NASA

Aeronautical Engineering
A Continuing Bibliography with Indexes

National Aeronautics and
Space Administration

Aeronautical Engineering Aeron
erin Aeronautical Engineering ing
ngi eering Aeronautical Engine
cal Engineering Aeronautical En
nautical Engineering Aeronauti
Aeronautical Engineering Aeron
ering Aeronautical Engineering
ngineering Aeronautical Engine
cal Engineering Aeronautical En
nautical Engineering Aeronauti
Aeronautical Engineering Aeror
ering Aeronautical Engineering

NASA SP-7037(145)

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY
WITH INDEXES

(Supplement 145)

A selection of annotated references to unclassified
reports and journal articles that were introduced into
the NASA scientific and technical information sys-
tem and announced in January 1982 in

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

INTRODUCTION

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

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 326 reports, journal articles, and other documents originally announced in January 1982 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*.

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

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

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

An annual cumulative index will be published.

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A82-10000 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 of accessions are available at $8.00 per document. Microfiche[1] of documents announced in *IAA* are available at the rate of $4.00 per microfiche on demand, and at the rate of $1.35 per microfiche for standing orders for all *IAA* microfiche.

Minimum air-mail postage to foreign countries is $2.50 and all foreign orders are shipped on payment of pro-forma invoices.

All inquiries and requests should be addressed to AIAA Technical Information Service. Please refer to the accession number when requesting publications.

STAR ENTRIES (N82-10000 Series)

One or more sources from which a document announced in *STAR* is available to the public is ordinarily given on the last line of the citation. The most commonly indicated sources and their acronyms or abbreviations are listed below. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source line.

Avail: NTIS. Sold by the National Technical Information Service. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code preceded by the letters HC or MF in the *STAR* citation. Current values for the price codes are given in the tables on page vii.

Documents on microfiche are designated by a pound sign (#) following the accession number. The pound sign is used without regard to the source or quality of the microfiche.

Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) is available at greatly reduced unit prices. For this service and for information concerning subscription to NASA printed reports, consult the NTIS Subscription Section, Springfield, Va. 22161.

NOTE ON ORDERING DOCUMENTS: When ordering NASA publications (those followed by the * symbol), use the N accession number. NASA patent applications (only the specifications are offered) should be ordered by the US-Patent-Appl-SN number. Non-NASA publications (no asterisk) should be ordered by the AD, PB, or other *report* number shown on the last line of the citation, not by the N accession number. It is also advisable to cite the title and other bibliographic identification.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The current price and order number are given following the availability line. (NTIS will fill microfiche requests, at the standard $4.00 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 Document 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 NASA Space Technology Laboratories, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

(1) A microfiche is a transparent sheet of film. 105 by 148 mm in size containing as many as 60 to 98 pages of information reduced to micro images (not to exceed 26.1 reduction).

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in *Energy Research Abstracts.* Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center - Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE 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) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this introduction. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

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 and mailing 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 the BLL.)

Avail: Fachinformationszentrum, Karlsruhe. Sold by the Fachinformationszentrum Energie, Physik, Mathematik GMBH, Eggenstein Leopoldshafen, 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 and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of 50 cents 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.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics and
    Astronautics
Technical Information Service
555 West 57th Street, 12th Floor
New York, New York 10019

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

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

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

ESA-Information Retrieval Service
ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

Fachinformationszentrum Energie, Physik,
    Mathematik GMBH
7514 Eggenstein Leopoldshafen
Federal Republic of Germany

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

NASA Scientific and Technical Information
    Facility
P.O. Box 8757
B.W.I. Airport; Maryland 21240

National Aeronautics and Space
    Administration
Scientific and Technical Information
    Branch (NST-41)
Washington, D.C. 20546

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

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

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

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

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey
1033 General Services Administration
    Building
Washington, D.C. 20242

U.S. Geological Survey
601 E. Cedar Avenue
Flagstaff, Arizona 86002

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

U.S. Geological Survey
Bldg. 25, Denver Federal Center
Denver, Colorado 80225

NTIS PRICE SCHEDULES

Schedule A
STANDARD PAPER COPY PRICE SCHEDULE

(Effective January 1, 1982)

Price Code	Page Range	North American Price	Foreign Price
A01	Microfiche	$ 4.00	$ 8.00
A02	001-025	6.00	12.00
A03	026-050	7.50	15.00
A04	051-075	9.00	18.00
A05	076-100	10.50	21.00
A06	101-125	12.00	24.00
A07	126-150	13.50	27.00
A08	151-175	15.00	30.00
A09	176-200	16.50	33.00
A10	201-225	18.00	36.00
A11	226-250	19.50	39.00
A12	251-275	21.00	42.00
A13	276-300	22.50	45.00
A14	301-325	24.00	48.00
A15	326-350	25.50	51.00
A16	351-375	27.00	54.00
A17	376-400	28.50	57.00
A18	401-425	30.00	60.00
A19	426-450	31.50	63.00
A20	451-475	33.00	66.00
A21	476-500	34.50	69.00
A22	501-525	36.00	72.00
A23	526-550	37.50	75.00
A24	551-575	39.00	78.00
A25	576-600	40.50	81.00
	601-up	-- 1/	-- 2/

A99 - Write for quote

1/   Add $1.50 for each additional 25 page increment or portion thereof for 601 pages up.

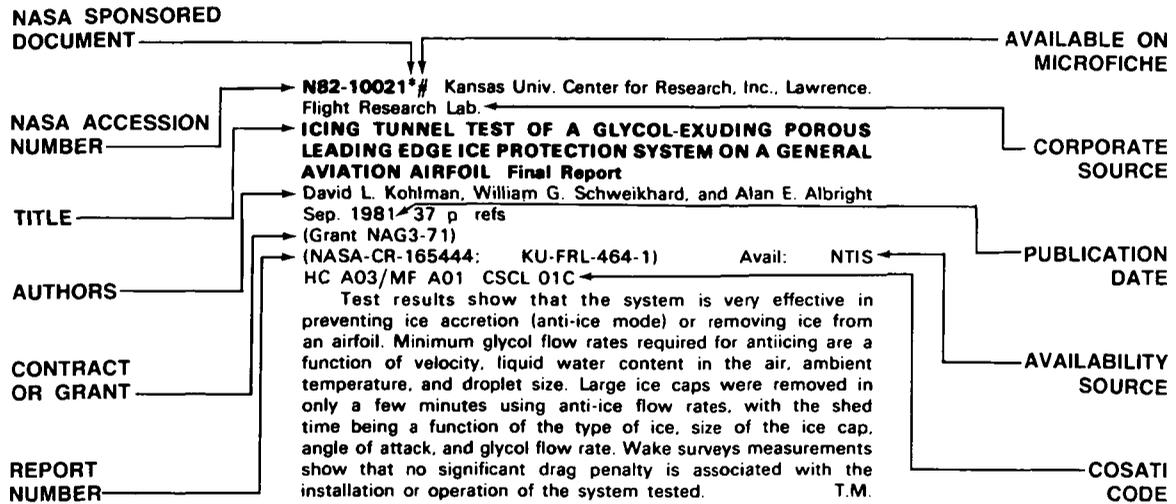2/   Add $3.00 for each additional 25 page increment or portion thereof for 601 pages and more.

Schedule E
EXCEPTION PRICE SCHEDULE
Paper Copy & Microfiche

Price Code	North American Price	Foreign Price
E01	$ 6.50	$ 13.50
E02	7.50	15.50
E03	9.50	19.50
E04	11.50	23.50
E05	13.50	27.50
E06	15.50	31.50
E07	17.50	35.50
E08	19.50	39.50
E09	21.50	43.50
E10	23.50	47.50
E11	25.50	51.50
E12	28.50	57.50
E13	31.50	63.50
E14	34.50	69.50
E15	37.50	75.50
E16	40.50	81.50
E17	43.50	88.50
E18	46.50	93.50
E19	51.50	102.50
E20	61.50	123.50

E-99 - Write for quote

| N01 | 30.00¹ | 45.00 |

TABLE OF CONTENTS

TYPICAL CITATION AND ABSTRACT FROM *STAR*

NASA SPONSORED
DOCUMENT ─── AVAILABLE ON
MICROFICHE

NASA ACCESSION NUMBER ──→ N82-10021*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab. ◄
──→ ICING TUNNEL TEST OF A GLYCOL-EXUDING POROUS LEADING EDGE ICE PROTECTION SYSTEM ON A GENERAL AVIATION AIRFOIL Final Report ───── CORPORATE SOURCE

TITLE ──→ David L. Kohlman, William G. Schweikhard, and Alan E. Albright
Sep. 1981 37 p refs
──→ (Grant NAG3-71)

AUTHORS ──→ (NASA-CR-165444; KU-FRL-464-1) Avail: NTIS ◄ ─── PUBLICATION DATE
HC A03/MF A01 CSCL 01C ◄

CONTRACT OR GRANT ─── Test results show that the system is very effective in preventing ice accretion (anti-ice mode) or removing ice from an airfoil. Minimum glycol flow rates required for antiicing are a function of velocity, liquid water content in the air, ambient temperature, and droplet size. Large ice caps were removed in only a few minutes using anti-ice flow rates, with the shed time being a function of the type of ice, size of the ice cap, angle of attack, and glycol flow rate. Wake surveys measurements ─── AVAILABILITY SOURCE

REPORT NUMBER ─── show that no significant drag penalty is associated with the installation or operation of the system tested. T.M. ─── COSATI CODE

TYPICAL CITATION AND ABSTRACT FROM *IAA*

AIAA ACCESSION NUMBER ──→ A82-11317 # Development of aircraft production engineer- ◄ ─── AVAILABLE ON MICROFICHE
ing discipline at IIT, Bombay. N. K. Naik (Indian Institute of ◄
Technology, Bombay, India). Aeronautical Society of India, Journal, ─── TITLE
vol. 31, Feb.-Nov. 1979, p. 119-125.

AUTHOR ──┘ The aircraft production engineering courses offered at the Indian Institute of Technology, in Bombay, are discussed. To demonstrate the value of the courses, the fundamentals of aircraft production are outlined, the discussion being confined to airframe ─── AUTHOR'S AFFILIATION
production. The loft-template method is described, and the principal loft-template scheme used in aircraft production is shown. Also

TITLE OF PERIODICAL ─── described are the theory and laboratory courses offered at the institute. C.R. ─── PUBLICATION DATE

IAA ENTRIES

A82-10049 **Three navigation systems and their costs of acquiring remote sensing data.** D. L. Hawley (EG & G, Inc., Las Vegas, NV). In: American Society of Photogrammetry, Annual Meeting, 46th, St. Louis, MO, March 9-14, 1980, ASP Technical Papers. Falls Church, VA, American Society of Photogrammetry, 1980, p. 426-431.

Three types of navigational systems have been analyzed and evaluated as to their capabilities for data acquisition. Two basic systems, visual navigation and strobe-aided navigation, are useful for daylight photographic flights. One additional system, more technical, is the microwave ranging system, crucial to the acquisition of multiple nighttime scanner data flights. These systems have been analyzed as to their capabilities and costs. A table of mission requirements and navigation techniques is presented. These types of studies are not unique, however in this paper, the information is presented in a comparison unique to the equipment involved. This comparison is presented relating the cost of the navigation systems and the costs of their use. The result is a time and dollar comparison of these navigation systems. (Author)

A82-10081 # **KC-135 Avionics Modernization Hot Bench.** J. L. Archdeacon and C. E. Wilent (TRW Defense and Space Systems Group, Dayton, OH). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 32-40. 10 refs. Contract No. F33600-80-C-0473. (AIAA 81-2105)

The U.S. Air Force has embarked upon an avionics update program for the KC-135 Stratotanker fleet. An overview is provided of the KC-135 Avionics Modernization Hot Bench (AMHB). The objective of the AMHB is to support conceptual definition of a representative KC-135 modernized avionics system. The KC-135 AMHB consists of the Modernization Avionics Suite (MAS), Environmental Systems Simulation (ESS), and the Hot Bench Monitor (HBM). Attention is given to actual avionics hardware, simulated avionic subsystems, avionic application tasks, system control, cockpit device management, guidance and performance management, flight plan management, backup control, and hot bench performance monitoring. The navigation system is also considered. TACAN, Doppler, and Digital Scan Converter data are preprocessed and compared with INS data. G.R.

A82-10082 * # **HiMAT onboard flight computer system architecture and qualification.** A. F. Myers, M. R. Earls (NASA, Flight Research Center, Edwards, CA), and L. A. Callizo (Rockwell International Corp., Los Angeles, CA). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 41-54. (AIAA 81-2107)

Two highly maneuverable aircraft technology (HiMAT) remotely piloted research vehicles (RPRV's) are being flight tested at NASA Dryden Flight Research Center, Edwards, California, to demonstrate and evaluate a number of technological advances applicable to future fighter aircraft. Closed-loop primary flight control is performed from a ground-based cockpit utilizing a digital computer and up/down

telemetry links. A backup flight control system for emergency operation resides in one of two onboard computers. Other functions of the onboard computer system are uplink processing, downlink processing, engine control, failure detection, and redundancy management. This paper describes the architecture, functions, and flight qualification of the HiMAT onboard flight computer systems. (Author)

A82-10083 # **Synchronous fault-tolerant flight control systems.** T. B. Smith (Charles Stark Draper Laboratory, Inc., Cambridge, MA). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 55-60. 5 refs. (AIAA 81-2109)

Synchronous fault-tolerant systems have some unique advantages over asynchronous systems, particularly as the flight control task becomes more complex. One of the advantages is related to channel fault-detection. Asynchronous systems must rely upon setting fault thresholds for detecting computational failure within a channel. The design of the threshold can be a difficult problem. There is a rule that a fault must be present for a number of frames to be significant. These problems are largely avoided with synchronous systems, outputs are identical, and a single test of exact agreement is a perfect test. Noisy and skew effects which plague asynchronous fault detection have no effect. Other advantages of synchronous fault-tolerant systems are related to sensor fault-detection and multimode operation. Attention is given to the reasons for the present preponderance of asynchronous designs, and the use of tightly synchronized processing. G.R.

A82-10096 # **Integration of computer graphics design with analytical models.** R. J. Ricci (Lockheed-California Co., Burbank, CA). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 144-149. (AIAA 81-2134)

The development of Computer-Augmented Design and Manufacturing (CADAM), an interactive computer graphics system is discussed. The system is used throughout the design process from conceptual design through product support. In the conceptual design phase, basic three-view general arrangement drawings are developed. These can be quickly and accurately converted into a three-dimensional mathematical surface definition. From this information, analysis data models are generated semi-automatically for input to batch computing programs. Major areas where analysis modelers have been developed include: parametric mission analysis, aerodynamic drag modelers, structural finite element modelers, 1 g load and mass distribution modelers, fuel tank and volume analyzers, and weight and balance modelers. (Author)

A82-10100 # **The Space Shuttle vehicle checkout involving flight avionics software.** J. T. B. Mayer (Intermetrics, Inc., Cambridge, MA). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 173-178. (AIAA 81-2141)

A description is presented of the process employed in generating a vehicle test using the flight avionics software. The three types of onboard software available to the verification engineer include flight avionics software, vehicle utility software, and dynamic integrated test software. In most cases the flight software was modified to perform the desired functions in a manner devised by the test

engineer. Attention is given to vehicle test development, test verification, vehicle test execution, and vehicle test considerations. The reported investigation shows that it should be possible in future systems to control the cost of verification and checkout by designing the verification process in conjunction with the operational software. There are operational tradeoffs that can greatly reduce the costs of verification, which in the long run can reduce the total program cost.

G.R.

A82-10101 # **Bridging the gap from aircraft to space computers.** P. Mitchell and C. Vlcek (Itek Corp., Applied Technology Div., Sunnyvale, CA). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers.
New York, American Institute of Aeronautics and Astronautics, 1981, p. 179-186. 7 refs. (AIAA 81-2142)

This paper investigates the design problems associated with avionics and space computers, and identifies those which are common to both, versus those which are unique to a specific application. Based on historical developments and predictions of future needs, a plan is presented which resolves many of these problems and supports real-time technology insertion in a low cost, rapid deployment approach. A computer development program is described which utilizes a modular family of functional elements, allowing a wide variety of space and aircraft requirements to be met using common hardware. Continuing development activities have expanded this system architecture into a highly fault tolerant and flexible family of computers with incremental design steps depending heavily on existing qualified hardware and software elements.

(Author)

A82-10104 # **Airborne associative processor /ASPRO/.** T. DiGiacinto (Goodyear Aerospace Corp., Digital Technology Dept., Akron, OH). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers.
New York, American Institute of Aeronautics and Astronautics, 1981, p. 202-205. (AIAA 81-2145)

The ASPRO associative processor is designed for an airborne early warning radar surveillance, command and control application. It augments the existing data processors aboard a surveillance aircraft. The functional requirements of ASPRO call for extraordinary processing capacity for its volume, weight and power constraints (less than 1/2 cubic foot). ASPRO development was made feasible by designing the architecture to make use of available LSI components for arithmetic operations, addressing, program and interrupt control. The memory and parallel processing sections of ASPRO required development of two special components, a multi-chip memory package, and a custom 32-PE chip for the parallel processor.

(Author)

A82-10116 # **Controlling the software/hardware interface for the validation of avionics systems.** T. G. Lahn and E. R. Rang (Honeywell, Inc., Minneapolis, MN). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 283-287. (AIAA 81-2159)

A methodology is outlined for designing critical embedded avionics by exposing the hardware/software interface during the design and validation of the system. The proposed approach involves the development of a finite-state machine representation for the control of flow of the system's functions and implementation of the finite-state machine by hardware and software. This produces a complete structure that is easy to review and validate. The approach is demonstrated for a triply-redundant flight augmentation system.

V.L.

A82-10120 # **Automated Paint and Process Line /APPL/.** N. E. Manion (Lockheed-Georgia Co., Marietta, GA). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 319, 321, 323 (3 ff.). (AIAA 81-2166)

In an effort to control costs, the military and industry are pursuing ways to improve production efficiency by increasing the degree of automation of factory operated chemical processing and

painting facilities used in the fabrication of aircraft parts. These parts, and especially those of major weapon systems, are not, however, easily amenable to automation. Critical operations are automated by a five-level control hierarchy developed for a new Automated Paint and Process Line with advanced software which provides operating flexibility. A variety of part sizes and shapes are transformed into uniform handling units by special part holders. The chemical processing computer is programmed to handle ten loads of work simultaneously. A painting robot is programmed by painting a selected target with a spray gun attached to the arm of the manipulator with the robot in a 'teach' mode. Systems will be added later to automatically track shop orders and control chemical solutions.

J.F.

A82-10125 # **Use of Space Shuttle technology in conventional aircraft.** W. A. Ragsdale (Intermetrics, Inc., Houston, TX). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers.
New York, American Institute of Aeronautics and Astronautics, 1981, p. 358-361. 7 refs. (AIAA 81-2176)

A number of advances in the state-of-the-art for aircraft systems and procedures have been implemented in the Space Shuttle. Much of the new technology used would benefit conventional aircraft, especially airliners. Automatic systems management as employed for the Shuttle would simplify the task of flying an airliner. The pilot is given by the computer only the information he needs to know. The area navigation (RNAV) system used by the Space Shuttle is three-dimensional RNAV. It steers the Space Shuttle not only to a latitude and longitude, but to a specific altitude. The use of a four-dimensional RNAV, including also the monitoring of time, would provide additional advantages. A use of RNAV systems in aircraft makes possible savings in the consumption of fuel and leads to simplifications in air traffic control. Further reduction in fuel consumption can be obtained with the aid of energy management approaches. Additional advantages for aircraft operations can be obtained by the employment of the Microwave Landing System and digital fly-by-wire flight controls.

G.R.

A82-10126 # **A microprocessor-based data acquisition system for stall/spin research.** M. Sri-Jayantha and R. F. Stengel (Princeton University, Princeton, NJ). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 362-372. 25 refs. Research supported by the Shultz Foundation. (AIAA 81-2177)

Accurate data are necessary for the identification of aerodynamic parameters at high angle of attack and in spinning flight. Modern sensors and microelectronic devices are employed in a stall/spin data acquisition system that will be tested in a Schweizer 2-32 sailplane. This instrumentation package will use a quaternion-based 'strapdown IMU' algorithm to derive vehicle attitude from angular rate data, and it will use fault-detection logic to identify in-flight sensor failures. Details of the system and flight test program are presented, together with results of pre-flight digital simulation analysis.

(Author)

A82-10127 # **Real-time, on-line digital simulation of optimum maneuvers of supersonic aircraft.** C.-F. Lin (Applied Dynamics International, Ann Arbor, MI). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 373-381. (AIAA 81-2178)

This paper discusses real-time simulation of automatic guidance and control computer system of a supersonic fighter including a complete simulation of the mission computer and the flight control computer before connecting them as hardware in the loop. In this simulation the mission computer generates real-time, on-line optimal trajectories. These trajectories include maximum range glide and minimum time zoom climb. They are then tracked by the flight control computer. For this kind of simulation it is essential that the computational speed be very fast, thus a very fast computer with real-time, on-line capabilities is used for the simulation. Results of the simulation show that the mission computer is capable of generating online optimal trajectories much faster than real time, and

that the flight control computer is capable of following very closely these trajectories at the same speed. (Author)

A82-10140 # **Performance analysis of enroute air traffic control computers in the National Airspace System.** J. Press (FAA, Systems Research and Development Service, Atlantic City, NJ). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers.
New York, American Institute of Aeronautics and Astronautics, 1981, p. 485-495. 12 refs. (AIAA 81-2203)
This paper describes a computer performance analysis recently completed at the Federal Aviation Administration Technical Center for all twenty enroute air traffic control centers in the National Airspace System. Based on linear regression, the analysis relied on field data collected nationwide in order to quantify the performance of the central computer complex operating at each facility. The data was recorded every minute for several days while the computers were supporting air traffic control operations. Graphs and tables summarize the study's results which will serve as a basis for management plans concerning future system acquisition. As a major conclusion, the methodology developed in this study applies consistently to all enroute traffic control centers. (Author)

A82-10143 # **Interoperability testing of decentralized command, control, communications and intelligence /C3I/ systems.** E. G. Ries (System Development Corp., McLean, VA) and R. C. Bjorklund (USAF, Tactical Air Command, Langley AFB, VA). In: Computers in Aerospace Conference, 3rd, San Diego, CA, October 26-28, 1981, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1981, p. 513-520. 8 refs. (AIAA 81-2205)
The testing of complex, real-time C3I systems by conventional methods requires considerable resources, time, and realistic operational conditions. The decentralization of systems among diverse locations imposes further demands. Tactical Air Command is developing the Simulation, Monitoring, and Analysis, Reduction, and Test System (SMARTS) to provide a controlled test environment for C3I systems, a design incorporating an operations-scenario generator for efficient test design and analysis. SMARTS is a flexible test platform for Air Force and Joint interoperability testing, configuration management, system testing, and software maintenance. The design of SMARTS provides intercommunications between geographically separated test nodes, test control, recording, analysis, and simulation of radar and data communications for a synchronized test environment. (Author)

A82-10214 * **Downbursts and microbursts - An aviation hazard.** T. T. Fujita (Chicago, University, Chicago, IL). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints. Boston, MA, American Meteorological Society, 1980, p. 94-101. 12 refs. NSF Grant No. ATM-78-01074; Grants No. NOAA-04-4-158-1; No. NGR-14-001-008.
Downburst and microburst phenomena occurring since 1975 are studied, based on meteorological analyses of aircraft accidents, aerial surveys of wind effects left behind downbursts, and studies of sub-mesoscale wind systems. It is concluded that microbursts beneath small, air mass thunderstorms are unpredictable in terms of weather forecast. Most aircraft incidents, however, were found to have occurred in the summer months, June through August. An intense microburst could produce 150 mph horizontal winds as well as 60 fps downflows at the tree-top level. The largest contributing factor to aircraft difficulties seemed to be a combination of the headwind decrease and the downflow. Anemometers and/or pressure sensors placed near runways were found effective for detecting gust fronts, but not for detecting downbursts. It is recommended that new detection systems placed on the ground or airborne, be developed, and that pilots be trained for simulated landing and go-around through microbursts. J.F.

A82-10215 **Applications of conventional and Doppler radars for aviation safety.** J. T. Lee and K. E. Wilk (NOAA, National Severe Storms Laboratory, Norman, OK). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints. Boston, MA, American Meteorological Society, 1980, p. 102-109. 24 refs.
Past and present efforts at the National Severe Storms Laborato-

ry to help provide improved operational procedures for aviation support are summarized. Quantitative data presentation and information assimilation now have greater importance, since Doppler radar is evolving toward operational use by weather services. Wind shear, vortices, and turbulence, which constitute weather hazards to aviation, must be identified and measured, and effective ways to disseminate information on the location, intensity, and movement of these hazards to the forecaster and pilot must be found. Despite the progress made thus far, research is still required to better validate radar signatures which identify storm hazards uniquely; even greater advances are needed in the design of displays and types of data parameterizations which will present significant information efficiently to the interpreter. It is suggested that user requirements be included in the designs of future radar systems at an early stage to reduce irrelevant information which complicates displays. J.F.

A82-10217 **Description of the meteorological research radar system aboard NOAA/Research Facilities Center WP-3D aircraft.** J. D. DuGranrut (NOAA, Environmental Research Laboratories, Miami, FL). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints. Boston, MA, American Meteorological Society, 1980, p. 115-117.
The radar system developed for the Research Facilities Center's WP-3D airborne research platform provides data from three radar sets recorded on computer-compatible media: the nose radar scans horizontally over the range + or - 120 deg from the aircraft, heading at tilt angles of + or - 20 deg from the horizon. It operates at C-band frequency (5445 MHz) and has a processed range of 100 nautical miles. The lower fuselage radar scans a full 360 deg horizontally at tilt angles of + or - 10 deg from the horizon; it also operates at C-band frequency (5370 MHz) and has a processed range of 200 nautical miles. The tail radar scans a plane perpendicular to the longitude axis of the aircraft; it operates at X-band frequency (9315 MHz) and has a processed range of 50 nautical miles. The data processing equipment of the radar data system is controlled by video integrator processors, scan converter display units, and magnetic tape units. The radars may be operated without the data system for display of weather avoidance and navigation information when data processing and recording are not required. A more detailed description is given of the receiver/transmitters, the antennas and antenna control units, the video integrator processors, the recording system, and the real-time display system. J.F.

A82-10219 **Airborne weather radar and severe weather penetration.** J. I. Metcalf (Georgia Institute of Technology, Atlanta, GA). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints. Boston, MA, American Meteorological Society, 1980, p. 125-129. 6 refs.
The effect of rain on airborne weather radar performance and its practical implications are examined. It is shown that whenever the actual reflectivity is greater than 45 dBZ (rainfall rate in excess of 25 mm/hr), significant attenuation (greater than 0.5 dB/km one way) can be expected, leading to major distortions of the reflectivity pattern observed with a 3-cm radar. Examples discussed illustrate the need for aircrews to obtain additional weather information including data from ground-based weather radars at any time when the on-board radar shows weather echoes near the projected flight path, particularly when weather penetration is contemplated. V.L.

A82-10220 * **An airport wind shear detection and warning system using Doppler radar.** J. McCarthy (National Center for Atmospheric Research, Boulder, CO), W. Frost, B. Terkel (Tennessee, University, Tullahoma, TN), R. J. Doviak (NOAA, National Severe Storms Laboratory, Norman, OK), D. W. Camp (NASA, Marshall Space Flight Center, Huntsville, AL), E. F. Blick, and K. L. Elmore (Oklahoma, University, Norman, OK). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints. Boston, MA, American Meteorological Society, 1980, p. 135-142. 7 refs. NSF Grants No. ATM-74-03406-A02; No. ATM-78-12401; Contracts No. NAS8-31377; No. NAS8-33458.
Two numerical models of aircraft performance are developed to relate atmospheric wind signals in wind-shear situations to aircraft response. Both models produce time histories of pitch angle, airspeed, height above the ground, and other parameters for simulating aircraft making precision approaches along a 3-deg glide

slope to the runway. Simulations conducted using thunderstorm environment wind data indicate that the horizontal wind component is at least as important as the vertical component in determining aircraft response to wind shear. Obtaining quantitative measurements of aircraft approach or departure quality is found to depend on several factors, including the knowledge of winds along the expected flight track, clear-air detection in a quasi-horizontal path, and a near continuous estimate of approach deterioration due to shear conditions.   D.L.G.

A82-10221 *   Instrumented aircraft verification of clear-air radar detection of low-level wind shear. J. McCarthy (National Center for Atmospheric Research, Boulder, CO), K. L. Elmore (Oklahoma, University, Norman, OK), R. J. Doviak, and D. S. Zrnic (NOAA, Severe Storms Laboratory, Norman, OK). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints.   Boston, MA, American Meteorological Society, 1980, p. 143-149. NSF Grants No. ATM-74-03406-A02; No. ATM-78-12401; Contracts No. NAS8-31377; No. NAS8-33458.

A technique is described in which the longitudinal wind component at airports, measured by Doppler radar, is put through a Fourier transformation to produce an energy density spectrum. The result is multiplied by the aircraft response characteristics to produce quantitative data on aircraft performance in a wind shear situation. The Doppler radar measurements are made along the intended flight path. Two case studies, along a 3 deg approach path, are described from measurements in two modes: Lagrangian, where predictions were computed one range gate ahead of the plane, and Eulerian, where samples were measured instantaneously along the flight path. Wind data obtained every second were interpolated to fit a numerical model by using a cubic spline. Eulerian data were superior to Lagrangian data in terms of ranging, and nearly equal for wind speeds. Improvements in current 75% accuracy are noted to be possible with shrouded antennas to reduce sidelobes and use of Doppler radar with higher resolution to eliminate effects of small scale disturbances within the pulse volume.   M.S.K.

A82-10222   Detection and display of wind shear and turbulence. J. Wilson, R. Carbone, and R. Serafin (National Center for Atmospheric Research, Boulder, CO). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints.   Boston, MA, American Meteorological Society, 1980, p. 150-156. 9 refs.

Displays of wind shear are given which are obtained by a method for certain cases collected by NCAR 5 cm wavelength radars. A Doppler radar located at an airport or in an aircraft measures the wind shear along flight paths on scales critical to aircraft operations. The magnitude of the shear on the desired scale is then obtained by measuring the wind shear over a distance of one-half the aircraft phugoid wavelength. Four cases classified as severe storms show that significant wind changes occur within 0.5 to 3.0 km, which includes the phugoid wavelength of modern aircraft. It is suggested that a practical solution for the detection of hazardous wind shear is to locate a scanning Doppler at an airport so that quantitative displays of wind changes at the phugoid wavelength can be generated. D.L.G.

A82-10223   Gust front structure observed by Doppler radar. R. J. Donaldson, Jr. and C. L. Bjerkaas (USAF, Geophysics Laboratory, Bedford, MA). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints.   Boston, MA, American Meteorological Society, 1980, p. 157-161. 6 refs.

Two gust fronts (April 30 and May 2, 1978) are discussed as representative samples of operational data taken during the Joint Doppler Operational Project of 1977-1979. Readings from the 10 cm Doppler radar at Norman, OK, during continuous recording at five or six elevation angles were color coded and displayed for speeds in m/s, range marked at one km intervals, and dated, with time of day indicated. Charts provided show wind direction changes with the passage of a gust front and windspeeds at 0.3 km altitude to be double that of surface wind speeds, a factor considered important for aviators. Extreme wind shears within the fronts were taken as evidence for severe vertical shears, which were not sensed by horizontally scanning radar. The effectiveness of the Doppler radar in identifying and ranging gust fronts commends it to airport use, where

shears invisible to the pilot's eye can be hazardous during takeoff and approach maneuvers at low altitudes.   M.S.K.

A82-10225   The evolution of airborne weather avoidance radar toward a calibrated remote rain gauge using REACT. J. F. Clark (RCA, Princeton, NJ). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints.   Boston, MA, American Meteorological Society, 1980, p. 169-175. 5 refs.

REACT (Rain Echo Attenuation Compensation Technique) is a new digital system that compensates for precipitation attenuation in each small-range increment of each sweep by adaptively increasing the radar receiver sensitivity for the next range increment by an amount equal to the two-way attenuation through the original range increment. A Probable Ground Track and Weather Radar Plot of the Apr. 4, 1977 storm near New Hope, GA was published and used as the ground truth in plotting rainfall data. The storm was first depicted by conventional X-band and C-band radar, and the resolution and range of these bands are compared. REACT was then used with the PriMUS 708 solid-state radar; the plotted result of precipitation attenuation was shown to agree well with the assumed ground truth. The PriMUS 708 airborne radar, compensated with REACT, combines the X-band advantage of higher resolution and antenna gain with an accurate rainfall rate calibration.   J.F.

A82-10292   Multiple Doppler radar observations of PBL structure. P. H. Hildebrand (National Center for Atmospheric Research, Boulder, CO). In: Conference on Radar Meteorology, 19th, Miami Beach, FL, April 15-18, 1980, Preprints.   Boston, MA, American Meteorological Society, 1980, p. 656-661. NSF Grant No. ATM-76-24236.

It is noted that during May and June of 1977, multiple Doppler radars, aircraft and other instrumentation were used to observe the characteristics of the convectively growing planetary boundary layer (PBL) in Central Oklahoma. The observations were made between midmorning and afternoon when the PBL was growing quickly. A preliminary analysis of the data from one of the days is given. It is found that data collected using such a large radar separation appear to be usable to describe large scale PBL kinematics.   C.R.

A82-10304   Helicopter engine technology - With particular reference to the Rolls-Royce Gem engine. D. Lewis (Rolls-Royce, Ltd., Watford, Herts., England). *Aeronautical Journal,* vol. 85, Sept. 1981, p. 313-319.

A description is presented of the design features incorporated by the Rolls-Royce Gem helicopter engine in light of the following criteria: (1) high structural strength, to withstand low frequency vibration and maneuvering loads; (2) optimization of low altitude performance; (3) operation over a wide power range; (4) high fuel efficiency at part load power; (5) fast and surge-free acceleration and deceleration; (6) insensitivity to intake pressure disturbances; (7) resistance to contaminated intake air; and (8) stability of control. It is observed that in general, the complexities introduced into helicopter engines of the last design generation to improve fuel consumption will be diminished in the next generation of engines for the sake of cost reduction. In addition to the Gem, these engines include the GE T700 and U.S. Army ATDE.   O.C.

A82-10305   The application of improved aluminium alloys and steels in aircraft structures. C. J. Peel and D. S. McDarmaid (Royal Aircraft Establishment, Materials Dept., Farnborough, Hants., England). *(Royal Aeronautical Society, Symposium on Developments in Structures and Manufacturing Techniques, London, England, Apr. 14, 1981.) Aeronautical Journal,* vol. 85, Sept. 1981, p. 320-326. 16 refs.

It is shown that development efforts in aircraft aluminum alloys and steels over the last 20 years have generally sought to overcome such problems as a lack of resistance to fatigue and stress corrosion cracking rather than achieve increases in specific strength. Significant improvements in fracture toughness and stress corrosion resistance have been achieved, and improved surface treatments are appearing for steel products. Attention is given to new aluminum alloys resulting from the addition of up to 3 wt % Li to Al-Mg, Al-Cu, and Al-Cu-Mg systems, yielding increased stiffness and reduced density. Improvements to 2000- and 7000-series aluminum alloys, rapid

solidification production techniques, and corrosion protection for aircraft steels are also covered. O.C.

A82-10306 **Design aspects of non rigid airship envelopes.** J. A. I. Reid (Airship Industries, Ltd., London, England). *(Royal Aeronautical Society, Symposium on Developments in Structures and Manufacturing Techniques, London, England, Apr. 14, 1981.) Aeronautical Journal,* vol. 85, Sept. 1981, p. 327, 328.

The design requirements of nonrigid airship envelopes are addressed in light of recent advances in both (1) the estimation of airship hull loadings under maneuvering and gusts and (2) high-strength fabrics for airship construction woven from polyamide, polyester, and Kevlar fibers. Attention is given to the degree of permeability by helium of hull and ballonet materials. When determining safety factors for use with such nonmetallic materials, a factor characterizing the degradation of material strength with age must be added to those normally associated with strength calculations. O.C.

A82-10307 **Some possibilities for composite light aircraft construction.** J. H. Webb (Cranfield Institute of Technology, Cranfield, Beds., England). *(Royal Aeronautical Society, Symposium on Developments in Structures and Manufacturing Techniques, London, England, Apr. 14, 1981.) Aeronautical Journal,* vol. 85, Sept. 1981, p. 328-331.

Alternative methods for the design and construction of light aircraft and remotely piloted vehicles with composite materials are described, with attention to the minimization of tooling, materials and construction man-hour costs. A four-seat, single-engine light aircraft is assumed for comparison of conventional metal and glass-reinforced plastic composite wing structure construction costs. Weight comparisons are also presented for three novel wing structure design concepts: (1) a tubular spar with plastic foam core and fiberglass-reinforced skin; (2) a similar arrangement incorporating a metal spar; and (3) fiberglass-reinforced plastic foam sandwich skins with a metal spar. The mixed metal/plastic composite structure is incorporated into the Machan RPV, and has proven to be satisfactory in recent flight trials. O.C.

A82-10308 **Light aircraft structural design in non-metallics - Use of composite honeycomb for light aircraft.** G. E. Woodley (Ciba-Geigy Plastics and Additives Co., Duxford, Cambs., England). *(Royal Aeronautical Society, Symposium on Developments in Structures and Manufacturing Techniques, London, England, Apr. 14, 1981.) Aeronautical Journal,* vol. 85, Sept. 1981, p. 332, 333.

Recommendations are made toward the application of high-technology prepreg composite systems for the production of nonmetallic honeycomb light aircraft structures. Attention is given to design and assembly methods for wings and control surfaces, with emphasis on the reduction of production costs rather than weight saving. It is shown that the designer's aim should cut down the honeycomb panel piece parts required, thereby reducing the man-hours cost of production, and that the use of composite honeycomb materials results in a more damage-tolerant surface than conventional light aircraft structures, with a more accurate overall shape and reductions of both corrosion and fatigue. O.C.

A82-10309 **Sophisticated aircraft structure developments - Combat aeroplanes.** R. J. Sellars and G. Terry (British Aerospace Public, Ltd., Co., Warton Div., Preston, Lancs., England). *(Royal Aeronautical Society, Symposium on Developments in Structures and Manufacturing Techniques, London, England, Apr. 14, 1981.) Aeronautical Journal,* vol. 85, Sept. 1981, p. 334-342. Research supported by the Ministry of Defence (Procurement Executive).

Comparisons of the structural materials and fabrication processes currently under development and assessment in Britain for future combat aircraft construction are presented, with attention to the demonstration of carbon fiber reinforced composites (CFC) and superplastic forming/diffusion bonding of titanium alloy (SPF/DB) in existing aircraft. CFC and SPF/DB structures are compared with respect to specific tensile and compressive strengths and moduli, specific shear strength and modulus, buckling, and ultimate design strengths and design criteria in the application of the materials to the stabilized skins of combat-aircraft surfaces. Emphasis is put on the possibility of aeroelastic tailoring that is introduced by the application of CFC to wing structures. O.C.

A82-10310 **Optimal flight paths for winged, supersonic flight vehicles - Extension to the case where thrust can be vectored.** E. Large (Marconi Space and Defence Systems, Ltd., Stanmore, Middx., England). *Aeronautical Journal,* vol. 85, Sept. 1981, p. 343-348. 5 refs.

A method for determining the optimal trajectory and thrust program of an aircraft or rocket employing vectored thrust is derived, for the practical cases in which the entire thrusting phase is supersonic. It is shown that finding the burning program which gives the Hamiltonian function a zero value automatically satisfies the optimal flight path conditions and makes the final fuel consumption independent of time. It is found that the optimal burning program is not, except in special cases, one that employs constant thrust, the general optimum instead being a linear rate of thrust increase with time. O.C.

A82-10362 # **The use of the Weber method for minicomputer-assisted numerical analysis of airfoils (Zastosowanie metody Webera do numerycznej analizy aerodynamicznej profili na minikomputerach).** K. Czyzewski and M. Lukaszewicz. *Instytut Lotnictwa, Prace,* no. 85, 1981, p. 9-21. 21 refs. In Polish.

A numerical version of the Weber method is developed for calculating pressure distribution over an airfoil in subsonic flow. The method is based on the fact that singularities representing the flow at the airfoil surface are distributed chordwise, and a correction coefficient is introduced, with allowance for airfoil thickness. If the airfoil shape is approximately represented by spline functions, numerical analysis is simplified considerably and the accuracy is improved. The present numerical results are compared with other numerical results for subcritical and supercritical flow conditions, and with wind-tunnel-test results. In addition, an iteration method for determining the critical Mach number has been developed. B.J.

A82-10363 # **Experimental study of subsonic and transonic flows past a wing (Eksperymentalne badania pod- i przydzwiekowego opływu skrzydła).** W. Kania and A. Krzysiak. *Instytut Lotnictwa, Prace,* no. 85, 1981, p. 23-44. 10 refs. In Polish.

The paper reports aerodynamic balance measurements of aerodynamic characteristics and flow visualization tests on a plane trapezoidal uniform-section wing with a small sweepback angle. Tests were performed in a transonic wind tunnel for Mach numbers ranging from 0.3 to 0.96 under conditions of fixed boundary layer transition. Lift, drag, and pitching moment were determined, with attention given to the effect of Mach number. Shock wave formation on the wing is examined, and flow separation and drag rise are determined. Four types of flow separation, depending on Mach number, are revealed; it is found that there is a correlation between the type of flow separation and the value of the lift coefficient at the onset of separation, which depends on the Mach number. B.J.

A82-10364 # **Analytical determination of undercarriage retraction kinematics (Analityczne okreslanie kinematyki chowania podwozia).** R. Stanczak. *Instytut Lotnictwa, Prace,* no. 85, 1981, p. 45-53. In Polish.

An analytical method is developed for calculating the kinematics of undercarriage retraction. The method is particularly suitable for the design of high-wing and mid-wing monoplanes, the undercarriages of which cannot be attached to the wing. Attention is given to undercarriages with one and two rotation axes. B.J.

A82-10396 **FAA developing new collision avoidance, data acquisition and transmission systems.** A. C. Schwartz. *Airport Forum,* vol. 11, Aug. 1981, p. 93, 94, 96, 97.

