold by University Microfilms as xerographic copy (HC) at $10.00 each and microfilm at $4.00 each, regardless of the length of the manuscript. Handling and shipping charges are additional. All requests should cite the author and the Order Number as they appear in the citation.

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc., (PHI), Redwood City, California. The U.S. price (including a service charge) is given, or a conversion table may be obtained from PHI.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown (If none is given, inquiry should be addressed to BLL).

Avail: ZLDI. Sold by the Zentralstelle für Luftfahrtdokumentation und -Information, Munich, Federal Republic of Germany, at the price shown in deutschmarks (DM).

Avail: Issuing Activity, or Corporate Author, or no indication of availability: Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: U.S. Patent Office. Sold by Commissioner of Patents, U.S. Patent Office, at the standard price of $.50 each, postage free.

Other availabilities: If the publication is available from a source other than the above, the publisher and his address will be displayed entirely on the availability line or in combination with the corporate author line.

GENERAL AVAILABILITY

All publications abstracted in this bibliography are available to the public through the sources as indicated in the *STAR Entries* and *IAA Entries* sections. It is suggested that the bibliography user contact his own library or other local libraries prior to ordering any publication inasmuch as many of the documents have been widely distributed by the issuing agencies, especially NASA. A listing of public collections of NASA documents is included on the inside back cover.

SUBSCRIPTION AVAILABILITY

This publication is available on subscription from the National Technical Information Service (NTIS). The annual subscription rate for the monthly supplements, excluding the annual cumulative index, is $18.00. All questions relating to subscriptions should be referred to the NTIS.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics
and Astronautics
Technical Information Service
750 Third Ave.
New York, N.Y. 10017

British Library Lending Division,
Boston Spa, Wetherby, Yorkshire,
England

Commissioner of Patents
U.S. Patent Office
Washington, D.C. 20231

Engineering Sciences Data Unit Ltd.
251–259 Regent Street
London W1R 7AD, England

ESRO/ELDO Space Documentation Service
European Space Research Organization
114, av. Charles de Gaulle
92-Neuilly-sur-Seine, France

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Scientific and Technical Information
Facility
P.O. Box 33
College Park, Maryland 20740

National Aeronautics and Space
Administration
Scientific and Technical Information
Office (KSI)
Washington, D.C. 20546

National Technical Information Service
Springfield, Virginia 22151

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, California 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

University Microfilms, Inc.
A Xerox Company
300 North Zeeb Road
Ann Arbor, Michigan 48106

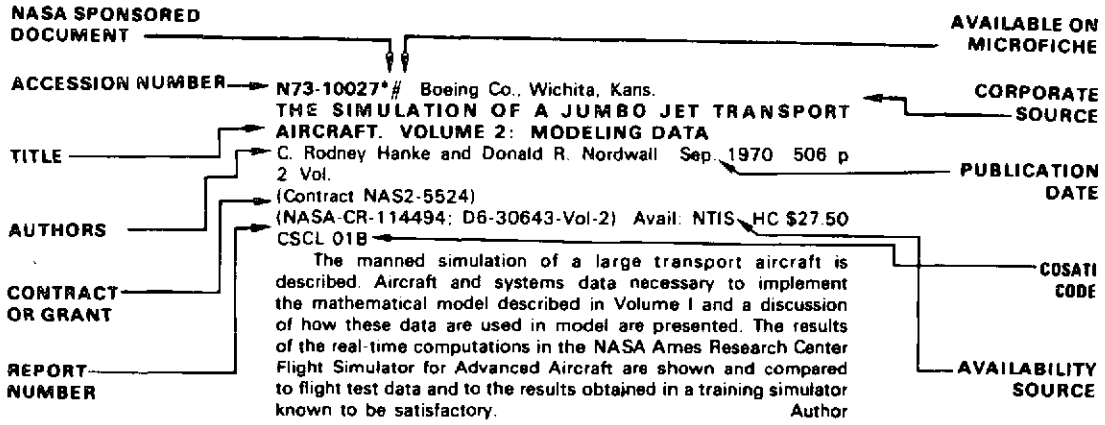
University Microfilms, Inc.
Tylers Green
London, England

U.S. Atomic Energy Commission
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

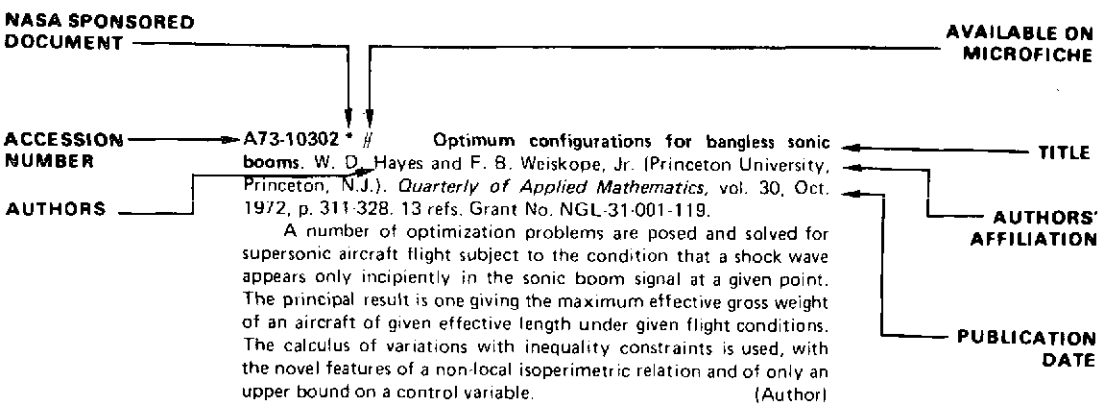
Zentralstelle für Luftfahrtdoku-
mentation und-Information
8 München 86
Postfach 880
Federal Republic of Germany

TABLE OF CONTENTS

TYPICAL CITATION AND ABSTRACT FROM *STAR*



TYPICAL CITATION AND ABSTRACT FROM *IAA*



AERONAUTICAL ENGINEERING

A Special Bibliography (Suppl. 38) DECEMBER 1973

IAA ENTRIES

A73-39956 # **Observation of the surface of hypersonic projectiles by holography (Observation de la surface de projectiles hypersoniques par holographie).** P. Smigielski, H. Fagot, A. Stimpfling, J. Schwab, and R. Schirrer (Institut Franco-Allemand de Recherches, Saint-Louis, Haut-Rhin, France). In: International Conference on Ultrahigh-Speed Cinematography, 10th, Nice, France, September 25-30, 1972, Transactions. Paris, Association Nationale de la Recherche Technique, 1973, p. 207-211. 8 refs. In French. Research supported by the Direction des Recherches et Moyens d'Essais.

By causing intervention, at the same time, of a relation involving parameters of the conic and the dimensions of the projectile and the hologram, and the limitations due to diffraction and aberrations, it was possible to establish a setup recording the hologram and a reconstitution setup making it possible to visualize a hypersonic projectile with a resolution equal to the movement. A study was made of an elliptical holographic setup for visualization by reflection of a projectile in hypersonic flight. The reconstituted images conform to predictions. F.R.L.

A73-39984 # **Holographic interferometry applied to aerodynamics (Application de l'interférométrie holographique en aérodynamique).** C. Veret (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). In: International Conference on Ultrahigh-Speed Cinematography, 10th, Nice, France, September 25-30, 1972, Transactions. Paris, Association Nationale de la Recherche Technique, 1973, p. 418-422. 11 refs. In French.

A recently developed holographic interferometer is described and compared with a Mach-Zehnder type conventional interferometer. The new instrument is shown to offer the following advantages: (1) superior ease of fabrication and use, (2) high recording speed, and (3) wider application versatility. Examples of applications in aerodynamic flow studies are discussed. M.V.E.

A73-39985 # **Study of turbulent wakes behind cones in hypersonic flight using Schlieren photograph correlation (Etude de sillages turbulents de cônes en vol hypersonique par correlation d'image strioscopique).** R. L. Oudin and F. Albe (Institut Franco-Allemand de Recherches, Saint-Louis, Hauts-Rhin, France). In: International Conference on Ultrahigh-Speed Cinematography, 10th, Nice, France, September 25-30, 1972, Transactions. Paris, Association Nationale de la Recherche Technique, 1973, p. 423-427. 5 refs. In French. Research supported by the Direction des Recherches et Moyens d'Essais.

Densitometer-aided analysis of a Schlieren photograph taken in the wake of a hypersonic cone at low pressure, at a distance of approximately 6 calibers from the projectile. From the density values obtained for a turbulence area, the illuminance distribution is reconstructed. The correlation function of the density distribution and the quadratic mean value of the density fluctuation rate are determined. M.V.E.

A73-40003 # **Aerodynamic forces on a triangular cylinder.** C. F. M. Twigge-Molecey (Hatch Assoc., Ltd., Toronto, Canada) and W. D. Baines (Toronto, University, Toronto, Canada). *American Society of Civil Engineers, Engineering Mechanics Division, Journal,* vol. 99, Aug. 1973, p. 803-818. 8 refs.

Forces on a cylinder of triangular cross section were measured. This cross section was chosen primarily because it produced a definable flow pattern. The stagnation point of the oncoming flow is on the upstream tip and boundary layer separation occurs along the downstream edges. The measured values of steady and fluctuating force coefficients obtained, are believed to be a useful contribution to engineering data. In the investigation the turbulence everywhere in the flow was of small amplitude and scale whereas the periodic and steady forces were much larger than the random components. G.R.

A73-40027 # **An aircraft digital fly-by-wire system.** P. G. Felleman (MIT, Cambridge, Mass.). *Institute of Navigation, Annual Meeting, 29th, St. Louis, Mo., June 19-21, 1973, Paper.* 19 p.

The program described was conceived as the first phase of a multiphase program to demonstrate the feasibility of digital fly-by-wire flight control systems for aircraft application. This initial system was configured to place a digital computer with appropriate sensor and effector interfaces in the primary control path of a modified F-8C aircraft, with a triply-redundant analog fly-by-wire control system as back-up. The Apollo guidance, navigation, and control hardware was chosen for use as the primary digital system because of the availability of space qualified hardware, the demonstrated reliability of the equipment, and the availability of an existing flight software verification capability. Particular emphasis is given to a description of the problem of interface design and fault detection mechanization. F.R.L.

A73-40028 # **A hybrid navigation system simulation for North Atlantic routes.** W. C. Hoffman, J. Zvara (Aerospace Systems, Inc., Burlington, Mass.), W. M. Hollister, and K. R. Britting (MIT, Cambridge, Mass.). *Institute of Navigation, Annual Meeting, 29th, St. Louis, Mo., June 19-21, 1973, Paper.* 13 p. 15 refs. U.S. Department of Transportation Contract No. TSC-473.

Present-day operations of commercial air traffic on North Atlantic routes are reviewed, and the need for improved navigational accuracy to provide increased capacity without corresponding reductions in existing safety levels is established. The application of hybrid navigation systems which combine information from two or more sources in an optimum manner to achieve more accurate performance is discussed. A digital computer simulation program referred to as NATNAV (North ATlantic NAVigation) was developed to evaluate the performance of various hybrid navigation system configurations which could be used by commercial aircraft operating in the North Atlantic region. The covariance matrix error analysis method is used to simulate aided inertial navigation system error

histories, using the optimum recursive Kalman filter to incorporate independent measurements of position or velocity. A number of computer results are presented for a typical east-bound North Atlantic flight. (Author)

A73-40029 # **A flight evaluation of pilotage error in area navigation with vertical guidance.** R. S. Jensen and S. N. Roscoe (Illinois, University, Savoy, Ill.). *Institute of Navigation, Annual Meeting, 29th, St. Louis, Mo., June 19-21, 1973, Paper.* 35 p. 8 refs. FAA-sponsored research.

Pilotage error in terminal and approach phases of three-dimensional area navigation operations was measured in flight. Pilot performance was measured in terms of altitude, crosstrack, airspeed, and procedural errors made while flying a complex 18-segment IFR flight plan presenting concentrated high levels of cockpit workload. Analysis of the data showed no statistically reliable difference between overall performances by airline transport pilots and commercial pilots with instrument ratings for any of the four vertical task variables: level flight, three-degree climb, three-degree descent, and six-degree descent. Also, there were no statistically reliable differences between altitude performance with the altimeter and the vertical deviation indicator in level flight. Relatively frequent procedural errors occurred even after four identical flights using VNAV guidance equipment. (Author)

A73-40030 # **Effectiveness limitations of midair collision avoidance strategies.** J. L. Ramsey (Mitre Corp., Bedford, Mass.). *Institute of Navigation, Annual Meeting, 29th, St. Louis, Mo., June 19-21, 1973, Paper.* 25 p. 16 refs. Contract No. F19628-73-C-0001.

Data are provided to help resolve the uncertainty about what specific technique or classes of techniques ought to be used to prevent midair collisions. A statistical analysis of recent midair collisions in the United States and of the pertinent factors surrounding these accidents is given. Three classes of midair collision prevention techniques, described briefly, are regulatory changes including structured or regulated airspace, introduction of an autonomous airborne collision avoidance system, and projected improvement to the ATC system. The statistical data are applied to these classes to estimate the fraction of fatalities and accidents that might be prevented. From the analysis it is possible to draw conclusions that suggest specific steps and ordering of steps that should and should not be undertaken in a unified program to reduce the incidence of collisions. F.R.L.

A73-40032 # **Horizontal collision avoidance study.** J. A. Sorensen, A. W. Merz, T. B. Cline, and J. S. Karmarkar (Systems Control, Inc., Palo Alto, Calif.). *Institute of Navigation, Annual Meeting, 29th, St. Louis, Mo., June 19-21, 1973, Paper.* 25 p. 16 refs. U.S. Department of Transportation Contract No. TSC-535.

The third-order relative dynamics of two conflicting aircraft are used to determine the horizontal maneuvers which produce maximum miss distance for arbitrary initial conditions and classes of aircraft. These maneuvers are then modified to determine a horizontal maneuver strategy which yields a safe miss distance and minimum deviation off course. Filtering techniques are examined which can be used to process noisy signals if the data required to mechanize the horizontal maneuvers are not fully available. Analyses are conducted to determine the effects of measurement errors on the performance of a typical horizontal collision avoidance system. (Author)

A73-40033 # **Time dissemination for aircraft.** F. D. Watson and J. M. Holt (McDonnell Douglas Electronics Co., St. Charles, Mo.). *Institute of Navigation, Annual Meeting, 29th, St. Louis, Mo., June 19-21, 1973, Paper.* 30 p. U.S. Department of Transportation Contract No. FA73WA-3172.

Brief description of work accomplished during the first portion of a study program in which ground station sites were evaluated on the basis of their effectiveness in disseminating time synchronization. Operations of all U.S. scheduled air carriers operating in CONUS have been discretely modeled. Then, air-to-air and air-to-ground communication linkages are determined. In addition to producing data for use by the computer, these processes produce maps of aircraft activity versus time of day for direct interpretation. With appropriate effectiveness equations, a computer-implemented algorithm automatically, or with operator interaction, determines the strategy and tradeoffs in site selection for ground-based time-disseminating equipment. Preliminary results indicate that with three ground stations most of CONUS can be synchronized by using hierarchal air-to-air relay of synchronization. (Author)

A73-40035 **National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings.** Meeting sponsored by the Institute of Navigation. Washington, D.C., Institute of Navigation, 1973. 167 p. Members, $15.; nonmembers, $20.

Inertial navigation, nonlinear trajectory-following and control techniques in the terminal area, recent improvements in the Navy navigation system, military application of the Transit navigation satellite system, and a navigation satellite development program are discussed. Attention is given to error analysis for a satellite-based air traffic control system, divergence in redundant systems, space shuttle optimal ascent guidance, orbiter abort guidance, the Bendix-Bell MLS signal-in-space, MLS navigation guidance and control, aspects of terminal air traffic control operations, the conventional ILS, use of MLS elevation data for flare-out guidance, and airport ground surveillance.

F.R.L.

A73-40038 # **Nonlinear trajectory-following and control techniques in the terminal area using the Microwave Landing System Navigation Sensor.** P. Madden and M. Desai (MIT, Cambridge, Mass.). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, *Proceedings.* Washington, D.C., Institute of Navigation, 1973, p. 24-34. 7 refs. U.S. Department of Transportation Contract No. TSC-551.

Guidance and control techniques have been developed to permit accurate nonlinear path-following in the terminal area using an MLS and DME data-base. The elements of the system including trajectory generation, mean-wind estimation, feedforward and perturbation control are described, and the performance of the integrated system is delineated. The investigation was made with the aid of a sophisticated digital simulation, including modeling of the sensor and environmental noise. A conventional jet transport was the subject aircraft. A conclusion of the investigation was that the integrated guidance and control system was adequate to the task of path tracking with errors within the resolution of ATC radar. (Author)

A73-40040 # **Military application of the TRANSIT Navigation Satellite System in the P-3C ASW aircraft.** T. B. Merkel (U.S. Naval Material Command, Naval Air Development Center, Warminster, Pa.). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 39-42.

The TRANSIT system of navigation by satellite, spurred by the concurrent development of the Navy's fleet ballistic missile submarines, became the reliable fixing aid fulfilling the world-wide submarine navigation requirements. Theoretical studies of airborne TRANSIT commenced in the mid-1960s, but the lack of a suitable airborne platform stymied the growth and practical development until early 1969, when the Navy embarked on an approach to investigate the feasibility of airborne TRANSIT. The YP-3C Anti-submarine Warfare (ASW) Weapons System aircraft was choosen as the test platform because it provided both a central data processing capability and a normally long mission profile, needed to minimize the effect of the periodic nature of available TRANSIT updates. (Author)

A73-40041 # **Navigation Satellite Development Program.** S. L. Lagna and R. H. Jessen (USAF, Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 43-50.

There is general agreement that a space-based radio navigation system can provide accurate, continuous, three-dimensional, world-wide and common-grid navigation and positioning information that could satisfy the needs of most military and civilian users. However, there are a number of outstanding questions on cost, value, application and design which preclude deploying an operational global navigation satellite system. These questions can be answered via a navigation satellite development program using four repeater satellites deployed over the continental United States. The navigation signals from the repeater satellites will provide the same electronic environment for the users that would be available from operational satellites. Repeater satellites could also provide radio links for limited digital communication, cooperative surveillance, and air traffic management experiments. (Author)

A73-40042 # **Error analysis for a satellite based Air Traffic Control System.** C. R. Traas (Nationaal Luchtvaartlaboratorium, Amsterdam, Netherlands). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 51-58. 6 refs.

Errors related to an Air Traffic Control System which uses a number of ground stations, a pair of stationary satellites, and direct airplane altitude measurements, have been analyzed numerically. A considerable part of the analysis is connected with the determination of the orbits of the satellites from radar range and range-rate measurements. The error sources considered are: the ground station position uncertainty, transponder delay time uncertainty, and uncertainty about the precise values of some parameters occurring in atmospheric refraction models. The other part of the analysis is devoted to the determination of aircraft position using radar range measurements from a single ground station, and direct altitude measurements. (Author)

A73-40046 # **The Bendix/Bell MLS signal-in-space.** R. J. Kelly (Bendix Corp., Communications Div., Towson, Md.). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 97-108. 8 refs.

The Bendix/Bell Microwave Landing System (MLS) is an air-derived sample data system operating at microwave frequencies using scanning narrow beam antennas which generate a signal-in-space. The MLS signal-in-space provides guidance information proportional to an aircraft's lateral and vertical displacement from a selected flight profile. This paper describes, in detail, the techniques and rationale used to generate and detect the MLS signal. Emphasized in the rationale are the system requirements developed by Bendix/Bell in their recently completed MLS Technique Analysis Study for the FAA. These requirements lead Bendix/Bell to choose the electronically scanned phased line array as the most adaptive technique to generate the angle guidance function. Since the line array is central to the Bendix/Bell concept, test results of a fully operating elevation guidance antenna are presented. (Author)

A73-40047 # **MLS - Navigation, guidance, and control.** G. L. Neal (Collins Radio Co., Cedar Rapids, Iowa). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 109-118. 8 refs.

This paper discusses application of the microwave landing system as a terminal area navigation tool, as an aid to vehicle guidance, and as a position control feedback element. Navigation in this context is used to mean velocity and position determination together with a description of desired velocity and position. Guidance relates to the usage of velocity and position information to describe progress along the desired path and specifically to describe changes required to maintain that path. Control relates to manipulation of the vehicle to satisfactorily achieve the guidance commands. These aspects of the general problem of terminal area navigation using the microwave landing system as a ground based aid are discussed from a flight control engineer's viewpoint with the emphasis on subtleties of the system characteristics that can greatly impact its eventual usefulness. (Author)

A73-40048 # **Relationships between operational flexibility and capacity in contemporary terminal air traffic control operations.** R. S. Ratner (Stanford Research Institute, Menlo Park, Calif.). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 119-122. FAA-supported research.

Observations and findings of an analysis of terminal area air traffic control operations are presented to show where flexible path management derogates efficient high-density terminal operations, and where such flexibility is necessary to facilitate operations. Strong and weak points related to the use of standard arrival procedures and standard instrument departures are delineated. Likely reasons for observed operational limitations in the use of such procedures are discussed. Some techniques that controllers have evolved for minimizing the sensitivity of operations to unforeseen occurrences are described. Considerations involved in a controller's selection of speed, vector or altitude control as a means for maintaining efficiency while ensuring safe separation are discussed. (Author)

A73-40049 # **The Conventional ILS - So what's new.** J. B. Battistelli (Ohio University, Athens, Ohio). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 123-132. 8 refs. U.S. Department of Transportation Contract No. FA69WA-2066.

The FAA, recognizing the increasingly stringent requirements being placed on the ILS, has been conducting research and development programs designed to yield significant improvements in ILS capability. This paper describes the results of some of these programs. The latest configurations for the localizer, glide-slope, and their monitor are discussed as well as the effects of snow and reflecting objects on or near the aerodrome and terrain. New localizer antenna arrays are being developed that limit the amount of stray radiation on the aerodrome and surrounding terrain. These new arrays yield improved course characteristics. Integral and wide aperture monitors have been developed that give a true analog of the signal in space. Glide-slope antenna arrays are being developed that do not utilize image effects. Therefore, they are not as susceptable to environmental effects. Optimized image-type arrays are under study to minimize the effects of shortened ground planes; and integral monitors have been developed to give increased monitoring reliability. (Author)

A73-40050 # **Use of MLS elevation data for flare-out guidance.** L. L. Sanders (ITT Gilfillan, Inc., Van Nuys, Calif.). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 133-138. 5 refs.

The discussion analyzes the issues associated with use of MLS elevation data or altimeter information for flare-out guidance. Technical limitations of altimeter at some airports and for some aircraft are described. Discussion includes consideration of airport factors, aircraft and autopilot equipment, MLS ground equipment and cost factors. With standardizing of touchdown zone parameters, MLS flare guidance appears both technically and economically justified. (Author)

A73-40051 # **Airport ground surveillance and ground guidance system LOCAR /Localized Cable Radar/.** A. M. Levine (ITT Gilfillan, Inc., Van Nuys, Calif.). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Washington, D.C., Institute of Navigation, 1973, p. 139-146.

A low-cost airport surveillance and ground guidance system, called LOCAR (Localized Cable Radar) to aid in solving the problems of airport ground traffic control resulting from ever-increasing airport traffic is described in this paper. LOCAR tracks all vehicles on runways or taxiways even if slightly airborne, and in all weather; it can indicate stationary vehicles and the speed of aircraft, and it provides guidance; the display can be relayed via standard CCTV; there is no high power radiation, no moving parts, and installation is low in cost compared to other discrete sensors or multiple conventional radars. The system consists of a series of small low-powered solid state radars of limited range, time sequenced by the inherent delay of the cable from a master timing pulse. LOCAR is compatible with additions for increased information on displays both in the control tower and in aircraft cockpits. (Author)

A73-40052 # **A survey of satellite-based systems for navigation, position surveillance, traffic control and collision avoidance.** K. D. McDonald (U.S. Department of Defense, Washington, D.C.). In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Addendum. Washington, D.C., Institute of Navigation, 1973. 16 p.

Summary of the satellite system concepts, orbital deployments, and measurement techniques on which the accomplishment of various recent applications is based. The systems and system concepts discussed include: Transit, the Navy Navigation Satellite System; the expanded Transit and Transit improvement program concepts; the Two-in-View configuration; the Defense Navigation Satellite System, including the System 621B and the Timation system concepts; the NASA Position Location and Communication Equipment (PLACE) experiment: the Maritime Satellite program of the Department of Commerce's Maritime Administration; the DOT/FAA Aeronautical Satellite Program; the Location, Identification by Transmission (LIT) and Satellite ATC and Navigation (SATAN) systems; the DOT's Advanced Air Traffic Management System concepts; and the FAA's recently developed ASTRO–DABS concept. (Author)

A73-40056 # **A numerical analysis of some practical aspects of airborne urea seeding for warm fog dispersal at airports.** A. I. Weinstein and B. A. Silverman (USAF, Cambridge Research Laboratories, Bedford, Mass.). *Journal of Applied Meteorology*, vol. 12, Aug. 1973, p. 771-780. 18 refs.

A two-dimensional Eulerian model of warm fog dispersal by airborne hygroscopic particle seeding is used to evaluate some practical aspects of urea seeding at airports. It is found that, although turbulence and wind shear reduce the effectiveness of single-line seeding to a point where it is of no practical value, seeding over a wide area (1 to 10 sq miles) can result in practically useful visibility improvements in the approach zone and over the runway of airports. The quantity of material and the cost of the wide-area seeding technique depend upon fog intensity, fog type, and cross-runway wind speed. For typical fog, approximately 80,000 lb/hr of urea costing $40,000 per hour are needed to keep the visibility above 1/2 mile. The figures are reduced to approximately 36,000 to 58,000 lb and $18,000 to 29,000 per hour, respectively, if the visibility needs only to be raised to 1/4 mile. (Author)

A73-40063 # **Low density extremes for ground elevations up to 15,000 ft.** R. V. Cormier (USAF, Cambridge Research Laboratories, Bedford, Mass.). *Journal of Applied Meteorology*, vol. 12, Aug. 1973, p. 863-866. 6 refs.

Atmospheric density, especially low values thereof, is important to aircraft takeoff and landing operations; therefore, probable extremes of low density are needed for aircraft design. This document provides, for the most extreme area and month, values of low density that are equaled or surpassed during 1, 5, 10 and 20% of the time (hours) for ground elevations up to 15,000 ft. Typical temperatures accompanying these values, needed for engine power calculations, are also given. In addition, empirical equations for estimating extremes of low density near the ground are evaluated. (Author)

A73-40087 # **On the aerodynamic damping moment in pitch of a rigid helicopter rotor in hovering. II - Analytical phase.** K. Takasawa (National Aerospace Laboratory, Tokyo, Japan). *Japan Society for Aeronautical and Space Sciences, Transactions*, vol. 16, no. 32, 1973, p. 77-101. 13 refs.

A73-40090 # **Manual control of an oscillatory divergent system. I.** N. Goto (Kyushu University, Fukuoka, Japan) and S. Endo (Tokyo, University, Tokyo, Japan). *Japan Society for Aeronautical and Space Sciences, Transactions*, vol. 16, no. 32, 1973, p. 129-140. 9 refs.

Manual control of a second-order oscillatory divergent system is investigated. Previous studies suggest that an experienced operator pays special attention to the periodicity in the error signal and is able to exercise control so that the periodically changing error is cancelled out. This work tries to give an experimental proof to the extended describing function proposed in compliance with the suggestion, by the use of the time domain analysis method. As a result, this work shows that the extension of the describing function is possible by taking the human operator's object of attention into consideration. (Author)

A73-40101 **Performance of a water-repellent radome coating in an airport surveillance radar.** R. M. Weigand (U.S. Department of Transportation, Transportation Systems Center, Cambridge, Mass.). *IEEE, Proceedings*, vol. 61, Aug. 1973, p. 1167, 1168. 5 refs.

The operational improvement in rain provided by a hydrophobic radome coating is experimentally verified for the case of an airport ground-surveillance radar. The efficacy of a hydrophobic radome coating is illustrated with photographs of the plan-position-indicator display during moderate rainfall before and after the application of the coating. (Author)

A73-40124 # **Design of axial flow fans by cascade method.** A. G. Deshpande (Indian Institute of Science, Bangalore, India). *Acta Technica CSAV*, vol. 18, no. 4, 1973, p. 352-362. 12 refs.

The flow of a perfect fluid past a rotor of an axial fan with nonfree vortex flow is studied using the lifting line method. The cascade method is applied for design purposes. The static pressure rise and the total head rise increase with the decrease in axial velocity. Camber angle decreases with the decrease in axial velocity, while the stagger angle decreases with decrease in axial velocity. The static efficiency of the fan increases with the decrease in axial velocity. The effect of the axial velocity on aerodynamic characteristics is greater compared to other parameters. The results obtained are in good agreement with those of Wallis (1961). F.R.L.

A73-40125 # **Strouhal number and flat plate oscillation in an air stream.** J. Novak (Statni Vyzkumny Ustav Konstrukce Stroju, Bechovice, Czechoslovakia). *Acta Technica CSAV*, vol. 18, no. 4, 1973, p. 372-386.

The results of an experimental investigation of Strouhal number S and the oscillation of a flat plate in an air stream as a function of Reynolds number Re, the intensity of turbulence I, and the angle of attack alpha are described. The Strouhal number, characterizing vortex shedding from the plate, is practically independent of Re, but decreases with the growing angle alpha. The plate oscillates in the air

stream practically with its natural frequency or close to this value irrespective of Re, l, and alpha. The oscillation amplitude changes relatively at random. The degree of this randomness grows with Re, slightly with l, and with the decreasing angle alpha in an interval in which periodic vortex shedding from the plate passes into a random one. F.R.L.

A73-40184 # **Construction of a minimum-wave-drag profile in inhomogeneous supersonic flow (K postroeniiu kontura minimal'nogo volnovogo soprotivleniia v neodnorodnom sverkhzvukovom potoke).** A. N. Kraiko and N. I. Tilliaeva. *Prikladnaia Matematika i Mekhanika,* vol. 37, May-June 1973, p. 469-487. 14 refs. In Russian.

The variational problem of constructing, for a plane or axisymmetric body, a generatrix that will ensure minimum wave resistance of the body in a supersonic inhomogeneous (nonisentropic and nonisoenergetic) flow of an ideal gas is examined for the case where the profile is affected by a region characterized by pronounced variation of the parameters along the lines of flow. In the passage to the limit, this region degenerates to a tangential discontinuity. The analysis is limited to configurations (nozzles, nose cones) for which no shock waves are present in this region. The shape of the optimal generatrix is determined by a method based on the use of Lagrange multipliers. V.P.

A73-40210 # **Planning for satellite airports.** W. Gelerman (Northrop Airport Development Corp., Vienna, Va.) and R. de Neufville (MIT, Cambridge Mass.). *ASCE, Transportation Engineering Journal,* vol. 99, Aug. 1973, p. 537-551. 8 refs. Research supported by the U.S. Department of Transportation, Massachusetts Institute of Technology, and NSF.

An analysis is conducted in order to determine whether satellite airports will divert a significant portion of the existing demand for service from the primary airports. The analysis indicates that satellite airfields will not, in general, play a significant role in air transportation as long as existing conditions prevail. It is conceivable, however, that national policy might wish to develop a viable system of air transportation through satellite airfields. Aspects of passenger response to airline frequency are discussed together with implications for airline behavior, passenger choice of airports, and airline use of satellite airports. G.R.

A73-40225 # **Selected problems in helicopter design (Wybrane zagadnienia projektowania smiglowca).** Z. Brodzki. *Instytut Lotnictwa, Biuletyn Informacyjny,* vol. 20, Mar.-Apr. 1973, p. 11-14. In Polish.

Helicopter design is contrasted with the design of fixed-wing aircraft by delineating differences in maintenance and reliability concepts and by describing helicopter structural and material requirements stemming from operational loading characteristics. Rigid rotors, tilting rotors, and hinged rotors are compared with respect to differences in types of loads and load support concepts. T.M.

A73-40244 On the Weis-Fogh mechanism of lift generation. M. J. Lighthill (Cambridge University, Cambridge, England). *Journal of Fluid Mechanics,* vol. 60, Aug. 21, 1973, p. 1-17. 6 refs.

Weis-Fogh's (1973) proposed new mechanism of lift generation could work even in inviscid two-dimensional motions starting from rest. The 'fling' of two insect wings of chord c turning with angular velocity omega generates irrotational motions associated with the sucking of air into the opening gap which are calculated as involving circulations around the wings when their trailing edges, which are stagnation points of those irrotational motions, break apart. The roles of two-dimensional inviscid flow theory and modifications due to viscous effects are discussed. F.R.L.

A73-40245 * **Experiment on convex curvature effects in turbulent boundary layers.** R. M. C. So and G. L. Mellor (Princeton University, Princeton, N.J.). *Journal of Fluid Mechanics,* vol. 60, Aug. 21, 1973, p. 43-62. 25 refs. Grant No. NGR-31-001-074.

Turbulent boundary layers along a convex surface of varying curvature were investigated in a specially designed boundary-layer tunnel. A fairly complete set of turbulence measurements was obtained. The effect of curvature is striking. For example, along a convex wall the Reynolds stress is decreased near the wall and vanishes about midway between the wall and the edge of a boundary layer where there exists a velocity profile gradient created upstream of the curved wall. (Author)

A73-40286 On the effect of swirling motion of sources of subsonic jet noise. H. K. Tanna (Southampton, University, Southampton, England). *Journal of Sound and Vibration,* vol. 29, Aug. 8, 1973, p. 281-293. 8 refs. Research supported by the Science Research Council.

Theoretical study of the effect of swirling motion of sources on the overall sound radiation from a subsonic jet. The general result for the sound field of a point acoustic stress in arbitrary motion is first applied to study the effect of uniform circular source motion on the far-field sound radiation from a randomly oriented point quadrupole of random time variation. By using the moving source approach, closed-form results are obtained for the overall radiation directly, without involving the radiation spectrum. A uniform axial motion is then superimposed and the sound field of a point quadrupole in helical motion is evaluated by applying retarded time transformations to the circular motion results. (Author)

A73-40289 Application of simultaneous iteration method to torsional vibration problems. V. Ramamurti (Indian Institute of Technology, Madras, India). *Journal of Sound and Vibration,* vol. 29, Aug. 8, 1973, p. 331-340. 10 refs.

The simultaneous iteration method of obtaining the eigenfrequencies and eigenvectors is utilized for solving torsional vibration problems. The finite-element approach is adapted to predict the behavior of the system. The effectiveness of the method is illustrated by employing it to the solution of the torsional vibration problem of a circular shaft, a conical shaft, a two-rotor system, and a composite structure. (Author)

A73-40301 Cobra and the lightweight fighter. *Flight International,* vol. 104, Aug. 23, 1973, p. 341-344.

The Northrop P-530 Cobra is designed for an air superiority role, broadened to take in ground attack to suit international needs for a multipurpose aircraft. The lightweight fighter (LWF) has very narrowly specified equipment for air superiority, and it is largely the extra avionics which will expand the performance into that of the multimission Cobra. The LWF will have a thrust/weight figure probably exceeding that of any other aircraft, including the Harrier and the F-15. The very unusual shape of the Cobra is a result of the demands for extreme maneuverability. F.R.L.

A73-40348 Basic principles and the theory of operation of the equipment for the identification-friend or foe /SIF/ in military aircraft (Principios básicos y teoría de funcionamiento de los equipos de identificación IFF /SIF/ en aviones militares). A. Millán Sánchez. *Revista de Aeronáutica y Astronáutica,* vol. 33, July 1973, p. 537-544. In Spanish.

The operation of the equipment for the identification-friend or foe (IFF) is based on the practical utilization of the theory of secondary radar. The characteristics of technical radar are discussed, giving attention to distance measurements, the determination of azimuth and elevation, a review of basic radar, aspects of radiation, wave propagation, reflection, and the principles of secondary radar. The three basic components of IFF systems are considered together with questions of pulse distribution, coding, amplification, and the generation of the reference signal. G.R.

A73-40387 # Some results of fuselage calculations on a digital computer by the finite-element method (Nekotorye rezul'taty rascheta fiuzeliazha metodom konechnykh elementov s ispol'zovaniem ETsVM). Z. I. Burman and V. I. Lukashenko. *Aviatsionnaia Tekhnika*, vol. 16, no. 1, 1973, p. 18-24. In Russian.

A73-40388 # Frame of a cylindrical shell under the action of a concentrated radial force (Shpangout tsilindricheskoi obolochki pod deistviem sosredotochennoi radial'noi sily). V. N. Zamolodchikova. *Aviatsionnaia Tekhnika*, vol. 16, no. 1, 1973, p. 25-29. In Russian.

A73-40390 # Designing a thin-wall fan-shaped wing (Raschet tonkostennogo veeroobraznogo kryla). V. A. Pavlov. *Aviatsionnaia Tekhnika*, vol. 16, no. 1, 1973, p. 38-44. In Russian.

A solution is obtained to the problem of determining the stresses and strains in a fan-shaped airfoil (with partial restraints along the root cord) composed of a thin skin and of spars that converge radially to one point. The structure may possess ribs situated parallel to the outer edge of the wing. The solution is obtained for arbitrary air loads (and also for arbitrary concentrated forces acting on the high-lift device and the end points of the wing) with the aid of strain compatibility conditions in the form of least work, reduced to a system of linear algebraic equations. V.P.

A73-40395 # Vibration tests with rotors as a rotor identification problem (Vibratsionnye ispytaniia rotorov kak zadacha ikh identifikatsii). S. P. Grivtsov, G. N. Rapoport, and A. A. Sheipak. *Aviatsionnaia Tekhnika*, vol. 16, no. 1, 1973, p. 69-74. In Russian.

A mathematical model of rotor vibration tests is constructed on the basis of the concept of an analytical signal, equivalent to the actual signal. The model can be used effectively for extrapolating test conditions to any rotor spin rates, and for analyzing a wide range of resonant systems, in particular for the case of continuously varying inputs. The model can serve also as a basis in the identification of a rotor as a dynamic system. V.P.

A73-40399 # Influence of the shape of the leading edge on the transition process in the boundary layer on a plate in longitudinal flow (Vliianie formy vkhodnoi kromki na protsess perekhoda v pogranichnom sloe pri prodol'nom omyvanii plastiny). V. M. Legkii and Iu. D. Koval'. *Aviatsionnaia Tekhnika*, vol. 16, no. 1, 1973, p. 92-95. 6 refs. In Russian.

A73-40401 # Influence of the effectiveness of jet vanes on the characteristics of VTOL aircraft (Vliianie effektivnosti gazostruinykh rulei na kharakteristiki samoletov vertikal'nogo vzleta i posadki). I. A. Khanin. *Aviatsionnaia Tekhnika*, vol. 16, no. 1, 1973, p. 98-102. In Russian.

A73-40403 # Trimming and checking aircraft gas-turbine engines with the aid of the ratio of total pressure behind the turbine to total pressure in front of the compressor (Ob otkladke i kontrole aviatsionnykh GTD s ispol'zovaniem parametra Pt-T/Pt-B). V. M. Akimov and M. F. Mokrous. *Aviatsionnaia Tekhnika*, vol. 16, no. 1, 1973, p. 103-105. In Russian.

It is shown that the effectiveness of trimming gas-turbine engines can be improved by evaluating trust on the basis of the ratio of total pressure behind the turbine to total pressure in front of the compressor. As an example, this approach is applied to a turbofan engine with a high bypass ratio. V.P.

A73-40404 # Small-scale suppressor of the aerodynamic noise of a subsonic gas jet (Malogabaritnyi glushitel' aerodinamicheskogo shuma dozvukovoi gazovoi strui). Iu. A. Bordovitsyn. *Aviatsionnaia Tekhnika*, vol. 16, no. 1, 1973, p. 105-107. In Russian.

The design and principles of operation of a device that will reduce noise levels over the entire range of acoustic frequencies are discussed. The suppressor is particularly well suited for application to exhaust gases of gas turbines. V.P.

A73-40426 # Linearized characteristics method for supersonic flow past vibrating shells. M. F. Platzer (U.S. Naval Postgraduate School, Monterey, Calif.), C. W. Brix, Jr. (U.S. Navy, Washington, D.C.), and K. A. Webster (U.S. Navy, Point Mugu, Calif.). *AIAA Journal*, vol. 11, Sept. 1973, p. 1302-1305. 12 refs.

A linearized characteristics method is developed for the aeroelastic stability analysis of cylindrical shells in supersonic flow. This procedure permits a rapid numerical solution of the complete unsteady linearized potential equation for arbitrarily prescribed axial deflection modes, reduced frequency, circumferential mode number, and cylinder length-to-radius ratio. The generalized aerodynamic forces calculated by the present aerodynamic theory are in excellent agreement with a previous Laplace-transform solution by Dowell and Widnall. (Author)

A73-40427 # Simplified aerodynamic theory of oscillating thin surfaces in subsonic flow. W. P. Jones and J. A. Moore (Texas A & M University, College Station, Tex.). *AIAA Journal*, vol. 11, Sept. 1973, p. 1305-1309. 7 refs. Grant No. DAHC04-69-C-0015. Project THEMIS.

A numerical technique for determining the aerodynamic forces on oscillating surfaces in subsonic flow is described. It differs from most other methods in that it is based on the use of the velocity rather than the acceleration potential of the flow. Comparisons of aerodynamic coefficients with known exact results for incompressible flow show good agreement over a wide range of frequency parameter values. Similar comparisons for M = 0.7 also proved reasonably satisfactory for the frequency parameters used. Preliminary calculations for three-dimensional wings in steady flow have also given good results. (Author)

A73-40428 # Approximation for hypersonic flow past an inclined cone. R. T. Doty and M. L. Rasmussen (Oklahoma, University, Norman, Okla.). *AIAA Journal*, vol. 11, Sept. 1973, p. 1310-1315. 16 refs.

An approximate analytical solution is obtained for hypersonic flow past an inclined circular cone. The governing equations are simplified by means of the constant-density approximation, and the ensuing quadrature solution is evaluated in closed form by approximations based on hypersonic small disturbance theory. This solution corresponds to the outer solution in a matched asymptotic expansion scheme and describes the region outside the thin vortical layer that lies adjacent to the surface of the cone. The results are in good agreement with tabulated numerical solutions and are also valid for values of the hypersonic similarity parameter that lie outside the range of the tabulated results. The present approximation is also applicable to much broader flow regimes than previous analytical descriptions, such as that of the Newtonian approximation. (Author)

A73-40437 # Analysis of airplane response to nonstationary turbulence including wing bending flexibility. II. Y. Fujimori (National Aerospace Laboratory, Tokyo, Japan) and Y. K. Lin (Illinois, University, Urbana, Ill.). *AIAA Journal*, vol. 11, Sept. 1973, p. 1343-1345. NSF Grant No. GK-34136X.

A73-40442 # Closed-form lift and moment for Osborne's unsteady thin-airfoil theory. N. H. Kemp (Avco Everett Research Laboratory, Inc., Everett, Mass.). *AIAA Journal*, vol. 11, Sept. 1973, p. 1358-1360.

Osborne (1973) presented an approximate theory for the unsteady motion of a two-dimensional thin airfoil in subsonic flow. As applications, he wrote the lift and moment for an airfoil subject to three oscillating upwash distributions whose chordwise dependence can be expressed in a cosine series. In only one of these three

cases was the lift and moment written in closed form. In the other two, they involved infinite series of products of Bessel functions. It is pointed out that all these series can be summed, so that closed form expressions for the lift and moment can be obtained in all the cases considered by Osborne, thereby considerably simplifying their use in numerical calculation. The lift and moment for the case of pitching oscillations is presented in closed form to complement the plunging oscillation case given by Osborne. F.R.L.

A73-40448 Future technology and economy of jet-supported VTOL transport aircraft (Zukunftstechnik und Wirtschaftlichkeit strahlgetragener VTOL-Transportflugzeuge). M. Lichte. *DGLR Mitteilungen*, vol. 6, July 1973, p. 3-5. In German.

It has been found that particularly in the case of large transport aircraft with a payload of about 10 tons and more jet VTOL capabilities provide promising possibilities. However, the installation of the equipment required to provide these capabilities results in enormous additional expenditures. The expenditures can be reduced by decreasing the weight of the aircraft. This can be done by selecting a delta-wing configuration for the aircraft. The design of a suitable aircraft type is discussed, giving attention for reasons of safety to the installation of several propulsion units for supplying the vertical thrust. An analysis of direct and indirect cost factors is conducted. It is estimated that an employment of the new aircraft type might become technically and economically feasible at about 1985. G.R.

A73-40477 # A method of complex design of the meridional form of the air flow path of a multistage axial-flow compressor (Metoda komplexniho navrhu meridialniho tvaru vzduchove cesty nekolikastupnoveho axialniho kompresoru). Z. Hujecek and V. Vanek. *Zpravodaj VZLU*, no. 3, 1973, p. 11-16. In Czech.

Application of a previously developed method of complex design of an axial-flow compressor stage on the center streamline to the first stage of design of a multistage compressor - namely, the design of the meridional form of the air flow path. The proposed method solves the problem of tuning rotating blades in parallel with the thermodynamic design and makes it possible to choose the initial values of the detailed calculation in such a way that the possibility of the occurrence of significant resonances in the rotating blades in the rpm range of the calculated regime is eliminated. A.B.K.

A73-40478 # Some method of nonlinear programming suitable for solving the task of optimization of a small transport aircraft (Nektere metody nelinearniho programovani vhodne pro reseni optimalizacni ulohy maleho dopravniho letounu). P. Rastica. *Zpravodaj VZLU*, no. 3, 1973, p. 17-26. In Czech.

Description of certain methods of so-called convex programming suitable for solving the problem of finding the optimal design parameters of a small transport aircraft under given operational conditions. The nonlinear programming methods proposed involve the solution of the problem of extremalizing a convex function defined on a convex set. The specific form of this problem and the basic possibilities of solving problems of this type are reviewed, a basic algorithm for solving the problem of optimization of a small transport aircraft is proposed, and two modifications of the basic algorithm are presented, one of which differs from the basic algorithm in the direction of descent to the desired minimum, while in the other the function to be minimized is not minimized merely with respect to one variable but with respect to all the variables together. A.B.K.

A73-40501 * # Airframe/propulsion system interactions - An important factor in supersonic aircraft flight control. D. T. Berry and G. B. Gilyard (NASA, Flight Research Center, Edwards, Calif.). *American Institute of Aeronautics and Astronautics, Guidance and Control Conference, Key Biscayne, Fla., Aug. 20-22, 1973, Paper 73-831.* 8 p. 6 refs. Members, $1.50; nonmembers, $2.00.

A73-40502 * # Control law synthesis and sensor design for active flutter suppression. M. G. Lyons, R. Vepa, S. C. McIntosh, Jr., and D. B. DeBra (Stanford University, Stanford, Calif.). *American Institute of Aeronautics and Astronautics, Guidance and Control Conference, Key Biscayne, Fla., Aug. 20-22, 1973, Paper 73-832.* 30 p. 17 refs. Members, $1.50; nonmembers, $2.00. Grants No. NGL-05-020-498; No. NGL-05-020-007.

Methods are presented for representing unsteady aerodynamic loadings, valid for arbitrary motion, for the two-dimensional typical section with a trailing-edge control surface in incompressible flow and a three-dimensional lifting surface with leading- or trailing-edge control surfaces in subsonic compressible flow. Loads for the two-dimensional incompressible case are obtained via analytic continuation of the Theodorsen function into the complex plane, with guidance from a time-domain approximation of the Wagner indicial function. For the three-dimensional case, it is proposed that oscillatory generalized aerodynamic forces be approximated by Pade fractions, thereby permitting an obvious continuation into the complex plane. A theoretical justification for this procedure is briefly outlined, and some practical aspects of its implementation are discussed. (Author)

A73-40510 Radar and radio navigation (Radiolokatsiia i radionavigatsiia). Edited by R. G. Mirimanov. Moscow, VINITI (Seriia Radiotekhnika. Volume 3), 1972. 400 p. In Russian.

Theoretical principles of operation and equipment design features are described in survey papers detailing the present state of development in monopulse and MTI radar techniques, atomic time and frequency standards, electronic navigation aids, and optical processing of radar signals. Topics considered include (1) RF circuitry, antenna and feed network design, signal processing functions, error sources, and performance limits in various surface and airborne monopulse and MTI radar systems; (2) design features, stability properties, and navigational applications of atomic and molecular beam standards, lasers, masers, and atomic vapor clocks; (3) on-board computer processing and updating of navigational data from primary autonomous sources on aircraft; and (4) the theoretical background and practical aspects of radar signal processing by optical methods, including spatial filtering, optical correlators, and holographic techniques. T.M.

A73-40514 # Complex radio navigation systems (Kompleksnye radionavigatsionnye sistemy). V. A. Boldin. In: Radar and radio navigation. Moscow, VINITI, 1972, p. 259-331. 40 refs. In Russian.