The U.S. Federal Aviation Agency (FAA) is concerned with the development of an aircraft collision avoidance system which, it is hoped, will be universally accepted as an aviation standard system. The Discrete Address Beacon System (DABS) contains advanced flight and data link equipment. According to the FAA program, DABS is to become the basis for a ground-based collision avoidance system called the Automatic Traffic Advisory and Resolution Service (ATARS). However, it was recently decided to review the DABS ground station program before a final decision is made regarding the ground installations. Another decision is concerned with the implementation of an airborne collision avoidance system called Threat Alert and Collision Avoidance System (TCAS). The TCAS is to take

the place of the Beacon Collision Avoidance System (BCAS). TCAS will operate independently of ground stations and use a highly directional transmitting antenna. To provide better information for en route air traffic controllers when the main radar system fails, FAA is installing the Direct Access Radar Channel (DARC) at its 20 centers in the continental U.S.   G.R.

A82-10401 * #   The balloon and the airship technological heritage. N. J. Mayer (NASA, Washington, DC). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1912.* 8 p. 7 refs.

The balloon and the airship are discussed with emphasis on the identification of commonalities and distinctions. The aerostat technology behind the shape and structure of the vehicles is reviewed, including a discussion of structural weight, internal pressure, buckling, and the development of a stable tethered balloon system. Proper materials for the envelope are considered, taking elongation and stress into account, and flight operation and future developments are reviewed. Airships and tethered balloons which are designed to carry high operating pressure with low gas loss characteristics are found to share similar problems in low speed flight operations, while possessing interchangeable technologies.   D.L.G.

A82-10403 #   Air bag impact attenuation system for the AQM-34V remote piloted vehicle. C. T. Turner (Teledyne Ryan Aeronautical, San Diego, CA) and L. A. Girard, Jr. (Goodyear Aerospace Corp., Akron, OH). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1917.* 8 p.

This paper describes the air bag impact attenuation system (ABIAS) for the AQM-34V remote piloted vehicle. The developed hardware, consisting of the main bag, tail bag, and inflation systems, is described. Operation of the system from electrical initiation, through cover deployment, main and tail bag inflation, and ground impact is discussed. Development ground drop tests, environmental tests, structural tests, and the contractor flight tests are summarized. Test results substantiated system performance.   (Author)

A82-10404 #   Limiting payload deceleration during ground impact. A. Mironer (Analytical Systems Engineering Corp., Burlington; Lowell, University, Lowell, MA), R. Urquhart (Analytical Systems Engineering Corp.; Burlington, MA), and R. Walters (USAF, Geophysics Laboratory, Bedford, MA). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1918.* 7 p.

This paper considers the problem of limiting the deceleration of balloon and sounding-rocket instrument payloads during ground impact by adding energy-dissipating, deformable structures. The basic physics of the two-step deceleration/energy-dissipation process is analyzed and simple force and energy-balance relationships are developed. The pertinent equations are organized in a form that is conducive for computer computation. Two example problems, one of a sounding-rocket payload and the other of a balloon payload are calculated and the results presented in the form of a performance map.   (Author)

A82-10405 #   Aerodynamics and performance of cruciform parachute canopies. D. S. Jorgensen and D. J. Cockrell (Leicester, University, Leicester, England). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1919.* 10 p. 8 refs. Research supported by the Ministry of Defence (Procurement Executive).

Effects of changing the ratio of the arm length and width (the 'arm ratio') on the aerodynamics of cruciform (cross-shaped) parachute canopies are described. Forces and moments were determined from measurements made when fabric canopies were towed under water in a ship tank as well as from integrated pressure distributions determined by using specially-designed pressure transducers fixed in fabric wind tunnel models. Using both techniques, the existence of stochastic variations in aerodynamic behavior was investigated. Experimental results will be analysed using an appropriate computer performance model and the variation of dynamic

performance characteristics thus determined as a function of the arm ratio.   (Author)

A82-10406 #   Experimental determination of parachute apparent mass and its significance in predicting dynamic stability. T. Yavuz and D. J. Cockrell (Leicester, University, Leicester, England). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1920.* 9 p. 6 refs. Research supported by the Ministry of Defence (Procurement Executive) and Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt.

Experimental techniques to measure the components of the apparent mass tensor for parachutes are descrbed. They are evaluated by force and moment measurement during relative motion of parachutes submerged in water in a ship tank. Results show that the components depend on canopy shape, angle of attack and acceleration modulus and, except at high values of the latter, can be considerably in excess of potential flow evaluations. The effect of these results on the dynamic stability of descending parachutes is demonstrated by reference to an appropriate computer model. General conclusions are drawn relevant to canopies whose shapes differ from those tested.   (Author)

A82-10407 #   Development of new lifting parachute designs with increased trim angle. W. R. Bolton (Sandia Laboratories, Livermore, CA) and I. T. Holt (Sandia Laboratories, Albuquerque, NM). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1921.* 12 p. Research supported by the U.S. Department of Energy.

A development program is being conducted by Sandia National Laboratories on a lifting parachute system which allows aircraft delivery of a payload at high speed from low altitude. Candidate lifting parachute designs, which included ram air inflated leading edge chambers and flow-directing side vents, were evaluated in small and full-scale wind tunnel tests, in whirl tower flight tests, and in aircraft flight tests. The results of these testing activities will be discussed along with the method of using test results to predict system performance.   (Author)

A82-10408 #   The effects of flexibility on the steady-state performance of small ribbon parachute models. T. Weber (McDonnell Aircraft Co., St. Louis, MO) and W. L. Garrard (Minnesota, University, Minneapolis, MN). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1923.* 7 p. 5 refs. Research supported by the U.S. Department of Energy.

Small textile ribbon parachute models were shown to exhibit steady-state aerodynamic coefficients similar to those of rigid parachute models. Since no detailed study of the effects of model flexibility on the steady-state aerodynamic performance of a parachute model has been reported, several ribbon parachute models of varying flexibility and equal geometric porosity were constructed and tested in the wind tunnel. No correlation was found between model flexibility and measured aerodynamic performance. (Author)

A82-10409 #   Comparison of simulation and experimental data for a gliding parachute in dynamic flight. T. F. Goodrick (U.S. Army, Natick Research and Development Laboratories, Natick, MA). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1924.* 5 p.

Comparisons are presented of descent rate, total airspeed, horizontal airspeed, yaw rate, pitch rate and roll rate between computer simulation in 6 DOF and flight data for a 200 square foot Parafoil of aspect ratio 2.0 carrying a 350-pound stabilized payload. The payload is specially designed to measure and record all essential parameters of dynamic flight independent of atmospheric wind. The comparison indicates a high degree of agreement in high-rate turns varying greatly from steady-state conditions. Thus, the 6 DOF simulation has been validated.   (Author)

A82-10410 #   Theoretical analysis of parachute inflation including fluid kinetics. J. W. Purvis (Sandia Laboratories, Albuquerque, NM). *American Institute of Aeronautics and Astronautics,*

Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1925. 12 p. 25 refs. Research supported by the U.S. Department of Energy.

An analysis is presented for predicting parachute inflation. Equations of motion for the complete system are developed from first principles, and are solved with no experimental inputs. Ballistic equations of motion are derived for the canopy, payload, and suspension line masses. However, the enclosed fluid mass is not lumped with the canopy as an apparent mass term. Instead, the fluid conservation equations for a deforming, accelerating control volume are solved to determine the behavior of the captured fluid and its interaction with the canopy. Only first order effects are included, and the analysis is limited to inviscid, incompressible flow. Results for both porous and nonporous canopies are compared with experimental data. (Author)

A82-10411 * # **A new thermal and trajectory model for high altitude balloons.** L. A. Carlson and W. J. Horn (Texas A & M University, College Station, TX). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1926.* 10 p. 17 refs. Contract No. NAS6-3072.

A new computer model for the prediction of the trajectory and thermal behavior of high altitude balloons has been developed. In accord with flight data, the model permits radiative emission and absorption of the lifting gas and daytime gas temperatures above that of the balloon film. It also includes ballasting, venting, and valving. Predictions obtained with the model are compared with flight data and newly discovered features are discussed. (Author)

A82-10412 # **The net-skirt to a parachute canopy as a device to prevent inversion.** G. W. H. Stevens. *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1927.* 8 p. 7 refs.

The paper gives a historical account of the circumstances which led to the invention of the net-skirt extension as a device to eliminate parachute canopy inversions, in particular, partial inversions known as 'Blown Peripheries'. Because previous papers do not give a precise account of the mechanism causing the phenomenon it is reanalysed. The paper also records the trends of thought which led to the invention. The phenomenon has been completely eliminated in parachutes modified in this way. Whereas the net-skirt extension solved the difficulties with the Airborne Forces' parachuting system it does not appear to be essential for all deployment systems if adequate line tension can be maintained. Because of the paper's historical nature, Imperial units are used throughout. (Author)

A82-10413 # **The constricted rigging line trials technique for assessing the opening characteristics of parachutes.** S. A. Birch (Irvin Great Britain, Ltd., Letchworth, Herts., England). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1932.* 8 p. 7 refs.

Constricted rigging line trials of a parachute in which the relationship between the inflation time and the effective line length can be established in drop tests from an aircraft or captive kite balloon, present a simple, quick, cost effective test technique for assessing the performance of a parachute against the known performance of a similar parachute. The technique is being used by Irvin Great Britain Limited as a routine test method for man-carrying and other parachute applications. This paper describes the method of test and gives examples of applications of the technique and the results obtained. (Author)

A82-10414 # **A modular asymmetric parachute for wind tunnel testing.** P. C. Klimas, H. E. Widdows, and R. H. Croll (Sandia Laboratories, Albuquerque, NM). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1933.* 9 p. Contract No. DE-Ac04-76DP-00789.

The construction of a series of asymmetrical wind tunnel model parachutes designed to a modular concept is described. The static force, inflation force, and dynamic force and motion time history

wind tunnel testing of up to 123 different configurations is discussed. (Author)

A82-10417 # **Reductions in parachute drag due to forebody wake effects.** C. W. Peterson and D. W. Johnson (Sandia Laboratories, Albuquerque, NM). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1939.* 11 p. 10 refs. Research supported by the U.S. Department of Energy.

The paper evaluates approximate analytic methods for predicting reduction in parachute drag due to forebody wake effects. Velocity distributions are measured behind realistic forebody configurations, and are compared to three turbulent wake velocity models. The velocities are integrated to determine the average effective dynamic pressure acting on the parachute, and comparisons are made of drag loss data and effective dynamic pressure ratios. Predictions are also made for no-fin and finned forebodies with 0 deg, 10 deg, and 20 deg angles of attack. The ratio of measured parachute drag behind a forebody divided by the wake free drag is found to equal the ratio of the average dynamic pressure acting on the parachute divided by the freestream dynamic pressure. Good agreement is found between wake velocity data and theoretical predictions, and the maximum angle of attack providing accurate predictions is determined. D.L.G.

A82-10420 # **Stress measurements in a ribbon parachute canopy during inflation and at steady state.** T. A. Konicke and W. L. Garrard (Minnesota, University, Minneapolis, MN). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1944.* 10 p. 9 refs. Research supported by the U.S. Department of Energy.

This paper describes the results of an experimental study of canopy stresses in a model ribbon parachute. The distribution of circumferential stress was measured during inflation and at steady state for different values of dynamic pressure. Testing was performed in the wind tunnel at the infininite mass condition. Omega sensors were used to measure stresses and were mounted in different ribbons along the gore centerline. It was found that the steady state stress had two maxima of about equal value. One maxima was near the skirt, the other half-way between the vent and skirt. The distribution of maximum stress during inflation was similar to the steady state distribution and the ratio of maximum stress during inflation to steady state stress ranged from 1.25 to 1.75 and was essentially independent of dynamic pressure. The spectral density of the steady state stress measured at several points on the canopy. (Author)

A82-10421 # **Stress measurements in bias constructed parachute canopies during inflation and at steady-state.** W. L. Garrard and T. A. Konicke (Minnesota University, Minneapolis, MN). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1945.* 10 p. 8 refs. Research supported by the U.S. Department of Energy.

This paper describes the results of an experimental study of canopy stresses in bias constructed solid flat parachutes. Stresses were measured in the warp and fill directions during inflation and at steady state for different values of dynamic pressure. Omega sensors were used to measure stress. These sensors were mounted along the gore center lines so that the warp and fill stress distributions could be determined as a function of distance from the vent. It was found that stresses in the fill direction were substantially larger than stresses in the warp direction. (Author)

A82-10425 # **Aeroballistic characteristics of sonobuoy parachute decelerators limited to a length of three feet.** C. T. Calianno (U.S. Naval Material Command, Naval Air Development Center, Warminster, PA). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1950.* 6 p.

Air drop and wind tunnel tests were conducted to verify the stability of sonobuoys with decelerators limited to a total length of 3 feet. This limitation was established for safety reasons. Existing decelerator systems are configured to a length of 5 to 12 feet, with cross-type canopies varying in area from 1.5 to 3.5 square feet.

Sonobuoys are blunt nose right circular cylinders, 4-7/8 inches in diameter, 36 inches long ranging in weight from 12 to 39 pounds. Testing established that 3-foot long decelerators are suitable replacements for the existing configurations. Drag coefficient, opening load, high altitude air descent characteristics, and stability data were determined for different types of decelerators with various area and length. (Author)

A82-10427 # **Development of a nylon-Kevlar recovery system for the CL-289 /AN/USD 502/ surveillance drone.** D. B. Webb and L. Palm (Irvin Industries Canada, Ltd., Fort Erie, Ontario, Canada). *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1952.* 12 p.

An innovative optimized system has been developed for the automatic recovery of a small (500 lb.) high speed surveillance drone along a precise trajectory. The system requires the use of advanced materials and techniques in order to meet stringent system weight, volume and performance limitations and consists of a two stage highly pressure packed unitized parachute package plus dual landing bags. The specification weight and volume constraints made the maximum use of Kevlar material mandatory for the entire system. Other innovative techniques required included stretch fabric orifices for the landing bags and main parachute opening control features; i.e., continuously variable geometric porosity and use of a special type of auxiliary parachute (Webb chute) positioned in the mouth of the canopy. (Author)

A82-10428 # **Inflatable system for fast deployment of parachutes at low altitudes from slow moving aircraft or stationary supports.** H. O. Bucker. *American Institute of Aeronautics and Astronautics, Aerodynamic Decelerator and Balloon Technology Conference, 7th, San Diego, CA, Oct. 21-23, 1981, Paper 81-1953.* 6 p. 5 refs.

A preinflated system has been developed for fast expansion and deployment of emergency parachute canopies from buildings or slow-moving aircraft. The model is based on the concept of a quick shape recovery of restrained folded inflated flexible tubing and is tested using modified conventional circular canopies. Three suspension lines are used on buildings at altitudes as low as 25 m, with a 55 kg load. Canopies achieve full deployment at 11 m at normal landing speeds of 4.6 m/sec with a frame expansion time of 0.35 sec. Prototypes tested for slow aircraft achieve a speed of 50 km/hr, with a frame pressure of 4.3 kg/sq cm, and a deployment time of 2 sec. Results indicate that fast expansion and subsequent deployment of canopies operated with portable gas sources can be useful in such sports as hang gliding, or as emergency equipment for firemen in rescue operations. D.L.G.

A82-10455 * # **Helicopter rotor trailing edge noise.** R. H. Schlinker and R. K. Amiet (United Technologies Research Center, East Hartford, CT). *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 7th, Palo Alto, CA, Oct. 5-7, 1981, Paper 81-2001.* 26 p. 44 refs. Contract No. NAS1-15730.

An experimental and theoretical study was conducted to assess the importance of trailing edge noise as a helicopter main rotor broadband noise source. The noise mechanism was isolated by testing a rotor blade segment in an open jet acoustic wind tunnel at close to full scale Reynolds numbers. Boundary layer data and acoustic data were used to develop scaling laws and assess a first principles trailing edge noise theory. Conclusions from the isolated blade study were analytically transformed to the rotating frame coordinate system to develop a generalized rotor noise prediction. Trailing edge noise was found to contribute significantly to the total helicopter noise spectrum at high frequencies. (Author)

A82-10456 * # **Rotor wake characteristics relevant to rotor-stator interaction noise generation.** L. M. Shaw and J. R. Balombin (NASA, Lewis Research Center, Cleveland, OH). *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 7th, Palo Alto, CA, Oct. 5-7, 1981, Paper 81-2031.* 24 p. 23 refs.

Mean and turbulence wake properties at three axial locations behind the rotor of an aerodynamically loaded 1.2 pressure ratio fan were measured using a stationary cross film anemometer in an anechoic wind tunnel. Wake characteristics at four radial immersions

across the duct at four different fan speeds were determined utilizing a signal enhancement technique. The shapes of the waveforms of the mean rotor relative and mean upwash velocities were shown to change significantly across the span of the blades. In addition, an increase in fan rotational speed caused an increase in the maximum wake turbulence intensity levels near the hub and tip. Spectral analysis was used to describe the complex nature of the rotor wake. (Author)

A82-10457 * # **Effects of vane/blade ratio and spacing on fan noise.** R. A. Kantola (General Electric Co., Power Generation Group, Lynn, MA) and P. R. Gliebe (General Electric Co., Aircraft Engine Group, Cincinnati, OH). *American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 7th, Palo Alto, CA, Oct. 5-7, 1981, Paper 81-2033.* 16 p. 11 refs. Contract No. NAS3-22062.

The effects of vane/blade ratio and spacing on fan noise are investigated to develop a fan noise prediction scheme which is calibrated against experimental data. A 44 blade, 0.504 diameter fan is used to demonstrate the production of fan noise data free from excess noise caused by rotor turbulence interaction. Two stator sets consisting of a cut-off set with 86 vanes, and a cut-on set of 48 vanes are used, with a total range of spacing from 0.5 to 2.3 rotor chords. The model includes viscous wake interaction noise and the potential field interactions of both the rotor and stator. A free-field acoustic environment is achieved by covering the walls, ceiling and floor with 0.7 m polyurethane foam wedges, providing less than + or - 1 dB standing wave ratio at 200 Hz. Only a 3 dB drop in tone level occurs as the spacing is increased from 0.5 to 2.3 rotor chords, and results indicate that the rotor wakes impinging on the stator vanes are the principal noise source for subsonic rotor speeds. D.L.G.

A82-10462 * # **Analysis of augmented aircraft flying qualities through application of the Neal-Smith criterion.** R. E. Bailey and R. E. Smith (Calspan Advanced Technology Center, Buffalo, NY). *American Institute of Aeronautics and Astronautics, Guidance and Control Conference, Albuquerque, NM, Aug. 19-21, 1981, Paper 81-1776.* 26 p. 9 refs. USAF-NASA-supported research.

The Neal-Smith criterion is examined for possible applications in the evaluation of augmented fighter aircraft flying qualities. Longitudinal and lateral flying qualities are addressed. Based on the application of several longitudinal flying qualities data bases, revisions are proposed to the original criterion. Examples are given which show the revised criterion to be a good discriminator of pitch flying qualities. Initial results of lateral flying qualities evaluation through application of the Neal-Smith criterion are poor. Lateral aircraft configurations whose flying qualities are degraded by roll ratcheting effects map into the Level 1 region of the criterion. A third dimension of the criterion for flying qualities specification is evident. Additional criteria are proposed to incorporate this dimension into the criterion structure for flying qualities analysis. (Author)

A82-10463 # **How large should a commuter transport be.** R. D. FitzSimmons, J. Seif, and S. C. Nelson (Douglas Aircraft Co., Long Beach, CA). *American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Dayton, OH, Aug. 11-13, 1981, Paper 81-1732.* 12 p. 11 refs.

Definitions of a commuter transport are examined from the viewpoint of a major airframe manufacturer. Selected milestones in commuter air service are reviewed. The impact of deregulation is creating new opportunities for commuter airlines to expand services, resulting in new economic and operating problems. Problems of acquisition and operating costs are discussed. Considerations for commuter transport capacity include number of passengers, frequency of service, airport facilities, and community compatibility. Capacity variations are explored in the 1980s and the 1990s. Some conceptual commuter transport candidates for the future are presented. (Author)

A82-10465 # **Design considerations for duty cycle, life and reliability of small limited life engines.** D. A. Gries (Williams International Corp., Walled Lake, MI). *AIAA, SAE, and ASME, Joint Propulsion Conference, 17th, Colorado Springs, CO, July 27-29, 1981, AIAA Paper 81-1402.* 4 p.

Design requirements, design criteria and verification methods related to preliminary design and program planning for small limited

life turbine engines have significant differences from other engine technologies. Design operating life of components is defined by development test requirements, rather than mission life requirements. Interpolation between operating mission limits is required to demonstrate operating life for limited life engines rather than extrapolation of accelerated testing required for long life. Storage life requirements are very stringent. The correlation of reliability prediction versus accelerated verification testing for engines requiring extended dormant storage is being validated. (Author)

A82-10466 * # Propfan installation aerodynamics of a supercritical swept wing transport configuration. R. C. Smith and A. D. Levin (NASA, Ames Research Center, Moffett Field, CA). *AIAA, SAE, and ASME, Joint Propulsion Conference, 17th, Colorado Springs, CO, July 27-29, 1981, AIAA Paper 81-1563.* 14 p. 6 refs.

A semispan model with a powered propeller has been tested to provide data on the installation drag penalty of advanced propfan-powered transports designed to cruise at a Mach number of 0.8. These tests, conducted in 14-foot and 11-foot transonic wind tunnels, are a part of a NASA program to develop efficient, high-speed propellers for more fuel-efficient commercial transports for the 1990s and beyond. The model is instrumented for measuring propeller forces, wing/nacelle forces and moments, and pressure distributions over the wing and nacelle. The body in these tests was nonmetric, being connected to the wing by an RTV seal at the wing/body juncture. Tests were run at angles of attack from -3 to +5 deg over the Mach number range 0.6 to 0.85 at a Reynolds number of about 9,000,000. Results of these tests indicate that the nacelle interference drag can be quite large relative to an uninstalled nacelle. However, the losses due to the nacelle were reduced to acceptable levels by changes to the wing leading edge and nacelle intersection. The propeller slipstream causes substantial changes in the wing span load distribution indicating that twist modifications are needed to recover a more favorable span load distribution. (Author)

A82-10495 # Characteristics and trends of energy consumption in transport missions with aircraft and surface vehicles (Caratteristiche e tendenze del consumo energetico nelle missioni di trasporto con aeroplani e con veicoli di superficie). G. Gabrielli. *Ingegneria, July-Aug. 1981, p. 193-198.* 6 refs. In Italian.

A nondimensional factor is defined which characterizes energy consumption in transport missions. Values of this energy utilization factor are given for a number of aircraft and surface vehicles (e.g., automobiles, buses, and trains). Particular attention is given to the energy utilization factor of turbofan and turbojet aircraft. B.J.

A82-10496 # The possibility of using deformable rubber components in landing gear (Possibilità di impiego di elementi deformabili in gomma in carrelli di atterraggio). C. Caprile and L. Salvioni (Milano, Politecnico, Milan, Italy). *Ingegneria, July-Aug. 1981, p. 201-212.* In Italian.

A test program was devised to evaluate the use of precompressed rubber components as vibration dampers in landing gear for light aircraft. The test program is described, and dynamic and static test results are presented. A dissipationless model is developed which is shown to satisfactorily describe the behavior of the rubber components. B.J.

A82-10497 # Problems relating to the classical rate-gyro (Problematiche relative al rate-gyro di tipo classico). L. Borello (Torino, Politecnico, Turin, Italy). *Ingegneria, July-Aug. 1981, p. 225-229.* In Italian.

A mathematical model is developed for evaluating the accuracy of classical rate-gyros. An analysis is presented of the influence of secondary input signals associated with the angular velocity components of the platform. Ways to minimize the effects of these secondary signals are examined. B.J.

A82-10500 Test Pilots' Aviation Safety Workshop, U.S. Naval Postgraduate School, Monterey, CA, February 25-28, 1981, Proceedings. Workshop sponsored by the Society of Experimental Test Pilots and American Institute of Aeronautics and Astronautics. Edited by C. Tuomela (California Agricultural Aircraft Association, Sacramento, CA), New York, American Institute of Aeronautics and

Astronautics, 1981. 100 p. Members, $12.50; nonmembers, $15.

Results are presented of discussions concerning existing and proposed training, equipment and methods for supplying the forecast demand for airline pilots for the period 1985-2000 from the cadre of general aviation. Areas covered include aeromedical education, training and equipment, the air traffic control system, the training and safety aspects associated with cockpit design analysis, pilot and maintenance personnel training accomplished by the fixed base operator, the effects of differences in flying qualities and performances between aircraft on safety and training effectiveness, pilot operating handbooks, regulatory aspects of pilot training and equipment, training and flight simulation programs for commercial pilots, and pilot weather knowledge. A.L.W.

A82-10545 Implementation of AVRADCOM MM&T. G. A. Gorline (U.S. Army, Aviation Research and Development Command, St. Louis, MO). *ManTech Journal, vol. 6, no. 1, 1981, p. 3-6.*

The general implementation plan of the Army Aviation Research and Development Command's (AVRADCOM) efforts in manufacturing methods and technology (MM&T) programs is described. A flowchart of the implementation procedure is presented, and attention is given to several examples of implementation, including a compressor casing, a titanium casting, and aluminum PM parts. B.J.

A82-10547 Composite main rotor tubular braided. M. White (Kaman Aerospace Corp., Bloomfield, CT). *ManTech Journal, vol. 6, no. 1, 1981, p. 14-16.* Army-supported research.

Mechanical tubular braiding has been demonstrated to be a viable blade spar manufacturing process after the completion of a program that included preliminary design of an improved main rotor blade for the OH-58 helicopter. The blade incorporates an advanced aerodynamic shape and has as its primary structural member a Kevlar 49/epoxy spar fabricated by braiding. The achievement of an analytically acceptable blade and spar design satisfying critical structural and dynamic requirements was not hindered by braiding process constraints. B.J.

A82-10646 Navigation task partitioning in distributed-processing avionics systems. J. L. Center (JAYCOR, Woburn, MA). *(Institute of Navigation, National Aerospace Meeting, Warminster, Pa., Apr. 8-10, 1981.) Navigation, vol. 28, Summer 1981, p. 93-100.* 10 refs. Contract No. N62269-80-C-0146.

An approach is presented for allocating navigation tasks among multiple processors prior to detailed design and implementation. The method is based on applying rate-distortion techniques from communication theory to navigation system design. All navigation activities are broken down into elementary functions, and rate-distortion methods are used to access the impact on rms position and velocity errors of limiting communication bandwidths among elementary functions. Groups of functions that require high-bandwidth communication are assigned to the same microprocessor, while those that can perform effectively with lower-bandwidth links are separated. The method is illustrated for aircraft motion and sensor errors in the north channel. J.F.

A82-10649 * Improving the MLS through enhanced cockpit displays. R. S. Jensen (Ohio State University, Columbus, OH). *(Institute of Navigation, National Aerospace Meeting, Warminster, Pa., Apr. 8-10, 1981.) Navigation, vol. 28, Summer 1981, p. 138-146.* 8 refs. NASA-sponsored research.

A simulator investigation of various prediction and quickening algorithms in computer-generated forward-looking displays is presented; the algorithms are used to improve manual aircraft control on curved microwave landing system approaches. The experimental facility consisted of a Link GAT-2 simulator, a PDP 11/40 minicomputer, a high-speed graphic display, a TV camera, and a CRT monitor. Results indicate that second- and third-order predictor displays provide the best lateral performance and that intermediate levels of prediction and quickening provide the best vertical control. Prediction/quickening algorithms of increasing computational order were found to significantly reduce aileron, rudder, and elevator control responses. The conventional crosspointer displays yielded an average 2-sigma lateral error of + or - 200 over all wind conditions at 500 m from touchdown, and was therefore unable to meet FAA

requirements (+ or - 22.9 m); the pictorial-preview display yielded much better results: an average 2-sigma lateral error of + or - 27 m. Neither display was able to approach the FAA specified accuracy requirement in the vertical dimension (+ or - 3.7 m).   J.F.

A82-10650   **Discrete address beacon, navigation and landing system.** R. P. Crow. *(Institute of Navigation, National Aerospace Meeting, Warminster, Pa., Apr. 8-10, 1981.) Navigation,* vol. 28, Summer 1981, p. 147-162.

The Discrete Address Beacon, Navigation and Landing System (DABNLS) is an integrated system which will provide not only air traffic control surveillance data and a two-way data link of the FAA's developmental Discrete Address Beacon System, but will provide precision area navigation and versatile landing guidance with a full Category IIIc capability. The DABNLS will utilize a single pair of L-band frequencies for the discretely addressed up-link interrogations and down-link replies. A ground facility will make precise azimuth and range measurements on the bi-phase coded reply pulses, as well as digitally process the reported altitude data to obtain the aircraft's latitude/longitude and other parameters. The data will be used for navigation, collision avoidance and ATC purposes. Multiple channels would be used in terminal areas, each having elevation facilities for landing guidance. Block diagrams of the DABNLS ground subsystem and air-borne transponders are given.   J.F.

A82-10816 †   **Optimization of the principal design parameters of a passenger aircraft (Optimizatsiia osnovnikh proektnikh parametriv pasazhirskogo litaka).** V. S. Mikalevich, G. M. Iun, and V. M. Kuz'menko. *Akademiia Nauk Ukrain'skoi RSR, Visnik,* vol. 45, Aug. 1981, p. 39-43. 7 refs. In Ukrainian.

A82-10821 #   **Strong matching method for computing transonic viscous flows including wakes and separations - Lifting airfoils.** J. C. Le Balleur (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *La Recherche Aérospatiale* (English Edition), no. 3, 1981, p. 21-45. 46 refs. Research supported by the Direction des Recherches, Etudes et Techniques.

A method is presented for computing two-dimensional lifting steady viscous flows with wakes and possibly separations inside the viscous layer. A transonic potential calculation is used, which strongly interacts with a defect integral method. A mathematical model is also presented for matching the viscous model for averaged mean velocities with reverse flow, and for turbulent closure in nonequilibrium layers. Numerical coupling is reached through an iterative relaxation technique; and the wake geometry is calculated. The viscous mean flow is determined, and examples of applications to subsonic or supercritical airfoils are given.   D.L.G.

A82-10822 #   **Electrical ground testing of aircraft antistatic protection.** A. Bruere (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). *La Recherche Aérospatiale* (English Edition), no. 3, 1981, p. 47-56. 5 refs.

After a review of the methods suggested to ensure aircraft protection regarding electrostatic spurious phenomena, one describes one of the two devices developed at ONERA for ground testing of this protection. These methods give the external surface of the aircraft a conductivity sufficient enough to enable on the one hand the measurement of the surface resistivity of the protected parts even if they are coated with a finishing layer of paint, and, on the other hand, to check the good electrical continuity of each structure element and the aircraft potential reference point.   (Author)

A82-10851   **Fluid power technology for the '80s.** Warrendale, PA. Society of Automotive Engineers, Inc. (SAE Proceedings P-85), 1980. 38 p. $8.00.

Aspects of energy conservation with variable displacement pumps and motors are examined, taking into account approaches for hydraulic power generation, friction loads, elastic loads, regenerative braking, gravity loads, inertia loads, variable displacement pump characteristics, integrated actuator packages, a servopump analysis, a valve analysis, and the computation of pump and motor parameters. High-efficiency hydraulic power transfer units for multisystem aircraft are discussed along with basic approaches for reducing hydraulic system noise in aircraft. A description of developments in boundary layer thrust vector control is also provided.   G.R.

A82-10853   **High-efficiency hydraulic power transfer units for multisystem aircraft.** W. E. Boehringer (Douglas Aircraft Co., Long Beach, CA). In: Fluid power technology for the '80s. Warrendale, PA, Society of Automotive Engineers, Inc., 1980, p. 15-20.

Multiple pumps are generally employed to provide fully powered aircraft flight controls with a redundant power source. The prime hydraulic source is, in most cases, a pump driven directly by one of the aircraft's engines. This approach provides the most efficient method of converting engine horsepower to hydraulic horsepower. The secondary hydraulic power source is generally not as efficient. Investigations were conducted with the objective to find sources of alternate hydraulic power with improved efficiency. The reasons for the inefficiency of current secondary hydraulic power sources were explored to obtain a basis for the design of systems with a better performance. A unit consisting basically of two hydraulic cylinders mounted back to back was designed and manufactured. The design of this unit was subsequently further improved. It is pointed out that the new hydraulic power transfer units obtained have a comparatively high running efficiency.   G.R.

A82-10854   **'Quiet please'.** S. J. Skaistis (Sperry Corp., Sperry Vickers Div., Troy, MI). In: Fluid power technology for the '80s.   Warrendale, PA, Society of Automotive Engineers, Inc., 1980, p. 21-26.

The considered investigation has the objective to indicate that noise control is the product of good engineering. It does not depend on learning a whole new discipline nor does it depend on invention. Because of the increasing use of hydraulics and the growth of noise sensitivity in aircraft, it was felt that aircraft hydraulic engineers should be aware of the desirability of noise control. A booklet was written for the general practitioner in aerospace hydraulics engineering. The first principle of quieting is that the most favorable cost-effectiveness ratio is achieved when noise control engineering is part of the original design effort. The second principle of quieting is that the loudest noise component must be reduced before appreciable quieting can be achieved.   G.R.

A82-10855   **Developments in boundary layer Thrust Vector Control.** R. E. Fitzgerald and R. F. Kampe (Chandler Evans, Inc., West Hartford, CT). In: Fluid power technology for the '80s. Warrendale, PA, Society of Automotive Engineers, Inc., 1980, p. 27-35. 7 refs.

Thrust Vector Control (TVC) is commonly employed on a vehicle to provide larger magnitude steering forces during low velocity flight than can be obtained with aerodynamic fins. A method of thrust vectoring called boundary layer thrust vector control (BLTVC) is considered. BLTVC involves a variation of the secondary injection procedure. The limited deflection and flow ratio is amplified by means of an approach including an injection into a highly overexpanded nozzle. Deflections of 15 degrees are possible and ambient air is used as the injectant. Attention is given to the principles of BLTVC operation, a breakthrough in reducing nozzle size, and a scheme for producing roll control. Rocket applications of BLTVC cover a range in size from microthruster to remote piloted vehicle booster. BLTVC can be used on aircraft gas turbines also. Drawbacks of BLTVC are related to the necessity to employ very large nozzles for high-altitude applications. These drawbacks can be overcome with the aid of Confined Jet Thrust Vector Control.   G.R.

A82-10889 #   **A new APU for medium place aircraft environmental control systems.** C. Rodgers (Solar Turbines International, Turbomach Div., San Diego, CA). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-1.* 7 p. Members, $2.00; nonmember, $4.00.

New small auxiliary power units (APU) are sought to provide aircraft pneumatic power for environmental control and start systems. A new small gas turbine APU in the 20-50 hp class has been developed to meet the smaller aircraft secondary power requirements. The Gemini APU utilizes a single-stage radial compressor and a single-stage radial turbine wheel; it incorporates a single-can combustor with a unique spinning cup fuel atomizer. The electrical control provides for shutdown in case of malfunctions and also has an automatic bleed load control system. The load control valve permits greater operational flexibility by modulating flow to

maintain rated turbine exhaust temperature under varying electrical loads. The engine is available in two configurations: one for combined bleed/shp applications and the other for shaftpower applications. Silent power versions of the Gemini military ground generator sets have been developed which produce an overall noise level as low as 60 dB, and fuel and oil requirements for the Gemini are compatible with those of most main propulsion gas turbines. Successful starting has been demonstrated by the APU from -65 F through 125 F, as well as through 2000 start-stop cycles.   J.F.

A82-10890 # **Closed loop environmental control systems for fighter aircraft.** G. S. Tsujikawa and V. K. Rajpaul (Boeing Military Airplane Co., Seattle, WA). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-2.* 6 p. Members, $2.00; nonmembers, $4.00. USAF-sponsored research.

A favorable thermal environment for aircraft avionics implemented in an energy efficient manner is an important factor in reducing aircraft life cycle costs through improved avionic reliability. This paper discusses the application of closed loop environmental control systems (CECS) to a tactical mission aircraft. The specific objective was to determine CECS configurations which would provide significant savings in fuel consumption and life cycle costs while maintaining stable, low temperature, clean and dry environment for avionics equipment. Preliminary designs were developed for a positive displacement rotary vaned air cycle machine system, hybrid air/vapor cycle system, centrifugal Freon compressor vapor cycle system and a turbo-machinery air cycle machine system. System characteristics, details of design, performance and life cycle cost data were compared with an existing open loop air cycle system. The study showed that closed loop system configurations and close avionic temperature control resulted in substantial life cycle cost savings.   (Author)

A82-10892 # **Towards minimum power for environmental control in transport aircraft.** D. Pierrepont (British Aerospace Public, Ltd., Co., Weybridge, Surrey, England). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-4.* 7 p. Members, $2.00; nonmembers, $4.00.

The minimization of the power consumed by the pneumatically powered environmental control system (ECS) on board transport aircraft, primarily the air conditioning system, is considered. It is noted that the development of a low-bleed ECS with subzero air cycle machine exit temperatures, condensing heat exchangers and recirculation leading to the doubling of the temperature difference between the fresh air supply and passenger and crew compartments has resulted in the halving of the fuel penalty associated with the ECS, (from 4% to 2%) while an additional halving of the penalty is possible by further reducing air flow or using a shaft-driven centrifugal compressor to provide the fresh air supply. Relative fuel savings to be had from air bleed reduction are shown to be significant with respect to those to be obtained in the areas of engines, aerodynamics and structures. The minimum fresh air flow required for the efficient operation of air supply systems within limits of passenger health and comfort is considered, and pneumatic and electrical means for the transmission of shaft power to the ECS are compared. The operating principles of air- and vapor-cycle cooling systems are then reviewed with respect to their performances, and advantages of the air cycle in the areas of complexity, maintenance and weight are noted. Consideration is also given to alternatives to bleed for anti-icing applications.   A.L.W.

A82-10893 # **Design analysis of high temperature transparent windshields for high performance aircraft.** V. E. Wilson, A. J. Bockstahler (Rockwell International Corp., North American Aircraft Div., Los Angeles, CA), and C. A. Babish, III (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-5.* 11 p. 10 refs. Members, $2.00; nonmembers, $4.00. Contract No. F33615-68-C-3421.

Design criteria and analysis methods that are required to extend the thermal performance capabilities of lightweight, large field-of-view transparent windshield systems of Air Force aircraft into the Mach 2.5 to 3.5 speed regime are developed and demonstrated. Windshield system design requirements are established and designs

are developed, analyzed, and revised in an iterative process until visual, structural, thermal, weight, and cost analyses show that the design requirements are satisfied. Design details on two windshield systems are presented. Because a successful windshield design for high speed aircraft depends, to a great extent, on the ability of the windshield to withstand the high temperatures associated with supersonic flight, the aerothermodynamic analysis method and results are emphasized.   (Author)

A82-10894 # **Design challenges of high performance aircraft POD EOCM cooling systems.** R. D. Buckingham (Fairchild Industries, Inc., Fairchild Stratos Div., Manhattan Beach, CA). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-6.* 7 p. Members, $2.00; nonmembers, $4.00.

Modern high performance aircraft and associated Electro-Optical/Countermeasure (EOCM) pods have introduced very complex, high heat density electronics and avionics equipment, which requires mechanically refrigerated cooling to reject large amounts of heat from relatively small confined areas because of: insufficient/no cooling air from the host aircraft; miniaturization/high heat density of electronics; high temperature heat sink of high performance fighter-type aircraft, precluding ram air cooling; need for increased electronics/avionics reliability through lower operating temperature ranges. Electrically driven vapor compression systems are most effective for the EOCM-type pod missions, operating well at high and low altitudes, as well as at high and low flight speeds. Vapor cycle systems provide full ground cooling performance capability. (Author)

A82-10895 # **Air supply system bite for Boeing 767 airplane.** J. P. Patrick and G. F. Atkinson (United Technologies Corp., Hamilton Standard Div., Windsor Locks, CT). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-7.* 7 p. Members, $2.00; nonmembers, $4.00.

Modern airplane air supply systems regulate the temperature and pressure of engine bleed air extracted for cabin pressurization, air conditioning, anti-icing, cross-engine starting, air-driven hydraulic pumps and other pneumatic demands. The air supply system for the Boeing Model 767 airplane consists of a set of equipment for each of the airplane's two engines and a remotely located built-in-test-equipment (BITE) module. The air supply BITE system isolates over 95 percent of all failures to the line replaceable unit (LRU) level. The BITE system achieves this fault isolation via a modern digital electronic BITE module that continuously monitors inputs on a time-shared basis from dedicated BITE elements which are integrally contained in the air supply system LRUs. The operation of the all-pneumatic bleed air supply system is unaffected by the BITE system. Faults detected during bleed air system operation are stored in the BITE module nonvolatile memory for interrogation by the ground crew. Provisions are also made to allow BITE detected faults to be used as inputs to aircraft airborne integrated data systems (AIDS).   (Author)

A82-10896 # **Air-film cooling returns to ramjets.** W. E. Roberts and S. Wasserberg (Marquardt Co., Van Nuys, CA). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-8.* 6 p. Members, $2.00; nonmembers, $4.00.

A ramjet engine was configured for the Navy Firebrand program to propel an antiship target missile. After years of using insulation to thermally protect engine combustor/nozzle assemblies, air-film cooling was used in the Firebrand engine. A combustor liner causes a layer of cool air to be injected between the combustion gas and combustor/nozzle structural shell. As this film flows downstream, mixing and reaction with combustion gas causes its cooling effectiveness to deteriorate. A satisfactory structural design requires shell temperature prediction. Using three film cooling correlations, a method of defining the Firebrand film cooling effectiveness is shown. Thermal models are presented which utilize this effectiveness and provide shell temperature predictions under ground test conditions. This analytical method is shown to be sufficient when predicted temperatures are compared with shell temperatures measured during these ground tests.   (Author)

A82-10901 # **In-situ calibration of flight heat transfer instrumentation.** H. W. Kipp and E. A. Eiswirth (McDonnell Douglas

Astronautics Co., St. Louis, MO). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-13.* 5 p. 8 refs. Members, $2.00; nonmembers, $4.00.

In-situ calibration offers a promising approach for economically minimizing errors in surface heating rates obtained from subsurface, transient, temperature measurements. Experience has shown that surface heat flux solutions are sensitive to inaccuracies in variables such as thermocouple location, temperature measurements, model thermal properties and joint conductances. It is the purpose of in-situ calibration to determine the values of finite difference thermal model parameters which result in the least square error solution. A calibration heat flux is imposed on the surface surrounding a thermocouple installation and the thermal response is recorded. The temperature history is used in an inverse solution to obtain the surface heat flux which is then compared with the calibration pulse. Repetitive values of surface heat flux are obtained by systematically varying model parameters until the calculated and calibration fluxes agree within a prescribed tolerance. The concept is illustrated with a numerical example. (Author)

A82-10920 # **Air-freon integrated environmental conditioning system for trainer subsonic aircraft.** M. Andriano, A. Mannini, and V. Marchis (Microtecnica-Torino, Turin, Italy). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, San Francisco, CA, July 13-15, 1981, Paper 81-ENAs-33.* 7 p. Members, $2.00; nonmembers, $4.00.

Development studies of a cabin environmental control system (ECS) for a new trainer subsonic aircraft are presented. The new vapor cycle cooling system is energy efficient for engines sensitive to bleed air extraction. The hybrid air-freon ECS is composed of four subsystems: the recirculation loop, the bleed air line, the ram air line, and the supplementary cooling assembly (SCA). The air system emergency control law and the SCA system emergency control law are shown schematically in flow charts: if the sensor in the recirculating loop duct measures a temperature higher than 100 C, the bypass valve is immediately closed; it is only opened if the duct temperature decreases below 70 C. The compressor in the SCA system is switched off in cases where the pressure is above 2.5 MPa and lower than 0.3 MPa. Performance tests correlated well with predicted ones, and the system overall weight was optimized at 30 kg. The ECS was compared with the bootstrap air system and found to have a substantially better bleed air flow rate (ECS = 1.20 kg/min; bootstrap = 7.0 kg/min). J.F.

A82-10934 * # **Multiple-scale turbulence modeling of free turbulent flows.** G. Fabris and P. T. Harsha (Science Applications, Inc., Combustion Dynamics and Propulsion Technology Div., Canoga Park, CA). *American Society of Mechanical Engineers and American Society of Civil Engineers, Joint Applied Mechanics, Fluids Engineering, and Bioengineering Conference, University of Colorado, Boulder, CO, June 22-27, 1981, ASME Paper 81-FE-20.* 11 p. 28 refs. Members, $2.00; nonmembers, $4.00. Contract No. NAS1-15988.

As part of an investigation into the application of turbulence models to the computation of flows in advanced scramjet combustors, the multiple-scale turbulence model has been applied to a variety of flowfield predictions. The model appears to have a potential for improved predictions in a variety of areas relevant to combustor problems. This potential exists because of the partition of the turbulence energy spectrum that is the major feature of the model and which allows the turbulence energy dissipation rate to be out of phase with turbulent energy production. To establish the general reliability of the approach, it has been tested through comparison of predictions with experimental data. An appreciable overall improvement in the generality of the predictions is observed, as compared to those of the basic two-equation turbulence model. A Mach number-related correction is found to be necessary to satisfactorily predict the spreading rate of the supersonic jet and mixing layer. (Author)

A82-10952 * # **Thermal and flow analysis of a convection, air-cooled ceramic coated porous metal concept for turbine vanes.** F. S. Stepka (NASA, Lewis Research Center, Cleveland, OH). *American Society of Mechanical Engineers and American Institute of Chemical Engineers, National Heat Transfer Conference, 20th, Milwaukee, WI, Aug. 2-5, 1981, ASME Paper 81-HT-48.* 7 p. 9 refs. Members, $2.00; nonmembers, $4.00.

Analysis was made of the heat transfer and pressure drop through turbine vanes made of a sintered, porous metal coated with a thin layer of ceramic and convection cooled by spanwise flow of cooling air. The analysis was made to determine the feasibility of using this concept for cooling very small turbines, primarily for short duration applications such as in missile engines. The analysis was made for gas conditions of approximately 10 and 40 atm and 1644 K and with turbine vanes made of felt-type porous metals with relative densities from 0.2 and 0.6 and ceramic coating thicknesses of 0.076 to 0.254 mm. (Author)

A82-10965 # **Fuel for future transport aircraft.** G. D. Brewer (Lockheed-California Co., Burbank, CA). *American Society of Mechanical Engineers and American Institute of Chemical Engineers, National Heat Transfer Conference, 20th, Milwaukee, WI, Aug. 2-5, 1981, ASME Paper 81-HT-80.* 8 p. 6 refs. Members, $2.00; nonmembers, $4.00.

Despite attempts at conservation and the development of synthetic aviation-grade kerosene from alternative fossil fuel materials, it is widely recognized that alternatives to conventional petroleum-base aircraft fuels must become available in the near future. The present paper discusses the prospects for liquid hydrogen as a future fuel for transport aircraft. Advantages of liquid hydrogen over synthetic fuels and liquid methane as alternative fuels in the areas of availability, safety, pollution, relative energy efficiency as a function of trip length and aircraft weight, overall costs and airport compatibility are considered. The possible requirements for a development program aimed at preparing liquid hydrogen for use in operational aircraft are examined, and the probable time characteristics of fuel use during the transition to liquid hydrogen, which may significantly replace synthetic fuels by the year 2000, are considered. A comprehensive plan for liquid hydrogen fuels R&D is then presented which is currently being considered for implementation on an international basis. A.L.W.

A82-10985 # **Control laws for adaptive wind tunnels.** E. H. Dowell (Princeton University, Princeton, NJ). *AIAA Journal,* vol. 19, Nov. 1981, p. 1486-1488. 5 refs. Research supported by Princeton University.

A control law is developed which will permit the systematic modification of wind tunnel wall conditions, in order to minimize the interference about a model. The approach is valid for both three-dimensional and lifting flows and, subject to the assumption of linearity, is not dependent on any particular theoretical description of the fluid. In addition, unlike previous control schemes, the present method does not require an iterative approach. O.C.

A82-10987 # **Wind tunnel tests on airfoils in tandem cascade.** S. Raghunathan (Belfast, Queen's University, Belfast, Northern Ireland), C. P. Tan, and N. A. J. Wells. *AIAA Journal,* vol. 19, Nov. 1981, p. 1490-1492.

Wind tunnel tests on airfoils in tandem cascade, of the type found on the Wells-type turbine, were conducted in a low-speed tunnel with a maximum air velocity of 35 m/sec. Airfoils tested had a chord of 85 mm and a span of 100 mm and included the NACA 0012, 0018 and 0021 profiles. The freestream dynamic pressure was measured upstream of the cascade by a Pitot tube, as well as the tangential and normal forces on the blades. Tests were performed for several cascade solidities and at angles of incidence varying from zero to 90 deg, with Reynolds numbers of about 100,000. O.C.

A82-11020 **Tangential sensitivity of EW receivers.** J. Tsui (USAF, Avionics Laboratory, Wright-Patterson AFB, OH). *Microwave Journal,* vol. 24, Oct. 1981, p. 99-102. 8 refs.

A systematic approach to the determination of the tangential sensitivity of a receiver is presented, and calculated results are compared with experimental data. Particular consideration is given to the following topics: the practical determination of the effective noise bandwidth to be used in the sensitivity calculations of an EW receiver; the influence of the RF gain in the receiver on the sensitivity; and the influence of the RF bandwidth and the video bandwidth on the sensitivity. B.J.

A82-11031 **Relationships between naval aviation safety and pilot flight experience.** M. S. Borowsky (U.S. Naval Safety

Center, Norfolk, VA). *Aviation, Space, and Environmental Medicine,* vol. 52, Oct. 1981, p. 608-610.

Flight activity of all aviators flying naval aircraft and aircraft accident data were analyzed to determine if statistical relationships among lifetime and recent experience variables and accident liability exist. The results demonstrate that accident potential, though not statistically related to flight hours in 30-d periods, is correlated with lifetime flight experience with the higher liability associated with minimal amounts of flight hours and with transitioning into new aircraft. (Author)

A82-11149 **Acoustic emission - An emerging technology for assessing fatigue damage in aircraft structure.** C. D. Bailey and W. M. Pless (Lockheed-Georgia Co., Marietta, GA). *Materials Evaluation,* vol. 39, Oct. 1981, p. 1045-1050. 12 refs.

Guidelines for the design of a dedicated acoustic emission (AE) system for aircraft fleet installations are discussed. It is shown that the successful development of an on-board AE crack detection system depends on the existence of an integrated body of technology combining AE detection technology, structural and crack growth characteristics, noise and EMI discrimination or rejection, and fleet maintenance practices. These technologies must be fully integrated through the development and deployment of the system to achieve cost-effective results. V.L.

A82-11177 * **Rheological behavior of progressively shear-thickening solutions.** S. T. J. Peng and R. F. Landel (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). *Journal of Applied Physics,* vol. 52, Oct. 1981, p. 5988-5993. 13 refs. Contract No. NAS7-100.

The rheological behavior of the recently developed polymer FM-9 in Jet A fuel and JP 8 fuel is reported. In aqueous solution, FM 9 is found to exhibit strong time-dependent shear thickening behavior. Induction time necessary for the onset of thickening is found to depend on shear rate, solvent, concentration, and molecular weight. Altering the nature of the solvent results in effects similar to those obtained by changing the concentration or molecular weight. A critical shear rate is derived, and is inversely proportional to the zero shear rate viscosity of the solution for the temperature and concentrations observed. The onset of shear thickening behavior appears to be related to the onset of viscoelastic response, and thus the time scale follows reduced variable behavior. D.L.G.

A82-11222 **Development of the Triflex rotor head.** A. Cassier (Société Nationale Industrielle Aérospatiale, Marignane, Bouches-du-Rhône, France). *American Helicopter Society, Journal,* vol. 26, July 1981, p. 25-31.

This paper reviews the development of a new hingeless rotor hub named Triflex. This hub is made of composite materials and features flexible arms that provide blade retention, flap/lag/pitch degrees of freedom through structural deflection, and lag damping. A large part of the Triflex hub design effort has been devoted to determination of the flexible arm characteristics, since these strongly affect the behavior of the rotor in flight. The Triflex hub dynamic characteristics were carefully checked during laboratory and whirl stand tests and found to be in agreement with theoretical predictions. Flight tests of the Triflex rotor on a Gazelle helicopter were successful in demonstrating the feasibility of the concept. Though rotor lag damping was found to be weak, no insurmountable stability problems were encountered, and the flying qualities of the Gazelle helicopter fitted with the Triflex hub were good. The next phase of the Triflex hub development will be aimed at improving the hub's structural damping characteristics and at optimizing the manufacturing process. (Author)

A82-11224 **Fatigue substantiation of non-linear structures.** B. P. W. Stocker (United Technologies Corp., Sikorsky Aircraft Div., Stratford, CT). *(American Helicopter Society, Midwest Region Helicopter Fatigue Methodology Specialists Meeting, St. Louis, MO, Mar. 1980.) American Helicopter Society, Journal,* vol. 26, July 1981, p. 51-55.

Structures such as preloaded joints and lugs frequently exhibit non-linear load/stress relationships at critical locations. This paper presents some examples of such structures, including typical attachment lugs and preloaded threaded attachments, to illustrate the importance of test load level selection and determination of load vs

stress relationships at fracture origins. The possibility that accelerated fatigue testing may sometime fail to reveal critical design weaknesses or result in unrepresentative modes of fracture is explored, and simple ways of avoiding this problem are discussed. (Author)

A82-11225 **On computing Floquet transition matrices of rotorcraft.** G. H. Gaonkar, D. Sastry (Indian Institute of Science, Bangalore, India), and D. S. S. Prasad (National Aeronautical Laboratory, Bangalore, India). *American Helicopter Society, Journal,* vol. 26, July 1981, p. 56-61. 23 refs.

There are conflicting claims concerning the efficiency of different schemes of computing the Floquet transition matrices of rotorcraft. In this paper, computer-generated data are presented on the comparative efficiency of four classes of methods: (1) Runge-Kutta one-step; (2) Hamming's predictor-corrector multistep; (3) Bulirsch-Stoer extrapolation; and (4) hybrid or variable order. Data pertain to single-pass and N-pass schemes for four flap-lag stability models. It is found that Hamming's fourth-order predictor-corrector method in single pass is the most economical with respect to three-significant-figure accuracy. The analytical formulation confirms the advantage of the single-pass approach over the N-pass, provides useful approximations to machine-time data, and is a feasible economical approach to comparing different methods with respect to machine time. B.J.

A82-11300 **Model helicopter rotor impulsive noise.** J. E. Hubbard, Jr. and W. L. Harris (MIT, Cambridge, MA). *Journal of Sound and Vibration,* vol. 78, Oct. 8, 1981, p. 425-437. 18 refs. Contract No. DAAG29-C-027.

An investigation of helicopter rotor blade slap was performed on a 1.27 m diameter model rotor. The rotor blades were a NACA 0012 section with a -8 deg linear twist. The experiments were conducted in the MIT Anechoic Wind Tunnel. The effects of number of blades, blade pitch, advance ratio, and shaft angle on the generation and intensity of blade slap have been investigated. The effect of each parameter was determined by varying the parameter of interest while keeping the others constant. The rotor tip speeds of the tests performed in this study were limited to approximately Mach 0.4. The directivity associated with the blade slap signature was measured. The results of this investigation are based on a subjective definition of blade slap. (Author)

A82-11302 # **Ideal and simulated performance of an aircraft in the terrain following mission.** U. R. Prasad (Indian Institute of Science, Bangalore, India) and B. S. Subrahmanyam. *Aeronautical Society of India, Journal,* vol. 31, Feb.-Nov. 1979, p. 13-19. 8 refs.

A new synthesis method of terrain following system design to realize closely the ideal performance obtainable from an aircraft in the mission is presented. Ideal performance analysis and division of the mission into Avoid and Follow modes of flight leads to natural template constructions imbedding the aircraft climb performance and human pilot tolerance limits to accelerations. Simulation of aircraft flight in the mission complements the analysis in fixing the configuration and parameters of the system. Step terrains are used in the design iterations of the system because of their worst-case character. (Author)

A82-11314 # **Dynamic response of aircraft structure to gun shock loads.** P. N. Raju and V. P. Rangaiah (Hindustan Aeronautics, Ltd., Bangalore, India). *Aeronautical Society of India, Journal,* vol. 31, Feb.-Nov. 1979, p. 103-105. 5 refs.

The dynamic response of a fighter aircraft to gun firing is assessed, the vibration levels on the airframe being measured by flight tests of the aircraft in the development phase. The aircraft is instrumented for measuring the vibration levels at various points on the aircraft structure, for example, the wing tip, fuselage, tail plane, and aileron and elevator. The flight vibration data thus obtained is analyzed using standard methods available in the literature. The analyzed data is plotted to ascertain whether the vibration levels fall below the upper bounds of the envelope drawn from the previous flight-test data for the aircraft of the same class. C.R.

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

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

A82-11359 Nonlinear prediction of subsonic aerodynamic loads on wings and bodies at high angles of attack. P. Zhu, W. Shou (China Aeronautical Establishment, Institute of Computing Technology, Xi'an, Shaanxi, People's Republic of China), and S. Luo (Northwestern Polytechnical University, Xi'an, Shaanxi, People's Republic of China). *Computer Methods in Applied Mechanics and Engineering*, vol. 26, June 1981, p. 305-319. 6 refs.

This paper predicts numerically the nonlinear aerodynamic loads on wings and bodies at high angles of attack in subsonic flow separating along certain known lines. It is assumed that the separation vortices are symmetric and unbursting. The wing mean surfaces and body surfaces are simulated by bound vortex lattices, and the separation vortex surfaces by free vortex lines. The vortex system satisfies boundary conditions on wing and body surfaces, separation conditions, and the condition that free vortex lines are tangent to local velocity. The velocity induced by a vortex is computed by the Biot-Savart law with Göthert transformation for subsonic small perturbation flows. The vortex strengths and the free vortex locations are solved by relaxation method. Then the aerodynamic loads on wings and bodies are computed. They agree well with experimental tests. (Author)

A82-11400 A note on fatal aircraft accidents involving metal fatigue. G. S. Campbell (National Aeronautical Establishment, Ottawa, Canada). *International Journal of Fatigue*, vol. 3, Oct. 1981, p. 181-185. 6 refs.

A world-wide survey of aircraft accidents was taken to determine the extent to which metal fatigue is responsible for the incidents. A total of 306 fatal accidents since 1934 were found to be either wholly or partially due to metal fatigue; these accidents resulted in 1803 deaths. Two-thirds of the accidents involved fixed-wing iarcraft, with wing failure (88 accidents) being the most common cause, followed by engine failure (56 accidents). Of the 90 fatal helicopter accidents, about a third were due to failure of the main-rotor system, and a quarter were due to tail-rotor failure. Over the last four years there has been an average of 18 fatal accidents per year resulting from metal fatigue; about 11 have been for fixed-wing aircraft and seven have been for helicopters. Thirteen accidents were attributed to a failure to increase the inspection frequency required for aircraft used in a role for which they were not originally designed. J.F.

A82-11406 A mathematical model of an over-sea airborne UHF radio link. T. Slator. *Marconi Review*, vol. 44, 2nd Quarter, 1981, p. 101-118. 9 refs.

A mathematical model is described which enables the performance of an over-the-sea airborne UHF radio link to be estimated as a function of terminal height and separation distance taking account statistically of variations of signal level caused by such factors as irregular antenna radiation patterns and a rough sea surface. (Author)

A82-11407 Optical sensors for displacement measurement. S. M. McGlade. *Marconi Review*, vol. 44, 2nd Quarter, 1981, p. 119-136. 7 refs.

A measurement system consists of sensors which are connected to a control center. The use of fiber optics as the communications link has a number of advantages. Two of the most important are immunity from electromagnetic interference and the elimination of the danger of electrical sparking in explosive environments. These advantages are reduced by the necessity to use electrical devices in the sensors. If the sensors were wholly optical then the advantages of fiber optics would apply to the entire system outside the control center. Optical sensors will be difficult to develop. Initially, at least, they are only justified in applications where such methods are becoming essential. One such area is in military aircraft. An optical displacement transducer can be obtained by using the displacement to alter the transmission aperture of a light beam. Attention is also given to strain measurement using two beam interferometry, Fabry-Pérot interferometry displacement measurement, and strain induced birefringence. G.R.

A82-11434 End losses in turbine cascades with porous cooling. V. M. Epifanov and V. I. Gus'kov. *(Aviatsionnaia Tekhnika, no. 3, 1980, p. 46-49.) Soviet Aeronautics, vol. 23, no. 3, 1980, p. 38-41. 7 refs. Translation.

Experimental results on porous-cooled turbine blades are presented and discussed. Exit losses in the blades are found to depend on coolant flowrate and the degree of roughness of the porous surface. B.J.

A82-11444 Study of reingestion of exhaust gases with different initial temperature in a reversed turbojet engine. Z. V. Akhtiamov and M. Sh. Giliazov. *(Aviatsionnaia Tekhnika, no. 3, 1980, p. 101-103.) Soviet Aeronautics, vol. 23, no. 3, 1980, p. 87-89. Translation.

A82-11446 Results of experimental study of heat transfer to turbine blades with porous cooling. S. G. Dezider'ev, A. G. Karimova, and V. I. Lokai. *(Aviatsionnaia Tekhnika, no. 3, 1980, p. 109-112.) Soviet Aeronautics, vol. 23, no. 3, 1980, p. 97-99. 8 refs. Translation.

A82-11448 One reason for the onset of high-frequency self-excited oscillations. V. P. Pavlovskii. *(Aviatsionnaia Tekhnika, no. 3, 1980, p. 116-118.) Soviet Aeronautics, vol. 23, no. 3, 1980, p. 104-106. 5 refs. Translation.

Experiments have been carried out to investigate generation mechanisms of high-frequency auto-oscillations resulting from an increase in the pressure differential across the combustion chamber injectors of a flight vehicle engine. It is found that a possible reason for the onset of the high-frequency auto-oscillations is breakdown of the annular gas cavity in the oxidizer injector nozzle which initiates unstable combustion due to the vapor phase removal. V.L.

A82-11459 Calculation of aerodynamic characteristics of jet flapped airplane. V. G. Akent'ev and V. V. Guliaev. *(Aviatsionnaia Tekhnika, no. 4, 1980, p. 3-6.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 1-4. Translation.

A numerical method is developed for calculating the steady-state aerodynamic characteristics of an aircraft with jet flaps. The flow past the aircraft and the jet are modeled as a system of oblique horseshoe-shaped vortices, and the problem is solved in the linear formulation for an incompressible medium. B.J.

A82-11462 On low-speed wind tunnels with deformable boundaries. A. A. Gruzdev. *(Aviatsionnaia Tekhnika, no. 4, 1980, p. 23-26.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 18-20. 7 refs. Translation.

Attention is given to the development of self-streamlining or self-correcting wind tunnels. Linear theory under the assumption of potential flow is used to study the shape of streamline surfaces near a wing of finite aspect ratio moving near a screen. The characteristics of flow macrostructure in the wake are analyzed; and it is shown that, in contrast to the case of two-dimensional flow, it is not possible to streamline the walls of the tunnel in the absence of a vortex wake in the case of three-dimensional flow. B.J.

A82-11463 Basic problem of aircraft gasturbine engine analytic design. II. Iu. V. Kozhevnikov, V. O. Borovik, V. S. Ivanov, V. A. Talyzin, I. N. Agliullin, and Iu. V. Meluzov. *(Aviatsionnaia Tekhnika, no. 4, 1980, p. 27-32.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 21-24. Translation.

The paper presents results of the analytical optimization of the basic thermogasdynamic parameters of the cycle and the characteristic areas of the air path of a turbojet bypass engine; the optimization criterion is minimum engine-mass and minimum fuel required for a given flight distance. The multimode character of engine operation is analyzed. B.J.

A82-11464 Formation of triangular-element stiffness matrix using sliding interpolation. P. D. Levashov. *(Aviatsionnaia Tekhnika, no. 4, 1980, p. 33-37.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 25-28. Translation.

The paper examines the use of sliding interpolation to construct the stiffness matrix of triangular elements of flat rib-stiffened panels. This approach makes it possible to raise the order of the displacement field by employing computational parameters from adjacent elements without increasing the total number of unknowns. A computational example is discussed.   B.J.

A82-11465   On evaluating the influence of local disruptions of flow over trailing edge and leading edge flaps from the data of wind tunnel tests of a rectangular wing segment. A. I. Matiazh, V. A. Sterlin, A. B. Kuznetsov, V. V. Isaev, A. A. Shapiro, and E. M. Ksenofontova. (Aviatsionnaia Tekhnika, no. 4, 1980, p. 38-42.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 29-32. 5 refs. Translation.

Equipment for the suspension and control of leading and trailing flaps was tested in a low-speed wind tunnel. The influence of the control mechanisms, and, of their positions along the wing span and in the cross section, on the integral aerodynamic characteristics of a rectangular wing was evaluated. It is found that local disturbances of flow past leading and trailing flaps produce a significant reduction of lift and an increase of drag.   B.J.

A82-11468   On the use of carbon composites in slat and stabilizer construction. B. N. Kornev, R. I. Guseva, and V. A. Tikhomirov. (Aviatsionnaia Tekhnika, no. 4, 1980, p. 72-74.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 59, 60. Translation.

Glass-graphite-plastic composite materials were used in the construction of aircraft deflectors and stabilizers. This paper reviews the details of construction, and examines static-load testing results for both deflector and stabilizer.   B.J.

A82-11469   Synthesis of system for evaluating gyrostabilizer state with unknown disturbances. A. A. Leporskii. (Aviatsionnaia Tekhnika, no. 4, 1980, p. 74-76.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 61-63. Translation.

A82-11470   On the question of trailing airplane motion. A. A. Novad. (Aviatsionnaia Tekhnika, no. 4, 1980, p. 79-81.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 67, 68. Translation.

Equations are derived for the three-dimensional motion of an aircraft and are solved analytically for the initiation of banking flight. The solution describes the effect of the specific wing load on the normal acceleration overloading of the aircraft. It is noted that the danger of a spin increases with increasing specific load.   B.J.

A82-11471   Experimental study of empennage snap-through vibrations. V. A. Pavlov, F. Sh. Khakimullin, A. Ia. Gur'ianov, and M. I. Gershtein. (Aviatsionnaia Tekhnika, no. 4, 1980, p. 81-84.) Soviet Aeronautics, vol. 23, no. 4, 1980, p. 69-71. 5 refs. Translation.

The snap-through oscillations of a rectangular-planform empennage model were studied in a subsonic wind tunnel. The aim of the study was to isolate the snap-through oscillations from all other possible oscillations in the flow. An analysis of changes of the normal and frontal curvatures of the control surface demonstrate the occurrence of snap-through oscillations. The frontal curvature falls to practically zero in the case of static snap-through.   B.J.

A82-11685   Fatigue life of lugs under service loading - Test results and predictions. A. Buch and A. Berkovits (Technion - Israel Institute of Technology, Haifa, Israel). Materialprüfung, vol. 23, Oct. 1981, p. 344-348. 27 refs.

Aircraft pin-lug joints with and without interference fit were tested in maneuver loading programs with random loading sequence in order to investigate the effect of design load, lug material and interference fit on the spectrum fatigue life. An interference fit of 0.3% had a strong beneficial effect on the fatigue life for all loading programs, even when local tensile stress peaks exceeded the material yield stress. The spectrum fatigue life of 2024-T351 lug specimens was longer than that of 7075-T7351 specimens, except under the most severe loading program. Test results were compared with predictions based on the Miner's rule, the relative Miner rule, and the Neuber-Topper notch analysis method. The relative Miner rule was superior to the conventional rule in predicting the spectrum fatigue life of aircraft lugs; the Neuber-Topper notch analysis method was

shown to have some application for the prediction of the effect of design load on the fatigue life of lugs with interference fit, but for the case of lugs without interference fit, predicted and test results disagreed completely. The disagreement is explained by the effect of fretting.   J.F.

A82-11715 #   New separators for battery systems. J. Lee and V. D'Agostino (RAI Research Corp., Hauppauge, NY). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1   New York, American Society of Mechanical Engineers, 1981, p. 111-116.

The reported study takes into consideration separators for miniature cells, such as silver/zinc button cells, and separators for aircraft nickel/cadmium batteries. It is pointed out that separators for energy systems having an aqueous electrolyte, either acid or basic, can be prepared by selective modification of radiation grafting parameters. A new family of separators, known as the 'SC' series, has been developed. The SC separators have very uniform electrolytic resistance, excellent mechanical strength, and lower cost. General improvements in battery service life could be observed as a result of the introduction of the grafted separators. The cycle life of vented aircraft Ni/Cd batteries could be extended three to four times.   G.R.

A82-11716 #   Sealed lead-acid batteries for aircraft applications. K. L. Senderak and A. W. Goodman (U.S. Navy, Naval Weapons Support Center, Crane, IN). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.   New York, American Society of Mechanical Engineers, 1981, p. 117-122.

In the 1970's, an important advance in lead-acid battery technology occurred with the introduction of sealed, no-maintenance, lead-acid batteries. A description is given of a wide variety of studies and tests conducted to evaluate the suitability of the new batteries for employment in Navy aircraft. The results show that the sealed lead-acid (SLA) cells can be successfully used in a potentially large number of aircraft applications, where very high-rate discharge performance is not required. The Navy is actively pursuing the SLA battery for these applications to substantially reduce the Navy's overall battery procurement and maintenance costs, and to improve reliability.   G.R.

A82-11717 #   Applications of finite element method in aerospace power systems design. E. U. A. Siddiqui. In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.   New York, American Society of Mechanical Engineers, 1981, p. 123-126.

Complex power systems are needed to satisfy the exacting power requirements of current avionic systems. A suitable tool for the design of such power systems is finite element analysis, based on the principle of minimization of total potential energy. This technique is being successfully used to eliminate excess weight and to accurately predict stresses and resonant frequencies. The new method was used to conduct an analysis in connection with a problem related to the occurrence of severe vibrations in a 30,000 rpm generator. The analysis had the objective to determine the effects of modifications made to the generator frame. It was found that the resonant frequency could be raised above the operational speed of the generator by introducing suitable modifications to the design of the frame.   G.R.

A82-11718 #   Advanced aircraft electric power system. J. D. Segrest (U.S. Naval Material Command, Naval Air Development Center, Warminster, PA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1.   New York, American Society of Mechanical Engineers, 1981, p. 127-129.

The Advanced Aircraft Electric Power System is to increase fuel efficiency and reduce life cycle costs. The system includes 270 volt DC generators, solid state regulation, flat bus distribution, solid state switching, digital multiplex control and protection of power distribution through a system algorithm, and switching regulator power conditioning. A description is presented of the system concept, the hardware development, and the status of the Navy program. A high voltage DC power system development had been initiated by the Navy to exploit the advantages of high-voltage DC operation for future aircraft.   G.R.

A82-11719 # **Variable speed constant frequency /VSCF/ electrical system cuts cost of ownership.** R. V. Hildebrant and R. C. VanNocker (General Electric Co., Aircraft Equipment Div., Binghamton, NY). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 130-135. 5 refs.

The methodology employed in the development of the electrical generating system for the F/A-18 aircraft is considered. This system was the first production application in which the cycloconverter electronics were packaged with the generator and mounted directly to the accessory gearbox. Being the first production system of this type, a detailed and comprehensive analysis and evaluation program was undertaken to provide assurance that the design could operate with a high degree of reliability in this generally hostile environment. A primary maintainability design objective was related to the design and the selection of parts and materials which would last for the life of the unit without scheduled maintenance. Attention is given to maintenance cost experience and life cycle costs. G.R.

A82-11720 # **A hidden advantage of permanent magnet electrical generating systems.** J. J. O'Neill (General Electric Co., Binghamton, NY). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 136-139. 7 refs. USAF-supported research.

The development of permanent magnet aircraft electrical generating systems heralds the beginning of a new era. This technique brings many advantages to the user in terms of size, weight and reliability. However, the most significant of these advantages is the extremely high efficiency which is characteristic of these systems. This paper examines the effect of the higher system efficiency on the user, specifically in the area of aircraft fuel consumption. Driven by rising fuel costs, engine and aircraft manufacturers are striving for more efficient performance to minimize life cycle costs. The results of a study which examines the effect of several permanent magnet ratings on different aircraft sizes are presented. (Author)

A82-11721 # **60 KVA ADP permanent magnet VSCF starter generator system - Generator system performance characteristics.** R. C. Webb (General Electric Co., Binghamton, NY). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 140-145. Contracts No. F33615-78-C-2200; No. F33615-74-C-2037.

A description is presented of a Variable Speed Constant Frequency (VSCF) system, which consists of a cycloconverter with a synchronous generator that uses samarium cobalt magnets for its excitation. As part of its normal operation, the converter regulates each output wave in frequency and in voltage providing the necessary voltage regulation for a permanent magnet (PM) generator. The cycloconverter is capable of reverse power flow and the PM generator has the necessary excitation at standstill to make it possible to run the system as a brushless starter. Attention is given to the phases of the development program, system operation, start mode operation, and test results. It is pointed out that the PM VSCF system offers a significant improvement in electrical generating system efficiency over presently used systems. G.R.

A82-11725 # **Unsolved problems of nickel cadmium batteries.** S. Gross (Boeing Aerospace Co., Seattle, WA). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 177-181. 8 refs.

A number of problems occurring with nickel cadmium battery systems are primarily important for aerospace applications, where reliable, long-life is essential. Some of the problems are related to the design of plaques to obtain a large capacity and a long operational life. Other subjects investigated are nickel electrode morphology changes, nickel electrode cycling degradation, and the effects of cadmium migration. It is found that more work is needed for a better understanding of the various factors involved. The development of a computerized mathematical model of the nickel cadmium cell is

suggested. The effects produced by electrode additives are also discussed. G.R.

A82-11740 # **High voltage surge and partial discharge test to evaluate aerospace equipment parts.** W. G. Dunbar (Boeing Aerospace Co., Seattle, WA) and D. Schweickart (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH). In: Intersociety Energy Conversion Engineering Conference, 16th, Atlanta, GA, August 9-14, 1981, Proceedings. Volume 1. New York, American Society of Mechanical Engineers, 1981, p. 250-254.

Eight test articles were selected for high voltage evaluation to verify the specifications. The test articles represent critical components of a high-voltage, high-power airborne system. A description is presented of the findings of these tests in the case of the capacitors. Each capacitor was given preliminary tests to determine insulation resistance at 100 volts dc, and the capacity using a standard ASTM capacitance bridge at low voltage. It was found that the insulation resistance and capacitance test methods and parameters are acceptable. The partial discharge and dielectric withstanding voltage and surge test methods are acceptable, but the test parameters for airborne capacitors must be lower than those specified for commercial capacitors. G.R.

A82-11899 **Increasing the lift:drag ratio of a flat delta wing.** A. A. Mattick and J. L. Stollery (Cranfield Institute of Technology, Cranfield, Beds., England). *Aeronautical Journal*, vol. 85, Oct. 1981, p. 379-386.

Increases in the lift/drag (L/D) ratio attained by placing flaps on the upper surface of a flat, 60 deg, small aspect ratio delta wing are reported. The flaps were positioned along a ray from the vertex of the wing; their height, increasing from the vertex to the trailing edge, was a percentage of the semispan, and they were hinged at the lower edge. Position and heights were varied and lift and drag forces were measured over a range of angles of attack. The flaps were found to cause a lift force to act on themselves, up to a height of 6.1% of the semispan, by causing air from the primary vortex core to separate and form a vortex on the outboard side of the flaps. A maximum increase of 33% in the L/D was determined and it is noted that all the vertical flaps tested produced a positive thrust force. Graphs are provided of the derived aerodynamic ratios. M.S.K.

A82-11927 # **Fast and accurate gyrocompass using strapdown tuned rotor gyros as a solution to combat helicopters navigation problems.** P. Lloret, X. Lagarde, and G. Lavoipierre (Société d'Applications Générales d'Electricité et de Mécanique, Paris, France). In: Symposium Gyro Technology 1980; Proceedings of the Symposium, Stuttgart, West Germany, September 24, 25, 1980. Düsseldorf, Deutsche Gesellschaft für Ortung und Navigation, 1981, p. 1.0-1.25.

Results of verification tests to determine if gyrocompass mechanization can be used to find true headings within 0.5 deg in less than two minutes for helicopter navigation are presented. A strapdown inertial-Doppler navigation system which uses a pair of two-axis tuned rotor gyroscopes is described. The high accuracy of mechanical gyroscopes is attributed to the repeatability of the thermal behavior of tuned rotor gyroscopes. The gyros were temperature measured externally and in the instrument block, and correlations were sought between temperatures and drift patterns. Although true correlations were necessarily synthetic, drift rates of 15 deg/hr were reduced to 0.5 deg/hr peak residual drifts, confirming the potential use of 0.5 deg accuracy, two minute true heading mechanical gyroscopes as a complement to magnetic headings.M.S.K.

A82-11932 # **Design and development of a low cost servoed rate gyro for unmanned aircraft.** D. R. McKenzie (Smiths Industries Aerospace and Defence Systems Co., Cheltenham, Glos., England). In: Symposium Gyro Technology 1980; Proceedings of the Symposium, Stuttgart, West Germany, September 24, 25, 1980. Düsseldorf, Deutsche Gesellschaft für Ortung und Navigation, 1981, p. 14.0-14.56.

The development of a low cost rate gyro for use in unmanned vehicles is presented. The design parameters for the low weight gyro, which has an input range of plus or minus 50 deg/sec and can operate from a low voltage dc power source are outlined. A conventional design, comprising a spinning rotor on a gimbal with torque restraint and dynamic damping, was chosen to minimize cost and time; a

feedback approach was adopted to maintain performance stability. A rotational speed of 10,000 rpm with a polar moment of inertia of 20 g/sq cm was selected. The pick-off, torque motor, servoamplifier, and plastic molding are discussed and performance figures for 25 gyros are presented. A pulsed motor circuit was developed to maintain motor speed within 7% of the set value over the operating temperature range; elimination of a wheel speed control improved nonlinearity and reduced costs. Circuitry diagrams and schematics are provided. M.S.K.

A82-11933 # **Design considerations for the direct digital control of dry-tuned gyroscope.** S. N. Puri (Indian Space Research Organization, Vikram Sarabhai Space Centre, Trivandrum, India). In: Symposium Gyro Technology 1980; Proceedings of the Symposium, Stuttgart, West Germany, September 24, 25, 1980.
Düsseldorf, Deutsche Gesellschaft für Ortung und Navigation, 1981, p. 15.0-15.25.
The use of direct digital processor control of dry-tuned gyros is examined. Direct control is implemented because of a finite processing time lag between input and output, and is aided by minimizing the computation time by compensating for the effects of rounding coefficients in the control algorithm. The minimum settling time is discussed analytically and a design is developed that reduces complexity in the control function, offers lower torque demands, and has acceptably small steady state error. A retarded response is mentioned, and the use of a digital processor is found to add delays in the rebalance loops, requiring specific positioning of zeroes in the determinant of the pulse transfer function. An example is given, noting that pick-off noise at the spin frequency or its harmonics can be eliminated by use of a notch filter. Finally, a compromise is viewed as possible if slightly increased overshoot and settling time are found acceptable with a prescribed computing delay. M.S.K.

A82-11934 **Digital avionics - Promise and practice; Proceedings of the Joint Symposium, London, England, March 20, 1980.** Symposium sponsored by the Royal Aeronautical Society and Institution of Electrical Engineers. London, Royal Aeronautical Society, 1981. 72 p.

Papers presented at the symposium provide an overview of the current status of digital avionic systems with emphasis on the practical experience in operating these systems, achievements and problems, and advanced technologies available. Topics discussed include: the influence of digital techniques on system architecture, certification of digital systems, the all digital military aircraft, and an airline's experience in the field. V.L.

A82-11937 # **The all digital military aircraft.** D. Roughton (British Aerospace Public, Ltd., Co., Brough, England). In: Digital avionics - Promise and practice; Proceedings of the Joint Symposium, London, England, March 20, 1980. London, Royal Aeronautical Society, 1981. 14 p.
Developments in avionic systems over the past two decades are reviewed. The main factor that emerges is the conflict between the increasing complexity required to meet operational demands and the need for simplicity of operation to ease the workload of the reduced aircrew. In future aircraft, as the number and type of systems continue to grow, system integration and system automation are essential to ensure that the pilot workload is kept at an acceptable level. V.L.

A82-11938 # **The digital civil aircraft.** J. F. Moore (British Aerospace Public, Ltd., Co., Aircraft Group Div., Bristol, England). In: Digital avionics - Promise and practice; Proceedings of the Joint Symposium, London, England, March 20, 1980.
London, Royal Aeronautical Society, 1981. 16 p.
The development of digital avionics is reviewed with particular reference to application in civil aircraft. Examples of in-service systems in which digital technology has been already implemented are examined, including inertial navigation systems, aircraft integrated data systems/accident data recording, multiplexing systems, and the air intake control system of Concorde. Attention is given to the potential benefits of new applications, current developments, practical aspects, and implications of functional integration. Finally, future applications are discussed such as full digital engine control and flight controls (fly-by-wire system). V.L.

A82-11940 # **The certification of digital systems.** D. J. Hawkes (Civil Aviation Authority, London, England). In: Digital avionics - Promise and practice; Proceedings of the Joint Symposium, London, England, March 20, 1980. London, Royal Aeronautical Society, 1981. 12 p. 9 refs.
The present situation in the field of airworthiness certification of digital systems is reviewed and the future certification task is examined with emphasis on safety-critical applications. It is shown that the existing certification requirements are adequate for the new generation of digital systems. For the foreseeable future, the certification task will be very similar to that currently undertaken and will involve performance verification, environmental testing, and safety analyses. The certification task will be refined and judgement will be improved as the weaknesses and peculiarities of digital systems are exposed. V.L.

A82-11941 # **Digital avionics systems - The RAF experience.** B. J. Hunter (RAF, London, England). In: Digital avionics - Promise and practice; Proceedings of the Joint Symposium, London, England, March 20, 1980. London, Royal Aeronautical Society, 1981. 6 p.
The RAF's practical experience in operating digital avionic systems is reviewed with reference to a computer-based navigation and attack system that forms part of a pilot/aircraft control loop for navigation, weapon aiming, and flight direction installed on Jaguar aircraft. The system has proved to be flexible and reliable; modifications of the system can now be accomplished by a software, rather than hardware, change; and the first and second line testing has been reduced. The software maintenance practice and management are discussed in detail. V.L.

A82-11942 # **Digital avionics: Promise and practice - An airlines experience in the field.** J. E. Mills (British Airways, Hounslow, Middx., England). In: Digital avionics - Promise and practice; Proceedings of the Joint Symposium, London, England, March 20, 1980. London, Royal Aeronautical Society, 1981. 4 p.
The British Airways experience with digital avionic systems is reviewed with regard to the initial expectations, achievements, and maintenance and engineering problems encountered. It is shown that the introduction of digital systems into civil aviation did not produce the promised increase in reliability, the self test results being particularly disappointing. However, no maintenance problems of any great significance have been encountered. It is expected that the use of custom LSI and microprocessors will diminish problems previously associated with hardware and will provide improved reliability and more competent self test and monitoring, leading to improved first line servicing. V.L.

A82-11997 # **The CIVIC - A concept in vortex induced combustion. II.** J. R. Shekleton (Solar Turbines International, Turbomach Div., San Diego, CA). *(American Society of Mechanical Engineers, International Gas Turbine Conference, Houston, TX, Mar. 8-12, 1981, Paper 81-GT-12.) ASME Transactions, Journal of Engineering for Power,* vol. 103, Oct. 1981, p. 708-717. 34 refs.
The development of vortex induced combustion is reviewed, noting that the modelling is based on convective processes in unequally heated adjacent air masses. The aerodynamics of vortex flow are analytically examined, and reaction criteria in gas turbine and reciprocating engine vortex combustors are presented. Buoyant mixing to achieve fast, near constant volume combustion in diesel engines is described for two cases. Use of a rotating cup fuel injector in a 10 kW gas turbine to provide good atomization with viscous fluids, even in arctic conditions, is discussed, including a new design feature which avoids injecting the fuel mist into the swirl air. Test results and schematics are presented of various applications, stressing the ability of vortex induced combustion to display efficiencies with standard liquid fuels usually obtained only with natural gas. M.S.K.