Survey of the operating principles and equipment in spacecraft and aircraft complex radio navigation systems. The term complex radio navigation designates the use of various electronic aids to update and correct such autonomous sources of navigational information as the inertial platform, Doppler measurements, airspeed indicators, and other on-board sensors. The principles of combining and processing electronic data from various sensors are analyzed, including the mathematical concepts of optimal linear Kalman filtering. Numerous examples illustrate multipurpose electronic navigation systems employing optimal Kalman filtering methods. T.M.

A73-40645 Survey of ground based phased array antennas. A. C. Schell (USAF, Microwave Physics Laboratory, Bedford, Mass.). In: Phased array antennas; Proceedings of the Symposium, Farmingdale, N.Y., June 2-5, 1970. Dedham, Mass., Artech House, Inc., 1972, p. 9-14. 5 refs.

This survey of phased array antennas in ground based sensor systems infers three main development directions. These are embodied in the antennas of the AN/FPS-85, HAPDAR, and the AP/TPN-19. The significance of each of these as a type is not the number of elements or the various radar parameters, but the design approach, with its attendant advantages and limitations. The re-

sultant antenna configuration qualifies for a limited range of performance, and the design becomes a candidate for those applications that match best to the antenna advantages. (Author)

A73-40646 Survey of airborne phased array antennas. J. F. Rippin, Jr. (USAF, Avionics Laboratory, Wright-Patterson AFB, Ohio). In: Phased array antennas; Proceedings of the Symposium, Farmingdale, N.Y., June 2-5, 1970. Dedham, Mass., Artech House, Inc., 1972, p. 21-29. 13 refs.

A brief status report on exploratory and advanced development programs that include airborne phased array antennas designed for use in radar and communication systems is provided. Planar phased arrays, conformal arrays, and distributed apertures are discussed. Many applications require combinations of the general types of phased array antennas enumerated; distributed arrays can be arranged in a planar or conformal configuration, and a planar array can utilize an active module for each element. F.R.L.

A73-40684 A single-plane electronically scanned antenna for airborne radar applications. D. J. Lewis, J. R. Lee, and D. K. McCarthy (Hughes Aircraft Co., Culver City, Calif.). In: Phased array antennas; Proceedings of the Symposium, Farmingdale, N.Y., June 2-5, 1970. Dedham, Mass., Artech House, Inc., 1972, p. 366-370. Contract No. NASC-66-0736-di.

An antenna system is described that was designed, fabricated, and tested to demonstrate the feasibility of a gimbal-mounted phase scanned antenna for use in airborne radar systems. It is shown that, by coupling the electronic coupling capability in one plane with mechanical scanning in the other, sufficiently high scan rates can be provided to obtain many of the desirable performance characteristics of two-plane phase-scanned arrays, but without their complexity and cost. M.V.E.

A73-40685 Physical design considerations for airborne electronic-scanning antennas. M. H. Rosengard (Hughes Aircraft Co., Culver City, Calif.). In: Phased array antennas; Proceedings of the Symposium, Farmingdale, N.Y., June 2-5, 1970. Dedham, Mass., Artech House, Inc., 1972, p. 372-378.

Description of the total physical design problem involved in an airborne electronic scanning antenna system. Critical elements such as the effect of aircraft installation on antenna surface deflection, thermal densities, the structural integrity of the total installed system, interconnections, materials, maintenance, reliability, manufacturability, and the use of advanced microelectronic techniques are discussed in the light of problems peculiar to airborne military environments and requirements. M.V.E.

A73-40702 # Spectroscopic studies of supersonic heterogeneous flows with a combustible condensed phase (Spektroskopicheskie issledovaniia sverkhzvukovykh geterogennykh techenii s goriuchei kondensirovannoi fazoi). E. G. Karpunov, L. M. Negrutsak, A. B. Ryzhik, S. I. Fraerman, and Iu. A. Iurmanov. *Fizika Goreniia i Vzryva*, vol. 9, May-June 1973, p. 387-391. 9 refs. In Russian.

A73-40753 Reduction of peak jet noise using jet refraction. P. J. Morris, W. Richarz, and H. S. Ribner (Toronto, University, Toronto, Canada). *Journal of Sound and Vibration*, vol. 29, Aug. 22, 1973, p. 443-455. 13 refs.

The directivity pattern of sound generated by a subsonic jet exhibits a peak at angles between 15 and 45 deg to the jet axis, decreasing to a minimum on the jet axis. Theoretical and experimental investigations have previously demonstrated that this minimum is due to refraction of sound by the jet flow. The present experimental study considers the effect of the introduction of a second jet of smaller exit area near to the main jet. It is shown that the small jet imposes its own heart-shaped directivity pattern on that of the first jet. Alteration of the angle between the two jets leads to a reduction in the peak sound level. Directivity patterns for unfiltered and filtered measurements are presented for changes in the jet velocities and temperature ratios. (Author)

A73-40799 # Matrix methods of calculating the strength of low-aspect-ratio wings (Matrichnye metody rascheta na prochnost' kryl'ev malogo udlineniia). N. I. Gur'ev, V. L. Pozdyshev, and Z. M. Starokadomskaia. Moscow, Izdatel'stvo Mashinostroenie, 1972. 260 p. 39 refs. In Russian.

A number of matrix algorithms are proposed for the calculation of discrete systems, in particular, low-aspect-ratio wings. The fundamentals of the structural mechanics of discrete systems are outlined systematically, including the use of the theory of linear algebra. General properties of the basic equations of discrete systems are considered, on the basis of which highly effective algorithms for calculation on a digital computer are developed. Particular attention is paid to the calculation of low-aspect-ratio wings on the basis of the force method and the displacement method and to the programming of these methods for digital computer. The structure of the initial matrices of these methods and the algorithms for constructing them on computers are examined in detail. A.B.K.

A73-40854 # A short description of the NAE airborne simulator feel system. W. E. B. Roderick (National Aeronautical Establishment, Ottawa, Canada). *Canada, National Research Council, Division of Mechanical Engineering and National Aeronautical Establishment, Quarterly Bulletin*, no. 2, 1973, p. 13-15, 17-20.

A73-40855 # Experience with the NRC 10 ft. x 20 ft. V/STOL propulsion tunnel - Some practical aspects of V/STOL engine model testing. R. A. Tyler and R. G. Williamson (National Research Council, Gas Dynamics Laboratory, Ottawa, Canada). *Canada, National Research Council, Division of Mechanical Engineering and National Aeronautical Establishment, Quarterly Bulletin*, no. 2, 1973, p. 43, 45-59, 61-75. 21 refs.

The V/STOL propulsion tunnel considered was designed to meet at minimum cost the main requirements for the transition testing of V/STOL propulsion systems involving reaction jets. The tunnel is of the open circuit type with a closed test section. The characteristics of a powered model appropriate to the test facility are examined. Practical aspects and general problem areas are discussed, giving attention to tunnel operation, force measurement, jet model problem areas, flow interference forces, wall constraint effects, tunnel flow breakdown, vortex interference and jet model testing limits. G.R.

A73-40862 * # The oculometer - A new approach to flight management research. A. A. Spady, Jr. and M. C. Waller (NASA, Langley Research Center, Hampton, Va.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-914.* 7 p. Members, $1.50; nonmembers, $2.00.

For the first time researchers have an operational, nonintrusive instrument for determining a pilot's eye-point-of-regard without encumbering the pilot or introducing other artifacts into the simulation of flight experience. The instrument (the oculometer developed for NASA by Honeywell, Inc.) produces data in a form appropriate for online monitoring and rapid analysis using state-of-the-art display and computer technology. The type and accuracy of data obtained and the potential use of the oculometer as a research and training tool will be discussed. (Author)

A73-40864 # A visual detection simulator /VDS/ for pilot warning instrument evaluation. W. Graham, J. Reed (FAA, Washington, D.C.), and E. Meyer (U.S. Department of Transportation, Transportation Systems Center, Cambridge, Mass.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-916.* 6 p. Members, $1.50; nonmembers, $2.00.

This simulator has been designed for the specific purpose of producing reproducible visual stimuli which will provide realistic detection ranges, in air-to-air encounters, by pilots who are simultaneously occupied with flying a trainer. The projection system produces a field 20 deg in elevation by 180 deg in azimuth at an

average brightness level of 200 ft-lamberts and with an angular resolution of better than one arc-minute. The stimuli are produced by 14 pairs of 35mm still projectors operated in the dissolve mode every ten seconds. Comparison of detection ranges in the simulator with those recorded in actual flight are presented. (Author)

A73-40865 # **Visual perception of pilots in carrier landing.** T. Gold (Sperry Rand Corp., Sperry Gyroscope Div., Great Neck, N.Y.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-917.* 14 p. 5 refs. Members, $1.50; nonmembers, $2.00. Navy-supported research.

Experimental investigations were performed in a visual carrier landing simulator to determine the accuracy and consistency with which Navy pilots can judge position on the glide slope and flight path during final approach. These studies covered conditions involving a quiet sea state in which there was no angular deck motion present, as well as a moving deck. The effects of dusk and night landings and the presence of the Fresnel Lens Optical Landing System (FLOLS) were included. The results indicate that pilots' mean estimates of position when on-course are within a small fraction of a degree of being correct under dusk and night conditions, with a static or moving carrier, with and without the FLOLS. However, variability in judgement is high. Sensitivity to changes in position is reduced with a moving carrier, and falls to a low value of about 40% at night, without the FLOLS. (Author)

A73-40866 # **An optimized video output from a wide angle optical probe.** J. A. Mays and R. E. Holmes (Systems Research Laboratories, Inc., Dayton, Ohio). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-918.* 7 p. Members, $1.50; nonmembers, $2.00. Contract No. F33615-72-C-1270.

A program has been conducted to develop a technique for obtaining low noise, high resolution, real time video signals from a 140-deg field of view optical probe and aircraft visual landing simulator terrain models. The primary goal was to investigate: (1) model paints, textures and illumination sources; (2) optical probe resolution, spectral response, and mapping functions; and (3) TV camera/intensifier spectral response, gain, resolution and distortion. A TV camera capable of 2000 TVL horizontal and 1000 TVL vertical resolution was developed to interface with the optical probe. (Author)

A73-40867 # **GDC/EOSS - Real-time visual and motion simulators for evaluation of fire control and electro-optical guidance systems.** S. Haselwood and R. Monroe (Martin Marietta Guidance Development Center, Orlando, Fla.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-919.* 9 p. Members, $1.50; nonmembers, $2.00. Grant No. DAAH01-71-C-0587.

The Guidance Development Center (GDC) completed in 1966 and the Electro-Optical Simulation System (EOSS) to be completed in early 1974 are discussed in terms of capability, performance and facility configuration. These two precision test facilities provide unique and realistic controlled spectral and dynamic environments for the testing of a wide variety of ultraviolet, visible and near-infrared guidance seeker systems. The GDC and EOSS are designed for adding simulation elements for evaluating a total weapon delivery system. Thus, the facilities provide a dynamic simulation of the men/machines/targets interaction for a wide variety of electro-optical and fire control system concepts. (Author)

A73-40870 # **The Large Amplitude Multi-Mode Aerospace Research /LAMAR/ Simulator.** R. L. Haas (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio), H. E. Hotz, and G. R. Mills (Northrop Corp., Aircraft Div., Hawthorne, Calif.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-922.* 12 p. 8 refs. Members, $1.50; nonmembers, $2.00.

The use of the LAMAR simulator system and highlights of its evolution are briefly outlined. The major subsystems are described, with principal emphasis on the features of the cockpit, motion system, and visual display system. Major considerations in the detail formulation of the concept are presented. The principal new design features of this simulator are: (1) the motion system's travel limit and deceleration devices, and (2) the target projector, which has a dual capability - to project either a narrow-angle (15-deg) beam for a target aircraft image or a wide-angle (60 deg) beam for a detailed terrain image. (Author)

A73-40874 * # **Touchdown performance with a computer graphics night visual attachment.** E. A. Palmer (NASA, Ames Research Center, Moffett Field, Calif.) and F. W. Cronn (NASA, Ames Research Center, Moffett Field; California State University, San Jose, Calif.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-927.* 7 p. 10 refs. Members, $1.50; nonmembers, $2.00.

A computer graphics system was programmed to display to the pilot a dynamic perspective view of an airport terminal area. The advantages of this system are that it has high resolution and it eliminates the camera optics and electromechanical servos of TV-model systems. The disadvantages are that it lacks fine ground texture and has a small computational delay. A brief experimental evaluation was conducted in which eight airline pilots made 50 landings each in a fixed-base simulation of a DC-8 transport. They were instructed to touch down at 0.6 m/sec. The vertical velocity of the aircraft at touchdown was displayed to the pilot at the completion of each run. Their average vertical velocity at touchdown for the last ten landings was about 0.8 m/sec. This performance was similar to that obtained on current TV-model systems. (Author)

A73-40875 # **An approach to computer image generator for visual simulation.** J. D. Basinger (USAF, Human Resources Laboratory, Wright-Patterson AFB, Ohio). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-928.* 8 p. Members, $1.50; nonmembers, $2.00.

A computer image generator (CIG) system is being developed to generate imagery for all T-37 training flights. The CIG development represents an advance in image generation technology for visual simulation. The CIG approach generates a television video signal which is similar to that generated by a television camera. This video signal is derived from a digital environment model stored in computer memory. This model is processed according to the simulated aircraft position and the output is generated by a high-speed digital-to-analog converter. Several advantages of digital generation of imagery include exact perspective, complete freedom of flight, high rates of motion and flexibility of operation. (Author)

A73-40876 * # **Washout circuit design for multi-degrees-of-freedom moving base simulators.** B. Conrad, S. F. Schmidt (Analytical Mechanics Associates, Mountain View, Calif.), and J. G. Douvillier (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-929.* 10 p. 12 refs. Members, $1.50; nonmembers, $2.00.

A mathematical framework is presented for designing logic to accept motion-dependent parameters from a simulation, attenuating them ('washing them out'), and generating appropriately limited drive signals. This framework is sufficiently general to encompass six-degree-of-freedom simulators with large motion capability. Emphasis is placed on preserving certain motion cue relations (such as those that would be observed in coordinated flight). Strategies for simulating side forces via tilts are shown. Finally, several specific circuits are shown. These circuits have proven to be readily adaptable to a variety of moving-base simulators. (Author)

A73-40878 # **A practical approach to motion simulation.** J. B. Sinacori (Northrop Corp., Hawthorne, Calif.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-931.* 15 p. 5 refs. Members, $1.50; nonmembers, $2.00.

A motion drive method is presented which offers the simulator user a means for rapidly designing an effective motion drive logic. Procedures and routines for adapting this method to any type of motion base are also included, together with design charts, tables, and related data which can be used to estimate an initial set of coefficients. User techniques are then presented which relate the logic scheme to the motion base type with consideration of data from human motion perception literature. Refinement procedures are given with some experiental data from simulations of fighters, STOL transports, and large helicopters. The material is organized so as to be useful as both a computer programmer's manual and a brief user's guide. (Author)

A73-40880 # **Visual and motion simulation in energy maneuvering.** E. A. Stark and J. M. Wilson, Jr. (Singer Co., Simulation Products Div., Binghamton, N.Y.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-934.* 11 p. Members, $1.50; nonmembers, $2.00. Contract No. F33657-72-C-0639.

Pilot evaluations were made of an F-4 flight simulator with a six-degree-of-freedom motion system, a terrain visual system, and a G-suit. The evaluation maneuvers required control close to the edges of the aircraft's aerodynamic and structural envelopes. Pilot comments indicated that very high fidelity data are required in simulating marginal aircraft performance. Visual cues and motion in all six degrees of freedom are required to permit control without excessive instrument reference. Cues to G-forces, sustained acceleration, buffet, and vibration are required to permit efficient control within structural limits. (Author)

A73-40881 # **Design and application of a part-task trainer to teach formation flying in USAF Undergraduate Pilot Training.** D. D. Fulgham, G. B. Reid, M. E. Wood (USAF, Human Resources Laboratory, Williams AFB, Ariz.), and I. N. McLeod (Goodyear Aerospace Corp., Akron, Ohio). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-935.* 9 p. Members, $1.50; nonmembers, $2.00. Contract No. F41609-72-C-0001.

A part-task trainer is developed that provides a safe, economical means to condition USAF Undergraduate Pilot Training (UPT) student pilots to the high performance formation flight environment prior to exposure in the aircraft. The Formation Flight Trainer (FFT) provides the pilot with a wide angle display of a USAF T-38 lead aircraft that is continuously variable in relative bearing, relative altitude and range. Students are provided varying amounts of practice in both the trainer and the T-38 aircraft and then comparisons are made to define the trainer contributions to the formation task. The initial experiment indicates that the FFT makes a significant contribution to early skill acquisition in the formation flying task. (Author)

A73-40939 **B-1 fuel/gravity control system readied.** M. L. Yaffee. *Aviation Week and Space Technology,* vol. 99, Aug. 27, 1973, p. 46, 47.

A system is described which controls the flow of fuel into and out of 10 fuel cells in order to keep the aircraft center of gravity within optimum range for different conditions such as supersonic cruise and takeoff. The heart of the system is a digital computer which is programmed to compensate automatically for significant shift in the B-1's center of gravity due to, e.g., wing sweeps, by transferring fuel from one pair of tanks to another. Using signals from the several sensors in each fuel tank, the computer corrects for altitude, attitude, and fuel density to obtain precise measurements of fuel quantities. It then computes actual and target center of gravity values, and provides pump and valve commands to the fuel transfer system. F.R.L.

A73-40942 **The design and construction of an anechoic chamber lined with panels and intended for investigation of aerodynamic noise (Réalisation d'une chambre anéchoïque revêtue de panneaux et destinée à l'étude des bruits d'origine aérodynamique).** J. P. Berhault, M. Sunyach, H. Arbey, and G. Comte-Bellot (Ecole Centrale Lyonnaise, Ecully, Rhône, France). *Acustica,* vol. 29, Aug. 1973, p. 69-78. 10 refs. In French. Research supported by the Electricité de France.

The wall lining of the chamber consists of successive layers of glass wool panels, of densities 70 kg/cu m and 38 kg/cu m. The former are 80 cm long, the latter, 40, 50, 60 or 70 cm long. The dimensions of the open space in the chamber are: 6.10 m (length) by 4.60 m (width) by 3.80 m (height). The acoustic characteristics of the chamber were examined by measuring the sound pressure level p as a function of the distance r from different sources. The deviations from the decay law p proportional to 1/r are apparent principally in the region of 80 Hz, where p decreases too rapidly, and for surveys near the walls, where the decay is frequency dependant. An air stream is ducted into the chamber for investigations of aerodynamic noise. (Author)

A73-40943 **On the radiation from an aerodynamic acoustic dipole source (Über die Strahlung von aerodynamischen akustischen Dipolen).** W. Dittrich (München, Technische Universität, Munich, West Germany). *Acustica,* vol. 29, Aug. 1973, p. 79-85. 26 refs. In German.

Lighthill used the pressure integral over the surface of circulating bodies and, with this formulation as a basis, set-up the beam model of the oscillating sphere (and through a modified aerodynamic parameter also that of the oscillating cylinder). Three models are developed. Under simplified assumptions, the estimated correlations between the radiation performance and the circulating velocity can be derived. This performance can be increased from the fifth to the eighth power of the circulating velocity. (Author)

A73-40975 **French study V/STOL approach system.** R. R. Ropelewski. *Aviation Week and Space Technology,* vol. 99, Sept. 3, 1973, p. 48, 49, 51, 53.

The system evaluated would allow pilots to make hands-off instrument approaches to an altitude of 100 ft. The incorporation of the approach system in the large transport helicopters of the French army is being considered. Basic elements of the system include an autopilot, a flight director, and the coupler. A variety of landing aids can be used for vector and altitude guidance. Demonstration approaches in which the new system was used are discussed, giving attention to airspeed, descent rate, and aspects of deceleration. G.R.

A73-41057 **An experimental study of strong injection at axisymmetrical bodies of revolution.** E. E. Borovskii, V. F. Zakharchenko, M. V. Tsvetkova, and V. N. Shashmurin (Moskovskoe Vysshee Tekhnicheskoe Uchilishche, Moscow, USSR). *Heat Transfer - Soviet Research,* vol. 5, July-Aug. 1973, p. 86-90. Translation.

A study is described of the feasibility of utilizing injection of a secondary fluid for controlling flows past various bodies in order to reduce heat transfer to their surface and to modify the drag within required limits. It is found that using an injection ratio close to unity permits substantial modification of the nature of flow past the body. The experimental results are presented in graphical form. (Author)

A73-41070 # **Gas-releasing additives to jet fuels (Gazovydeliaiushchie prisadki k reaktivnym toplivam).** L. K. Chumakova (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian

SSR). *Khimiia i Tekhnologiia Topliv i Masel*, vol. 18, no. 8, 1973, p. 43-45. In Russian.

Data are presented on thermally unstable organic compounds of the type of butyric acid azide, which will decompose in jet fuels at elevated temperatures, and will release an inert gas (nitrogen) required to suppress the thermal-oxidation effects produced by the oxygen dissolved in the fuel. Calculations show that the required amounts of these additives range between 0.01 and 0.05% of the fuel weight. V.P.

A73-41075 The limits of today's instrument landing procedure (Grenzen des heutigen Blindlandeverfahrens). H. Fricke (Braunschweig, Technische Universität, Braunschweig, West Germany). *Nachrichtentechnische Zeitschrift*, vol. 26, Aug. 1973, p. 397-400. 7 refs. In German.

The basic concept involved in instrument landing was already described by Kramar (1933, 1935). The determination of the glide path and the course for landing is discussed, together with disturbances due to interferences because of multipath propagation and disturbances produced by ground effects. Certain limitations of the instrument landing system (ILS) are connected with the use of frequencies in the vicinity of 100 MHz and 300 MHz. New instrument landing methods which are to replace ILS sometine around 1985 will be operating at higher frequencies. Frequency ranges at 5 GHz or 15 GHz are being considered. G.R.

A73-41076 Nitrogen oxides, nuclear weapon testing, Concorde and stratospheric ozone. P. Goldsmith, A. F. Tuck, J. S. Foot, E. L. Simmons, and R. L. Newson (Meteorological Office, Bracknell, Berks., England). *Nature*, vol. 244, Aug. 31, 1973, p. 545-551. 34 refs.

The production of nitrogen oxides in the shock wave of explosions associated with the testing of nuclear weapons in the atmosphere is calculated. It is found that past nuclear explosions have been equivalent, as far as nitrogen oxide injections into the stratosphere are concerned, to large numbers of Concorde aircraft. Analyses of the ozone records reveal no detectable changes in the total atmospheric ozone during and after the periods of nuclear weapon testing. G.R.

A73-41086 # Aerospace in the next century. I. I. Glass (Toronto, University, Toronto, Canada). *Canadian Aeronautics and Space Journal*, vol. 19, May 1973, p. 193-215. 39 refs.

Brief survey of the history of aeronautics and astronautics from their earliest germinal stages to their latest accomplishments. Special attention is given to the impact of aerospace developments upon civilization. In conclusion, Canada's role in the space age is discussed. M.V.E.

A73-41087 # Investigation of multi-element airfoils with external flow jet flap. F. Mavriplis (Canadair, Ltd., Montreal, Canada). *Canadian Aeronautics and Space Journal*, vol. 19, May 1973, p. 217-233. 12 refs. Research supported by the Defence Research Board and Canadair.

An investigation was conducted to provide detailed information on the aerodynamics of externally blown flap systems. Wind tunnel tests were made with a two-dimensional high-lift airfoil model in interaction with a jet from an 8-inch diameter tip-turbine fan. An analysis of the test results led to the establishment of a semi-empirical method for calculating the aerodynamic forces on multi-element airfoils with external or internal flow jet flap. The method is based on jet-flap theory suitably modified to account for the individual flap element chord length and deflection angle as well as jet deflection angle. With this method it was possible to predict reasonably well the experimental lift and drag coefficient of the model airfoil with a slat and double-slotted flap for trailing edge jet momentum coefficients Cj ranging from 0 to 2.0. (Author)

A73-41125 # Airframe bearings. R. Pichaud (ADR, Champigny-sur-Marne, Val-de-Marne, France). *Tech Air*, Sept. 1973, p. I-VIII.

Airframe bearings are primarily used in elevator and rudder mechanisms, flight control and landing gear attachments, wing mechanisms, and special control. THe flight control mechanisms enable the pilot to control the hydraulic servo systems directly linked to the control surfaces. There are three different systems for the transmission of control movements from the pilot to the servo systems. Whichever system is used, the moving parts must operate with an extremely low frictional torque. For this reason, rolling bearings must be used. Usually single or double-row deep-groove ball bearings and self-aligning ball bearings are employed. G.R.

A73-41129 # A method of optimization of algorithms for secondary processing of radio signals (Metoda optimalizace algoritmu druhotneho zpracovani radiolokacniho signalu). F. Vejrazka (Ceske Vysoke Uceni Technicke, Prague, Czechoslovakia). *Slaboproudy Obzor*, vol. 8, Aug. 1973, p. 354-359. 14 refs. In Czech.

Brief explanation of the fundamentals of secondary processing of radar signals and its place in a system of automatic processing of primary scanning radar signals. A secondary-processing algorithm for radar tracking of aerial targets is proposed, the functions of an automaton which performs secondary processing of a radar signal are reviewed, and a method of establishing the optimal decision rule in applying the algorithm is outlined. The determination of the statistical parameters of a system presumed to be a fictitious elementary automaton is discussed, and an optimality criterion similar to the well-known Neumann-Pearson criterion is proposed. An example is given which illustrates the determination of statistical parameters for a very simple decision rule. A.B.K.

A73-41172 # Arctic resources airplane transportation system. M. T. Friedl. *RAeS, AIAA, and CASI, Anglo-American Aeronautical Conference, 13th, London, England, June 4-8, 1973, Paper.* 25 p.

A transportation system specifically designed to move natural resources, primarily crude oil or liquid natural gas (LNG) out of the arctic by air is discussed. A typical gross weight for the aircraft is 3,500,000 lb, carrying a payload of over 2,000,000 lb at a relatively low Mach number at altitudes up to 40,000 ft. As a liquid natural gas transporter, 35 aircraft of this size in operation at 1800 n mi range are equivalent in capacity to a 48-in. gas pipeline. The importance of design for low cost is emphasized, and various configurations are evaluated. Attention is given to aspects of cargo handling and terminals. F.R.L.

A73-41174 # Sonic bang investigations associated with the Concorde's test flying. C. H. E. Warren (Royal Aircraft Establishment, Farnborough, Hants., England). *RAeS, AIAA, and CASI, Anglo-American Aeronautical Conference, 13th, London, England, June 4-8, 1973, Paper.* 26 p. 9 refs.

Some of the Concorde's supersonic test flying has been conducted along a so-called West Coast Route of Great Britain, and opportunity was taken to glean information on the effects of the sonic bangs. The sonic bang waveform was measured for each flight at up to 12 measuring stations positioned along the route. The results of these measurements were analyzed, providing information on the signal interval, characteristic overpressure, and maximum pressure rise rate. Some indication of the subjective effects on humans was obtained from analysis of complaints. Qualitative studies were made on some animals, birds, and fish. Observations and measurements were made on various buildings, and two specific studies on terrain effects were made. F.R.L.

A73-41189 The rotor and its future /13th Cierva Memorial Lecture/. J. P. Jones (Westland Helicopters, Ltd., Yeovil, Somerset, England). *Aeronautical Journal*, vol. 77, July 1973, p. 327-337. 5 refs.

Rotorcraft are considered to be aircraft of the future and will set, in a different way from fixed wind aircraft, a pace of progress in aeronautics. The rotor provides lift for hover in a cheap manner; in forward flight the aerodynamic and structural combination produces lift as easily as a fixed wing; the propulsion, control, and trim devices are all built in, and in the last resort it provides for a controlled landing if the power fails. Various aspects of the limits of the rotor are discussed extensively, and attention is given to the Sikorsky advancing blade concept (ABC) as a means of dealing with asymmetry by mechanical means. The straightforward evolution of the conventional rotor is believed to be the proper way to progress. The necessary elements are the exploitation of new materials and the development of an advanced rotor aerodynamics based on increased tip speed. F.R.L.

A73-41192 The aerodynamic development of the wing of the A 300B. D. M. McRae (Hawker Siddeley Aviation, Ltd., Kingston on Thames, Surrey, England). *Aeronautical Journal*, vol. 77, July 1973, p. 367-379.

Major aerodynamic considerations involved wing configuration, sweep, thickness, and aspect ratio. It was decided at an early stage that the wing design would be matched to performance at a temperature of not less than International Standard Atmosphere + 10 C, and that comparisons with the speed of competitive aircraft would be considered with this in mind. The provision of an unnecessary margin between actual cruise speed and maximum permitted cruise speed is an expensive luxury, since it implies an unnecessarily thin and heavy wing. Details of high speed design and of design for high lift are discussed, and brief attention is given to miscellaneous details. F.R.L.

A73-41200 Technical progress on new vibration and acoustic tests for proposed MIL-STD-810C, 'environmental test methods.' D. L. Earls (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). *(Institute of Environmental Sciences, Annual Meeting, 19th, Anaheim, Calif., Apr. 3-5, 1973.) Journal of Environmental Sciences*, vol. 16, July-Aug. 1973, p. 22-32. 16 refs.

A73-41201 The role of testing in achieving aerospace systems effectiveness. Edited by A. M. Smith (General Electric Co., Philadelphia, Pa.). New York, American Institute of Aeronautics and Astronautics, Inc., 1973. 92 p. Members, $5.00; nonmembers, $7.00.

A survey of practices and beliefs in the field of aerospace testing is provided, with special emphasis on the achievement of product reliability, maintainability, and safety. Information is offered that describes the technical problems or gaps existing in the area of test technology. The data for the findings are based on responses to a survey questionnaire. The product areas of interest were launch vehicles, spacecraft, Department of Defense (DOD) aircraft, and commercial aircraft.

F.R.L.

A73-41204 # DOD aircraft. J. C. Sindt (Honeywell, Inc., Minneapolis, Minn.). In: The role of testing in achieving aerospace systems effectiveness. New York, American Institute of Aeronautics and Astronautics, Inc., 1973, p. 4-1 to 4-21.

Twenty-one responses were received from component, subsystem, and system suppliers. Most of the major (current and recent) Department of Defense (DOD) aircraft programs, as listed in the products/programs item of the questionnaire, form the basis of this chapter. In tabulating the responses, some trends appeared to be possibly related to the supplier level (component, subsystem, or system). As much raw data is provided as possible to permit the reader to make his own analysis, comparisons, and conclusions.

F.R.L.

A73-41205 # Commercial aircraft. T. D. Matteson (United Air Lines, Inc., San Francisco, Calif.). In: The role of testing in achieving aerospace systems effectiveness. New York, American Institute of Aeronautics and Astronautics, Inc., 1973, p. 5-1 to 5-9.

Testing in the manufacturing environment and testing in the operations environment are dealt with. 'Creators' and 'maintainers' are treated separately. Since the requirements for testing are generally much less specific for commercial aircraft systems, the questionnaire used for this survey was treated less rigorously by the respondents than for those products that are created in response to a military or NASA requirement. The combined experience of the respondents includes all of the major aircraft used today, both from a supplier and operator point of view. F.R.L.

A73-41281 # Structural mechanics of tapered thin-walled systems (Stroitel'naia mekhanika skoshennykh tonkostennykh sistem). I. F. Obraztsov and G. G. Onanov. Moscow, Izdatel'stvo Mashinostroenie, 1973. 660 p. 29 refs. In Russian.

Tapered aircraft and rocket components, such as swept wings, delta wings, small-aspect-ratio wings, conical rocket bodies and aircraft fuselages, but also straight wings and cylindrical bodies and fuselages are treated from a unified point of view as special cases of a conical shell of arbitrary contour. General equations describing the work of thin-walled tapered systems under arbitrary static, dynamic, and thermal loads are derived. Static and thermoelastic problems are examined, together with natural-vibration problems and vibrations of (wing-type) shells containing liquid. Solutions are obtained with the aid of the formalism of generalized functions and by a method of solving differential equations with variable coefficients having the form of a delta-function and its derivatives. V.P.

A73-41283 # Cable communications lines at airports (Kabel'nye linii sviazi aeroportov). O. S. Nabatov. Moscow, Izdatel'stvo Transport, 1973. 164 p. 26 refs. In Russian.

The book discusses the major aspects of such topics as the design and construction of airport cable lines; the theory of signal transmission in such lines; the calculation of cable elements and electrical parameters; the influence of external electromagnetic and galvanic effects, and methods of reducing them; and the installation and operation of cable lines. The structural and electrical characteristics of modern airport cable lines are examined. V.P.

A73-41287 # Prestressed pavements of airports and roads (Predvaritel'no napriazhennye pokrytiia aerodromov i dorog). B. S. Raev-Bogoslovskii, A. N. Zashchepin, B. I. Demin, E. N. Smirnov, and A. Ia. Apollonov. Moscow, Izdatel'stvo Transport, 1972. 200 p. 35 refs. In Russian.

Domestic and foreign experience in designing, constructing, and operating monolithic and sectional prestressed airport and road pavements is reviewed and generalized. The results obtained with pavements of various type are examined. Characteristic features of the production technology of monolythic tensioned-concrete pavements and sectional pavements composed of plates are noted. V.P.

A73-41288 # Aerohydrodynamic methods for measuring input parameters of automatic systems: Fluidic measuring elements (Aerogidrodinamicheskie metody izmereniia vkhodnykh parametrov avtomaticheskikh sistem: Izmeritel'nye elementy pnevmoniki). L. A. Zalmanzon. Moscow, Izdatel'stvo Nauka, 1973. 464 p. 719 refs. In Russian.

It is shown how fluidic sensors can be used to measure such parameters as the Mach number, absolute gas pressure, absolute and excess pressure ratios, gas and liquid flow rates, temperatures, the dimension and attitude of objects, and of force, moment, and strength parameters. The theory of chamber-type automatic timers and of clocks employing fluid oscillators is outlined. The application of fluids to the measurement of luminous intensity and of electric and magnetic quantities is examined. Some general aspects of the theory of dynamic fluidic elements are studied. V.P.

A73-41294 # **Economic efficiency and planning of air freight transportation (Voprosy ekonomiki i planirovaniia gruzovykh perevozok vozdushnym transportom).** B. M. Parakhonskii and B. S. Balashov. Moscow, Izdatel'stvo Transport, 1972. 81 p. 31 refs. In Russian.

The history of the development of air freight transportation and its current status and future trends are reviewed. The distribution of air freight transportations in the USSR with respect to their nature, volume, and distance is analyzed. Means of improving air freight transportation planning are suggested, and the economic efficiency of air bridges in roadless regions of northern Siberia is evaluated. V.P.

A73-41316 **Measurement of low levels of turbulence with a hot-wire anemometer.** V. S. Demin, O. V. Morin, N. F. Poliakov, and V. A. Shcherbakov (Akademiia Nauk SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR). *(Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskikh Nauk,* June 1972, p. 21-24.) *Fluid Mechanics - Soviet Research,* vol. 2, May-June 1973, p. 59-63. Translation.

Description of low-turbulence wind-tunnel experiments in which a thermoanemometer was used for measurement of turbulence levels on the order of several hundredths of a per cent. The thermoanemometer was a DISA made with a 5 micron gilded tungsten filament. Five wire grids with 1-mm meshes were set in the forechamber to control turbulence. Turbulence levels of 0.02 to 0.03% were recorded by measurements at flow velocities from 5 to 45 m/sec. V.Z.

A73-41317 **Interpretation of hot-wire anemometer readings in a flow with velocity, pressure and temperature fluctuations.** V. S. Demin and N. A. Zheltukhin (Akademiia Nauk SSSR, Institut Teoreticheskoi i Prikladnoi Mekhaniki, Novosibirsk, USSR). *(Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskikh Nauk,* June 1972, p. 25-36.) *Fluid Mechanics - Soviet Research,* vol. 2, May-June 1973, p. 64-75. 16 refs. Translation.

A mode method proposed by Kovasznay (1950, 1953) is applied as a basis for decoding constant-resistance anomometer measurements of flow parameters involving velocity, pressure, and temperature fluctuations. Calibration of a thermoanemometer for this operation is discussed. Procedures are given for calculation of time-averaged flow parameters, flow parameter pulsation characteristics, and flow rate, density, pressure and temperature pulsations from thermoanemometer readings. The procedures are applicable when the Reynolds number of the thermoanemometer sensor filament is 50 to 100 and higher and the Mach number of the flow is below 0.4 or between 1.2 and 5. V.Z.

A73-41425 # **Arrangement of equipment in airplanes (Komponovka oborudovaniia na samoletakh).** L. L. Kerber. Moscow, Izdatel'stvo Mashinostroenie, 1972. 306 p. 44 refs. In Russian.

Weight-saving schemes for the arrangement of instruments and of electrical, radar, navigation, flight-control and other equipment on board civil-aviation and military aircraft are discussed. Examples of the layout of instrument panels, compartments, and bays are presented, together with expedient methods of building radar antennas and radomes, fuel meters, deicers, photographic and other equipment into the aircraft fuselage. V.P.

A73-41431 **Flying B-1 at ground zero.** *Skyline,* vol. 31, no. 3, 1973, p. 4-13.

The extensive ground testing and component evaluation program for the B-1 bomber prior to actual construction and flight testing is described. Wind tunnel investigations on models study the aerodynamic characteristics, performance in the stall mode, the drag factors, and determine what would happen during a spin. Materials are assessed for their ability to stand up under pressures and strains that simulate real flight parameters as closely as possible. The performance of the ejectable crew capsule, the operation of the landing gear, the compatibility of the electrical systems, and the impact resistance of the windshield are intensively studied. Particulars of the various facilities used are given. F.R.L.

A73-41437 # **Gyroscopes (Giroskopy).** N. F. Babaeva. Leningrad, Izdatel'stvo Mashinostroenie, 1973. 104 p. 28 refs. In Russian.

The fundamentals of gyroscope theory are reviewed, and the design and principles of operation of modern marine, aircraft, and space gyroscopes are discussed. Factors affecting the precision of gyroscopic devices are examined, together with methods of improving precision. An attempt is made to interpret some complex gyroscopic phenomena in an easily understandable way. The laws governing the behavior of gyroscopes are illustrated by devices used in various areas of modern technology. V.P.

A73-41519 # **Early results from Skylab 1.** *Astronautics and Aeronautics,* vol. 11, Sept. 1973, p. 22-30.

The Skylab medical experiments aimed at getting as complete a picture as practical of the major interrelated physiological processes as they would be affected by the exposure to the space-flight environment. The preliminary medical findings clearly show that future manned space flight should not be limited by physiological factors provided the necessary countermeasures receive adequate attention. The astronauts succeeded in making observations regarding all the major solar physics problems which were to be investigated. Intensive observations of more than five-million square miles of the terrestrial surface were made with multispectral instruments. In support of meteorological and oceanographic studies, the crew obtained the first active microwave measurements of a major storm. G.R.

A73-41522 # **A look at Soviet ATC and nav facilities and avionics.** S. B. Poritzky (Air Transport Association of America, Washington, D.C.). *Astronautics and Aeronautics,* vol. 11, Sept. 1973, p. 69-75.

The characteristics of the Soviet ATC are determined by the widespread utilization of jet aircraft in the USSR and the great volume of the air traffic which included the transportation of 83 million passengers in 1972. The impressions of American visitors in the USSR with respect to the Soviet ATC systems and the equipment used are discussed, giving attention also to the attitude of the Soviet government regarding a utilization of Western technology and approaches concerning a cooperation of the USSR and the other countries in the further development of ATC. G.R.

A73-41557 **The testing of varnishing products used in aeronautics (Il collaudo dei prodotti vernicianti di impiego aeronautico).** L. Falco. *L'Aerotecnica - Missili e Spazio,* vol. 52, Apr. 1973, p. 155-158. 17 refs. In Italian.

Brief review of the testing procedures employed in an air force laboratory for controlling the quality and characteristics of varnish and various types of paints used in aeronautics. It is shown how the difficulties and uncertainties involved in technological testing of this type mandate the adoption of new criteria based on instrumental chemical analysis of the various components of the paints and varnish so as to obtain rapid and reliable evaluations. A.B.K.

A73-41569 **Drag due to regular arrays of roughness elements of varying geometry.** R. A. Wooding (Department of Scientific and Industrial Research, Applied Mathematics Div., Wellington, New Zealand), E. F. Bradley (Commonwealth Scientific and Industrial Research Organization, Div. of Environmental Mechanics, Canberra, Australia), and J. K. Marshall. *Boundary-Layer Meteorology,* vol. 5, July 1973, p. 285-308. 42 refs.

Comparisons are made of experimental studies on the drag, at high Reynolds number, due to regular arrays of roughness elements of various shapes immersed in a turbulent boundary layer. Using a variant of Millikan's dimensional analysis, the form of the velocity profile is deduced in terms of the dimensions and concentration of the roughness elements. A drag formula results which is shown to be in good agreement with data. Available measurements of the partition of drag between the elements and the intervening surface indicates that equipartition occurs at quite low concentrations. The interaction between elements is then small, so that the drag coefficient of a typical roughness element is nearly constant.
(Author)

A73-41571 **Geostrophic drag coefficients.** E. L. Deacon (Commonwealth Scientific and Industrial Research Organization, Div. of Atmospheric Physics, Aspendale, Australia). *Boundary-Layer Meteorology*, vol. 5, July 1973, p. 321-340. 44 refs.

Data on the relationship of the surface wind to the geostrophic wind at Porton Down, Salisbury Plain, are presented for various stability conditions and are analysed in the light of the Rossby-number similarity theory. For near-neutral conditions, the geostrophic drag coefficients for geostrophic wind speeds of 5 to 15 m/sec are close to those found by other workers, but at higher speeds the values are low. Comparisons of geostrophic and radar wind speeds for a 900-m height, suggest that undetectably small mean cyclonic curvatures of the trajectories of the air are responsible for this departure. A value of the geostrophic drag coefficient for the open sea at wind speeds around 8 m/sec (neutral conditions) is deduced from recent observations of the drag in relation to the surface wind, combined with the ratios of 900-mb radar wind to surface wind obtained from North Atlantic weather ship data tabulations.
(Author)

A73-41577 # **Influence of wing flexibility on sailplane loading by individual gusts (Wplyw sprezystosci gietnej skrzydla na obciazenia szybowca od pojedynczych podmuchow).** J. Sandauer. *Instytut Lotnictwa, Prace*, no. 53, 1973, p. 3-18. 7 refs. In Polish.

A73-41581 # **Effects of certain flight parameters and of certain structural parameters on helicopter main-rotor blade flutter (Wplyw parametrow lotu i niektorych parametrow konstrukcyjnych na flatter lopat wirnika nosnego smiglowca).** L. Zerek. *Instytut Lotnictwa, Prace*, no. 54, 1973, p. 3-25. 10 refs. In Polish.

A73-41582 # **Influence of geometrical parameters on propeller performance at low advance ratios (Wplyw parametrow geometrycznych na osiagi smigla przy malych posuwach).** Z. Brodzki. *Instytut Lotnictwa, Prace*, no. 54, 1973, p. 27-46. 24 refs. In Polish.

The effects of the geometrical parameters of the propeller planform and profile on its performance at low advance ratios or at operation in a fixed position are studied with allowance for compressibility. A propeller operating at low advance ratios or in a fixed position is subject to heavy loading, and analytical methods of evaluating the efficiency are inadequate. Experimental data obtained in original studies and published in the literature are presented in graphs illustrating the effects of propeller geometry on the ratio of the thrust coefficient to the power coefficient. Paddle propellers show advantages when it is necessary to obtain high thrust at a given input power.
T.M.

A73-41584 # **Study of flow around an airfoil with a spoiler at Mach numbers ranging from 0.5 to 2.3 (Badanie oplywu profilu z interceptorem w zakresie liczb Macha od 0,5 do 2,3).** W. Kania and M. Buczek. *Instytut Lotnictwa, Prace*, no. 54, 1973, p. 83-118. 17 refs. In Polish.

Results of wind tunnel tests conducted with airfoils having a spoiler mounted on the upper surface of the profile at distances from the leading edge equivalent to 0.5, 0.7, and 0.9 of the chord length. Four tested spoilers differed in height which ranged between 0.02 and 0.10 of the chord length. Flow visualization and static pressure measurements on the profile were conducted at six angles of attack between 4 and 15 deg for freestream Mach numbers of 0.5, 0.8, 0.9, 1.0, 1.1, 1.52, and 2.30. Physical features of flow around an airfoil with a spoiler are described, and a detailed analysis illustrates the effects of spoiler geometry and position on the drop in profile lift and on the profile pressure distribution.
T.M.

A73-41593 # **Macrofractographic studies of fatigue fractures in aircraft engine elements (Badania makrofraktograficzne zlomow zmeczeniowych w elementach silnikow lotniczych).** E. Gruszczynski. *Technika Lotnicza i Astronautyczna*, vol. 28, Aug. 1973, p. 12-18, 41. In Polish.

A73-41603 # **Specific problems of the dynamics of composite systems (Einzelne Probleme der Dynamik zusammengesetzter Systeme).** A. Bosznay (Budapesti Muszaki Egyetem, Budapest, Hungary). *Periodica Polytechnica, Mechanical Engineering*, vol. 17, no. 1, 1973, p. 7-27. In German.

Two methods are presented for solving certain problems pertaining to composite dynamic systems, such as sets or aggregates of machines. One of these methods makes it possible to derive from the dynamic matrix (or scalar) factors of the individual system components the overall system factor, while the other helps infer the frequency equation of the whole system from the frequency equations of the system components. The application of these methods is illustrated by an example involving a generator rotor and a turbine on separate test beds.
M.V.E.

A73-41648 # **Dolphin airship with undulating propulsion system - Results of static thrust measurements with model 192x108 (Delphinluftschiff mit Wellantrieb - Ergebnisse von Standschubmessungen am Modell 192x108).** W. Schmidt. *Technisch-ökonomische Informationen der zivilen Luftfahrt*, vol. 9, no. 4, 1973, p. 240-244. 7 refs. In German.

Wind tunnel tests conducted with the propeller of the new propulsion system are discussed together with the design details of the investigated model. Thrust forces were measured with the aid of weights. System parameter relations for the various thrust directions are shown in a number of graphs.
G.R.

A73-41649 # **Synthetic radio direction defining methods with virtual antenna patterns.** K. Kohler (Standard Elektrik Lorenz AG, Stuttgart, West Germany). *Electrical Communication*, vol. 48, no. 3, 1973, p. 299-304.

The generation of a real pattern by a line of equidistant isotropic radiators is considered together with the generation of virtual patterns. Aspects of the application of virtual patterns for localization and direction finding are discussed, giving attention to the scanning method, the quotient procedure, and the advantages of virtual patterns. The characteristics of virtual and real patterns are compared, taking into account directivity, multipath propagation, single radiator characteristics, coupling between single radiators, and the signal-to-noise ratio.
G.R.

A73-41691 **Symposium on Electromagnetic Interference in Aircraft, London, England, February 15, 1973, Proceedings.** Symposium sponsored by the Institution of Electrical Engineers and Royal Aeronautical Society. London, Institution of Electrical Engineer, 1973. 113 p. $5.55.

Techniques of measurement related to electromagnetic interference (EMI) are discussed together with questions of EMI in military transport. Other subjects considered include the susceptibility of modern instrument systems to interference in the HF band,

equipment design to meet electromagnetic compatibility (EMC) specification requirements, and a review of some current EMC specifications. The significance of EMC problems for the airframe manufacturer is examined along with the importance of EMC for modern aircraft.

G.R.

A73-41692 # **Electromagnetic interference - Techniques of measurement.** G. A. Jackson (Electrical Research Association, Leatherhead, Surrey, England). In: Symposium on Electromagnetic Interference in Aircraft, London, England, February 15, 1973, Proceedings. London, Institution of Electrical Engineers, 1973. 12 p.

Possible techniques of measurement considered are related to the use of a Helmholtz coil system for low frequency magnetic fields and a parallel strip transmission line for EM fields involving frequencies up to 30 MHz. The measuring receivers used are discussed, taking into account detectors and a multichannel measuring receiver. RF current and voltage measurements are considered together with approaches for determining the RF impedance. Attention is given to the coupling effects between power supply wiring and aerials. Current investigations are concerned with the use of an AF voltmeter to determine the signal to noise ratio at the output terminals of the system under examination. G.R.

A73-41693 # **Electromagnetic interference in military transport aircraft.** D. A. Bull (Electrical Research Association, Leatherhead, Surrey, England). In: Symposium on Electromagnetic Interference in Aircraft, London, England, February 15, 1973, Proceedings. London, Institution of Electrical Engineers, 1973. 15 p.

The measurements made in the studies are discussed, giving attention to the measurement of radio frequency terminal voltage and current, measurements of the radio frequency radiated field, the fuselage as a radio frequency screen, the radio frequency impedance of the DC power supplies, and the measurements of the external radiated interference fields. The quantitative analysis of the work is presented mainly in graphical form. The significance of the results obtained is considered, taking into account aspects of RF interference on DC primary systems, RF interference on AC primary systems, the interference measured at the sources of the utilization equipment, the interference on the secondary AC supplies, RF impedance of the DC power cables, RF attenuation of the aircraft fuselage, and the measurement of the magnetic field. G.R.

A73-41694 # **The susceptibility of modern aircraft instrument systems to interference in the HF band.** R. D. Jones (British Overseas Airways Corp., London Airport, Hounslow, Middx., England). In: Symposium on Electromagnetic Interference in Aircraft, London, England, February 15, 1973, Proceedings. London, Institution of Electrical Engineers, 1973. 19 p.

The aircraft instrument systems susceptible to HF interference are considered, taking into account the HF communication system, the interference mechanism, the oil quantity system, the KW/KVAR system, the N1 tachometer, the engine vibration monitor, the total air temperature/engine pressure ratio limit system, and the cabin pressure control system. It is pointed out that systems operating in the audio frequency band are not immune from RF interference. Systems contained entirely within the fuselage are as susceptible as those extending into the antenna region. A common feature of these systems is that they are essentially broadband. G.R.

A73-41695 # **Equipment design to meet E.M.C. specification requirements.** P. Campbell (Lucas Aerospace, Ltd., Solihull, Warwicks., England) and M. Le Grys (Marconi-Elliott Avionic Systems, Ltd., Rochester, Kent, England). In: Symposium on Electromagnetic Interference in Aircraft, London, England, February 15, 1973, Proceedings. London, Institution of Electrical Engineers, 1973. 24 p.

Questions regarding the generation of interference are considered together with approaches suitable for controlling this interference. Man made interference in aircraft can be generated by communication and electronic equipment. Natural interference is caused by electrical storms, snow storms, rain particles, and interstellar radiation. Inherent interference is produced by the natural random movement of free electrons in a conductor and the movement of holes and electrons in semiconductor devices. The prediction of interference levels is considered together with the strength of the radiated interference field and the methods of coupling EMI. Device design considerations are examined and the application of the principles described is illustrated. G.R.

A73-41696 # **A review of current E.M.C. specifications and their impact.** G. T. Clarkson and L. O'Beirne (Ferranti, Ltd., Hollinwood, Lancs., England). In: Symposium on Electromagnetic Interference in Aircraft, London, England, February 15, 1973, Proceedings. London, Institution of Electrical Engineers, 1973. 13 p. 5 refs.

The E.M.C. specifications are concerned with tests in four main areas. Examples of equipment classification are discussed together with details regarding the control and the test plan which the manufacturer of equipment is to provide. British specifications for aircraft equipment are examined, taking into account grades of protection, basic objectives, the equipment of the test facility, and questions of compatibility and the cost of achieving it. It is felt that the British Standard is not adequate for modern aircraft electronic systems and that in its revised state it should clearly detail the test methods and their application. G.R.

A73-41697 # **EMC for a modern aircraft.** M. L. Jarvis (Royal Aircraft Establishment, Farnborough, Hants., England) and D. Ramsbottom (British Aircraft Corp., Ltd., Warton, Lancs., England). In: Symposium on Electromagnetic Interference in Aircraft, London, England, February 15, 1973, Proceedings. London, Institution of Electrical Engineers, 1973. 14 p.

The reasons for initiating an electromagnetic compatibility (EMC) program are examined. It has become recognized that adequate and careful consideration of compatibility questions in the initial design will obviate the necessity for costly aircraft and equipment redesign. System engineering aspects are considered together with questions regarding the education of specialists and equipment suppliers. The system EMC control plan is discussed along with EM interference specifications, aspects of cable separation, final aircraft testing, and an EMC systems rig. G.R.

A73-41702 # **Shock associated noise.** M. J. Fisher, M. H. Bourne, and P. A. Lush (Southampton, University, Southampton, England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 4 p.

The influence of shock associated noise on the variation of noise levels with jet efflux velocity if investigated, taking into account the case of an unheated jet flow. It is found that the overall level of shock associated noise is principally a function of jet pressure ratio and is relatively independent of either angle of observation or jet stagnation temperature. The spectral characteristics of shock associated noise are discussed, giving attention to an empirical method which provides a satisfactory degree of collapse of the measured spectra. G.R.

A73-41703 # **Noise from hot jets.** P. A. Lush, M. J. Fisher, and K. K. Ahuja (Southampton, University, Southampton, England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973). British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 4 p.

It has been shown by Cocking and Jamieson (1971) that the heated jet is quieter only at jet velocities above a certain critical

value. Below this velocity the noise levels increase progressively with increasing jet temperature. These findings contradict commonly accepted conclusions that the effect of heating a jet at constant velocity would be to reduce the noise. A theoretical analysis is conducted with the objective to resolve this difficulty. A scaling law which uses a more complete version of the Lighthill source term is considered. G.R.

A73-41705 # **Basic acoustic considerations for model noise experiments in wind-tunnels.** T. A. Holbeche and J. Williams (Royal Aircraft Establishment, Aerodynamics Dept., Farnborough, Hants., England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 4 p.

Special problems of tunnel experiments on noise are considered, taking into account questions regarding the adequate simulation at model-scale, the production of unacceptable parasitic noise fields, and approaches to facilitate the analysis of model noise measurements and the extrapolation to full-scale far-field conditions. Special factors in tunnel design are discussed along with the application of these factors in noise experiments. Attention is given to tunnel circuit type, tunnel drive-fan, test-section type, and test-section size. G.R.

A73-41706 # **Boundary layer induced cockpit noise.** K. H. Heron (Royal Aircraft Establishment, Farnborough, Hants., England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 3 p.

Airflow generated noise can be the dominant source of cockpit noise. Most of this noise can be eliminated by appropriate streamlining. However, noise due to the turbulent boundary layer cannot easily be reduced at the source. Hence the only practical reduction has to come from either increasing the transmission loss of the cockpit structure or, possibly, increasing cockpit absorption. A flight experiment is considered to gain a better understanding of the mechanisms involved in boundary-layer-generated cockpit noise. G.R.

A73-41708 # **Helicopter noise - Can its annoyance or loudness be rated using existing methods.** J. W. Leverton (Westland Helicopters, Ltd., Yeovil, Somerset, England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 4 p.

Helicopter noise is normally rated in terms of either the perceived noise level (PNL) or the dBA value. The use of the PNL approach, and by implication the dBA method, for rating helicopter noise is reviewed. Nonimpulsive helicopter noise, blade slap or impulsive noise and tail rotor noise aspects are discussed separately. It is found that neither of the two methods is really suited to the rating of helicopter noise. Possibilities for a new approach are briefly considered. G.R.

A73-41709 # **The effect of aircraft noise on the countryside.** R. A. Waller. *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 4 p.

The significance of noise to existing residents is explored, taking into account the adaptation of those living in the airport vicinity to the environmental noise levels. The question is investigated whether the use of land for recreational and other countryside purposes is more sensitive to noise than its use as residential land. Attention is given to the use of appropriate values in a cost benefit analysis. G.R.

A73-41712 # **Sound generation by open supersonic rotors.** D. L. Hawkings and M. V. Lowson (Loughborough University of Technology, Loughborough, Leics., England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 4 p.

A theoretical analysis of the noise characteristics of an open rotor operating at supersonic tip speeds is presented. Lighthill aerodynamic noise analysis describing the generation of sound and Whitham's (1956) theory determining the subsequent nonlinear sound propagation underlie the investigation. M.V.E.

A73-41713 # **Reduction of fan noise by annulus boundary layer removal.** C. J. Moore (Rolls-Royce, Ltd., Derby, England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 4 p. 7 refs.

It is shown that reducing flow distortion by annulus boundary layer bleed in an isolated fan considerably reduces the radiated noise in agreement with distortion/rotor interaction theory. However, care must be taken to ensure that the boundary layer bleed system does not introduce new distortions. M.V.E.

A73-41714 # **Attenuation of spiral modes in a circular and annular lined duct.** D. J. Snow and M. V. Lowson (Rolls-Royce, Ltd., Derby, England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 4 p. 14 refs. Research sponsored by Rolls-Royce, Ltd.

Theoretical and experimental investigation of the behavior and properties of noise-radiation dominating high-order circumferential (spiral) modes in circular and annular lined ducts. For the circular duct, the theoretical results have been calculated exactly based on a locally reacting model. Exceptionally good agreement between theory and experiment was found. Theoretical calculations for the annular duct were made by using an approximate theory. Reasonable agreement between theory and experiment was found for this case, with experimental attenuation values being generally somewhat higher than the theoretical ones. M.V.E.

A73-41715 # **The refraction of sound by rotating flow.** G. F. Butler (Royal Aircraft Establishment, Farnborough, Hants., England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 3 p. 6 refs.

Review of the results of an investigation of sound propagation through the rotating flow downstream of a delta wing at incidence performed upon a theoretical model, as well as experimentally in a 24-foot wind tunnel appropriately equipped for acoustic experiments. The incomplete experimental results presented indicate some qualitative agreement between theory and experiment, but quantitatively the agreement is disappointing. M.V.E.

A73-41717 # **Quieter aero engines - Cause and effect.** M. J. T. Smith (Rolls-Royce, Ltd., Derby, England). *(British Acoustical Society, Spring Meeting, Chelsea College, London, England, Apr. 25-27, 1973.) British Acoustical Society, Proceedings,* vol. 2, Summer 1973. 24 p. 11 refs.

The Rolls-Royce RB-211 jet engine program is reviewed in detail to understand the problems created, the lessons learned, and the questions the program has raised. In the RB-211 over 80% of the air flow bypasses the core, where energy is generated to enable the turbines to drive the fan and the compressor systems. This cycle requires a far greater total airflow to achieve the same thrust as its earlier counterparts, and basic benefits are felt in the reduced jet noise from the much lower velocity jet exit conditions. Aspects of fan, compressor, and turbine noise are discussed. Internal acoustic absorption is considered as an integral part of the solution to the noise problem, and jet and tailpipe noise are treated. F.R.L.

A73-41739 **Finite element program for flight structure analysis.** P. Mantegazza and C. Cardani (Milano, Politecnico, Milan, Italy). *Meccanica,* vol. 8, Mar. 1973, p. 68-76. 25 refs.

A computer program is developed for the analysis of large complex structures of any kind but especially for those used in flight vehicles. The displacement method chosen, using the finite element algorithm and the related matrix calculation, allows a high degree of automation in the data processing, the human intervention being confined to introducing the topoelastic quantities that are essential to the correct definition of the structural problem. The program is organized in such a way as to allow subsequent developments including, on the initial basis, dynamic and nonlinear effects. Given the contained calculating times and limited occupation of the core storage, the program can be used on medium-sized computers. (Author)

A73-41750 **Helicopter transmission research.** D. K. Brighton and T. R. Smith (Royal Aircraft Establishment, Engineering Physics Dept., Farnborough, Hants., England). *Aircraft Engineering,* vol. 45, Aug. 1973, p. 6-9.

The research effort on transmission systems, and specifically on gearboxes, is directed in general terms toward achieving improved reliability, increased life, reduced weight, and improved cost effectiveness. The harmonic drive is attractive as a high speed reducing mechanism because it is capable of producing gear ratios greater than 50:1 in a single stage; it has few moving parts, small volume, and a high power to weight ratio. The harmonic drive comprises three basic elements: a circular spline, a flexible spline (the flexspline) and a wave generator. The follower tooth gear and hydrostatic journal bearings are discussed. F.R.L.

A73-41751 # **Artificial stabilisers and the need for simulation.** G. K. Kissel (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany). *Aircraft Engineering;* vol. 45, Aug. 1973, p. 10-13.

In the design of the artificial stabilizer forming a part of the flight control system for VTOL aircraft, simulation is an essential tool. The design, development, and flight testing of the VJ 101 C is a good example of the close interrelation of the various engineering disciplines. The VJ 101 C is a high speed VTOL research aircraft being designed to investigate the VTOL capability combined with high supersonic level flight capability. The flight test results proved to be well in line with the simulation prediction. The actual test time could be considerably reduced and after only three hours of flying, the first verticircuit, i.e., a vertical takeoff, transition to aerodynamic flight, aerodynamic flying, and transition back to vertical landing, was achieved. F.R.L.

A73-41752 # **VAK 191B.** *Aircraft Engineering,* vol. 45, Aug. 1973, p. 17-22, 24-27.

The fuel bladder tanks of the VFW-Fokker VAK 191B aircraft are of nonmetallic, flexible cell construction intermittently supported. The method of construction is particularly suitable for tanks with a complicated shape and many convolutions, so that maximum use is made of space within the aircraft frame. The aircraft is equipped with a tank pressurization and venting system for its ten permanently installed fuel tanks. The fuel management system is considered in three basic parts related to the primary functions: fuel quantity measuring, balance, and fueling and defueling. The fire detectors and ejection seats are described, and results of flight and structural tests are given. F.R.L.

A73-41802 **A rational basis for determining the EMC capability of a system.** R. B. Schulz (Southwest Research Institute, San Antonio, Tex.). In: International Electromagnetic Compatibility Symposium, New York, N.Y., June 20-22, 1973, Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 315-322. Research supported by the Southwest Research Institute.

A logical procedure is presented for determining the EMC capability of a system, based upon an analytical approach developed earlier. The procedure is illustrated using as a system an airplane with a manageable number of electrical/electronic subsystems. The result is a single number which can be used in a weapon system effectiveness equation and is generally useful not only to EMC engineers, but also to other electronic engineers and managers. Byproducts of the procedure are enhanced highlighting of critical parameters for design purposes and a means for economic evaluation of EMC efforts. (Author)

A73-41807 **Preliminary results of Martian altitude determinations with CO2 bands /2 micron wavelength/ from the automatic interplanetary space station Mars 3.** V. I. Moroz, L. V. Ksanfomaliti, A. M. Kasatkin, B. S. Kunashev, and K. A. Tsoi (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR). *(Akademiia Nauk SSSR, Doklady,* vol. 208, Feb. 11, 1973, p. 1048 1051.) *Soviet Physics - Doklady,* vol. 18, Aug. 1973, p. 94-96. 16 refs. Translation.

A73-41841 **Antenna radiation-pattern measurement using model aircraft.** C. W. Gliddon (Andrew Antennas, Reservoir, Victoria, Australia) and C. T. Carson (Monash University, Clayton, Victoria, Australia). *IEEE Transactions on Antennas and Propagation,* vol. AP-21, Sept. 1973, p. 700-702. 6 refs.

It is shown that model aircraft can provide a useful method of on site evaluation of antenna performance, with advantages of economy and speed over existing antenna measurement methods. Recommendations for further development of this technique are also included. (Author)

A73-41861 **New developments in aircraft refuelling vehicles.** H. Petersen (Ad. Strüver, Hamburg, West Germany). *Interavia,* vol. 28, Sept. 1973, p. 975, 976.

The development of a new generation of refuelling vehicles did not bring with it any standardization. The operational requirements, depending on airport, aircraft type regulations, airport management, airlines, etc., differ too greatly to permit the employment of standard vehicles. The major vehicle manufacturers therefore tend to offer a broad range of models which can be modified to meet particular requirements. With two vehicles fueling a Boeing 747, there was a necessity for 80,000 liter tankers. In order to utilize them effectively, they also have to be used for fueling conventional aircraft. To replace or complement older examples of small and medium-sized vehicles, designs are being formulated for a new generation of medium class tankers. F.R.L.

A73-41862 **Europlane Qstol - 'The Q is for quiet.'** R. Salvy. *Interavia,* vol. 28, Sept. 1973, p. 988, 989.

Europlane's objective is to produce an economical solution to the problems of noise and congestion which currently exist in short and medium-haul transport. In examining the various types of vehicles, Europlane rejected short takeoff and landing (STOL) as being economically unjustifiable in the immediate future. The most important characteristic of a new aircraft must undoubtedly be its quietness. The correct choice of size of aircraft is considered fundamental, as on this depends the right balance of aircraft-mile and seat-mile costs, and the ability to maintain attractive frequencies with good load factors. F.R.L.

A73-41863 **New materials in aircraft windshields.** G. L. Wiser (Sierracin Corp., Sylmar, Calif.). *Interavia,* vol. 28, Sept. 1973, p. 992-994.

The characteristics of stretched acrylic plastic and thin chemically strengthened glass as materials for aircraft windshields are outlined. After exploring and evaluating several different windshield shapes and constructions, Boeing's final choice for the 747 was a pair

of curved, electrically-heated composite panels. The curved shape permits the exceptional toughness of stretched acrylic to be fully exploited. The Lockheed L-1011 also makes use of a curved composite windshield, which is thinner than that of the 747. The use of polycarbonate in windshields as a means of withstanding aerodynamic heating is discussed. F.R.L.

A73-41866 **Flight measured load factors.** I. W. Stafiej (Szybowcowy Zaklad Doswiadczalny, Bielsko-Biala, Poland). *(Organisation Scientifique et Technique Internationale du Vol à Voile, Congress, 13th, Vrsac, Yugoslavia, July 9-22, 1972.) Aero-Revue,* Sept. 1973, p. 496, 497.

Results obtained in investigations involving four Polish gliders are reported. The aircraft include a wide range of designs, including a popular-performance and training single seater, high-performance sailplanes, and a two-seater school and training glider. Two approaches for performing the pull-out manoeuvre are considered together with the range of load factors reached in several loop manoeuvres. G.R.

A73-41968 **Cadmium embrittlement of high strength, low alloy steels at elevated temperatures.** J. F. Hildebrand (Gulf Energy and Environmental Systems, Inc., San Diego, Calif.). *Materials Protection and Performance,* vol. 12, Sept. 1973, p. 35-40. 5 refs.

Tests were conducted a few years ago to determine the lower temperature limit at which cadmium embrittlement might occur on D6ac, AISI 4340, and maraging 200 steels, candidate materials for supersonic aircraft. Also, the tests attempted to distinguish between cadmium and hydrogen embrittlement. This study indicated that cadmium plating does cause hydrogen and cadmium embrittlement when a highly stressed steel part is exposed to 325 F or more. (Author)

A73-41971 # **Drive logic for in-flight simulators.** P. A. Reynolds, A. E. Schelhorn, and R. Wasserman (Calspan Corp., Buffalo, N.Y.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-933.* 13 p. 8 refs. Members, $1.50; nonmembers, $2.00. USAF-FAA-supported research.

Computation and implementation techniques are described that have been devised for providing the desired dynamic motion, ground effects, apparent crosswind, and other special effects for variable-stability aircraft used as in-flight simulators. These techniques can be used to provide the proper drive logic for an in-flight simulator with six independent controllers. M.V.E.

A73-41972 * # **Simulator performance validation and improvement through recorded data.** D. L. Seay (United Air Lines, Inc., Denver, Colo.). *American Institute of Aeronautics and Astronautics, Visual and Motion Simulation Conference, Palo Alto, Calif., Sept. 10-12, 1973, Paper 73-938.* 8 p. Members, $1.50; nonmembers, $2.00. Contract No. NAS2-7208.

During the development of two-segment approach procedures instrumentation systems were installed on a 727 flight simulator to monitor a variety of flight parameters. Parameters monitored and data format were designed to be the same as those to be used in later flight tests with line aircraft. Good correlation existed between simulator and aircraft data in many areas. Previously identified areas of poor simulation were checked with quantitative data. The objective data obtained could be used for simulation improvements in areas previously changed primarily by using subjective data obtained from pilots. Areas where similar techniques could improve simulation were identified. (Author)

A73-41991 **Use of edge-tone resonators as gas temperature sensing devices.** G. L. Innes (Honeywell Corporate Research Center, Hopkins, Minn.). In: Symposium on Temperature, 5th, Washington, D.C., June 21-24, 1971, Proceedings. Part 1. Pittsburgh, Instrument Society of America, 1972, p. 689-700. 14 refs.

Description of an acoustic technique, which employs an edge-tone resonator, for measuring turbine inlet temperature. The basic operating principle of this temperature sensor are outlined, and the development of the device is discussed. Both parametric and operational tests data are included. The sensor operating characteristics are described, and hypotheses explaining these characteristics are put forth. (Author)

A73-41995 **A device for the on-line measurement of nitrogen rotational temperature in low density flows.** R. F. Carpenter (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio). In: Symposium on Temperature, 5th, Washington, D.C., June 21-24, 1971, Proceedings. Part 1. Pittsburgh, Instrument Society of America, 1972, p. 763-767. 5 refs.

A73-42034 * **Catalytic considerations in temperature measurement.** R. L. Ash, G. R. Crossman (Old Dominion University, Norfolk, Va.), and R. V. Chitnis (Wyle Laboratories, Inc., Hampton, Va.). In: Symposium on Temperature, 5th, Washington, D.C., June 21-24, 1971, Proceedings. Part 3. Pittsburgh, Instrument Society of America, 1972, p. 1663-1670. 66 refs. Contract No. NAS1-94347.

Literature discussing catalytic activity in platinum group temperature sensors is surveyed. Methods for the determination and/or elimination of catalytic activity are reported. A particular application of the literature is discussed in which it is possible to infer that a shielded platinum total temperature probe does not experience significant catalytic activity in the wake of a supersonic hydrogen burner, while a bare iridium plus rhodium, iridium thermocouple does. It is concluded that catalytic data corrections are restricted and that it is preferable to coat the temperature sensor with a noncatalytic coating. Furthermore, the desirability of transparent coatings is discussed. (Author)

A73-42042 **Some designs using sheathed thermocouple wire for jet engine applications.** J. A. Tauras (United Aircraft Corp., Pratt and Whitney Aircraft Div., East Hartford, Conn.). In: Symposium on Temperature, 5th, Washington, D.C., June 21-24, 1971, *Proceedings. Part 3.* Pittsburgh, Instrument Society of America, 1972, p. 1805-1810. 7 refs.

Many temperature sensors have been designed which incorporate the metallic sheathed, ceramic insulated thermocouple. Sheathed thermocouples are commonly used in probes designed as part of the engine control system. Vane metal and turbine inlet temperatures can be measured by thermocouples, using the wedge wire technique. The sheathed thermocouple is a tool which allows the instrumentation designer to measure gas stream or metal temperature at practically any location in a jet engine. The designer should know how insulation resistance varies with temperature and what effect it will have on the measurement. The thermoelectric drift rate should also be known. F.R.L.

A73-42043 **Trends of design in gas turbine temperature sensing equipment.** P. B. R. Baas and K. Mai (Engelhard Minerals and Chemicals Corp., Carteret, N.J.). In: Symposium on Temperature, 5th, Washington, D.C., June 21-24, 1971, Proceedings. Part 3. Pittsburgh, Instrument Society of America, 1972, p. 1811-1821. 13 refs.

Past and present thermocouple designs used for sensing gas temperatures in gas turbines are reviewed. Distinctions are pointed out in requirements and design concepts for two classes of gas turbine sensors: production sensors in service engines, and sensors for obtaining data in test-stand operation of experimental engines. A high degree of success is being achieved in meeting present production engine requirements by using thermocouples with enclosed ungrounded junctions. Miniaturization ensures meeting re-

quirements for fast response. Test-stand thermocouples whose chief requirement is accuracy, are used at various locations whose temperatures range from -55 to 1900 C. Noble metals are used extensively for the structural parts of test-stand probes between 1200 and 1800 C, but durability limitations of noble metals preclude their use as structural parts of probes in production turbines. (Author)

A73-42076 # **An aeroelastic whirl phenomenon in turbomachinery rotors.** F. F. Ehrich (General Electric Co., Group Engineering Div., Lynn, Mass.). *American Society of Mechanical Engineers, Design Engineering Technical Conference, Cincinnati, Ohio, Sept. 9-12, 1973, Paper 73-DET-97.* 5 p. Members, $1.00; nonmembers, $3.00.

It has been noted in the technical literature that axial flow turbomachines are sometimes subject to whirling instability when subject to high mass flow. This paper hypothesizes an instability model, where destabilizing forces are induced on the turbomachine's blading as a result of its incremental motions when elastically deflected in the internal stream of working fluid. The model bears some analytical resemblance to the instability which propellers can experience when they are elastically deflected in an external stream. A simple stability criterion is derived, which implies that decreasing density or mass flow rate, average stage radius, and fluid discharge angle (from the axial direction) relative to the rotor tends to destabilize the stage, while increasing damping, rotor mass, rotor stiffness, and the distance from the rotor to its virtual pivot point tends to stabilize the stage. (Author)

A73-42078 # **Experimental investigation of a simple squeeze film damper.** K. K. Thomsen and H. Andersen (Danmarks, Tekniske Hojskole, Lyngby, Denmark). *American Society of Mechanical Engineers, Design Engineering Technical Conference, Cincinnati, Ohio, Sept. 9-12, 1973, Paper 73-DET-101.* 4 p. 6 refs. Members, $1.00; nonmembers, $3.00.

Description of an experimental investigation of a squeeze film damper for the control of rotor amplitudes. From direct measurements of the transmitted force and the velocity of the damper sleeve, the damping coefficient of the squeeze film is obtained over a range of frequencies and for several values of film thickness and oil viscosity. The results are compared with the theoretical formula, based on assumptions of linearity, and from a practical application point of view the correlation is found to be satisfactory. (Author)

A73-42079 * # **Transient response of rotor-bearing systems.** R. G. Kirk (United Aircraft Corp., Pratt and Whitney Aircraft Div., East Hartford, Conn.) and E. J. Gunter (Virginia, University, Charlottesville, Va.). *American Society of Mechanical Engineers, Design Engineering Technical Conference, Cincinnati, Ohio, Sept. 9-12, 1973, Paper 73-DET-102.* 9 p. 10 refs. Members, $1.00; nonmembers, $3.00. Grant No. NGR-47-005-050.

The equations of motion necessary to calculate the transient response of a multimass flexible rotor supported by nonlinear, damped bearings are derived from energy principles. Rotor excitation may be the result of imbalance, internal friction, rotor acceleration, nonlinear forces due to any number of bearing or seal stations, and gyroscopic couples developed from skewed disk effects. The method of solution for transient response simulation is discussed in detail and is based on extensive evaluation of numerical methods available for transient analysis. Examples of the application of transient response for the analysis of rotor bearing systems are presented and compared to actual machine performance. Recommendations for the use and extension of the present system simulation model are discussed. (Author)

A73-42080 # **Design and analysis of an energy absorbing restraint system for light aircraft crash-impact.** M. S. Hundal, R. W. McLay (Vermont, University, Burlington, Vt.), and L. Folsom (General Electric Co., Aircraft Equipment Div., Burlington, Vt.). *American Society of Mechanical Engineers, Design Engineering Technical Conference, Cincinnati, Ohio, Sept. 9-12, 1973, Paper 73-DET-111.* 8 p. 21 refs. Members, $1.00; nonmembers, $3.00.

A73-42113 **Effect of an adjustable nonuniform pitch in the distributor on the alternating stresses in compressor rotor blades.** V. N. Tiulenev and V. A. Skibin (Tsentral'nyi Nauchno-Issledovatel'skii Institut Aviatsionnogo Motorostroeniia, Moscow, USSR). *(Problemy Prochnosti,* vol. 4, Dec. 1972, p. 102-105.) *Strength of Materials,* vol. 4, no. 12, Sept. 1973, p. 1523-1526. Translation.

A73-42114 **Cracks in turbine disks of gas-turbine engines.** Ch. L. Svetlakov, A. G. Makhnev, and V. F. Kozhevnikov. *(Problemy Prochnosti,* vol. 4, Dec. 1972, p. 106-110.) *Strength of Materials,* vol. 4, no. 12, Sept. 1973, p. 1527-1531. Translation.

Cracks were observed to form on the downstream face of the rotor disk of a low-power single-stage turbine, in a grove between two coaxial circular ridges used to press fit a rotor bearing. An experimental investigation is described in which the stress distribution and stress concentration factors at the center of the disk were determined by an optical polarization technique. The results led to an improved disk design in which the groove was eliminated. V.P.

A73-42127 # **Experimental investigation of a gas-liquid thruster model with a ballasting-reinforced thrust (Eksperimental'noe issledovanie modeli gazozhidkostnogo reaktivnogo dvizhitelia s forsirovaniem tiagi putem ballastirovaniia).** Iu. G. Mokeev (Akademiia Nauk Ukrainskoi SSR, Institut Gidromekhaniki, Kiev, Ukrainian SSR). *Gidromekhanika,* no. 24, 1973, p. 73-77. In Russian.

A73-42186 # **The nondestructive tests in the maintenance of commercial aircraft (Los ensayos no destructivos en el mantenimiento de los aviones comerciales).** M. Lazaro Verdier and J. A. Guillen Martinez (IBERIA, Líneas Aéreas de España, S.A., Madrid, Spain). *Ingeniería Aeronáutica y Astronáutica,* vol. 25, May-June 1973, p. 21-29. In Spanish.

The economic employment of commercial aircraft depends to a large degree on efficient control and maintenance methods. These methods involve the use of modern equipment for checking the conditions of the vital components of the aircraft. The methods employed include a direct visual inspection, a visual inspection conducted with the aid of optical instruments, the use of liquids for observing small defects which cannot be detected by visual inspection, the utilization of eddy currents, conductivity measurements, ultrasonic procedures, sonic methods, and the employment of X rays and gamma rays. Attention is given to the approaches used for the detection of cracks in aircraft components. G.R.

A73-42196 # **Application of electron beam welding to aircraft turbine engine parts.** K. Iinuma. *Ishikawajima-Harima Engineering Review,* vol. 13, May 1973, p. 305-317. 5 refs. In Japanese, with abstract in English.

Electron beam welding is suitable for the welding of aircraft turbine parts that demand high heat and corrosion resistance, adequate mechanical properties, high precision, and low weight. Accordingly this welding method is applied to almost all sections of the aircraft turbine engine from stator to rotating sections, and cold to hot sections. Attention is given to electron beam welding equipment widely used in the aircraft turbine industry, the advantages of electron beam welding, quality control, and welding procedures. F.R.L.

A73-42200 # **Structure of ionizing shock waves with radiative energy loss.** Y. Enomoto (Agency of Industrial Sciences and Technology, Tokyo, Japan). *Hiroshima University, Journal of Science, Series A - II*, vol. 36, Dec. 1972, p. 95-120. 49 refs.

Theoretical and experimental studies have been made of the structure of shock ionized xenon both in the ionizational relaxation region and in the downstream radiating region. The experimental studies were based on measurements of the ionizational relaxation time by means of the cold electrode system and measurements of the change of electrical conductivity by means of the conductivity probe of magnetic induction type. The shock Mach number was varied from 8.4 to 24.5, and the initial pressure was varied from 1 to 10 Torr. Comparisons were made with theoretical results based on simple and realistic models. The measured ionization times were about one-half as large as the corresponding predicted values. The cause of this inconsistency may be attributed to the flow-nonuniformities due to the wall boundary layer. The variations of the electrical conductivity agreed with the theoretical ones calculated from the corresponding flow parameter based on the assumption that the plasma lost its energy through both continuum and line radiations. (Author)

A73-42219 # **A new approach to gust alleviation of a flexible aircraft using an open loop device (Une nouvelle méthode pour calculer un absorbeur de rafales pour un avion souple, utilisant un dispositif en boucle ouverte).** P.-M. Hutin (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *(NATO, AGARD, Symposium on Flight in Turbulence, Bedford, England, May 14-17, 1973.) ONERA, TP* no. 1236, 1973. 11 p. In French.

One of the current problems facing aircraft designers is the optimization of flight through a turbulent atmosphere. This paper is concerned with the use of optimization techniques for the purpose of gust alleviation. The basic approach is an extension of Wiener's optimization theory to two control parameters and its application to the Caravelle aircraft. Finally, we present a comparison between the theoretical responses to a Gaussian stationary excitation and the responses to actual records of turbulence given by an analog computer taking into account the nonlinearities due to limited efficiency of controls. (Author)

A73-42315 **Seattle-Tacoma's unconventional concept.** P. L. Jacobson and E. K. McCagg. *Airport Forum*, Sept. 1973, p. 9-23. In English and German.

A73-42316 **Schiphol as a tourist attraction.** A. A. Dulle. *Airport Forum*, Sept. 1973, p. 35-39. In English and German.

A73-42317 **World Bank support for airports.** B. Bostrom. *Airport Forum*, Sept. 1973, p. 57-60. In English and German.

A73-42321 **Air traffic control in the EUROCONTROL area.** G. H. Trow (EUROCONTROL, Brussels, Belgium). *(NATO, AGARD, Symposium, Edinburgh, Scotland, June 26-29, 1972.) Eurocontrol*, vol. 3, no. 1, 1973, p. 4-13.

Review of the present organization of traffic control in the EUROCONTROL area, covering France, the United Kingdom, the Federal Republic of Germany, the Benelux countries, and Ireland. The topics include supersonic transports control, difficulties in the Belgian airspace, the Maastricht and Karlsruhe centers, application of automatic data processing, airspace organization, and ground environment. Selected air traffic statistical data are also given. V.Z.

A73-42322 **SSR code assignment.** K. H. B. Führer. *Eurocontrol*, vol. 3, no. 1, 1973, p. 14-19.

Discussion of applications of Secondary Surveillance Radar (SSR) as a means of aircraft identification in the airspace of EUROCONTROL member states. Attention is given to the implementation of the Originating Region Code Assignment Method (ORCAM) as a code assignment technique effective in applications with SSR in the EUROCONTROL area. It is visualized that ORCAM may be suitable also outside the EUROCONTROL area and may facilitate cooperation with external areas regarding the use of SSR. V.Z.

A73-42323 **The MINFAP system - First phase in the automation of the EUROCONTROL Maastricht Centre.** A. Lemaire. *Eurocontrol*, vol. 3, no. 1, 1973, p. 20-24. Translation.

Description of the Minimum Facilities Project (MINFAP) system, an interim air traffic control system designed to facilitate the subsequent introduction of the Maastricht Data Processing (MADAP) system for simultaneous integrated upper airspace control of Belgium, Luxemburg, the Netherlands and Northern Germany. Details are given on data processing and display equipment at Maastricht. The outstanding reliability of the system during its operation from March 1972 through April 1973 is noted. V.Z.

A73-42324 **Time, space, and energy management in the airways traffic control medium.** C. W. Vietor (American Airlines, Inc., Los Angeles, Calif.). *Navigation*, vol. 20, Summer 1973, p. 159-170. 11 refs.

This paper presents a philosophy and concept for sloped airways path design and derives mathematical formulas from which the fundamental requirements for instrumentation design for vertical navigation for time, space, and energy management requirements can be derived. (Author)

A73-42423 **RPV's as communications relays.** R. W. Blanchard (USAF, Electronic Systems Div., Bedford, Mass.) and R. H. Wood (Mitre Corp., Bedford, Mass.). *Signal*, vol. 28, Oct. 1973, p. 22-24.

New services and user end instruments are made possible by, and require, high capacity multichannel transmission trunks. The requisite capacity will be supplied by devices and technology associated with satellite relay and digital transmission and data handling techniques. These electronic technologies, along with recent remotely piloted vehicle (RPV) developments, provide the basis for a tactical pseudo-satellite multichannel relay. In such a relay, a high altitude RPV would carry an electronics relay transponder similar to that contained in a satellite such as the DSCS II. F.R.L.

A73-42477 **The use of analytic surfaces for the design of centrifugal impellers by computer graphics.** D. J. L. Smith (National Gas Turbine Establishment, Farnborough, Hants., England) and H. Merryweather (Computer Aided Design Centre, Cambridge, England). *International Journal for Numerical Methods in Engineering*, vol. 7, no. 2, 1973, p. 137-154. 6 refs.

This paper shows how analytic surfaces can be used to define the vanes of an impeller of a centrifugal compressor. The analysis has been given of a cubic-linear patch for representing three-dimensional geometries. An example has shown how this type of patch can be successfully used to model the geometry of centrifugal or mixed flow impellers having swept back vanes at the outlet. The analysis has been programmed for the Atlas computer at the Computer Aided Design Centre (CADC), Cambridge and is set up in such a way that the designer can examine systematically a range of impeller shapes. (Author)

A73-42522 **Flow control concepts and airline operations.** A. F. Pitas (Air Transport Association of America, Washington, D.C.). *Journal of Air Traffic Control*, vol. 15, Sept.-Oct. 1973, p. 16-20.

Any flow control plan must insure that the responsibility and authority for flight despatching and scheduling will remain the prerogative of the user, regardless of the degree of organization or automation in the air traffic control system. Flow control decisions, with or without the aid of automation should not involve the

separation of aircraft, but concentrate on the act of having aircraft avoid saturated airports and airspace. Such decisions may require actions that vary from a cautionary nature to that of command. Possibilities of automating the flow control process are discussed. F.R.L.

A73-42523 **Reducing approach and landing accidents.** H. G. Gatlin (Air Transport Association of America, Washington, D.C.). *Journal of Air Traffic Control*, vol. 15, Sept.-Oct. 1973, p. 24, 25.

To reduce approach and landing accidents, there is a need for guidance aimed at the runway to position aircraft in the proper approach window and to preclude premature descent and/or excessive descent rate by providing descent path guidance to the pilot. With increased implementation of the instrument landing system (ILS), increased availability of visual approach slope indicators (VASI), sensible operating rules, and sound ground training and crew discipline, the problem of approach and landing accidents can be greatly reduced. F.R.L.

A73-42533 # **A technology tool for urban applications - The remotely piloted blimp.** G. R. Seemann, G. L. Harris, G. J. Brown, and C. A. Cullian (Developmental Sciences, Inc., City of Industry, Calif.). *American Institute of Aeronautics and Astronautics and Public Technology, Inc., Urban Technology Conference and Technical Display, 3rd, Boston, Mass., Sept. 25-28, 1973, AIAA Paper 73-981.* 8 p. Members, $1.50; nonmembers, $2.00. Research sponsored by Developmental Sciences, Inc.

The remotely piloted blimp concept is to provide flexible, safe, economical airborne surveillance, measurement of monitoring systems for urban applications. The Traffic Eye, Enforcement Eye, and Enviro Eye are basically remotely piloted, ultra slow, low altitude buoyant airborne platforms equipped with television cameras. The flight characteristics of the blimp are discussed together with questions of control, takeoff, landing, and ground support. G.R.

A73-42534 **Effect of nuclear explosions on stratospheric nitric oxide and ozone.** H. Johnston, G. Whitten, and J. Birks (California, University, Berkeley, Calif.). *Journal of Geophysical Research*, vol. 78, Sept. 20, 1973, p. 6107-6135. 27 refs. Research supported by the Climatic Impact Assessment Program.

The derivation by Foley and Ruderman (1973) of the injection of nitric oxide into the stratosphere by nuclear bomb tests is reviewed and compared with similar studies. Upper and lower limits of this pollutant are estimated by us and compared with the amount and distribution of nitric oxide in the stratosphere possible from supersonic transports. The distribution of Sr-90 in the stratosphere was measured by balloons and planes after the 1961-1962 nuclear tests, and there is a linear relation between bomb-produced Sr-90 and bomb-produced nitric oxide. The total ozone data for the world for 1960-1970 inclusive have been examined in detail. There appears to be a real (about 5%) increase of ozone over the period 1963-1970. The increase in ozone during 1963-1970 is roughly parallel to the decrease of bomb-produced Sr-90 and thus bomb-produced NO. Hence this increase of ozone may be due to the stratosphere's returning to normal after the nitric oxide injections by the nuclear bomb tests of 1952-1962. (Author)

A73-42551 # **Vibration and stability of nondivergent elastic systems.** C. Sundararajan. *AIAA Journal*, vol. 11, Oct. 1973, p. 1418-1420. 7 refs. National Research Council of Canada Grant No. A-8119.

An undamped, linear, continuous elastic system occupying a domain inside a closed boundary is considered. Aspects of the free vibration of the system are discussed together with questions of the vibration of the system under the forces and the reversal of the direction of the forces. The theorems derived are applied to the 'panel flutter problem' in aeroelasticity. It is found that a supported panel exposed to a supersonic flow loses its stability by flutter. The panel has no divergence instability at any flow velocity. G.R.

A73-42552 # **Aerodynamic interference of pitot tubes in a turbulent boundary layer at supersonic speed.** R. E. Wilson (U.S. Navy, Naval Ordnance Laboratory, Silver Spring, Md.). *AIAA Journal*, vol. 11, Oct. 1973, p. 1420, 1421.

The measurement of the aerodynamic interference effects of pitot tubes in a supersonic turbulent boundary layer conducted by Allen (1972) is considered. It is pointed out that the interference effects measured by Allen are unnecessarily large, and that they are applicable only to this particular pitot tube and support configuration. In order to illustrate this point, an investigation of pitot interference is discussed. G.R.

A73-42554 # **Reattachment of a separated boundary layer to a convex surface.** J. L. Amick (Michigan, University, Ann Arbor, Mich.) and T. Masoud (Defence Science Organization, Chaklala, Pakistan). *AIAA Journal*, vol. 11, Oct. 1973, p. 1426, 1427. Navy-supported research.

Experimental determinations of the location of reattachment on the curved surface are discussed. The tests were conducted at Mach number 3.9 and Reynolds number 120,000 per inch in a 8- by 13-in. supersonic wind tunnel. Most of the tests were made under conditions that gave pure laminar separation. Reasonable agreement is seen between the simple maximum-deflection theory and the experimental results. G.R.

A73-42562 # **Methods for calculating nonlinear flows with attached shock waves over conical wings.** W. H. Hui (Southampton, University, Southampton, England). *AIAA Journal*, vol. 11, Oct. 1973, p. 1443-1445. 7 refs.

A theory developed by Hui (1971) for the analysis of supersonic and hypersonic flow with attached shock waves over delta wings is generalized to include any conical wings. The attached shock case is considered, and only the flow on the compression side is calculated. M.V.E.

A73-42590 **Aerial-survey aircraft of the new generation (Vermessungsflugzeuge der neuen Generation).** J. Hothmer and O. Margenfeldt (Institut für angewandte Geodäsie, Frankfurt am Main, West Germany). *Bildmessung und Luftbildwesen*, vol. 41, Sept. 1, 1973, p. 189, 190. In German.

Aerial-survey aircraft are aircraft which can be used for recording data regarding the earth's surface. The data can be obtained with the aid of aerial-mapping cameras or devices for remote surveillance. Recent advances concerning the propulsion systems used for the aircraft are considered, giving attention to improvements in the piston engines and the employment of jet propulsion systems. The new developments regarding the aircraft in conjunction with improvements of the photographic equipment make it possible to utilize greater altitudes for the aerial-survey operations. G.R.

A73-42625 # **Evaluation of slip factor of centrifugal impellers.** R. Yadav (MNR Engineering College, Allahabad, India) and S. S. Misra (RIT, Jamshedpur, India). *Institution of Engineers (India), Journal, Mechanical Engineering Division*, vol. 53, May 1973, p. 203-210; Discussion, p. 210. 21 refs.

A review of methods of explaining and evaluating the slip factor of a centrifugal impeller is presented in this paper. Experimentally, the slip of factors of 21 and 18 radial bladed impellers of centrifugal blower are calculated by accounting the temperature rise of air. It has been found that slip factor is not only a function of the number of blades but it is also a function of volume flow rate, speed, blade height at tip of impeller and impeller diameter. A general equation for the slip factor of radial bladed impeller has been established. Theory in describing the slip factor is also given in this paper. (Author)

A73-42627 * # **Approximation for maximum centerline heating on lifting entry vehicles.** V. T. Helms, III (NASA, Langley Research Center, Space Systems Div., Hampton, Va.). *Journal of Spacecraft and Rockets*, vol. 10, Sept. 1973, p. 599-601. 10 refs.

A centerline heating approximation is proposed in which only three basic equations need be solved. The heat rates correlate well with those obtained by more complex procedures. The approximation is readily adaptable to existing trajectory optimization programs to provide realistic surface temperature constraint capability with little increase in computer storage capacity and computer time. It is based on an analysis of heat-rate data computed for altitudes from 36,000 to 122,000 m, velocities from 600 to 7900 m/sec, and angles of attack from 0 to 60 degrees. V.P.

A73-42629 # **Transverse deflection of guided projectile tail fins during deployment.** W. R. Chadwick (U.S. Naval Material Command, Naval Weapons Laboratory, Dahlgren, Va.). *Journal of Spacecraft and Rockets*, vol. 10, Sept. 1973, p. 606-608.

High-aspect-ratio rearward opening tail fins deployed under the influence of projectile spin may experience excessive bending stresses at the root. It is shown that the problem is one of large transverse blade flexure initiated by Coriolis inertia forces. The high stress levels encountered, however, are due mainly to the associated buildup of large aerodynamic forces which develop as the blade tip sections bend in the supersonic airstream. V.P.

A73-42635 * # **Correlation of hypersonic zero-lift drag data.** J. J. Rehder (NASA, Langley Research Center, Space Systems Div., Hampton, Va.). *Journal of Spacecraft and Rockets*, vol. 10, Sept. 1973, p. 622, 623. 5 refs.

A pseudo-one-dimensional model of the supersonic combustion ramjet engine cycle is revised on the basis of recent (additional) data obtained from combustor tests. The data were generated in a simple nonreacting system which produces shock structures and shock/boundary layer interactions analogous to those observed at the entrance of supersonic combustors. It is shown that the revised model provides better descriptions of the wall pressure distributions and the overall shock pressure rises for the available test data. V.P.

A73-42645 # **Calculation of a turbocompressor intended for compression of real gases (K raschetu turbokompressora dlia szhatiia real'nogo gaza).** N. N. Bukharin. *Energomashinostroenie*, vol. 19, June 1973, p. 38, 39. In Russian.

A procedure is proposed which makes it possible to calculate a compressor operating with a real gas along the same lines as a compressor operating with an ideal gas. It is shown that by introducing the concept of a fictitious temperature, and substituting it for the thermodynamic temperature, the equations of the fundamental thermodynamic processes can be written and the specific work of isentropic and polytropic processes can be defined in the same form as for an ideal gas. V.P.

A73-42646 # **Calculation of the maximum attainable efficiency of a moving compressor blade cascade (Raschet maksimal'no vozmozhnoi proizvoditel'nosti dvizhushcheisia kompressornoi reshetki profilei).** E. G. Litvinenko. *Energomashinostroenie*, vol. 19, June 1973, p. 39, 40. In Russian.

An iterative method for calculating the maximum efficiency of a compressor cascade as a function of the velocity at the inlet is described. The influence of energy losses at the leading edges on the maximum flow rate is assessed, and means of increasing the cascade efficiency are examined. V.P.

A73-42675 # **Quasi homogeneous approximations for the calculation of wings with curved subsonic leading edges flying at supersonic speeds.** R. Coene. Delft, Technische Hogeschool, Doctor in de Technische Wetenschappen Thesis, 1973. 184 p. 54 refs.

Fenain's (1969) homogeneous flow theory for supersonic wings with straight leading edges is extended to supersonic wings with curved subsonic leading edges. It is shown that by formulating the boundary conditions at the wing surface, and using leading edges of polynomial form, boundary value problems can be reduced to the solution of algebraic problems. Coefficients appearing in the solutions for lifting problems are evaluated analytically. V.P.

A73-42694 **UV sensors for operation at 1000 F.** R. J. Bondley (General Electric Co., Schenectady, N.Y.). In: Conference on Electron Device Techniques, New York, N.Y., May 1, 2, 1973, Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 21-24. 9 refs. Contract No. F33615-72-C-1269.

To be solar blind at sea level, an ultraviolet responsive device must respond only to that part of the spectrum below 2950 A. The ultraviolet spectra in flames in the region below 2950 A is exceedingly small, hence the sensor must possess inherent high amplification to be a useful device. For many applications, such as flame surveillance in jet engine environments, the detector may be subjected to temperatures approaching 1000 F. A UV sensor is described which is in essence a miniature Geiger-Mueller tube constructed from materials chosen to meet the environmental and spectral response requirements. F.R.L.

A73-42740 # **Contribution to the experimental study of a boundary layer trap in a supersonic air inlet (Contribution à l'étude expérimentale d'un piége à couche limite dans une entrée d'air supersonique).** H. A. Kiet. Aix-Provence, Université, Docteur de Spécialité Thesis, 1973. 124 p. 10 refs. In French.

The purpose of an air intake is to bring the flow of the initial supersonic regime to a subsonic regime at the entrance to the reactor; thus, study of an air intake is most often intended to characterize the internal flow within which the change of regime takes place. The study concerns a two-dimensional air intake consisting of a dihedral ramp and an external flat plate whose leading edge is in the plane of the shock wave attached to the leading edge of the dihedral. The boundary layer developed on the dihedral is aspirated in a cavity (boundary layer trap) limited by the base of the dihedral and an internal flat plate. The diffuser, at the outlet of which the reactor is located, is thus simulated between the two internal and external flat plates. The study is of an experimental character, because taking account of the complexity of the phenomena, a theoretical treatment could not be considered, even for a functioning steady state regime. F.R.L.

A73-42741 # **Lifetime detection in the case of acoustically loaded structures on the basis of the appropriate form of vibration (Lebensdauer-Nachweis akustisch belasteter Strukturen auf der Grundlage der hierfür massgebenden Schwingungsform).** G. Bayerdörfer. München, Technische Universität, Fakultät für Maschinenwesen, Dr.-Ing. Dissertation, 1972. 66 p. 13 refs. In German.

The approach considered takes into account the simulation of a certain jet-noise spectrum. It is attempted to simulate the stresses that are present in the area in which fatigue fracture may occur. It is found that the narrow-band excitation of the vibrational form which is characteristic for this area provides a very good representation of the parameters that determine the fatigue behavior of the considered domain. The narrow-band excitation method requires only about 30% of the acoustic power needed in the case of a broadband excitation for equivalent stress conditions. The new approach is also useful for the determination of the admissible stresses. G.R.