A82-11999 * # **Thermal expansion accommodation in a jet engine frame.** M. H. Schneider (General Electric Co., Cincinnati, OH). *(American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, Houston, TX, Mar. 9-12, 1981.) ASME Transactions, Journal of Engineering for Power,* vol. 103, Oct. 1981, p. 776-780. Contract No. NAS3-20643.

Design advancements to enhance stress accommodation in gas turbine engine frames are described. Consideration is given to mechanical stiffness to maintain an adequate spring rate, and to thermal stresses in both ambient and transient modes. Noting that thermal stresses occur due to differing temperatures at different parts of the frame, the matching of the thermal expansion rates of different structural materials is emphasized. Adequate stiffness is necessary to avoid dynamic reactions leading to case cracking as a result of normal imbalances of moving parts. Stress and deflection analysis of a total frame concept using a three-dimensional finite element stress analysis computer program, with modelling of all frame components, is presented, and illustrations are provided.

M.S.K.

A82-12021 † **Jet fuel from carbon (Reaktivnoe toplivo iz uglia).** A. A. Krichko, M. K. Iulin, A. C. Arifulin, T. C. Nikiforova, and V. A. Puchkov (Akademiia Nauk SSSR, Institut Goriuchikh Iskopaemykh, Moscow, USSR). *Khimiia i Tekhnologiia Topliv i Masel,* no. 9, 1981, p. 3-5. 8 refs. In Russian.

A jet fuel of the T-8V type has been obtained by isomerization and hydrogenation at 4 MPa of the hydrorefined 180-320 C fraction of a liquid-phase carbon hydrogenation product. The flow scheme and the material balance of the process are presented. V.L.

A82-12022 † **A protective additive for jet fuels (Zashchit-naia prisadka k reaktivnym toplivam).** O. P. Lykov, G. I. Shor, V. P. Lapin, V. V. Sashevskii, and L. I. Mosina (Moskovskii Institut Neftekhimicheskoi i Gazovoi Promyshlennosti, Moscow, USSR). *Khimiia i Tekhnologiia Topliv i Masel,* no. 10, 1981, p. 37-40. 6 refs. In Russian.

A study has been carried out to investigate the protective action of an additive to jet fuels which consists of a mixture of dimers and trimers of synthetic fat acids. Results indicate that there exists a correlation between changes in the protective properties of the fuel as a function of the additive content, on the one hand, and changes in certain electrophysical characteristics of the fuel (e.g., conductivity, contact potential difference change, and electrifiability), on the other hand. V.L.

A82-12025 * **Design predictions for noise control in the cryogenic National Transonic Facility.** W. S. Lassiter (NASA, Langley Research Center, Hampton, VA). *Noise Control Engineering,* vol. 17, Sept.-Oct. 1981, p. 76-84. 6 refs.

Noise control in the National Transonic Facility - a cryogenic wind tunnel - has been examined in terms of acoustical design criteria, drive-fan noise and exhaust system noise. A duct lining with two layers of perforated sheeting and a gas-filled honeycomb core was selected for attenuating drive-fan noise. With the exception of attenuation peaks, attenuation of the lining was found to experimentally agree with predicted values at 20 C air temperatures. Exhaust system noise will be attenuated with a large muffler used in conjunction with a 6.1-m high acoustical enclosure. Fan noise from the fan-ejector system will be attenuated by fan silencers and the acoustic enclosure. S.C.S.

A82-12026 **Emerging technologies in aerospace structures, design, structural dynamics and materials; Proceedings of the Aerospace Conference, San Francisco, CA, August 13-15, 1980.** Conference sponsored by the American Society of Mechanical Engineers. Edited by J. R. Vinson (Delaware, University, Newark, DE). New York, American Society of Mechanical Engineers, 1980. 333 p. $20.

Topics discussed include the emerging technologies in composite materials structures, in materials, and in structural dynamics, shock and impact. Particular attention is given to impact-initiated damage thresholds, adhesively bonded joints in composites, stress concentrations in bonded multilayer stiffened strips and base plates, and the fatigue life of coldworked holes. Consideration is also given to the response of nonlinear aircraft structural panels to high intensity noise, the dynamic numerical analysis of crack initiation, fast crack propagation and crack arrest, and the energy release rate of a penny-shaped crack at the fiber-end of a composite. J.F.

A82-12028 * # **Impact-initiated damage thresholds in composites.** A. V. Sharma (North Carolina Agricultural and Technical State University, Greensboro, NC). In: Emerging technologies in aerospace

structures, design, structural dynamics and materials; Proceedings of the Aerospace Conference, San Francisco, CA, August 13-15, 1980.

New York, American Society of Mechanical Engineers, 1980, p. 11-26. 10 refs. Grant No. NsG-1296.

An experimental investigation was conducted to study the effect of low velocity projectile impact on the sandwich-type structural components. The materials used in the fabrication of the impact surface were graphite-, Kevlar-, and boron-fibers with appropriate epoxy matrices. The testing of the specimens was performed at moderately low- and high-temperatures as well as at room temperature to assess the impact-initiated strength degradation of the laminates. Eleven laminates with different stacking sequences, orientations, and thicknesses were tested. The low energy projectile impact is considered to simulate the damage caused by runway debris, dropping of the hand tools during servicing, etc., on the secondary aircraft structures fabricated with the composite materials. The results show the preload and the impact energy combinations necessary to cause catastrophic failures in the laminates tested. A set of faired curves indicating the failure thresholds is shown separately for the tension- and compression-loaded laminates. The specific-strengths and -moduli for the various laminates tested are also given.

(Author)

A82-12039 # **Coupled fluid/structure response predictions for soft body impact of airfoil configurations.** J. J. Engblom (United Technologies Corp., Government Products Div., West Palm Beach, FL). In: Emerging technologies in aerospace structures, design, structural dynamics and materials; Proceedings of the Aerospace Conference, San Francisco, CA, August 13-15, 1980.

New York, American Society of Mechanical Engineers, 1980, p. 209-223. 8 refs. Research supported by the United Technologies Corp.

Jet engine overhaul costs related to foreign object damages (FOD) are a significant concern in aircraft operations. Present FOD design systems, however, are not applicable to advanced airfoil configurations. An analytical design tool has therefore been developed to improve the FOD response prediction capability for the soft body impact of metal or composite fan blades, and is implemented by a finite element computer code. The basic approach involves coupling a fluid loading model with a structural model for the blade. Iterative effects are included in the solution, i.e., applied loads are a function of the structural response. Solutions include the effects of large displacement (geometric) and material (inelastic) nonlinearities. The code is also modified to treat the response of hybrid composite materials, demonstrating its capability to meet impact response predictions for complex metal or composite airfoil configurations. It is concluded that the analysis can be used to support the design of future high tip speed FOD-tolerant fan blades. J.F.

A82-12041 # **Response of nonlinear aircraft structural panels to high intensity noise.** C. Mei (Old Dominion University, Norfolk, VA). In: Emerging technologies in aerospace structures, design, structural dynamics and materials; Proceedings of the Aerospace Conference, San Francisco, CA, August 13-15, 1980.

New York, American Society of Mechanical Engineers, 1980, p. 245-272. 17 refs. Contract No. F49620-79-C-0169.

Design methods and design criteria for sonic fatigue prevention have been developed based on analytical and experimental techniques. This paper presents an analytical method for predicting the response of rectangular nonlinear structural panels subjected to broadband random acoustic excitation. The formulation is based on the Karman-Herrmann large deflection plate equations, a single-mode Galerkin approximation, the equivalent linearization method, and an iterative procedure. Both simply-supported and clamped-support conditions with immovable or movable inplane edges are considered. Panel mean-square deflection, maximum mean-square stress, and equivalent linear frequency at various acoustic loadings are determined and presented in graphical form. The results obtained were shown to agree well with experimental ones, and suggestions for further research are given. J.F.

A82-12043 # · **Crack growth evaluation of a method to convert real-time loads history to a simplified engineering spectra.** E. J. Ferko (Lockheed-Georgia Co., Marietta, GA). In: Emerging technologies in aerospace structures, design, structural dynamics and

materials; Proceedings of the Aerospace Conference, San Francisco, CA, August 13-15, 1980. New York, American Society of Mechanical Engineers, 1980, p. 285-294. 6 refs.

The random and independent nature of shear and axial stresses due to gust sources poses a complex problem for the structural analysis of cracks emanating from fastener holes in spanwise and beam-web splices of a transport aircraft wing. A practical engineering solution to the shear/axial stress interaction problem was developed for the C-5A wing, and a box beam test program was conducted to evaluate the solution. The evaluation was accomplished by comparing crack propagation rates generated by testing flight measured real time histories (RTH) with the engineering solution (referred to as the Equivalent Analytical Representation spectra). The baseline RTH spectra consisted of loads data recorded during dynamic response flight testing. The EAR spectra was derived from the aforementioned RTH data and was analytically developed utilizing peak counting methods and the empirical shear/axial stress interaction solution. Fractographic correlation of numerous cracks indicated that the EAR spectra adequately simulated the random nature of shear and axial stresses in the RTH data. (Author)

A82-12045 # **Numerical treatment of helicopter rotor stability problems.** R. Vepa and T. S. Balasubramanian (National Aeronautical Laboratory, Bangalore, India). In: Emerging technologies in aerospace structures, design, structural dynamics and materials; Proceedings of the Aerospace Conference, San Francisco, CA, August 13-15, 1980. New York, American Society of Mechanical Engineers, 1980, p. 307-319. 14 refs. Research supported by the Ministry of Defence.

The problem of calculating the Floquet transition matrix for parametric stability problems is considered. A new method of calculating the transition matrix with a minimum number of time steps is described. The method is shown to be extremely efficient for a wide class of helicopter stability problems, including flapping stability of a helicopter rotor, helicopter ground resonance with a nonisotropic rotor and pitch-flap-bending stability of a helicopter rotor in forward flight. The relationship of the method to the classical method of averaging is pointed out. (Author)

A82-12048 **ACMA - Fact or fantasy.** W. T. Mikolowsky and W. A. Garrett (Lockheed-Georgia Co., Marietta, GA). *Lockheed Horizons,* Fall 1981, p. 2-12.

The feasibility of the advanced civilian/military aircraft (ACMA) for use as both an advanced military airlift vehicle and a commercial airfreighter is discussed. A partnership in development between government and industry is expressed as necessary to reduce costs through larger production quantities, to increase emergency airlift capabilities in the Civil Reserve Air Fleet, and commercial maintenance of military aircraft. Design options and requirements are presented along with timetables, showing production delivery to commence in 1994. Topics such as commercial need, energy use, engine design, and financial planning are examined, with emphasis on system features that enhance the commercial attractiveness of the vehicle. A preliminary configuration shows a payload capability of 390,000 lbs with a fuel efficiency 50% better than that of the 747-200F. M.S.K.

A82-12049 **History of flight testing the L-1011 TriStar jet transport. II - Testing highlights since initial certification of the L-1011-1.** R. J. Gatineau (Lockheed-California Co., Palmdale, CA). *Lockheed Horizons,* Fall 1981, p. 14-29.

A82-12087 # **Considerations and applications for the use of fluidics in aerospace controls.** T. G. Sutton (AiResearch Manufacturing Company of Arizona, Phoenix, AZ). In: 20th Anniversary of Fluidics Symposium, Chicago, IL, November 16-21, 1980, Proceedings. New York, American Society of Mechanical Engineers, 1980, p. 73-79. 6 refs.

Fluidics technology has been considered for use in controls in aerospace environments in order to obtain reliable and cost-effective systems. While many applications involving fluidics have been in production for several years, there have been a number of failures while attempting to apply fluidics technology to aerospace applications. Because of this, fluidic techniques must be very carefully evaluated for any application before being considered as the most desirable technology to be used. An overview is given of design

parameters which must be given due consideration by the fluidic system designer. Included are the interfacing of the technology with other system components. Case histories of three fluidic control applications are cited. C.R.

A82-12100 **Quantification of the thermal environment for externally carried aircraft stores and ordnance.** H. Schafer and I. Barbe (U.S. Naval Weapons Center, China Lake, CA). *Journal of Environmental Sciences,* vol. 24, Sept.-Oct. 1981, p. 23-26.

Thermal testing procedures for aircraft external stores and ordnance are discussed, noting the importance of considering the entire range of possible thermal environments for each tested component. A method is proposed in which necessary parameters of environmental variables such as aircraft speed, altitude, air temperature, and amount of fuel available are considered in terms of percentiles. A Gaussian distribution is assumed for each environmental range, enabling for example, the elimination of extreme high and low flight speeds from average environment estimates. Use of the Arnold Research and Development Center standard atmosphere was found to be preferrable for engineering considerations because of inherent biasing errors in the MIL-STD-210 hot and cold data atmosphere. Techniques of cross-correlating environmental percentiles are defined, and it is emphasized that thermal gradients cause the greatest hardware performance degradation. M.S.K.

A82-12107 # **The dispersion of drop sizes in gas turbine fuel nozzle sprays.** D. L. Markham (Ex-Cell-O Corp., Walled Lake, MI). In: Fluid mechanics of combustion systems; Proceedings of the Fluids Engineering Conference, Boulder, CO, June 22, 23, 1981. New York, American Society of Mechanical Engineers, 1981, p. 95-100. 6 refs.

The dispersion of drop sizes in sprays as produced by gas turbine fuel nozzles was studied by conducting a large number of tests on several fuel nozzle sprays using a Malvern ST1800 Particle and Droplet Size Distribution Analyzer. It is found that the size dispersion of a spray depends on the location where the spray cloud is sampled, nozzle type, and nozzle operating condition. It is concluded that to fully specify the drop size characteristics of a gas turbine fuel nozzle spray, not only must the mean drop size of the drop size distribution be reported, but also the drop size dispersion. P.T.H.

A82-12118 # **Application of numerical modeling to gas turbine combustor development problems.** G. J. Sturgess, S. A. Syed, and D. Sepulveda (United Technologies Corp., Commercial Products Div., East Hartford, CT). In: Fluid mechanics of combustion systems; Proceedings of the Fluids Engineering Conference, Boulder, CO, June 22, 23, 1981. New York, American Society of Mechanical Engineers, 1981, p. 241-250. 23 refs.

The effects of dome cooling air changes in an experimental combustor for a large, turbofan gas turbine engine are investigated by means of perturbation studies carried out with numerical modeling. Two geometrical configurations are examined at high engine power levels, and calculated changes in the flow fields are compared with evidence obtained from experimental engines. Changes in dome and liner pressure drops are observed with severe dome distress in one of the configurations. It is concluded that the combustor simulations are qualitatively correct and have satisfactory quantitative agreement without requiring exact geometrical representations. D.L.G.

A82-12120 * # **On the prediction of swirling flowfields found in axisymmetric combustor geometries.** D. L. Rhode, D. G. Lilley, and D. K. McLaughlin (Oklahoma State University, Stillwater, OK). In: Fluid mechanics of combustion systems; Proceedings of the Fluids Engineering Conference, Boulder, CO, June 22, 23, 1981. New York, American Society of Mechanical Engineers, 1981, p. 257-266. 32 refs. Grant No. NAG3-74.

The paper reports research restricted to steady turbulence flow in axisymmetric geometries under low speed and nonreacting conditions. Numerical computations are performed for a basic two-dimensional axisymmetrical flow field similar to that found in a conventional gas turbine combustor. Calculations include a stairstep boundary representation of the expansion flow, a conventional k-epsilon turbulence model and realistic accomodation of swirl effects. A preliminary evaluation of the accuracy of computed flowfields is accomplished by comparisons with flow visualizations using neutrally-buoyant helium-filled soap bubbles as tracer particles.

Comparisons of calculated results show good agreement, and it is found that a problem in swirling flows is the accuracy with which the sizes and shapes of the recirculation zones may be predicted, which may be attributed to the quality of the turbulence model.   D.L.G.

A82-12149   **Determination of vertical profiles of aerosol size spectra from aircraft radiative flux measurements. II - The effect of particle nonsphericity.** R. M. Welch (Mainz, Universität, Mainz, West Germany), S. K. Cox (Colorado State University, Fort Collins, CO), and K. Ia. Kondrat'ev (Glavnaia Geofizicheskaia Observatoriia, Leningrad, USSR). *Journal of Geophysical Research*, vol. 86, Oct. 20, 1981, p. 9795-9800. 28 refs. NSF Grants No. ATM-78-05743; No. ATM-77-22384.

A82-12170 †   **Control of electromechanical actuator elements for flight vehicles (Upravlenie ispolnitel'nymi elementami slediashchikh elektroprivodov letatel'nykh apparatov).** B. I. Petrov, V. V. Bal'bukh, N. P. Pappe, V. P. Pappe, V. A. Serdiuk, and V. G. Stebletsov. Moscow, Izdatel'stvo Mashinostroenie, 1981. 222 p. 40 refs. In Russian.

The control theory of electromechanical actuator elements is developed with particular reference to application in electrical flight control systems (e.g., for tactical missiles). Attention is given to the use of ac motors and dc motors in such systems, and to digital actuator systems. The limiting dynamic possibilities and energetic characteristics of electromechanical actuators are considered.   B.J.

A82-12222 †   **The enhancement of heat exchange in channels /2nd revised and enlarged edition/ (Intensifikatsiia teploobmena v kanalakh /2nd revised and enlarged edition/).** E. K. Kalinin, G. A. Dreitser, and S. A. Iarkho. Moscow, Izdatel'stvo Mashinostroenie, 1981. 208 p. 199 refs. In Russian.

An analysis is presented of various means for the enhancement of heat exchange in the heat exchange channels of flight vehicles. The factors governing the selection of heat exchange enhancement method are considered, and specific methods applicable to right channels and longitudinal flow around a bundle of tubes, and curved channels are indicated. Attention is then given to the methods and mechanisms of heat exchange enhancement in pipes, around pipe bundles and in circular channels, in two-dimensional and triangular channels, taking into account the effects of hydraulic resistance and the effectiveness of the various methods is evaluated. The enhancement of heat exchange in the presence of film boiling on the one hand and condensation on the other in channels is also examined.
A.L.W.

A82-12267 #   **Validation studies of turbulence and combustion models for aircraft gas turbine combustors.** S. A. Syed and G. J. Sturgess (United Technologies Corp., Commercial Products Div., East Hartford, CT). In: Momentum and heat transfer processes in recirculating flows; Proceedings of the Winter Annual Meeting, Chicago, IL, November 16-21, 1980.   New York, American Society of Mechanical Engineers, 1980, p. 71-89. 29 refs.

The paper describes work performed as part of a continuing program to explore computational fluid dynamics procedures and related turbulence and combustion models for application to the design, understanding, and development of aircraft gas turbine combustors. Validation studies were conducted using a finite difference procedure (TEACH) to solve the relevant steady, two-dimensional, elliptic transport equations for turbulent flow. The familiar two equation (k-epsilon) turbulence model was used. The combustion model was based on the dissipation rate of oxidant, fuel, and product containing eddies. It was concluded that for confined, nonreacting flows with reasonably well defined boundary conditions, the turbulence model predicts mean flow quantities to an accuracy of about 85 percent in regions of parabolic flow. The size of the recirculation zone is underpredicted by about 15-20 percent, and its strength is underpredicted by 20-25 percent.   (Author)

A82-12318   **Extending the limits of reliability theory.** H. Goldberg. New York, Wiley-Interscience, 1981. 275 p. 15 refs. $32.50.

Aspects of probability and statistics are examined, taking into account the objective view of probability, the binomial distribution, the use of probability for prediction, the meaning of the reliability (survivor) function, questions of discrete and continuous distribution, time-to-failure distributions, and distributions found in the reliability literature. Attention is given to the determination of the time-to-failure distribution of a component, the sources of component failure data, the real world of electronic component procurement, the time to first failure for new systems, and system survivor functions for certain component distributions. Redundancy and survivor functions of systems are considered along with questions related to renewal theory and mean time between failures, a Monte Carlo investigation of systems based on normal distributions, and subjects related to precision, confidence, and numbers tested.   G.R.

A82-12323   **Antenna theory and design.** W. L. Stutzman (Virginia Polytechnic Institute and State University, Blacksburg, VA) and G. A. Thiele (Dayton, University, Dayton, OH). New York, John Wiley and Sons, 1981. 608 p. 158 refs. $30.95.

Antenna fundamentals and definitions are examined, taking into account electromagnetic fundamentals, the solution of Maxwell's equations for radiation problems, the ideal dipole, the radiation pattern, directivity and gain, reciprocity and antenna pattern measurements, antenna impedance and radiation efficiency, antenna polarization, antennas in communication links and radar, and the receiving properties of antennas. Some simple radiating systems are considered along with arrays, line sources, wire antennas, broadband antennas, moment methods, and aperture antennas. High-frequency methods and aspects of antenna synthesis are discussed, giving attention to geometrical optics, physical optics, wedge diffraction theory, the ray-fixed coordinate system, the cylindrical parabolic antenna, and linear array methods.   G.R.

A82-12449   **Commercial EMS considerations for small gas turbine engines.** R. Halliday (Pratt and Whitney of Canada, Ltd., Longueuil, Quebec, Canada). In: Aircraft gas turbine engine monitoring systems; Proceedings of the Aerospace Congress and Exposition, Los Angeles, CA, October 13-16, 1980. Congress and Exposition sponsored by the Society of Automotive Engineers. Warrendale, PA, Society of Automotive Engineers, Inc., 1981, p. 23-26.

It is shown that electronic automated engine monitoring systems (EMS) offer advantages over manual methods for power assurance, trend and limit exceedance monitoring, and low cycle fatigue and creep life recording. System cost, which is the main constraint on EMS for small gas turbines, is proportional to the number of parameters measured. Although EMS cost may preclude a full diagnostic capability, it may be reduced by 'piggy backing' with other systems, such as those for fuel control or flight monitoring. Future EMS are predicted to be part of modular, fully integrated systems employing multiplexing techniques. It is concluded that ARP 1587 is needed for that level of integration to be achieved. Among the parameters monitored by an EMS are turbine temperature, gas generator speed, free turbine speed, output torque, pressure altitude, and outside air temperature.   O.C.

A82-12450   **Further application and development of an engine usage/life monitoring system for military services.** R. Holl. In: Aircraft gas turbine engine monitoring systems; Proceedings of the Aerospace Congress and Exposition, Los Angeles, CA, October 13-16, 1980. Congress and Exposition sponsored by the Society of Automotive Engineers. Warrendale, PA, Society of Automotive Engineers, Inc., 1981, p. 27-30.

The Engine Usage Monitoring System (EUMS) which determines the rate and extent to which major and critical components of military engines are being consumed. Rapid development and limited funding constraints led to the production of the Mk I EUMS, which incorporates a Phillips-type magnetic tape cassette as the recording medium and serial digital data formatting and has shown good performance point recording accuracy and reliability. The Mk II development of the EUMS incorporates a microprocessor, a solid state memory, and associated large scale electronics miniaturization and integration. With the addition of a visual display unit, onboard computing/display facility requirements are also satisfied. A civil aviation application of the EUMS is projected on the strength of its basic simplicity and low cost.   O.C.

A82-12495   **Powder metallurgy superalloys - Aerospace materials for the 1980's; Proceedings of the Conference, Zurich, Switzerland, November 18-20, 1980. Volume 1.** Shrewsbury, Salop, England, MPR Publishing Services, Ltd., 1980. 237 p.

The conference focused on the latest advances in the powder metallurgy of superalloys, including developments in powder production, consolidation, and shape-making techniques, and applications. Papers are presented on the novel aspects for high-quality metal powder production equipment, oxide dispersion strengthened materials by mechanical alloying, potential for PM superalloys in aero engine application, HIP systems for superalloys, and electron-beam welding of PM nickel-base superalloys.　　　　V.L.

A82-12496　　　　Superclean superalloy powders by the rotating electrode process. P. Loewenstein (Nuclear Metals, Inc., Concord, MA). In: Powder metallurgy superalloys - Aerospace materials for the 1980's; Proceedings of the Conference, Zurich, Switzerland, November 18-20, 1980. Volume 1.　　　　Shrewsbury, Salop, England, MPR Publishing Services, Ltd., 1980, p. 7, 7-1 to 7-28. 18 refs.

A REP (rotating electrode process) powder system with inert gas handling has been developed for the manufacture of 'superclean' superalloy powders for fatigue-critical turbine applications. The system employs a noncontaminating plasma arc source and input electrodes in the form of precision ground bars that are free from nonmetallic inclusions. The production capability of the superalloy powder facility is approximately 500,000 kg per year.　　　　V.L.

A82-12497　　　　Superalloy turbine components - Which is the superior manufacturing process, as-HIP, HIP plus Isoforge, or 'gatorizing' of extrusion consolidated billet. J. Coyne, W. H. Couts, C. Chen, and R. P. Roehm (Wyman-Gordon Co., North Grafton and Worcester, MA). In: Powder metallurgy superalloys - Aerospace materials for the 1980's; Proceedings of the Conference, Zurich, Switzerland, November 18-20, 1980. Volume 1.
Shrewsbury, Salop, England, MPR Publishing Services, Ltd., 1980, p. 11, 11-1 to 11-31.

Identical parts of superalloys IN-100, René 95, MERL-76, AF-115, and Astroloy, which are being considered for turbine engine applications, have been produced by three different powder metallurgy techniques: as-HIP, HIP plus Isoforge, and gatorizing of extrusion-consolidated billet. The mechanical properties of parts produced by the different processes are found to be equivalent. Thus, the choice of a process should be based on factors other than the currently expected mechanical properties; namely, materials utilization, inspectability, and economics.　　　　V.L.

A82-12499　　　　Superalloy powder engine components; controls employed to assure high quality hardware. J. E. Coyne, W. H. Everett, and S. C. Jain (Wyman-Gordon Co., North Grafton and Worcester, MA). In: Powder metallurgy superalloys - Aerospace materials for the 1980's; Proceedings of the Conference, Zurich, Switzerland, November 18-20, 1980. Volume 1.
Shrewsbury, Salop, England, MPR Publishing Services, Ltd., 1980, p. 24, 24-1 to 24-27.

A program involving the production of several hundred turbine engine components from René 95 alloy is reviewed. Consideration is given to powder transportation and handling, development of stock acceptance tests and quality assurance program, precautions taken to avoid powder contamination in the process of handling prior to HIP'ing, and final testing. Examples of crack initiating defects and their effect on mechanical properties are included.　　　　V.L.

A82-12560　#　　　　Lineup of the IM-series aircraft-derivative gas turbines. *Ishikawajima-Harima Engineering Review,* vol. 21, July 1981, p. 279-285. 13 refs. In Japanese, with abstract in English.

In order to establish the reliability of the power turbines to be developed by IHI, extensive investigations are carried out, in particular, on the rotor assemblies. With engine test runs using actual IM5000 gas turbines, confirmation of the power turbine blade vibratory stress is carried out through the whole operating range. The measured stress levels reveal that they are far below the critical limits and that no detrimental resonance is to be expected. The same procedure is used with the IM2500 power turbine. In addition to analyses of the rotating parts, the various stationary parts are tested, especially the transient behavior of the casing for quick thermal response at the time of starting, stopping and emergency shutdown of the engine.　　　　C.R.

A82-12563　　　　Fuel conservation - DC-9 series 20/30/40. *Society of Flight Test Engineers, Journal,* vol. 3, Sept. 1981, p. 2-17.

Operational performance penalties and approximate fuel costs associated with the aerodynamics, flight operations, fuel gage system and performance analysis aspects of the DC-9 Series 20, 30 and 40 aircraft are presented. Degradations in aerodynamic cleanness, caused by the gradual deterioration of various seals, rigging adjustments and skin surface smoothness, are shown to lead to drag increases of less than 0.5%, which, however, represents a significant cost in view of the amount of fuel consumed. Flying off-optimum altitude or Mach number may result in excess fuel expenditures greater than those due to degraded aerodynamic cleanness. Other operational factors with substantial influence on fuel use include fuel or aircraft weight, center of gravity, flight time, the use of automatic flight control systems, APU operation, engine starting times, takeoff procedures, climb speed, en route profile, descent profile, and approach maneuvers. The DC-9 fuel gage system has been designed to be as accurate as possible in all phases, in order to minimize the necessity of carrying excess fuel for a given flight. Finally, investigations of aircraft performance may be used to identify areas requiring correction through the comparison of the indicated performance level against a reference, the assessment of engine and airframe contributions, and the investigation of the most likely areas for correction - the external control surfaces and internal systems. S.C.S.

A82-12564　　　　Procedures and analysis techniques for determining static air minimum control speeds. E. N. Bradfield (USAF, Flight Test Center, Edwards AFB, CA). *Society of Flight Test Engineers, Journal,* vol. 3, Sept. 1981, p. 18-48. 6 refs.

A method is presented which can be used to establish the minimum air speed required for the static lateral and directional control of a multiengined aircraft following the failure of one or more engines. Equations for the thrust moment and rudder pedal force coefficient in an asymmetrical force condition are derived from minimum directional control speed theory, and applied to the analysis of data obtained in climbs of the B-57 aircraft through a significant altitude band at minimum directional control speed with wings level and banked at various angles, and with a rudder power assist system both operational and inoperative. An analysis procedure is also presented for aircraft for which minimum control is defined by the lack of lateral, rather than directional control, such as STOL and powered-lift aircraft. These methods allow minimum control speed testing to be accomplished safely, without the necessity of flying at extreme low altitudes with an engine shut down, and permit extrapolation to off-standard-day conditions and various gross weights.　　　　S.C.S.

A82-12626　　　　National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Meeting sponsored by the Institute of Navigation. Washington, DC, Institute of Navigation, 1981. 190 p.

Papers are presented on such topics as all-digital GPS receiver mechanization, worldwide coverage of the Phase II Navstar satellite constellation, real-time missile tracking with GPS, navigation task partitioning in distributed-processing avionics systems, and memory requirements for future aerospace navigation systems. Consideration is also given to the simulation study of a hybrid strapdown attitude and heading reference system, a comparative study of strapdown algorithms, ring laser gyro navigator flight test results, and size effects in strapdown navigators.　　　　P.T.H.

A82-12630　#　　　　Satellite geometry considerations for low cost GPS user equipment. Y. Rosenthal (Intermetrics, Inc., Cambridge, MA). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings.　　　　Washington, DC, Institute of Navigation, 1981, p. 30-32. FAA-supported research.

The paper evaluates the geometrical properties of various GPS satellite configurations as seen by a low-cost user equipment designed for use by general aviation (GA). The GA user is equipped with one antenna which covers an 85-deg cone perpendicular to the plane of the aircraft. Therefore, when the aircraft banks, satellites which are above the horizon may be shadowed. Through a nominal turn at a bank angle of 25 deg, the identity of the visible satellites is changing rapidly. Hence, preselection of the best four satellites is impossible. Criteria for comparing 24 satellites from the GA user point of view is

presented, as well as some preliminary results which indicate the different results provided by different constellations. Results show that as far as GA is concerned, the coverage provided by various 24 satellite constellations is not of equal value. P.T.H.

A82-12634 # **A solution to the static geometry problem for JTIDS relative navigation.** R. Weiss (Intermetrics, Inc., Cambridge, MA) and P. Asher (USAF, Joint Program Office, Bedford, MA). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 62-64.

The current JTIDS (Joint Technical Information Distribution System) relative navigation algorithm restricts the use of relative position data in order to maintain stability. In a static geometry situation, the position quality will be degraded. This paper proposes a solution to the static geometry problem which involves a second source that maintains a high position quality by constraining its covariance matrix. There are several ways to implement this situation, each of which must be evaluated in a simulation environment for scenarios involving transitions from static geometry to normal mode. P.T.H.

A82-12636 # **Hard limited approaches to correlation velocity sensing.** T. J. Lund, R. E. Chapman, and G. A. Murdock (Teledyne, Inc., Teledyne Ryan Electronics, San Diego, CA). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 79-83. 6 refs.

Correlation velocity sensors determine velocity by measuring the time delay required for best correlation between signals gathered by two downward looking radar receiver antennas having known separation along the velocity axis being measured. This paper discusses a variation of this basic technique in which the received signals are hard limited such that correlation is only performed on the phase of the signal. The hard limiting approach avoids the need for AGC and allows the receiver outputs to be applied directly to a digital processor. Comparisons of correlation functions are presented for linear correlations on the total signal (phase and amplitude), amplitude only and phase only. It is shown that the correlation properties of hard limited signals are well suited to correlation velocity sensing. The results of simulations of the correlation velocity sensing process, which included a realistic terrain scattering model, are presented for various flight conditions and terrain types. The implementation of a hard limited correlation velocity sensor is discussed. (Author)

A82-12637 # **Memory requirements for future navigation systems.** R. Fedorak (U.S. Naval Material Command, Naval Air Development Center, Warminster, PA) and B. A. Zempolich (U.S. Navy, Naval Air Systems Command, Washington, DC). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 84-89.

The paper examines current problems concerning memories used in aerospace navigation systems, identifies technical management concerns relative to various aspects of current use of specific memory technologies, and discusses memory requirements for future aerospace navigation systems. Particular attention is given to such aspects as nonvolatility, electrical reprogrammable memories, commonality of memory hardware between platforms, packaging, and memory capacity. MNOS EEPROM, MNOS 8K BORAM, MNOS EAROM, and bubble memories are considered. P.T.H.

A82-12638 # **Omega station 10.2 kHz signal selection made easy.** R. R. Gupta and R. S. Warren (Analytic Sciences Corp., Reading, MA). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 90-103. 7 refs.

Recently developed Omega station signal coverage prediction diagrams for 10.2 kHz at eight representative diurnal and seasonal global times of the year provide the most complete presentation of Omega station signal coverage ever available to Omega users. This paper presents minimum and maximum coverage extremes characterized by the coverage diagrams for the eight representative coverage times of the year for two signal selection criteria. A simplified algorithm which yields a conservative determination of the coverage

is obtained by using the maximum coverage boundary. The range and bearing coordinates of minimum and maximum SNR boundaries for -20 dB and -30 dB are provided in tabular form for each Omega station. P.T.H.

A82-12639 # **FAA acceptance tests on the NAVSTAR GPS Z-Set receiver.** R. J. Esposito (FAA, Technical Center, Atlantic City, NJ). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 104-107.

This paper describes FAA acceptance tests on the NAVSTAR GPS Z-Set receiver which were conducted in a USAF System Command C-141 aircraft over the instrumented range located at the Yuma Proving Ground. The Yuma laser tracking system computed a reference trajectory against which the GPS receiver solution was compared. Data from five flights, totalling over six hours, are presented with the objective of assessing Z-Set capabilities to meet civil aviation requirements for non-precision approaches. (Author)

A82-12640 # **A navigation systems planning model.** H. L. Solomon and A. R. Stephenson (Systems Control, Inc., Palo Alto, CA). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 108-119.

The advent of Navstar/GPS has directed the attention of government decision-makers to the possibility of ultimately replacing or supplementing existing navigation systems with one or more alternative systems. To assist these decision-makers in evaluating these and other navigation policy alternatives, a navigation system cost/benefit model is being developed. A comprehensive data base is also being developed from which the appropriate information can be extracted by the model in response to navigation system implementation/decommissioning scenarios, as defined by the model users. The model will predict the user's annualized response to a stipulated scenario in terms of receiver purchases, thereby permitting navigation planners not only to consider operator costs but also the expected costs and benefits on either an individual or combined user group basis. The model's outputs will also be useful to individual user groups in assessing their position vis-a-vis navigation system policy alternatives. P.T.H.

A82-12641 # **Simulation study of a hybrid strapdown attitude and heading reference system.** D. B. Reid, B. N. McWilliam (Philip A. Lapp, Ltd., Toronto, Canada), and D. F. Liang (Defence Research Establishment, Ottawa, Canada). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 139-147. 13 refs.

The aircraft attitude and heading reference system (AHRS) considered in this paper comprises a low-accuracy strapdown inertial measurement unit (IMU), a strapdown magnetometer triad, which provides reference heading information, and air data sensors from which barometric altitude and true airspeed measurements are derived. A variable-dimension U-D factorized Kalman filter is employed to estimate the AHRS error state from the redundant sensor data. Estimated errors are fed back into the system using a combination of continuous and impulsive control methods to bound the inertial attitude, heading, and velocity errors and reduce the rate of position error growth. A data compression algorithm is employed for smoothing of incoming measurement data to enable high-rate information to be incorporated into the filtering process at minimum computational cost. The system operates in three modes: normal AHRS mode, alignment (erection) mode and magnetics calibration mode, in which the U-D filter is utilized to estimate systematic errors in the sensed magnetic field during a ground 'swing' procedure. Initial results obtained by full-scale simulation indicate that, with a low-accuracy strapdown IMU, the system can achieve roll and pitch accuracies of about 5 arc minutes (RMS) and a heading accuracy of approximately .75 degree (RMS). (Author)

A82-12642 # **The integrated inertial sensor assembly /IISA/ - A redundant strapdown system for advanced aircraft navigation and flight control functions.** M. S. Dipasquo (U.S. Naval Material Command, Naval Air Development Center, Warminster, PA). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation,

1981, p. 153-162.

In order to achieve the benefits of an integrated inertial sensor assembly (IISA) for the next generation aircraft, the U.S. Navy has embarked on an advanced development program to demonstrate the IISA concept. This paper examines the requirements definition, the system concept formulation, and the design definition of the advanced development model (ADM) that will be used for concept validation in a later flight test program. P.T.H.

A82-12643 # **Integrated satellite navigation and strapdown attitude and heading reference systems for civil air carriers.** J. J. Hopkins (Navigation Development Services, Inc., Northridge, CA). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 163-170. 17 refs.

The potential of the integrated GPS navigator and the strapdown AHRS as a replacement for several existing avionics systems is investigated. Its application is discussed including the economic impact with regard to acquisition and maintenance. The system components and integration approach are described, and the expectations for favorable performance comparisons with its competition are presented. It is concluded that the economic and performance advantages are unmistakably outstanding. Consequently, to save costs and to safely handle increased traffic there is a strong likelihood that integrated GPS/AHRS will become the standard position, velocity, and attitude reference system for future civil aircraft. P.T.H.

A82-12644 # **Ring Laser Gyro Navigator /RLGN/ flight test results.** K. L. Bachman (U.S. Naval Material Command, Naval Air Development Center, Warminster, PA). In: National Aerospace Meeting, Trevose, PA, April 8-10, 1981, Proceedings. Washington, DC, Institute of Navigation, 1981, p. 171-178.

This paper describes a flight test program and the resultant navigation performance achieved on an Advanced Development Model (ADM) Ring Laser Gyro Navigator (RLGN) in Navy A-7E and P-3C aircraft. As the RLGN represents a significant departure from conventional gimballed inertial system technology, a brief functional system description is given highlighting key hardware and software design features. This is followed by a description of the A-7E flight test program, its objective, flight profiles, method of data acquisition, and analysis of results. The P-3C flight test program is discussed including a description of the flight test recording instrumentation, flight profiles, data reduction, and analysis of results. An indication of system reliability, maintenance, and calibration actions versus system design goals is given. Effects of high latitude on system alignment and navigation performance are also highlighted. (Author)

A82-12646 **Kevlar composites; Proceedings of the Symposium, El Segundo, CA, December 2, 1980.** Symposium sponsored by the Technology Conferences. El Segundo, CA, Technology Conferences, 1980. 96 p. $24.

Papers presented cover Kevlar-49 properties and Kevlar/epoxy composite materials. Kevlar roles in the aerospace industry were noted in the design of the L-1011 Tristar components, in the materials processing for commercial aircraft, and applications in commuter aircraft; additional papers describe Kevlar use in life-saving equipment, for rocket motors, pressure vessels, and fuel tanks. Finally, the methods and tools necessary for using Kevlar are presented. D.H.K.

A82-12647 **Seven years experience with Kevlar-49 in the Lockheed L-1011 Tristar.** R. H. Stone (Lockheed-California Co., Burbank, CA). In: Kevlar composites; Proceedings of the Symposium, El Segundo, CA, December 2, 1980. El Segundo, CA, Technology Conferences, 1980, p. 25-43.

A history of the use of Kevlar-49 in aircraft structures is presented. The aramid fibers provide a 25-30% weight reduction over fiberglass with 1.5 times the stiffness, in addition to comparable tensile strength; compressive strength is lower, though acceptable. Aircraft parts were fabricated on fiberglass production equipment using epoxy resin prepregs and tested for durability, impact resistance, and flammability; all were found to be comparable to fiberglass. Wing body sandwich fairings, underwing fillet panels, and aft engine fairings were built, tested for aerodynamic loads, and found acceptable in a NASA flight service program. The parts were then mounted on Lockheed L-1011's for use in commercial airline service; after 50,000 flying hours wear was equivalent to the use of fiberglass. Interior and exterior applications in aircraft, such as for rudder and trailing edge flaps, are discussed. D.H.K.

A82-12694 **Wings in the sun - The evolution of Solar Challenger.** M. Cowley. *Flight International,* vol. 119, June 13, 1981, p. 1865-1868.

The design, development and testing of the Solar Challenger aircraft are described, with attention to its lightweight structural design and photovoltaic cell array-powered electric propulsion system. The configuration features a cantilever wing and horizontal tail, whose upper surfaces support 236 sq ft of solar cells that are rated at 13% conversion efficiency. The main wing spar and fuselage boom are constructed by wrapping a carbon fiber tube with 1/4-in.-thick Nomex honeycomb, followed by two layers of Kevlar cloth. Flutter tests of the airframe have been conducted at speeds of up to 65 mph by mounting the tail, fin and wing on a van. The aircraft is designed for 100-mile flights at 5000-10,000 ft altitudes and 25-35 mph, but the nearly horizontal mounting of the solar cells restricts flight conditions to those with high sun angles, at midday. When the sun is low in the sky, as in winter, the Solar Challenger must fly due north to maximize insolation. O.C.

A82-12696 # **Helicopter icing spray system - Improvements and flight experience.** D. Belte (U.S. Army, Edwards AFB, CA). *(Canadian Aeronautics and Space Institute, Flight Test Symposium, Medley, Alberta, Canada, Mar. 31, Apr. 1, 1981.) Canadian Aeronautics and Space Journal,* vol. 27, 2nd Quarter, 1981, p. 93-106. 6 refs.