A73-42774 **Aerodynamic and thermal structures of the laminar boundary layer over a flat plate with a diffusion flame.** T. Hirano and Y. Kanno (Ibaraki University, Ibaraki, Japan). In: International Symposium on Combustion, 14th, University Park, Pa., August 20-25, 1972, Proceedings. Pittsburgh, Combustion Institute, 1973, p. 391-398. 13 refs.

A73-42785 **Experiments on the propagation of mixing and combustion injecting hydrogen transversely into hot supersonic streams.** H. Wilhelmi, J. P. Baselt, and K. Bier (Karlsruhe, Universität, Karlsruhe, West Germany). In: International Symposium on Combustion, 14th, University Park, Pa., August 20-25, 1972, Proceedings. Pittsburgh, Combustion Institute, 1973, p. 585-593. 20 refs. Research supported by the Stiftung Volkswagenwerk.

A73-42786 **Influence of aerodynamic field on shock-induced combustion of hydrogen and ethylene in supersonic flow.** J. C. Bellet, H. P. Donzier, J. Soustre, and N. Manson (Poitiers, Université, Poitiers, France). In: International Symposium on Combustion, 14th, University Park, Pa., August 20-25, 1972, Proceedings. Pittsburgh, Combustion Institute, 1973, p. 595-602; Comments, p. 602. 18 refs.

A73-42849 # **Characteristics of motion of an elastically supported rotor with interior damping (Bewegungsverhalten eines elastisch gelagerten Rotors mit innerer Dämpfung).** H. Pichert. München, Technische Universität, Fakultät für Maschinenwesen und Elektrotechnik, Dr.-Ing. Dissertation, 1972. 115 p. 10 refs. In German. Research supported by the Deutsche Forschungsgemeinschaft.

The rotor system considered consists of two rigid rotor components which are connected with the aid of an elastic joint. The equations of motion are derived by making use of the Lagrange equations. Matrix approaches are used to determine eigenvalues, eigenvectors, and perturbational characteristics. The amount of calculations required is considerably reduced by the introduction of complex coordinates. In the low-speed range the behavior of the two-component rotor is found to be similar to that of a rigid rotor. With increasing speed the system characteristics are more and more influenced by the properties of the joint. G.R.

A73-42864 * # **Runway configuration improvement programming model.** J. C. Yu (Virginia Polytechnic Institute and State University, Blacksburg, Va.) and D. R. Gibson (U.S. Department of Commerce, Dept. of Highways and Traffic, Washington, D.C.). *American Society of Civil Engineers, National Transportation Engineering Meeting, Tulsa, Okla., July 9-12, 1973, Preprint 2034.* 31 p. 44 refs. $0.50. Grant No. NGR-47-004-090.

The basic objectives of the study were to subject a set of runway configurations to cost analysis and to develop a dynamic programming model which would enable an airport to economically match the ground capacity to its air traffic demand. Quantitative differences in the capacity of runway configurations result from the various aircraft/aircraft and aircraft/air-system interactions. A problem formulation and solution procedure is presented which is intended to be a meaningful technique for the long-range planning of runway expansion programs. F.R.L.

A73-42865 # **Use of simulation in airport planning and design.** D. E. Low. *American Society of Civil Engineers, National Transportation Engineering Meeting, Tulsa, Okla., July 9-12, 1973, Preprint 2038.* 22 p. $0.50.

Some of the potential pitfalls in the use of simulation in airport planning and design are described, and guidelines are suggested. Simulation is a technique for developing artificial historical data about a situation described by the model builder. The four general uses for simulation are sizing and locating design elements, analyzing interdependent elements, and analyzing operating procedures. Attention is given to factors governing design of a simulation model, elements of an airport operations simulation model, scale and level of simulation, sensitivity of simulation results, and communications between model user and model builder. F.R.L.

A73-42866 # **Estimation of general aviation air traffic.** K. A. Brewer, S. L. Ring, and R. L. Carstens (Iowa State University of Science and Technology, Ames, Iowa). *American Society of Civil Engineers, National Transportation Engineering Meeting, Tulsa, Okla., July 9-12, 1973, Preprint 2041.* 26 p. $0.50. FAA-supported research.

A method is developed for estimating general aviation traffic activity at airports serving populations of 250,000 persons or less, comparing this method with existing estimating procedures. The method has been applied in the development of the Iowa State Airport System Plan (ISASP). ISASP estimates general aviation activity by determining the based aircraft at each system candidate airport, estimating the annual operations per based aircraft, estimating the percentage of the total annual operations that are itinerant, estimating air taxi operations, and estimating the general aviation peak-hour operations activity. F.R.L.

A73-42867 # **Computer-aided design of airport system plans.** E. S. Joline (R. Dixon Speas Associates, Manhasset, N.Y.). *American Society of Civil Engineers, National Transportation Engineering Meeting, Tulsa, Okla., July 9-12, 1973, Preprint 2058.* 27 p. $0.50.

An investigation was conducted to determine how the computer could be used to facilitate planning of airport systems. The objectives of the investigation were to develop a well rationalized cost benefit evaluation procedure that would produce computer documented statistics on the costs and benefits of a particular plan, and develop automated means of system suboptimization with respect to quantifiable input data and parameters so as to facilitate plan development, sensitivity analysis, and contingency planning. The computer-aided approach described incorporates a cost/benefit methodology for airport system planning that should result in a better and more thoroughly researched and documented plan than is likely to result using conventional techniques. F.R.L.

A73-42868 # **GASP simulation of terminal air traffic system.** J. C. Yu, S. A. Akhand (Virginia Polytechnic Institute and State University, Blacksburg, Va.), and W. E. Wilhelm, Jr. (Ohio State University, Columbus, Ohio). *American Society of Civil Engineers, National Transportation Engineering Meeting, Tulsa, Okla., July 9-12, 1973, Preprint 2059.* 30 p. 22 refs. $0.50. NSF Grant No. GK-30325.

A model is described which proved the flexibility and capability of a somewhat unique modeling philosophy to simulate the air terminal system. A discrete events type of simulation model was used. An event is defined as an occurrence which may change the state of the system. A separate subroutine was written to process each event identified in the system and the GASP simulation language was used as the executive controller of the simulation. GASP provides an efficient and proven means of simulating large-scale systems. This general purpose simulation language is essentially a set of Fortran-coded subroutines which act as the executive controller of the simulation, collect desired statistics, generate output reports, and provde an efficient dynamic storage of operating variables. F.R.L.

A73-42870 **French eclipse studies.** S. Koutchmy (CNRS, Institut d'Astrophysique, Paris, France). *Sky and Telescope*, vol. 46, Oct. 1973, p. 215-217.

The main ground observations were for photometric, colorimetric, polarimetric, and spectrophotometric studies of both the K and F coronas. Data recording was photographic, except in the infrared spectral region at 2.2 micron wavelength, where photoelectric detectors were used. Homogeneous sequences taken from the Concorde SST during its totality of 74 min reveal structural changes taking place in the corona near the sun's poles, as well as a coronal enhancement that occurred on the eastern limb. F.R.L.

A73-42871 **Airborne studies of the African eclipse.** A. N. Cox and D. H. Liebenberg (California, University, Los Alamos, N. Mex.). *Sky and Telescope,* vol. 46, Oct. 1973, p. 222-225. AEC-sponsored research.

Results of observations from a USAF NC-135 aircraft, and from the supersonic Concorde are reviewed. The most successful observations were of the shape of the green coronal line at 5303 A at many places around the solar limb. Television recording systems were linked to Fabry-Pérot interferometers and to long-focus telescopes. From both aircraft geophysical studies were made of the deexcitation of atmospheric molecular bands and atomic lines when the earth's atmosphere was suddenly shadowed by the moon. F.R.L.

A73-42879 # **The unsteady aerodynamics of a finite supersonic cascade with subsonic axial flow.** J. M. Verdon (United Aircraft Research Laboratories, East Hartford, Conn.). *American Society of Mechanical Engineers, Applied Mechanics Western Conference, Menlo Park, Calif., Sept. 17-19, 1973, Paper 73-APMW-6.* 5 p. 5 refs. Members, $1.00; nonmembers, $3.00. Research sponsored by the United Aircraft Corp.

A method is presented for determining the unsteady flowfield and the aerodynamic response which occurs when a finite oscillating cascade is placed in a supersonic stream, which has a subsonic velocity component normal to the cascade. Solutions are obtained through the combined use of closed-form and numerical procedures. Computed results indicate that the finite-cascade analysis should provide a reasonable indication of the influence of the cascade parameters on the response of the infinite array. A brief parametric study for a typical configuration reveals possible aerodynamic instabilities when the blades perform single-degree-of-freedom pitching oscillations over a broad range of frequencies and interblade phase angles. (Author)

A73-42903 **Power subsystem for Skylab radiometer/scatterometer/altimeter experiment.** S. Capodici (General Electric Co., Space Div., Philadelphia, Pa.). In: Power Electronics Specialists Conference, Pasadena, Calif., June 11-13, 1973, Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 24-29.

Description of the power subsystem of the radiometer/scatterometer/altimeter experiment for Skylab 1, and of the design implemented to provide a high-quality bus to supply widely varying power demands. Some of the load conditions considered include initial turn-on of power and the associated inrush current; low frequency operation of a traveling wave tube; bursts of calibration pulses; periodic high-power radar pulsing; waveguide switch operation; antenna gimbal slewing; and heater control circuitry to provide constant temperature. Power processing circuits are also discussed, including a pulse-width-modulated voltage regulator, dc-to-dc conversion for isolation, and additional converters to provide various voltage levels. (Author)

A73-42905 **Decentralized power processing for large-scale systems.** J. W. Williams (Hughes Aircraft Co., Culver City, Calif.). In: Power Electronics Specialists Conference, Pasadena, Calif., June 11-13, 1973, Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1973, p. 41-45.

Description of successful applications of decentralized power processing to large-scale aircraft and spacecraft electronics systems. Tradeoff studies, performance results, and circuit examples are summarized. Problem areas and suggestions for further research are discussed. M.V.E.

A73-42943 # **Atmospheric absorption considerations in airplane flyover noise at altitudes above sea level.** N. Shapiro (Lockheed-California Co., Burbank, Calif.). *Acoustical Society of America, Meeting, 85th, Boston, Mass., Apr. 10-13, 1973, Paper.* 8 p. 6 refs.

Airplane flyover noise propagation calculations commonly include atmospheric absorption values from SAE Aerospace Recommended Practice ARP 866. These are appropriate for sea level atmospheric pressure. The limited published data for air absorption at reduced pressures show a shift of peak absorption toward lower humidity with reduced absorption in the range of humidities of usual interest. An analysis indicates that flyover noise measured at elevations of 2500 to 8000 feet above sea level may be on the order of one PNdB higher than would be measured at sea level at the same temperature and humidity conditions. Consequently, noise data from such high altitude measurements when corrected to sea level conditions will give noise levels that are too high. (Author)

A73-42944 # **Helicopter noise experiments in an urban environment.** W. A. Kinney and A. D. Pierce (MIT, Cambridge, Mass.). *Acoustical Society of America, Meeting, 85th, Boston, Mass., Apr. 10-13, 1973, Paper.* 48 p. 10 refs. U.S. Department of Transportation Contract No. TSC-93.

In two series of helicopter noise experiments, sound pressure level recordings were made on the ground while a helicopter flew at low altitude over (1) an array of microphones placed in an open field, and (2) a similar array placed in the center of a city street surrounded by tall buildings. For given helicopter altitude and airspeed, it was found that the flyover noise recorded in the street, although initially lower, built up rapidly as the aircraft approached such that the peak recorded noise was actually more intense than that recorded in the open field. This result is in qualitative accord with the results of previous laboratory scale model experiments performed by Lyon and Pande. The differences between the two sets of field data are attributed in major part to the fact that a reverberant sound field builds up in the street during a flyover. This enhancement is less pronounced for higher flight altitudes. A simple theory based on geometrical acoustics and statistical concepts is described which quantitatively explains the second enhancement found for a helicopter flying over a city street. (Author)

A73-42945 # **Sideline measurement of aircraft noise - Is it necessary.** J. W. Vogel (Lockheed-California Co., Burbank, Calif.). *Acoustical Society of America, Meeting, 85th, Boston, Mass., Apr. 10-13, 1973, Paper.* 18 p.

Discussion of some of the problems associated with sideline noise measurements on takeoff and approach that are designed to enforce the observance of community noise limits in accordance with Federal Aviation Regulations on aircraft type certification. Various alleviation possibilities for these problems are reviewed, and some are recommended. M.V.E.

A73-42946 # **Aircraft flyover noise - Spectral analysis of sounds and sound intensity fluctuations.** R. H. Gonter (Massachusetts, University, Amherst, Mass.). *Acoustical Society of America, Meeting, 85th, Boston, Mass., Apr. 10-13, 1973, Paper.* 18 p. 5 refs.

Tape recorded sounds from aircraft flyovers were digitized 2000 times per second and spectral analysis performed. These spectra show peaks near 400 Hertz with a decrease of 80 dB by 1000 Hertz. Intensity fluctuations of the sounds were obtained with a peak detector and digitized 100 times per second. The spectra of intensity fluctuations show an 80 dB drop between zero and five Hertz then variability or gradual decrease up to 50 Hertz. For stereo recordings with the microphones spaced 33 meters, cross spectra of the fluctuations have very low coherence indicating that the scale of the fluctuations is considerably less than 33 meters. One case of a high flying jet aircraft shows a regular change in phase with increasing frequency which would occur with fluctuations reaching the microphone array with a constant angle of incidence. (Author)

A73-42947 # **Community noise impact study from military helicopter operations.** J. Goldstein, R. Heymann (U.S. Army, Bio-Acoustics Div., Aberdeen Proving Ground, Md.), and C. R.

Bragdon (Georgia Institute of Technology, Atlanta, Ga.). *Acoustical Society of America, Meeting, 85th, Boston, Mass., Apr. 10-13, 1973, Paper.* 22 p. 13 refs.

Description of the procedures and review of the results of a study of the noise pollution problems resulting from military helicopter operations near populated residential areas. It is concluded that helicopter noise levels and resulting community annoyance can be effectively minimized through procedural means until engineering noise reduction becomes more feasible, both technically and economically. M.V.E.

A73-42949 # **Compensation of the longitudinal-trim and altitude control systems of an aircraft (Compensazione dei sistemi di controllo dell'assetto longitudinale e della quota di un aereo).** G. Jacazio (Torino, Politecnico, Turin, Italy). *Ingegneria,* July-Aug. 1973, p. 346-353. In Italian.

Description of a method for rapidly determining the compensation to be introduced into the longitudinal-trim and altitude control systems of an aircraft to ensure good maneuverability of the aircraft. A study is made of the dynamic behavior of an aircraft during small displacements of the aircraft from the equilibrium position. It is shown that the type and value of the compensation to be introduced into a longitudinal-trim control system must be determined in such a way that the root locus of the system transfer function assumes a particular aspect. It is then shown that the transfer function thus determined can be introduced into a broader system for controlling the altitude of the aircraft. A numerical example of the results obtained is presented, and the results of simulation of the two systems on an analog computer are summarized. A.B.K.

A73-42998 # **Heat transfer from an enclosed rotating disk with uniform suction and injection.** R. S. Garwal (Roorkee, University, Roorkee, India) and K. G. Upmanyu. *Aeronautical Society of India, Journal,* vol. 25, May 1973, p. 73-78. 5 refs.

The heat transfer phenomenon associated with incompressible laminar flow over an enclosed rotating disk when the rotor is subjected to uniform injection and the stator to an equal suction and vice versa has been studied. The effects of net radial outflow and inflow on the temperature profile and Nusselt numbers, on the rotor and stator in regions of no recirculation and circulation have been investigated. (Author)

A73-43000 # **Design of a contraction cone of a sub-sonic wind tunnel.** B. N. Chanda and B. Bose (Jadavpur University, Calcutta, India). *Aeronautical Society of India, Journal,* vol. 25, May 1973, p. 82-87. 20 refs.

An electric analogy technique is applied to the design of a contraction cone that acts as a transition between the inlet section and usable length of a low-turbulence subsonic wind tunnel. Tests showed that the contraction cone obtained will provide a uniform velocity distribution and a separation-free flow in the usable length, and will minimize the energy losses in the upstream section. V.P.

A73-43032 # **Evolution of blind landing systems (Evolutia sistemelor de aterizare fara vizibilitate).** I. Aron. *Transporturi Auto, Navale si Aeriene,* vol. 3 (20), June 1973, p. 321-326. In Rumanian.

Review of various systems that have been developed for determining the position and evolution of an aircraft with respect to a landing strip under conditions of greatly reduced visibility. The systems discussed include those based on the detection of electromagnetic fields produced on the ground - namely, a magnetic field landing system and an electromagnetic wave beam landing system - and radar systems, including systems based on the use of a ground radar, systems involving the use of an onboard radar, and systems employing interrogation-response stations. Trends of development of landing aids involving the use of radio wave beams are discussed, with particular attention given to an analysis of the Microwave Landing System, which provides angular information concerning deviations from a standard landing curve. Finally, trends of development of landing systems involving onboard radar are reviewed, noting both active and passive variants of a so-called Independent Landing Monitor. A.B.K.

A73-43056 # **Contribution to the rotorcraft ground resonance theory (K teorii zemnogo rezonansa vertoletov).** R. F. Ganiev (Akademiia Nauk SSSR, Institut Mekhaniki, Kiev, Ukrainian SSR) and I. G. Pavlov (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian SSR). *Prikladnaia Mekhanika,* vol. 9, May 1973, p. 50-56. 16 refs. In Russian.

The ground resonance problem is formulated as a problem of the stability of motion of a mechanical system under conditions of nonlinear resonances. The problem is solved by an approximate approach based on the use of methods of nonlinear mechanics and of specific forms of motion that make it possible to obtain qualitative laws of rotorcraft behavior at ground resonance in an analytical form. Various resonance effects are examined, and conditions for the stability of motion in the presence of ground resonance are derived. V.P.

A73-43057 # **Forced vibrations of a cylindrical shell in the presence of gas pressure fluctuations (Vynyzhdennye kolebaniia tsilindricheskoi obolochki pri kolebaniiakh davleniia gaza).** V. I. Prokop'ev and S. V. Morgulets. *Prikladnaia Mekhanika,* vol. 9, May 1973, p. 57-63. In Russian.

The vibrations of a jet-engine combustion chamber casing caused by gas pressure fluctuations are studied by formulating the conditions for the onset of resonant vibrations in a thin-walled circular cylindrical shell experiencing a specific mode of natural acoustic oscillations of the gas column in the shell. A method for calculating the variable stresses in the shell in the presence of steady resonant vibrations is developed. V.P.

A73-43061 # **Critical velocities of the steady motion of a pliable thread in plane homogeneous flow (O kriticheskikh skorostiakh statsionarnogo dvizheniia gibkoi niti v ploskom odnorodnom potoke).** V. A. Svetlitskii and R. A. Miroshnikh (Moskovskoe Vysshee Tekhnicheskoe Uchilishche, Moscow, USSR). *Prikladnaia Mekhanika,* vol. 9, May 1973, p. 94-98. 10 refs. In Russian.

The steady-state operating conditions of a ballistic antenna under the action of wind loads is examined. Two critical velocities are determined, one of which defines the minimum velocity at which steady motion exists, and the other defines the minimum velocity required for directional deployment of the antenna. Expressions for the radius of curvature at any point of the antenna are derived. V.P.

A73-43070 **On optimal asymptotically stabilizing control.** L. A. Igbo (Ife, University, Ile-Ife, Nigeria). *International Journal of Control, First Series,* vol. 18, Sept. 1973, p. 607-631. 8 refs.

The optimal asymptotically stabilizing control problem is formulated, and the theorem for the sufficient condition that guarantees its existence and uniqueness is stated and proved. The close relationship with Pontryagin's equations is discussed. It is shown that the control problem falls into the framework of optimal linear regulators with quadratic cost functionals. Furthermore, an alternate approach is presented that, for the problem solved, leads to the same optimal control. (Author)

A73-43111 # **An experimental investigation of a jet issuing from a wing in crossflow.** W. Mikolowsky and H. McMahon (Georgia Institute of Technology, Atlanta, Ga.). *Journal of Aircraft,* vol. 10, Sept. 1973, p. 546-553. 20 refs.

The aerodynamic interference resulting from a jet issuing normal to the chordal plane of a two-dimensional wing in a crossflow has

been experimentally investigated. Measurements of the interference surface pressure distribution on the wing and of the wing interference force and moment coefficients have been made for a systematic variation of jet exit location, jet exit diameter, wing angle-of-attack, and the ratio of jet exit velocity to freestream velocity, lambda. A comparison of the contours of constant interference surface pressure on the wing lower surface with those for an infinite flat plate reveals that they are much the same for lambda greater than 6. The dissimilarity becomes greater as lambda is decreased, primarily through the growth of an extensive region of positive interference surface pressure foward of the jet on the wing. Interference lift losses of approximately the same magnitude for all geometries were observed for lambda greater than 6. However, a lift augmentation occurred for lambda less than 6 which was attenuated by increases in angle-of-attack, forward movement of the jet exit location, and decreases in jet exit size. (Author)

A73-43114 # **Fuel tank wall response to hydraulic ram during the shock phase.** R. E. Ball, H. L. Power, and A. E. Fuhs (U.S. Naval Postgraduate School, Monterey, Calif.). *Journal of Aircraft*, vol. 10, Sept. 1973, p. 571, 572.

The effects of hydraulic ram in fuel tanks upon aircraft survivability and vulnerability are studied. The hydraulic ram phenomenon may be divided into two phases: the shock phase where the projectile exchanges some of its energy with the fluid by the production of a strong, nearly hemispherical shock wave originating from the entry wall, and the cavity phase where further energy is imparted to the fluid by the production and collapse of a vapor-filled cavity formed by separation of the fluid from the surface of the projectile as it moves through the tank. The shock phase is considered and the structural response of the entry wall during this phase is examined. F.R.L.

A73-43117 **The sun - Observatories, satellites, and an eclipse (Le soleil - Des observatoires, des satellites et une éclipse).** J. M. Pasachoff. *La Recherche*, vol. 4, June 1973, p. 576-579. In French.

The atmosphere is the major obstacle to observation of the solar surface from the ground, but under good conditions, and with new instruments, good results have been obtained. Internal parts of the corona can be observed with coronagraphs, and numerous aspects of the corona can be studied from space. Various solar observatories launched by NASA have carried apparatus which can observe very short wavelengths in the ultraviolet. Procedures for studying the eclipse of June 30, 1973, are discussed. One of these involves use of the Concorde SST, which could observe the eclipse for an hour by flying along the path of totality. F.R.L.

A73-43134 * **Non-linear flap-lag dynamics of hingeless helicopter blades in hover and in forward flight.** P. Friedmann (California, University, Los Angeles, Calif.) and P. Tong (MIT, Cambridge, Mass.). *Journal of Sound and Vibration*, vol. 30, Sept. 8, 1973, p. 9-31. 16 refs. Contract No. NAS2-6175.

The aeroelastic instability of the coupled nonlinear flap-lag motion of a torsionally rigid helicopter blade is treated by using the perturbation method in multiple time scales. The nonlinearities present in the equations are those arising from the inclusion of moderately large deflections in the inertia and aerodynamic loading terms. The stability boundaries, amplitudes of nonlinear response, and conditions for existence of limit cycles are obtained analytically. Thus the different roles played by the forcing, parametric excitation, and nonlinear coupling in affecting the solution can be easily identified. Numerical results illustrating the behavior of the blade are presented. (Author)

A73-43138 * **Effect of shear on duct wall impedance.** M. Goldstein and E. Rice (NASA, Lewis Research Center, Cleveland, Ohio). *Journal of Sound and Vibration*, vol. 30, Sept. 8, 1973, p. 79-84. 14 refs.

The solution to the equation governing the propagation of sound in a uniform shear layer is expressed in terms of parabolic cylinder functions. This result is used to develop a closed-form solution for acoustic wall impedance which accounts for both the duct liner and the presence of a boundary layer in the duct. The effective wall impedance can then be used as the boundary condition for the much simpler problem of sound propagation in uniform flow. (Author)

A73-43161 **Instrumentation for remote sensing solar radiation from light aircraft.** J. A. Howard and I. J. Barton (Melbourne, University, Melbourne, Australia). *Applied Optics*, vol. 12, Oct. 1973, p. 2472-2476. 20 refs. Research supported by the Reserve Bank of Australia.

The paper outlines the instrumentation needed to study, from a light aircraft, the solar radiation reflected by ground surfaces and the incoming solar radiation. A global shortwave radiometer was mounted on the roof of the aircraft and a specially designed mount was used to support a downward pointing 70-mm aerial camera, a downward pointing narrow-beam pyranometer, and, sometimes, a downward pointing global shortwave pyranometer. Calibration factors were determined for the three pyranometers by comparison with a standard Angstrom compensation pyrheliometer. Results have indicated trends in the albedos of major plant communities and have shown that the calculated albedo values vary according to whether the downward pointing instrument is narrow-beam or global. Comparisons were also made with albedos measured on the ground. (Author)

STAR ENTRIES

N73-29994*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF NOZZLE LATERAL SPACING, ENGINE INTERFAIRING SHAPE, AND ANGLE OF ATTACK ON THE PERFORMANCE OF A TWIN-JET AFTERBODY MODEL WITH CONE PLUG NOZZLES
Bobby L. Berrier Washington Aug. 1973 143 p refs
(NASA-TM-X-2724; L-8690) Avail: NTIS HC $4.50 CSCL 01A

Twin-jet afterbody models were investigated by using two balances to measure separately the thrust minus total axial force and the afterbody drag at Mach numbers from 0 to 1.3. Angle of attack was varied from minus 2 deg to 8.5 deg. Translating shroud cone plug nozzles were tested at dry-power and maximum-afterburning-power settings with a high-pressure air system used to provide jet total-pressure ratios up to 9.0. Two nozzle lateral spacings were studied by using afterbodies with several interfairing shapes. The close- and wide-spaced afterbodies had identical cross-sectional area distributions when similar interfairings were installed on each. The results show that the highest overall performance was obtained with the close-spaced afterbody and basic interfairings. Increasing angle of attack decreased performance for all configurations and conditions investigated. Author

N73-29995*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE COMPARISON OF A LOBED-DAISY MIXER NOZZLE WITH A CONVERGENT NOZZLE AT SUBSONIC SPEEDS
Donald L. Maiden Washington Sep. 1973 27 p refs
(NASA-TM-X-2806; L-8939) Avail: NTIS HC $3.00 CSCL 20D

An investigation to determine the performance, in terms of thrust minus nozzle axial force, of a lobed-daisy mixer nozzle has been conducted in a 16-foot transonic tunnel at static conditions and at Mach numbers from 0.40 to 0.90 at angles of attack from 4 minus to 8. Jet-total-pressure ratio was varied from about 1.2 to 2.0. The performance of a reference convergent nozzle with a similar nozzle throat area and length was used as a base line to evaluate the performance of the lobed-daisy mixer nozzle. The results of this investigation indicate that with no external airflow (Mach number M of 0), and at values of jet-total-pressure ratio between 1.2 and 2.0, the static thrust exerted by the lobed-daisy mixer nozzle is less than that of the convergent nozzle by about 10 percent of ideal gross thrust. About 3.4 percent of the thrust loss was attributed to an unintentional internal area expansion in the fan passage. Author

N73-29996*# Bell Helicopter Co., Fort Worth, Tex.
AN EXPERIMENTAL INVESTIGATION OF VORTEX STABILITY, TIP SHAPES, COMPRESSIBILITY, AND NOISE FOR HOVERING MODEL ROTORS Final Report
James L. Tangler, Robert M. Wohlfeld, and Stan J. Miley Washington NASA Sep. 1973 85 p refs
(Contract NAS1-10946)
(NASA-CR-2305; Bell-299-099-641) Avail: NTIS HC $3.75 CSCL 01B

Schlieren methods of flow visualization and hot-wire anemometry for velocity measurements were used to investigate the wakes generated by hovering model propellers and rotors. The research program was directed toward investigating (1) the stability of the tip vortex, (2) the effects produced by various tip shapes on performance and tip vortex characteristics, and (3) the shock formation and noise characteristics associated with various tip shapes. A free-wake analysis was also conducted for comparison with the vortex stability experimental results. Schlieren photographs showing wake asymmetry, interaction, and instability are presented along with a discussion of the effects produced by the number of blades, collective pitch, and tip speed. Two hot-wire anemometer techniques, used to measure the maximum circumferential velocity in the tip vortex, are discussed. Author

N73-29997# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
ON THE DESIGN CONDITIONS OF A CARET WING
D. Liu Apr. 1973 38 p refs
(AASU-327) Avail: NTIS HC $4.00

The design conditions of the lower surfaces of caret wings of various sweep angles were investigated. The two-dimensional aspect of the problem and the three-dimensional one were analysed separately. The dual design condition is defined, as a result of two dimensionality of the wing. Working charts were prepared for the purpose of specification of the flow field characteristics of the wing. A conically elliptic region was found where shock attachment is possible, when the wing is at a slightly off design condition. Author (ESRO)

N73-29999# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
AUXILIARY FUNCTIONS OF THE THEORY OF THE OSCILLATING LIFTING SURFACE WITH LARGE ASPECT RATIO FOR MACH NUMBERS BETWEEN 0 AND 1. PART 1: ANALYTICAL REPRESENTATION [HILFSFUNKTIONEN ZUR THEORIE DER SCHWINGENDEN TRAGFLAECHE GROSSER STRECKUNG IM BEREICH DER MACH'SCHEN ZAHLEN 0 BIS 1. TEIL 1: ANALYTISCHE DARSTELLUNG]
H.-G. Kuessner 1973 32 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-16; AVA-FB-7227) Avail: NTIS HC $3.75; DFVLR: Porz, West Ger. 9,90 DM

Starting from the general linear three-dimensional integral equation of first kind of the unsteady lifting surface theory, an approximative theory of the oscillating lifting surface of large aspect ratio is derived for Mach numbers between 0 and 1. For this purpose three basic assumptions are introduced. The two-dimensional integral equation for the oscillating profile is applied. All auxiliary functions involved in this approximative theory are analytically presented in a rational form suitable for numerical calculations. Author (ESRO)

N73-30000# National Aerospace Lab., Amsterdam (Netherlands).
A METHOD FOR THE CALCULATION OF THE FLOW FIELD INDUCED BY A FREE JET
H. Snel Apr. 1972 25 p refs Sponsored by Neth. Agency for Aerospace Programs (NIVR)
(NLR-TR-72040-U) Avail: NTIS HC $3.25

A method for the calculation of the flow field induced by a jet exhausted from an infinite flat plate into a stagnant medium is presented. The method represents the jet as a body of known dimensions, on which a normal velocity distribution is prescribed to simulate the entrainment. The Neumann problem for the induced flow was solved using a method of singularity distributions. That an accurate representation can be obtained, using a moderate

number of panels was shown. The results of the computation are in excellent agreement with measurements. It is argued that the present method may be more successfully extended to the case of a jet deflected by a cross wind, than a different, simpler method (due to Wygnanski) for the calculation of the flow field induced by a free jet. The method is of importance for the description of the flow field about VTOL aircraft configurations with lift jets. Author (ESRO)

N73-30001# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

THE LOAD NEAR THE APEX OF A LIFTING SWEPT WING IN LINEARISED SUBSONIC FLOW

Patricia J. Davies London Aeron. Res. Council 1972 32 p refs Supersedes RAE-TR-72031; ARC-33584

(ARC-R/M-3716; RAE-TR-72031; ARC-33584) Avail: NTIS HC $3.75; HMSO £1.20; PHI $4.90

Recent work on subsonic lifting-surface theory for wings with pointed apices has shown that representing both the singularity in the load at the apex and the detailed behavior of the load near the apex leads to large increases in the accuracy of collocation methods. The strength of the singularity has been found in earlier calculations as a function of the apex angle of the wing. These calculations are extended here to include the nonsingular factor in the load, which also depends on the apex angle. Interpolation formulae are obtained, which provide an accurate closed-form approximation to the behavior of the load distribution near the apex for all apex angles. Author (ESRO)

N73-30002# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN EXACT TEST CASE FOR THE PLANE POTENTIAL FLOW ABOUT TWO ADJACENT LIFTING AEROFOILS

B. R. Williams London Aeron. Res. Council 1973 38 p refs Supersedes RAE-TR-71197; ARC-33661

(ARC-R/M-3717; RAE-TR-71197; ARC-33661) Avail: NTIS HC $4.00; HMSO £1.40; PHI $5.80

A method for calculating the incompressible potential flow about two particular airfoil sections is presented. The potential flow about two lifting circles is calculated by the method of images, and the two circles are mapped conformally onto two airfoils by a double application of the Karman-Trefftz transformation. The results for the test cases are then compared with those from a numerical method, which uses a surface distribution of sources. Author (ESRO)

N73-30003# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN ANALYSIS OF THE DRAG OF TWO ANNULAR AEROFOILS

C. Young London Aeron. Res. Council 1973 61 p refs Supersedes RAE-TR-71126; ARC-33662

(ARC-R/M-2718; RAE-TR-71126; ARC-33662) Avail: NTIS HC $5.25; HMSO £2.25; PHI $8.80

An analysis of the drag and pressure measurements made in subsonic wind tunnel tests on two annular airfoils is described. The relation between the design pressure distribution in incompressible flow and the pressure distribution on the airfoil at high speed, is discussed. An attempt has also been made to see what changes in the flow field are associated with the drag-rise and whether the drag-rise Mach number can be predicted by methods similar to those used for ordinary airfoils and bodies of revolution. A comparison has been made of the measurements on a two-dimensional aerofoil and the annular aerofoils; no significant differences in the structure of local regions of supersonic flow were found at Mach numbers near the drag-rise.

Author (ESRO)

N73-30004# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN ITERATIVE METHOD FOR CALCULATION OF THE LOADING ON A THIN UNSWEPT WING

C. C. L. Sells London Aeron. Res. Council 1973 33 p refs Supersedes RAE-TR-72009; ARC-33585

(ARC-R/M-3719; RAE-TR-72009; ARC-33585) Avail: NTIS HC $3.75; HMSO £1.35; PHI $5.30

A pilot method has been developed, and an EMA computer program written, for the iterative calculation of the load distribution on a thin wing with prescribed warp (downwash). At each iteration the downwash due to the current loading iterate is computed and loading corrections are calculated from the downwash difference field until this is sufficiently small. The method has been applied to two rectangular wings of aspect ratio 6, one a flat plate, the other with parabolic camber, and except for a small region near the tip leading edge, has been found to converge quickly, 3 iterations being sufficient to obtain overall accuracy better than 1% in both cases. The method awaits extension to deal with a swept wing. Author (ESRO)

N73-30005# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN EXPERIMENTAL INVESTIGATION OF THE SUBSONIC LONGITUDINAL CHARACTERISTICS OF FIVE SLENDER-WING MODELS WITH GOTHIC PLANFORMS

D. L. I. Kirkpatrick and D. A. Kirby London Aeron. Res. Council 1973 48 p refs Supersedes RAE-TR-71137; ARC-33473

(ARC-R/M-3720; RAE-TR-71137; ARC-33473) Avail: NTIS HC $4.50; HMSO £1.75; PHI $6.75

The lift drag and pitching moment on five symmetrical slender-wing models with sharp edges and aspect ratios of 1.28 and 1.46 have been measured at low subsonic speed. Four of the models had a gothic planform and one a mild gothic planform. Variations in thickness distributions were covered by the range of models and the tests included a modification of one of the models to reduce the lift-dependent drag. These tests extended, earlier work on slender wings to higher aspect ratios and the results have been analysed to show how the lift, drag and longitudinal stability of wings in this higher range of aspect ratio are affected by planform shape and the chordwise and spanwise distribution of wing thickness. Author (ESRO)

N73-30006# Saab-Scania, Linkoping (Sweden). Aerospace Div.

APPLICATON OF THE POLAR COORDINATE METHOD TO OSCILLATING WING CONFIGURATIONS

Valter J. E. Stark Mar. 1973 45 p refs

(SAAB-L-O-R64) Avail: NTIS HC $4.25

The Polar Coordinate Method (PCM), previously applied to oscillating finite wings with control surfaces in subsonic flow, has been generalized and programmed in FORTRAN for the CDC 6600 computer. The program, called SALOWC 3 (Aerodynamic Loads on Oscillating Wing Configurations), based on the assumption that the configuration may be idealized as a combination of planar, trapezoidal surfaces (up to 10), was applied to various wing configurations such as AGARD, Cornell, Laschka-Schmid, Stark T-tail, fin with rudder, and F-14-like configuration. In the majority of cases the results are in good agreement with corresponding results obtained by kernel function and the Doublet Lattice Methods. The program has proved more economical than a previous program based on the Lifting Line Element method. ESRO

N73-30007# Aeronautical Research Labs., Melbourne (Australia).

REVIEW OF SONIC BOOM

N. W. Page and A. S. Kaye Feb. 1973 63 p refs Supersedes ARL/A-TM-254

(ARL/A-Note-337; ARL/A-TM-254) Avail: NTIS HC $5.25

A review of current knowledge on sonic boom generation and propagation is presented. The effects of the sonic boom on structures, people, and animals are discussed. Measurements of the effect of sonic booms on structures indicate that, under most conditions, only superficial damage is caused. The effect of the sonic boom on people and animals is a startle response with no direct injury resulting. Author

N73-30008# Federal Aviation Administration, Washington, D.C. Aircraft and Noise Abatement Div.

ENGINEERING AND DEVELOPMENT PROGRAM PLAN: AIRCRAFT SAFETY Program Plan as of Apr. 1973
Apr. 1973 44 p refs
(FAA-ED-18-1) Avail: NTIS HC $4.25

The objectives, scope of work, and funding requirements for a research project in aircraft safety improvement during the 1973 to 1982 time period are discussed. The subjects covered are: (1) fire safety, (2) general aviation aircraft safety, (3) transport safety, (4) quiet short haul air transport, and (5) aviation security. Author

N73-30009*# Boeing Vertol Co., Philadelphia, Pa.
V/STOL TILT ROTOR AIRCRAFT STUDY. VOLUME 5: DEFINITION OF STOWED ROTOR RESEARCH AIRCRAFT
Virgil A. Soule Mar. 1973 134 p refs Sponsored in part by Army
(Contract NAS2-6598)
(NASA-CR-114598; D222-10060-1-Vol-5) Avail: NTIS HC $8.75 CSCL 01C

The results of a study of folding tilt rotor (stowed rotor) aircraft are presented. The effects of design cruise speed on the gross weight of a conceptual design stowed rotor aircraft are shown and a comparison is made with a conventional (non-folding) tilt rotor aircraft. A flight research stowed rotor design is presented. The program plans, including costs and schedules, are shown for the research aircraft development and a wind tunnel plan is presented for a full scale test of the aircraft. Author

N73-30010*# Boeing Vertol Co., Philadelphia, Pa.
V/STOL TILT ROTOR AIRCRAFT STUDY. VOLUME 6: PRELIMINARY DESIGN OF A COMPOSITE WING FOR TILT ROTOR RESEARCH AIRCRAFT
Virgil A. Soule and Y. Badri-Nath Mar. 1973 126 p refs Sponsored in part by Army
(Contract NAS2-6598)
(NASA-CR-114599; D222-10060-2-Vol-6) Avail: NTIS HC $8.50 CSCL 01C

The results of a study of the use of composite materials in the wing of a tilt rotor aircraft are presented. An all-metal tilt rotor aircraft was first defined to provide a basis for comparing composite with metal structure. A configuration study was then done in which the wing of the metal aircraft was replaced with composite wings of varying chord and thickness ratio. The results of this study defined the design and performance benefits obtainable with composite materials. Based on these results the aircraft was resized with a composite wing to extend the weight savings to other parts of the aircraft. A wing design was then selected for detailed structural analysis. A development plan including costs and schedules to develop this wing and incorporate it into a proposed flight research tilt rotor vehicle has been devised. Author

N73-30011*# Boeing Vertol Co., Philadelphia, Pa.
V/STOL TILT ROTOR AIRCRAFT STUDY. VOLUME 7: TILT ROTOR FLIGHT CONTROL PROGRAM FEEDBACK STUDIES
H. R. Alexander, W. Eason, K. Gillmore, J. Morris, and R. Spittle Mar. 1973 364 p refs Sponsored in part by Army
(Contract NAS2-6598)
(NASA-CR-114600; D222-10060-3-Vol-7) Avail: NTIS HC $20.25 CSCL 01C

An exploratory study has been made of the use of feedback control in tilt rotor aircraft. This has included the use of swashplate cyclic and collective controls and direct lift control. Various sensor and feedback systems are evaluated in relation to blade loads alleviation, improvement in flying qualities, and modal suppression. Recommendations are made regarding additional analytical and wind tunnel investigations and development of feedback systems in the full scale flight vehicle. Estimated costs and schedules are given. Author

N73-30012*# Boeing Vertol Co., Philadelphia, Pa.
V/STOL TILT ROTOR AIRCRAFT STUDY. VOLUME 9: PILOTED SIMULATOR EVALUATION OF THE BOEING VERTOL MODEL 222 TILT ROTOR AIRCRAFT
H. Rosenstein, M. A. McVeigh, and P. A. Mollenkof Feb. 1973 92 p refs Sponsored in part by Army
(Contract NAS2-6598)
(NASA-CR-114602; D222-10052-1-Vol-9) Avail: NTIS HC $6.75 CSCL 01C

The results of a real time piloted simulation to investigate the handling qualities and performance of a tilting rotor aircraft design are presented. The aerodynamic configuration of the aircraft is described. The procedures for conducting the simulator evaluation are reported. Pilot comments of the aircraft handling qualities under various simulated flight conditions are included. The time histories of selected pilot maneuvers are shown. Author

N73-30013*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL AND ANALYTICAL DETERMINATION OF STABILITY PARAMETERS FOR A BALLOON TETHERED IN A WIND
L. Tracy Redd, Robert M. Bennett, and Samuel R. Bland Washington Sep. 1973 57 p refs
(NASA-TN-D-7222; L-8524) Avail: NTIS HC $3.50 CSCL 01B

Experimental and analytical techniques for determining stability parameters for a balloon tethered in a steady wind are described. These techniques are applied to a particular 7.64-meter-long balloon, and the results are presented. The stability parameters of interest appear as coefficients in linearized stability equations and are derived from the various forces and moments acting on the balloon. In several cases the results from the experimental and analytical techniques are compared and suggestions are given as to which techniques are the most practical means of determining values for the stability parameters. Author

N73-30014*# University of Technology, Leicester (England).
SOURCE MECHANISMS FOR ROTOR NOISE RADIATION Interim Report
M. V. Lowson, A. R. Whatmore, and C. E. Whitfield Washington NASA Aug. 1973 61 p refs
(Grant NGR-52-140-002)
(NASA-CR-2077; TT-7202) Avail: NTIS HC $3.50 CSCL 20A

Source mechanisms for subsonic rotor noise radiation have been investigated both theoretically and via a series of experiments on a low speed open rotor mounted in an anechoic chamber. Basic theoretical models for both discrete frequency and broad band noise generation are directly verified by the present experiments. The experiments have also demonstrated the potential significance of a new source of noise associated with the tips. This source appears to govern the high frequency portion of the radiated rotor noise spectrum and could be particularly important at lower speeds for large rotors. The source can be controlled by tip shape modifications. More detailed investigation of these phenomena will be performed during the coming year. Author

N73-30015*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC INVESTIGATION OF THE ENGINE-OVER-THE-WING CONCEPT USING A D-SHAPED NOZZLE
Meyer Reshotko and Robert Friedman 1973 18 p refs Proposed for presentation at Aero-Acoustic Specialists Conf., Seattle, Wash., 15-17 Oct. 1973; sponsored by AIAA
(NASA-TM-X-71419) Avail: NTIS HC $3.00 CSCL 20A

Small-model experiments were conducted of the engine-over-the-wing concept using a D-shaped nozzle in order to determine the static-lift and acoustic characteristics at two wing-flap positions. Configurations were tested with the flow attached and unattached to the upper surface of the flaps. Attachment was obtained with a nozzle flow deflector. In both cases, high frequency noise shielding by the wing was obtained. Configurations using the D-shaped nozzle are compared with corresponding ones using

a circular nozzle. With flow attached to the flaps, the static lift and acoustic results are almost the same for both nozzles. Without the nozzle flow deflector, (unattached flap flow), the D-nozzle is considerably noisier than a circular nozzle in the low and middle frequencies.
Author

N73-30016*# Boeing Commercial Airplane Co., Seattle, Wash.
THE DEVELOPMENT OF AN AUGMENTOR WING JET STOL RESEARCH AIRPLANE (MODIFIED C-8A). VOLUME 1: SUMMARY
R. H. Ashleman and H. Kavdahl Aug. 1972 182 p refs 2 Vol.
(Contract NAS2-6025)
(NASA-CR-114503; D6-40720-1-Vol-1) Avail: NTIS HC $11.25 CSCL 01C

A project to develop an experimental aircraft for use as an inflight demonstrator of the augmentor wing, short takeoff concept is discussed. The required modifications were made on a de Havilland C-8A aircraft. The modifications to the aircraft are explained and the performance of the modified aircraft is reported.
Author

N73-30017*# Boeing Commercial Airplane Co., Seattle, Wash.
THE DEVELOPMENT OF AN AUGMENTOR WING JET STOL RESEARCH AIRCRAFT (MODIFIED C-8A). VOLUME 2: ANALYSIS OF CONTRACTOR'S FLIGHT TEST
H. Skavdahl and D. H. Patterson Aug. 1972 206 p
(Contract NAS2-6025)
(NASA-CR-114504; D6-40720-2-Vol-2) Avail: NTIS HC $12.50 CSCL 01C

The initial flight test phase of the modified C-8A airplane was conducted. The primary objective of the testing was to establish the basic airworthiness of the research vehicle. This included verification of the structural design and evaluation of the aircraft's systems. Only a minimum amount of performance testing was scheduled; this has been used to provide a preliminary indication of the airplane's performance and flight characteristics for future flight planning. The testing included flutter and loads investigations up to the maximum design speed. The operational characteristics of all systems were assessed including hydraulics, environmental control system, air ducts, the vectoring conical nozzles, and the stability augmentation system (SAS). Approaches to stall were made at three primary flap settings: up, 30 deg and 65 deg, but full stalls were not scheduled. Minimum control speeds and maneuver margins were checked. All takeoffs and landings were conventional, and STOL performance was not scheduled during this phase of the evaluation.
Author

N73-30018*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SINGLE WING SUPERSONIC AIRCRAFT Patent Application
Robert T. Jones, inventor (to NASA) Filed 5 Jan. 1973 39 p
(NASA-Case-ARC-10470-2; US-Patent-Appl-SN-321180) Avail: NTIS HC $4.00 CSCL 01C

An aircraft is described with a single fuselage having a main wing and a horizontal stabilizer airfoil pivotally attached at their centers to the fuselage. The pivotal attachments allow the airfoils to be yawed relative to the fuselage for high speed flight, and to be positioned at right angles with respect to the fuselage during take-off, landing, and low speed flight. The main wing and the horizontal stabilizer are upwardly curved from their center pivotal connections towards their ends to form curvilinear dihedrals.
NASA

N73-30019*# Techtran Corp., Silver Spring, Md.
METHODS AND TECHNIQUES OF AIRFRAME STRENGTH FLIGHT TESTS
A. I. Gudkov and P. S. Leshakov Washington NASA Aug. 1973 224 p refs Transl. into ENGLISH of the book "Metody i Tekhnika Letnykh Ispytaniy Samoletov na Prochnost' Moscow, Mashinostr., 1972 p 1-248
(Contract NASw-2485)
(NASA-TT-F-769) Avail: NTIS HC $5.50 CSCL 01C

Methods of flight tests for evaluating the strength of airplanes and helicopters are presented. The basic types of modern measurement equipment used for measuring vibrations, stresses, temperatures and other parameters are described and recommendations are given concerning the preparation and calibration of the equipment. Brief information on laboratory airframe tests is included. Methods of flight tests for strength in which loads and vibrations are measured are discussed. Methods of analyzing measurement data in terms of airframe load features are presented. The basic computer hardware used for processing and analyzing measurement results are described.
Author

N73-30020*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF WING ASPECT RATIO AND FLAP SPAN ON AERODYNAMIC CHARACTERISTICS OF AN EXTERNALLY BLOWN JET-FLAP STOL MODEL
Charles C. Smith, Jr. Washington Aug. 1973 137 p refs
(NASA-TN-D-7205; L-8752) Avail: NTIS HC $4.50 CSCL 01A

An investigation has been conducted to determine the effects of flap span and wing aspect ratio on the static longitudinal aerodynamic characteristics and chordwise and spanwise pressure distributions on the wing and trailing-edge flap of a straight-wing STOL model having an externally blown jet flap without vertical and horizontal tail surfaces. The force tests were made over an angle-of-attack range for several thrust coefficients and two flap deflections. The pressure data are presented as tabulated and plotted chordwise pressure-distribution coefficients for angles of attack of 1 and 16. Pressure-distribution measurements were made at several spanwise stations.
Author