In 1979 improvements were made to the helicopter icing spray system used in icing qualification tests. The improvements were aimed at reducing drop diameter and eliminating ice formation on the spray boom. A Sonicore nozzle was selected to replace the original atomizers and the number of atomizers on the spray boom was tripled. The newly modified configuration was evaluated using a UH-1H helicopter. Measurements were made of drop size distribution and liquid water content. Spray cloud measurements showed great improvement over earlier characteristics, and the median volumetric diameter approached that of natural clouds. The types of ice formation also reflected the improvement in cloud quality. Since in-flight spray simulation cannot duplicate the 100% relative humidity of a natural icing cloud, a computer program was developed to define the evaporation effect on liquid water content. An expanded airspeed range was used for 1980-1981 tests and results were compiled for the UH-60A, UH-1H ice phobics, Bell Model 412 and Grumman OV-1D. S.C.S.

A82-12697 # **Fractographic determination of fatigue crack growth rates in aircraft components.** W. Wiebe and R. V. Dainty (National Aeronautical Establishment, Structures and Materials Laboratory, Ottawa, Canada). *(Canadian Aeronautics and Space Institute, Annual General Meeting, Montreal, Canada, May 11, 12, 1981.) Canadian Aeronautics and Space Journal,* vol. 27, 2nd Quarter, 1981, p. 107-117.

The application of electron fractography to the failure analysis of aircraft components is considered to be rewarding because it frequently permits the precise identification of the causes of component failure. Quantitatively, considerable effort has been devoted to the development of techniques specifically directed to the evaluation of fatigue crack growth rate information, both from service fatigue failures, and from components fractured during full-scale aircraft laboratory fatigue tests. Originally, the fractographic determination of crack growth rate data in these laboratory tests was relatively straightforward, since discrete numbers of load cycles were applied at each of the various load levels in the fatigue loading spectrum. However, recent use of computer-controlled random fatigue loading equipment has produced new problems associated with the identification and correlation of the randomly spaced fatigue striations on the fracture surface, and the derivation of crack growth rate data from them. The fractographic methods developed for the solution of these problems are described. (Author)

A82-12698 # **SARSAT applications.** W. R. McPherson (Defence Research Establishment, Ottawa, Canada). *(Canadian Aeronautics and Space Institute, Canadian Conference on Astronautics, 1st, Ottawa, Canada, Oct. 20-22, 1980.) Canadian Aeronautics and Space Journal,* vol. 27, 2nd Quarter, 1981, p. 118-126.

The SARSAT system is designed to utilize satellite technology for the rapid detection and location of marine and air distress incidents. The system consists of (1) emergency beacons for small aircraft and boats operating at 406 MHz; (2) space components including on-board receivers and processors; and (3) a ground receiving station with related communication links. The system is expected to detect an emergency beacon within six hours of its activation with local accuracy to the order of 20 km at present, and 5 km or better for the 406 MHz test units. The first SAR instrumented spacecraft will be launched in mid-1982. Five countries are presently involved in the project, including the USSR COSPAS/-SARSAT project and the SARSAT Investigator in Norway.   S.C.S.

A82-12775   **F-5G Tigershark.** D. Richardson. *Flight International,* vol. 120, Oct. 17, 1981, p. 1144-1150.

Design features, production goals, and potential markets for the F-5G fighter are reviewed. The aircraft was developed as a counter to the MiG-23 and third generation MiG-21. A GE F404 turbofan engine was chosen, with space left in the redesigned fuselage to accommodate minor engine improvements. A Mach 2 top speed is noted, and an 8,000 hr service life with a 9 g limiting load is projected; fuel consumption is lower than in the F5-E, with more available thrust. Design changes affected the rear fuselage profile, added a carbon composite tailplane, spar, and vertical fin, thicker wing skins to withstand 9 g combat maneuvers, and a larger canopy for greater visibility, in addition to instrument console flexibility. Armament options are provided, with mounts capable of using non-US ordnance; performance characteristics, including the 16,400 lb thrust are given, along with estimated selling price and production schedules. Over 90% of the ground support equipment of the F5-E is mentioned as being compatible with the F-5G.   M.S.K.

A82-12801 #   **The case for a defensive air-to-air fighter.** W. Hill, Jr. (Rockwell International Corp., North American Aircraft Div., Los Angeles, CA). *Astronautics and Aeronautics,* vol. 19, Nov. 1981, p. 28-36.

An investigation is conducted regarding the approaches available to compensate for the imbalance of tactical air power which favors the Soviets/Warsaw Pact over the U.S./NATO forces, taking into account the constraints of the U.S. Air Force budget. One approach can be to increase the fighter procurement monies, by reducing other budget items, to buy large quantities of the expensive multimission fighter. However, in connection with budgetary considerations related to the urgency of other requirements, it appears that new aircraft the size and capability of the F-15 and F-16 cannot be obtained in quantities sufficient to gain parity with Soviet air forces. It is, therefore, proposed to employ a single-mission aircraft which, because of its simple design and low cost, can be built in quantity. This proposal is based on the recognition that an effective NATO interceptor does not need all the capabilities of the F-15 and F-16.

G.R.

A82-12803 * #   **Solution to the hidden-line problem.** D. R. Hedgley (NASA, Flight Research Center, Edwards AFB, CA). *Astronautics and Aeronautics,* vol. 19, Nov. 1981, p. 51.

It is pointed out that realistic three-dimensional renderings of solid objects or surfaces by computers have long been needed. The NASA Dryden Flight Research Center will soon publish a report and the computer program on an algorithm that solves for hidden lines. The computer program is written in FORTRAN IV and its size is approximately $35N + 9500$ words, where N is the number of elements. A number of pictures are presented which were drawn by a computer using the algorithm.   G.R.

A82-12804 #   **Parachute technology under pressure.** E. A. Reed (U.S. Naval Material Command, Naval Air Development Center,

Warminster, PA). *Astronautics and Aeronautics,* vol. 19, Nov. 1981, p. 56-61. 22 refs.

A description is presented of advances in specific areas of parachute technology, taking into account developments occurring since 1975. It is pointed out that stress and parachute design analysis continue to have the same needs as in 1975. Some analytic work has related nonlinear elasticity, energy dissipation and textile weave to the propagation of step strain pulses due to snatch or impact loadings. Sophisticated computer programs exist for stress analysis of parachutes and for calculating their opening load. Attention is given to the improved performance of new textile materials, possibilities for improvements related to supersonic parachutes, aspects of parachute packing, and developments concerning ejection seats. G.R.

STAR ENTRIES

N82-10002# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Festigkeit.
MATHEMATICAL MODEL FOR THE MAINTENANCE PROGRAM OF MODERN JET AIRCRAFT
Rudolf Prinz, Hans-Christian Goetting, Karl-Heinz Galda (Deutsche Lufthansa A.G., Hamburg), and Juergen Kreth (Deutsche Lufthansa A.G., Hamburg) Oct. 1980 44 p refs In GERMAN; ENGLISH summary Report will also be announced as Translatation (ESA-TT-724)
(DFVLR-FB-81-14) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 10,40
Step-by-step escalation of structural inspection intervals based on long-term experience with a fleet of transport aircraft is described by a mathematical model. Fundamental to the model are statistical distributions of load and detectable crack length in a fatigue loaded component. Knowing realistic probabilities of failure enables the calculation of appropriate inspection intervals. Calculation procedure yields increasing intervals up to a maximum value and a decrease when approximating the mean value of detectable crack length. As to usual interval steps, the results show good agreement with practice. Restrictions and possible applications of the model are discussed. Author (ESA)

N82-10016# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
STANDARD TESTS OF A RESEARCH MODEL ROTOR IN A WIND TUNNEL, INCLUDING MODEL SIMILARITY [STANDARD-ERPROBUNG DES FORSCHUNGS-MODELLROTORS IM WINDKANAL, EINSCHLIESSLICH MODELLVERGLEICHEN]
R. Stricker, V. Mikulla, and E. Allramseder Bonn Bundesministerium der Verteidigung 1979 93 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium der Verteidigung (BMVg-FBWT-79-16) Avail: NTIS HC A05/MF A01; Dokzentbw, Bonn DM 30
A wind tunnel test program was developed, as a basis the actual flight regime of the BO-105 helicopter. Operation of the test stand and calibration of measuring devices is described. The procedure for data reduction (digital programs) is given. Results include the parameters: mean and fluctuating components of rotor forces and moments; blade bending moments (flapping, lagging); and control forces. Control and static stability derivatives are also determined. The calculations done for comparison with measurements, using aerodynamic/aeroelastic/flight mechanic digital programs, show in almost all cases very good agreement with model test results. The correlation with flight test data of the BO-105 helicopter shows that model similarity according to the most important scaling laws is fulfilled to a high degree and that the results can be used for real comparison of various sizes of hingeless helicopter rotors. Author (ESA)

N82-10017# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Experimentelle Stroemungsmechanik.
EXPERIMENTAL INVESTIGATIONS OF THE SEPARATED FLOW AROUND A RECTANGULAR WING
Hans Bippes, Michael Turk, and Klaus Jacob Oct. 1980 56 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-81-12) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 10
For the aspect ratios lambda = 3.1 and 2.3, pressure distributions over the whole span were measured at angles of attack up to alpha approximately = 27 deg. For selected cases, oil flow patterns were produced and velocity profiles behind the wing along with shear stresses at the surface were measured. Most of the model and the experiments were carried out at Re approximately = 2,100,000 and M approximately = 0.17. The model and the experiments are described. The results are

discussed and partly compared with results from a theoretical model. Author (ESA)

N82-10020# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AIRCRAFT EXCRESCENCE DRAG
A. D. Young, J. H. Paterson, and J. Lloyd Jones, ed. Jul. 1981 172 p refs
(AGARD-AG-264; ISBN-92-835-1392-4) Avail: NTIS HC A08/MF A01
A review was undertaken of the available data on the subject of the drag of excrescences on aircraft surfaces. Information from this review is summarized and presented in a way that is readily usable for prediction and design purposes. The basic characteristics of boundary layers are discussed and, where possible, the drag of excrescences is related to those characteristics. In particular, because the size of many types of surface imperfection is small in comparison with boundary layer thicknesses, the drag of such imperfections can be correlated in terms of the properties of inner regions of the boundary layer. Several previously published analyses of this type are highlighted and, where possible, extensions to other data sources or other types of excrescence are presented. The practical problems of applying these data in the varying velocity gradients existing on aircraft surface are treated and one section is devoted to the drag of auxiliary air inlet and exit openings. Gaps in existing data which offer opportunities for research effort are pointed out. J.M.S.

N82-10021*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
ICING TUNNEL TEST OF A GLYCOL-EXUDING POROUS LEADING EDGE ICE PROTECTION SYSTEM ON A GENERAL AVIATION AIRFOIL Final Report
David L. Kohlman, William G. Schweikhard, and Alan E. Albright Sep. 1981 37 p refs
(Grant NAG3-71)
(NASA-CR-165444; KU-FRL-464-1) Avail: NTIS HC A03/MF A01 CSCL 01C
Test results show that the system is very effective in preventing ice accretion (anti-ice mode) or removing ice from an airfoil. Minimum glycol flow rates required for antiicing are a function of velocity, liquid water content in the air, ambient temperature, and droplet size. Large ice caps were removed in only a few minutes using anti-ice flow rates, with the shed time being a function of the type of ice, size of the ice cap, angle of attack, and glycol flow rate. Wake surveys measurements show that no significant drag penalty is associated with the installation or operation of the system tested. T.M.

N82-10022# Committee on Science and Technology (U. S. House).
SPIN RECOVERY TRAINING
Washington GPO 1980 15 p Presented by the Subcomm. on Invest. and Oversight of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., Jul. 1980
(GPO-66-020) Avail: Subcommittee on Investigations and Oversight
The FAA policy of not requiring spin recovery training as a prerequisite for a private pilot license was examined in an effort to determine if such a requirement would result in a net savings of life. Only FAA remained adamant in defense of the no-spin training policy. All other witnesses, to varying degrees, expressed the need for spin and recovery training as a common sense safety requirement. It can be concluded without equivocation that experienced aviators overwhelmingly demand that aspiring pilots be trained to protect themselves and be able to recover from post stall gyrations, incipient spins, and spins. The subcommittee's recommendations that such training be required for licensing is discussed with emphasis on the development of a flight training manual and an implementation plan. A.R.H.

N82-10023# Naval Postgraduate School, Monterey, Calif. Dept. of Operations Research.
A PROPOSED FLIGHT SAFETY PROGRAM FOR THE KOREAN AIR FORCE M.S. Thesis
Chong Kwan Lee Mar. 1981 136 p refs
(AD-A102373) Avail: NTIS HC A07/MF A01 CSCL 05/1
Several methodologies relevant to the development of a safety program for the Korean Air Force were reviewed. Methodologies considered included: Control charts; System safety analysis; and

Critical incident technique. Data collection methods applicable to accident analysis were proposed. Recommendations for the incorporation of these methods into a safety program for the K.A.F. were developed. The safety program described in this thesis possesses the potential for reducing overall operational costs and maximizing aircraft availability. The end result of such a program can only serve to increase operational readiness and thereby maximize overall efficiency and military capability of the K.A.F. GRA

N82-10024# Research Inst. of National Defence, Stockholm (Sweden). Huvudavdelning 2.
LIGHTNING EFFECTS ON AIRCRAFT AND COMPOSITES. LITERATURE STUDY ON LIGHTNING STRIKES AND PROTECTION [VERKAN AV BLIXT I FLYGPLAN OCH KOMPOSITER. LITTERATURSTUDIE OEVER SKADOR OCH SKYDD]
Anita Alm Nov. 1980 102 p refs In SWEDISH
(FOA-C-20388-F9) Avail: NTIS HC A06/MF A01
The frequency and different types of lightning strike on different parts of aircraft and several ways of protection against direct and indirect lightning effects were reviewed. Fiber composites, lightning damage and testing of lightning protection for modern aircraft material are studied by means of simulation techniques. Unshielded composite materials are damaged by lightning. With a correctly shaped lightning shield damage can be prevented. Author (ESA)

N82-10025# Societe Nationale Industrielle Aerospatiale, Paris (France).
COST REDUCTION IN AIR TRANSPORTATION
P. Lebouc 1980 21 p Presented at French Aerospace Week, Indonesia, 8-12 Dec. 1980
(SNIAS-811-150-101) Avail: NTIS HC A02/MF A01
Historical trends in costs are reviewed. By adopting fuel conservation policies, such as renewal of the jet fleet, adaptation of flight operation, and modification of air traffic control procedures, the airlines can limit the effect of expected fuel price increases. In parallel, productivity gains should keep at a constant level all the other costs of airline operations. Under the above conditions, growth of the industry seems to be certain even if fuel prices increase at a rate of 2 to 4% per year above inflation during the next 20 years. Author (ESA)

N82-10026# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bonn (West Germany). Inst. fuer Flugmedizin.
DEVELOPMENT AND CONSTRUCTION OF PILOT EJECTOR SEATS IN GERMANY FROM 1938-1945
Siegfried Ruff Feb. 1981 110 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-81-04) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 26
Pioneering research, leading to the development of an ejector seat for the Junkers Ju 88, is reviewed. Fundamentals in establishing human acceleration tolerances are discussed. The experimental simulation of shock induced acceleration is described, and human resistance is quantified. Exploitation and follow-up of accident related data are summarized, including investigations of the accelerations experienced with an aircraft out of control, e.g., shot down. The action of airspeed pressure on a person is considered, and experience gained with research aircraft is recounted. Measuring methods for technical and physiological parameters are indicated. The beginning of ejector seat development in England, Sweden, and the U.S. (1944-45) is also briefly reviewed in comparison. Author (ESA)

N82-10027# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE STATISTICAL THEORY OF RADIO DIRECTION FINDING
R. L. Holland Jun. 1981 47 p refs
(Contract N00024-81-C-5301)
(AD-A104156; JHU/APL/TG-1330) Avail: NTIS HC A03/MF A01 CSCL 17/3
The statistical theory of radio direction finding as it applied to three-dimensional geometrics is presented in this report. This theory is an extension of the two-dimensional theory presented by R. G. Stansfield in 1947. The theory has application in situations where airborne targets are maneuvering in three dimensions at

high speed, especially when the platforms with the direction finding equipment are also aircraft. Author (GRA)

N82-10028*# Wyle Labs., Inc., Huntsville, Ala.
EXPERIMENTAL MODAL ANALYSIS OF THE FUSELAGE PANELS OF AN AERO COMMANDER AIRCRAFT Final Report
David Geisler Sep. 1981 164 p refs Prepared in cooperation with Structural Dynamics Res. Corp., Cincinnati, Ohio
(Contract NAS1-14693)
(NASA-CR-165750; Rept-10568) Avail: NTIS HC A08/MF A01 CSCL 01C
The reduction of interior noise in light aircraft was investigated with emphasis the thin fuselage sidewall. The approach used is theoretical and involves modeling of the sidewall panels and stiffeners. Experimental data obtained from tests investigating the effects of mass and stiffness treatments to the sidewalls are presented. The dynamic characteristics of treated panels are contrasted with the untreated sidewall panels using experimental modal analysis techniques. The results include the natural frequencies, modal dampling, and mode shapes of selected panels. Frequency response functions, data relating to the global fuselage response, and acoustic response are also presented. J.M.S.

N82-10029*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
V/STOL AIRCRAFT AND FLUID DYNAMICS
Leonard Roberts (Stanford Univ., Calif.) and Seth B. Anderson Oct. 1981 8 p refs
(NASA-TM-81328; A-8730) Avail: NTIS HC A02/MF A01 CSCL 01C
The impact of military applications on rotorcraft and V/STOL aircraft design is summarized with respect to fixed-wing aircraft. The influence of the mission needs on the configurational design of V/STOL aircraft, the implications regarding some problems in fluid dynamics relating to propulsive flows, and their interaction with the aircraft and the ground plane, are also considered. Additional research in fluid dynamics that can contribute to an improvement in performance of V/STOL aircraft is suggested. B.W.

N82-10030*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN INVESTIGATION OF A STOPPABLE HELICOPTER ROTOR WITH CIRCULATION CONTROL
John D. Ballard, John L. McCloud, III, and T. J. Forsyth Aug. 1980 372 p refs
(NASA-TM-81218; A-8278) Avail: NTIS HC A16/MF A01 CSCL 01C
A stoppable helicopter rotor with circulation control was investigated in the Ames 40 by 80 foot wind tunnel. The model was tested as a rotating wing, a fixed wing, and during transition start/stop sequences. The capability of the model's control system to maintain pitch and roll moment balance during the start/stop sequence, the ability of the blades to withstand the start/stop loads, the adequacy of the control system to maintain balance in the helicopter mode, and the control system capabilities in the fixed-wind mode were assessed. Time-history data of several start/stop sequences of the X-wing rotor, and the steady-state data relating to the model as both a rotor and as a fixed-wing aircraft are presented. In addition, stability data are presented which were acquired during open-loop and closed-loop tests of the hub moment feedback control system. J.M.S.

N82-10031*# National Aeronautics and Space Administration. Washington, D. C.
QUIET SHORT-HAUL RESEARCH AIRCRAFT FAMILIARIZATION DOCUMENT, REVISION 1
Joseph C. Eppel Sep. 1981 81 p refs
(NASA-TM-81298; A-8601) Avail: NTIS HC A05/MF A01 CSCL 01C
The design features and general characteristics of the Quiet Short Haul Research Aircraft are described. Aerodynamic characteristics and performance are discussed based on predictions and early flight test data. Principle airplane systems, including the airborne data acquisition system, are also described. The aircraft was designd and built to fulfill the need for a national research facility to explore the use of upper surface blowing, propulsive lift technology in providing short takeoff and landing capability, and perform advanced experiments in various technical disciplines such as aerodynamics, propulsion, stability and control,

handling qualities, avionics and flight control systems, trailing vortex phenomena, acoustics, structure and loads, operating systems, human factors, and airworthiness/certification criteria. An unusually austere approach using experimental shop practices resulted in a low cost and high research capability.   Author

N82-10032*# Old Dominion Univ., Norfolk, Va.   Dept. of Mechanical Engineering and Mechanics.
COMPARATIVE STUDY OF FLARE CONTROL LAWS Final Report, 15 Dec. 1979 - 15 Oct. 1981
A. A. Nadkarni Oct. 1981 52 p refs
(Grant NsG-1480)
(NASA-CR-164903) Avail: NTIS HC A04/MF A01 CSCL 01C
   The development of a digital, three dimensional, automatic control law designed to achieve an optimal transition of a B-737 aircraft between glide slope conditions and the desired final touchdown condition is presented. The digital control law is a time invariant, state estimate feedback law, and the design is capable of using the microwave landing system. Major emphasis is placed on the reduction of aircraft noise in communities surroundings airports, the reduction of fuel consumption, the reduction of the effects of adverse weather conditions on aircraft operations, and the efficient use of airspace in congested terminal areas. Attention is also given to the development of the capability to perform automatic flares from steep glide slopes to precise touchdown locations.   B.W.

N82-10033# Aberdeen Univ. (Scotland).   Dept. of Engineering.
APPLICATION OF NUMERICAL METHODS TO THE CALCULATION OF ELECTROSTATIC FIELDS IN AIRCRAFT FUEL TANKS Final Scientific Report, 1 Jul. 1980 - 30 Jun. 1981
J. R. Smith, P. Lees, and D. McAllister Aug. 1981 65 p refs
(Grant AF-AFOSR-0223-80; AF Proj. 2301; AF Proj. 3048)
(AD-A103270;   EOARD-TR-81-9)   Avail: NTIS HC A04/MF A01 CSCL 01/3
   The solution of electrostatic field problems occurring during the refueling of aircraft fuel tanks containing explosion suppressant foams is discussed. A computational model of a fuel tank is set up, and the finite element method is used to calculate the electrostatic potential distribution within the tank. Author (GRA)

N82-10034# Boeing Military Airplane Development, Seattle, Wash.
LOW MAINTENANCE HYDRAULIC ACCUMULATOR Final Report, Aug. 1976 - Dec. 1980
E. C. Wagner and W. E. Willard Jun. 1981 65 p
(Contract F33615-76-C-2088; AF Proj. 3145)
(AD-A103947;   AFWAL-TR-81-2031)   Avail: NTIS HC A04/MF A01 CSCL 13/7
   This report presents the results of a program to develop a low maintenance accumulator, compatible with current MS envelopes and competitive in cost with conventional accumulators. The purpose of the program was to select and develop a metal bellows configuration/concept to replace the conventional moving piston and seal of conventional accumulators. The selected bellows are of welded construction and welded in place to allow bellows movement identical to piston movement. The accumulator housing is of welded construction to eliminate all possible leak points. The program goal was to develop an accumulator to provide a ten year unserviced life. Test results indicate an accumulator design is possible to achieve a service life of 6 to 10 years based on installation on an F-16 aircraft.   Author (GRA)

N82-10035# Messerschmitt-Boelkow-Blohm G.m.b.H., Otto-brunn (West Germany).   Unternehmensbereich Flugzeuge.
A CFRP TAILERON FOR THE TORNADO: CONSTRUCTION AND PRODUCTION [CFK-TAILERON FUER DEN TORNADO: KONSTRUKTION UND FERTIGUNG]
L. Lemmer, W. Hartmann, and R. Guenther 1980 67 p In GERMAN Presented at Gastvortrag im KL 624, Mannheim, West Germany, 10-14 Nov. 1980
(MBB-FE-212/KFK/PUB/2)   Avail: NTIS HC A04/MF A01
   A CFRP lightweight structure, i.e., CFRP taileron, for the Tornado aircraft was developed. The CFRP taileron is interchangeable with the currently used metal horizontal stabilizer as far as geometry, function and durability are concerned while a 30% weight reduction is achieved with CFRP construction. The assembly of the CFRP taileron is detailed and results from static,

dynamic, and vibration testing of the structure are presented. A series production method is then outlined, including inspection and certification procedures.   Author (ESA)

N82-10036# European Space Agency, Paris (France).
THEORETICAL INVESTIGATION OF THE INFLUENCE OF SPOILER DYNAMICS ON THE HANDLING QUALITIES OF AN AIRCRAFT WITH DIRECT LIFT CONTROL
Dieter Schafranek Jul. 1981 66 p refs Transl. into ENGLISH of "Theoretische Untersuchung ueber den Einfluss der Spoilerdynamik auf die Fliegbarkeit eines Flugzeugs mit direkter auftriebssteuerung" Rept. DFVLR-FB-80-07 DFVLR, Brunswick, 1980 Original report in GERMAN previously announced as N81-13975
(ESA-TT-681; DFVLR-FB-80-07) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 14,70
   Theoretical parameters describing the pilot's workload during aircraft control pitch tracking and flight path tracking tasks on a transport aircraft equipped with spoiler direct lift control (DLC) were studied. The determined parameters are the necessary phase compensation and gain adapation which the pilot must perform, and also the closed loop resonance. The influence of the DLC-gain factor, spoiler actuator rate, and spoiler deflection washout time constant on pilot workload is presented. Simulated time histories of pitch rate and normal acceleration response due to step type control inputs show the corresponding reactions of the various DLC-configurations which are essential for pitch control and flight path control. Direct lift control using spoilers is shown to be sensible for the aircraft in the test only if the pitching moment of the spoiler is completely compensated, the time constant for the spoiler deflection washout is not too small (greater than 5 seconds) and if the spoiler moves with more delay than the elevator.   Author (ESA)

N82-10037*# Detroit Diesel Allison, Indianapolis, Ind.
PROPULSION STUDY FOR SMALL TRANSPORT AIRCRAFT TECHNOLOGY (STAT) Contractor Final Report
J. C. Gill, R. V. Earle, D. V. Staton, P. C. Stolp, D. S. Huelster, and B. A. Zolezzi 16 Dec. 1980 186 p refs
(Contract NAS3-21995)
(NASA-CR-165499;   DDA-EDR-10470)   Avail: NTIS HC A09/MF A01 CSCL 21E
   Propulsion requirements were determined for 0.5 and 0.7 Mach aircraft. Sensitivity studies were conducted on both these aircraft to determine parametrically the influence of propulsion characteristics on aircraft size and direct operating cost (DOC). Candidate technology elements and design features were identified and parametric studies conducted to select the STAT advanced engine cycle. Trade off studies were conducted to determine those advanced technologies and design features that would offer a reduction in DOC for operation of the STAT engines. These features were incorporated in the two STAT engines. A benefit assessment was conducted comparing the STAT engines to current technology engines of the same power and to 1985 derivatives of the current technology engines. Research and development programs were recommended as part of an overall technology development plan to ensure that full commercial development of the STAT engines could be initiated in 1988.   T.M.

N82-10038*# Detroit Diesel Allison, Indianapolis, Ind.
PROPULSION STUDY FOR SMALL TRANSPORT AIRCRAFT TECHNOLOGY (STAT), APPENDIX B Final Report
[1980] 11 p refs
(Contract NAS3-21995)
(NASA-CR-165499-App-B; DDA-EDR-10470-App-B) Avail: NTIS HC A02/MF A01 CSCL 21E
   Data are tabulated for two conceptual engines designed for small transport aircraft. These are the 1790 W (2400 shp) class engine and the 3579 kW (4800 shp) class engine for the 0.5 M sub N and 0.7 M sub N airplanes, respectively. All data points required to perform the STAT missions are provided including take-off, climb, cruise, loiter, and fuel allowances. The weight, dimensions, price, and maintenance costs are given as well as the installation criteria and equations used for adjusting horsepower for gearbox loss, and converting horsepower to thrust. Scaling equations are included.   A.R.H.

N82-10039*#   United Technologies Research Center, East Hartford, Conn.
DEVELOPMENT OF LOW MODULUS MATERIAL FOR USE

IN CERAMIC GAS PATH SEAL APPLICATIONS Final **Report**
H. E. Eaton and R. C. Novak Oct. 1981 83 p refs
(Contract NAS3-22134)
(NASA-CR-165469; R81-915188-13) Avail: NTIS
HC A05/MF A01 CSCL 21E

Three candidate materials were examined: Brunsbond (I Pad; plasma sprayed porous NiCrAlY; and plasma sprayed low modulus microcracked zirconia. Evaluation consisted of mechanical, thermophysical, and oxidation resistance testing along with optical microscopy and a feasibility demonstration of attaching the material to a suitable substrate. The goals of the program were the following: feasibility of fastening or depositing the low modulus system onto a broad range of substrate alloys; feasibility of depositing or forming the low modulus system to a thickness of 0.19 cm to 0.38 cm; potential to attain a modulus of elasticity in the range of 3.4 to 6.9 GPa (0.5 to 1.0 MSI), and an ultimate strength of 17.2 MPa (2.5 ksi); suitable thermal conductivity; and static oxidation life of at least 1000 hours at 1311 K. The results of the program indicate that all three systems offer attractive properties as a strain isolator material. T.M.

N82-10040*# General Electric Co., St. Petersburg, Fla.
THERMAL-BARRIER-COATED TURBINE BLADE STUDY Final Report
P. A. Siemers and W. B. Hillig Aug. 1981 134 p refs
(Contract NAS3-21727)
(NASA-CR-165351; SRD-81-083) Avail: NTIS
HC A07/MF A01 CSCL 21E

The effects of coating TBC on a CF6-50 stage 2 high-pressure turbine blade were analyzed with respect to changes in the mean bulk temperature, cooling air requirements, and high-cycle fatigue. Localized spallation was found to have a possible deleterious effect on low-cycle fatigue life. New blade design concepts were developed to take optimum advantage of TBCs. Process and material development work and rig evaluations were undertaken which identified the most promising combination as ZrO_2 containing 8 w/o Y_2O_3 applied by air plasma spray onto a Ni22Cr-10Al-1Y bond layer. The bond layer was applied by a low-pressure, high-velocity plasma spray process onto the base alloy. During the initial startup cycles the blades experienced localized leading edge spallation caused by foreign objects. T.M.

N82-10041*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DETERMINATION OF AIRPLANE MODEL STRUCTURE FROM FLIGHT DATA BY USING MODIFIED STEPWISE REGRESSION
Vladislav Klein (Joint Inst. for Advancement of Flight Sciences, Hampton, Va.), James G. Batterson, and Patrick C. Murphy Oct. 1981 48 p refs
(NASA-TP-1916; L-14613) Avail: NTIS HC A03/MF A01 CSCL 01C

The linear and stepwise regressions are briefly introduced, then the problem of determining airplane model structure is addressed. The MSR was constructed to force a linear model for the aerodynamic coefficient first, then add significant nonlinear terms and delete nonsignificant terms from the model. In addition to the statistical criteria in the stepwise regression, the prediction sum of squares (PRESS) criterion and the analysis of residuals were examined for the selection of an adequate model. The procedure is used in examples with simulated and real flight data. It is shown that the MSR performs better than the ordinary stepwise regression and that the technique can also be applied to the large amplitude maneuvers. T.M.

N82-10042*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ESTIMATION OF AIRPLANE STABILITY AND CONTROL DERIVATIVES FROM LARGE AMPLITUDE LONGITUDINAL MANEUVERS
James G. Batterson Oct. 1981 43 p refs
(NASA-TM-83185; L-14524) Avail: NTIS HC A03/MF A01 CSCL 01C

The application of a modified stepwise regression algorithm to both a complete data string and to that same data partitioned into bins as a function of angle of attack was demonstrated. Results from the large-scale maneuver agree well with results from 20 maneuvers in which small perturbation from trim at various angles of attack were induced. T.M.

N82-10043*# Lear Siegler, Inc., Santa Monica, Calif. Astronics Div.
DEVELOPMENT AND EVALUATION OF AUTOMATIC LANDING CONTROL LAWS FOR LIGHT WING LOADING STOL AIRCRAFT
B. Feinreich, O. Degani, and G. Gevaert Jul. 1981 371 p refs
(Contract NAS2-9410)
(NASA-CR-166160) Avail: NTIS HC A16/MF A01 CSCL 01C

Automatic flare and decrab control laws were developed for NASA's experimental Twin Otter. This light wing loading STOL aircraft was equipped with direct lift control (DLC) wing spoilers to enhance flight path control. Automatic landing control laws that made use of the spoilers were developed, evaluated in a simulation and the results compared with these obtained for configurations that did not use DLC. The spoilers produced a significant improvement in performance. A simulation that could be operated faster than real time in order to provide statistical landing data for a large number of landings over a wide spectrum of disturbances in a short time was constructed and used in the evaluation and refinement of control law configurations. A longitudinal control law that had been previously developed and evaluated in flight was also simulated and its performance compared with that of the control laws developed. Runway alignment control laws were also defined, evaluated, and refined to result in a final recommended configuration. Good landing performance, compatible with Category 3 operation into STOL runways, was obtained. Author

N82-10044# Messerschmitt-Boelkow-Blohm G.m.b.H., Otto-brunn (West Germany).
ACTIVE CONTROL ELEMENTS ON THE TRANSONIC WING OF THE AIRBUS A-300 (ACTTA A). AIRBUS A-300 WITH REDUCED LONGITUDINAL STABILITY (ACTTA-C) [AKTIVE STEUERELEMENTE AM TRANSSONISCHEN FLUEGEL DES AIRBUS A300 (ACTTA A). AIRBUS A300 MIT REDUZIER-TER LAENGSSTABILITAET (ACTTA-C)]
H. G. Klug 1980 34 p In GERMAN Presented at 2nd Bundesministerium fuer Forschung und Technologie Statusseminar Luftfahrtforsch. und Luftfahrttechnol., Garmisch-Partenkirchen, West Germany, 8-9 Oct. 1980
Avail: NTIS HC A03/MF A01

Two projects concerned with the development and design optimization of the Airbus A-300 are reviewed. Studies related to active control are discussed. Investigations specific to gust loading and maneuver induced loading of the A-300 structure are emphasized. Results influence design criteria. e.g., open or closed loop control, sensor selection, etc. Reduced longitudinal stability of the A-300 is then considered as a tradeoff in favor of weight reduction through the use of lightweight materials. Wind tunnel and other simulation tests are described.
Author (ESA)

N82-10045# European Space Agency, Paris (France).
SYSTEM IDENTIFICATION OF THE LONGITUDINAL MOTION OF THE DFVLR HFB 320 RESEARCH AIRCRAFT WITH PARTICULAR CONSIDERATION OF CONTROL SURFACE EFFECTIVENESS
Ohad Rix Apr. 1981 55 p refs Transl. into ENGLISH of "Systemidentifizierung des DFVLR-Forschungsflugzeugs HFB 320 in der Laengsbewegung mit besonderer Beruecksichtigung der Steuerflaechenwirksamkeit" Rept. DFVLR-Mitt-79-66 DFVLR, Brunswick, Jul. 1979 Original report in GERMAN previously announced as N81-13971
(ESA-TT-666; DFVLR-Mitt-79-16) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 12

Analysis of the longitudinal motion of the DFVLR HFB-320 research aircraft by means of a maximum likelihood method is described. The control surface effectiveness of separately or simultaneously deflected DLC flaps and spoilers was determined. The flight test technique, and the influence of different mathematical models on the results obtained, are illustrated and discussed. Author (ESA)

N82-10046# European Space Agency, Paris (France).
A CONTRIBUTION TO THE STABILIZATION OF FLIGHT VEHICLE PARACHUTE SYSTEMS
Christos Saliaris and Dieter Muenscher Jun. 1981 30 p refs Transl. into ENGLISH of "Beitrag zur Stabilisierung von Flugkoerp-er-Fallschirm-Systemen" Rept. Mitt-80-05 DFVLR, Brunswick,

Apr. 1980

(ESA-TT-679; DFVLR-Mitt-80-05) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8.30

The dynamic behavior of a parachute-load system moving in a plane is analyzed. A mathematical model is adopted and a system of nonlinear equations of motion is produced, which are then solved without linearization using a digital computer. Calculations are carried out using a modified guide surface parachute in order to investigate the effects of parachute size, distance between attachment point and canopy, and distance between the attachment point and the center of gravity of the load on the oscillation of the missile. Parameters influencing the variation of the pitch angle of the load with time are also studied. Increasing the canopy and moving the attachment point behind the center of gravity of the load results in better stabilization. The damping increases, i.e. the pitch angle of the load becomes smaller and the period of oscillation decreases. If the distance between the attachment point on the load and the center of the canopy base is varied, there is scarcely any detectable change to the period of oscillation. However, the damping is influenced by a change in this distance; it has a maximum when the distance is approximately that which is customarily used.   Author (ESA)

N82-10047# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).   Abteilung Elastomechanik und Aeroelastische Stabilitaet.
A METHOD FOR DETERMINATION OF THE AEROELASTIC BEHAVIOR OF AIRCRAFT WITH ACTIVE CONTROL SYSTEMS Ph.D. Thesis - Tech. Univ. Carolo-Wilhelmina
Raymond Freymann Feb. 1981 128 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-719)
(DFVLR-FB-81-05) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 26.30

An analytical method for the performance of dynamic calculations on servocontrolled aircraft, based on an extended formulation of the generalized aeroelastic equations is presented. The additional parameters introduced in the extended equations of motion are determined experimentally in a ground vibration test performed on a real aircraft structure as well as with help from an experimental-analytical method for determination of the transfer functions of the hydraulic actuators. The elaborated method is shown satisfactory by comparison of measured and calculated data resulting from investigations performed on a model wing structure with a rudder driven by a hydraulic actuator.
Author (ESA)

N82-10048# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
MULTI-VARIABLE ANALYSIS AND DESIGN TECHNIQUES
Sep. 1981 168 p refs Presented at a Lecture Series held at Ankara, 28-29 Sep. 1981, Bolkesjo, Norway, 1-2 Oct. 1981, and Delft, The Netherlands, 5-6 Oct. 1981
(AGARD-LS-117) Avail: NTIS HC A08/MF A01

The basic theories and concepts involved in the design of advanced guidance and control systems employing state-space and multi-variable design methods are explained. The main topics reviewed include: (1) analysis and synthesis techniques; (2) application of observer and estimation principles; (3) computer-aided design and analysis methods; (4) system simulation techniques; and (5) tests evaluation and validation.

N82-10049# Honeywell, Inc., Minneapolis, Minn.   Systems and Research Center.
THE NEED FOR MULTIVARIABLE DESIGN AND ANALYSIS TECHNIQUES
Rhall E. Pope In AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 10 p

Avail: NTIS HC A08/MF A01

Demand for higher accuracy, improved reliability/survivability, and more automation are placing increased emphasis on the control function for successful operation of aircraft weapon systems. Modifications to airframe designs directed at increased maneuverability and reduced weight are placing stringent on flight control systems. Fly-by-wire systems, particularly digital systems, provide the flexibility to not only accommodate but influence airframe design modifications and led to the control configured vehicle (CCV) concept. These advances in air, vehicle design and flight control system implementation are overwhelming

traditional design and analysis techniques. Stability and control design specification are inadequate in dealing with statistically unstable vehicles, multiple control loops and high dynamic coupling. Better control system design and analysis techniques are needed which address the multi-input closely coupled dynamic nature of today's and tomorrows aircraft weapon systems.
A.R.H.

N82-10050# Cambridge Univ. (England).   Dept. of Engineering.
CHARACTERISTIC AND PRINCIPAL GAINS AND PHASES AND THEIR USE AS MULTIVARIABLE CONTROL DESIGN TOOLS
Alistair G. J. MacFarlane In AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 34 p refs

Avail: NTIS HC A08/MF A01

The key to the generalization of classical frequency-response design techniques to the multivariable case lies in the development of ways of suitably extending the concepts of gain and phase. It is shown how algebraic function theory can be used to generalise Nyquist diagram and Root-Locus diagram techniques for use with systems having many inputs and outputs. This is done in such a way that the main structural features of such diagrams can be related to state-space model parameters. The shortcomings of characteristic gains and phases (used in a generalised Nyquist approach) are then noted. An alternative way of introducing amplitude and phase information, via the polar decomposition of an operator, leads to the introduction of principal gains and principal phases. Their properties are examined and, in particular, it is shown how they may be used to characterise robustness. The use of these techniques for design purposes is discussed.
A.R.H.

N82-10051# Honeywell Systems and Research Center, Minneapolis, Minn.
MULTIVARIABLE DESIGN TECHNIQUES BASED ON SINGULAR VALUE GENERALIZATIONS OF CLASSICAL CONTROL
John C. Doyle In AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 15 p refs

Avail: NTIS HC A08/MF A01

Singular value analysis was used to generalize the fundamental feedback ideas from classical single loop control theory to multiloop systems. The classical view of measuring the benefit of feedback in terms of desensitizing the system to plant variations and disturbances is discussed. Uncertainty is shown to play a critical role in determining the way in which feedback may be used. Certain singular value plots, called sigma-plots, are introduced as natural and effective generalizations of Bode gain plots and form the basic tools for analysis of multiloop feedback systems. These tools provide reliable means for assessing the stability margins, bandwidth, and desensitizing effects of multiloop feedback systems. Examples of a two input oscillator and control of the rotors of the CH-47 helicopter are given to illustrate the use of the sigma-plots and their interpretations.   A.R.H.

N82-10052# Honeywell, Inc., Minneapolis, Minn.   Systems and Research Center.
LIMITATIONS ON ACHIEVABLE PERFORMANCE OF MULTIVARIABLE FEEDBACK SYSTEMS
John C. Doyle In AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 9 p refs

Avail: NTIS HC A08/MF A01

The design tradeoffs that are the focus of classical single-loop theory were generalized to multiloop systems using singular value analysis techniques. The first tradeoff is algebraic between large loop gain for good sensitivity properties and small loop gain for stability margins. Another is the functional tradeoff imposed by the Bode gain/phase relations. These tradeoffs impose limitations on the achievable performance of any feedback design. The limitations caused by nonminimum phase zeros are also discussed. The problem of directionality in multiloop systems has no analog in single loop feedback systems is presented and analyzed.
A.R.H.

N82-10053# Honeywell, Inc., Minneapolis, Minn.   Systems and Research Center.
LQG-BASED MULTIVARIABLE DESIGN: FREQUENCY DOMAIN INTERPRETATION

Gunter Stein *In* AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 9 p refs

Avail: NTIS HC A08/MF A01
The use of the Linear-Quadratic-Gaussian (LOG) methodology in designing feedback compensators which meet multivarible performance, stability, and stability robustness requirements expressed as singular value conditions in the frequency domain is demonstrated. A.R.H.

N82-10054# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
LQG MULTIVARIABLE DESIGN TOOLS
Gunter Stein and Stephen Pratt *In* AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 16 p refs

Avail: NTIS HC A08/MF A01
The basic design algorithms needed for frequency domain oriented Linear-Quadratic-Gaussian feedback design are described and experimental interactive computer aided design package through which these algorithms can be effectively acessed is introduced. The algorithms and design package are illustrated with several flight control design examples for highly maneuverable aircraft. A.R.H.

N82-10055# Groningen Rijksuniversiteit (Netherlands). Mathematics Inst.
DESIGN OF HIGH INTEGRITY MULTIVARIABLE CONTROL SYSTEMS
J. C. Williams *In* AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 10 p refs

Avail: NTIS HC A08/MF A01
The notions of (almost) controlled and conditionally invariant subspaces of linear systems are explained and their application to the synthesis of feedback compensators for disturbance rejection and to robust controller is outlined. The disturbance rejection and the robust controller design problems are viewed as a procedure for designing a high integrity feedback control system. A.R.H.

N82-10056# Toronto Univ. (Ontario). Systems Control Group.
A GEOMETRIC APPROACH TO MULTIVARIABLE CONTROL SYSTEM SYNTHESIS
W. Murray Wonham *In* AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 21 p refs

Avail: NTIS HC A08/MF A01
Multivariable control is discussed with emphasis on Multivariable Control: fundamentals, disturbance decoupling and output stabilization, controllability subspaces, noninteracting control, and regulation and tracking in linear systems and structurally stable nonlinear regulation with step inputs. A version of the internal model principle for controlled sequential machines is included.
A.R.H.

N82-10057# McGill Univ., Montreal (Quebec). Dept. of Electrical Engineering.
MULTIVARIABLES DESIGN: THE OPTIMIZATION OF APPROXIMATE INVERSES
G. Zames *In* AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 6 p refs

Avail: NTIS HC A08/MF A01
A mathematical framework for the analysis of sensitivity in multi-input-multi-output linear feedback systems is proposed, based on the concepts of a multiplicative seminorm and an approximate inverse. Many of the empirical results of classical control theory pertaining to the use of lead-lag networks can be deduced in this framework as solutions to well-posed mathematical optimization problems. Moreover, new classes of optimal filters for the reduction of sensitivity are introduced. A definition of optimal sensitivity to plant uncertainty is established. The multiplicative property of seminorms is used to obtain the following principle: for any specified aposteriori accuracy, there is a maximum of apriori plant uncertainty that can be tolerated, and a minimum of identification that is required. Author

N82-10058# McGill Univ., Montreal (Quebec). Dept. of Electrical Engineering.

FEEDBACK AND MINIMAX SENSITIVITY
George Zames and Bruce A. Francis (Waterloo Univ.) *In* AGARD Multi-Variable Analysis and Design Tech. Sep. 1981 8 p refs
Sponsored in part by National Science and Engineering Research Council of Canada
(Grant NSF ECS-80-12-565)
Avail: NTIS HC A08/MF A01
Feedbacks that minimize tne sensitivity function of a linear, single variable feedback system represented by its frequency responses were considered. Sensitivity is measured in a weighted H (infinity) norm. The single variable cases are studied. The results are extended to unstable plants, and explicit formulas for the general situation of a finite number of RHP plant zeros or poles are provided. The Q or 'approximate-inverse' parameterization of feedbacks that maintain closed-loop stability is extended to the case of unstable plants. The H (infinity) and Wiener-Hopf approaches are compared. A.R.H.

N82-10059*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EVALUATION OF THE ACOUSTIC MEASUREMENT CAPABILITY OF THE NASA LANGLEY V/STOL WIND TUNNEL OPEN TEST SECTION WITH ACOUSTICALLY ABSORBENT CEILING AND FLOOR TREATMENTS Final Report
Mark A. Theobald May 1978 46 p refs
(Contract NAS1-14611)
(NASA-CR-165796; Rept-3820) Avail: NTIS HC A03/MF A01 CSCL 14B
The single source location used for helicopter model studies was utilized in a study to determine the distances and directions upstream of the model accurate at which measurements of the direct acoustic field could be obtained. The method used was to measure the decrease of sound pressure levels with distance from a noise source and thereby determine the Hall radius as a function of frequency and direction. Test arrangements and procedures are described. Graphs show the normalized sound pressure level versus distance curves for the glass fiber floor treatment and for the foam floor treatment. A.R.H.

N82-10062# Committee on Science and Technology (U. S. House).
AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1981, PART 1
Washington GPO 1981 56 p Rept. to accompany H. R. 2643 Presented by the Comm. on Sci. and Technol. at the 97th Congr., 1st Sess., 19 Mar. 1981
(GPO-76-241-Pt-1) Avail: US Capitol, House Document Room
A bill authorizing appropriations to the FAA in the amount of $85,000,000 for air traffic control, navigation, aviation weather, aviation medicine, and ATC computer modernization for FY-1981-1982 is presented. The Committee directs that funds be reprogrammed to permit completion of the Flight Level 290 and to expedite development of the Doppler weather radar (Nexrad). The request for a trust fund to support $19.81 million of regulatory support research and development was denied. A.R.H.

N82-10063# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AIR-BREATHING ENGINE TEST FACILITIES REGISTER
Joachim H. Krengel, comp. Jul. 1981 122 p
(AGARD-AG-269) Avail: NTIS HC A06/MF A01
A register was compiled, aimed at comprising the test facilities relevant for research and development in NATO countries. Included are test facilities being in use or under construction at the various research organizations, industrial firms, and universities. Test facilities and their technical data are given as far as the response to a questionnaire was received or open literature was available. Test engineers will be able to find whether a test facility suiting their specific demands already exists or may be easily adapted to their purposes. T.M.

N82-10107# European Space Agency, Paris (France).
FLIGHT TEST RESULTS OF THE MODEL SIMULATION CONTROLLER FOR THE HFB 320 FOR IN-FLIGHT SIMULATION OF THE A310 AIRBUS
Hans-Heinz Lange Apr. 1981 72 p refs Transl. into ENGLISH of 'Flugerprobung des modellfolgereglers fuer die HFB 320 zur Simulation des Airbus A 310 in Fluge" Rept. DFVLR-Mitt-79-13

DFVLR, Brunswick, 1979 Original report in GERMAN previously announced as N81-10078
(ESA-TT-660; DFVLR-Mitt-79-13) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 15,40

The onboard computer program which completes the model simulating control system is presented and its fundamental operations explained. The effect of nonlinearities is demonstrated by means of the results of ground simulation of the test aircraft, the control system and the simulated aircraft. The flight test results show the achieved quality of in-flight simulation of the modeled A310 aircraft. Examples of the ground simulation predictions of the overall aircraft and controller system behavior are cited. Author (ESA)

N82-10254# KVB, Inc., Irvine, Calif..
BASELINE DATA ON UTILIZATION OF LOW-GRADE FUELS IN GAS TURBINE APPLICATIONS. VOLUME 3: EMISSIONS EVALUATION Final Report
T. Sonnichsen Jun. 1981 108 p refs Sponsored in part by Electric Power Research Inst.
(EPRI Proj. 1079-3)
(DE81-903764; EPRI-AP-1882-Vol-3) Avail: NTIS HC A06/MF A01

A series of field tests was conducted on two residual-oil-fired gas turbine/heat recovery steam generators (HRSG) comprising a Westinghouse PACE 260-MW combined-cycle unit. Base load emission levels were determined. A series of tests was also made at reduced operating loads. Emission measurements included: (1) gaseous constituents measured by continuous monitoring instrumentation (O_2, CO_2, NO, NO sub x, and SO2) and by wet chemistry methods (SO3, aldehydes, and chlorides); and (2) particulate characteristics (mass loding, smoke spot number; submicron particle size, and particle morphology). Corrected NO sub x emissions at base load were 170 ppM and 200 ppM with and without HRSG afterburners in service, respectively. The NO sub x emissions decreased with water injection by 50% and were unchanged with the turbine wash. The NO sub x increased with load. DOE

N82-10286*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SYNTHETIC APERTURE RADAR TARGET SIMULATOR Patent Application
Howard A. Zebker (JPL, California Inst. of Technology, Pasadena), Daniel N. Held (JPL, California Inst. of Technology, Pasadena), Richard M. Goldstein (JPL, California Inst. of Technology, Pasadena), and Thomas C. Bickler, inventors (to NASA) (JPL, California Inst. of Technology, Pasadena) Filed 17 Jul. 1981 15 p
(Contract NAS7-100)
(NASA-Case-NPO-15024-1; US-Patent-Appl-SN-284287) Avail: NTIS HC A02/MF A01 CSCL 17I

A simulator for simulating the radar return, or echo, from a target seen by a SAR antenna mounted on a platform moving with respect to the target is described. It includes a first-in first-out memory which has digital information clocked in at a rate related to the frequency of a transmitted radar signal and digital information clocked out with a fixed delay defining range between the SAR and the simulated target, and at a rate related to the frequency of the return signal. An RF input signal having a frequency similar to that utilized by a synthetic aperture array radar is mixed with a local oscillator signal to provide a first baseband signal to provide a first baseband signal having a frequency considerably lower than that of the RF input signal.
T.M.

N82-10326# Boeing Military Airplane Development, Seattle, Wash. Mechanical/Electrical Systems Technology Dept.
ADVANCED AIRCRAFT ELECTRICAL SYSTEM CONTROL TECHNOLOGY DEMONSTRATOR. PHASE 1: REQUIREMENTS ANALYSIS AND CONCEPTUAL DESIGN Interim Technical Report, 1 Sep. 1980 - 28 Feb. 1981
G. L. Dunn, P. J. Leong, and I. S. Mehdi Jul. 1981 103 p refs
(Contract F33615-80-C-2004; AF Proj. 3145)
(AD-A103922; D180-25927-2; AFWAL-TR-81-2058) Avail: NTIS HC A06/MF A01 CSCL 09/3

In Task 1, the requirements for the electrical power system and the integrated power system control were defined. In Task 2, three conceptual designs for the electrical power system were prepared. Each design incorporated a different data bus architec-

ture, integrated, hierarchical, and non-integrated dedicated. The three designs were evaluated for application to a two engine tactical aircraft. Processor and data bus loading were examined for each architecture. Based on the evaluation, the conceptual design based on the integrated architecture is recommended for preliminary design in Task 3, phase I. Author (GRA)

N82-10421# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 13, NO. 9
Judith Nagle-Eshleman, ed. Sep. 1981 123 p refs
(AD-A105062) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375; $15.00/set CSCL 20/11

Structural dynamic problems inherent to design, analysis, and operation of rotating machinery were investigated. The following Space Shuttle related problems are discussed: analytical and experimental loads, and dynamics efforts; development of data systems and environmental testing programs; Space Shuttle thermal protection system and the Space Shuttle main engine; structural dynamics, dynamic testing, and vibration control.

N82-10452# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastic.
CALCULATION OF NATURAL MODES OF VIBRATION FOR ROTOR BLADES BY THE FINITE ELEMENT METHOD
Fritz Kiessling and Dieter Ludwig Jan. 1981 66 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-81-07) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 14,20

The mass and stiffness matrices for a rotating blade are established by the finite element method. The formulation is based on the Lagrange function presented for combined flapwise bending, chordwise bending, and torsion of twisted nonuniform rotor blades. The element matrices were created by the nonnumeric computer program REDUCE by which it is possible to evaluate the formulas by symbolic manipulation. An ordering scheme was introduced to demonstrate which terms were simplified or neglected. As examples, eigenanalyses are performed for a nonrotating homogeneous beam and for the rotor blade of a wind energy converter. Author (ESA)

N82-10812# Hope Associates, Inc., Washington, D.C.
A COMPREHENSIVE BIBLIOGRAPHY OF LITERATURE ON HELICOPTER NOISE TECHNOLOGY Final Report
A. M. Carter, Jr. Jun. 1981 116 p
(Contract DTFA01-80-Y-10597)
(AD-A103331; FAA-EE-81-4) Avail: NTIS HC A06/MF A01 CSCL 20/1

This bibliography, covering the period 1975 through calendar 1980 also provides abstracts on literature that appear to make a significant contribution to the field of helicopter noise technology. The helicopter is recognized as a complex noise generator, with significant contributions from the rotors, the engine and the gearbox. Progress continues to be made in the noise areas of: (a) Formulations, math models and analytical procedures; (b) Noise prediction methodology; (c) Noise reduction techniques; and (d) Subjective response to helicopter noise. The body of information, data and knowledge has use in many applications, including the reduction of helicopter noise in a cost effective manner and in minimizing annoyance to the civil populace. GRA

N82-10959# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1982: INDEX
Washington GPO 1981 316 p Hearings on H.R. 1257 before the Comm. on Sci. and Technol., 97th Congr., 1st Sess., No. 2, 1981
(GPO-84-713) Avail: Committee on Science and Technology

A subject and name index is presented to the testimony delivered, statements received, and questions raised in relation to NASA's budget requests, for program management, construction of facilities, and research and development. A.R.H.

N82-10981# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FINITE DIFFERENCE COMPUTATION OF THE STEADY TRANSONIC POTENTIAL FLOW AROUND AIRPLANES

N82-10982

Luo Shijun, Zheng Yuwen, Qian Hong, and Wang Dieqian *In its* Recent Selected Papers of NW Polytech. Univ., pt. 1 (FTD-ID(RS)T-0259-81-Pt-1) 20 Aug. 1981 p 5-30 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 1 (Xian Shaanxi), 1979

Avail: NTIS HC A17/MF A01

The velocity potential equation was approximated by assuming that the perturbation velocity component in the transverse plane of the body is much smaller than the undistributed flow velocity, while the perturbation velocity component in the longitudinal direction may not be so. It was then solved with mixed schemes of finite differences. The boundary condition on wings (tails) and its wake were approximated similarly. Two numerical examples are included and the results agree well with known wind tunnel test results. T.M.

N82-10982# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SECOND ORDER APPROXIMATION THEORY OF AN ARBITRARY AEROFOIL IN COMPRESSIBLE POTENTIAL FLOW
Lin Chaoqiang *In its* Recent Selected Papers of NW Polytech. Univ., pt. 1 (FTD-ID(RS)T-0259-81-Pt-1) 20 Aug. 1981 p 31-50 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 1 (Xian Shaanxi), 1979

Avail: NTIS HC A17/MF A01

The region outside an arbitrary airfoil is conformally transformed into the region outside a unit circle. The transformation functions are expanded into ascending power series and then only those terms up to and including the second order are retained. The resulting formulae are given analytically. The method is nearly an exact solution from the engineering point of view, even for an airfoil with thickness as much as 30 percent of the chord and with maximum camber as much as 10 percent of the chord. T.M.

N82-10983# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMIC CALCULATIONS AND DESIGN OF SUBCRITICAL AEROFOILS
Lin Chaoqiang *In its* Recent Selected Papers of NW Polytech. Univ., pt. 1 (FTD-ID(RS)T-0259-81-Pt-1) 20 Aug. 1981 p 51-64 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 1 (Xian Shaanxi), 1979

Avail: NTIS HC A17/MF A01

A method of calculating the velocity and pressure distribution on an airfoil of given geometrical profile at a given angle of attack in subcritical potential flow is described. Inversely, designing appropriate airfoil geometry and the corresponding angle of attack for a given pressure distribution is discussed. T.M.

N82-10984# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN AERODYNAMIC DESIGN METHOD FOR TRANSONIC AXIAL FLOW COMPRESSOR STAGE
Zhu Fangynan, Zhou Xinhai, Liu Songling, and Fan Feida *In its* Recent Selected Papers of NW Polytech. Univ., pt. 1 (FTD-ID(RS)T-0259-81-Pt-1) 20 Aug. 1981 p 65-86 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 1 (Xian Shaanxi), 1979

Avail: NTIS HC A17/MF A01

The method is comprised of three main parts: the mean S sub 2 streamsurface calculation, the approximate calculation of S sub 1 streamsurface of revolution, and defining the blade element on the conical surface and stacking the blade airfoil sections. The method is unusual in that the calculation stations for making the S sub 2 streamsurface computations are curves, and particularly in that the airfoil parameters of blade are calculated on a plane tangent to the approximate streamsurface of revolution. On this tangential plane, two dimensional flow is used as basic model to calculate the Mach wave system on the suction surface of cascade entrance region. T.M.

N82-10994# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE AUTOMATIC MATRIX FORCE METHOD AND TECHNIQUES FOR HANDLING MORE COMPLEX COMPUTA-

TIONS WITH GIVEN COMPUTER CAPACITY
Yang Qingxiong *In its* Recent Selected Papers of NW Polytech. Univ., pt. 1 (FTD-ID(RS)T-0259-81-Pt-1) 20 Aug. 1981 p 338-358 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 1 (Xian Shaanxi), 1979

Avail: NTIS HC A17/MF A01

The history of using the method for structural computation in domestic aeronautical engineering was reviewed. The development and application of the matrix method was examined. T.M.

N82-10995# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURAL ANALYSIS OF FUSELAGES WITH CUTOUTS BY FINITE ELEMENT METHOD
G. Shoulian, Sun Can, Tang Xuunchun, and Ye Tiangi *In its* Recent Selected Papers of NW Polytech. Univ., pt. 1 (FTD-ID(RS)T-0259-81-Pt-1) 20 Aug. 1981 p 359-378 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 1 (Xian Shaanxi), 1979

Avail: NTIS HC A17/MF A01

The rear part of a transport aircraft's fuselage was studied. It consists of two sections, the front section being a closed cylinder with a floor and the other section containing a large cutout. An idealized structure is considered to have 1950 degrees of freedom. In this analysis, three kinds of finite element were adopted: a flange element with various cross sections; a constant shear flow quadrilateral of arbitrary shape; and a beam element of various cross sections taking account of eccentricity of the nodes from the axes of moment and inertia. A factorization algorithm was adopted in the solution of the system of linear algebraic equations. T.M.

N82-10998# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MATRIX ANALYSIS OF WINGS
Xu Yuan, Zhu Runziang, Jiang Jinqiag, and Cai Yiuliu *In its* Recent Selected Papers of NW Polytech. Univ., pt. 2 (FTD-ID(RS)T-0260-81-Pt-2) 28 Aug. 1981 p 76-111 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 2 (Xian Shaanxi), 1979

Avail: NTIS HC A18/MF A01

The plate-beam wing constructions are simplified either as plane stress or plate bending models. The triangular element matrix of a laminated plate is introduced as well as the element stiffness matrix of the beam of axially variable rectangular cross section. Two general computer calculation programs are also compiled. Calculations are shown for wings consisting of plates and beams, honeycomb core and solid wings. Compared to the experimental results, the errors in the nodal deflections are generally less than 5%. It is clear that the method adopted has finite accuracy and generality. R.C.T.

N82-11006# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INITIAL EXPERIMENTAL RESEARCH INTO THE RESPONSE OF TURBOJET ENGINE COMPRESSORS TO DISTORTION OF INTAKE PRESSURE
Chen Fu-qun, Tang Di-yi, Hu Zi-long, Id Wen-lan, Yu Jin-di, Wu Xin-yuan, Zhao Jue-liang, Lin Qi-xun, Wang Zong-yuan, Liu Si-hong et al *In its* Recent Selected Papers of NW Polytech. Univ., pt. 2 (FTD-ID(RS)T-0260-81-Pt-2) 28 Aug. 1981 p 287-316 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 2 (Xian Shaanxi), 1979

Avail: NTIS HC A18/MF A01

The influence which distorations in intake pressure have on the stability and characteristics of the compressors of turbojet engines was investigated. The test bed of a turbojet engines with a nine stage compressor was used as a test bed. The first stage of the compressor was transonic. It was concluded that the capabilities of compressors of this type of turbojet engine are not only determined by the capabilities or characteristics of the compressor but also by the structural arrangement and actual situation of the other components in system of the compressor. Other significant conclusions are reported. R.C.T.

N82-11007# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A PRELIMINARY EXPERIMENTAL INVESTIGATION OF THE RESPONSE OF A TURBOJET ENGINE TO INLET PRESSURE DISTORTION
Chen Fu-qun, Tang Di-yi, Hu Zi-long, Id Wen-lan, Yu Jin-di, Wu Xin-yuan, Zhao Jue-liang, Lin Qi-xun, Wang Zong-yuan, and Liu Si-hong *In its* Recent Selected Papers of NW Polytech. Univ., pt. 2 (FTD-ID(RS)T-0260-81-Pt-2) 28 Aug. 1981 p 317-346 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 2 (Xian Shaanxi), 1979

Avail: NTIS HC A18/MF A01
Preliminary experimental results about the effect of inlet pressure distortion on the characteristics and instability of the axial compressor of a turbojet engine are presented. The experiments were conducted on the test bed on a turbojet engine with a 9-stage compressor, whose first stage is transonic. The tests were run for each of the following cases: (1) at 99% design speed with 180 deg triple-deck 36 mesh screen in front of the engine inlet, i.e., 3x36 mesh; (2) at 90% design speed with 180 deg single-deck 35 mesh screen, i.e., 1x36 mesh; (3) at 90% design speed with clean inlet; and (4) at 87% design speed with a decrease of about 12% of the first stage turbine nozzle exit area. R.C.T.

N82-11008# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENTAL INVESTIGATION OF THE ROTATING STALL, SURGE AND WAKE BEHIND THE ROTOR FOR A SINGLE STAGE AXIAL COMPRESSOR
Zhang Weide, Zbang Changsheng, Liu Zhiwei, and Liu Jiafeng *In its* Recent Selected Papers of NW Polytech. Univ., pt. 2 (FTD-ID(RS)T-0260-81-Pt-2) 28 Aug. 1981 p 347-370 refs Transl. into ENGLISH from Recent Selected Papers of NW Polytech. Univ., pt. 2 (Xian Shaanxi), 1979

Avail: NTIS HC A18/MF A01
Dynamic tests were conducted in order to investigate the rotating stall, surge, and wake behind the rotor of a single stage axial compressor. The relationship between the rotating stall and the total turbulence behind the rotor caused by the wake was also studied. It was found that the waveform of the wake behind the rotor shows marked changes when rotating stall approaches. The wake induced degree of total turbulence increases sharply, and therefore may be used as a way to predict rotating stall. The total process of rotating stall and surge as well as the differences between the two and their connection were also compared. R.C.T.

N82-11013*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF VORTEX FLAPS ON THE LOW-SPEED AERODYNAMIC CHARACTERISTICS OF AN ARROW WING
Long P. Yip and Daniel G. Murri Nov. 1981 64 p refs
(NASA-TP-1914; L-14575) Avail: NTIS HC A04/MF A01 CSCL 01B
Tests were conducted in the Langley 12-foot low-speed wind-tunnel to determine the longitudinal and lateral-directional aerodynamic effects of plain and tabbed vortex flaps on a flat-plate, highly swept arrow-wing model. Flow-visualization studies were made using a helium-bubble technique. Static forces and moments were measured over an angle-of-attack range from 0 deg to 50 deg for sideslip angles of 0 deg and + or - 4 deg. A.R.H.

N82-11014# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technol. Div.
ACTA MECHANICA SINICA
11 Sep. 1981 47 p refs Transl. into ENGLISH from Acta Mech. Sinica (China), no. 1, 1979 70-73
(AD-A105184; FTD-ID(RS)T-0704-81) Avail: NTIS HC A03/MF A01 CSCL 01/2
Various fluid dynamics problems are discussed including the computation of three-dimensional flow in turbomachinery, the design of wing root regions of aircraft wing-body combinations, and the diffraction and reflection of traveling shock waves.

N82-11015# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ARBITRARY QUASI-ORTHOGONAL SURFACE METHOD FOR COMPUTING THREE-DIMENSIONAL FLOW IN TURBINE MACHINERY. 2. CALCULATION OF THE

THREE-DIMENSIONAL FLOW WITH THE S SUB 1-SURFACE TWISTED
Xin Xiao-Kang, Jiang Jin-Liang, and Zhu Shi-Can *In its* Acta Mech. Sinica (FTD-ID(RS)T-0704-81) 11 Sep. 1981 p 1-19 refs Transl. into ENGLISH from Acta Mech. Sinica (China), no. 1, 1979
Avail: NTIS HC A03/MF A01 CSCL 01/2
On the basis of the quasi-orthogonal surface method, a three-dimensional flow field solution of inviscid fluids in turbine machinery is obtained. This method, under the condition allowed by the storage of the computer, can calculate any shapes of S sub 1 and S sub 2 surfaces (including twisting S sub 1 surfaces) and obtain the shapes of space streamlines and the three-dimensional distribution of parameters such as velocity. The calculations for the two conditions of a centrifugal compressor with a small impeller (phi 110) indicate the relative value of the twist of the S sub 1 surface is about 3 to 10 percent. The S sub 1 surface shows a double twist like a twist drill from the inlet to the outlet. M.G.

N82-11016# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PRINCIPLES AND METHODS FOR SHAPING THE WING ROOT REGIONS OF A WING-BODY COMBINATION AT TRANSONIC AND LOWER SUPERSONIC SPEEDS
Yang Tso Sheng, Tai Chia Tsun, Chen Ching Sung, and Fan I. Chia *In its* Acta Mech. Sinica (FTD-ID(RS)T-0704-81) 11 Sep. 1981 p 20-35 refs Transl. into ENGLISH from Acta Mech. Sinica (China), no. 1, 1979

Avail: NTIS HC A03/MF A01 CSCL 01/2
The principles and methods for the combined shaping of the wing root regions of a wing-body combination, in accordance with the requirements of area rule and shockless pressure field, are discussed. It is shown that the favorable non-midwing arrangement is able to reduce the amount of fuselage shaping required for the reduction of the zero lift wave drag of a wing-body combination. The combined shaping so designed may thus be realized more easily in structural arrangement. M.G.

N82-11024# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORETICAL INVESTIGATIONS AND EXPERIMENTAL RESEARCHES FOR HIGHER SUBSONIC TWO-DIMENSIONAL COMPRESSOR CASCADE
Yan Ru-qun and Qian Zhao-yan *In its* J. of Eng. Thermophys. (Selected Articles) (FTD-ID(RS)T-0570-81) 16 Sep. 1981 p 1-34 refs Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 2, no. 1, Feb. 1981 Presented at the 3rd Ann. All-China Thermophys. Eng. Technol. Conf., Gui Lin, China, Apr. 1980
Avail: NTIS HC A05/MF A01 CSCL 21/5
Compressible turbulence flow boundary layer theory and several characteristic boundary layer parameters (momentum thickness, form factors, energy factors and other combinational parameters) were combined with simplified gas flow speed distributions in the boundary layers in the wake behind the blade cascade and used to deduce, on the basis of the research foundation accumulated in the past about the theory of blade cascade losses, a simplified equation for the calculation of total two-dimensional blade cascade pressure losses for subsonic and transonic speeds. With this equation, it is possible to calculate the two-dimensional blade cascade pressure losses in designed operational configurations and off-designed operational configurations. A graphical method for determining the corrected gas compressibility effect in the blade cascade of compressors under operating conditions involving higher subsonic and transonic speeds is also introduced. A.R.H.

N82-11025# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A THEORETICAL ANALYSIS OF THE STREAM SURFACE OF REVOLUTION WITH SUPERSONIC INLET FLOW IN A TRANSONIC AXIAL COMPRESSOR
Xu Jian-zhong, Yang Zuo-ren, Yang Jin-sheng, Zhang Ying, and Du Zhuan-she *In its* J. of Eng. Thermophys. (Selected Articles) (FTD-ID(RS)T-0570-81) 16 Sep. 1981 p 35-50 refs Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 2, no. 1, Feb. 1981 Presented at the 3rd Ann. All-China Eng. Thermophys. and Technol. Conf., Gui Lin, China, Apr. 1980

Avail: NTIS HC A05/MF A01 CSCL 21/5

Changes in the gas flow velocity triangle behind the shock waves being considered were studied in an effort to analyze the effect which shock waves have on gas flow. A planar oblique relationship formula was used to deduce the corresponding values of changes in velocity moment, pressure losses, and total pressure ratios. This explains the important phenomenon involved when the supersonic intake cross section shock waves of transonic compressors cause addition pressurization of gas flow (supercharging). Aerodynamic and thermodynamic analyses and calculations were then carried out on the tip cross sections of the rotors. The characteristic curve calculations for the shock waves in front of the blade cascades and for the intake areas of these cascades are examined. Passageway shock waves are also calculated. Results are discussed. A.R.H.

N82-11027# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NEW METHOD OF COOLING TURBINE VANES
Gu Wei-zao, Zhang Yu-ming, and Xu Hong-kun In its J. of Eng. Thermophys. (Selected Articles) (FTD-ID(RS)T-0570-81) 16 Sep. 1981 p 65-71 refs Transl. into ENGLISH from Gongcheng Rewuli Xuebao (China), v. 2, no. 1, Feb. 1981 Presented at the 3rd Ann. All-China Eng. Thermophys. Technol. Conf., Gui Zhoy, China, Apr. 1980

Avail: NTIS HC A05/MF A01 CSCL 21/5

The combined use of an internal cooling process with strengthened blades and of additives to lessen heat transfer to the blades from fuel gasses is proposed as a means of increasing intake temperature in aircraft turbine engines. Topics covered include coarseness-strengthened heat exchange in the inner passageways of blades and the precipitation of silicon dioxide particles in fuel gases onto blade surfaces. Temperature calculations made for the first stage guide vanes of the MK202 engine are included. A.R.H.

N82-11033*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND-TUNNEL RESULTS FOR A MODIFIED 17-PERCENT-THICK LOW-SPEED AIRFOIL SECTION
Robert J. McGhee and William D. Beasley Nov. 1981 87 p refs
(NASA-TP-1919; L-14666) Avail: NTIS HC A05/MF A01 CSCL 01A

Wind-tunnel tests were conducted in the Langley low-turbulence pressure tunnel to evaluate the effects on performance of modifying a 17-percent-thick low-speed airfoil. The airfoil contour was altered to reduce the pitching-moment coefficient by increasing the forward loading and to increase the climb lift-drag ratio by decreasing the aft upper surface pressure gradient. The tests were conducted over a Mach number range from 0.07 to 0.32, a chord Reynolds number range 1.0 x 10 to the 6th power to 12.0 x 10 to the 6th power, and an angle-of-attack range from about -10 deg to 20 deg. Author

N82-11034# National Aerospace Lab., Tokyo (Japan).
NEW ESTIMATION METHOD FOR FLUTTER OR DIVERGENCE BOUNDARY FROM RANDOM RESPONSES AT SUBCRITICAL SPEEDS
Yuji Matsuzaki and Yasukatsu Ando Apr. 1981 15 p refs
(NAL-TR-667T; ISSN-0389-4-10) Avail: NTIS HC A02/MF A01

A new technique for estimating the flutter or divergence boundary from responses due to turbulence at subcritical speeds is described. The boundary can be predicted without estimating or measuring the dampings and frequencies of the aeroelastic modes. The sampled time response is modeled by the mixed autoregressive moving average process. The orders and coefficients of both autogressive and moving average parts of the process are determined with the aid of Akaike's estimation procedure. The stability boundary is estimated by using Jury's stability determinants which are expressed in terms of the autogressive coefficients alone. The modal frequencies and dampings are also evaluated from the coefficients. The technique proposed has been applied with success to signals from a cantilever wing model tested in a low supersonic flow. Comparison between the actual and estimated flutter boundaries shows that an accurate estimation can be made from data obtained in a narrow range of the dynamic pressure which is sufficiently below the boundary. Author

N82-11035# National Aerospace Lab., Tokyo (Japan). First Airframe Div.
A STUDY ON NUMERICAL METHOD FOR EVALUATING SPANWISE INTEGRAL IN SUBSONIC LIFTING-SURFACE THEORY
Teruo Ichikawa Mar. 1981 22 p refs
(NAL-TR-661T; ISSN-3989-4010) Avail: NTIS HC A02/MF A01

Two disputable points are discussed. The first point is the coincidence of each collocation section with one of the spanwise integration points. The second point is the relatively small, but undesirable, sharp variation of the regularized influence functions near the collocation sections. Two proposals for coping with these difficulties are made. Their effects are examined by computing the downwash at the surface of a steady rectangular wing subjected to a simple wing loading. It is shown that method 1, which avoids the coincidence, makes it possible, with no losses in accuracy, to greatly reduce the computing time in cases of oscillating wings. Further, it is shown that remarkable improvement in convergence with respect to the number of spanwise integration points is obtained by method 2 which distributes the spanwise integration points densely only near the collocation sections. T.M.

N82-11039*# North Carolina State Univ., Raleigh. Center for Sound and Vibration.
AIRCRAFT WING TRAILING-EDGE NOISE
Ronald L. Underwood and Thomas H. Hodgson 1981 145 p refs
(Grant NsG-1377)
(NASA-CR-164952) Avail: NTIS HC A07/MF A01 CSCL 01A

The mechanism and sound pressure level of the trailing-edge noise for two-dimensional turbulent boundary layer flow was examined. Experiment is compared with current theory. A NACA 0012 airfoil of 0.61 m chord and 0.46 m span was immersed in the laminar flow of a low turbulence open jet. A 2.54 cm width roughness strip was placed at 15 percent chord from the leading edge on both sides of the airfoil as a boundary layer trip so that two separate but statistically equivalent turbulent boundary layers were formed. Tests were performed with several trailing-edge geometries with the upstream velocity U sub infinity ranging from a value of 30.9 m/s up to 73.4 m/s. Properties of the boundary layer for the airfoil and pressure fluctuations in the vicinity of the trailing-edge were examined. A scattered pressure field due to the presence of the trailing-edge was observed and is suggested as a possible sound producing mechanism for the trailing-edge noise. T.M.

N82-11042*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW SPEED TESTING OF THE INLETS DESIGNED FOR A TAMDEN-FAN V/STOL NACELLE
Robert C. Williams and Andres H. Ybarra (Vough Corp., Dallas) 1981 13 p refs Presented at the V/STOL Conf., Palo Alto, Calif., 7-9 Dec. 1981
(NASA-TM-82728; E-1031; AIAA-81-2627) Avail: NTIS HC A02/MF A01 CSCL 01A

An approximately 0.25 scale model of a tandem fan nacelle, designed for a subsonic V/STOL aircraft, was tested in a Lewis wind tunnel. Model variables included long and short aft inlet cowls and the addition of exterior strakes to the short inlet cowl. Inlet pressure recoveries and distortion were measured at pitch angles to 40 deg and at combinations of pitch and yaw to 30 deg. Airspeeds covered a range to 135 knots (69 m/sec). The short aft inlet with added strakes had the best aerodynamic performance and is considered suitable for the intended V/STOL application. T.M.

N82-11043*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A SUMMARY OF V/STOL INLET ANALYSIS METHODS
Danny P. Hwang 1981 12 p refs Presented at the V/STOL Conf., Palo Alto, Calif., 7-9 Dec. 1981
(NASA-TM-82725; E-1027) Avail: NTIS HC A02/MF A01 CSCL 01A

Recent extensions and applications of the methods are emphasized. They include the specification of the Kutta condition for a slotted inlet, the calculation of suction and tangential blowing for boundary layer control, and the analysis of auxiliary inlet geometries at angles of attack. A comparison is made with

experiment for the slotted inlet. An optimum diffuser velocity distribution was developed.   T.M.

N82-11046*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATION OF HIGH REYNOLDS NUMBER INTERNAL/ EXTERNAL FLOWS
Michael C. Cline and Richard G. Wilmoth 1981 12 p refs
Presented at the 5th AIAA Computational Fluid Dyn. Conf., Palo Alto, Calif., 22-23 Jun. 1981
(Contract W-7405-eng-36)
(NASA-TM-84049; DE81-025343; LA-UR-81-1882; CONF-810664-2) Avail: NTIS HC A02/MF A01 CSCL 01A
A general, user oriented computer program, called VNAP2, was developed to calculate high Reynolds number, internal/ external flows. The VNAP2 program solves the two dimensional, time dependent Navier-Stokes equations. The turbulence is modeled with either a mixing-length, a one transport equation, or a two transport equation model. Interior grid points are computed using the explicit MacCormack Scheme with special procedures to speed up the calculation in the fine grid. All boundary conditions are calculated using a reference plane characteristic scheme with the viscous terms treated as source terms. Several internal, external, and internal/external flow calculations are presented.   DOE

N82-11047# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
THREAT ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS) SYMPOSIUM
22 Jul. 1981 177 p refs Symp. held at Washington, D.C., 22 Jul. 1981
(AD-A104563; FAA-RD-81-76) Avail: NTIS HC A09/MF A01 CSCL 01/4
The Federal Aviation Administration held a symposium on Threat Alert and Collision Avoidance System (TCAS) in Washington, D.C., July 22, 1981, which was attended by representatives of 68 organizations and 21 airlines. This report contains the news release announcing the new approach to providing protection against mid-air collisions. 10 presentations and the transcript of the panel discussion. The TCAS will provide a range of capabilities and costs which will meet the requirements of all airspace users. The least complex part of the system is designed for private pilots and would cost about $2,500. The fully capable, or airline, version would cost between $45,000 and $50,000. This new concept represents a new capability which draws on all FAA has learned about collision avoidance in its past efforts, extends and simplifies FAA's efforts to date, provides new capabilities to all users, and is fully compatible with international standards and improvement activities on the Secondary Surveillance Radar (SSR).   Author (GRA)

N82-11048# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
FLIGHT TRAJECTORY CONTROL INVESTIGATION Final Report, 15 May 1978 - 30 Oct. 1980
M. Bird and J. Karmarker Wright-Patterson AFB, Ohio AFWAL Mar. 1981 174 p refs
(Contract F33615-78-C-3607; AF Proj. 2403)
(AD-A104542; ID-05R-1180; AFWAL-TR-81-3012) Avail: NTIS HC A08/MF A01 CSCL 17/9
Optimal control algorithms for four-dimensional guidance of a transport aircraft were investigated for feasibility. Cost function constraints on the optimal reference path generator appeared impossible to achieve and the optimal guidance algorithms do not achieve significant performance improvement without excessive increases in sophistication and cost of the onboard avionics computer. A modularized existing Mission Management system allows a three-phase flight test plan to demonstrate the operational capability of the existing classical integrated flight trajectory control algorithms.   Author (GRA)

N82-11049# General Accounting Office, Washington, D. C. Community and Economics Development Div.
FAA MISSES OPPORTUNITIES TO DISCONTINUE OR REDUCE OPERATING HOURS OF SOME AIRPORT TRAFFIC CONTROL TOWERS Report to the Congress
1 Jun. 1981 39 p
(PB81-224214; CED-81-100) Avail: NTIS HC A03/MF A01 CSCL 17G

FAA is not adequately surveying or evaluating air traffic levels at 24 hour control towers to identify opportunities to reduce operating hours and save money.   GRA

N82-11050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PARAMETRIC STUDY OF MICROWAVE-POWERED HIGH-ALTITUDE AIRPLANE PLATFORMS DESIGNED FOR LINEAR FLIGHT
Charles E. K. Morris, Jr. Nov. 1981 74 p refs
(NASA-TP-1918; L-14606) Avail: NTIS HC A04/MF A01 CSCL 01C
The performance of a class of remotely piloted, microwave powered, high altitude airplane platforms is studied. The first part of each cycle of the flight profile consists of climb while the vehicle is tracked and powered by a microwave beam; this is followed by gliding flight back to a minimum altitude above a microwave station and initiation of another cycle. Parametric variations were used to define the effects of changes in the characteristics of the airplane aerodynamics, the energy transmission systems, the propulsion system, and winds. Results show that wind effects limit the reduction of wing loading and the increase of lift coefficient, two effective ways to obtain longer range and endurance for each flight cycle. Calculated climb performance showed strong sensitivity to some power and propulsion parameters. A simplified method of computing gliding endurance was developed.   S.L.

N82-11052*# Kansas Univ. Center for Research, Inc., Lawrence. Flight Research Lab.
ICING TUNNEL TESTS OF A COMPOSITE POROUS LEADING EDGE FOR USE WITH A LIQUID ANTI-ICE SYSTEM
David L. Kohlman Sep. 1981 21 p refs
(Grant NAG3-71)
(NASA-CR-164966; KU-FRL-464-3) Avail: NTIS HC A02/MF A01 CSCL 01C
The efficacy of liquid ice protection systems which distribute a glycol-water solution onto leading edge surfaces through a porous skin was demonstrated in tests conducted in the NASA Lewis icing research tunnel using a composite porous leading edge panels. The data obtained were compared with the performance of previously tested stainless steel leading edge with the same geometry. Results show: (1) anti-ice protection of a composite leading edge is possible for all the simulated conditions tested; (2) the glycol flow rates required to achieve anti-ice protection were generally much higher than those required for a stainless steel panel; (3) the low reservoir pressures of the glycol during test runs indicates that more uniform distribution of glycol, and therefore lower glycol flow rates, can probably be achieved by decreasing the porosity of the panel; and (4) significant weight savings can be achieved in fluid ice protection systems with composite porous leading edges. The resistance of composite panels to abrasion and erosion must yet be determined before they can be incorporated in production systems.   A.R.H.

N82-11053*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELECTED BIBLIOGRAPHY OF NACA-NASA AIRCRAFT ICING PUBLICATIONS
John J. Reinmann, comp. Aug. 1981 127 p
(NASA-TM-81651; E-668) Avail: NTIS HC E15/MF A01 CSCL 01C
A summary of NACA-NASA icing research from 1940 to 1962 is presented. It includes: the main results of the NACA icing program from 1940 to 1950; a selected bibliography of 132 NACA-NASA aircraft icing publications; a technical summary of each document cited in the selected bibliography; and a microfiche copy of each document cited in the selected bibliography.   T.M.