N73-30021*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND TUNNEL INVESTIGATION OF EFFECTS OF VARIATIONS IN REYNOLDS NUMBER AND LEADING-EDGE TREATMENT ON THE AERODYNAMIC CHARACTERISTICS OF AN EXTERNALLY BLOWN JET-FLAP CONFIGURATION
Lysle P. Parlett, Charles C. Smith, Jr., and James L. Megrail (Army Air Mobility R and D Lab., Hampton Va.) Washington Aug. 1973 155 p refs Prepared in cooperation with Army Air Mobility R and D lab., Hampton, Va.
(NASA-TN-D-7194; L-8745) Avail: NTIS HC $4.75 CSCL 01A

An investigation has been conducted in a full-scale tunnel to determine the effects of variations in Reynolds number and leading-edge treatment on the aerodynamic characteristics of an externally blown jet-flap transport configuration. The model had a double-slotted trailing-edge flap and was powered by four high-bypass-ratio turbofan engines. Tests were performed by using each of three leading-edge devices (a 30-percent-chord flap and 15- and 25-percent-chord slats) at Reynolds numbers from 0.47 x one million to 1.36 x one million thrust coefficients up to 3.5. The use of a 25-percent-chord slat was found to be more effective than a 15-percent-chord slat or a 30-percent-chord flap in extending the stall angle of attack and in minimizing the loss of lift after the stall. The large slat was also effective in reducing the rolling moments that occurred when the engine-out wing stalled first.
Author

N73-30022# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: AIRCRAFT NOISE AND SONIC BOOM Program Plan
Jun. 1973 38 p
(FAA-ED-20-2) Avail: NTIS HC $4.00

A program plan is designed to provide a data base, from which to develop rule making, for control and abatement of aircraft noise and sonic boom. The primary objectives are to minimize the environmental impact of sonic boom and aircraft generated noise and to develop prediction, reduction, and

certification criteria for all categories of aircraft. Development activities currently in progress and programs planned for a period of the next five years are described. Author

N73-30023*# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
SOME EFFECTS OF GROUND AND SIDE PLANES ON THE ACOUSTIC OUTPUT OF A ROTOR
A. R. Whatmore and M. V. Lowson Jul. 1973 28 p refs Sponsored in part by Natl. Gas Turbine Establishment
(Grant NGR-52-140-002)
(NASA-CR-132306; TT-73-R-07) Avail: NTIS HC $3.50 CSCL 20A

Fan Noise levels have been measured for a fan in the proximity of a side and ground plane. The side plane is found to produce substantial increases in noise in the lower harmonics, up to 10 db for the fundamental. The results suggest that fuselage/propeller separations should be greater than about 0.25 dia to minimize interaction noise. The ground plane is found to increase fan noise output up to a separation of one diameter, but to reduce noise at the closest separations. The effects are particularly confined to the harmonics which entirely disappear at the close separations. Under these conditions thrust increases, by over 70% in one case. The effects appear to be due to an improvement in the aerodynamic input to the rotor at small ground plane separations. Author

N73-30024# Boeing Co., Seattle, Wash. Commercial Airplane Group.
A STATUS REPORT ON JET NOISE SUPPRESSION AS SEEN BY AN AIRCRAFT MANUFACTURER
Walter C. Swan and Craig D. Simcox 1972 42 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-22 Jun. 1972 Sponsored by Aeron. and Astronaut. Assoc. of France and Soc. of Mech. Engr. of France
Avail: NTIS HC $4.25 CSCL 20A

The activities of an aircraft company on the reduction of jet efflux noise for three major applications of commercial aircraft are discussed. The SST noise problem is discussed. Activities on the use of chutes, spades, and tubes in combination with C-D and plug nozzles are outlined. Comparisons of noise suppression and thrust loss, and how these data support the compatibility of an SST with the community are shown. The conventional subsonic jet noise problem is reviewed in the light of current and proposed noise regulations. A discussion of recent test experience and an estimate of the apparent jet noise floor which can be economically accepted is made. The jet noise problem for future STOL or short haul aircraft is discussed and the apparent lack of agreement on noise data in the low velocity, 300 - 800 ft/sec range is reported. Author

N73-30025# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SIMULATED GROUND LEVEL STOL RUNWAY/AIRCRAFT EVALUATION Final Report, Jul. 1970 - Jul. 1972
Roman M. Spangler, Jr. Sep. 1973 172 p
(FAA-NA-72-77; FAA-RD-73-110) Avail: NTIS HC $10.75 CSCL 01C

A De Havilland DHC-6, Series 100 Twin Otter was flown by a representative group of pilots on various steep-gradient approaches onto a ground-level STOL runway. Approximately 800 approaches and landings were accomplished to provide a data base to approve a first-generation STOL operation. Areas investigated included: (1) aircraft handling and response on steep-gradient approaches with various approach electronic beam sensitivities; (2) location of the ground point of intercept; (3) co-located versus split localizer/glide slope signal source; (4) obstacle clearance requirements; (5) field length requirements; and (6) influence of command-steering on aircraft/pilot performance. Author 2

N73-30026*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRPORT-AREA AIRSPACE USED IN SIMULATED OPERATIONS WITH AN EXPERIMENTAL POWERED-LIFT STOL AIRPLANE
Norman S. Silsby and Richard H. Sawyer Washington Sep. 1973 29 p refs
(NASA-TN-D-7300; L-8869) Avail: NTIS HC $3.00 CSCL 01C

Simulation tests were made using an experimental powered-lift STOL airplane to help define airport-area airspace requirements for STOL operations. The operational feasibility and airspace used in take-offs followed by climbing turns, offset (bent localizer) approaches, missed approaches, and two-segment (bent glide-slope) approaches were studied. Flight-director guidance was provided for the approach maneuvers. Author

N73-30027*# Kanner (Leo) Associates, Redwood City, Calif.
ON THE PITCH DAMPING MOMENT IN HOVERING OF A RIGID HELICOPTER ROTOR
K. Takasawa Washington NASA Sep. 1973 143 p refs Transl. into ENGLISH from Kogyo Gijutsuin, Hakko Kenkyusho Kenkyu Hokoku (Tokyo), NAL TR-256, Nov. 1971 80 p
(Contract NASw-2481)
(NASA-TT-F-15010; NAL-TR-256) Avail: NTIS HC $9.25 CSCL 01C

The aerodynamic damping moment in pitch was measured with a hovering helicopter rotor. Three kinds of model blades with different rigidity were tried. A flow visualization study was performed for the purpose of determining the relative position between the blade and the vortices in steady hovering state. The perfectly rigid rotor was determined. Aerodynamic damping moment in pitch was analyzed. A quasi-steady theory is devised. A simple formula for calculating the pitch damping derivative of a helicopter rotor with spring constrained flapping hinge is proposed. The validity of the formula is ascertained by comparison with experimental results. Author

N73-30028*# Kanner (Leo) Associates, Redwood City, Calif.
METEOROLOGICAL SAFETY OF AIRCRAFT FLIGHTS
K. Yankin Washington NASA Sep. 1973 13 p Transl. into ENGLISH from Grazhdanskaya Aviats. (Moscow), no. 5, 1973 p 12-13
(Contract NASw-2481)
(NASA-TT-F-15069) Avail: NTIS HC $3.00 CSCL 01B

The instruction on meteorological safety of civil aviation, coming into effect at the end of 1973 is presented. Authorized means and frequencies of meteorological and aerological observations of cloud bottom heights, visibility and wind, the collection and distribution of actual weather, types of weather forecasts, composition and itemization of forecasts, evaluation of forecasts, meteorological documentation and preflight meteorological briefings are discussed. Meteorological documentation given to crews of supersonic transport aircraft is included. Author

N73-30029# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
STUDIES OF THE INFLUENCE OF DENSITY ON JET NOISE
R. G. Hoch, J. P. Duponchel, B. J. Cocking (Natl. Gas Turbine Estab., Pyestock, Engl.), and W. D. Bryce (Natl. Gas Turbine Estab., Pyestock, Engl.) 1972 36 p refs Presented at the 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1972
Avail: NTIS HC $4.00 CSCL 20A

Studies of exhaust noise from turbofan or turbojet engines at low thrust have emphasized the lack of consistency of jet noise prediction methods, particularly at low exhaust velocities. This situation has arisen mainly from difficulties with engine noise analysis and from the presence of rig noise in many model test facilities. These problems have masked the true effect of density on jet noise. Two independent research programs on model jets have been developed using advanced research facilities to study the effect of density by varying the jet temperature, at velocities from 150 to 800 m/s. Data for the sound power and peak noise levels are presented together with a range of spectra and directivity patterns. A principal result of these studies is that, while at high jet velocities the jet noise decreases with

decreasing density, at low velocities the trend is reversed. It is shown that the noise data can be normalized using a velocity-dependent function of the jet density. Author

N73-30030# Dowty Rotol Ltd., Gloucester (England).
THE VARIABLE PITCH FAN - PROPULSION FOR QUIET STOL
D. G. M. Davis [1972] 30 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, France, 19-23 Jun. 1972
Avail: NTIS

The use of variable pitch fan propulsion for quiet short takeoff aircraft is discussed. The basic feasibility of using a fully variable pitch fan driven by a turboshaft engine has been investigated. The aerodynamic and acoustic testing of different blade designs over the complete pitch range using a compressor test rig has been conducted. The refinement of the mechanical design aspects with consideration of different applications is reported. Author

N73-30031*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESULTS OF THE NOISE MEASUREMENT PROGRAM ON A STANDARD AND MODIFIED OH-6A HELICOPTER
Herbert R. Henderson, Robert J. Peegg, and David A. Hilton Washington Sep. 1973 105 p refs
(NASA-TN-D-7216; L-8129) Avail: NTIS HC $4.25 CSCL 20A

A field noise measurement program has been conducted on a standard OH-6A helicopter and one that had been modified by reducing the rotor speed, altering rotor tip shape, and treating the engine exhaust and inlet to reduce the external noise levels. The modifications consisted of extensive aircraft design changes resulting in substantial noise reductions following state-of-art noise reduction techniques. The purpose of this study was to document the ground noise characteristics of each helicopter during flyover, hover, landing, and take-off operations. Based on an analysis of the measured results, the average of the overall on-track noise levels of the final modified helicopter was approximately 14 db lower than that for the standard helicopter. Narrow-band-spectra data of the hovering helicopter show a reduction in the overall noise due to the reductions achieved for the lifting main and antitorque tail rotor, engine exhaust, and gear box noise for the modified helicopter. The noise results of the test program are found to correlate generally with noise measurements made previously on this type of aircraft. Author

N73-30032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LANDING PERFORMANCE OF AN AIR CUSHION LANDING SYSTEM INSTALLED ON A 1/10-SCALE DYNAMIC MODEL ON THE C-8 BUFFALO AIRPLANE
William C. Thompson Washington Sep. 1973 27 p refs
(NASA-TN-D-7295; L-8724) Avail: NTIS HC $3.00 CSCL 01C

An experimental study was conducted to evaluate the landing behavior of a 1/10-scale dynamic model of the C-8 Buffalo airplane equipped with an air-cushion landing system (ACLS) on a variety of surfaces including both calm and rough water and a smooth hard surface. Taxi runs were made on the hard surface over several obstacles. Landings were made with the model at various pitch and roll attitudes and vertical velocities and at one nominal horizontal velocity. Data from the landings include time histories of the trunk and air-cushion pressures and accelerations at selected locations on the model. Author

N73-30033*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FULL-SCALE WIND-TUNNEL INVESTIGATION OF EFFECTS OF SLOT SPOILERS ON THE AERODYNAMIC CHARACTERISTICS OF A LIGHT TWIN-ENGINE AIRPLANE
Harry A. Verstynen, Jr. and Dominick Andrisani, II Washington Sep. 1973 34 p refs
(NASA-TN-D-7315; L-8865) Avail: NTIS HC $3.00 CSCL 01C

A wind-tunnel investigation has been conducted to determine the effects of slot spoilers on the longitudinal and lateral aerodynamic characteristics of a full-scale mockup of a light twin-engine airplane. The slots were located along the leading edge of the flaps and were used to modulate the flap-induced lift as a possible means of achieving direct lift control. The data showed that the slots were effective in spoiling up to 61 percent of the flap-induced lift, but that an adverse pitching-moment change (nose up) accompanied opening the slots. Opening the slots was found to decrease slightly the downwash angle at the tail and to increase slightly the longitudinal stability of the model. Author

N73-30034# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Instrumentierung und Anthropotechnik.
TACHISTOSCOPIC INVESTIGATIONS ON ELECTRONIC AND CONVENTIONAL COCKPIT DISPLAYS [TACHISTOSKOPISCHE UNTERSUCHUNGEN AN ELEKTRONISCHEN UND KONVENTIONELLEN ANZEIGEN FUER DIE FLUGFUEHRUNG]
Wolfgang Heinze 1973 56 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft Prepared jointly with Tech. Univ. Brunswick
(DLR-FB-73-27) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. 13,50 DM

In connection with investigations on the possibility of application of electronically produced data representations to guidance and control, a comparison of electromechanical and electronic indicating instruments was carried out using a tachistoscope. The results showed significantly better identification performances measured in the case of the electronic display than in the case of using corresponding, conventional indicator instruments. It could be proved that confusions are probable when employing the usual symbology for horizon and horizontal bar flight director display. For the ILS and flight director displays, respectively, interesting indicators resulted for future display designs. Author (ESRO)

N73-30035# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
DYNAMIC AND AEROELASTIC PROBLEMS OF STOP-ROTORS AND THEIR ANALYTICAL TREATMENT. PART 2: DETAILS OF ANALYTICAL SOLUTION [DYNAMISCHE UND AEROELASTISCHE PROBLEME DES STOP-ROTORS UND IHRE ANALYTISCHE BEHANDLUNG. TEIL 2: ANALYTISCHE ANSAETZE UND LOESUNGSVERFAHREN]
H. Foersching 17 Jan. 1973 82 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-19; AVA-FB-7229) Avail: NTIS HC $6.25; DFVLR, Porz, West Ger. 17,40 DM

Based upon the analytical relations derived in Part I the details of the analytical solutions of dynamic and aeroelastic problems of stop-rotors of V/STOL-aircraft, occuring during blade folding and retracting, are presented. In particular, the problems of static aeroelastic torsional stability, the flutter behavior and the dynamic response of a stopped rotor blade to a discrete gust are treated. The investigations are completed by some typical computation examples. For part 1 see N73-18027.
Author (ESRO)

N73-30036# National Aerospace Lab., Amsterdam (Netherlands).
BEHAVIOR OF VERY LARGE AIRCRAFT DISTURBED BY WIND SHEAR AND ATMOSPHERIC TURBULENCE
W. P. deBoer 10 Feb. 1972 61 p refs
(NLR-TR-72023-U) Avail: NTIS HC $5.25

The behavior of very large aircraft disturbed by wind shear and atmospheric turbulence (vertical gust during the landing approach) is analyzed by means of a multiloop system. The aircraft considered were a B-747-like aircraft and two hypothetical aircraft, the VLAC-1A and The VLAC-4A, with weights ranging from 500,000 to 4,000,000 lbs. A combined system, consisting

of an autothrottle to control airspeed and a human pilot model to control altitude, was developed. It was shown that because of the decreasing value of short period value with increasing aircraft weight, a larger value of the lead time constant is needed for the larger aircraft resulting in a worse pilot rating. Results indicated that due to higher approach speeds of the larger aircraft, a higher percentage of the available thrust will be needed to cope with a given wind shear. Increased engine response lag can deteriorate altitude control. ESRO

N73-30037# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Manufacturing Research and Product Development Dept.

ADHESIVE BONDING IN THE FOKKER-VFW F-28 'FELLOWSHIP'

Rob J. Schliekelmann Feb. 1973 15 p

(FOK-K-67) Avail: NTIS HC $3.00

For achievement of the required long fatigue life, suitable failsafe characteristics and high durability, a choice for all-out use of adhesive bonded structures in the Fokker F-28 'fellowship' was made. As a target for the fatigue life 30,000 flying hours or 60,000 flights were specified. The various design aspects of adhesive bonded structures, including bonded sheet laminations, bonded stringers, and sandwich structures are presented. The adhesive bounding processes, as well as the adhesive bonded Fokker F-28 structures, are outlined. Adhesion and cohesion quality methods used to control and develop reliable and reproducible manufacturing processes for all phases of the adhesive bonding production cycle are described. ESRO

N73-30039# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INCREASING THE RELIABILITY OF GLASSWORK PARTS MADE FROM ORGANIC GLASS UNDER OPERATING CONDITIONS

I. V. Rozhdestvenskii 22 Jun. 1973 9 p Transl. into ENGLISH from Ekspluatatsionnaya Nadezhnost, Kachestvo i Svoistva Samoletnogo Organicheskogo Stekla (USSR), no. 177, 1971 p 25-27

(AD-763263; FTD-HT-23-436-73) Avail: NTIS CSCL 01/3

Studies were made to develop new materials having high physical-mechanical properties and high stability to atmospheric influences and operational loads. GRA

N73-30040# Franklin Inst. Research Labs., Philadelphia, Pa.

SNOW STABILIZATION FOR HELICOPTER LANDINGS Final Report

Edward R. Evans May 1973 37 p refs

(Contract DAAD05-73-C-0170)

(AD-763231; FIRL-F-3549-01; LWL-CR-01C73) Avail: NTIS CSCL 01/2

The report describes the procedures for and the results of field tests conducted to stabilize snow by chemical treatment. Sintering of the snow by spraying methanol on its surface suppresses a possible white out condition when helicopters perform normal take-off and landings upon the treated areas. The addition of a violet dye to the methanol also provided the aircraft pilot with a definitive form of reference when the ground was covered with snow and no nearby markers were present. Author (GRA)

N73-30041# Army Aviation Systems Command, St. Louis, Mo.

MAJOR ITEM SPECIAL STUDY (MISS), CH-47A SYNCHRONIZING DRIVE SHAFT ADAPTER Interim Report, 1 Jan. 1964 - Jul. 1972

Jun. 1973 23 p

(AD-763186; USAAVSCOM-TR-73-11) Avail: NTIS CSCL 13/5

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports than investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N73-30042# Army Aviation Systems Command, St. Louis, Mo.

MAJOR ITEM SPECIAL STUDY (MISS), CH-47A MAIN ROTOR BLADE, FORWARD Interim Report, 1 Jan. 1964 - 1 Jul. 1973

Jul. 1973 23 p Revised

(AD-763187; USAAVSCOM-TR-73-13) Avail: NTIS CSCL 01/3

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for itensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From these data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigates possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible product improvement program (PIP) areas. Author (GRA)

N73-30043# Army Aviation Systems Command, St. Louis, Mo.

MAJOR ITEM SPECIAL STUDY (MISS), OH-58A TAIL ROTOR BLADE Interim Report, 1 Jan. 1964 - 30 Jun. 1972

Jul. 1973 33 p Revised

(AD-763188; USAAVSCOM-TR-73-14) Avail: NTIS CSCL 01/3

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for itensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From these data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigates possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible product improvement program (PIP) areas. Author (GRA)

N73-30044# Boeing Aerospace Co., Seattle, Wash.

INVESTIGATION OF REINFORCED THERMOPLASTICS FOR NAVAL AIRCRAFT STRUCTURAL APPLICATION Final Report, 1 Jun. 1972 - 1 May 1973

John T. Hoggatt Jun. 1973 117 p refs

(Contract N00019-72-C-0526)

(AD-763470; D180-17531-1) Avail: NTIS CSCL 11/4

The report discusses research on reinforced plastics. It was conducted in three phases. Phase I, which constituted the major portion of the effort, concentrated on studying 181 style glass fabric reinforced thermoplastic laminates. Phase II investigated the practicality of using graphite reinforcements rather than glass fabric, and finally, Phase III investigated potential methods of production and the cost impact of this concept on component manufacture. It was demonstrated in the program that reinforced thermoplastic laminates could perform competitively with epoxy glass fabric laminates and result in a potentially lower cost

production material. The materials were compared on a basis of mechanical properties, environmental resistance and electrical properties. (Modified author abstract) GRA

N73-30045# Kaman Avidyne, Burlington, Mass.
MASMOD: A PREPROCESSOR PROGRAM FOR PREPARING THE DYNAMIC MODEL FOR VIBRA-4 Final Report
Thomas A. Dalton, Norman P. Hobbs, and Joan M. Coco May 1973 704 p refs
(Contract DNA001-72-C-0111; DNA Proj. NWED-NB-003)
(AD-763701; KA-TR-92; DNA-3050G) Avail: NTIS CSCL 01/3

A digital computer program, MASMOD (Mass Model), which is capable of generating both the mass and aerodynamic aircraft models required for the VIBRA-4 (Vehicle Inelastic Bending Response Analysis) computer program is presented in this report. MASMOD employs basic data given for an aircraft to generate either individual component or entire aircraft lumped-mass and aerodynamic models, three-dimensional influence coefficients, and mode shapes and frequencies. Additionally, MASMOD has the capability of plotting the formulated mass and aerodynamic models as well as the components: relative bending and torsion in each vibrational mode calculated by the program. Author (GRA)

N73-30046# California Univ., Los Angeles. School of Engineering and Applied Science.
IDENTIFICATION OF SYSTEMS SUBJECT TO RANDOM STATE DISTURBANCE
A. V. Balakrishnan Jun. 1973 23 p refs
(Grant AF-AFOSR-2492-73; AF Proj. 9769)
(AD-763741; UCLA-ENG-7348; AFOSR-73-1223TR) Avail: NTIS CSCL 01/3

A theory of identification of a class of linear systems - lumped and distributed - in the presence of state or process noise is presented. As a specific application, the problem of identifying aircraft stability - control derivatives in turbulence is considered, and results obtained on actual flight data are included. Author (GRA)

N73-30047# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPANSION OF THE POTENTIALITIES OF AUTOMATIC FLIGHT CONTROL BY USING ADAPTIVE CONTROL SYSTEMS AND VARIABLE-STRUCTURE CONTROL SYSTEMS
G. I. Avrutskii and L. S. Valkov 8 Mar. 1973 10 p refs
Transl. into ENGLISH from an unidentified Russian monograph
(AD-763415; FSTC-HT-23-1387-72) Avail: NTIS CSCL 01/3

Basic requirements for automatic flight control systems are described in a generalized manner. GRA

N73-30048# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
SURFACE EFFECT TAKE-OFF AND LANDING SYSTEM (SETOLS) SUBSONIC STATIC STABILITY OUT OF GROUND EFFECT
H. Dulany Davidson, Jr. and Lawrence A. Frank Oct. 1972 34 p refs
(ARPA Order 2121)
(AD-763365; Evaluation-AL-97) Avail: NTIS CSCL 01/2

The effect of a deployed air cushion landing gear on the stability of a high performance aircraft was studied at the Naval Ship Research and Development Center's 8 x 10 foot subsonic wind tunnel. Air cushion designs submitted by Bell Aerospace Corporation and Boeing were fitted to a ten percent scale A-4E and air cushions designed by Goodyear (two configurations), San Diego Aircraft Engineering Incorporated (SANDAIRE), and Bell were fitted to a ten percent scale F-8C. The effects of the air cushion landing gear ranged from minor destabilization, to very detrimental destabilization on both aircraft in the landing approach configuration. Author (GRA)

N73-30049# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AN ELEMENTARY THEORETICAL COMPARISON OF THE AERODYNAMIC CHARACTERISTICS OF JET, BLOWN AND EJECTOR FLAPS
Robert Poplawski May 1973 45 p refs
(AD-763793; ASD/XR-72-25) Avail: NTIS CSCL 01/3

The document aims to provide a basic capability to calculate the aerodynamic performance of jet, blown, and ejector flaps. It avoids complex mathematics and only presents general graphical results that are necessary to perform the elementary theoretical calculations. The graphical data is used to perform some basic comparisons between the jet, blown, and ejector flaps. For the cases considered, the ejector flap was found to provide the best performance. To caution the novice in his use of the theoretical results, some wind tunnel data are presented which appear to contradict the theoretical results. Improper use of the momentum coefficient term and flow separation is noted. (Modified author abstract) GRA

N73-30050# Allied Research Associates, Inc., Newton Upper Falls, Mass.
EXPERIMENTAL INVESTIGATION OF WAKE VELOCITY FLUCTUATIONS BEHIND STALLED WINGS AT REYNOLDS NUMBERS UP TO 4.8 MILLION Final Report, Feb. 1971 - Feb. 1973
Robert F. Smiley Feb. 1973 62 p refs
(Contract N00019-71-C-0360)
(AD-763468; ARA-9G87-F) Avail: NTIS CSCL 01/3

A wind tunnel investigation was made of transient wake velocities behind three stalled wings with NACA 0012 airfoils and spans equal to test section width up to a maximum Reynolds number of 4.8 million. Two wings had constant chords of 6 inches and 3 inches and one was tapered with a root chord of 12 inches and a tip chord of 6 inches. Anemometer time-history data were recorded on tape for angles of attack of 16.2 degrees, 21.1 degrees, 25.8 degrees and 30.3 degrees, and were used to evaluate wake geometry, frequency and mean and perturbation velocities for the constant chord wings. (Modified author abstract) GRA

N73-30051# California Univ., Los Angeles. Dept. of System Sciences.
IDENTIFICATION AND STOCHASTIC CONTROL WITH APPLICATION TO FLIGHT CONTROL IN TURBULENCE
Kenneth W. Liff May 1973 260 p refs
(Grant AF-AFOSR-2492-73; AF Proj. 9769)
(AD-763739; UCLA-eng-7340; AFOSR-73-1138TR) Avail: NTIS CSCL 01/3

The report deals with the problem of adaptive control of an aircraft in atmospheric turbulence. The problem is approached by first identifying the unknown coefficients and then applying optimal control theory to the system so determined. The theory developed is general enough to apply to any linear system with unknown coefficients and state noise. The bulk of the development concerns the identification problem and several methods are studied. In particular, what may be called (stochastic) identification method, taking into account the unknown state noise, is studied for the first time. GRA

N73-30052# McDonnell Aircraft Co., St. Louis, Mo.
SONIC FATIGUE TEST METHODS AT ELEVATED TEMPERATURES Final Report, Mar. 1971 - Dec. 1972
M. H. Hieken, W. E. Noonan, and E. F. Shroyer Jun. 1973 148 p refs
(Contract F33615-71-C-1217; AF Proj. 4437)
(AD-763798; MDC-A1622; AFFDL-TR-73-8) Avail: NTIS CSCL 01/3

Sonic fatigue testing at elevated temperatures has become increasingly important as aerospace vehicle structures are designed for the combined environments. Work is described in four areas related to thermal/acoustic testing: acoustic simulation, thermal simulation, specimen mounting effects, and instrumentation and measurements. Acoustic field studies considered the directional properties of various fields, as well as coupling of the acoustic

fields with structural specimens. Thermal environment studies dealt with predicting temperatures in a heated structural specimen. The design of heating systems was also discussed. In specimen mounting effects, equations were presented to show how thermal loads enter into the general dynamic equations. Panels with free edges and panels with fixed edges were treated in detail. Measurement methods related to sonic fatigue testing at elevated temperatures were surveyed for availability of devices which operate in the combined environment. (Modified author abstract) GRA

N73-30053# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
IN-FLIGHT SAFETY OF PASSENGERS AND FLIGHT ATTENDANTS ABOARD AIR CARRIER AIRCRAFT
14 Mar. 1973 41 p refs
(PB-220374/3; NTSB-AAS-73-1) Avail: NTIS HC $3.75 CSCL 01B

The study examines nonfatal in-flight injuries of passengers and flight attendants in air carrier operations during the years 1968 through 1971. Injuries caused by turbulence, evasive maneuvers to avoid a collision, and self-initiated injuries are summarized. Conditions, circumstances, and preexisting factors instrumental in creating a hazardous environment for persons aboard aircraft are examined, as well as types of injuries sustained and the treatment of such injuries. Also examined is the relationship of injuries to passenger seatbelt discipline, structure and design of cabin furnishings, flight attendants, duties, consumption of alcoholic beverages, and the location in the airplane of passengers and flight attendants. Six safety recommendations are presented. Author (GRA)

N73-30054# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
PREDICTION OF V/STOL NOISE FOR APPLICATION TO COMMUNITY NOISE EXPOSURE Final Report, Jun. - Dec. 1972
Charles L. Munch May 1973 280 p refs
(Contracts DOT-TSC-438; DOT-OS-207)
(PB-221140/7; DOT-TSC-OST-73-19) Avail: NTIS HC $6.75 CSCL 20A

A computer program to predict the effective perceived noise level (EPNL), the tone corrected perceived noise level (PNLT), and the A-weighted sound level (dBA) radiated by a V/STOL vehicle as it flies along a prescribed takeoff, landing, or cruise flight path is described and a complete users guide for the program is presented. The procedures used to predict the noise radiated by helicopter rotors, propellers, turboshaft engines, lift and cruise fans, and jets are described in detail. Helicopter rotor noise and jet noise are theoretically predicted with some empirical modifications while propeller, fan, and turboshaft engine noise is calculated with primarily empirical procedures. Author (GRA)

N73-30106*# Aeronautical Research Associates of Princeton, Inc., N.J.
THE DEVELOPMENT AND PRELIMINARY APPLICATION OF AN INVARIANT COUPLED DIFFUSION AND CHEMISTRY MODEL Final Report
Glenn R. Hilst, Coleman duP. Donaldson, Milton Teske, Ross Contiliano, and Johnny Freiberg Washington NASA Sep. 1973 83 p refs
(Contract NAS1-11433)
(NASA-CR-2295; Rept-193) Avail: NTIS HC $3.75 CSCL 07D

In many real-world pollution chemical reaction problems, the rate of reaction problems, the rate of reaction may be greatly affected by unmixedness. An approximate closure scheme for a chemical kinetic submodel which conforms to the principles of invariant modeling and which accounts for the effects of inhomogeneous mixing over a wide range of conditions has been developed. This submodel has been coupled successfully with invariant turbulence and diffusion models, permitting calculation of two-dimensional diffusion of two reacting (isothermally) chemical species. The initial calculations indicate the ozone reactions in the wake of stratospheric aircraft will be substantially affected by the rate of diffusion of ozone into the wake, and in the early wake, by unmixedness. Author

N73-30119# Howard Univ., Washington, D.C. School of Engineering.
A STUDY ON COMMUNICATION ANTENNA ISOLATION Final Report
Bing A. Chiang FAA Jun. 1973 144 p refs
(Contract DOT-FA73WA-3156)
(FAA-RD-73-94) Avail: NTIS HC $9.25

Problems on FAA communication antennas related to isolation are analyzed. The concept of using progressively phased circular array to achieve high isolation is studied. The method of study is divided into theoretical and experimental. Theoretical study involved using moment method. Symmetrical dipoles were used as elements. Factors analyzed include array radius, antenna size, position accuracy, impedance, radiation pattern, and isolation. The experimental study involved building scale antennas from existing FAA coaxial dipoles and using them as array elements, and simulated matrix feed conditions to study isolation and radiation pattern. An isolation of 55 db was found possible. The concept is shown to provide high isolation in a very limited space which provides flexibility for beam forming and azimuth scanning. Author

N73-30137*# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
GEOMETRIC ASPECTS IN DIGITAL ANALYSIS OF MULTI-SPECTRAL SCANNER (MSS) DATA
Edward M. Mikhail and James R. Baker 1973 37 p refs
(Grant NGL-15-005-112)
(NASA-CR-133641; LARS-042573) Avail: NTIS HC $4.00 CSCL 05B

Present automated systems of interpretation which apply pattern recognition techniques on MSS data do not fully consider the geometry of the acquisition system. In an effort to improve the usefulness of the MSS data when digitally treated, geometric aspects are analyzed and discussed. Attempts to correct for scanner instabilities in position and orientation by affine and polynomial transformations, as well as by modified collinearity equations are described. Methods of accounting for panoramic and relief effects are also discussed. It is anticipated that reliable area as well as position determinations can be accomplished during the process of automatic interpretation. A concept for a unified approach to the treatment of remote sensing data, both metric and nonmetric is presented. Author

N73-30206# Federal Aviation Administration, Washington, D.C.
TANDEM ELECTRONIC VOICE SWITCHING (EVS) SYSTEM
John F. Schroeder 1 Jun. 1973 142 p refs
(FAA-RD-73-133) Avail: NTIS HC $9.25

The tandem electronic voice switching (EVS) system project plan identifies responsibilities and describes events and activities which must be completed in order to integrate the tandem EVS system with NAS en route stage A. Initial emphasis is on the installation and evaluation testing of a preproduction EVS system at NAFEC for which the System Research and Development Service has primary responsibility. Implementation of the production systems and provides for the transition of primary responsibility to the Airway Facilities Service for this activity is also presented. The tandem EVS system project plan does not assign responsibilities, but rather amalgamates and synchronizes the planning of participating organizations with respect to their inherent responsiblilites for the tandem EVS project. Author

N73-30213# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

DEVELOPMENT OF CHEMICAL COATING FOR AIRFIELD RUNWAY MARKING Final Report
Stanley P. Dowdy Washington FAA Feb. 1973 59 p refs
(Contract DOT-FA69WAI-154)
(FAA-RD-73-23) Avail: NTIS HC $5.00

An airfield runway marking paint superior to paint and/or systems presently utilized was developed. A high-molecular weight, linear bisphenol polyether was developed. Methyl ethyl ketone as a pure solvent was found to be the most effective in producing rapid completely dry, flexible paint that is practically nonreactive with the substrates and conform to pollution requirements of Los Angeles (Rule 66). Three different anti-skid additives were studied as well as a water resistant (silicone) additive to improve bead retention and adhesion of the coating to the substrate. A styrene acrylate and a chlorinated rubber alkyd were evaluated. Field tests were conducted. A proposed specification for the procurement of the desired paint was developed. Author

N73-30215# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: TERMINAL/TOWER CONTROL Interim Report
Apr. 1973 151 p
(FAA-ED-14-2) Avail: NTIS HC $9.75

The FAA engineering and development program 14 terminal/tower control is presented. It provides the definition of the development program for the terminal air traffic control portion of the third and upgraded third generation of the National Airspace System. The product of this development program is terminal ATC improvements, which, if implemented, satisfy stated requisites. The plan defines the goals, general approach, development activities, schedules and resource requirements for the development program. The following topics are discussed: background and general requirements, purpose, scope, objectives, factors influencing terminal/tower system configurations and program development, structure and allocation of technical efforts, and implementation considerations. Author

N73-30216# Technology, Inc., San Antonio, Tex. Life Sciences Div.
DEVELOPMENT OF VISUAL AIDS TO ALLEVIATE SPATIAL DISORIENTATION DURING TAKEOFF AND LANDING Final Report
W. H. Bowie, S. C. Collyer, and D. S. Stolarski Washington FAA Jun. 1973 48 p refs
(Contract DOT-FA72WA-2760)
(FAA-RD-73-26) Avail: NTIS HC $4.50

The concept for a ground based visual aid to help alleviate spatial disorientation during takeoff and landing approaches was developed. The proposed device consists of a 2/3 mile diameter circle of 12 lights mounted at least 2 miles from the end of the runway. This array has the appearance of a flat ellipse during most of the departure phase of flight. However, the array's usefulness deteriorates as the pilot approaches a distance of 1/2 mile from the array. The relative degree of spatial disorientation hazard associated with a particular runway was researched. A device was designed and built with which to assess such hazards. The device is designated a visibility meter. In addition, a tentative design for visibility markers to aid in determining horizontal visibility was proposed. Author

N73-30226# Naval Postgraduate School, Monterey, Calif.
MODEL TEST OF A TURBO-TYPE ENERGY ABSORBER FOR AIRCRAFT CARRIER ARRESTING GEAR M.S. Thesis
Thomas Albert Morgenfeld Mar. 1973 80 p refs
(AD-761502) Avail: NTIS CSCL 01/5

Increasing energy absorption requirements are being placed on present day aircraft carrier arresting gear engines. Hydraulic ram type engines have reached the upper limit of their development due to weight and space limitations. A turbo-type energy absorber has been proposed as an alternative. The Naval Air Engineering Center is currently developing such a machine. Theoretical analyses have determined the absorber to be practical. This study involves the testing of a flow model of that absorber with the objective to verify loss coefficients and check for flow separation in the passages. (Modified author abstract) GRA

N73-30227# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
WIND TUNNEL MODEL PARAMETRIC STUDY FOR USE IN THE PROPOSED 8 ft x 10 ft HIGH REYNOLDS NUMBER TRANSONIC WIND TUNNEL (HIRT) AT ARNOLD ENGINEERING DEVELOPMENT CENTER Final Report, Jun. - Dec. 1972
Walter K. Alexander, Stanley A. Griffin, and Robert L. Holt Mar. 1973 196 p refs
(Contract F40600-72-C-0015)
(AD-763725; GDCA-DHJ-72-001; AEDC-TR-73-47) Avail: NTIS CSCL 14/2

The need for a high Reynolds number transonic wind tunnel (HIRT) has been recognized throughout the industry for some years. The proposed HIRT facility at Arnold Engineering Development Center will provide a much needed tool for the study of phenomena sensitive to Reynolds number. The usefulness of the HIRT facility will be largely influenced by the ability of industry to design and build wind-tunnel models for an acceptable cost capable of operating within the severe environment of the tunnel. The object of this study is to determine the feasibility of designing and building models capable of withstanding the loads and environmental conditions of the facility. The aircraft configurations chosen for study cover a wide spectrum of flight conditions. (Modified author abstract) GRA

N73-30229# Aeronautical Research Labs., Melbourne (Australia).
FLOW VISUALISATION USING THE HYDROGEN BUBBLE TECHNIQUE
D. H. Thompson Feb. 1973 50 p refs
(ARL/A-Note-338) Avail: NTIS HC $4.50

The application of the hydrogen bubble flow visualisation technique to the study of aerodynamic problems in water flow facilities is described. The effects of water chemical composition, water temperature, and electrode size and spacing on bubble production are described. The influence of bubble buoyancy on bubble formation and flow path distortion is discussed. Lighting and photographic techniques are outlined and examples are given of visualisation of two-and three-dimensional flows. Author

N73-30232*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY OF THE EFFECT OF A BOUNDARY LAYER PROFILE ON THE DYNAMIC RESPONSE AND ACOUSTIC RADIATION OF FLAT PANELS Ph.D. Thesis - Virginia Univ.
John Scott Mixson Jun. 1973 132 p refs
(NASA-TM-X-69568) Avail: NTIS HC $8.75 CSCL 20D

The response of a thin, elastic plate to a harmonic force which drives the plate from below and a compressible air stream with a viscous boundary layer flowing parallel to the upper surface along the length was investigated. Equations governing the forced response of the coupled plate-aerodynamic system are derived along with appropriate boundary conditions. Calculations of basic solution parameters for a linear velocity profile and for a Blasius profile showed that the same system response could be obtained from each profile if appropriate values of boundary layer thickness were chosen for each profile. Author

N73-30236# National Aerospace Lab., Tokyo (Japan).
A DESCRIPTION OF THE IDEAS UNDERLYING A COMPUTER PROGRAM FOR PREDICTING THE AEROFOIL PRESSURE DISTRIBUTIONS IN SUB-CRITICAL VISCOUS FLOW
Masao Ebihara, Youji Ishida, and Tokio Okonogi 1971 18 p refs In JAPANESE; ENGLISH summary
(NAL-TR-248) Avail: NTIS HC $3.00

A computer program for determining the airfoil pressure distribution for subcritical attached viscous flow was developed. The calculation is based on a compressibility correction for the boundary layer camber model to account for viscous effects. The process by which the modification is accomplished is explained and the limitation of the boundary layer camber model is discussed. Comparisons between theoretical and experimental results are submitted. Author

N73-30243*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOADING AND HEATING OF A LARGE FLAT PLATE AT MACH 7 IN THE LANGLEY 8-FOOT HIGH-TEMPERATURE STRUCTURES TUNNEL
William D. Deveikis and L. Roane Hunt Washington Sep. 1973 67 p refs
(NASA-TN-D-7275; L-8760) Avail: NTIS HC $3.50 CSCL 20D

Surface pressure and cold-wall heating rate distributions (wall-temperature to total-temperature ratio approximately 0.2) were obtained on a large, flat calibration panel at a nominal Mach number of 7 in an 8-foot high-temperature structures tunnel. Panel dimensions were 42.5 by 60.0 in. Test objectives were: (1) to map available flat-plate loading and heating provided by the facility and (2) to determine effectiveness of leading-edge bluntness, boundary-layer trips, and aerodynamic fences in generating a uniform, streamwise turbulent flow field over the test surface of a flat-sided panel holder. Author

N73-30244*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LASER DOPPLER VELOCIMETER INVESTIGATION OF TRAILING VORTICES BEHIND A SEMI-SPAN SWEPT WING IN A LANDING CONFIGURATION
D. L. Ciffone, K. L. Orloff, and G. R. Grant Aug. 1973 45 p refs
(NASA-TM-X-62294) Avail: NTIS HC $4.25 CSCL 20D

Measured axial and tangential velocity profiles in the near wake vortices of a semi-span model of the Convair 990 wing in the NASA-Ames 7- by 10-foot wind tunnel are presented. A scanning laser Doppler velocimeter was used to obtain data at two different downstream stations (0.49 and 1.25 wing spans) at various angles of attack and configurations from wing alone to wing plus nacelles, anti-shock bodies, and flaps deflected 27 deg (landing configuration). It is shown that the velocity distributions within the wake are quite sensitive to span loading. Specifically, it is illustrated that an aircraft flying at given lift coefficient (C SUB L), can substantially reduce its trailing vortex upset potential by deploying its flaps and altering its flight attitude to maintain the same C SUB L. This might be taken into consideration along with performance and noise considerations in the selection of aircraft approach lift over drag. Author

N73-30248# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
DRAG MEASUREMENTS ON PLATES IN PARALLEL FLOW AND DISCS IN PERPENDICULAR FLOW IN SUPERSONIC HIGHLY RAREFIED FREE JETS Ph.D. Thesis - Goettingen Univ., West Ger.
H. Legge 1973 107 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-17; AVA-FB-7225) Avail: NTIS HC $7.50; DFVLR, Porz, West Ger. 33.30 DM

Drag measurements on a parallel flat plate and a perpendicular disk were carried out in hypersonic low density facilities. The flow field of a free jet at low densities, especially the influence of the background molecules and the freezing effects, on the drag are examined by measurements on parallel flat plates in free molecular flow. The experiments are compared with theoretical studies. The drag coefficient of a perpendicular disk is measured in the whole range from free molecular to continuum flow. This is achieved by measurements in a low density free jet, an isentropic free jet, and a conical nozzle flow. General conclusions on drag measurements in low density free jets are drawn. Author (ESRO)

N73-30251# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF FLOW CHARACTERISTICS BEHIND DIFFUSERS WITH LARGE ANGLES OF FLARE
B. V. Belyanin, A. M. Kharitonov, and D. V. Chusov 16 Jun. 1973 12 p refs Transl. into ENGLISH from Izv. Sibirsk. Otd. Akad. Nauk SSSR, Ser. Tekhn. Nauk (Novosibirsk), no. 8, Jun. 1972
(AD-763257; FTD-HT-23-586-73) Avail: NTIS CSCL 20/4

The attempt to obtain the most uniform flow possible in wind tunnels dictates the use of diffusers at the entrance to the precombustion chamber. Comparatively long diffusers with small angles of flare, 6-8 deg, are usually used. The use of diffusers with large angle of flare enables one to considerably reduce the length of the inlet contour of the tunnel, while the uniformity of the flow can be ensured by the same equalizing devices. GRA

N73-30255# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF THE LAMINAR BOUNDARY LAYER ON A SLIPPING WING BY THE METHOD OF INTEGRAL RELATIONSHIPS
V. A. Barinov 18 Jun. 1973 14 p refs Transl. into ENGLISH from Uch. Zap. Tsagi (USSR), v. 3, no. 5, 1972 p 9-15
(AD-763285; FTD-HT-23-612-73) Avail: NTIS CSCL 20/4

A numerical method is described for the calculation of equations for an incompressible three-dimensional boundary layer on a slipping wing. It is a development of the method of integral relationships of A. A. Dorodnitsyn. Examples are given for the calculation of two flows - with suction of a gas across a surface and without suction. The results obtained using this method practically coincide with the results of calculation by the finite-difference method. GRA

N73-30256# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
PRESSURE FIELDS OVER HYPERSONIC WING-BODIES AT MODERATE INCIDENCE Interim Report
N. Malmuth 26 Sep. 1972 44 p refs
(Contract F44620-71-C-0021; AF Proj. 9781)
(AD-763762; SCPP-72-89; AFOSR-73-1157TR) Avail: NTIS CSCL 20/4

Delta wings with conically subsonic cone-bodies mounted on their compressive side are analyzed in the hypersonic small disturbance regime. The weakly three dimensional conditions associated with slender parabolic Mach cones are used to validate a linearized rotational approximation of the flow field. A combined integral-series representation is obtained for the pressure distribution between the wing-body and shock wave for arbitrary body cross sections, and is specialized to give analytical formulae for arbitrary order polynomial transversal contours. Numerical results are presented for wedge, parabolic, and higher order cross sections illustrating the dominant character of the cross-flow stagnation singularity associated with sharp wing-body intersections having a finite slope discontinuity. (Modified author abstract) GRA

N73-30258# ARO, Inc., Arnold Air Force Station, Tenn.
NUMERICAL CALCULATION OF THE SUBSONIC AND TRANSONIC TURBULENT BOUNDARY LAYER ON AN INFINITE YAWED AIRFOIL Final Report, Apr. 1972 - Apr. 1973
AEDC Jul. 1973 110 p refs
(AD-763730; ARO-VKF-TR-73-52; AEDC-TR-73-112) Avail: NTIS CSCL 20/4

Formulation and application of a three-dimensional compressible turbulent boundary-layer analysis is presented for

subsonic and transonic flow over a yawed airfoil of infinite extent. The governing turbulent boundary-layer equations are integrated using an implicit finite-difference procedure in conjunction with a scalar eddy viscosity model of three-dimensional turbulence. Comparisons with other analysis techniques as well as experimental measurements under subsonic wind tunnel conditions are presented to establish and ascertain the basic validity and applicability of the current technique. Also considered are the effects of a hot wall on the transonic, three-dimensional, turbulent boundary layer which have practical application to transonic space shuttle reentry. (Modified author abstract) GRA

N73-30261# Naval Ship Research and Development Center, Bethesda, Md.
SOME ENVIRONMENTAL EFFECTS ON HEADFORM CAVITATION INCEPTION
Terry Brockett Oct. 1972 91 p refs
(AD-763367; NSRDC-3974) Avail: NTIS CSCL 20/4

Cavitation-inception tests were performed on two headforms for which changes were made in the environment. Quantities which were varied, included type and amount of dissolved gas, chemical additives, time rate of change to cause inception, and temperature changes. Experimental procedure and relative air content had an appreciable effect on cavitation inception. Both headforms had the same designed minimum pressure coefficient; however, for one it was located 0.03 diam from the nose, and for the other, 0.73 diam. Inception was characterized by traveling bubbles on both headforms, with significant differences occurring in the bubble dynamics. Inception was determined visually and by counting occurrences. (Modified author abstract) GRA

N73-30353# European Space Research Organization, Paris (France). Space Applications Div.
AN EARTH RESOURCES AIRCRAFT FACILITY
J. Plevin 1973 27 p refs Presented at the Brit. Interplanet. Soc. Symp. on Earth Observation Satellites, London, Apr. 1973
Avail: NTIS HC $3.50

An earth resources aircraft facility (ERAF) is described, fitted with a wide range of advanced remote sensing instruments, e.g. side-looking radar multispectral scanners and passive microwave radiometers. The facility would provide the central component for the preparatory phase of a European earth resources satellite program. The ERAF missions are considered, and the sensors, sensor support systems, and avionics requirements are discussed. The basic aircraft specifications are given, and the Brequet 1150 Atlantic aircraft is described. The data processing facility for the program is also discussed. ESRO

N73-30365# Stanford Research Inst., Menlo Park, Calif.
STRATOSPHERIC ELECTRICITY Final Report
Richard D. Hake, Edward Pierce, and William Viezee Apr. 1973 149 p refs
(Contract N00014-72-C-0259; SRI Proj. 1724)
(AD-763471) Avail: NTIS CSCL 04/1

The motivation behind the study described in this report is the possible climatic impact of operating a fleet of supersonic transports (SSTs). The report first summarizes information on the physical properties of the stratosphere and on its gaseous and particulate trace consituents. A critical review of experimental data on stratosphere electrification is then presented. Information is given on profiles of conductivity (positive and negative); small- (cluster-) ion densities (positive and negative); and electric field. Some of the experimental results are shown to be suspect. The more reliable experimental results, obtained between 10 and 30 km, indicate conductivities increasing monotonically with increasing height; electric fields decreasing monotonically as height increases; small-ion densities of the order of thousands per cu cm with a maximum at about 15 km; little space charge; a constant vertical air/earth current; and positive and negative small-ion mobilities. Fine- and larger-scale spatial and temporal variations are superimposed upon the general trend of the results. Simple theory shows that the major phenomena of stratospheric electricity can be mostly explained by considering ion production by cosmic rays alone, and ion loss only by mutual neutralization (recombination). It was concluded that stratospheric electrification is little affected by gaseous constituents, but should be quite responsive to changes in the number density and size distribution of the stratospheric aerosol. (Modified author *abstract)* GRA

N73-30369# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
DEVELOPMENT OF REGIONAL EXTREME MODEL ATMOSPHERES FOR AEROTHERMODYNAMIC CALCULATIONS (2)
Frank L. Martin 1 Jul. 1973 49 p refs
(AD-763671; NPS-51MR73071A) Avail: NTIS CSCL 04/1

In an earlier paper (Model Atmospheres (1)), a procedure was developed for determining the most probable vertical temperature profile associated with the occurrence of 1% global temperature extreme at mandatory-pressure levels at stations in the North American Arctic. The same technique, based upon a variation of the stepwise multiple regression procedure, was employed in the current study. The ensuing multiple regression analysis applied to the geographically and climatologically diverse set of stations of the current study led to realistic estimates of the temperature profiles which were conditionally dependent upon the existence of 1% extreme forcing-level temperature T(J) at previously designated pressure levels P(J). (Modified author abstract) GRA

N73-30416*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
THREE-AXIS, ADJUSTABLE LOADING STRUCTURE Patent Application
Edward J. Lynch and Darwyn T. Gray, inventors (to NASA) Filed 16 May 1972 12 p
(NASA-Case-FRC-10051-1; US-Patent-Appl-SN-253725) Avail: NTIS HC $3.00 CSCL 14B

A three-axis, adjustable loading structure is described for resting the soundness of a structure, such as the skin of an aircraft, by applying pressure. The device has three electric drives which permit rapid and accurate measurement of wall angle, horizontal position, and vertical position of the test device. K.M.M.

N73-30420# Joint Publications Research Service, Arlington, Va.
GYRO INSTRUMENTS
8 Aug. 1973 22 p refs Transl. into ENGLISH from Izv. Vuzov, Priborostr. (Leningrad), no. 5, 1973
(JPRS-59740) Avail: NTIS HC $3.25

Articles are presented on: (1) the influence of the elastic deformation of the gimbal suspension on the frequency of the nutational oscillations of a gyroscope; (2) moments acting on a spherical rotor in a magnetic suspension; and (3) a differentiating linear accelerometer. Author

N73-30422 Joint Publications Research Service, Arlington, Va.
MOMENTS ACTING ON A SPHERICAL ROTOR IN A MAGNETIC SUSPENSION
V. V. Lebedev and P. I. Chinayev *In its* Gyro Instruments (JPRS-59740) 8 Aug. 1973 1973 p 7-12 ref Transl. into ENGLISH from Izv. Vuzov, Priborostr. (Leningrad), no. 5, 1973 p 85-88

Moments due to the non-sphericity of a sphere and the dissipation of energy in the material of the rotor were considered. The dependences between the braking moments and precession moments were established, and methods of their practical determination are indicated. Author

N73-30446# Illinois Univ., Urbana. Coordinated Science Lab.
THE DESIGN OF AN INTEGRATED AIRCRAFT INSTRUMEN-

TATION DISPLAY SYSTEM UTILIZING A PLASMA DISPLAY/MEMORY UNIT
Michael Lewis McMahan May 1973 99 p refs
(Contracts N00014-67-A-0305-0021; DAAB07-67-C-0199)
(AD-763599; R-613; UILU-ENG-73-2215) Avail: NTIS CSCL 01/4

Background information that was used as the basis for the design specification of a generalized display processor is presented. Included are a review of state of the art airborne computer systems, a study of modern aircraft information display philosophy, and finally the development of a generalized instrumentation system architecture. A digital systems model for flat-panel matrix displays with inherent memory is introduced and one such display technology, the plasma display/memory panel is described. The design of a generalized display processor which will interface with the airborne CPU and a semi-parallel plasma panel configuration is also described. GRA

N73-30448# Honeywell, Inc., Minneapolis, Minn.
ENERGY/ENERGY RATE METER FOR ENERGY MANAGEMENT IN FLIGHT Final Report
D. C. Sederstrom, N. R. Zagalsky, and R. C. McLane Feb. 1973 111 p refs
(Contract N00014-72-C-0194)
(AD-763450; F2039-FR) Avail: NTIS CSCL 01/4

A 14-month program is described which culminated in fabrication and limited flight tests of a cockpit meter instrumentation system displaying aircraft specific energy and energy rate (specific excess power). Detailed account is given of the analysis and design processes, including man-in-the-loop hybrid simulation and display, through which the meter and its uses were developed. Preliminary flight test results are also cited. Author (GRA)

N73-30450# General Electric Co., Wilmington, Mass. Aerospace Instrument Programs.
INTEGRATED ENGINE INSTRUMENT SYSTEM Final Technical Report, on Phase 2, 4 Jun. 1971 - 3 Oct. 1972
Richard L. Skovholt, Fred P. Johnson, Walter A. Doerle, Robert E. Glusick, Martin Fine, and Robert R. Merritt Oct. 1972 206 p refs
(Contract N62269-71-C-0331)
(AD-763440; DF72AEE173) Avail: NTIS CSCL 21/5

The document is the Final Report for Phase 2 of the Integrated Engine Instrument System (IEIS) Program. This phase is primarily concerned with developing equipment that will interact with the display generator and display terminal developed under Phase 1 of the program so that various display formats can be generated under a variety of situations. Therefore, typical IEIS display information will be presented and can be controlled and responded to by the pilot. The primary source of data for the various displays is a scenario contained in a cassette tape recorder which is used as a means of mass storage. Interaction with this scenario is primarily via an operator keyboard. The task of generating the information on the scenario has been the result of display engineering and information analysis activities. (Modified author abstract) GRA

N73-30452# Singer Co., Glendale, Calif. Librascope Div.
PROJECT REPORT FOR THE MOVING IMAGE RECONNAISSANCE DISPLAY Final Report
William S. Oakleu Griffiss AFB, N. Y. RADC May 1973 76 p refs
(Contract F30602-71-C-0327)
(Ad-763789; RADC-TR-73-104) Avail: NTIS CSCL 01/3

The report contains the results of a study program designed to develop techniques for creating a moving image reconnaissance display. The display is to be generated from downward looking line scan sensor inputs. The study included construction of a breadboard unit which is described in the report. Author (GRA)

N73-30463*# AiResearch Mfg. Co., Phoenix, Ariz.
PRELIMINARY DESIGN OF A MINI-BRAYTON COMPRESSOR-ALTERNATOR-TURBINE (CAT) Final Report
12 Mar. 1973 103 p
(Contract NAS3-16739)
(NASA-CR-133810; APS-5440-R) Avail: NTIS HC $7.25 CSCL 13I

The preliminary design of a mini-Brayton compressor-alternator-turbine system is discussed. The program design goals are listed. The optimum system characteristics over the entire range of power output were determined by performing a wide-range parametric study. The ability to develop the required components to the degree necessary within the limitations of present technology is evaluated. The sensitivity of the system to various individual design parameters was analyzed. Author

N73-30546# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Manufacturing Research and Product Development Dept.
INVESTIGATION OF THE INFLUENCE OF OUTDOOR WEATHERING ON THE MECHANICAL PROPERTIES AND THE QUALITY OF APPEARANCE OF SEVERAL GLASSCLOTH REINFORCED THERMOSETTING RESIN LAMINATES Interim Report
R. Scheltes 6 Mar. 1973 70 p
(FOK-R-1627) Avail: NTIS HC $5.50

Changes in the flexural strength properties and appearance of the surface of solid polyester and epoxy glasscloth reinforced laminates which are applied in primary and secondary constructions in the F-27 and F-28 aircraft, by means of outdoor weathering, were determined. As parameters several manufacturing methods were introduced under different circumstances such as variation of time and/or temperature curing, variation of the atmospheric environment, such as temperature and humidity of the air, and the presence or absence of paint scheme on the exterior surface of the laminate. ESRO

N73-30558# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
APPLICATION OF OPTIMALITY CRITERION TO FIBER-REINFORCED COMPOSITES
N. S. Khot, V. B. Venkayya, C. D. Johnson, and V. A. Tischler May 1973 55 p refs
(AD-763732; AFFDL-TR-73-6) Avail: NTIS CSCL 11/4

The report presents an efficient optimization method, based on an optimality criterion and a numerical search, for the minimum weight design of structures made from fiber-reinforced composite materials. A recurrence relation is derived and is incorporated into the computer program based on the displacement method of finite element analysis. The optimum design procedure takes into consideration multiple loading conditions and displacement constraints on the structure. Several sample problems consisting of both isotropic and composite elements are solved and the results are presented. Author (GRA)

N73-30571# United Aircraft Corp., East Hartford, Conn.
AN ANALYTICAL METHOD FOR THE SYNTHESIS OF NONLINEAR MULTIVARIABLE FEEDBACK CONTROL Final Report, 10 Apr. 1972 - 30 Apr. 1973
Gerald J. Michael and Florence A. Farrar Jun. 1973 77 p refs
(Contract N00014-72-C-0414; NR Proj. 041-435)
(AD-762797; UARL-M941338-2) Avail: NTIS CSCL 12/1

An analytical synthesis method for the feedback control of nonlinear multivariable systems was developed. The synthesis procedure derived is based on linearizing a system about a set of closely-spaced steady-state operating points and applying linear optimization methods at each point. A single nonlinear control problem is thereby reduced to a series of linear control problems. This permits the use of established analytical and numerical methods associated with linear optimal control theory. At each operating point, an optimal linear feedback controller is generated by minimizing a quadratic performance criterion. Weighting factors within each performance criterion enable the control designer to satisfy performance specifications by trading-off

system response against control actuation rates. Nonlinear feedback control is then constructed by combining the series of linear controllers into a single nonlinear controller whose feedback gains vary with system state. (Modified author abstract) GRA

N73-30576 National Lending Library for Science and Technology, Boston Spa (England).
CHARACTERISTICS OF THE VARIABILITY OF OBLIQUE AND HORIZONTAL VISIBILITY, FROM EXPERIMENTAL DATA
M. Ja. Racimor [1973] 8 p refs Transl. into ENGLISH from Gidromet. Inst., Proc. (Leningrad), 1971 p 284-289 Presented at the All Union Conf. Problems Met Safety Supersonic Aviat. (Leningrad), 24-26 Mar. 1971
(NLL-M-23046-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon CSCL 04B

The results are presented several hundred simultaneous measurements of oblique and horizontal visibility, and of the cloud base height, as taken every 15 minutes by a group of meteorological observers. The measurements were conducted in the autumn to winter period, for a cloud base of 200 m and lower, and for a horizontal visibility of 3000 m and less. These data indicate that the frequency of small relative changes in horizontal visibility predominates over that of changes in oblique visibility, while large relative changes are preponderant oblique visibility. It is considered significant that for the same values of the parameters, the mean magnitudes of changes in oblique and horizontal visibility agree closely with each other. D.L.G.

N73-30641* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR AIDING A PILOT IN AVOIDING A MIDAIR COLLISION BETWEEN AIRCRAFT Patent
James H. Schrader and Richard H. Couch, inventors (to NASA) Issued 31 Jul. 1973 13 p Filed 7 Apr. 1972 Supersedes N72-27703 (10 - 18, p 2463)
(NASA-Case-LAR-10717-1; US-Patent-3,750,168; US-Patent-Appl-SN-242028; US-Patent-Class-343-6.5R; US-Patent-Class-343-112CA) Avail: US Patent Office CSCL 17G

An apparatus for aiding a pilot in avoiding a midair collision between aircraft is described. A protected aircraft carries a transmitter, a transponder, a receiver, and a data processor; and an intruding cooperating aircraft carries a transponder. The transmitter of the protected aircraft continuously transmits a signal to the transponders of all intruding aircraft. The transponder of each of the intruding aircraft adds the altitude of the intruding aircraft to the signal and transmits it back to the receiver of the protected aircraft. The receiver selects only the signal from the most hazardous intruding aircraft and applies it to the data processor. From this selected signal the data processor determines the closing velocity between the protected and intruding aircraft, the range between the two aircraft, their altitude difference and the time to a possible collision.
Official Gazette of the U.S. Patent Office

N73-30646*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VANGUARD/PLACE EXPERIMENT SYSTEM DESIGN AND TEST PLAN
Ralph E. Taylor Aug. 1973 22 p refs Proposed for presentation at Internatl. Telemetering Conf. (ITC/USA/'73), Washington, D. C., 9-11 Oct. 1973
(NASA-TM-X-70447; X-750-73-232) Avail: NTIS HC $3.25 CSCL 17G

A system design and test plan are described for operational evaluation of the NASA-Goddard position location and aircraft communications equipment (PLACE), at C band (4/6GHz), using NASA's ship, the USNS Vanguard, and the ATS 3 and ATS 5 synchronous satellites. The Sea Test phase, extending from March 29, 1973 to April 15, 1973 was successfully completed; the principal objectives of the experiment were achieved. Typical PLACE-computed, position-location data is shown for the Vanguard. Position location and voice-quality measurements were excellent; ship position was determined within 2 nmi; high-quality, 2-way voice transmissions resulted as determined from audience participation, intelligibility and articulation-index analysis. A C band/L band satellite trilateration experiment is discussed.
Author

N73-30647# Federal Aviation Administration, Washington, D.C.
USER'S MANUAL FOR THE LOS ANGELES BASIN STANDARD TRAFFIC MODEL (CARD DECK/CHARACTER TAPE VERSION) Final Report
Mark Hildenberger May 1973 14 p refs
(FAA-RD-73-89) Avail: NTIS HC $3.00

For users of the 1982 Los Angeles Basin Standard Traffic Model data, precise descriptions of the recorded information fields and their corresponding formats are give. Complete lists of the 25 major-size airports investigated and the 73 distinct aircraft types simulated are also included along with several directly related references to other documents pertaining specifically to the Los Angeles Basin Model project. Author

N73-30648# Meta Systems, Inc., Santa Clara, Calif.
FLIGHT PLAN POSITION EXTRAPOLATION IN AN AUTOMATED OCEANIC AIR TRAFFIC CONTROL SYSTEM Final Report, Mar. 1972 - May 1973
Frank V. Giallanza, Charles P. Giallanza, and James C. Brown May 1973 52 p
(Contract DOT-FA72WA-2851)
(FAA-RD-73-72) Avail: NTIS HC $4.75

A method was developed to extrapolate the position of an aircraft along its flight plan route based on information contained in a stored flight plan and current meteorological data. The method assumes great circle flying. Author

N73-30649# Mitre Corp., McLean, Va.
USER'S MANUAL FOR THE LOS ANGELES BASIN STANDARD TRAFFIC MODEL Final Report
Saul Cohen and Frank Maginnis Apr. 1973 22 p refs
(Contract DOT-FA70WA-2448)
(FAA-RD-73-88; MTR-6377) Avail: NTIS HC $3.25

For users of the Los Angeles Basin Standard Traffic Model computer tapes, on the tapes and the format in which the data is recorded are described. This manual applies to users of a combined binary/character tape produced on the IBM System/360. A list of related documents is given by title and report number. Author

N73-30650# National Aviation Facilities Experimental Center, Atlantic City, N.J.
MEASUREMENT AND ANALYSES OF ASR-4 SYSTEM ERROR. PART 2: ANALYSES Interim Report, Dec. 1969 - Mar. 1970
Allen C. Busch and Paul W. Bradbury Aug. 1973 152 p refs
(FAA Proj. 142-177-010)
(FAA-NA-72-87-Pt-2; FAA-RD-73-62-Pt-2) Avail: NTIS HC $9.75

The positional accuracy of aircraft radar targets as displayed in an air traffic control airport surveillance radar system (ASR-4) was sought as one of the inputs essential for determining aircraft separation standards. Using inputs from the Atlantic City (N.J.) ASR-4, the radar targets of two test aircraft were photographed as displayed in both primary and beacon modes on scan-converted and PPI displays. The displayed positions were related to simultaneous precision track from single-target instrumentation radars (EAIR and TAIR) to derive error measures for range, azimuth, and separation. The analysis program employed a least squares analysis of variance on some 17 response variables for a set of six system control variables. Author

N73-30651# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON

SYSTEM Quarterly Technical Summary, 1 Apr. - 30 Jun. 1973
1 Jul. 1973 102 p refs
(Contracts DOT-FA72WAI-261; F19628-73-C-0002; FAA Proj. 034-241-012)
(FAA-RD-73-101) Avail: NTIS HC $7.25

Activities in development of a Discrete Address Beacon System (DABS) are described. Included in the report are brief reviews of: (1) DABS link design modulation and interference studies; (2) transponder design-cost studies, (3) ATCRBS transponder tests; (4) transponder antenna/airframe pattern measurements; and (5) Sensor monopulse antenna-processor studies. Also included are the results of system design studies pertaining to: the impact of locating IPC computation at the DABS sensor; the effects of synchronizing ATCRBS sensors; the effects on DABS of incorporating Synchro-DABS scheduling and requirements imposed by netting DABS sensors. Author

N73-30652# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF A SYSTEM FOR PRECISE TIME DISSEMINATION USING DME(VORTAC) SYNCHRONIZATION Final Report, Jul. - Nov. 1972
Vincent J. Luciani Aug. 1973 58 p
(FAA-NA-73-23; FAA-RD-73-104) Avail: NTIS HC $5.00

The test and evaluation of an experimental system designed to provide precise time to aircraft via a DME (VORTAC) ground station modified to utilize a cesium-beam atomic clock for a time base are discussed. Data acquired from a flight test demonstrated the feasibility of this time-dissemination concept for application in time/frequency collision avoidance systems. The standard deviation of time-dissemination error was found to be 0.47 microseconds. DME one-way ranging capability was also demonstrated, wherein ranging accuracy of a modified airborne DME operated one-way averaged 0.1-nautical mile difference over that of an unmodified airborne DME in conventional two-way operation. Author

N73-30653# Mitre Corp., McLean, Va.
STATISTICAL SUMMARY OF THE 1982 LOS ANGELES BASIN STANDARD TRAFFIC MODEL, VOLUME 1 Final Report
Saul Cohen and Frank Maginnis Apr. 1973 59 p refs
(Contract DOT-FA70WA-2448; FAA Proj. 013-601-010)
(MTR-6387-Vol-1; FAA-RD-73-87-Vol-1) Avail: NTIS HC $5.00

The 1982 Los Angeles Basin Standard Traffic Model is statistically summarized. Included are the distributions of traffic by speed, altitude density, and various aircraft categories. The 1972 distributions are displayed, for comparison with those projected for 1982. In addition, an airport by airport-count between 1982 and actual data is tabulated, and the effect of excluding the less busy airports for the 1972 model is investigated. Author

N73-30654# Mitre Corp., McLean, Va.
STATISTICAL SUMMARY OF THE 1982 LOS ANGELES BASIN STANDARD TRAFFIC MODEL, VOLUME 2 Final Report
Saul Cohen and Frank Maginnis Apr. 1973 277 p
(Contract DOT-FA70WA-2448; FAA Proj. 013-601-010)
(MTR-6387-Vol-2; FAA-RD-73-87-Vol-2) Avail: NTIS HC $16.00

The model for the Los Angeles Basin Standard Traffic model of the 1982 time period is dicussed. The following data are presented: (1) model snapshots, (2) listing of aircraft in the snapshot, (3) counts of the aircraft in various categories, (4) speed and altitude distributions, (5) closest distance measures, and (6) density maps. Author

N73-30655# Mitre Corp., Bedford, Mass.
FEASIBILITY ANALYSIS OF AN AIR TRAFFIC CONTROL RADAR BEACON SYSTEM (ATCRBS) BASED SURFACE TRILATERATION SURVEILLANCE SYSTEM Final Report, 1 Jun. - 1 Sep. 1972
John D. Vinatieri Jun. 1973 233 p refs
(Contract DOT-TSC-393)
(AD-763328; FAA-RD-73-75) Avail: NTIS CSCL 17/7

Analysis indicates there are feasible methods for achieving surveillance of vehicles on the airport surface by means of time-of-arrival measurements of the vehicle's ATCRBS Transponder reply at three or more receiver sites. The report contains a definition of an ATCRBS based surface surveillance system, analyses of various problems and techniques to achieve a satisfactory data acquisition subsystem, and criteria for conducting a test program for further verification of feasibility and design. GRA

N73-30657# Mitre Corp., McLean, Va.
AN EXTENSION OF THE THROUGHPUT RUNWAY CAPACITY METHODOLOGY TO INCLUDE MULTIPLE GLIDE PATH LENGHTS AND ANGLES Final Report
May 1973 59 p refs
(Contract DOT-FA69NS-162)
(AD-763142; MTR-6338-Vol-5; FAA-QS-73-3-V-Vol-5) Avail: NTIS CSCL 01/2

The report extends the single runway IFR (Instrument Flight Rules) capacity methodology developed in MTR-4102 to include multiple glide path lengths and angles. Particular emphasis was placed on examples which are representative of short-haul operations. Analysis was performed to indicate the sensitivity of the model to the glide path parameters, approach control system precision, separation standards, and approach speed mixes. A combination of altitude separation on the glide path is considered as a means of increasing capacity. Author (GRA)

N73-30662# Portland General Electric Co., Oreg.
EVALUATION OF AIRCRAFT HAZARDS AT THE BOARDMAN NUCLEAR PLANT SITE Final Report
K. Hornyik (Oregon State Univ.), A. H. Robinson (Oregon State Univ.), and J. E. Grund May 1973 174 p refs
(PB-220715/7; PGE-2001) Avail: NTIS HC $3.00 CSCL 18E

An assessment is presented of the probability of aircraft crashing into a proposed nuclear power generating plant located near Boardman in Morrow County, Oregon. Quantitative estimates of crash probabilities into the proposed plant are based on analyses of operations of commercial aircraft using Federal airways and the U.S. Navy aircraft use of a nearby Navy weapons System Training Facility. GRA

N73-30665* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SWIRL CAN PRIMARY COMBUSTOR Patent
Robert E. Jones and Richard W. Niedzwiecki, inventors (to NASA) Issued 31 Jul. 1973 4 p Filed 27 Oct. 1971 Supersedes N72-15714 (10 - 06, p 0811)
(NASA-Case-LEW-11326-1; US-Patent-3,748,853; US-Patent-Appl-SN-192970; US-Patent-Class-60-39.65; US-Patent-Class-60-39.72; US-Patent-Class-60-39.74R; US-Patent-Class-60-39.66; US-Patent-Class-431-9; US-Patent-Class-431-173) Avail: US Patent Office CSCL 21E

A swirl can full annulus combustor, operable over a wide range of exit average temperatures is used in a high performance gas turbine engine for advanced aircraft. A large number of swirl can modules are mounted in an array in each combustor. Official Gazette of the U.S. Patent Office

N73-30668*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE COMPARISONS FROM FULL-SCALE FAN TESTS AT NASA LEWIS RESEARCH CENTER
Marcus F. Heidmann and Charles E. Feiler 1973 20 p refs

Proposed for presentation at the Aero-Acoustics Conf., Seattle, 15-17 Oct. 1973; sponsored by AIAA
(NASA-TM-X-68289; E-7637) Avail: NTIS HC $3.00 CSCL 20A

The overall aero and acoustic design features of eight 6-foot-diameter, single stage fans tested in an outdoor acoustic facility are described. A correlation of the acoustic results for subsonic tip-speed fans showed the total sound power was proportional to the mechanical power imparted to the fan and the specific work performed on the air to within + or - 2 dB. The correlation was relatively insensitive to fan design variables over a broad range of operating conditions. Maximum perceived noise levels were generally proportional to the sound power levels with both noise levels exhibiting a relatively unique increase with *fan pressure ratio when normalized by the delivered thrust.* Author

N73-30669*# El-Sum Consultants, Atherton, Calif.
DIAGNOSTIC TECHNIQUES FOR MEASUREMENT OF AERODYNAMIC NOISE IN FREE FIELD AND REVERBERANT ENVIRONMENT OF WIND TUNNELS
H. M. A. El-Sum and O. K. Mawardi May 1973 126 p refs
(Contract NAS2-6872)
(NASA-CR-114636) Avail: NTIS HC $8.50 CSCL 20A

Techniques for studying aerodynamic noise generating mechanisms without disturbing the flow in a free field, and in the reverberation environment of the ARC wind tunnel were investigated along with the design and testing of an acoustic antenna with an electronic steering control. The acoustic characteristics of turbojet as a noise source, detection of direct sound from a source in a reverberant background, optical diagnostic methods, and the design characteristics of a high directivity acoustic antenna. Recommendations for further studies are included. F.O.S.

N73-30677# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Abteilung Stroemungen Geringer Dichte und Hoher Enthalpie.
DENSITY AND TEMPERATURE MEASUREMENTS IN NONRADIATING GASES BY ANALYSIS OF SCATTERED LIGHT [MOEGLICHKEITEN DER STREULICHTANALYSE ZUR DICHTE- UND TEMPERATURMESSUNG IN NICHTSTRAHLENDEN GASEN]
G. Schweiger and M. Fiebig Bad Godesberg, West Ger. Bundesmin. fuer Bildung und Wiss. Jul. 1972 35 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-72-20) Avail: NTIS HC $3.75; ZLDI, Munich 6,75 DM

The possibility of analyzing nonradiating flow in wind tunnels using light scattering experiments was investigated. A theoretical analysis of the Rayleigh, Thomson, MIE scattering, and resonance scattering showed that gas density and temperature, electron density, can be measured from gas light scattering analysis. The determination of local gas density by the light scattering technique was proved by experiments. Possible application of laser light scattering technique to the investigation of ablation during atmospheric entry of space vehicles is presented. ERSO

N73-30686# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
INVESTIGATION OF JET NOISE USING OPTICAL HOLOGRAPHY Final Report, Feb. - Aug. 1972
Richard F. Salant Apr. 1973 60 p refs
(Contract DOT-TSC-146)
(PB-220641/5; DOT-TSC-146-2; DOT-TSC-OST-73-11) Avail: NTIS HC $4.50 CSCL 14B

Holographic interferograms were made of cold, laboratory scale, supersonic air and nitrogen jets in the Mach number range of 2.1 to 3.4, and of helium jets in the Mach number range of 1.5 to 2.95. These holograms demonstrate that the acoustic field in the vicinity of such jets is *dominated* by Mach waves, each of which can be traced back to a generating disturbance within the jet. The Mach waves are generated from an axial position slightly downstream of the nozzle exit to a position near the tip of the potential core. Measurements of Mach angle indicate that the average convection velocity of the generating disturbances in the air/nitrogen jet is approximately 84% to 90% of the jet velocity for the Mach number range of 2.1 to 2.7, and approximately 77% of the jet velocity for the Mach number range of 2.8 to 3.4. (Modified author abstract) GRA

N73-30727# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 Feb. - 30 Apr. 1973
Melvin A. Herlin, Herbert G. Weiss, and Alan L. McWhorter 15 May 1973 28 p
(Contract F1962B-73-C-0002; AF Proj. 649L)
(AD-763731; ESD-TR-73-61) Avail: NTIS CSCL 20/12

The Quarterly Technical Summary covers the period 1 February through 30 April 1973. It consolidates the reports of Division 2 (Data Systems), Division 4 (Air Traffic Control), and Division 8 (Solid State) on the Advanced Electronic Technology Program. Author (GRA)

N73-30735 Rolls-Royce, Ltd., Derby (England).
SOURCES OF NOISE IN AERO-ENGINES
D. A. A. Marshall 1972 25 p refs Presented at the 1st Intern. Symp. on Air Breathing Engines
Copyright. Avail: Issuing Activity

Aircraft engine noise sources and expected reduction in noise around airports with the use of high bypass ratio engines are discussed. The change from low to high bypass ratio has produced a marked noise reduction and character change transferring the dominance from jet noise with a low frequency roar to the fan, compressor, and turbine noise which are characterized by discrete tone and broadband noise of generally higher frequency than jet noise. To control and assess aircraft engine noise, single measurement units which allow regulatory action have been developed. Methods of conducting the acoustic measurements are described. Results of acoustic measurements are presented in graph form. Author

N73-30736# Detroit Diesel Allison, Indianapolis, Ind. Allison Div.
COLLECTION AND ASSESSMENT OF AIRCRAFT EMISSIONS BASE LINE DATA TURBOPROP ENGINES (ALLISON T56-A-15) Final Technical Report, 1 Jun. - 16 Aug. 1971
J. M. Vaught, W. M. Parks, S. E. J. Johnsen, and R. L. Johnson Sep. 1971 69 p refs
(Contract EPA-68-04-0029)
(EDR-7200) Avail: NTIS HC $5.50 CSCL 21E

Computerized data handling and statistical analysis programs were developed, exhaust emissions of eleven production T56-A-15 engines were measured, and a landing-takeoff emission test cycle was developed. Author

N73-30737*# Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATION OF THE HEAT TRANSFER BETWEEN THE GAS AND CASING IN THE AREA OF THE INTER-VANE CHANNELS OF THE STATOR AND GUIDE VANES OF TURBINES
V. I. Lokay, M. N. Bodunov, V. A. Podgornov, and A. G. Karimova Washington NASA 3 Sep. 1973 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), v. 15, no. 3, 1972 p 62-67
(Contract NASw-2483)
(NASA-TT-F-15051) Avail: NTIS HC $3.00 CSCL 21E

Heat transfer between a gas and a turbine casing in the intervane channels of stators and guide vanes is studied. Author

N73-30747# Marquardt Corp., Van Nuys, Calif.
RECENT ADVANCES IN MIXED CYCLE ENGINE DESIGN AND APPLICATION
Arnold Brema 1972 25 p Presented at 1st Intern. Symp. on

Air Breathing Engines, Marseille, 19-23 Jun. 1972
Avail: NTIS HC $3.25

The relative merits of various mixed cycle engines are reviewed and the impact on component choices of the application of the propulsion system is given. Emphasis is placed on the supercharged ejector ramjet system and its relative merit compared for advanced aircraft propulsion. The advantages of multi-mode operation of the propulsion system are outlined and critical component technologies are briefly reviewed. Author

N73-30749*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSIENT ANALYSIS OF ENERGY TRANSFER CONTROL (ECT) AND COMPRESSOR BLEED CONCEPTS OF REMOTE LIFT FAN CONTROL
James F. Sellers Washington Sep. 1973 54 p refs
(NASA-TM-X-2863; E-7437) Avail: NTIS HC $3.50 CSCL 21E

The transient performance of two concepts for control of vertical takeoff aircraft remote lift fans is analyzed and discussed. Both concepts employ flow transfer between pairs of lift fans located in separate parts of the aircraft in order to obtain attitude control moments for hover and low-speed flight. The results presented are from a digital computer, dynamic analysis of the YJ97/LF460 remote drive turbofan. The transient responses of the two systems are presented for step demands in lift and moment. Author

N73-30750# British Aircraft Corp., Weybridge (England). Commercial Aircraft Div.
AN AIRCRAFT DESIGNER'S REVIEW OF SOME AIRFRAME AND ENGINE INTEGRATION CONCEPTS
P. R. G. Williams and D. J. Stewart 23 Jun. 1972 26 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, France, 19-23 Jun. 1972
Avail: NTIS HC $3.50

Attention was given to buried engines in the rear fuselage which ingest fuselage boundary layer air. It is shown that this type of integrated installation potentially offers significant improvements in overall performance, especially if cruise Mach numbers are to be increased into the high subsonic/transonic speed range. It is noted that in the application of boundary layer ingestion the realization of the potential gains and the engineering of the installation would be easier with an aft fan rather than a front fan engine. Author

N73-30752# Rolls-Royce, Ltd., Derby (England).
DEVELOPMENT OF THE OLYMPUS TURBOJECT TO MEET SUPERSONIC CIVIL TRANSPORT REQUIREMENTS
A. B. Street 1971 33 p ref Presented at the 1st Intern. Symp. on Air Breathing Engines, Marseille, 19-23 Jun. 1972
Avail: NTIS HC $3.75

Modifications to the Olympus turbojet engine are described that make it suitable for civil operation. The modifications to the following engine components are discussed: compressors, main shafts, bearing compartments, combustion system, turbine, and control system. Pollution control, servicing, and engine monitoring are also described. F.O.S.

N73-30753*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY STATE ANALYSIS OF ENERGY TRANSFER CONTROL (ETC) AND COMPRESSOR BLEED CONCEPTS OF REMOTE LIFT FAN CONTROL
James F. Sellers Washington Sep. 1973 38 p refs
(NASA-TM-X-2876; E-7436) Avail: NTIS HC $3.00 CSCL 21E

Two new concepts of control for VTOL aircraft remote lift fans are analyzed and discussed. Both concepts employ flow transfer among lift fans located in separate parts of the aircraft in order to obtain attitude control moments in hover and low-speed flight. The results presented are from a digital computer analysis of the YJ97/LF460 remote drive turbofan, although qualitative conclusions should apply to any remote fan system. The basic operating principles of the two systems are described, and their steady-state moment generating capabilities are discussed. Lift-recovery strategies for component failures are also analyzed. Author

N73-30756# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHUTTERLESS PULSO-RAMJET ENGINE
Werner Eick 7 Jun. 1973 15 p refs Transl. into ENGLISH from Flug-Rev. Int. (West Germany), no. 8, 1972 p 27-31
(AD-763173; FTD-HC-23-468-73) Avail: NTIS CSCL 21/5

The report describes the development of a transonic jet engine that has the capability of ingesting air without the aid of a compressor. GRA

N73-30800*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MISSION PLANNING FOR PIONEER SATURN/URANUS ATMOSPHERIC PROBE MISSIONS
Byron L. Swenson, Edward L. Tindle, and Larry A. Manning Washington Sep. 1973 20 p refs
(NASA-TM-X-2824; A-4934) Avail: NTIS HC $2.75 CSCL 22A

Mission planning for a series of atmospheric probe missions to Saturn and Uranus using a modified Pioneer spacecraft launched in 1979 and 1980 was examined. The operational options and the associated systems requirements consistent with the major scientific goals and spacecraft constraints of the missions is summarized. It is feasible to obtain in-situ atmospheric measurements in the atmosphere of Saturn and Uranus down to a pressure level of 10 bars using a common probe and spacecraft design. Spacecraft can be launched to both objectives with an adequate launch window in 1979 and 1980 using a Titan/Centaur launch vehicle with a TE-364-4 upper stage. Other scientific objectives can be accomplished by the flyby spacecraft. Encounters with the satellite Titan and RF occultations of Saturn, the ring system of Saturn, and Uranus can be obtained. Author

N73-30857 National Lending Library for Science and Technology, Boston Spa (England).
THE WIND LOAD ON STRUCTURES
G. A. Savitskii 5 Jun. 1973 86 p refs Transl. into ENGLISH of the publ. "Vetrovaya Nagruzka na Sooruzheniya" Moscow, Izd-vo Lit. po Stroit., 1972
(NLL-Lib-Trans-1705-(5205.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: 9 NLL photocopy coupons

The regional wind load intensity map was formulated on the basis of flat regions. Local relief peculiarities at a given geographic point are not indicated in the map because of numerical deficiencies in the disposition of the meteorological stations and the small scale of the map. Thus major significance attaches to general data concerning the effect of valleys, hills, mountain systems, large water surfaces, urban development with tall buildings, large wooded areas, etc. In view of the random nature of the phenomenon, an estimate of the calculated wind speed and an analysis of the effects of its gustiness can only be made on the basis of mathematical statistics. The wind load on structures depends not only on the dimensions of the structure and the wind speed, but also on their structural shape, characterised by aerodynamic coefficients. The only guarantee for correct design of structures is a clear-cut physical representation of the effect of wind on the structures, based among other things on adjacent scientific disciplines, in particular applied climatology, aerodynamics, mathematical statistics, and oscillation theory. Author

N73-30864*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATUS OF TWO STUDIES ON ACTIVE CONTROL OF AEROELASTIC RESPONSE

Irving Abel and Matnard C. Sandford Washington Sep. 1973 29 p refs
(NASA-TM-X-2909; L-9251) Avail: NTIS HC $3.00 CSCL 20K

The application of active control technology to the suppression of flutter has been successfully demonstrated during two recent studies in the Langley transonic dynamics tunnel. The first study involved the implementation of an aerodynamic-energy criterion, using both leading- and trailing-edge controls, to suppress flutter of a simplified delta-wing model. Use of this technique has resulted in an increase in the flutter dynamic pressure of approximately 12 percent for this model at a Mach number of 0.9 Analytical methods used to predict the open- and closed-loop behavior of the model are also discussed. The second study, was conducted to establish the effect of active flutter suppression on a model of the Boeing B-52 Control Configured Vehicle (CCV). Some preliminary results of this study indicate significant improvements in the damping associated with the critical flutter mode.
Author

N73-30866*# Technology, Inc., Dayton, Ohio. Instruments and Control Div.
METHODOLOGY FOR A DECISION OF THE STATIC TEST OF LARGE VEHICLES
Gary L. Martin and Innes Bouton Feb. 1973 66 p refs
(Contract NAS8-26918)
(NASA-CR-124366; TI-42520-73-20) Avail: NTIS CSCL 20K

Considerations are reported of factors and objectives of the design procedures for static tests as part of the structural verification. Data is presented which supports the effectiveness of the test in the function of error-disclosure. Also, data passing the static test. The costs and risks associated with both test alternatives are discussed and combined with respect to the possible outcomes of the decision. A decision model, based on cost-effectiveness, is then derived and several design procedures are reviewed in the light of the model to demonstrate the utility of the model.
Author

N73-30876# Aeronautical Research Labs., Melbourne (Australia).
TWO PHASE EVAPORATIVE COOLING OF AN AEROFOIL
B. Parmington Oct. 1972 28 p refs
(ARL/ME-338) Avail: NTIS HC $3.50

Preliminary experiments on two phase cooling of an airfoil immersed in a stream of combustion gas at temperatures of 800, 900, 1000, 1100, and 1200 C were conducted. Over the stated temperature range, the airfoil metal temperature varied from 170 C to 230 C giving a gas to metal temperature difference of 607 C to 982 C respectively. The application of the two phase cooling system to gas turbine blade cooling is proposed.
Author

N73-30882# Cranfield Inst. of Technology (England). School of Mechanical Engineering.
CURRENT PROBLEMS AND TRENDS IN GAS TURBINE COMBUSTION
Arthur H. Lefebvre 1972 38 p refs Presented at 1st Intern. Symp. on Air Breathing Engines, Marseille, France, 19-23 Jun. 1972
Avail: NTIS HC $4.00

The combustion performance requirements of gas turbine engines are discussed. The problems involved in gas turbine combustion are: (1) altitude relighting for aircraft engines, (2) combustion of fuels ranging from natural gas to residual oil, and (3) wide variations in compressor discharge pressure, temperature, and airflow. Various methods for improving gas turbine combustion and reducing the amounts of emissions in the exhaust gases are described. The influence of aerodynamic processes on the design of matching fuel injection systems is analyzed.
Author

N73-30909# National Transportation Safety Board, Washington, D.C.
THE SAFETY BOARD Annual Report, 1972
1972 70 p
Avail: SOD $0.55

The National Transportation Safety Board reported to Congress, concerning the work they had performed in 1972. Their investigations into air taxi safety, the Chicago train crash, and pipeline damage and rapid shutdown are highlighted. Problem areas and investigations into aviation and surface transportation safety are reported. Their recommendations for legislation and rulemaking are presented, along with certificate and license appeals of airmen and seamen.
J.A.M.

N73-30916# Committee on Aeronautical and Space Sciences (U. S. Senate).
TOWARD A BETTER TOMORROW WITH AERONAUTICAL AND SPACE TECHNOLOGY From Hearings on Fiscal Year 1974 NASA Authorization Act
Washington GPO 1973 206 p refs Hearings before Comm. on Aeron. and Space Sci., 93d Congr., 1st Sess., 6 and 14 Mar. 1973
Avail: SOD HC $1.55

A Congressional hearing to review the accomplishments of NASA and to forecast the expected future accomplishments was held. Reports submitted on NASA contributions to aviation and space flight are presented. The impact of NASA programs on industry and the civilian community are analyzed. The benefits to be derived from artificial satellite programs are explained. Examples of technology utilization and transfer are submitted. The desirability of publicizing the space program benefits is stressed.
Author

N73-30917# National Aeronautical Lab., Bangalore (India).
[RESEARCH PROGRESS IN AERODYNAMICS, PROPULSION, ELECTRONICS, INSTRUMENTATION, AND MATHEMATICAL SCIENCES] Annual Report, 1971 - 1972
1972 91 p refs
Avail: NTIS

Research activities are discussed, including topics such as: aerodynamics, propulsion, structural sciences, materials science, electronics, instrumentation, and mathematical sciences. Pilot plant projects are also reviewed. Members of the executive council and research teams are mentioned, as well as various publications and seminars.
J.A.M.

N73-30918# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: PROGRAM STRUCTURE AND OBJECTIVES
1 Jul. 1973 40 p
(FAA-ED-00-A) Avail: NTIS $4.00

Program plans are presented covering the present twenty-two engineering and development programs within the Federal Aviation Administration. These plans are required to provide more detailed information on the objectives, goals, program structure, technical approach, resources, possible implementation, and a number of other aspects for each of these programs. This planning process has been formalized in order to provide a record of the status and availability of each plan. An introductory background is presented to the planning process, the objectives in each of the program areas, and an index of the plans, available or under preparation.
Author

N73-30925# Factory Mutual Research Corp., Norwood, Mass.
FIRE PROTECTION STUDY: USAF MOBILITY PROGRAM STRUCTURES AND LARGE AIR FORCE WAREHOUSES *Technical Report on Phase 2, Nov. 1971 - Nov. 1972*
L. M. Krasner and D. G. Goodfellow Kirtland AFB, N. Mex. AFWL May 1973 70 p refs
(Contract F29601-70-C-0082; AF Proj. 683M)
(AD-762948; AFWL-TR-72-246) Avail: NTIS CSCL 13/12

The report describes the second phase of a fire protection study comprising: (1) evaluation of self-contained portable extinguishing systems meeting specific criteria for the protection

of Air Force Mobility Program structures (Potential alternative protection systems are described, compared, and discussed for the various types of bare-base structures. The discussion includes inert gas systems, low expansion foam systems, high expansion foam systems, dry chemical systems and vaporizing liquid systems); and (2) the development of a 0.64-inch orifice upright prototype sprinkler for Air Force warehouse retrofit applications. The success criteria were based upon penetration, drop size, and distribution data previously generated for a pendent version of a large orifice retrofit sprinkler. Nonfire tests were conducted to monitor changes in the above parameters as design changes were instituted. These tests are described and discussed in detail. A successful large-scale fire test was conducted which verified initial findings. Author (GRA)

N73-30926*# Wisconsin Univ., Milwaukee.
FINITE ELEMENT ANALYSIS AND COMPUTER GRAPHICS VISUALIZATION OF FLOW AROUND PITCHING AND PLUNGING AIRFOILS
Theodore Bratanow and Akin Ecer Washington NASA Sep. 1973 72 p refs
(Grant NGR-50-007-001)
(NASA-CR-2249) Avail: NTIS HC $3.50 CSCL 01A

A general computational method for analyzing unsteady flow around pitching and plunging airfoils was developed. The finite element method was applied in developing an efficient numerical procedure for the solution of equations describing the flow around airfoils. The numerical results were employed in conjunction with computer graphics techniques to produce visualization of the flow. The investigation involved mathematical model studies of flow in two phases: (1) analysis of a potential flow formulation and (2) analysis of an incompressible, unsteady, viscous flow from Navier-Stokes equations. Author

N73-30927*# Creare, Inc., Hanover, N.H.
PRESSURE RECOVERY PERFORMANCE OF CONICAL DIFFUSERS AT HIGH SUBSONIC MACH NUMBERS
Francis X. Dolan and Peter W. Runstadler, Jr. Washington NASA Jul. 1973 146 p refs
(Contract NAS3-15331)
(NASA-CR-2299; TN-165) Avail: NTIS HC $4.50 CSCL 01A

The pressure recovery performance of conical diffusers has been measured for a wide range of geometries and inlet flow conditions. The approximate level and location (in terms of diffuser geometry of optimum performance were determined. Throat Mach numbers from low subsonic (m sub t equals 0.2) through choking (m sub t equals 1.0) were investigated in combination with throat blockage from 0.03 to 0.12. For fixed Mach number, performance was measured over a fourfold range of inlet Reynolds number. Maps of pressure recovery are presented as a function of diffuser geometry for fixed sets of inlet conditions. The influence of inlet blockage, throat Mach number, and inlet Reynolds number is discussed. Author

N73-30928*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF THE FLOW AROUND SHARP-EDGED SLENDER DELTA WINGS WITH LARGE ANGLES OF ATTACK
D. Hummel Washington NASA Sep. 1973 29 p refs Transl. into ENGLISH from Z. Flugwiss. (W. Germany), v. 15, Oct. 1967 p 376-385 Presented at the 10th Meeting for the Aerodynamic Group of the WGLR, Munich, 8 Dec. 1966
(Contract NASw-2483)
(NASA-TT-F-15107) Avail: NTIS HC $3.50 CSCL 01A

Evaluation of measurements carried out on a sharp-edged slender delta wing of an aspect ratio of 1 at an angle of attack of 20.5 degrees and a Reynolds number RE = 900,000. The bound vortex lines in the lifting surface were determined from the measured velocities of the outer edge of the boundary layer on the upper and lower side of the wing. In the region of maximum lift, the vortex breakdown was prevented by means of suction within the vortices. Measurements of forces and pressure distributions show a considerable increase of lift due to suction within the vortices. The reasons for the decrease of lift on sharp-edged slender wings at large angles of attack are discussed. Author

N73-30929*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF AN AIRFOIL OPTIMIZED FOR MAXIMUM LIFT COEFFICIENT
Gene J. Bingham (Army Air Mobility R and D Lab., Ft. Eustis, Va.) and Allen When-shin Chen Washington Dec. 1972 54 p refs
(NASA-TN-D-7071; L-8491) Avail: NTIS HC $3.50 CSCL 01A

An investigation has been conducted in the Langley low-turbulence pressure tunnel to determine the two-dimensional characteristics of an airfoil optimized for maximum lift coefficient. The design maximum lift coefficient was 2.1 at a Reynolds number of 9.7 million. The airfoil with a smooth surface and with surface roughness was tested at angles of attack from 6 deg to 26 deg, Reynolds numbers (based on airfoil chord) from 2.0 million to 12.9 million, and Mach numbers from 0.10 to 0.35. The experimental results are compared with values predicted by theory. The experimental pressure distributions observed at angles of attack up to at least 12 deg were similar to the theoretical values except for a slight increase in the experimental upper-surface pressure coefficients forward of 26 percent chord and a more severe gradient just behind the minimum-pressure coefficient location. The maximum lift coefficients were measured with the model surface smooth and, depending on test conditions, varied from 1.5 to 1.6 whereas the design value was 2.1. Author

N73-30930*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
A STUDY OF TRAILING EDGE BLOWING AS A MEANS OF REDUCING NOISE GENERATED BY THE INTERACTION OF FLOW WITH A SURFACE
Terry D. Scharton, Benjamin Pinkel, and John F. Wilby 28 Sep. 1973 54 p refs
(Contract NAS1-9559)
(NASA-CR-132270; BBN-2593) Avail: NTIS HC $4.75 CSCL 01A

A system for reducing the noise generated when a jet impinges against a flap is described. The eddies formed by the alternate zones of positive and negative pressure on the flap surface are identified as the sound source. In the proposed concept, a stream of low velocity secondary air is ejected from a slot near the trailing edge of the flap as a buffer between the flap and the primary air jet to reduce the intensity of the fluctuating surface pressure field near the flap edge and thus reduce the intensity of the aerodynamic noise. Author

N73-30931# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
AERODYNAMIC COMPARISON OF TWO REAR FUSELAGE SHAPES (PENCIL-POINT AND KNIFE-EDGE) [AERODYNAMISCHER VERGLEICH ZWEIER RUMPFHECKFORMEN (SPINDELHECK UND TUBENHECK)]
Gerhard Schulz and Karl Wichmann 30 Mar. 1972 65 p refs In GERMAN; ENGLISH summary
(DLR-FB-72-25) Avail: NTIS HC $5.25; DFVLR, Porz, West Ger. 23.10 DM

In order to optimise the aerodynamic shape of the rear part of aircraft fuselages, two models with the same shape rotational front part but with different rear parts were developed. The first rear part was an axisymmetric body, while the second ran out into a knife-edge. The influence of the knife-edge rear part (also called 'tube rear part') on the aerodynamic forces and moments were investigated using lateral force and pressure distribution measurements. ESRO

N73-30932# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

THE CALCULATED GROWTH OF LIFT AND MOMENT ON A SWEPT WING ENTERING A DISCRETE VERTICAL GUST AT SUBSONIC SPEEDS

H. C. Garner London Aeron. Res. Council 1973 58 p refs Supersedes RAE-TR-72010; ARC-33854

(ARC-CP-1241; RAE-TR-72010; ARC-33854) Avail: NTIS HC $5.00; HMSO 95p; PHI $3.90

Unsteady aerodynamic forces on a wing due to a uniform step gust are expressed as a sine transform of those due to sinusoidal gusts over the spectrum of wavelength. The sinusoidal gusts are treated by subsonic lifting-surface theory until the wavelength becomes so small as to demand excessive terms in the chordwise loading. Beyond this, the substitution of piston theory is discussed for a wing representative of design for subsonic cruise. Lift and pitching moment are calculated for normal entry into a step gust at Mach numbers 0.4 and 0.8, with reasonable success in the latter case. The results for small distances of penetration are examined critically. It is recommended that the proportional growth of aerodynamic force be taken between the results of piston theory and the present method of small distances before approaching the latter result, which leads to the correct asymptotic behavior soon after the wing is completely immersed in the gust. The investigation ends with some calculations by the present method of normal entry into a ramp gust and by piston theory for oblique entry into a step gust. Author (ESRO)

N73-30933# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

MEASUREMENT OF THE INTERNAL PERFORMANCE OF A RECTANGULAR AIR INTAKE HAVING VARIABLE GEOMETRY COMPRESSION SURFACES AT MACH NUMBERS FROM 1.7 TO 2.5 PART 2: THE EFFECT OF INCIDENCE

C. S. Brown and E. L. Goldsmith London ARC 1973 67 p refs

(ARC-CP-1242) Avail: NTIS HC S5.50; HMSO £1.20; PHI $4.90

Measurements were made of the internal performance of a rectangular intake having variable geometry compression surfaces. The measurements were made within a range of Mach numbers from 1.7 to 2.46 at angles of incidence up to 10 degrees. The Reynolds number based on intake height was about 1.5 times one million for Mach numbers above 2 and 0.6 times one million for Mach numbers below 2. It was determined that shock patterns can be used to predict accurately maximum mass flow and shock pressure recovery provided the assumption is made that the initial wedge angle is increased by just under one degree. It is also shown that simple assumptions can be made as to the form of the shock pattern in order to extend these predictions into regions of shock detachment which arise inevitably when the intake is at large angles of incidence. Author (ESRO)

N73-30934# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

MEASUREMENT OF THE INTERNAL PERFORMANCE OF A RECTANGULAR AIR INTAKE WITH VARIABLE GEOMETRY AT MACH NUMBERS FROM 1.7 TO 2.5, PART 1

C. S. Brown and E. L. Goldsmith London Aeron. Res. Council 1973 71 p refs Supersedes RAE-TR-71159; ARC-33681

(ARC-CP-1243-Pt-1; RAE-TR-71159; ARC-33681) Avail: NTIS HC $5.75; HMSO £1.10; PHI $4.30

Measurements were made of the internal performance of a rectangular intake having variable geometry compression surfaces. The measurements have been made over a range of Mach numbers from 1.70 to 2.46. The Reynolds number based on intake height was between 1.27 and 1.54 million. Pressure recoveries at zero bleed are well below those predicted from simple shock patterns, but there is a substantial gain with increase of bleed flow particularly at Mach numbers above 2. Subcritical stable flow range correlated quite well with the Ferri instability criterion.