N82-11054*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPARISON OF THEORETICAL AND EXPERIMENTAL PRESSURE DISTRIBUTIONS FOR TWO ADVANCED FIGHTER WINGS
H. P. Haney (Vought Corp., Dallas) and R. M. Hicks Oct. 1981 87 p refs
(NASA-TM-81331; A-8741) Avail: NTIS HC A05/MF A01 CSCL 01C
A comparison was made between experimental pressure

distributions measured during testing of the Vought A-7 fighter and the theoretical predictions of four transonic potential flow codes. Isolated wind and three wing-body codes were used for comparison. All comparisons are for transonic Mach numbers and include both attached and separate flows. In general, the wing-body codes gave better agreement with the experiment than did the isolated wing code but, because of the greater complexity of the geometry, were found to be considerably more expensive and less reliable.   Author

N82-11055# Computational Mechanics Consultants, Knoxville, Tenn.
A NUMERICAL THREE-DIMENSIONAL TURBULENT SIMULATION OF A SUBSONIC VSTOL JET IN A CROSS-FLOW USING A FINITE ELEMENT ALGORITHM Final Report, Sep. 1979 - Sep. 1980
A. J. Baker, J. A. Orzechowski, and P. D. Manhardt Jun. 1981
72 p refs
(Contract N62269-79-C-0295)
(AD-A104514; NADC-79021-60)   Avail: NTIS
HC A04/MF A01 CSCL 01/3
     The purpose of this study, the results of which are reported herein, was to formulate a mathematical model of the basic VSTOL jet, and to validate its appropriateness by performing a series of computational experiments on the discrete analog (numerical) approximation to the mathematical description. Since the VSTOL jet problem is essentially steady, turbulent and fully three-dimensional, the mathematical description must be quite comprehensive. The approach selected was to utilize a continuity-constrained, finite element algorithm for solution of the parabolized form of the time-averaged, three-dimensional Navier-Stokes equations (3DPNS). The essential ingredients of this algorithmic description are presented and discussed. A production finite element computer code (COMOC:3DPNS) was utilized to conduct the computational experiments, and the description of problem definition and data deck preparation is contained at the end of the report. The key results of the computational experiments are discussed, regarding the basic causal mechanisms of the VSTOL jet, as well as results for confirmation test cases documenting viability of the constructed computational model.   Author (GRA)

N82-11056# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
ROTORCRAFT ICING: STATUS AND PROSPECTS
Aug. 1981 136 p refs
(AGARD-AR-166; ISBN-92-835-1397-5)   Avail: NTIS
HC A07/MF A01
     The impact of icing meteorological conditions on helicopter operations was examined, and methods for improving ice protection investigated.

N82-11057# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
OPERATIONAL ENVIRONMENT, METEOROLOGICAL CONDITIONS AND WEATHER FORECASTING
In its Rotorcraft Icing Aug. 1981 p 1-13 refs

Avail: NTIS HC A07/MF A01
     Helicopter icing is a significant operational consideration for helicopters operating throughout Europe. Existing weather statistics demonstrate significant operational limitations during the winter months, and for as much as five percent of the time on a year-around basis. Unfortunately the existing meteorological data base is insufficient to describe the operating environment in which NATO rotorcraft must conduct flight. At present for design purposes, the United States Federal Air Regulation 25 Appendix C or the UK Icing Atmosphere are employed for determination of airworthiness release of helicopters. However, neither of these atmospheres adequately defines the operational environment. This condition is exacerbated by the fact that forecasting techniques are currently inadequate to allow unrestricted helicopter operations in icing conditions. Increased coordination among cloud physicists, forecasters, and helicopter icing specialists is needed - and ultimately a new icing atmosphere is required to better define the helicopter operational icing requirements.   J.D.H.

N82-11058# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

TECHNOLOGY BASE FOR ICING INSTRUMENTATION AND MATHEMATICAL MODELLING
In its Rotorcraft Icing Aug. 1981 p 14-33 refs

Avail: NTIS HC A07/MF A01
     The fundamental mechanisms of ice accretion and shedding from rotor airfoils are considered. It is felt that an opportunity exists to exploit a combination of two-dimensional model and three-dimensional model scale testing, measurement of ice release mechanisms, inclusion of heat transfer models, and considera-tion of icing simulation. These efforts should be aimed at development of analytical models verified by both laboratory and full-scale data which then can be used to better predict performance of rotors in icing conditions. Only with the above analytical basis can ice accretion and shedding characteristics become sufficiently predictable to permit the determination of what type of ice protection is necessary or, conversely, what degree of flight envelope release might be permitted with a given level of ice protection. Further improvement in research and development of operational icing sensors is recommended.
                                                         J.D.H.

N82-11059# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
FACILITIES FOR DEVELOPMENT AND CLEARANCE
In its Rotorcraft Icing Aug. 1981 p 34-53

Avail: NTIS HC A07/MF A01
     A catalog of all NATO icing test facilities was compiled. It is recommended that the Canadian National Research Council's small high speed icing tunnel is a one-of-a-kind facility that needs to be available to support analytical development recom-mended, and that the tunnel should be reactivated or replaced. A decision has been made to retain the Ottawa Spray Rig in operational status for the near future. Efforts underway at the NASA-Lewis Research Center regarding rehabilitation of the Icing Research Tunnel and considering a major new icing test facility are endorsed. The US Army Helicopter Icing Spray System Improvement Program is also supported by the Working Group and, as a recommendation for future discussion, the need for European airborne icing spray systems should be considered. A conclusion reached by the Working Group is that current full scale development and qualification facilities and procedures are extremely expensive and time consuming.   J.D.H.

N82-11060# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
ICE PROTECTION SYSTEM TECHNOLOGY
In its Rotorcraft Icing Aug. 1981 p 54-99 refs

Avail: NTIS HC A07/MF A01
     Deicing systems technology concepts are discussed. The conclusion is that electrothermal deicing systems are the only effective present system for broad application. However, it is noted that the cost of electrothermal deicing in terms of weight, power and expense is high, and provides an incentive for examination of alternatives. Therefore, additional work is clearly warranted on options such as ice phobics, fluid ice suppressant systems, pneumatic boots, vibratory surface systems, microwave and other hybrid systems concepts. It is recommended that the operational limitations of ice protected aircraft such as the Black Hawk and Puma, be explored with the ice protection systems deliberately turned off, so as to simulate an aircraft without (or with inoperative) ice protection. Only through such definition of the actual icing environment can a better estimation be made of the operational impact of icing conditions on helicopter flight operations.   J.D.H.

N82-11061# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
PROPOSED STANDARD REQUIREMENTS AND PRO-CEDURES FOR ICING CLEARANCE
In its Rotorcraft Icing Aug. 1981 p 100-117

Avail: NTIS HC A07/MF A01
     A set of proposed standard requirements and procedures for icing clearance is presented. It is felt that this clearance procedure constitutes a basis for NATO-wide icing clearance and should be adopted by the NATO military community as an interim approach. The opportunity also exists to consider this proposal for civil icing clearance.   J.D.H.

N82-11062# Hughes Aircraft Co., El Segundo, Calif. Display Systems Lab.
STUDY AND DEVELOPMENT OF AN INTEGRATED HEAD-UP DISPLAY Final Report, 1 Jul. 1976 - 31 Aug. 1980
Michael N. Ernstoff Jun. 1981 112 p refs
(Contract F33615-76-C-1243; AF Proj. 2003)
(AD-A104337; HAC-D6210; AFWAL-TR-81-1042) Avail: NTIS HC A06/MF A01 CSCL 14/5
The purpose of the Integrated Head-Up Display (I-HUD) program was to demonstrate the advantages associated with using a Liquid Crystal Matrix Display and Diffraction Optics combiner in the design and construction of a high brightness head-up display system. The program resulted in the design and fabrication of the I-HUD brassboard consisting of a pilot's display unit, built in a form factor similar to that of the production F16 HUD, and test support equipment. The following devices and modules were developed: A 350-by-350 pixel Liquid Crystal Matrix Display complete with custom LSI circuit drivers, a diffraction optics combiner, a diffraction optics diffusing screen, a specular mode projector, and custom lamp with a narrow band (green) spectral output. Although the completed I-HUD brassboard did not meet all of its design goals, it does demonstrate the feasibility of applying advanced technology to the designs of Head-Up Displays. The I-HUD program has succeeded in solving many of the fundamental design problems associated with this approach and stands as a milestone in the development of solid state display devices and the development of more highly reliable, cost effective Head-Up Displays. GRA

N82-11063# Panametrics, Inc., Waltham, Mass.
ADVANCED FUEL FLOWMETER FOR FUTURE NAVAL AIRCRAFT Final Report, Dec. 1977 - Apr. 1981
L. C. Lynnworth, N. E. Pedersen, J. E. Bradshaw, J. E. Matson, E. S. Johansson, and T. H. Nguyen 28 Jun. 1981 149 p refs
(Contract N62269-78-C-0069)
(AD-A104364; NADC-80254-60) Avail: NTIS HC A07/MF A01 CSCL 21/4
A fuel mass flowmeter was developed with the objective of accurately measuring the mass flow rate M-dot of various fuels and their mixtures, for flow rates from 91 to 11,364 kg/hr (200 to 25,000 lb/hr). The delivered system included: (1) an area averaging zigzag flow velocimeter cell, in which the fuel was interrogated in opposite directions by an alternating sequence of ultrasonic pulses, to determine the area averaged flow velocity, V-bar; (2) a densitometer based on the Clausius-Mosotti law, in which the fuel density rho is determined; and (3) electronics which computed rho and V-bar separately, and then generated a square wave output having a frequency proportional to the product of rho and V-bar, namely M-dot = rho(V-bar)A, where A = velocimeter cell cross sectional area. The transducers can operate beyond the temperature range -38 to +150 C, and the flow cell, with transducers, at pressures up to 1500 psig and in the 3-axis, 20 g, 5 to 2000 Hz vibration environment specified by MIL Std. 810-514.1, except for noise problems at a few discrete frequencies. GRA

N82-11064# General Electric Co., Binghamton, N.Y. Aircraft Equipment Div.
ELECTRONIC MASTER MONITOR AND ADVISORY DISPLAY SYSTEM, DATA TRANSMISSION STUDY Interim Report, Jun. 1979 - Aug. 1980
Aug. 1980 57 p refs
(Contract DAAK80-79-C-0270; DA Proj. 1L2-62202-AH-85)
(AD-A104243; ACS-12177; USAAVRADCOM-TR-79-0270-1; IR-1) Avail: NTIS HC A04/MF A01 CSCL 17/2
The development of nonmission-related status information is one area of rotary wing instrumentation which has not kept pace with the state of art. This includes raw data, discrete and summary status information related to the engine, transmission, rotor, fuel, hydraulic and electrical subsystems. The objective of this report is to define an efficient and cost effective data transmission method for an electronic master monitor and advisory display system (EMMADS). Several current standard and nonstandard data bus specifications which are applicable to the EMMADS system are introduced. Their tradeoff in terms of hardware, software and system considerations are compared. It should be noted that a typical standard bus specs addresses only the protocol and message formats, not the mechanization of the control algorithm. Hence there is a considerable variation

in implementation and cost even for the same bus standard. The materials represent a snapshot of the current state of the art technology. The use of optical fiber instead of conventional electrical cable (such as coaxial) as the transmission medium is also investigated based on the current technical reports. The problems of electromagnetic interference (EMI), and rejection techniques are mentioned. GRA

N82-11065# General Electric Co., Binghamton, N.Y. Aircraft Equipment Div.
ELECTRONIC MASTER MONITOR AND ADVISORY DISPLAY SYSTEM, HUMAN ENGINEERING SUMMARY REPORT Interim Report, Jun. 1979 - Jun. 1981
Jun. 1981 227 p refs
(Contract DAAK80-79-C-0270; DA Proj. 1L2-62202-AH-85)
(AD-A104244; ACS-12385; USAAVRADCOM-TR-79-0270-3; IR-3) Avail: NTIS HC A11/MF A01 CSCL 17/2
Information requirements, information handling formats, and the necessary display/control design criteria are discussed for a system being developed to integrate and display nonmission related information on the status of various subsystems on rotary wing aircraft. GRA

N82-11066# Los Alamos Scientific Lab., N. Mex. Electronics Div.
OUTSIDER'S LOOK AT FLIGHT INSTRUMENTATION
Arvid S. Lundy 1981 7 p refs Presented at the AIAA/SAE/ASME Joint Propulsion Conf., Colorado Springs, Colo., 27-29 Jul. 1981
(Contract W-7405-eng-36)
(DE81-025409; LA-UR-81-1748; CONF-810724-1) Avail: NTIS HC A02/MF A01
Ideas and speculations on possible diagnostic instrumentation for use in missile flight testing are presented. Techniques for use in the development of flight instrumentation are recommended. DOE

N82-11067# National Aerospace Lab., Tokyo (Japan).
NEW MOLDING METHOD OF THREE-DIMENSIONAL HOLLOW PHOTOELASTIC MODEL AND CENTRIFUGAL STRESS ANALYSIS OF AIR COOLED TURBINE BLADE MODEL
Toyoaki Yoshida, Katsutashi Matsusue, Kitao Takahara, and Ryosaku Hashimoto May 1981 17 p refs In ENGLISH; JAPANESE Summary
(NAL-TR-427T; ISSN-0389-4010) Avail: NTIS HC A02/MF A01
A new molding method for a three dimensional hollow photoelastic model was invented and centrifugal stress analysis performed for air cooled turbine blade models to which the new method was applied. A distinctive feature of the molding method is the introduction of a copper coated wax core which forms a three dimensional hollow shape inside a model. The air cooled turbine photoelastic model with a coolant passage simulates the first stage rotor blade in the high temperature turbine full scale model HT-10H used at the NAL. The results of stress analysis cleared the critical regions and stress magnitude and thus they are of great aid to the successful development of a full scale turbine model. Author

N82-11068*# Teledyne Continental Motors, Muskegon, Mich. General Products Div.
LIGHTWEIGHT DIESEL ENGINE DESIGNS FOR COMMUTER TYPE AIRCRAFT
Alex P. Brouwers Jul. 1981 70 p refs
(Contract NAS3-22149)
(NASA-CR-165470; Rept-995) Avail: NTIS HC A04/MF A01 CSCL 21E
Conceptual designs and performance of advanced technology lightweight diesel engines, suitable for commuter type aircraft power plants are defined. Two engines are discussed, a 1491 kW (2000 SHP) eight-cylinder engine and a 895 kW (1200 SHP) six-cylinder engine. High performance and related advanced technologies are proposed such as insulated cylinders, very high injection pressures and high compressor and turbine efficiencies. The description of each engine includes concept drawings, a performance analysis, and weight data. Fuel flow data are given for full and partial power up to 7620m altitude. The performance data are also extrapolated over a power range from 671 kW(900 SHP) to 1864 kW (2500 SHP). The specific fuel consumption of the 1491 kW (2000 SHP) engine is 182

g/hWh (.299 lb/HPh) at cruise altitude, its weight 620 kg (1365 lb.) and specific weight .415 kg/kW (.683 lb/HP). The specific fuel consumption of the 895 kW (1200 SHP) engine is 187 g/hWh (.308 lb/HPh) at cruise altitude, its weight 465 kg (1025 lb.) and specific weight .520 kg/kW (.854 lb/HP).   R.J.F.

N82-11069# Naval Postgraduate School, Monterey, Calif.   Dept. of Aeronautics.
SUBSONIC CASCADE WIND TUNNEL TESTS USING A COMPRESSOR CONFIGURATION OF DCA BLADES
M.S. Thesis
Frank S. Cina Jun. 1981 210 p refs
(AD-A104597) Avail: NTIS HC A10/MF A01 CSCL 21/5
Tests are reported in which air incidence angle was varied to a cascade of 20 blades, 5 inches in chord with aspect ratio of 2.0 and solidity of 1.67. Preliminary blade element performance data were obtained using pneumatic probe surveys and surface pressures were also measured. Results of preparatory tests of a similar cascade of 15 C-series blades at a solidity of 1.28 are also included. Whereas the flow in the C-series blading cascade was always acceptable; the flow in the DCA blading cascade was not acceptable at negative incidence angles. A modification of the cascade inlet guide vanes is recommended which will guarantee periodic conditions and serve to generate more nearly uniform inlet flow at all test conditions.   Author (GRA)

N82-11070*# Analytical Mechanics Associates, Inc., Hampton, Va.
AN INFLUENCE COEFFICIENT METHOD FOR THE APPLICATION OF THE MODAL TECHNIQUE TO WING FLUTTER SUPPRESSION OF THE DAST ARW-1 WING **Final Report**
Samuel Pines Nov. 1981 49 p refs
(Contract NAS1-15593)
(NASA-CR-165772; AMA-81-25) Avail: NTIS HC A03/MF A01 CSCL 01C
The methods used to compute the mass, structural stiffness, and aerodynamic forces in the form of influence coefficient matrices as applied to a flutter analysis of the Drones for Aerodynamic and Structural Testing (DAST) Aeroelastic Research Wing. The DAST wing was chosen because wind tunnel flutter test data and zero speed vibration data of the modes and frequencies exist and are available for comparison. A derivation of the equations of motion that can be used to apply the modal method for flutter suppression is included. A comparison of the open loop flutter predictions with both wind tunnel data and other analytical methods is presented.   S.L.

N82-11071*# Massachusetts Inst. of Tech., Cambridge.   Dept. of Aeronautics and Astronautics.
AEROACOUSTIC THEORY FOR NONCOMPACT WING-GUST INTERACTION
Rudolph Martinez and Sheila E. Widnall Oct. 1981 124 p refs
(Grant NsG-2142)
(FDRL-81-7) Avail: NTIS HC A06/MF A01 CSCL 01C
Three aeroacoustic models for noncompact wing-gust interaction were developed for subsonic flow. The first is that for a two dimensional (infinite) wing passing through an oblique gust. The unsteady pressure field was obtained by the Wiener-Hopf technique; the airfoil loading and the associated acoustic field were calculated, respectively, by allowing the field point down on the airfoil surface, or by letting it go to infinity. The second model is a simple spanwise superposition of two dimensional solutions to account for three dimensional acoustic effects of wing rotation (for a helicopter blade, or some other rotating planform) and of finiteness of wing span. A three dimensional theory for a single gust was applied to calculate the acoustic signature in closed form due to blade vortex interaction in helicopters. The third model is that of a quarter infinite plate with side edge through a gust at high subsonic speed. An approximate solution for the three dimensional loading and the associated three dimensional acoustic field in closed form was obtained. The results reflected the acoustic effect of satisfying the correct loading condition at the side edge. R.J.F.

N82-11072# Boeing Military Airplane Development, Seattle, Wash.   Advanced Airplane Branch.
AIRCRAFT DIGITAL INPUT CONTROLLED HYDRAULIC ACTUATION AND CONTROL SYSTEM **Final Report, Aug. 1977 - Dec. 1980**
Eugene T. Raymond and Curtiss W. Robinson Mar. 1981

214 p refs
(Contract F33615-77-C-2034; AF Proj. 3145)
(AD-A104263;   AFWAL-TR-81-2012)   Avail: NTIS HC A10/MF A01 CSCL 09/2
The development of an Incremental digitally-controlled electrohydraulic incremental digitally-controlled electrohydraulic actuation system (DEHA) is reported. An electronic digital controller and a prototype DEHA unit, with an electric-stepper-motor-driven rotary distributor valve, two hydraulic drive motors, and a torque-summing gearbox, were assembled. Significant reductions in the hydraulic power normally required with a conventional geared hydraulic motor system, and some degree of hydraulic power recovery were obtained.   Author (GRA)

N82-11073# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).   Guidance and Control Panel.
THEORY AND APPLICATIONS OF OPTIMAL CONTROL IN AEROSPACE SYSTEMS
Pieter Kant, ed. (National Aerospace Lab., Emmeloord, Netherlands) London Jul. 1981 283 p refs
(AGARD-AG-251; ISBN-92-835-1391-6)   Copyright. Avail: NTIS HC A13/MF A01
The basic concepts of control theory were reviewed. Pratical design techniques that were developed from the theory are presented. Design examples and practical applications in real systems are described. Major emphasis is on flight control of distributed parameter systems.

N82-11074# Stanford Univ., Calif.   Dept. of Aeronautics and Astronautics.
AN OVERVIEW OF OPTIMAL CONTROL IN AEROSPACE SYSTEMS
Arthur E. Bryson, Jr. In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 5 p refs

Avail: NTIS HC A13/MF A01
Optimal control started with the calculus of variations (COV). The digital computer made the calculus of variations a practical tool for synthesis of optimal control logic. Optimal control concepts and algorithms are used not only in the field of automatic control but also in fields of structural optmization, econometrics, and operations research.   T.M.

N82-11075# Universite Catholique de Louvain (Belgium).
THEORY OF STOCHASTIC OPTIMAL CONTROL SOME BASIC NOTIONS
In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 19 p refs

Avail: NTIS HC A13/MF A01
The optimal control problem for stochastic systems is described in details. Several classes of policy are defined and compared. The corresponding solutions are deduced from Bellman's principle and discussed in connection with the concept of dual effect of the control. After the derivation of the optimal closed-loop solution for the linear quadratic Gaussian problem, several algorithms are proposed for the nonlinear problem and discussed in the perspective of their implementation in aerospace applications.   T.M.

N82-11076# Princeton Univ., N. J.   Flight Research Lab.
AN INTRODUCTION TO STOCHASIC OPTIMAL CONTROL THEORY
In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 33 p refs

Avail: NTIS HC A13/MF A01
The design of control logic that commands a dynamic system to a desired output or that augments the system's stability is facilitated if objectives are expressed in a quantitative criterion, because the optimization of this criterion establishes a feasible design point for control. If the information which the control logic must use is uncertain or if the dynamic system is forced by random disturbances, only the expected value can be optimized. The methodology for design is based upon stochastic optimal control theory. After introducing the dynamic models of interest, optimal control and estimation are presented separately. Limitations of this approach are addressed, and the unified design of linear stochastic optimal controllers for analog and digital

implementations is described. The principal benefit of stochastic optimal control theory is that it provides an engineering framework within which practical control design can be accomplished for complex dynamic systems. T.M.

N82-11077# Royal Aircraft Establishment. Farnborough (England). Flight Systems Dept.
DESIGN CONSIDERATIONS FOR OPTIMAL FLIGHT CONTROL SYSTEMS
F. R. Gill In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 21 p refs

Avail: NTIS HC A13/MF A01
Following a review of the several interacting factors affecting the design of control laws for any kind of flight control system (FCS), the modelling problem is discussed, including accuracy requirements for computer models of the aircraft, FCS, external disturbances and sensor noise. The state-of-the-art in designing the control and scheduling laws is surveyed and the limits of conventional control techniques are exposed. To overcome these limits, the use of selected nonlinear control techniques is discussed, including the concept of redundant adaptation with safeguards. T.M.

N82-11078*# Honeywell Systems and Research Center, Minneapolis, Minn. Systems and Control Technology Sect.
DESIGN TECHNIQUES FOR MUTLIVARIABLE FLIGHT CONTROL SYSTEMS
In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 33 p refs

(Contracts NAS4-2518; N00014-75-C-01444)
Avail: NTIS HC A13/MF A01 CSCL 01C
Techniques which address the multi-input closely coupled nature of advanced flight control applications and digital implementation issues are described and illustrated through flight control examples. The techniques described seek to exploit the advantages of traditional techniques in treating conventional feedback control design specifications and the simplicity of modern approaches for multivariable control system design. T.M.

N82-11079# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
PRACTICAL DESIGN AND REALIZATION OF A DIGITAL ADAPTIVE FLIGHT CONTROL SYSTEM
V. Krebs and U. Hartmann In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 22 p refs Sponsored in part by the West German Ministry of Defense

Avail: NTIS HC A13/MF A01
A new approach for the design and the practical realization of a digital adaptive command and stability system is proposed. The control law for the longitudinal motion of the aircraft is obtained by state vector feedback using the MIL-F-8785 B handling qualities requirements. The design principle is based on decoupling of the angle of attack and pitch rate on the one hand and the pole allocation method for the eigenvalues of the control system on the other hand. Since the necessary gain factors contain unknown and variable aircraft parameters, an on-line fading-memory least squares algorithm for the estimation of these parameters is used. Only conventional aircraft sensors (rate gyros and accelerometers) and an airborne digital computer are necessary. Hybrid simulations of the complete system as well as flight test results demonstrate the efficiency of the concept. T.M.

N82-11080# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
CONTROL LAW DESIGN FOR TRANSPORT AIRCRAFT FLIGHT TASKS
Volkmar Adam and Hagen Leyendecker In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 13 p refs
Avail: NTIS HC A13/MF A01
An integrated digital flight control system was developed. The primary objective of the program was, both to improve the manual control of the aircraft assisted by control systems, and to develop new control and display systems. In addition, automation is to be provided for loner flight phases which are to be optimized with respect to fuel consumption, flight time, or

other criteria. Aspects of the control law design and flight test experience with the integrated digital flight control system are described. DOE

N82-11081# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
CONTROL DESIGN OF FLEXIBLE SPACECRAFT
Robert E. Skelton In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 28 p refs

Avail: NTIS HC A13/MF A01
When compared to other large scale systems, flexible spacecraft have some peculiarities which can make control more difficult. Emphasis is placed upon the time domain and suboptimal linear quadratic guassian (LOG) methods, with special attention given to the effects of modeling errors. These effects are discussed in light of the model reduction problem, stability, and control design. Stability, controllability and observability computations are reduced to their simplest form possible to provide insight and to facilitate the location of sensors and actuators. The techniques of modal cost analysis are used to identify the critical parameters and the critical models of the structure. In the final stage of design, component cost analysis reveals which states of the optimal dynamical controller should be deleted to produce a reduced controller which is compatible with the on-line computer software limitations. T.M.

N82-11082*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMUM CLIMB AND DESCENT TRAJECTORIES FOR AIRLINE MISSIONS
Heinz Erzberger In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 15 p refs

Avail: NTIS HC A13/MF A01 CSCL 01C
The characteristics of optimum fixed-range trajectories whose structure is constrained to climb, steady cruise, and descent segments are derived by application of optimal control theory. The performance function consists of the sum of fuel and time costs, referred to as direct operating cost (DOC). The state variable is range to go and the independent variable is energy. In this formulation a cruise segment always occurs at the optimum cruise energy for sufficiently large range. At short ranges (400 n. mi. and less), a cruise segment may also occur below the optimum cruise energy. The existence of such a cruise segment depends primarily on the fuel flow vs thrust characteristics and on thrust constraints. If thrust is a free control variable along with airspeed, it is shown that such cruise segments will not generally occur. If thrust is constrained to some maximum value in climb and to some minimum in descent, such cruise segments generally will occur. T.M.

N82-11083*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF NONLINEAR SYSTEMS INVERSES TO AUTOMATIC FLIGHT CONTROL DESIGN: SYSTEM CONCEPTS AND FLIGHT EVALUATIONS
George Meyer and Luigi Cicolani In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 29 p refs
Avail: NTIS HC A13/MF A01 CSCL 01C
A practical method for the design of automatic flight control systems for aircraft with complex characteristics and operational requirements, such as the powered lift STOL and V/STOL configurations, is presented. The method is effective for a large class of dynamic systems requiring multi-axis control which have highly coupled nonlinearities, redundant controls, and complex multidimensional operational envelopes. It exploits the concept of inverse dynamic systems, and an algorithm for the construction of inverse is given. A hierarchic structure for the total control logic with inverses is presented. The method is illustrated with an application to the Augmentor Wing Jet STOL Research Aircraft equipped with a digital flight control system. Results of flight evaluation of the control concept on this aircraft are presented. T.M.

N82-11084*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MANAGEMENT OF REDUNDANCY IN FLIGHT CONTROL SYSTEMS USING OPTIMAL DECISION THEORY
In AGARD Theory and Appl. of Optimal Control in Aerospace

Systems Jul. 1981 12 p refs

Avail: NTIS HC A13/MF A01 CSCL 01C

The problem of using redundancy that exists between dissimilar systems in aircraft flight control is addressed. That is, using the redundancy that exists between a rate gyro and an accelerometer--devices that have dissimilar outputs which are related only through the dynamics of the aircraft motion. Management of this type of redundancy requires advanced logic so that the system can monitor failure status and can reconfigure itself in the event of one or more failures. An optimal decision theory was tutorially developed for the management of sensor redundancy and the theory is applied to two aircraft examples. The first example is the space shuttle and the second is a highly maneuvering high performance aircraft--the F8-C. The examples illustrate the redundancy management design process and the performance of the algorithms presented in failure detection and control law reconfiguration.   T.M.

N82-11087# Systems Control, Inc., Palo Alto, Calif.
DEVELOPMENT OF MULTIVARIABLE CONTROLLERS FOR AIRCRAFT TURBINE ENGINES
Ronald L. DeHoff, Stephen M. Rock, and Muhammed M. Akhter
In AGARD Theory and Appl. of Optimal Control in Aerospace Systems Jul. 1981 12 p refs

Avail: NTIS HC A13/MF A01

A model reference structure is discussed which is shown to be a flexible framework within which digital control programs of a wide variety of function and complexity can be formulated. The development of the plant reference model is discussed and trade-offs between accuracy and complexity presented. The techniques used to produce optimized, feed-forward state, control and output trajectories are presented. The well-known methods of regulator synthesis using quadratic performance functions are briefly reviewed and the results of several successful applications of this methodology are summarized.   T.M.

N82-11089 Royal Aircraft Establishment, Bedford (England). Library.
ADAPTATION OF A TURBINE TEST FACILITY TO HIGH-TEMPERATURE RESEARCH
J. Francois, Y. LeBot, J. Michard, and P. Deguest Dec. 1980 30 p refs Transl. into ENGLISH from AGARD Conf. Proc. No. 229, Ankara, Sept.
(RAE-Lib-Trans-2064; BR78650) Copyright. Avail: Issuing Activity

A facility for research on a high temperature (1800 K) and high pressure (4.5 bar) turbine stage is described. The turbine operates in a realistic engine environment and is comprehensively instrumented to permit wide variation of mainstream and coolant flow parameters. The development of robust probes for the measurement of turbulence and temperature fluctuations and optical pyrometry techniques is described. Results of studies of nozzle guide vane heat transfer coefficients, metal temperatures and film cooling efficiency are presented together with rotor blade surface temperature distributions. The MINOS rig confirmed the validity of turbine design prediction methods by providing performance data to correlate theory, scale model testing and gas turbine engine testing.   T.M.

N82-11212# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
POLYURETHANE FOAMS FOR AIRCRAFT SHOCK MOUNTS. 3: VIBRATION DAMPING BY POLYETHER FOAMS Progress Report, Sep. 1979 - Jun. 1980
James V. Duffy Jul. 1981 38 p refs
(AD-A104496; NSWC/TR-80-343) Avail: NTIS HC A03/MF A01 CSCL 11/9

The objective of this program was to develop flexible foam systems which would meet the specifications outlined in MIL-F-81334B(AS). The vibration damping and mechanical properties of a series of foams based on mixtures of poly (oxytetramethylene) glycol and poly(oxypropylene) polyol were determined. The effect of polyol ratio, foam density, surfactant type and unit loading on vibration output transmissibility for these systems is reported.   Author (GRA)

N82-11224*# Lockheed-California Co., Burbank.
EXPERIMENTAL STUDY OF FUEL HEATING AT LOW TEMPERATURES IN A WING TANK MODEL, VOLUME 1 Final Report
Francis J. Stockemer Aug. 1981 75 p refs
(Contract NAS3-21977)
(NASA-CR-165391; LR-29935-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21D

Scale model fuel heating systems for use with aviation hydrocarbon fuel at low temperatures were investigated. The effectiveness of the heating systems in providing flowability and pumpability at extreme low temperature when some freezing of the fuel would otherwise occur is evaluated. The test tank simulated a section of an outer wing tank, and was chilled on the upper and lower surfaces. Turbine engine lubricating oil was heated, and recirculating fuel transferred the heat. Fuels included: a commercial Jet A; an intermediate freeze point distillate; a higher freeze point distillate blended according to Experimental Referee Broadened Specification guidelines; and a higher freeze point paraffinic distillate used in a preceding investigation. Each fuel was chilled to selected temperature to evaluate unpumpable solid formation (holdup). Tests simulating extreme cold weather flight, without heating, provided baseline fuel holdup data. Heating and recirculating fuel increased bulk temperature significantly; it had a relativley small effect on temperature near the bottom of the tank. Methods which increased penetration of heated fuel into the lower boundary layer improved the capability for reducing holdup.   S.L.

N82-11228# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Fuels and Lubrication Div.
JET FUEL LOCKS TO SHALE OIL: THE 1980 TECHNOLOGY REVIEW
Herbert R. Lander May 1981 156 p refs Proceedings of Conf. held at Cincinnatti, 19-20 Nov. 1980
(AF Proj. 2480)
(AD-A104414; AFWAL-TR-81-2063) Avail: NTIS HC A08/MF A01 CSCL 11/4

The progress of several Air Force shale oil related programs is reported. Three shale oil processing studies evaluating the yield, cost, and quality of JP-4 and JP-8 turbine fuel produced from whole crude shale oil are discussed. Details of a fourth program that produced 11,300 gallons of specification JP-4 from Geokinetics shale oil are reported. Some of this jet fuel was tested in Air Force Fuel Mainburner/Turbine Effects Programs and was shown to behave very similar to petroleum derived JP-4. An additional study concentrated on developing hydrotreating catalysts that would more efficiently convert shale oil into aviation turbine fuel.   Author (GRA)

N82-11230*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
AN ASSESSMENT OF THE USE OF ANTIMISTING FUEL IN TURBOFAN ENGINES Final Report, Sep. 1979 - Nov. 1980
A. Fiorentino, R. DeSaro, and T. Franz Jun. 1981 53 p refs
(Contract NAS3-22045)
(NASA-CR-165258; AD-A104673; PWA-5697-29; FAA-CT-81-58) Avail: NTIS HC A04/MF A01 CSCL 21/4

An evaluation was made on the effects of using antimisting kerosene (AMK) on the performane of the components from the fuel system and the combustor of a current in-service JT8D aircraft engine. The objectives were to identify problems associated with using antimisting kerosene and to determine the extent of shearing or degradation required to allow the engine components to achieve satisfactory operation. The program consisted of a literature survey and a test program which evaluated the antimisting kerosene fuel in laboratory and bench component testing, and assessed the performance of the combustor in a high pressure facility and in an atitude relight/cold ignition facility. Performance of the fuel pump and control system was evaluated in an open loop simulation. Thus far, results of the program would not preclude the use of antimisting kerosene in a jet engine application.   GRA

N82-11232# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
AN INVESTIGATION OF THE COMBUSTION PROCESS IN SOLID FUEL RAMJETS M.S. Thesis
William Vernon Goodwin Jun. 1981 58 p refs
(AD-A104603) Avail: NTIS HC A04/MF A01 CSCL 21/4

An experimental investigation was conducted into four areas of the solid fuel ramjet combustion process: (1) the effects of near-wall turbulent mixing and equivalence ratio on combustion efficiency, (2) the effects of bypass air on combustion efficiency, (3) the combustion process in a cylindrically perforated fuel grain with a twin side-dump/dome configuration, and (4) the comparison of experimental radial temperature profiles to computer generated radial profiles. Polymethylmethacrylate fuel grains were burned in a ramjet motor and a thrust stand. Combustion efficiencies were determined and compared for different configurations. It was found to be insensitive to variations in the mixture ratio and to near-wall mixing. Bypass air was found to adversely affect the combustion efficiency both in stable and unstable combustion environments. The twin side-dump/dome configuration was unable to sustain combustion for all conditions investigated. Theoretical radial temperature profiles were found to have larger near wall gradients than were measured experimentally. Author (GRA)

N82-11313# New Mexico Univ., Albuquerque. Engineering Research Inst.
DESIGN OF AIRPORT PAVEMENTS FOR EXPANSIVE SOILS
Final Report
R. Gordon McKeen Jan. 1981 198 p refs
(Contract F29601-76-C-0051)
(AD-A104660; NMERI-AP-37; FAA-RD-81-25) Avail: NTIS HC A09/MF A01 CSCL 08/13
Expansive soil subgrades exhibit volume changes with variation in moisture condition. These changes result in differential movement of airport pavements resting on these soils. Special design procedures must be used to account for the expansive soil activity during equilibration. In addition, special precautions are required to protect the subgrade from moisture variation with climate. Measurement of soil suction is a key step in quantifying moisture-induced soil behavior. Procedures are outlined for suction characterization of the soil and for estimating the in situ differential movement likely to occur under the pavement. Once the wavelength and amplitude characteristics of the differential movement are obtained, design calculations to select the thickness and materials for the pavement may proceed. GRA

N82-11339*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GENERAL AVIATION AIRCRAFT ANTENNAS FOR THE GLOBAL POSITIONING SYSTEM
Melvin C. Gilreath and J. S. Chatterjee Oct. 1981 37 p refs
(NASA-TM-83212) Avail: NTIS HC A03/MF A01 CSCL 17G
Several antenna designs that utilize the NAVSTAR Global Positioning System in a low-cost system for general aviation aircraft were evaluated. Experimental investigations were made of crossed-dipoles, various types of crossed-slots, and microstrip antennas with modifications to improve their coverage. Principal plane radiation patterns for several of these antennas were measured on a one-seventh scale model of a Gates Lear Jet. R.J.F.

N82-11354# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.
SYSTEM SAFETY PROGRAM PLAN **Final Report, 31 Mar. - 8 Aug. 180**
A. J. Bonham 8 Aug. 1980 79 p refs
(Contract DNA001-80-C-0177)
(AD-A104557; AG-1446; DNA-5467F) Avail: NTIS HC A05/MF A01 CSCL 12/12
This document, System Safety Program Plan, is the implementing document covering the safety aspects of performing an EMP Test on the A7E aircraft in the HPD (Horizontally Polarized Dipole), VPD (Vertically Polarized Dipole), and NWEF hangar facilities at Kirtland AFB, New Mexico. GRA

N82-11391*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AMPLIFIED CROSSFLOW DISTURBANCES IN THE LAMINAR BOUNDARY LAYER ON SWEPT WINGS WITH SUCTION
J. Ray Dagenhart Nov. 1981 90 p refs
(NASA-TP-1902; L-14423) Avail: NTIS HC A05/MF A01 CSCL 20D
Solution charts of the Orr-Sommerfeld equation for stationary

crossflow disturbances are presented for 10 typical velocity profiles on a swept laminar flow control wing. The critical crossflow Reynolds number is shown to be a function of a boundary layer shape factor. Amplification rates for crosslow disturbaces are shown to be proportional to the maximum crossflow velocity. A computer stability program called MARIA, employing the amplification rate data for the 10 crossflow velocity profiles, is constructed. This code is shown to adequately approximate more involved computer stability codes using less than two percent as much computer time while retaining the essential physical disturbance growth model. Author

N82-11491*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTEGRATED ANALYSIS OF ENGINE
Christos C. Chamis 1981 24 p refs Presented at the Ann. Meeting of the ASME, Washington, D.C., 16-21 Nov. 1981
(NASA-TM-82713; E-995) Avail: NTIS HC A02/MF A01 CSCL 20K
The need for light, durable, fuel efficient, cost effective aircraft requires the development of engine structures which are flexible, made from advanced materials (including composites), resist higher temperatures, maintain tighter clearances and have lower maintenance costs. The formal quantification of any or several of these requires integrated computer programs (multi-level and/or interdisciplinary analysis programs interconnected) for engine structural analysis/design. Several integrated analysis computer prorams are under development at Lewis Reseach Center. These programs include: (1) COBSTRAN-Composite Blade Structural Analysis, (2) CODSTRAN-Composite Durability Structural Analysis, (3) CISTRAN-Composite Impact Structural Analysis, (4) STAEBL-StruTailoring of Engine Blades, and (5) ESMOSS-Engine Structures Modeling Software System. Three other related programs, developed under Lewis sponsorship, are described. Author

N82-11498# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.
STRUCTURAL ANALYSIS COMPUTER PROGRAMS FOR RIGID MULTICOMPONENT PAVEMENT STRUCTURES WITH DISCONTINUITIES, WESLIQID AND WESLAYER. REPORT 1: PROGRAM DEVELOPMENT AND NUMERICAL PRESENTATIONS Technical Report, 1 Oct. 1978 - 30 Sep. 1979
Yu T. Chou May 1981 150 p refs
(DA Proj. 4A7-62719-AT-40)
(AD-A104545; WES/TR/GL-81-6-1) Avail: NTIS HC A07/MF A01 CSCL 13/13
This study was conducted to develop finite element computer programs to calculate stresses and deflections in rigid pavements with cracks and joints subjected to loads and temperature warping, as well as in the supporting subgrade soil. The joints are connected by dowel bars or other load transfer devices. The slabs can have full or partial loss of subgrade support over designed regions of the slabs. Multiple-wheel loads can be handled and the number of wheels is not limited. Two programs were developed, one called WESLIQID and the other WESLAYER. The former is for pavements on liquid foundations and the latter is for linear layered elastic solids. Variable slab thicknesses and moduli of subgrade reaction are incorporated in the WESLIQID program, and any number of slabs arrayed in an arbitrary pattern can be handled. Because of larger computer storage requirement and computational complexity, the WESLAYER program is limited to two slabs. GRA

N82-11514*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR MAPPING, ARCHAEOLOGY, AND ANCIENT LAND USE IN THE MAYA LOWLANDS
R. E. W. Adams (Cambridge Univ.), W. E. Brown, Jr., and T. Patrick Culbert (Arizona Univ.) 31 Mar. 1981 27 p refs
(Contract NAS7-100)
(NASA-CR-164931) Avail: NTIS HC A03/MF A01 CSCL 08B
Data from the use of synthetic aperture radar in aerial survey of the southern Maya lowlands suggest the presence of very large areas drained by ancient canals for the purpose of intensive cultivation. Preliminary ground checks in several very limited areas confirm the existence of canals and raised fields. Excavations and ground surveys by several scholars provide valuable comparative information. Taken together, the new data suggest

that Late Classic period Maya civilization was firmly grounded in large-scale and intensive cultivation of swampy zones. A.R.H.

N82-11636*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF AIRCRAFT NOISE ON THE EQUILIBRIUM OF AIRPORT RESIDENTS: TESTING AND UTILIZATION OF A NEW METHODOLOGY
Jacques Francois Sep. 1981 34 p Transl. into ENGLISH of "Repercussion du Bruit des Avions sur l'Equilibre des Riverains des Aeroports: Test et Mise au Point d'une Methodologie Nouvelle" Paris, Aug. 1977 p 1-134 Transl. was announced as N81-27692 Transl. Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by IFOP/ETMAR
(Contract NASw-3542)
(NASA-TM-76628) Avail: NTIS HC A03/MF A01 CSCL 13B
The focus of the investigation is centered around two main themes: an analysis of the effects of aircraft noise on the psychological and physiological equilibrium of airport residents; and an analysis of the sources of variability of sensitivity to noise. The methodology used is presented. Nine statistical tables are included, along with a set of conclusions. T.M.