Author (ESRO)

N73-30935# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

THE LIFT AND STALLING CHARACTERISTICS OF A 35 deg SWEPT BACK WING DESIGNED TO HAVE IDENTICAL CHORDWISE PRESSURE DISTRIBUTIONS AT ALL SPANWISE STATIONS WHEN NEAR MAXIMUM LIFT

D. S. Woodward and D. E. Lean London Aeron. Res. Council 1973 135 p refs Supersedes RAE-TR-71050; ARC-33417

(ARC-R/M-3721; RAE-TR-71050; ARC-33417) Avail: NTIS HC $8.75; HMSO £4.80; PHI $18.65

A 35 degree swept back wing with aspect ratio of 7 has been designed so that the planform gives a constant spanwise coefficient of lift distribution, while the camber and twist distributions, coupled with local thickness modifications, combine to provide identical chordwise pressure distributions at all spanwise stations at an overall coefficient of lift of 0.8. At mid-semi span the airfoil section normal to the mean sweep line was 12.2 percent thick and the design coefficient of lift was chosen to be close to the maximum value obtained experimentally for this section. Overall forces, flow visualization, and pressure plotting tests were conducted at three Reynolds numbers.

Author (ESRO)

N73-30936# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

ON VISCOUS AND WIND-TUNNEL WALL EFFECTS IN TRANSONIC FLOWS OVER AIRFOILS

Robert E. Melnik and David C. Ives Jul. 1973 21 p refs Presented at the 6th AIAA Fluid and Plasma Dyn. Conf., Palm Springs, Calif., 16-18 Jul. 1973

(AD-764133; RE-459J) Avail: NTIS CSCL 01/3

An extensive correlation between wind-tunnel data and finite-difference solutions of the exact potential-flow equation was performed. Two procedures are compared, one using the Kutta condition and the other using the experimental lift coefficient to determine the circulation. The numerical calculations are used to extract viscous and wall interference effects from the data. The correlation results indicate that viscous effects on lift are greater than 30%, even for turbulent boundary layers and Reynolds numbers greater than 2 x 10 to the seventh power. It is shown that viscous effects can be almost completely accounted for in numerical calculations by adjusting the circulation to match the experimental lift. Author (GRA)

N73-30937 Tennessee Univ., Knoxville.

TURBULENCE AND AERODYNAMIC NOISE CHARACTERISTICS OF JET FLAP TYPE EXHAUST FLOWS Ph.D. Thesis

Guenter Otto Herbert Schrecker 1972 163 p

Avail: Univ. Microfilms Order No. 73-12436

An experimental investigation of the aerodynamic noise and flow field characteristics of internal-flow jet-augmented flap configurations is presented. A parametric study of the influence of the Mach number (subsonic range only), the slot nozzle aspect ratio and the flap length on the overall radiated sound power and the spectral composition of the jet noise as measured in a reverberation chamber was conducted. Mean and fluctuating velocity profiles, spectra of the fluctuating velocity and space correlograms were measured in the flow field of jet flaps by means of hot-wire anemometry. An attempt was made to estimate the overall sound power radiated by the free mixing region that originates at the orifice of the slot nozzle (primary mixing region) relative to the overall sound power generated by the free mixing region that originates at the trailing edge of the flap (secondary mixing region). Dissert. Abstr.

N73-30938*# Aeronautical Research Associates of Princeton, Inc., N.J.

INTEGRATED LIFT/DRAG CONTROLLER FOR AIRCRAFT Patent Application

John W. Olcott, Edward Seckel, and David R. Ellis, inventors (to NASA) Filed 23 Mar. 1972 25 p

(Contract NAS2-5589)

(NASA-Case-ARC-10456-1; US-Patent-Appl-SN-237491) Avail: NTIS HC $3.25 CSCL 01C

An integrated lift/drag controller for aircraft is described. The system integrates the control of engine power and devices

which are capable of altering the lift/drag ratio of a powered aircraft. Specific application is to control the glide path angle and air speed of the aircraft during approach, flare, touchdown, rollout, and emergency descents. Diagrams of the system and details of the operation are presented. P.N.F.

N73-30939*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A FUSELAGE MODEL WITH VARIOUS ARRANGEMENTS OF ELONGATED LIFT JETS
Raymond D. Vogler and Kenneth W. Goodson Washington Aug. 1973 86 p refs
(NASA-TN-D-7299; L-8753) Avail: NTIS HC $3.75 CSCL 01A

Data were obtained for a round jet located on the center of the bottom of a fuselage and for elongated slots separated spanwise by distances of 0.8 and 1.2 of the fuselage width. The effect of yawing the slots, inclining the jets laterally, and combining slot yaw with jet inclination was determined. Data were obtained in and out of ground effect through a range of effective velocity ratios and through a range of sideslip angles. Author

N73-30940*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
COMPARISONS OF PREDICTIONS OF THE XB-70-1 LONGITUDINAL STABILITY AND CONTROL DERIVATIVES WITH FLIGHT RESULTS FOR SIX FLIGHT CONDITIONS
Chester H. Wolowicz and Roxanah B. Yancey Washington Aug. 1973 44 p refs
(NASA-TM-X-2881; H-773) Avail: NTIS HC $3.00 CSCL 01C

Preliminary correlations of flight-determined and predicted stability and control characteristics of the XB-70-1 reported in NASA TN D-4578 were subject to uncertainties in several areas which necessitated a review of prediction techniques particularly for the longitudinal characteristics. Reevaluation and updating of the original predictions, including aeroelastic corrections, for six specific flight-test conditions resulted in improved correlations of static pitch stability with flight data. The original predictions for the pitch-damping derivative, on the other hand, showed better correlation with flight data than the updated predictions. It appears that additional study is required in the application of aeroelastic corrections to rigid model wind-tunnel data and the theoretical determination of dynamic derivatives for this class of aircraft. Author

N73-30941*# Columbia Univ., New York. Noise Research Unit.
ANNOYANCE JUDGEMENTS OF AIRCRAFT WITH AND WITHOUT ACOUSTICALLY TREATED NACELLES
Paul N. Borsky and Skipton Leonard Washington NASA Aug. 1973 73 p
(Grant NGL-33-008-118)
(NASA-CR-2261) Avail: NTIS HC $3.00 CSCL 01C

A series of subjective response laboratory tests were conducted to determine the effectiveness of reducing aircraft noise by treating the aircraft engine nacelles with acoustically absorbent material. A total of 108 subjects participated in the magnitude estimation tests. The subjects were selected from persons who had previously been interviewed and classified according to selected psychological characteristics. The subjects lived in three general areas located at three specified distances from New York's Kennedy Airport. The aircraft signals used in the tests consisted of tape recordings of the landing approach noise of a B-727 aircraft under normal operating conditions. These recordings were electronically altered to simulate an aircraft with acoustically treated nacelles to achieve noise reductions of approximately 6 EPNdB and 12 EPNdB. The results from these tests indicate that significant reductions in annoyance resulted from the synthesized nacelle treatments. Author

N73-30942# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France).
DIRECTIONAL EQUIPMENT FOR REDUCING JET NOISE AT HIGH SPEED [DISPOSITIES DIRECTIONNELS DE REDUCTION DU BRUIT DES JETS A GRANDE VITESSE]
R.-G. Hoch, M. Julliand, and H. Lacombe [1972] 32 p refs In FRENCH Presented at 1st Intern. Symp. on the Progr. of Aviation Reactors, Marseille, 19-23 Jun. 1972
Avail: NTIS HC $3.75

A study was made of methods used to reduce the noise ejected by Concorde propellers at different speeds. The equipment developed to suppress the noise along with aerodynamic parameters and geometrics is described. Transl. by E.H.W.

N73-30943*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTERIZED PRELIMINARY DESIGN AT THE EARLY STAGES OF VEHICLE DEFINITION
Thomas J. Gregory Sep. 1973 35 p refs
(NASA-TM-X-62303) Avail: NTIS HC $3.75 CSCL 01C

Criteria for acceptance of early design information, modern methods of providing it, and suggestions for defining adequate levels of resources to accomplish the objectives of the activity are described. Specific examples of the most difficult type of early design studies, those requiring significant undeveloped technology, are used to discuss these points. The examples include design studies and cost estimates of liquid hydrogen fueled aircraft, oblique winged aircraft and remotely piloted vehicles. Author

N73-30944*# National Research Council of Canada, Ottawa (Ontario). Unsteady Aerodynamics Lab.
SUPERSONIC EXPERIMENTS ON DYNAMIC CROSS-DERIVATIVES DUE TO PITCHING AND YAWING OF AIRCRAFT-LIKE VEHICLES
K. J. Orlik-Ruckemann, J. G. LaBerge, and E. S. Hanff Aug. 1973 45 p refs
(Contract NASw-2369)
(NASA-CR-114663; LTR-UA-24) Avail: NTIS HC $4.25 CSCL 01C

A wind tunnel apparatus has been developed and constructed for the determination of moment cross-derivatives due to pitching and yawing on models at moderate angles of attack and sideslip. The apparatus can also be used to determine the direct moment derivatives in pitch and yaw. Experimental results were obtained at Mach 2 on a cone-wing-fin configuration at angles of attack and sideslip up to 15. Although at small values of these angles the cross-derivatives were always negligibly small, measureable effects were sometimes observed, at all angles of attack included in this investigation (i.e. up to 15 deg), when the angle of sideslip was 10 deg or 15 deg. Author

N73-30945# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: NORTH CENTRAL AIRLINES, INCORPORATED, MCDONNEL DOUGLAS DC-9-31, N954N AND DELTA AIR LINES, INCORPORATED, CONVAIR CV-880, N8807E, O'HARE INTERNATIONAL AIRPORT, CHICAGO, ILLINOIS, 20 DECEMBER 1972
5 Jul. 1973 45 p
(NTSB-AAR-73-15) Avail: NTIS HC $4.25

An aircraft accident involving the collision of a DC-9 and a CV-880 at the intersection of a runway and a taxiway at O'Hare International Airport, Chicago, Illinois on 20 December 1972 is reported. The probable cause of the accident was failure of the traffic control system to insure separation of the aircraft during a period of restricted visibility. Incomplete and ambiguous instructions from the traffic controller are cited as well as failure of the CV-880 flight crew to request clarification of communication. Author

N73-30946# Mitre Corp., McLean, Va.
CIVIL AVIATION MIDAIR COLLISIONS ANALYSIS, JANUARY 1964 - DECEMBER 1971
T. R. Simpson, R. A. Rucker, and J. P. Murray Washington FAA May 1973 174 p refs
(Contract DOT-FA70WA-2448)

(MTR-6334; FAA-EM-73-8) Avail: NTIS HC $10.75

A statistical analysis of civil aviation midair collisions occurring during the period January 1964 to December 1971 is presented. The effectiveness of the air traffic control system in preventing midair collisions is assessed. Problem areas for which solutions are required are identified. The analysis shows that no midair collisions occurred when both aircraft were identified and under radar/beacon surveillance, under positive control, and both pilots conformed to their air traffic control clearances. Author

N73-30947# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: UNITED AIR LINES, INCORPORATED BOEING 737, N9031U CHICAGO-MIDWAY AIRPORT, CHICAGO, ILLINOIS, 8 DECEMBER 1972

8 Dec. 1972 65 p refs

(NTSB-AAR-73-16; SA 435) Avail: NTIS

The crash of a Boeing 737 aircraft during an instrument approach to Chicago-Midway airport, Illinois on 8 December 1972 is reported. The aircraft crashed in a residential area approximately 1.5 miles from the runway approach. The probable cause of the accident was the pilot's failure to exercise positive flight management during the approach, which culminated in a critical deterioration of airspeed into the stall regime. Author

N73-30948*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft.

APPLICATION OF COMPOSITES TO HELICOPTER AIRFRAME AND LANDING GEAR STRUCTURES Technical Report, Jul. 1972 - Feb. 1973

M. J. Rich, G. F. Ridgley, and D. W. Lowry Jun. 1973 138 p refs Sponsored in part by Army Air Mobility R and D Lab., Hampton, Va.

(Contract NAS1-11688)

(NASA-CR-112333) Avail: NTIS HC $9.00 CSCL 01C

A preliminary design study has indicated that advanced composite helicopter airframe structures can provide significant system cost advantages in the 1980's. A seven percent increase in productivity and a five percent reduction in life cycle cost are projected. Due to their complexity, landing gear structures do not substantially benefit from the use of advanced composites. The most successful concept was found to be all-molded composite modular panels, which provide integral skin/stringer and frame subassemblies. These subassemblies significantly reduce the number of parts relative to present construction. The subassemblies are mechanically jointed together for economical, rapid final assembly and permit field replacement in the event of major damage. Author

N73-30949*# Bell Helicopter Co., Fort Worth, Tex.

V/STOL TILT ROTOR STUDY. VOLUME 5: A MATHEMATICAL MODEL FOR REAL TIME FLIGHT SIMULATION OF THE BELL MODEL 301 TILT ROTOR RESEARCH AIRCRAFT

P. B. Harendra, M. J. Joglekar, T. M. Gaffey, and R. L. Marr 13 Apr. 1973 265 p refs

(Contract NAS2-6599)

(NASA-CR-114614; Bell-301-099-001-Vol-5) Avail: NTIS HC $15.25 CSCL 01C

A mathematical model for real-time flight simulation of a tilt rotor research aircraft was developed. The mathematical model was used to support the aircraft design, pilot training, and proof-of-concept aspects of the development program. The structure of the mathematical model is indicated by a block diagram. The mathematical model differs from that for a conventional fixed wing aircraft principally in the added requirement to represent the dynamics and aerodynamics of the rotors, the interaction of the rotor wake with the airframe, and the rotor control and drive systems. The constraints imposed on the mathematical model are defined. Author

N73-30950*# Bell Helicopter Co., Fort Worth, Tex.

V/STOL TILT ROTOR STUDY. VOLUME 6: HOVER, LOW SPEED AND CONVERSION TESTS OF A TILT ROTOR AEROELASTIC MODEL (MODEL 300)

R. L. Marr, K. W. Sambell, and G. T. Neal 15 May 1973 326 p refs

(Contract NAS2-6599)

(NASA-CR-114615; Bell-301-099-002-Vol-6) Avail: NTIS HC $18.50 CSCL 01C

Stability and control tests of a scale model of a tilt rotor research aircraft were conducted. The characteristics of the model for hover, low speed, and conversion flight were analyzed. Hover tests were conducted in a rotor whirl cage. Helicopter and conversion tests were conducted in a low speed wind tunnel. Data obtained from the tests are presented as tables and graphs. Diagrams and illustrations of the test equipment are provided. Author

N73-30951*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECT OF REYNOLDS NUMBER AND ENGINE NACELLES ON THE STALLING CHARACTERISTICS OF A MODEL OF A TWIN-ENGINE LIGHT AIRPLANE

Vernard E. Lockwood Washington Dec. 1972 36 p refs

(NASA-TN-D-7109; L-8591) Avail: NTIS HC $3.00 CSCL 01C

The investigation was made on a 1/18-scale model of a twin-engine light airplane. Static longitudinal, lateral, and directional characteristics were obtained at 0 deg and plus or minus 5 deg sideslip at a Mach number of about 0.2. The angle of attack varied from about 20 deg at a Reynolds number of 0.39 times one million to 13 deg at a Reynolds number of 3.7 times one million, based on the reference chord. The effect of fixed transition, vertical and horizontal tails, and nacelle fillets was studied. Author

N73-30952*# Rao (G. V. R.) and Associates, Sherman Oaks, Calif. Aerodynamics and Propulsion Technology.

ANALYTICAL LIFT FAN NOISE STUDY Interim Report, 13 Apr. 1971 - 13 June 1972

G. V. R. Rao, Wing T. Chu, and R. V. Digumarthi 13 Jul. 1973 78 p refs

(Contract NAS2-6401)

(NASA-CR-114576) Avail: NTIS HC $6.00 CSCL 01C

Based on reasonable estimates of flow conditions occurring in an axial fan, acoustic radiation from various noise sources is evaluated. Results of computations on two specific fans are presented, and relative significance of the various sources is examined. Author

N73-30953# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Flugbahnen.

DESIGN OF A LATERAL FLIGHT DIRECTOR

Wolfram Schattenmann 13 Jul. 1972 42 p refs In GERMAN; ENGLISH summary

(DLR-FB-72-44) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. 12.80 DM

In designing a Flight Direct (FD), two aspects have to be considered: effective director-vehicle-system performance and good pilot rating. Recently the knowledge about the human controller has reached a level where the analytical design of a manual control system is possible. With regard to the FD design principles for a FD were developed and applied to a longitudinal FD in landing approach. In the present paper, a lateral FD is designed for the same requirements. The state variables for computing the FD-signal are specified and their influence on the system FD-pilot-vehicle is analytically estimated.

Author (ESRO)

N73-30954# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

AIRCRAFT FLUTTER SIMULATION BY MEANS OF THE ELECTRONIC ANALOG COMPUTER WITH SPECIAL REGARD TO STRUCTURAL NONLINEARITIES Ph.D.

Thesis - Tech. Univ. Brunswick
E. Breitbach 24 Jan. 1973 129 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-30; AVA-FB-7228) Avail: NTIS HC $8.50; DFVLR, Porz, West Ger. 39 DM

The fundamental theoretical relations for aircraft flutter simulation by means of an electronic analog computer and a general description of an appropriate computer mechanization are presented. Processing from Lagrange's equations, the governing aeroelastic stability equations are given in terms of natural mode functions. With regard to a real time flutter simulation, the unsteady aerodynamic forces are determined by application of the two-dimensional incompressible strip theory including Wagner's function for arbitrary non-uniform motions. The practical application of the developed method is demonstrated for a wing-aileron system and some typical results are presented and discussed. As a special advantage of the analog simulation, the influence of a nonlinear spring in the aileron hinge on the flutter stability is investigated for numerous variations of spring characteristics. Author (ESRO)

N73-30955# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
COMPARATIVE TURBULENCE FOR A CANBERRA AND A VULCAN FLYING TOGETHER AT LOW ALTITUDE
J. K. Curran London Aeron. Res. Council 1973 26 p refs Supersedes RAE-TR-71100; ARC-33862
(ARC-CP-1244; RAE-TR-71100; ARC-33862) Avail: NTIS HC $3.50; HMSO 45p; PHI $1.95

Measurements were made of the response of turbulence of two aircraft, a Vulcan and a Canberra, while flying together over land and over the sea. Gust velocities derived from the normal acceleration of the two aircraft were compared and reference made to the spectral densities of the normal accelerations to account for differences in the results. Additional information on aircraft response was obtained from the spectra of wing strain measured near the wing root. Author (ESRO)

N73-30956# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
POSTBUCKLING BEHAVIOR OF A SECTION OF THE B-1 AFT INTERMEDIATE FUSELAGE Technical Report, Jul. - Dec. 1972
J. Skogh and P. Stern May 1973 51 p refs
(Contract F33615-69-C-1523; AF Proj. 1467)
(AD-763813; AFFDL-TR-73-63) Avail: NTIS CSCL 01/3

A section of the B-1 aft intermediate fuselage consisting of a combination of flat and curved panels was analyzed for postbuckling strength under a combination of torque and axial loading. The analysis, which extended to load levels about ten times the load that produces the first buckle, was carried out rigorously by the use of the finite-difference computer code STAGS. The results show that the fuselage section does not collapse at the applied load were calculated. These data can be used as inputs for a finite-element analysis of the fuselage section. Author (GRA)

N73-30957# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
STRUCTURAL DYNAMICS OF A HELICOPTER ROTOR BLADE M.S. Thesis
Michael D. Rudy Jun. 1973 163 p refs
(Grant DA-ARO(D)-31-124-71-G13)
(AD-763934; PSU-AERSP-73-6; AROD-9334-2-E) Avail: NTIS CSCL 01/3

In the investigation of the structural dynamic problems associated with a helicopter rotor blade, a fully articulated rotor blade is considered in the analysis of the aeroelastic model. Therefore, there are three degrees of freedom considered; flapping, torsion, and lead-lag. The flapping and torsional motions are coupled inertially and the lead-lag motion is uncoupled from the other motions. The study is concerned with developing an aeroelastic model which takes into consideration the effects of the shearing force and rotary inertia upon the fundamental frequencies and mode shapes of the rotor blade. Also, the effect of inertial coupling between flapping and torsion on the fundamental frequencies and mode shapes is considered. Author (GRA)

N73-30958# United Aircraft Corp., Stratford, Conn. Aircraft Div.
HELICOPTER GUST RESPONSE INCLUDING UNSTEADY AERODYNAMIC STALL EFFECTS Final Report
Russell R. Bergquist May 1973 57 p refs
(Contract DAAJ02-71-C-0024)
(AD-763957; USAAMRDL-TR-72-68) Avail: NTIS CSCL 01/1

The Sikorsky/UARL Normal Mode Rotor Aeroelastic Analysis (Computer Program Y-200) was modified to provide the capability of predicting the gust-response characteristics of pure and compound, single-rotor helicopters, including the effects of unsteady aerodynamics on rotor blade stall. The analysis was applied to examine the effects of rotor configuration, flight condition, and gust profile variables on rotor response characteristics. Only the short-term, controls-fixed response was investigated. The results were used to assess the accuracy of the gust-alleviation factor relation given by MIL-S-8698 (ARG) and USAAVLABS Technical Report 69-1 and to provide a basis for developing a more accurate relation. In addition, the impact of the gust on other quantities of interest such as blade vibratory moments and forces was briefly studied. Finally, an assessment of the relative importance of some of the assumptions in the analysis was also made. (Modified author abstract) GRA

N73-30959# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF KINEMATIC PARAMETERS OF A JET AIRCRAFT IN A TAKE-OFF RUN
D. S. Neklyudov 7 Jul. 1973 13 p refs Transl. into ENGLISH from Tr. Lvauga (USSR), no. 24, 1965 p 77-81
(AD-764314; FTD-HT-23-709-73) Avail: NTIS CSCL 01/2

The kinematic parameters of a jet aircraft in a take-off run are studied in the report. The method of the experimental study of parameters of a take-off run of an aircraft by means of the motion-picture recording of landing lights is examined. The experimental and theoretical examination of the problem leads to the construction of a certain universal dependence which can be used in the programming of the take-off run of a jet aircraft. Author (GRA)

N73-30960# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
OPTIMAL LIFTING RE-ENTRY BY REDUCED-ORDER APPROXIMATION
W. ODwyer and H. Hinz May 1973 60 p refs
(AD-764132; RE-457) Avail: NTIS CSCL 01/2

A faster method for computing optimal three-dimensional trajectories that maximize the landing footprint of a lifting re-entry vehicle has been developed. The method uses energy approximations based on the assumption that the flight path angle is small and the flight path angular rate is zero. Thus, the vertical component of lift is considered equal to the weight minus centrifugal relief, and the equation of motion are reduced in order from six to four. Because of this simplification, the classical indirect method of the calculus of variations is used to compute families of optimal solutions Using data corresponding to one of the space shuttle configurations, computations have been carried out for both unconstrained trajectories and for solutions that have aerodynamic heating rates and lift coefficients limited to specified values. During the investigation, several interesting analytical finds were uncovered that could be used as a basis for an onboard guidance scheme. Author (GRA)

N73-30961# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SURFACE VELOCITIES AND TEMPERATURE CHANGES FOR C-130, C-141, AND C-5A EXHAUST BLASTS AND C-5A WING-TIP VORTEX Final Report

James W. Carr Jun. 1973 43 p refs
(DA Proj. 1T0-62112-A-131)
(AD-764228; AEWES-Misc-Paper-S-73-61) Avail: NTIS CSCL 01/2

The report describes a series of field investigations conducted to determine exhaust-blast velocities and temperatures at the ground level for various aircraft and the wing-tip vortex velocity of the C-5A. Measurements of exhaust-blast velocities and temperature rise during static conditions were collected for C-130, C-141, and C-5A aircraft. Taxi, breakway, and lift-off tests were conducted with the C-141 and C-5A to record velocity during actual aircraft operations. Wind velocity created by the wing-tip vortex of the C-5A was recorded during actual aircraft operations. Results of these tests indicate that temperature increases from engine exhaust blasts are not sufficient to cause detrimental effects on runway surfacing in use to date. (Modified author abstract) GRA

N73-30962# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
AN EXPERIMENTAL INVESTIGATION OF WIND TUNNEL WALL CORRECTIONS AND TEST LIMITS FOR V/STOL VEHICLES Final Report, 1 Jul. 1969 - 30 Jun. 1972
William H. Rae, Jr. and Shojiro Shindo 12 Jul. 1973 38 p refs
(Grant DA-ARO(D)-31-124-G809)
(AD-764255; AROD-4506-5-E) Avail: NTIS CSCL 01/3

The report deals with an experimental investigation of some of the problems associated with wind tunnel testing of V/STOL type aircraft. The models used in the study were either rotors or propellers acting as a rotor. Various size and shape wind tunnel test sections were simulated by the use of inserts installed within a larger main wind tunnel test section. The study investigated the application of wind tunnel wall corrections to models with large values of downwash. A physical limit, called flow breakdown, to the size and allowable downwash for a given model-tunnel combination was also studied. (Modified author abstract) GRA

N73-30963# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
WIND TUNNEL DRAG AND STABILITY OF SOLID FLAT CIRCULAR, T-10, AND RINGSLOT PARACHUTE MODELS WITH CENTERLINES Final Report, Jun. 1968 - Dec. 1972
H. G. Heinrich and R. A. Noreen May 1973 141 p
(Contract F33615-68-C-1227, AF Proj. 6065)
(AD-764364; AFFDL-TR-73-17) Avail: NTIS CSCL 01/3

Wind tunnel measurements of the aerodynamic force coefficients of solid flat circular, T-10, and ringslot parachute models with and without centerlines were made. Test conditions were M = 0.1 and Re/ft = 670,000 on models with a nominal diameter of approximately 16 in. The results showed general similarities in the effects of various centerline lengths on the different models. With centerline lengths about equal to the suspension line length, tangent force increases from 20% to 26% were obtained. At these configurations the force in the centerline is about one-half the total tangent force. The model trim angle and slope of the moment curve at that point were determined. These show the solid flat circular and T-10 models to be less stable, while the ringslot parameters were nearly unchanged. Author (GRA)

N73-30964# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
STUDIES IN LOW SPEED FLIGHT Final Report, 1 Oct. 1967 - 31 May 1973
Robert L. Carlson, Arnold L. Ducoffe, Robin B. Gray, James E. Hubbartt, and Howard M. McMahon Jun. 1973 27 p refs
(Contract DAHC04-68-C-0004)
(AD-764264; AROD-T-2-29-E) Avail: NTIS CSCL 01/3

Research studies on problems in low speed flight conducted under the THEMIS program are summarized for the period from 1 October 1967 to 31 May 1973. Results of investigations on heavily loaded ducted fans, vortex-wake analysis of a single-bladed hovering rotor, rotor blade flutter analyses, jet-in-crosswind, wall jets, and instability in tensioned sheets with cutouts are described. Lists of publications which describe the research are given and the faculty and student participation in the program is summarized. Author (GRA)

N73-30965# Technology, Inc., Dayton, Ohio.
OPERATIONAL USE OF UH-1H HELICOPTERS IN SOUTHEAST ASIA Final Report, 16 Apr. 1971 - 31 Oct. 1972
Raymond B. Johnson, Jr., Larry E. Clay, and Ruth E. Meyers May 1973 242 p refs
(Contract DAAJ02-71-C-0039; DA Proj. 1F1-62208-AA-82)
(AD-764260; USAAMRDL-TR-73-15) Avail: NTIS CSCL 01/2

From operational usage parameter measurements on three UH-1H helicopters, 203 hours of valid multichannel flight data were recorded while the helicopters operated from bases in Southeast Asia. Data were processed and analyzed according to four flight phases, called mission segments: ascent, maneuver, descent, and steady state. Data are presented in the form of time and occurrence tables, cumulative frequency distribution curves, and exceedance curves. These data indicate the time spent in the mission segments and parameter ranges; the number of peak parameter values occurring in the ranges of the given parameter during each of the mission segments, and in the ranges of one or more related parameters; and the time to reach or exceed given maneuver or gust normal load factors. The data presented were recorded between September 1971 and March 1972. Author (GRA)

N73-30966# Southwest Research Inst., San Antonio, Tex.
AN EXPERIMENTAL STUDY OF SKIRT FLUTTER ON SURFACE EFFECT TAKE-OFF LANDING (SETOL) CRAFT Final Report
R. L. Bass and J. E. Johnson Jun. 1973 61 p refs
(Contract N62269-73-C-0216)
(AD-764137) Avail: NTIS CSCL 01/3

The report summarizes all work performed in conducting an experimental study of surface effect take-off and landing (SETOL) craft skirt flutter. The test results reported were obtained utilizing two-dimensional models representing typical trunk segment configurations. Test results obtained with these models are being used to provide baseline flutter data for a corresponding theoretical effort. In addition to providing data for the theoretical work, these model tests were directed toward discovering the types of flutter oscillations that can occur, the mechanisms that are important in predicting the occurrence and magnitude of skirt flutter and the ranges of parameters over which flutter can occur. Author (GRA)

N73-30967# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
AN EVALUATION OF THE NEED FOR DECK MOTION PREDICTION ON THE WAVE-OFF ADVISORY SYSTEM Final Report
Ronald L. Nave 12 Jul. 1973 32 p
(AD-764516; NADC-73155-30) Avail: NTIS CSCL 01/2

A statistical model of the carrier wave-off situation is developed using experimentally measured data for carrier deck motion and aircraft approach geometry. This model is used to estimate the effect of ramp motion on the operation of the WOAS (Wave-Off Advisory System). In this manner the performance gains that could be achieved by adding a Deck Motion Prediction System to the WOAS are evaluated. Author (GRA)

N73-30968# Army Foreign Science and Technology Center, Charlottesville, Va.
NONLINEAR VIBRATIONS OF PIPELINES CONTAINING FLOWING FLUIDS
15 Mar. 1973 6 p refs Transl. into ENGLISH from Samoletostroenie i Tekhnika Vozdushnogo Flota (USSR), no. 21, 1970 p 56-58
(AD-764154; FSTC-HT-23-1974-72) Avail: NTIS CSCL 01/3

The report presents a study of the oscillations of aircraft hydraulic systems containing a pressurized fluid. GRA

N73-30969# National Materials Advisory Board, Washington, D.C.
APPLICATION OF FRACTURE PREVENTION PRINCIPLES TO AIRCRAFT Final Report
Feb. 1973 274 p refs
(Contract DA-49-083-OSA-3131)
(AD-764513; NMAB-302) Avail: NTIS CSCL 01/3

The elements of current fracture control plans and associated technologies were reviewed. After reviewing the status, applicability, and potential of the elements and technologies, it was concluded that fracture control plans and development of related technologies not only afford an opportunity to reduce catastrophic failures of aircraft structures and structural maintenance but also can help to quantify many structural material, design, nondestructive evaluation, and maintenance decisions that now are made on a relatively qualitative basis. The Committee recommended careful trade studies, together with caution and flexibility, in the use of existing criteria and prior to the issuance of new criteria. (Modified author abstract) GRA

N73-30970# Grumman Aerospace Corp., Bethpage, N.Y.
TRACKED AIR CUSHION RESEARCH VEHICLE: DYNAMICS SIMULATION PROGRAM USER'S MANUAL Final Report
E. Magnani, R. Lee, and R. Coppolino Oct. 1973 206 p refs
(Contract DOT-FR-10039)
(PB-219984/2; PMT-B4-R72-07; FRA-RT-73-19) Avail: NTIS HC $3.00 CSCL 13F

A digital computer program was generated for use on the IBM 370/165 to evaluate the dynamic characteristics of the tracked air cushion research vehicle. The manual provides a summary review of the analytical basis, the construction of the computer program and the necessary instructions for the use of the program. The analytical model is formulated with the primary objective of obtaining vehicle ride qualities. The major vehicle components (body, chassis, guidance cushions and levitation cushions) supported by the vehicle suspension system are represented in a dynamic mathematical model with a maximum of twenty degrees of freedom. The non-linear response of this model to rigid and flexible guideway excitations, turn and superelevation excitations, and aerodynamic forces are obtained using numerical integration. Author (GRA)

N73-30971# Duke Univ., Durham, N.C. Dept. of Civil Engineering.
LOADING CRITERIA AND DYNAMIC RESPONSES OF A GUIDEWAY FOR AIR CUSHION VEHICLES Final Report
James F. Wilson Feb. 1973 69 p refs
(PB-221688/5; FRA-RT-73-32) Avail: NTIS HC $4.50 CSCL 13F

The purpose of the report is threefold: first, to review all available contract reports to determine loading criteria for proposed tracked air cushion vehicle guideways; second, to present methods for calculating dynamic responses of double-span beam-type guiderails and soil supported slabs subjected to high speed vehicle loading; and third, to obtain the dynamic load factors for the guiderail and slab components. Assuming that the post-supported guiderails are dynamically uncoupled from the slabs, dynamic load factors of up to 2.8 are calculated here for the rails, and these are in substantial agreement with previously reported results. (Modified author abstract) GRA

N73-31064 Joint Publications Research Service, Arlington, Va.
STATISTICAL ERROR ANALYSIS OF AM RADIO ALTIMETERS WITH PHASE READOUT
V. V. Tsvetnov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 71-96 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 71-96 (For availability see N73-31054 22-07)

A study was made of the effect of the extent of the earth's surface on the statistical structure of the signals of a phase radial altimeter with amplitude modulation and a coherent detector. The altitude readings were analyzed. It was demonstrated that under certain conditions, the phase information about the measured altitude can be suppressed. Author

N73-31065 Joint Publications Research Service, Arlington, Va.
EFFECT OF THE TYPE OF DETECTION ON THE STATISTICAL PROPERTIES OF THE SIGNAL IN AN AM RADIO ALTIMETER WITH PHASE READOUT
V. V. Tsvetnov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 100-124 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 96-120 (For availability see N73-31054 22-07)

The effect of the type of detection on the statistical properties of the signal in amplitude modulation radio altimeters with phase readout was investigated. It was demonstrated that the application of a quadratic or synchronous detector instead of a coherent detector improves the phase and amplitude statistical characteristics of the signal. The synchronous detector is unable to eliminate the effect of suppression of the phase and range finding information. Author

N73-31066 Joint Publications Research Service, Arlington, Va.
STATISTICAL ERROR ANALYSIS OF AN FM RADIO ALTIMETER WITH PHASE READOUT
Yu. L. Pivovarov *In its* Radar Theory and Practice (JPRS-56143) 1 Jun. 1973 p 125-139 refs Transl. into ENGLISH of the book "Teoriya i Tekhnika Radiolokatsii" Moscow, Machine Building Press p 125-139 (For availability see N73-31054 22-07)

A statistical error analysis of a frequency modulated radio altimeter with phase readout was conducted. A study was made of the representation of the range finder power distribution of an echo from an extended surface in the signal parameters of the altimeter during signal processing. Systematic and fluctuation range measurement errors were determined. Author

N73-31084*# North American Rockwell Corp., Downey, Calif.
AIRCRAFT-MOUNTED CRASH-ACTIVATED RADIO DEVICE Patent Application
Robert Manoli and Bertram R. Ulrich, inventors (to NASA) Filed 17 Nov. 1972 13 p Sponsored by NASA
(NASA-Case-MFS-16609-2; US-Patent-Appl-SN-307714) Avail: NTIS HC $3.00 CSCL 17B

A description is given of an aircraft crash location transmitter device. The device is mounted on the tail of an aircraft in a round sealed case held by a shear pin that releases under crash impact of 7 to 8 G's. The transmitter is powered by a batter which is kept charged by a trickel charge from the aircraft electrical system, preferably the wiring leading to the navigational light on the tail. The transmitter has a button actuated meter to test the transmitter battery condition while the apparatus is installed on an aircraft. At the time of the crash, the transmitter is released and ejected, the concave-formed metal spring blade antenna wound around the case unwinds and the transmitter starts emitting on emergency frequencies 121.5 MHz and 243 MHz. The transmitter, which is shock mounted within outer and inner cases, lands and continues transmitting for about 48 hours. NASA

N73-31086# IIT Research Inst., Annapolis, Md.
AN EXTENDED AVIONICS INTERFERENCE PREDICTION MODEL Final Report
Leo C. Friske Jun. 1973 100 p refs
(Contract DOT-FA70WAI-175; F19628-73-C-0031; AF Proj. 649E)
(ECAC-PR-73-002; FAA-RD-73-9) Avail: NTIS HC $7.00

A previous ECAC modeling effort is extended. Options are provided to express the terms of the standard interference equation deterministically or probabilistically. A data base of most commonly found avionics equipments is established for automatic retrieval and application in the prediction model. Author

N73-31087# Rome Air Development Center, Griffiss AFB, N.Y.
RADAR MICROWAVE LINK (RML) ANTENNA PATTERN MEASUREMENTS Final Report

Roger G. Hunter Aug. 1973 191 p
(Contract DOT-FA71WAI-208)
(FAA-RD-73-118) Avail: NTIS HC $11.75

Results of the Radar Microwave Link (RML) antenna pattern measurements performed by Rome Air Development Center are reported. The data were taken with a C-131 aircraft equipped with a AN/FSM-17 antenna measuring system. The raw data from the measurements were converted to values of absolute gain and processed to form a series of polar plots which are presented in this report. Absolute gain is defined as the ratio of radiation intensity in a given direction to the radiation intensity produced by an isotropic radiator with the same input. Author

N73-31142*# Intermetrics, Inc., Cambridge, Mass.
SHUTTLE AVIONICS AND THE GOAL LANGUAGE INCLUDING THE IMPACT OF ERROR DETECTION AND REDUNDANCY MANAGEMENT Final Report
J. H. Flanders, C. T. Helmers, and S. F. Stanten Jun. 1973 63 p
(Contract NAS9-12291)
(NASA-CR-134034) Avail: NTIS HC $5.25 CSCL 09B

The relationship is examined between the space shuttle onboard avionics and the ground test computer language GOAL when used in the onboard computers. The study is aimed at providing system analysis support to the feasibility analysis of a GOAL to HAL translator, where HAL is the language used to program the onboard computers for flight. The subject is dealt with in three aspects. First, the system configuration at checkout, the general checkout and launch sequences, and the inventory of subsystems are described. Secondly, the hierarchic organization of onboard software and different ways of introducing GOAL-derived software onboard are described. Also the flow of commands and test data during checkout is diagrammed. Finally, possible impact of error detection and redundancy management on the GOAL language is discussed. Author

N73-31158# Douglas Aircraft Co., Inc., Long Beach, Calif.
FORMAT-FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 2, SUPPLEMENT 4: DESCRIPTION OF DIGITAL COMPUTER PROGRAM-EXTENDED Final Report, 1 May 1971 - 30 Apr. 1973
L. Chahinian and S. H. Miyawaki Wright-Patterson AFB, Ohio AFFDL Apr. 1973 106 p refs
(Contract F33615-71-C-1627; AF Proj. 1467)
(AD-764360; DAC-33569-Vol-2-Suppl-4;
AFFDL-TR-66-207-Vol-2-Suppl-4) Avail: NTIS CSCL 09/2

The FORMAT System has been augmented with highly efficient and reliable procedures for structural analysis via an alternate solution approach which combines the rigorous generation features of the existing force method with a new equation solving process characteristic of current displacement methods. As a result, a tenfold increase in potential problem size to in excess of 10,000 elastic degrees of freedom is the minimum currently anticipated as attainable on present major digital computers, and linear behavioral characteristics can take immediate advantage of any advance in hardware capabilities. In making these provisions, considerable emphasis was placed on the control of both physical and numerical error throughout the total solution process. To date an extensive range of complex configurations representing actual aerospace structures with up to 6500 degrees of freedom have been successfully processed as single entities on a production basis, that is, within the confines of a production schedule and with maximum reliability at minimum cost. Complete machine independence has been maintained in this latest release of FORMAT and many additions and refinements incorporated which either complement the efficiency afforded by the alternate solution approach or provide increased generality and reliability of the program. (Modified author abstract) GRA

N73-31159# Douglas Aircraft Co., Inc., Long Beach, Calif.
FORMAT-FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 5, SUPPLEMENT 2: ENGINEERING USER AND TECHNICAL REPORT-EXTENDED Final Report, 1 May 1971 - 30 Apr. 1973
J. Pickard Wright-Patterson AFB, Ohio AFFDL Apr. 1973 141 p refs
(Contract F33615-71-C-1627; AF Proj. 1467)
(AD-763812; DAC-33569-Vol-5-Suppl-2;
AFFDL-TR-66-207-Vol-5-Suppl-2) Avail: NTIS CSCL 20/11

N73-31160# Douglas Aircraft Co., Inc., Long Beach, Calif.
FORMAT-FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 6, SUPPLEMENT 2: DESCRIPTION OF DIGITAL COMPUTER PROGRAM PHASE 1-EXTENDED Final Report, 1 May 1971 - 30 Apr. 1973
R. C. Morris Wright-Patterson AFB, Ohio AFFDL Apr. 1973 111 p refs
(Contract F33615-71-C-1627; AF Proj. 1467)
(AD-764366; DAC-33569-Vol-6-Suppl-2;
AFFDL-TR-66-207-Vol-6-Suppl-2) Avail: NTIS CSCL 09/2

The FORMAT System has been augmented with highly efficient and reliable procedures for structural analysis via an alternate solution approach which combines the rigorous generation features of the existing force method with a new equation solving process characteristic of current displacement methods. As a result, a tenfold increase in potential problem size to in excess of 10,000 elastic degrees of freedom is the minimum currently anticipated as attainable on present major digital computers, and linear behavioral characteristics can take immediate advantage of any advance in hardware capabilities. In making these provisions, considerable emphasis was placed on the control of both physical and numerical error throughout the total solution process. To date an extensive range of complex configurations representing actual aerospace structures with up to 6500 degrees of freedom have been successfully processed as single entities on a production basis, that is, within the confines of a production schedule and with maximum reliability at minimum cost. Complete machine independence has been maintained in this latest release of FORMAT and many additions and refinements incorporated which either complement the efficiency afforded by the alternate solution approach or provide increased generality and reliability of the program. (Modified author abstract) GRA

N73-31190# Bendix Corp., Sidney, N.Y. Electrical Components Div.
RELIABLE INTEGRATED WIRE TERMINATION DEVICES Final Report
Donald L. Pfendler and Donald H. Gould Jul. 1973 203 p
(Contract DAAB07-71-C-0090; DA Proj. 1F1-62203-A-119)
(AD-764248; ECOM-0090-71-F) Avail: NTIS CSCL 09/1

The final report covers an investigation into the design and evaluation of a single wire termination system capable of interconnection to various existing designs of multi-contact connectors. The devices using this termination system were to be capable of assembly and maintenance with a common tool. In addition, the devices were to reliably withstand the environmental conditions encountered by ground and airborne Army equipment with emphasis on improvement for Army aircraft. The concept designed and evaluated makes waterproof connectors having crimp removable MS27491 series contacts practical to produce. (Modified author abstract) GRA

N73-31212# Naval Ship Research and Development Center, Bethesda, Md. Ship Acoustics Dept.
THE ANECHOIC FLOW FACILITY: AERODYNAMIC CALIBRATION AND EVALUATION
Brian E. Bowers May 1973 46 p refs
(SF43452007)
(AD-763668; SAD-48E-1942) Avail: NTIS CSCL 14/2

Since May 1971, the new anechoic flow facility at the Naval Ship Research and Development Center has been undergoing periodic operational exercises and calibrations to determine the extent to which the facility may be used in the study of flow-induced noise. Some preliminary results are available with respect to both acoustical and aerodynamic calibrations. The purpose of this report is to evaluate the aerodynamic performance

characteristics of the facility with regard to the established design specifications and to present some preliminary aerodynamic calibration data. (Modified author abstract) GRA

N73-31213# Army Construction Engineering Research Lab., Champaign, Ill.
AIRCRAFT-PAVEMENT INTERACTION STUDIES, PHASE 1: A FINITE-ELEMENT MODEL OF A JOINTED CONCRETE PAVEMENT ON A NON-LINEAR VISCOUS SUBGRADE (DYNAMIC INTERACTION OF AIRCRAFT-PAVEMENT SYSTEMS) Preliminary Report, Jul. 1971 - Jul. 1972
Arthur C. Eberhardt Jun. 1973 31 p refs
(DA Proj. 4A6 64717-D 895)
(AD-764243; CERL-PR-S-19) Avail: NTIS CSCL 01/5

The report describes a finite-element procedure for analyzing multilayered concrete airfield pavements. An equivalent plate theory is used to account for the increased stiffness provided by a stabilized base or a structural overlay. The stiffness is also adjusted to provide for the effects of various bond levels developed between the pavement layers. The finite-element pavement model was developed to aid the study of airfield-pavement interaction and especially to help analyze surface deformations resulting from multi-wheel aircraft loads. Pavement joints are given finite dimensions and treated as separate entities to permit more accurate determination of stress at an edge in a jointed pavement. Subsoil material can be modeled as a linear elastic, non-linear, or non-linear viscous material. (Modified author abstract) GRA

N73-31214# Purdue Univ., Lafayette, Ind.
APPLICATION OF ENERGY CONCEPTS TO THE PERFORMANCE OF AIRFIELD PAVEMENTS Technical Report, Nov. 1970 - Feb. 1973
William H. Highter and M. E. Harr Kirtland AFB, N. Mex. Jun. 1973 174 p refs
(Contract F29601-71-C-0014; AF Proj. 683M)
(AD-763118; AFWL-TR-72-225) Avail: NTIS CSCL 01/5

Pavement engineers have not been able to predict the performance of pavement systems prior to actual construction and operational utilization. A solution to this problem was obtained by verifying the following hypothesis developed from energy concepts: A functional relationship exists between the cumulative energy as measured by cumulative peak deflections imparted to a given pavement system and the condition of that system. Because of the paucity of airfield condition and deflection data, indirect means has to be used to test the working hypothesis for airfield pavements. Traffic records and construction histories for two Air Force Bases were analyzed, and indicated a threshold cumulative total peak deflection at which cracking develops in airfield pavements. (Modified author abstract) GRA

N73-31215# Army Construction Engineering Research Lab., Champaign, Ill.
PROCEEDINGS, ALLERTON PARK CONFERENCE ON SYSTEMS APPROACH TO AIRFIELD PAVEMENTS (RATIONAL PAVEMENT DESIGN)
R. W. Woodhead and R. H. Wortman Jun. 1973 511 p refs Conf. held at Allerton Park, Ill., 23-26 Mar. 1970
(DA Proj. 4A0-62112-A-891)
(AD-763212; CERL-TR-P-5) Avail: NTIS CSCL 01/5

Prior to the 1970's, design methodology for airfield pavements represented empirical and theoretical extrapolation of pavement strength based on structural considerations and slab support, with judgment factors to compensate for lack of technology and differences in user requirements. With the great weight range and variations in ground control characteristics of modern aircraft, this combination of judgment and theory no longer adequately serves the pavement designer in meeting the user needs. New approaches and concepts are needed to bring pavement design up to the level of sophistication of aircraft design. Design problems must be related to needs of a wide range of users over extended periods of time and service conditions. (Modified author abstract) GRA

N73-31216# Arizona State Univ., Tempe. School of Engineering.
A SUMMARY OF OPTIMIZATION TECHNIQUES THAT CAN BE APPLIED TO SUSPENSION SYSTEM DESIGN Final Report
J. Karl Hedrick Mar. 1973 42 p refs
(Contract DOT-OS-335)
(PB-220553/2; DOT-TSC-OST-73-9) Avail: NTIS HC $3.00 CSCL 13F

Summaries are presented of the analytic techniques available for three levitated vehicle suspension optimization problems; optimization of passive elements for fixed configuration; optimization of a free passive configuration; optimization of a free active configuration. The techniques are applied to a heave dynamic model which includes gravity forces, random aerodynamic forces and random guideways making use of penalty functions which include vehicle acceleration, suspension displacement, gap variation, power requirements. GRA

N73-31217# Tennessee State Planning Commission, Nashville.
AIRPORT ENVIRONS PLAN, JACKSON, TENNESSEE Final Report
Jun. 1973 70 p Sponsored by HUD
(PB-221129; TN-JACN-73-1006) Avail: NTIS HC $5.50 CSCL 01E

The report presents a guide by which the governmental leaders of Jackson and Madison County can utilize in assuring that the McKellar Airport and the community surrounding it will always be compatible with each other. The report is presented in the following four sections: (1) goals and objectives, (2) basic background data, (3) the environs plan, and (4) plan implementation. Also included is an environmental assessment statement as required by the Department of Housing and Urban Development. A major highlight of the report is the presentation of a schematic design for a planned air industrial park proposed to be located adjacent to the airport which integrates the use of several modes of transportation. GRA

N73-31226 Illinois Inst. of Tech., Chicago.
STARTING VORTEX, SEPARATION BUBBLES AND STALL: A NUMERICAL STUDY OF LAMINAR UNSTEADY FLOW AROUND AN AIRFOIL Ph.D. Thesis
Unmeel B. Mehta 1972 270 p
Avail: Univ. Microfilms Order No. 73-12222

The stalling characteristics of an airfoil in a viscous incompressible fluid are investigated. The behavior of the time dependent laminar flow structure, force evolution and vortical formation is determined. The details of flow past a nine per cent thick symmetric airfoil at 15 deg angle of attack with R = 1000. are studied. The governing equations in terms of vorticity and stream function are solved utilizing an implicit finite difference scheme and point successive relaxation procedure. The development of the impulsively started flow, the initial generation of circulation and the structure of the starting vortex are investigated. Dissert. Abstr.

N73-31228 Engineering Sciences Data Unit, London (England).
AEROFOILS HAVING A SPECIFIED FORM OF UPPER SURFACE PRESSURE DISTRIBUTION: DETAILS AND COMMENTS ON DESIGN
Dec. 1971 23 p refs Supersedes ESDU-67010 Sponsored by Min. of Defence and Roy. Aeron. Soc.
(ESDU-71020; ESDU-67010) Copyright. Avail: Issuing Activity

The aerodynamic configuration of a series of airfoils used in parametric studies of drag-rise Mach number are discussed. The particular form of upper surface pressure distribution over the airfoil under various flow conditions is described. The influence of the principal design variables on the geometrical shape of the cambered airfoils to obtain the specified upper surface pressure distribution is discussed. Author

N73-31229 Engineering Sciences Data Unit, London (England).

DRAG-RISE MACH NUMBER OF AEROFOILS HAVING A SPECIFIED FORM OF UPPER SURFACE PRESSURE DISTRIBUTION: CHARTS AND COMMENTS ON DESIGN
Dec. 1971 53 p refs Supersedes ESDU-67009 Sponsored by Min. of Defence and Roy. Aeron. Soc.
(ESDU-71019; ESDU-67009) Copyright. Avail: Issuing Activity

The drag-rise Mach number of airfoils with specified upper surface pressure distribution is analyzed. Charts for estimating the drag-rise Mach number as a function of the lift coefficient and the thickness to cord ratio for an infinite family of airfoils in viscous flow are presented. The derivation of charts, the accuracy, inherent limitations, and predictions of the principal charts in relation to those for alternative combinations of thickness and upper surface pressure distributions are discussed. Author

N73-31230 Engineering Sciences Data Unit, London (England).
A METHOD FOR ESTIMATING DRAG-RISE MACH NUMBER OF SMOOTH NONDUCTED AXISYMMETRIC BODIES AT ZERO INCIDENCE
Aug. 1971 24 p refs Sponsored by Min. of Defence and Roy. Aeron. Soc.
(ESDU-71008) Copyright. Avail: Issuing Activity

A method is given for estimating drag rise Mach number of smooth, non-ducted, axisymmetric bodies at zero incidence without discontinuities in surface slope. The method is based on the observation in the limited number of experimental data available that shock-wave drag develops rapidly as shock waves form downstream of the axial location of the body maximum cross-sectional area. Analogy with the observed development of shock-wave drag on two-dimensional airfoils suggests that the drag rise Mach number is that at which the shock, either on first being formed or on moving from an upstream station, first appears to the rear of this location. The problem of predicting drag-rise Mach number is thus reduced to that of predicting the free-stream Mach number at which the shock first appears at or downstream of this location and is achieved by applying a simple criterion to the calculated equivalent shock-free pressure distribution. Author

N73-31231 Connecticut Univ., Storrs.
ANALYTICAL AND EXPERIMENTAL STUDY OF SPATIALLY GROWING DISTURBANCES IN SHEAR LAYERS BETWEEN PARALLEL STREAMS Ph.D. Thesis
Bruce Virgil Johnson 1972 201 p
Avail: Univ. Microfilms Order No. 73-9808

The effects of translational velocity on the spatial growth of wavy disturbances in an inviscid shear layer were analytically studied using linearized theory. A series expansion was developed for regions near the zero wave number and for the neutral stability wave number and employed previously obtained temporal growth solutions to determine the spatial growth characteristics. An algebraic spatial growth stability solution was obtained for the linear velocity profile with an arbitrary translational velocity. Numerical solutions were obtained for the hyperbolic tangent velocity profile with several translational velocities and were compared with the previous temporal growth and spatial growth results. Dissert. Abstr

N73-31238*# Chrysler Corp., New Orleans, La. Space Div.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ROCKET PLUME SIMULATORS ON THE RADIAL AND LONGITUDINAL PRESSURE DISTRIBUTION OF A STING MOUNTED BODY OF REVOLUTION AT TRANSONIC MACH NUMBERS
James R. Burt, Jr. Redstone Arsenal, Ala. Army Missile Command Jul. 1973 393 p refs
(Contract NAS9-13247)
(NASA-CR-133916; AD-763904; RD-TR-74-21) Avail: NTIS HC $21.75 CSCL 16/4

Experimental aerodynamic investigations were conducted at the Cornell Aeronautical Laboratory (CAL) transonic wind tunnel to determine the effects of several rocket plume simulators on the pressure distribution of a body of revolution. These tests were conducted during September, 1971, on a sting supported model and were extensions of earlier (August 1970) tests on similar strut supported models. Therefore, these data can also be utilized to determine the effects of strut mounting on data validity. Local surface pressure data were recorded over an angle of attack range of plus or minus 2 degrees at Mach numbers of 0.9, 1.0 and 1.2 on a four-caliber tangent ogive nose with a cylindrical, a boattailed, and a flared afterbody and on the cylindrical afterbody with either a solid disc or a perpendicular (normal) jet flow acting as plume simulators. Author (GRA)

N73-31245*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace Engineering.
VORTEX AGE AS A WAKE TURBULENCE SCALING PARAMETER
J. R. Marshall and J. F. Marchman, III Aug. 1973 138 p refs
(Contract NAS1-10646)
(NASA-CR-132312; VPI-Aero-006) Avail: NTIS HC $9.00 CSCL 20D

Research which was conducted to determine the significance of vortex age as a scaling parameter in wake turbulence development and dissipation is reported. Tests were conducted at three angles of attack, three free stream speeds, and seven downstream positions from 2 to 30 chordlengths using an NACA 0012 wing and a five hole yawhead pitot probe. The end surface of the wing tip was flat. Speeds were selected to give a predetermined range of vortex ages. The complete velocity structure of the vortex was measured at each station and speed. The resulting plots of maximum tangential velocity and vortex core diameter versus downstream distance and vortex age indicate that vortex age is not a self sufficient scaling parameter. In addition to the expected effect of lift coefficient there is also a definite free stream speed influence at high wing angles of attack. The exact cause and nature of this effect is not fully understood, but it does not appear to be explainable in terms of Mach number or Reynolds number; however, the influence of tip edge shape on spanwise flow separation appears to be an important factor. Author

N73-31253*# Illinois Univ., Urbana. Mechanical Engineering Dept.
A STUDY OF THE LOCAL PRESSURE FIELD IN TURBULENT SHEAR FLOW AND ITS RELATION TO AERODYNAMIC NOISE GENERATION Status Report, 31 Jul. 1972 - 31 Jan. 1973
Barclay G. Jones and H. Peter Planchon, Jr. 31 Jan. 1973 35 p refs
(Grant NGR-14-005-149)
(NASA-CR-134493; SR-5) Avail: NTIS HC $3.75 CSCL 20D

Work during the period of this report has been in three areas: (1) pressure transducer error analysis, (2) fluctuating velocity and pressure measurements in the NASA Lewis 6-inch diameter quiet jet facility, and (3) measurement analysis. A theory was developed and experimentally verified to quantify the pressure transducer velocity interference error. The theory and supporting experimental evidence show that the errors are a function of the velocity field's turbulent structure. It is shown that near the mixing layer center the errors are negligible. Turbulent velocity and pressure measurements were made in the NASA Lewis quiet jet facility. Some preliminary results are included. Author

N73-31260# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
TRANSONIC VISCOUS INTERACTIONS Final Report, 1 Sep. 1969 - 31 Mar. 1973
F. O. Smetana 31 Mar. 1973 7 p refs
(Grant DA-ARO(D)-31-124-70-G95;
DA-ARO(D)-31-124-G1162)
(AD-763295; AROD-8130-2-E) Avail: NTIS CSCL 20/4

The problem to which work reported addressed itself is,

briefly, how can one predict the aerodynamic characteristics of airfoils at transonic speeds simply while at the same time including the effects of fluid viscosity. Author (GRA)

N73-31306*# Houston Univ., Tex. Wave Propagation Labs.
[SKYLAB OVERPASS AND VERIFICATION OF LOCAL ENVIRONMENTAL AND SPATIAL FEATURES] Quarterly Report, May - Aug. 1973
H. S. Hayre, Principal Investigator 11 Sep. 1973 1 p EREP
(Contract NAS9-13462)
(E73-11001; NASA-CR-133782) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-31318*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-31 Aug. 1973
A. G. Mourad and D. M. Fubara, Principal Investigators 17 Sep. 1973 9 p refs EREP
(Contract NAS9-13276)
(E73-11013; NASA-CR-133806; PR-6) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-31427# Naval Postgraduate School, Monterey, Calif.
INSTRUMENTATION OF A CESSNA 310H AIRCRAFT FOR ACADEMIC INVESTIGATION OF FLYING QUALITIES AND PERFORMANCE CHARACTERISTICS M. S. Thesis
George Harrison Davis, Jr. and Paul Joseph Valovich, Jr. Jun. 1973 116 p refs
(AD-764479) Avail: NTIS CSCL 01/4

The two-course study of flight evaluation techniques offered by the Aeronautics Department of the Naval Postgraduate School requires an airborne laboratory phase of instruction that introduces the student to the actual problems encountered in obtaining accurate inflight data. To satisfy this need, a civilian registered Cessna 310H aircraft, N164X, was leased by the Naval Postgraduate School in April, 1973. An airborne data acquisition system was designed and installed that allows three students to obtain individual measurements of twelve performance and stability and control parameters. The measurements are obtained using both electrical and differential pressure sensors, and are manually recorded by each student. Due to time constraints, no in-flight evaluation of the system has yet been conducted. Author (GRA)

N73-31429# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
HYBRID CONTROL COMPONENTS, FLUIDIC: HYDRO-MECHANICAL INTERFACE STUDY Technical Report, Jun. 1972 - Apr. 1973
David A. Stignani Jun. 1973 66 p
(Contract F33615-72-C-2089; AF Proj. 3066)
(AD-764368; GAPD-2770-3411; AFAPL-TR-73-33) Avail: NTIS CSCL 13/7

A (pinch tube) concept was evaluated as a fluidic-to-hydromechanical interface for application to gas turbine engine control systems. The particular application selected for implementation in prototype hardware was a fuel flow valve for small gas turbine or ramjet engines. Based on initial testing of a ponch tube which utilized only fluid interactions, it was established that a mechanical advantage would be required to multiply the low-level fluidic signal (plus or minus 5 psid) to a high-level hydraulic signal (700 psia). Bench testing of a prototype pinch tube, using a 4-inch diameter force multiplying piston, demonstrated comparatively high slew rates and an insensitivity to Mil Spec vibration. However, significant non-linearities and hysteresis were evident. (Modified author abstract) GRA

N73-31430# Army Aviation Systems Test Activity, Edwards AFB, Calif.
FLIGHT EVALUATION - AEROFLEX TRUE AIRSPEED VECTOR SYSTEM Final Report, 17 Nov. 1970 - 29 Aug. 1972
Kenneth R. Ferrell, Albert L. Winn, James S. Kishi, and Robert P. Jefferis Mar. 1973 98 p refs
(AD-764240; USAASTA-71-30-2; Rept-2) Avail: NTIS CSCL 01/4

Test airspeed probes are generally pitot-static systems. These systems measure an indicated airspeed which must be corrected for position error and air density deviations from sea-level, standard-day conditions to obtain true airspeed. The pitot-static system is normally inaccurate at low airspeeds and may have a limited acquisition range for angles of attack and sideslip. In this case, directional airflow information must be obtained from an independent source. A true airspeed vector system was developed which measures true airspeed and sideslip angle directly. The system design threshold was 0.1 knot, with omnidirectional sensing of sideslip angle. Successful laboratory and wind tunnel results of prototype systems led to the construction of a production system which was flight-tested on UH-1C and OH-58A helicopters, and an F-51D fixed wing aircraft. The Aeroflex system was tested at five locations on the helicopters. (Modified author abstract) GRA

N73-31455# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF ISOTHERMAL FORGING OF TITANIUM CENTRIFUGAL COMPRESSOR IMPELLER Final Technical Report, 7 Dec. 1971 - 31 May 1973
T. Watmough May 1973 98 p refs
(Contract DAAG46-72-C-0067)
(AD-764266; IITRI-B6115-16; AMMRC-CTR-73-19) Avail: NTIS CSCL 13/8

The technology of isothermal forging of titanium has been successfully extended to the production of impeller forgings. A four-part nickel-base superalloy die set weighing approximately 2000 lb was made and used to produce ten Ti-6Al-4V alloy forgings. The ten forgings were 13 1/2 in. OD, had a plan area of 114 sq. in., weighed between 24 and 25 1/2 lb, and had 36 blades radially emanating from the hub. The blades were 0.160 in. thick at the thinnest portion and had depths ranging from 3/4 to 1/2 in. depending upon location. The thickness of the hub portion of the forging at the 13 1/2 in. OD was typically 0.210 in. Preform temperatures were typically 1750F and die temperatures 1600F. Press forging loads were usually 1000 tons, equivalent to 17 kpsi forging pressure. (Modified author abstract) GRA

N73-31456# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
HYDRAULIC PUMP-LOOP CIRCUIT EVALUATION OF NAVAL AIR DEVELOPMENT CENTER DEVELOPED SILICONE BASE NONFLAMMABLE HYDRAULIC FLUID (NADRAUL MS-5 Progress Report
Paul J. Ceban and Alfeo A. Conte, Jr. 25 Apr. 1973 39 p refs
(AD-764064; NADC-73090-30) Avail: NTIS CSCL 11/8

A candidate silicone base nonflammable hydraulic fluid designated NADRAUL MS-5 was evaluated for performance in a hydraulic pump-loop circuit test stand. A Vickers offset model pump was operated at 225F and 3000 psi system pressure in conjunction with Buna N elastomer seals. A total of 500 hours of performance was achieved before the test was arbitrarily stopped in order to determine the condition of pump components. Based on the operating conditions monitored during the test and a pretest and post-test examination of the pump, it was determined that NADRAUL MS-5 silicone base fluid possesses improved antiwear properties in comparison to other silicone fluids. No abnormal wear or deterioration of the pump was observed. In addition, no operating difficulties were experienced throughout the 500 hour test. Author (GRA)

N73-31480# TRW Systems Group, Redondo Beach, Calif.
AERODYNAMICS REACTIVE FLOW STUDIES OF THE H2/F2 LASER Technical Report, 16 Oct. 1971 - 15 Feb. 1973
A. B. Witte, J. E. Broadwell, W. L. Shackleford, J. E. Trost, and T. A. Jacobs Kirkland AFB, N. Mex. AFWL Jun. 1973 147 p refs
(Contract F29601-72-C-0021; AF Proj. 1256)
(AD-763828; AFWL-TR-72-247) Avail: NTIS CSCL 20/5

The research investigated experimentally and theoretically the mixing process and its influence on performance of a continuous H2-F2 laser. In the experimental investigation, detailed flow field and chemical species measurements were made in the reaction zone of two parallel flow injector configurations. A hydrogen spray bar injector configuration, similar to many of today's operating chemical lasers, was also tested, but to a lesser extent. For the parallel configuration, one important experimental result was the identification of laminar, transitional, and turbulent regions for the mixing reaction zone. In the theoretical investigation, a simplified theory of a mixing limited production of vibrationally excited HF was constructed. A closed form expression was developed which shows the effects of pertinent flow parameters on laser performance and on HF concentrations for nonlasting cases. Author (GRA)

N73-31510# National Aerospace Lab., Amsterdam (Netherlands).
SOME CONSIDERATIONS FOR THE APPLICATION OF TITANIUM ALLOYS IN COMMERCIAL AIRCRAFT
R. J. H. Wanhill Mar. 1972 191 p refs Sponsored by the Neth. Agency for Aerospace Programs
(NLR-TR-72034-U) Avail: NTIS HC $11.75

The suitability of titanium alloys for application in conventional commercial aircraft was considered, as well as some aspects of fail-safe and safe-life design of aircraft components to be made from these alloys, by investigating material properties such as static strength, creep strength, low and high cycle fatigue strength, fracture toughness, hot salt and aqueous stress corrosion resistance, and fracture crack propagation. Data were compiled for high-cycle fatigue strength under axial loading, fracture toughness, and stress corrosion resistance in 3.5% aqueous NaCl. Some problems in designing for titanium alloys in commercial aircraft are summarized. ESRO

N73-31545# Army Construction Engineering Research Lab., Champaign, Ill.
LIME-CEMENT COMBINATION STABILIZATION
Lovick P. Suddath May 1973 41 p refs
(AD-762552; CERL-TM-M-47) Avail: NTIS CSCL 13/2

Soil stabilization is used extensively in road and airfield construction. In particular, soil-cement appears to be a favorite among the engineers. As the plasticity of a soil increases, the ability to adequately mix the cement with the soil becomes a critical factor. Also the quantity of cement required to stabilize the soil becomes excessive. The objective of the study was to determine the effect of reduced compacted density on the durability of cement stabilized clays, pretreated with lime. The reduction in density did not impair the durability of cement stabilized clay soils, which were pretreated with lime. Most of the test results indicated an improved resistance to freeze-thaw. An evaluation of the unconfined compressive strength results obtained during freeze-thaw shows that lime pretreatment improved the strengths. (Modified author abstract) GRA

N73-31573 Joint Publications Research Service, Arlington, Va.
DESIGN FOR THE DEVELOPMENT OF MESOMETEOROLOGICAL OBSERVATIONS IN MOSCOW AND IN THE VICINITY OF MOSCOW
V. L. Sklyarov *in its* Meteorology and Hydrol., No. 6, Jun. 1973 (JPRS-59962) 5 Sep. 1973 p 87-93 Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 6, Jun. 1973 p 93-96

A study was made of the basic principles of the planning of the development and the technical reconstruction of the meteorological network in the territory of Moscow and Moscow Oblast as applied to the problems of mesometeorology. Author

N73-31594# Argonne National Lab., Ill. Center for Environmental Studies.
AN AIR POLLUTION IMPACT METHODOLOGY FOR AIRPORTS, PHASE 1 Final Report
J. E. Norco, R. R. Cirillo, T. E. Baldwin, and J. W. Gudenas Jan. 1973 309 p refs
(Contract EPA-IAG-0171(D))
(PB-220987/2; ANL/ES-22; APTD-7470) Avail: NTIS HC $9.00 CSCL 13B

It has been demonstrated that large airports have a direct impact on environmental quality as a result of aircraft operation and an indirect impact by providing a focal point for urban development and industrialization. This report addresses the air pollution impact of an airport and its environs. A methodology is presented for integrating the air pollution impact of an airport and its associated ground-support activities with that of the induced urban development in its vicinity, to provide a quantitative basis for decisions related to airport site selection and for the development of land surrounding the site. Procedures for estimating airport-related air pollutant emissions are defined. The flexible impact methodology is achieved through a general protocol for identifying, isolating and quantifying an array of airport related and urban activities which provide environmental insults. The procedures are general and applicable to either existing or proposed airport facilities. It was developed and field tested using data from the proposed St. Louis Airport at Waterloo/Columbia, Illinois, from the Chicago O'Hare International Airport and from several other existing facilities. Author

N73-31602# Ohio Univ., Athens. Avionics Engineering Center.
SNOW EFFECTS ON IMAGE GLIDE PATH SYSTEMS, WINTER OF 1971-1972 Final Report
Jack B. Morehart, Richard H. McFarland, and David C. Hildebrand Jul. 1972 19 p refs
(Contract DOT-FA69WA-2066)
(FAA-RD-72-85) Avail: NTIS HC $3.00

Results of tests to determine the effect of snow on image glide path systems are presented. Effects on three systems, capture effect, null reference, and sideband reference are discussed in terms of change in the far-field signal characteristics. Data include; (1) far-field signals such as received in the aircraft,(2) conventional near-field monitor signals,(3) analog, integral-monitor signals, and (4) trends of the signals as a function of environmental condition. The primary conclusions are that new snow depths less than eight inches do not generally cause a change in the path but a change in the snow surface condition such as during a thaw tends to make the path move upward as if the ground plane were simply elevated. The conclusions agree with theoretical predictions. Author

N73-31603# Federal Aviation Administration, Washington, D.C.
EVALUATION OF A TERRAIN PROXIMITY WARNING SYSTEM (DOWNWARD LOOKING RADAR) FOR POSSIBLE ENHANCEMENT OF FLIGHT SAFETY Interim Report, Mar. - May 1973
Jack J. Shrager Aug. 1973 26 p refs
(FAA Proj. 076-311-000)
(FAA-RD-73-134) Avail: NTIS HC $3.50

A review of all literature and available test results of an airborne independent altitude monitor based on radio altitude information was undertaken. Results indicated that limited flight safety enhancement is attainable by use of such a device. Author

N73-31605# National Aviation Facilities Experimental Center, Atlantic City, N.J.

THE 1972 LOS ANGELES BASIN STANDARD AIR TRAFFIC MODEL Final Report
Francis M. Willett, Jr. Sep. 1973 53 p refs
(FAA Proj. 013-601-010)
(FAA-NA-73-51; FAA-RD-73-90) Avail: NTIS HC $4.75

The methodology used in the construction of a three dimensional aircraft movement operating in the Los Angeles Basin area is described. From data obtained, the Los Angeles Basin air traffic model of 1972 was constructed. The model contains approximately 80-percent VFR flight operations, and represents a particular time period of nonpeak operations which occurred during a 3 hour period on 20 August 1972. The purpose of the traffic sample is to develop a standard model to test future air traffic systems and equipment. Since most air traffic operation models are generally made from IFR-controlled operations, this is the first of a series of air traffic models that include both IFR and VFR operations. Author

N73-31606# Meta Systems, Inc., Santa Clara, Calif.
POTENTIAL CONFLICT PREDICTION AND ASSOCIATED FUNCTIONS FOR OCEANIC AIR TRAFFIC CONTROL AUTOMATION Final Report, Mar. 1972 - May 1973
Frank V. Giallanza, Charles P. Giallanza, and James C. Brown May 1973 56 p
(Contract DOT-FA72WA-2851)
(FAA-RD-73-73) Avail: NTIS HC $5.00

Algorithms to determine potential conflicts over an oceanic airspace based on given vertical, lateral, and longitudinal separation criteria were developed. Additional algorithms to handle special cases have yet to be developed. Associated functions used by air traffic controllers to resolve conflict situations are also described. Author

N73-31607# System Development Corp., Santa Monica, Calif.
SOUTHERN CALIFORNIA REGIONAL AVIATION SYSTEM STUDY Summary Report
1972 23 p Presented to the SCAG Airport Study Authority, Los Angeles, 19 July 1972 Supplement to the Final Report and Final Technical Document Sponsored in part by FAA and HUD Prepared jointly by the System Develop. Corp. and by Pereira (William L.) Associates for the Southern Calif. Assoc. of Govt. Aviation Study Authority
Avail: NTIS HC $3.25

A study of the Southern California regional aviation system was conducted. The study was aimed at delineating the broad areas and linkages that reveal the interactions between the air transportation system and the life styles, socioeconomic structure, and total environment. One objective was to provide broad planning guidance in the development of plans, policies, standards, and strategies for the future of aviation on a national wide basis. The study indicates the need for a national system of global airports to cope with future requirements. Author

N73-31623*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN IMPROVED METHOD FOR DESIGN OF EXPANSION-CHAMBER MUFFLERS WITH APPLICATION TO AN OPERATIONAL HELICOPTER
Tony L. Parrott Washington Oct. 1973 73 p refs
(NASA-TN-D-7309; L-8888) Avail: NTIS HC $3.50 CSCL 20A

An improved method for the design of expansion-chamber mufflers is described and applied to the task of reducing exhaust noise generated by a helicopter. The method is an improvement of standard transmission-line theory in that it accounts for the effect of the mean exhaust-gas flow on the acoustic-transmission properties of a muffler system, including the termination boundary condition. The method has been computerized, and the computer program includes an optimization procedure that adjusts muffler component lengths to achieve a minimum specified desired transmission loss over a specified frequency range. A printout of the program is included together with a user-oriented description. Author

N73-31625*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INVESTIGATION OF THE EFFECT OF INLET TURBULENCE LENGTH SCALE ON FAN DISCRETE TONE NOISE
Brent K. Hodder Sep. 1973 13 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62300) Avail: NTIS HC $3.00 CSCL 20A

Results of an experimental investigation at the Ames 40- by 80-Foot Wind Tunnel of fan rotor alone discrete tone noise is presented. The investigation examines rotor interaction with fan inlet turbulence. The importance of turbulence length scale is shown by comparing the fan radiated acoustic spectrum with and without modified turbulence length scales. A small-scale low pressure ratio fan was used for the experiment. Author

N73-31629# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
COMPARATIVE STUDIES OF THE SUPERSONIC JET NOISE GENERATED BY RECTANGULAR AND AXISYMMETRIC NOZZLES Final Report, Oct. 1971 - Dec. 1972
Khoon Cheang Low and Jean F. Louis Jun. 1973 119 p refs
(Contract DOT-TSC-142)
(PB-221855/0; DOT-TSC-OST-73-22) Avail: NTIS HC $3.00 CSCL 20A

The main purpose of the study is to develop experimental scaling laws useful for predicting the overall sound power of supersonic jets operating under a range of high stagnation temperatures and pressures and under various exit Mach numbers. A shock tube is used as a flexible tool to provide the range of high stagnation temperatures and pressures involved. Two different nozzle configurations are examined to determine how a basic difference in shape of the jet changes the relative importance of the different noise generating mechanisms. Concurrent use of a theoretical model and experimental data allows the formulation of scaling laws for the overall sound power. GRA

N73-31689# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
OPTIMIZATION OF C3 AND C4 OLEFIN OLIGOMER SUPERSONIC FUELS BY n-PARAFFINS [OPTIMIERUNG VON UEBERSCHALLKRAFTSTOFFEN AUS OLIGOMERISATEN VON C3- UND C4- OLEFINEN DURCH n-PARAFFINE]
Robert Erlmeier 17 Jan. 1973 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-32) Avail: NTIS HC $3.75; DFVLR, Porz, West Ger. 11.50 DM

Fuels from completely hydrogenated low molecular C3/C4 olefin polymers are suitable as supersonic fuels due to their high stability, but in general, their low temperature viscosities and vapor pressures exceed limitations. The optimization of C3/C4-polymer fuels by straight chain hydrocarbons containing 10 to 16 carbon atoms is discussed. The influence of n-paraffins on the freezing point, low temperature viscosity, vapor pressure, energy content, and combustion characteristics of four polymer fuels were investigated. Low temperature viscosity, vapor pressure and luminometer number can be optimized on account of the freezing point to such an extent that they meet current maximum requirements for Mach 3 conditions. Author (ESRO)

N73-31691# Naval Postgraduate School, Monterey, Calif.
INTERNAL BALLISTICS OF SOLID FUEL RAMJETS M.S. Thesis
Lowell David Boaz Mar. 1973 97 p refs
(AD-764491) Avail: NTIS CSCL 21/4

An experimental investigation of the internal ballistics of solid fuel ramjets was conducted in order to determine the regression rate of the fuel as a function of chamber pressure, inlet air temperature, and air flux rate, and to model the flow in solid fuel ramjets which use sudden expansion flame-holders at the

inlet. In addition, flame stabilization limits were investigated. A computer solution for the non-reacting flow field gave results in good agreement with experiments. (Modified author abstract) GRA

N73-31693# Esso Research and Engineering Co., Linden, N.J.
EVALUATION OF THE HAZARD OF STATIC ELECTRICITY IN NONMETALLIC POL SYSTEMS-STATIC EFFECTS IN HANDLING JET FUEL IN FIBERGLASS REINFORCED PLASTIC PIPE Technical Report, Jun. 1971 - Jun. 1972
Kenneth C. Bachman and J. C. Munday Kirtland AFB, N. Mex. AFWL Jun. 1973 218 p refs
(Contract F29601-71-C-0071)
(AD-764358; RL-4PD-72; AFWL-TR-72-90) Avail: NTIS CSCL 21/4

There is an increasing interest in fiberglass reinforced plastic (FRP) pipe for minimizing contamination in ground handling of aviation fuels. The report presents the results of a literature search and experimental study conducted to determine if static electricity hazards would be increased by substituting FRP for metal pipe in such systems. Experiments were conducted in 6 inch diameter, matched volume, carbon steel and Bondstrand 2000 pipes at four fuel conductivities between 0.2 and 5.5 CU and at flow rates between 200 and 1500 GPM at controlled temperatures. Charge generation in the pipes was low; generation in FRP was generally less than in steel. Relaxation in FRP pipe depended on fuel polarity; on the average, relaxation was 8 percent faster, with negatively-charged fuel and 30 percent slower with positively-charged fuel than in steel. (Modified author abstract) GRA

N73-31698*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL STUDY OF ROTATING STALL IN HIGH-PRESSURE STAGES OF AN AXIAL FLOW COMPRESSOR
V. S. Beknev, A. V. *Zemlyanskiy, and R. Z. Tumashev Washington* NASA Sep. 1973 10 p refs Transl. into ENGLISH from Mashinostr. (Moscow), no. 8, 1970 p 116-122
(Contract NASw-2485)
(NASA-TT-F-15115) Avail: NTIS HC $3.00 CSCL 21E

An experimental study of rotating stall in axial-flow compressor stages with different types of profiling along the blade height and with different calculated regimes of flow past a profile in the cascade was conducted. It is found that, in spite of the different safety margins with respect to boundary layer separation in the cascades of the different stages, their boundaries of stable operation are almost the same. It is shown that profiling taking into account end effects has a stabilizing influence and leads to a smoother transition to the rotating stall regime. The flow in rotating stall zones is shown to be of three-dimensional nature. It is shown that this three-dimensional structure can be detected with the aid of straight and L-shaped tensoanemometer probes. Author

N73-31699*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DUAL CYCLE AIRCRAFT TURBINE ENGINE Patent Application
Mark R. Nichols, inventor (to NASA) Filed 6 Sep. 1973 16 p
(NASA-Case-LAR-11310-1; US-Patent-Appl-SN-394898) Avail: NTIS HC $3.00 CSCL 21E

A method and apparatus applicable to jet engines is presented for improving operating efficiency over broad ranges of flight conditions and for reducing engine noise output in take-off and landing by controlling the airflow entering and exiting the engines. A turbojet engine apparatus is described which operates efficiently at both subsonic and supersonic speeds and a method is described which enables a turbofan with an associated satellite turbojet or turbofan to operate more efficiently at both subsonic and supersonic speeds. In both cases, take-off and landing noise is reduced substantially. The apparatus consists essentially of arranging for two separate portions of an engine to act upon one airstream or, alternately, to operate on independent airstreams. NASA

N73-31704# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
COMPRESSOR STALL ANTICIPATION Final Report, Jan. 1972 - Mar. 1973
Stephen B. Tucker Mar. 1973 82 p refs
(Contract F33615-72-C-1886; AF Proj. 0100; AF Proj. 3066) (AD-763816; R73AEG159; AFAPL-TR-73-53) Avail: NTIS CSCL 21/5

The report describes a program whose objective was to continue to investigate compressor parameters during pre-stall conditions and to expand the analytical predictability of these parameters. The performance parameters (delta P/P and delta P/Q) were analyzed on a steady state basis whereas the high frequency pressure data were analyzed by spectral and broadband noise analysis techniques. The results obtained from the data were limited somewhat due to intermittent failures in the high response sensors but the dalta P/Q parameter as analyzed by Wright-Patterson Air Force Base shows significant promise as a stall anticipation signal. (Modified author abstract) GRA

N73-31726*# North American Rockwell Corp., Downey, Calif. Space Div.
SAFETY IN EARTH ORBIT STUDY Final Report (contract summary)
12 Jul. 1972 26 p refs
(Contract NAS9-12004)
(NASA-CR-134023; SD-72-SA-0095; MSC-04478) Avail: NTIS HC $3.50 CSCL 22C

Safety aspects are studied of the space shuttle orbiter, the shuttle payloads, and space stations in earth orbital operations. The tasks generated safety requirements, guidelines, recommendations, and conceptual safety devices. The tasks studied were: hazardous payloads, docking, onboard survivability tumbling spacecraft, and escape and rescue operations. T.M.R.

N73-31729*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY OF AIRBORNE SCIENCE EXPERIMENT MANAGEMENT CONCEPTS FOR APPLICATION TO SPACE SHUTTLE, VOLUME 2
Donald R. Mulholland, John O. Reller, Jr., Carr B. Neel, and Louis C. Haughney Jul. 1973 132 p refs
(NASA-TM-X-62287) Avail: NTIS HC $8.75 CSCL 22A

Airborne research management and shuttle sortie planning at the Ames Research Center are reported. Topics discussed include: basic criteria and procedures for the formulation and approval of airborne missions; ASO management structure and procedures; experiment design, development, and testing aircraft characteristics and experiment interfaces; information handling for airborne science missions; mission documentation requirements; and airborne science methods and shuttle sortie planning. F.O.S.

N73-31800# Federal Aviation Administration, Washington, D.C.
A POTENTIAL DESIGN WINDOW FOR SUPERSONIC OVERFLIGHT BASED ON THE PERCEIVED LEVEL (PLdB) AND GLASS DAMAGE PROBABILITY OF SONIC BOOMS Final Report
Thomas H. Higgins and Larry K. Carpenter Aug. 1973 27 p refs
(FAA-RD-73-116) Avail: NTIS HC $3.50

A potential design window for supersonic overflight based on the perceived level (PLdB) and glass damage probability of sonic booms is outlined. The evaluation of a simple operational method of estimating the perceived level (PLdB) of sonic booms is discussed and compared with the Fourier transform computer program calculations of Pease based on the theory of Zepler and Harel. The resulting estimated perceived levels are in good agreement i.e., within 1 to 2 PLdB of each other in the important potential certification or design window that is in the 90 to 100 PLdB range. These perceived levels are shown to be acceptable to 95 to 100 percent of the people exposed to them. Author

N73-31808# Technische Univ., Berlin (West Germany). Inst. fuer Raumfahrttechnik.
VIBRATIONS OF CYLINDRICALLY CURVED SANDWICH SHELLS, WITH FLEXIBLE SUPPORTS AND RIGID CLAMPING, AT RESONANCE AND UNDER ACOUSTIC LOADS [SCHWINGUNGEN ZYLINDRISCH GEKRUEMMTER GELENKIG GELAGERTER UND FEST EINGESPANNTER SANDWICHSCHALEN BEI RESONANZ UND UNTER SCHALLBELASTUNG]
H. K. Petrick Dec. 1972 70 p refs In GERMAN; ENGLISH summary
(TUB-IR-1972/2) Avail: NTIS HC $5.50

The vibration of a cylindrically curved sandwich shell was analyzed by two methods: the approximate solution of the differential equations and the energy method. Beam functions for the mode shapes were applied not only to the flexibly supported but also to the fixed edges of the shell. By solving the set of linear equations, the frequencies of vibration and the ratios of the deflection and stress amplitudes were computed for the sandwich shell, strip, and cylinder. The analysis of the shell's response to random pressure fields is demonstrated. From this, it is then possible to calculate the spectral expressions of deflection, acceleration, and stress at arbitrary shell coordinates. ESRO

N73-31828*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL STUDY OF SUPERSONIC COMBUSTION OF HYDROGEN IN A VITIATED AIRSTREAM
Marshall C. Burrows and Anatole P. Kurkov Washington Sep. 1973 25 p refs
(NASA-TM-X-2828; E-6319) Avail: NTIS HC $2.75 CSCL 21B

Detailed probe measurements of total temperature, pressure, and composition were taken in a two-dimensional test section 35.6 cm downstream of hydrogen injection. A high pressure gas generator supplied Mach 2.44 vitiated air or inert gas at elevated temperatures and at a static pressure equal to that of the hydrogen. Special water-cooled probes and sampling techniques were developed for the short test times required by heat-sink hardware. Independent methods of measuring stream total temperatures are compared. For the pure mixing case, the computed composition profile agreed well with the experimental profile. The analysis takes into account the wall boundary layer and the initial boundary layer in the main stream. Ignition of hydrogen, as determined from photographic exposures of the radiating gases, varied from 30 to 10 cm downstream from injection for a 45 K increase in local free-stream static temperature. Author

N73-31830# Advisory Group for Aerospace Research and Development, Paris (France).
GAS SAMPLING AND ANALYSIS IN COMBUSTION PHENOMENA
G. Lengelle (ONERA, Paris) and C. Verdier (ONERA, Paris) Jul. 1973 185 p refs
(AGARD-AG-168; AGARDOGRAPH-168) Avail: NTIS HC $11.25

The application of gas analysis techniques to determine combustion efficiency in turbine engines and rocket engine combustion chambers is discussed. The fundamental data for combustion kinetics in a perfectly stirred reactor and in premixed laminar flames are reported. Various methods of gas analysis using gas phase chromatography, mass spectrometry, absorption of electromagnetic, absorption of electromagnetic radiations, and physicochemical methods of flow-through analysis are explained. Author

N73-31846# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A STUDY OF THE DECOMPOSITION PRODUCTS OF POLYURETHANE FOAM RELATED TO AIRCRAFT CABIN FLASH FIRES Final Report, Mar. 1971 - Jun. 1972
Maya Paabo and J. J. Comeford Jul. 1973 41 p refs
(Contract DOT-FA67NF-AP-21)
(AD-763327; FAA-NA-73-69; FAA-RD-73-46) Avail: NTIS CSCL 07/4

A laboratory model of a flash fire cell using a high voltage arc as an ignition source was assembled and tested. The cell is designed to pyrolyze the sample in air while measuring the time of onset of a flash fire and simultaneously allowing withdrawal of gas samples for analysis. Some of the low molecular weight products produced from the pyrolysis of flexible polyether type urethane foams were identified. The flash fire cell was used to compare the flash fire potential of polymers of potential interest to the aircraft industry. Studies of the role of smoke in flash fire produced in the pyrolysis of flexible urethanes were undertaken. Flash fires in the cell were recorded on 16 mm motion picture film. Author (GRA)

N73-31853# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 APRIL - 30 JUNE 1973
30 Jun. 1973 112 p refs
(DME/NAE-1973(2)) Avail: NTIS $7.75

Research progress in sleep deprivation effects on accuracy and speed of response, airborne simulator feel system, and bed forms generated by wave action is presented. Experience with the NRC 10 ft x 20 ft V/STOL propulsion tunnel used for testing V/STOL engine models is also reviewed.

N73-31857 National Research Council of Canada, Ottawa (Ontario). Gas Dynamics Lab.
EXPERIENCE WITH THE NRC 10 FT x 20 FT V/STOL PROPULSION TUNNEL, SOME PRACTICAL ASPECTS OF V/STOL ENGINE MODEL TESTING c11
R. A. Tyler and R. G. Williamson *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 30 Jun. 1973 p 34-59 refs

This research facility, designed specifically for the investigation of problems relating to V/STOL engine systems, was first operated in December 1962. Representative experimental programs carried out in the tunnel since that time are used to illustrate general problem areas associated with the testing of high powered models. Author

N73-31900* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATIONS, OVERVIEW
William Nordberg *In its* Significant Accomplishments in Sci 1973 p 161-177 (For availability see N73-31867 22-34)
CSCL 08E

An overview is given of research and development activities at the Laboratory for Meteorology and Earth Sciences. Highlights of satellite techniques in earth observation missions and projects are outlined, as are remote sensing methods by aircraft overflights; most noteworthy among these is the development of multispectral scanners that monitor both the reflected infrared solar radiation and the emitted terrestrial radiation. The application of observations to the survey of environmental conditions and resource management is emphasized. G.G.

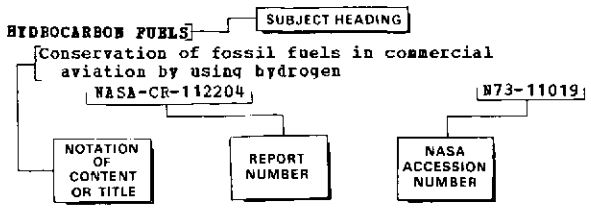
N73-31915# National Aerospace Lab., Amsterdam (Netherlands).
THE FUTURE OF SHORT-HAUL AIR TRANSPORT WITHIN WESTERN EUROPE
Jun. 1973 69 p refs
(SP-73-001) Avail: NTIS HC $5.50

The potential growth of air transport in Western Europe is

assessed in terms of the serious problems which may be associated with conventional takeoff and landing characteristics of existing aircraft. The technologies and prospects for applications are discussed, and it is concluded that short-haul jet aircraft with reduced takeoff and landing distances offers the best compromise for relieving the noise and congestion problems and the economic penalties involved. Several recommendations are given, primarily related to alleviating the problems of the present air traffic system, and the introduction of new aircraft categories. Author

SUBJECT INDEX

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The Notation of Content (NOC), rather than the title of the document, is usually used to provide a more exact description of the subject matter. (In some cases *AIAA uses the title in lieu of an NOC.) The report number helps to indicate the* type of document cited (e.g., NASA report, translation, NASA contractor report). The accession number is located beneath and to the right of the Notation of Content, e.g., N73-11019. Under any one subject heading, the accession numbers are arranged in sequence with the *IAA* accession numbers appearing first.

A

A-300 AIRCRAFT
The aerodynamic development of the wing of the A 300B.
A73-41192

ACCELEROMETERS
Elastic deformation of gimbal suspension on gyroscope nutation, moments acting on spherical rotor in magnetic suspension, and differentiating linear accelerometer
[JPRS-59740] N73-30420

ACCIDENT PREVENTION
Design and analysis of an energy absorbing restraint system for light aircraft crash-impact.
[ASME PAPER 73-DET-111] A73-42080
Reducing approach and landing accidents.
A73-42523
Objectives, scope of work, and funding requirements of research project for improvement of aircraft safety
[FAA-ED-18-1] N73-30008

ACOUSTIC ATTENUATION
Attenuation of spiral modes in a circular and annular lined duct.
A73-41714

ACOUSTIC DUCTS
Attenuation of spiral modes in a circular and annular lined duct.
A73-41714
Rolls-Royce RB-211 jet engine noise reduction program, considering fan, compressor, turbine and tailpipe noise and acoustic linings and powerplant configurations
A73-41717
Shear layer effect on acoustic duct wall impedance for sound propagation in uniform flow in terms of parabolic cylinder functions
A73-43138

ACOUSTIC EXCITATION
German monograph - Lifetime detection in the case of acoustically loaded structures on the basis of the appropriate form of vibration.
A73-42741

ACOUSTIC IMPEDANCE
Shear layer effect on acoustic duct wall impedance for sound propagation in uniform flow in terms of parabolic cylinder functions
A73-43138

ACOUSTIC MEASUREMENTS
The design and construction of an anechoic chamber lined with panels and intended for investigation of aerodynamic noise
A73-40942
Sonic bang investigations associated with the Concorde's test flying.
A73-41174
Technical progress on new vibration and acoustic tests for proposed MIL-STD-810C, 'environmental test methods.'
A73-41200
Basic acoustic considerations for model noise experiments in wind-tunnels.
A73-41705
Perceived noise level ratings for helicopter noise, discussing blade slap, tail rotor whine, broadband noise and PNL rating shortcomings
A73-41708
Atmospheric absorption considerations in airplane flyover noise at altitudes above sea level.
A73-42943
Helicopter noise experiments in an urban environment.
A73-42944
Runway sideline aircraft noise measurements on takeoff and approach for enforcing community noise levels based on FAA aircraft type certification, noting associated problems
A73-42945
Community noise impact study from military helicopter operations.
A73-42947
Analysis of fan noise levels for fan in proximity of side and ground plane to determine effects on harmonic frequencies
[NASA-CR-132306] N73-30023
Measurements of aerodynamic noise produced by modified and standard OH-6A helicopter configurations to determine noise reduction effectiveness
[NASA-TN-D-7216] N73-30031
Aero and acoustic design features of single stage fans tested in outdoor acoustic facility
[NASA-TM-X-68289] N73-30668
Analysis of aircraft engine noise sources and characteristics of engine noise produced by turbofan engines
N73-30735
Aerodynamic noise and flow field characteristics of internal flow, jet augmented flap configurations
N73-30937
Reduction of aircraft noise by installing acoustically absorbent material
[NASA-CR-2261] N73-30941

ACOUSTIC PROPERTIES
Analysis of discrete frequency and broad band noise generation by subsonic rotary wings for vertical takeoff aircraft
[NASA-CR-2077] N73-30014
Analysis of acoustic properties and aerodynamic characteristics of engine over wing configuration with flow attached and unattached on upper surface of flaps
[NASA-TM-X-71419] N73-30015
Analysis of fan noise levels for fan in proximity of side and ground plane to determine effects on harmonic frequencies
[NASA-CR-132306] N73-30023
Analysis of noise problems created by supersonic transport aircraft, conventional aircraft, and short takeoff aircraft to show methods for jet exhaust noise reduction
N73-30024

B

C

D

E

F

G

H

J

K

L

M

N

O

P

Q

R

S

T

U

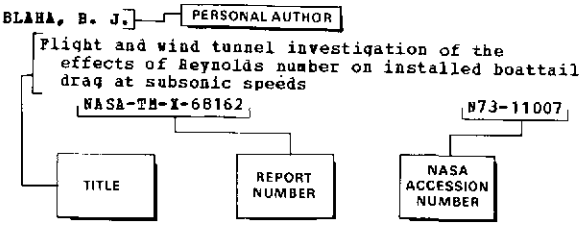
V

W

Y

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The accession number is located beneath and to the right of the title, e.g., N73-11007. Under any one author's name the accession numbers are arranged in sequence with the *IAA* accession numbers appearing first.

A

B

C

D

E

F

G

H

L

M

N

O

P

R

S

T

U

V

W

Y

Z

CONTRACT NUMBER INDEX

Typical Contract Number Index Listing

Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the IAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in either the *IAA* or *STAR* section.