N82-11859*# United Technologies Research Center, East Hartford, Conn.
HELICOPTER ROTOR TRAILING EDGE NOISE Final Report
Robert H. Schlinker and Roy K. Amier Washington NASA Nov. 1981 150 p refs
(Contract NAS1-15730)
(NASA-CR-3470) Avail: NTIS HC A07/MF A01 CSCL 20A
A two dimensional section of a helicopter main rotor blade was tested in an acoustic wind tunnel at close to full-scale Reynolds numbers to obtain boundary layer data and acoustic data for use in developing an acoustic scaling law and testing a first principles trailing edge noise theory. Results were extended to the rotating frame coordinate system to develop a helicopter rotor trailing edge noise prediction. Comparisons of the calculated noise levels with helicopter flyover spectra demonstrate that trailing edge noise contributes significantly to the total helicopter noise spectrum at high frequencies. This noise mechanism is expected to control the minimum rotor noise. In the case of noise radiation from a local blade segment, the acoustic directivity pattern is predicted by the first principles trailing edge noise theory. Acoustic spectra are predicted by a scaling law which includes Mach number, boundary layer thickness and observer position. Spectrum shape and sound pressure level are also predicted by the first principles theory but the analysis does not predict the Strouhal value identifying the spectrum peak. A.R.H.

N82-11860*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEL AND EPNL NOISE DURATION COEFFICIENTS FOR THE 747 AND T-38 AIRCRAFT
William L. Willshire, Jr. Sep. 1981 12 p refs
(NASA-TM-83214) Avail: NTIS HC A02/MF A01 CSCL 20A
Duration coefficient were calculated for Boeing 747 and T-38 airplanes for sound exposure level (SEL) and effective perceived noise level (EPNL) scales. The measured SEL duration coefficients were 8.4 for the Boeing 747 and 5.5 for the T-38 result was in good agreement with a previous result for a similar F-5 airplane. In EPNL, the duration coefficients were 7.2 for the Boeing 747 and 5.7 for the T-38. The difference in the results between the two airplanes is believed to be due to their different engine noise source spectra. The difference in the Boeing 747 results in the two different metric was due to the different frequency weighting of A-weighted sound pressure level, used in SEL, and tone-corrected perceived noise level, used in EPNL, when applied to the 747 spectra. B.W.

N82-12023# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE KERNEL FUNCTION COLLOCATION METHOD IN STEADY SUBSONIC FLOW FOR WING WITH CONTROL SURFACES
Chen Jing Song In its Acta Mech. Sinica (Selected Articles) (FTD-ID(RS)T-0705-81) 15 Sep. 1981 p 35-50 refs Transl. into ENGLISH from Acta Mech. Sinica (China), no. 2, 1979

Avail: NTIS HC A05/MF A01 CSCL 20/4
The forms of the lift distribution function for wings with control surfaces in steady subsonic flow are analyzed. Methods for treating kernel singularities of linear integral equations and singularities of the lift distribution function are discussed and the numerical solution to the integral equation is given. These methods may be used to calculate the lift distribution of the wing by itself or of the wing with partial or full control surfaces on both the leading and trailing edges. The numerical values agree well with experimental data and have the same accuracy as those given by other theories. As compared with the vortex lattice method, the computational storage requirement for this method is smaller and the computational time is less. The numerical computation may be carried out on smaller computers.

SUBJECT INDEX

Typical Subject Index Listing
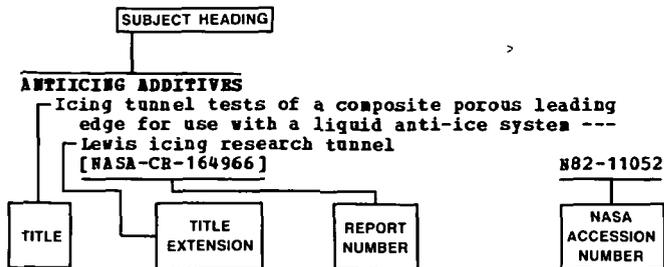
The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, a title extension is added, separated from the title by hyphens. The NASA or AIAA accession number is included in each entry to assist the user in locating the abstract in the abstract section of this supplement. If applicable, a report number is also included as an aid in identifying the document.

A

A-7 AIRCRAFT
A comparison of theoretical and experimental pressure distributions for two advanced fighter wings
[NASA-TM-81331]   N82-11054
System safety program plan --- electromagnetic pulse testing of the A-7E aircraft
[AD-A104557]   N82-11354
A-300 AIRCRAFT
Active control elements on the transonic wing of the Airbus A-300 (ACTTA A). Airbus A-300 with reduced longitudinal stability (ACTTA-C) --- advanced control transonic transport aircraft (ACCTA); design considerations
                    N82-10044
ABSORBERS (MATERIALS)
Evaluation of the acoustic measurement capability of the NASA Langley V/STOL wind tunnel open test section with acoustically absorbent ceiling and floor treatments
[NASA-CR-165796]   N82-10059
AC GENERATORS
60 KVA ADP permanent magnet VSCF starter generator system - Generator system performance characteristics
                    A82-11721
ACCIDENT PREVENTION
A proposed flight safety program for the Korean Air Force
[AD-A102373]   N82-10023
Lightning effects on aircraft and composites. Literature study on lightning strikes and protection --- advanced composite materials
[POA-C-20388-F9]   N82-10024
ACCUMULATORS
Low maintenance hydraulic accumulator
[AD-A103947]   N82-10034
ACOUSTIC EMISSION
Acoustic emission - An emerging technology for assessing fatigue damage in aircraft structure
                    A82-11149
ACOUSTIC FATIGUE
Response of nonlinear aircraft structural panels to high intensity noise
                    A82-12041
ACOUSTIC MEASUREMENTS
Effects of vane/blade ratio and spacing on fan noise
[AIAA PAPER 81-2033]   A82-10457

ACOUSTIC PROPAGATION
SEL and EPNL noise duration coefficients for the 747 and T-38 aircraft
[NASA-TM-83214]   N82-11860
ACOUSTIC PROPERTIES
Evaluation of the acoustic measurement capability of the NASA Langley V/STOL wind tunnel open test section with acoustically absorbent ceiling and floor treatments
[NASA-CR-165796]   N82-10059
ACTIVE CONTROL
Active control elements on the transonic wing of the Airbus A-300 (ACTTA A). Airbus A-300 with reduced longitudinal stability (ACTTA-C) --- advanced control transonic transport aircraft (ACCTA); design considerations
                    N82-10044
A method for determination of the aeroelastic behavior of aircraft with active control systems
[DFVLR-FB-81-05]   N82-10047
ACTUATORS
Control of electromechanical actuator elements for flight vehicles --- Russian book
                    A82-12170
Aircraft digital input controlled hydraulic actuation and control system
[AD-A104263]   N82-11072
ADAPTIVE CONTROL
Control laws for adaptive wind tunnels
                    A82-10985
Practical design and realization of a digital adaptive flight control system
                    N82-11079
ADDITIVES
Rheological behavior of progressively shear-thickening solutions --- aircraft fuel polymer additives for fire protection in survivable crashes
                    A82-11177
A protective additive for jet fuels
                    A82-12022
AERIAL PHOTOGRAPHY
Three navigation systems and their costs of acquiring remote sensing data
                    A82-10049
AEROACOUSTICS
Helicopter rotor trailing edge noise
[AIAA PAPER 81-2001]   A82-10455
Design predictions for noise control in the cryogenic National Transonic Facility
                    A82-12025
Aeroacoustic theory for noncompact wing-gust interaction
[PDRL-81-7]   N82-11071
AERODYNAMIC BALANCE
Development of new lifting parachute designs with increased trim angle
[AIAA PAPER 81-1921]   A82-10407
AERODYNAMIC BRAKES
Aeroballistic characteristics of sonobuoy parachute decelerators limited to a length of three feet
[AIAA PAPER 81-1950]   A82-10425
AERODYNAMIC CHARACTERISTICS
Experimental study of subsonic and transonic flows past a wing
                    A82-10363
Aerodynamics and performance of cruciform parachute canopies
[AIAA PAPER 81-1919]   A82-10405
Development of new lifting parachute designs with increased trim angle
[AIAA PAPER 81-1921]   A82-10407

AIR FLOW
   Application of numerical modeling to gas turbine
      combustor development problems
                                         A82-12118
AIR INTAKES
   Low speed testing of the inlets designed for a
      tandem-fan V/STOL nacelle --- conducted in the
      Lewis 10 by 10 foot wind tunnel
      [NASA-TM-82728]   N82-11042
AIR NAVIGATION
   Three navigation systems and their costs of
      acquiring remote sensing data
                                         A82-10049
   Navigation task partitioning in
      distributed-processing avionics systems
                                         A82-10646
   Discrete address beacon, navigation and landing
      system
                                         A82-10650
   Fast and accurate gyrocompass using strapdown
      tuned rotor gyros as a solution to combat
      helicopters navigation problems
                                         A82-11927
   National Aerospace Meeting, Trevose, PA, April
      8-10, 1981, Proceedings
                                         A82-12626
   Satellite geometry considerations for low cost GPS
      user equipment
                                         A82-12630
   A solution to the static geometry problem for
      JTIDS relative navigation
                                         A82-12634
   Memory requirements for future navigation systems
                                         A82-12637
   A navigation systems planning model
                                         A82-12640
   The integrated inertial sensor assembly /IISA/ - A
      redundant strapdown system for advanced aircraft
      navigation and flight control functions
                                         A82-12642
   Integrated satellite navigation and strapdown
      attitude and heading reference systems for civil
      air carriers
                                         A82-12643
   Ring Laser Gyro Navigator /RLGN/ flight test results
                                         A82-12644
AIR TRAFFIC CONTROL
   Performance analysis of enroute air traffic
      control computers in the National Airspace System
      [AIAA 81-2203]   A82-10140
   FAA developing new collision avoidance, data
      acquisition and transmission systems
                                         A82-10396
   Discrete address beacon, navigation and landing
      system
                                         A82-10650
   Airport and Airway Improvement Act of 1981, part 1
      [GPO-76-241-PT-1]   N82-10062
   FAA misses opportunities to discontinue or reduce
      operating hours of some airport traffic control
      towers
      [PB81-224214]   N82-11049
AIR TRANSPORTATION
   Cost reduction in air transportation --- energy
      conservation
      [SNIAS-811-150-101]   N82-10025
AIRBORNE EQUIPMENT
   Instrumented aircraft verification of clear-air
      radar detection of low-level wind shear
                                         A82-10221
   A mathematical model of an over-sea airborne UHF
      radio link
                                         A82-11406
   High voltage surge and partial discharge test to
      evaluate aerospace equipment parts
                                         A82-11740
AIRBORNE SURVEILLANCE RADAR
   Airborne weather radar and severe weather
      penetration
                                         A82-10219
AIRBORNE/SPACEBORNE COMPUTERS
   KC-135 Avionics Modernization Hot Bench
      [AIAA 81-2105]   A82-10081
   HiMAT onboard flight computer system architecture
      and qualification
      [AIAA 81-2107]   A82-10082
   Synchronous fault-tolerant flight control systems
      [AIAA 81-2109]   A82-10083

The Space Shuttle vehicle checkout involving
   flight avionics software
   [AIAA 81-2141]   A82-10100
Bridging the gap from aircraft to space computers
   [AIAA 81-2142]   A82-10101
Airborne associative processor /ASPRO/ --- for
   early warning radar surveillance, command, and
   control applications
   [AIAA 81-2145]   A82-10104
Controlling the software/hardware interface for
   the validation of avionics systems --- in flight
   control systems
   [AIAA 81-2159]   A82-10116
A microprocessor-based data acquisition system for
   stall/spin research
   [AIAA 81-2177]   A82-10126
Performance analysis of enroute air traffic
   control computers in the National Airspace System
   [AIAA 81-2203]   A82-10140
Interoperability testing of decentralized command,
   control, communications and intelligence /C3I/
   systems
   [AIAA 81-2205]   A82-10143
Navigation task partitioning in
   distributed-processing avionics systems
                                         A82-10646
Memory requirements for future navigation systems
                                         A82-12637
Ring Laser Gyro Navigator /RLGN/ flight test results
                                         A82-12644
AIRCRAFT ACCIDENT INVESTIGATION
   Downbursts and microbursts - An aviation hazard
      --- downdrafts beneath thunderstorms
                                         A82-10214
   Airborne weather radar and severe weather
      penetration
                                         A82-10219
   A note on fatal aircraft accidents involving metal
      fatigue
                                         A82-11400
AIRCRAFT ACCIDENTS
   Relationships between naval aviation safety and
      pilot flight experience
                                         A82-11031
   SARSAT applications
                                         A82-12698
AIRCRAFT ANTENNAS
   General aviation aircraft antennas for the global
      positioning system
      [NASA-TM-83212]   N82-11339
AIRCRAFT COMMUNICATION
   A mathematical model of an over-sea airborne UHF
      radio link
                                         A82-11406
AIRCRAFT COMPARTMENTS
   Experimental modal analysis of the fuselage panels
      of an Aero Commander aircraft
      [NASA-CR-165750]   N82-10028
AIRCRAFT CONFIGURATIONS
   Analysis of augmented aircraft flying qualities
      through application of the Neal-Smith criterion
      [AIAA PAPER 81-1776]   A82-10462
   V/STOL aircraft and fluid dynamics
      [NASA-TM-81328]   N82-10029
AIRCRAFT CONSTRUCTION MATERIALS
   The application of improved aluminium alloys and
      steels in aircraft structures
                                         A82-10305
   Sophisticated aircraft structure developments -
      Combat aeroplanes
                                         A82-10309
   On the use of carbon composites in slat and
      stabilizer construction
                                         A82-11468
   Powder metallurgy superalloys - Aerospace
      materials for the 1980's; Proceedings of the
      Conference, Zurich, Switzerland, November 18-20,
      1980. Volume 1
                                         A82-12495
   Kevlar composites; Proceedings of the Symposium,
      El Segundo, CA, December 2, 1980
                                         A82-12646
   Seven years experience with Kevlar-49 in the
      Lockheed L-1011 Tristar
                                         A82-12647

AIRCRAFT CONTROL
Controlling the software/hardware interface for
the validation of avionics systems --- in flight
control systems
[AIAA 81-2159]   A82-10116
Use of Space Shuttle technology in conventional
aircraft
[AIAA 81-2176]   A82-10125
Analysis of augmented aircraft flying qualities
through application of the Neal-Smith criterion
[AIAA PAPER 81-1776]   A82-10462
Improving the MLS through enhanced cockpit displays
                                            A82-10649
Procedures and analysis techniques for determining
static air minimum control speeds
                                            A82-12564
Simulation study of a hybrid strapdown attitude
and heading reference system
                                            A82-12641
Theoretical investigation of the influence of
spoiler dynamics on the handling qualities of an
aircraft with direct lift control
[ESA-TT-681]   N82-10036
Estimation of airplane stability and control
derivatives from large amplitude longitudinal
maneuvers
[NASA-TM-83185]   N82-10042
Control law design for transport aircraft flight
tasks
                                            N82-11080

AIRCRAFT DESIGN
Integration of computer graphics design with
analytical models --- for aircraft design
[AIAA 81-2134]   A82-10096
Use of Space Shuttle technology in conventional
aircraft
[AIAA 81-2176]   A82-10125
Design aspects of non rigid airship envelopes
                                            A82-10306
Some possibilities for composite light aircraft
construction
                                            A82-10307
Light aircraft structural design in non-metallics
. - Use of composite honeycomb for light aircraft
                                            A82-10308
Analytical determination of undercarriage
retraction kinematics
                                            A82-10364
The balloon and the airship technological heritage
[AIAA PAPER 81-1912]   A82-10401
Air bag impact attenuation system for the AQM-34V
remote piloted vehicle
[AIAA PAPER 81-1917]   A82-10403
Analysis of augmented aircraft flying qualities
through application of the Neal-Smith criterion
[AIAA PAPER 81-1776]   A82-10462
How large should a commuter transport be
[AIAA PAPER 81-1732]   A82-10463
Optimization of the principal design parameters of
a passenger aircraft
                                            A82-10816
Towards minimum power for environmental control in
transport aircraft
[ASME PAPER 81-ENAS-4]   A82-10892
Design analysis of high temperature transparent
windshields for high performance aircraft
[ASME PAPER 81-ENAS-5]   A82-10893
Calculation of aerodynamic characteristics of jet
flapped airplane
                                            A82-11459
Design and development of a low cost servoed rate
gyro for unmanned aircraft
                                            A82-11932
Response of nonlinear aircraft structural panels
to high intensity noise
                                            A82-12041
Crack growth evaluation of a method to convert
real-time loads history to a simplified
engineering spectra --- for aircraft structural
analysis
                                            A82-12043
ACMA - Fact or fantasy --- Advanced
Civilian/Military Aircraft
                                            A82-12048
F-5G Tigershark
                                            A82-12775
The case for a defensive air-to-air fighter
                                            A82-12801

Solution to the hidden-line problem
                                            A82-12803
V/STOL aircraft and fluid dynamics
[NASA-TM-81328]   N82-10029
Quiet short-haul research aircraft familiarization
document, revision 1
[NASA-TM-81298]   N82-10031
Active control elements on the transonic wing of
the Airbus A-300 (ACTTA A). Airbus A-300 with
reduced longitudinal stability (ACTTA-C) ---
advanced control transonic transport aircraft
(ACCTA); design considerations
                                            N82-10044
Acta mechanica sinica
[AD-A105184]   N82-11014
The principles and methods for shaping the wing
root regions of a wing-body combination at
transonic and lower supersonic speeds
                                            N82-11016
New estimation method for flutter or divergence
boundary from random responses at subcritical
speeds
[NAL-TR-667T]   N82-11034
Design techniques for mutlivariable flight control
systems
                                            N82-11078

AIRCRAFT ENGINES
Design considerations for duty cycle, life and
reliability of small limited life engines
[AIAA PAPER 81-1402]   A82-10465
Air-film cooling returns to ramjets
[ASME PAPER 81-ENAS-8]   A82-10896
One reason for the onset of high-frequency
self-excited oscillations --- in combustion
chambers of aircraft engines
                                            A82-11448
Basic problem of aircraft gasturbine engine
analytic design. II
                                            A82-11463
Coupled fluid/structure response predictions for
soft body impact of airfoil configurations ---
ice and bird impact on aircraft engines
                                            A82-12039
History of flight testing the L-1011 TriStar jet
transport. II - Testing highlights since initial
certification of the L-1011-1
                                            A82-12049
Considerations and applications for the use of
fluidics in aerospace controls
                                            A82-12087
The enhancement of heat exchange in channels /2nd
revised and enlarged edition/ --- Russian book
                                            A82-12222
Validation studies of turbulence and combustion
models for aircraft gas turbine combustors
                                            A82-12267
Commercial EMS considerations for small gas
turbine engines --- automated engine monitoring
systems
                                            A82-12449
Further application and development of an engine
usage/life monitoring system for military services
                                            A82-12450
Superclean superalloy powders by the rotating
electrode process
                                            A82-12496
Superalloy turbine components - Which is the
superior manufacturing process, as-HIP, HIP plus
Isoforge, or 'gatorizing' of extrusion
consolidated billet
                                            A82-12497
Lineup of the IM-series aircraft-derivative gas
turbines
                                            A82-12560
Propulsion study for Small Transport Aircraft
Technology (STAT), Appendix B
[NASA-CR-165499-APP-B]   N82-10038
A new method of cooling turbine vanes
                                            N82-11027
Lightweight diesel engine designs for commuter
type aircraft
[NASA-CR-165470]   N82-11068
Development of multivariable controllers for
aircraft turbine engines
                                            N82-11087
Integrated analysis of engine
[NASA-TM-82713]   N82-11491

AIRCRAFT EQUIPMENT
  A new APU for medium place aircraft environmental
    control systems
    [ASME PAPER 81-ENAS-1]   A82-10889
  Air-freon integrated environmental conditioning
    system for trainer subsonic aircraft
    [ASME PAPER 81-ENAS-33]   A82-10920
  New separators for battery systems
                                              A82-11715
  Sealed lead-acid batteries for aircraft applications
                                              A82-11716
  A hidden advantage of permanent magnet electrical
    generating systems
                                              A82-11720
  60 KVA ADP permanent magnet VSCF starter generator
    system - Generator system performance
    characteristics
                                              A82-11721
  Design and development of a low cost servoed rate
    gyro for unmanned aircraft
                                              A82-11932
  Digital avionics - Promise and practice;
    Proceedings of the Joint Symposium, London,
    England, March 20, 1980
                                              A82-11934
  The all digital military aircraft
                                              A82-11937
  The digital civil aircraft
                                              A82-11938
  Low maintenance hydraulic accumulator
    [AD-A103947]   N82-10034
  Advanced aircraft electrical system control
    technology demonstrator. Phase 1: Requirements
    analysis and conceptual design
    [AD-A103922]   N82-10326
  Threat Alert and Collision Avoidance System (TCAS)
    Symposium
    [AD-A104563]   N82-11047
  Polyurethane foams for aircraft shock mounts. 3:
    Vibration damping by polyether foams
    [AD-A104496]   N82-11212
AIRCRAFT FUEL SYSTEMS
  Application of numerical methods to the
    calculation of electrostatic fields in aircraft
    fuel tanks
    [AD-A103703]   N82-10033
  Advanced fuel flowmeter for future naval aircraft
    [AD-A104364]   N82-11063
  Experimental study of fuel heating at low
    temperatures in a wing tank model, volume 1
    [NASA-CR-165391]   N82-11224
AIRCRAFT FUELS
  Fuel for future transport aircraft
    [ASME PAPER 81-HT-80]   A82-10965
  Rheological behavior of progressively
    shear-thickening solutions --- aircraft fuel
    polymer additives for fire protection in
    survivable crashes
                                              A82-11177
  Fuel conservation - DC-9 series 20/30/40
                                              A82-12563
  Experimental study of fuel heating at low
    temperatures in a wing tank model, volume 1
    [NASA-CR-165391]   N82-11224
AIRCRAFT HAZARDS
  Detection and display of wind shear and turbulence
                                              A82-10222
  Selected bibliography of NACA-NASA aircraft icing
    publications
    [NASA-TM-81651]   N82-11053
  System safety program plan --- electromagnetic
    pulse testing of the A-7E aircraft
    [AD-A104557]   N82-11354
AIRCRAFT HYDRAULIC SYSTEMS
  Fluid power technology for the '80s --- Book
                                              A82-10851
  High-efficiency hydraulic power transfer units for
    multisystem aircraft
                                              A82-10853
  'Quiet please' --- aircraft hydraulic systems
    noise reduction
                                              A82-10854
AIRCRAFT INSTRUMENTS
  The evolution of airborne weather avoidance radar
    toward a calibrated remote rain gauge using REACT
    --- Rain Echo Attenuation Compensation Hardware
                                              A82-10225
  Problems relating to the classical rate-gyro
                                              A82-10497

Optical sensors for displacement measurement
                                              A82-11407
Determination of vertical profiles of aerosol size
  spectra from aircraft radiative flux
  measurements. II - The effect of particle
  nonsphericity
                                              A82-12149
Commercial EMS considerations for small gas
  turbine engines --- automated engine monitoring
  systems
                                              A82-12449
Further application and development of an engine
  usage/life monitoring system for military services
                                              A82-12450
Hard limited approaches to correlation velocity
  sensing
                                              A82-12636
AIRCRAFT MAINTENANCE
  Digital avionics: Promise and practice - An
    airlines experience in the field
                                              A82-11942
  Mathematical model for the maintenance program of
    modern jet aircraft --- crack detection;
    inspection intervals
    [DFVLR-FB-81-14]   N82-10002
AIRCRAFT MANEUVERS
  Real-time, on-line digital simulation of optimum
    maneuvers of supersonic aircraft
    [AIAA 81-2178]   A82-10127
  Estimation of airplane stability and control
    derivatives from large amplitude longitudinal
    maneuvers
    [NASA-TM-83185]   N82-10042
AIRCRAFT MODELS
  Determination of airplane model structure from
    flight data by using modified stepwise regression
    [NASA-TP-1916]   N82-10041
AIRCRAFT NOISE
  'Quiet please' --- aircraft hydraulic systems
    noise reduction
                                              A82-10854
  Model helicopter rotor impulsive noise
                                              A82-11300
  Experimental modal analysis of the fuselage panels
    of an Aero Commander aircraft
    [NASA-CR-165750]   N82-10028
  Aeroacoustic theory for noncompact wing-gust
    interaction
    [FDRL-81-7]   N82-11071
  Effects of aircraft noise on the equilibrium of
    airport residents: Testing and utilization of a
    new methodology
    [NASA-TM-76628]   N82-11636
  Helicopter rotor trailing edge noise --- noise
    prediction
    [NASA-CR-3470]   N82-11859
AIRCRAFT PARTS
  Implementation of AVRADCOM MM&T --- for military
    aircraft parts production engineering
                                              A82-10545
  Fatigue life of lugs under service loading - Test
    results and predictions
                                              A82-11685
AIRCRAFT PERFORMANCE
  An airport wind shear detection and warning system
    using Doppler radar
                                              A82-10220
  Design challenges of high performance aircraft POD
    EOCM cooling systems ---
    Electro-Optical/Countermeasure
    [ASME PAPER 81-ENAS-6]   A82-10894
  Ideal and simulated performance of an aircraft in
    the terrain following mission
                                              A82-11302
  On the question of trailing airplane motion
                                              A82-11470
  Fuel conservation - DC-9 series 20/30/40
                                              A82-12563
  Quiet short-haul research aircraft familiarization
    document, revision 1
    [NASA-TM-81298]   N82-10031
AIRCRAFT PILOTS
  Relationships between naval aviation safety and
    pilot flight experience
                                              A82-11031
AIRCRAFT PRODUCTION
  Automated Paint and Process Line /APPL/ --- for
    aircraft production
    [AIAA 81-2166]   A82-10120

Development of aircraft production engineering
  discipline at IIT, Bombay
                                          A82-11317
AIRCRAFT RELIABILITY
The certification of digital systems
                                          A82-11940
AIRCRAFT SAFETY
FAA developing new collision avoidance, data
  acquisition and transmission systems
                                          A82-10396
Test Pilots' Aviation Safety Workshop, U.S. Naval
  Postgraduate School, Monterey, CA, February
  25-28, 1981, Proceedings
                                          A82-10500
Electrical ground testing of aircraft antistatic
  protection
                                          A82-10822
AIRCRAFT SPIN
Spin recovery training --- licensing requirement
  [GPO-66-020]   N82-10022
AIRCRAFT STABILITY
On computing Floquet transition matrices of
  rotorcraft
                                          A82-11225
A note on fatal aircraft accidents involving metal
  fatigue
                                          A82-11400
Numerical treatment of helicopter rotor stability
  problems
                                          A82-12045
Estimation of airplane stability and control
  derivatives from large amplitude longitudinal
  maneuvers
  [NASA-TM-83185]   N82-10042
AIRCRAFT STRUCTURES
The application of improved aluminium alloys and
  steels in aircraft structures
                                          A82-10305
Some possibilities for composite light aircraft
  construction
                                          A82-10307
Sophisticated aircraft structure developments -
  Combat aeroplanes
                                          A82-10309
Analytical determination of undercarriage
  retraction kinematics
                                          A82-10364
The balloon and the airship technological heritage
  [AIAA PAPER 81-1912]   A82-10401
Design analysis of high temperature transparent
  windshields for high performance aircraft
  [ASME PAPER 81-ENAS-5]   A82-10893
Acoustic emission - An emerging technology for
  assessing fatigue damage in aircraft structure
                                          A82-11149
Fatigue substantiation of non-linear structures
                                          A82-11224
Dynamic response of aircraft structure to gun
  shock loads
                                          A82-11314
Emerging technologies in aerospace structures,
  design, structural dynamics and materials;
  Proceedings of the Aerospace Conference, San
  Francisco, CA, August 13-15, 1980
                                          A82-12026
Impact-initiated damage thresholds in composites
                                          A82-12028
Response of nonlinear aircraft structural panels
  to high intensity noise
                                          A82-12041
Quantification of the thermal environment for
  externally carried aircraft stores and ordnance
                                          A82-12100
Fractographic determination of fatigue crack
  growth rates in aircraft components
                                          A82-12697
Aircraft excrescence drag
  [AGARD-AG-264]   N82-10020
A method for determination of the aeroelastic
  behavior of aircraft with active control systems
  [DFVLR-FB-81-05]   N82-10047
Finite difference computation of the steady
  transonic potential flow around airplanes
                                          N82-10981
AIRCRAFT SURVIVABILITY
Lightning effects on aircraft and composites.
  Literature study on lightning strikes and
  protection --- advanced composite materials
  [FOA-C-20388-F9]   N82-10024

AIRCRAFT WAKES
Strong matching method for computing transonic
  viscous flows including wakes and separations -
  Lifting airfoils
                                          A82-10821
AIRFOIL PROFILES
The use of the Weber method for
  minicomputer-assisted numerical analysis of
  airfoils
                                          A82-10362
Strong matching method for computing transonic
  viscous flows including wakes and separations -
  Lifting airfoils
                                          A82-10821
Wind tunnel tests on airfoils in tandem cascade
                                          A82-10987
Coupled fluid/structure response predictions for
  soft body impact of airfoil configurations ---
  ice and bird impact on aircraft engines
                                          A82-12039
Wind-tunnel results for a modified
  17-percent-thick low-speed airfoil section
  [NASA-TP-1919]   N82-11033
Aeroacoustic theory for noncompact wing-gust
  interaction
  [FDRL-81-7]   N82-11071
AIRFOILS
Icing tunnel test of a glycol-exuding porous
  leading edge ice protection system on a general
  aviation airfoil --- conducted in the Lewis
  Research Center icing research tunnel
  [NASA-CR-165444]   N82-10021
Second order approximation theory of an arbitrary
  aerofoil in compressible potential flow
                                          N82-10982
Aerodynamic calculations and design of subcritical
  aerofoils
                                          N82-10983
Matrix analysis of wings
                                          N82-10998
AIRFRAME MATERIALS
Lightning effects on aircraft and composites.
  Literature study on lightning strikes and
  protection --- advanced composite materials
  [FOA-C-20388-F9]   N82-10024
AIRFRAMES
Development of aircraft production engineering
  discipline at IIT, Bombay
                                          A82-11317
Design techniques for mutlivariable flight control
  systems
                                          N82-11078
AIRLINE OPERATIONS
How large should a commuter transport be
  [AIAA PAPER 81-1732]   A82-10463
Optimum climb and descent trajectories for airline
  missions
                                          N82-11082
AIRPORT TOWERS
FAA misses opportunities to discontinue or reduce
  operating hours of some airport traffic control
  towers
  [PB81-224214]   N82-11049
AIRPORTS
An airport wind shear detection and warning system
  using Doppler radar
                                          A82-10220
Airport and Airway Improvement Act of 1981, part 1
  [GPO-76-241-PT-1]   N82-10062
Design of airport pavements for expansive soils
  [AD-A104660]   N82-11313
Effects of aircraft noise on the equilibrium of
  airport residents: Testing and utilization of a
  new methodology
  [NASA-TM-76628]   N82-11636
AIRSHIPS
Design aspects of non rigid airship envelopes
                                          A82-10306
The balloon and the airship technological heritage
  [AIAA PAPER 81-1912]   A82-10401
AIRSPEED
Comparison of simulation and experimental data for
  a gliding parachute in dynamic flight
  [AIAA PAPER 81-1924]   A82-10409
Procedures and analysis techniques for determining
  static air minimum control speeds
                                          A82-12564

ALUMINUM ALLOYS
The application of improved aluminium alloys and
steels in aircraft structures
A82-10305
AMPLIFICATION
Characteristic and principal gains and phases and
their use as multivariable control design tools
--- generalizing Nyquist and root-locus diagram
techniques
N82-10050
ANALYSIS (MATHEMATICS)
Multi-variable analysis and design techniques
[AGARD-LS-117] N82-10048
ANGLE OF ATTACK
Nonlinear prediction of subsonic aerodynamic loads
on wings and bodies at high angles of attack
A82-11359
Estimation of airplane stability and control
derivatives from large amplitude longitudinal
maneuvers
[NASA-TM-83185] N82-10042
Aerodynamic calculations and design of subcritical
aerofoils
N82-10983
ANTENNA DESIGN
Antenna theory and design --- Book
A82-12323
General aviation aircraft antennas for the global
positioning system
[NASA-TM-83212] N82-11339
ANTENNA RADIATION PATTERNS
Antenna theory and design --- Book
A82-12323
ANTIICING ADDITIVES
Icing tunnel tests of a composite porous leading
edge for use with a liquid anti-ice system ---
Lewis icing research tunnel
[NASA-CR-164966] N82-11052
ANTIMISTING FUELS
An assessment of the use of antimisting fuel in
turbofan engines
[NASA-CR-165258] N82-11230
ANTISHIP MISSILES
Air-film cooling returns to ramjets
[ASME PAPER 81-ENAS-8] A82-10896
APPROXIMATION
Multivariables design: The optimization of
approximate inverses
N82-10057
Second order approximation theory of an arbitrary
aerofoil in compressible potential flow
N82-10982
ARCHAEOLOGY
Radar mapping, archaeology, and ancient land use
in the Maya lowlands
[NASA-CR-164931] N82-11514
ARCHITECTURE (COMPUTERS)
HiMAT onboard flight computer system architecture
and qualification
[AIAA 81-2107] A82-10082
Airborne associative processor /ASPRO/ --- for
early warning radar surveillance, command, and
control applications
[AIAA 81-2145] A82-10104
AREA NAVIGATION
Use of Space Shuttle technology in conventional
aircraft
[AIAA 81-2176] A82-10125
Discrete address beacon, navigation and landing
system
A82-10650
ARMED FORCES (FOREIGN)
A proposed flight safety program for the Korean
Air Force
[AD-A102373] N82-10023
ARROW WINGS
Effects of vortex flaps on the low-speed
aerodynamic characteristics of an arrow wing
[NASA-TP-1914] N82-11013
ASTRIONICS.
Memory requirements for future navigation systems
A82-12637
ATMOSPHERIC CIRCULATION
Multiple Doppler radar observations of PBL structure
A82-10292
ATMOSPHERIC ELECTRICITY
Electrical ground testing of aircraft antistatic
protection
A82-10822

ATMOSPHERIC SCATTERING
Determination of vertical profiles of aerosol size
spectra from aircraft radiative flux
measurements. II - The effect of particle
nonsphericity
A82-12149
ATMOSPHERIC SOUNDING
Limiting payload deceleration during ground impact
[AIAA PAPER 81-1918] A82-10404
ATMOSPHERIC TURBULENCE
Downbursts and microbursts. - An aviation hazard
--- downdrafts beneath thunderstorms
A82-10214
Detection and display of wind shear and turbulence
A82-10222
ATTITUDE CONTROL
Simulation study of a hybrid strapdown attitude
and heading reference system
A82-12641
AUTOMATIC CONTROL.
Problems relating to the classical rate-gyro
A82-10497
Application of nonlinear systems inverses to
automatic flight control design: System
concepts and flight evaluations
N82-11083
AUTOMATIC FLIGHT CONTROL
HiMAT onboard flight computer system architecture
and qualification
[AIAA 81-2107] A82-10082
Controlling the software/hardware interface for
the validation of avionics systems --- in flight
control systems
[AIAA 81-2159] A82-10116
Ideal and simulated performance of an aircraft in
the terrain following mission
A82-11302
The digital civil aircraft
A82-11938
AUTOMATIC LANDING CONTROL
Development and evaluation of automatic landing
control laws for light wing loading STOL aircraft
[NASA-CR-166160] N82-10043
AUTOMATIC TEST EQUIPMENT
Air supply system bite for Boeing 767 airplane ---
Built-In-Test-Equipment
[ASME PAPER 81-ENAS-7] A82-10895
Commercial EMS considerations for small gas
turbine engines --- automated engine monitoring
systems
A82-12449
AUTOMATION
Automated Paint and Process Line /APPL/ --- for
aircraft production
[AIAA 81-2166] A82-10120
AUXILIARY POWER SOURCES
A new APU for medium place aircraft environmental
control systems
[ASME PAPER 81-ENAS-1] A82-10889
AVIONICS
KC-135 Avionics Modernization Hot Bench
[AIAA 81-2105] A82-10081
Bridging the gap from aircraft to space computers
[AIAA 81-2142] A82-10101
Controlling the software/hardware interface for
the validation of avionics systems --- in flight
control systems
[AIAA 81-2159] A82-10116
Closed loop environmental control systems for
fighter aircraft
[ASME PAPER 81-ENAS-2] A82-10890
Design challenges of high performance aircraft POD
EOCM cooling systems ---
Electro-Optical/Countermeasure
[ASME PAPER 81-ENAS-6] A82-10894
Sealed lead-acid batteries for aircraft applications
A82-11716
Applications of finite element method in aerospace
power systems design
A82-11717
Advanced aircraft electric power system
A82-11718
Variable speed constant frequency /VSCF/
electrical system cuts cost of ownership
A82-11719
Digital avionics - Promise and practice;
Proceedings of the Joint Symposium, London,
England, March 20, 1980
A82-11934

The all digital military aircraft
A82-11937
The digital civil aircraft
A82-11938
Digital avionics systems - The RAF experience
A82-11941
Digital avionics: Promise and practice - An
airlines experience in the field
A82-11942
Memory requirements for future navigation systems
A82-12637
The integrated inertial sensor assembly /IISA/ - A
redundant strapdown system for advanced aircraft
navigation and flight control functions
A82-12642
F-5G Tigershark
A82-12775
Electronic master monitor and advisory display
system, data transmission study
[AD-A104243]   N82-11064

AWACS AIRCRAFT
Airborne associative processor /ASPRO/ --- for
early warning radar surveillance, command, and
control applications
[AIAA 81-2145]   A82-10104

AXIAL STRESS
Crack growth evaluation of a method to convert
real-time loads history to a simplified
engineering spectra --- for aircraft structural
analysis
A82-12043

AXISYMMETRIC FLOW
On the prediction of swirling flowfields found in
axisymmetric combustor geometries
A82-12120

B

BALLISTICS
Aeroballistic characteristics of sonobuoy
parachute decelerators limited to a length of
three feet
[AIAA PAPER 81-1950]   A82-10425
BALLOON FLIGHT
A new thermal and trajectory model for high
altitude balloons
[AIAA PAPER 81-1926]   A82-10411
BALLOON-BORNE INSTRUMENTS
Limiting payload deceleration during ground impact
[AIAA PAPER 81-1918]   A82-10404
BALLOONS
The balloon and the airship technological heritage
[AIAA PAPER 81-1912]   A82-10401
BEAMS (SUPPORTS)
Matrix analysis of wings
N82-10998
BELLOWS
Low maintenance hydraulic accumulator
[AD-A103947]   N82-10034
BENDING FATIGUE
Matrix analysis of wings
N82-10998
BIBLIOGRAPHIES
Selected bibliography of NACA-NASA aircraft icing
publications
[NASA-TM-81651]   N82-11053
BIT SYNCHRONIZATION
Synchronous fault-tolerant flight control systems
[AIAA 81-2109]   A82-10083
BLADE SLAP NOISE
Model helicopter rotor impulsive noise
A82-11300
BODY-WING AND TAIL CONFIGURATIONS
Experimental study of empennage snap-through
vibrations
A82-11471
BODY-WING CONFIGURATIONS
Acta mechanica sinica
[AD-A105184]   N82-11014
The principles and methods for shaping the wing
root regions of a wing-body combination at
transonic and lower supersonic speeds
N82-11016
BOEING 747 AIRCRAFT
SEL and EPNL noise duration coefficients for the
747 and T-38 aircraft
[NASA-TM-83214]   N82-11860

BOEING 767 AIRCRAFT
Air supply system bite for Boeing 767 airplane ---
Built-In-Test-Equipment
[ASME PAPER 81-ENAS-7]   A82-10895
BOUNDARY LAYER CONTROL
Developments in boundary layer Thrust Vector Control
A82-10855
New estimation method for flutter or divergence
boundary from random responses at subcritical
speeds
[NAL-TR-667T]   N82-11034
Amplified crossflow disturbances in the laminar
boundary layer on swept wings with suction
[NASA-TP-1902]   N82-11391
BOUNDARY LAYER FLOW
Multiple-scale turbulence modeling of free
turbulent flows
[ASME PAPER 81-FE-20]   A82-10934
BOUNDARY LAYER SEPARATION
A summary of V/STOL inlet analysis methods
[NASA-TM-82725]   N82-11043
BOUNDARY LAYERS
Aircraft excrescence drag
[AGARD-AG-264]   N82-10020
Aircraft wing trailing-edge noise
[NASA-CR-164952]   N82-11039
BRAKES (FOR ARRESTING MOTION)
Aeroballistic characteristics of sonobuoy
parachute decelerators limited to a length of
three feet
[AIAA PAPER 81-1950]   A82-10425

C

C-135 AIRCRAFT
KC-135 Avionics Modernization Hot Bench
[AIAA 81-2105]   A82-10081
CALIBRATING
In-situ calibration of flight heat transfer
instrumentation
[ASME PAPER 81-ENAS-13]   A82-10901
CANOPIES
Aerodynamics and performance of cruciform
parachute canopies
[AIAA PAPER 81-1919]   A82-10405
Experimental determination of parachute apparent
mass and its significance in predicting dynamic
stability
[AIAA PAPER 81-1920]   A82-10406
Theoretical analysis of parachute inflation
including fluid kinetics
[AIAA PAPER 81-1925]   A82-10410
The net-skirt to a parachute canopy as a device to
prevent inversion
[AIAA PAPER 81-1927]   A82-10412
Stress measurements in a ribbon parachute canopy
during inflation and at steady state
[AIAA PAPER 81-1944]   A82-10420
Stress measurements in bias constructed parachute
canopies during inflation and at steady-state
[AIAA PAPER 81-1945]   A82-10421
CAPACITORS
High voltage surge and partial discharge test to
evaluate aerospace equipment parts
A82-11740
CARBON FIBER REINFORCED PLASTICS
Sophisticated aircraft structure developments -
Combat aeroplanes
A82-10309
On the use of carbon composites in slat and
stabilizer construction
A82-11468
A CFRP taileron for the Tornado: Construction and
production --- horizontal stabilizer
[MBB-FE-212/KPK/PUB/2]   N82-10035
CARGO AIRCRAFT
ACMA - Fact or fantasy --- Advanced
Civilian/Military Aircraft
A82-12048
CASCADE FLOW
Wind tunnel tests on airfoils in tandem cascade
A82-10987
End losses in turbine cascades with porous cooling
A82-11434
Theoretical investigations and experimental
researches for higher subsonic two-dimensional
compressor cascade
N82-11024

Computation of high Reynolds number
  internal/external flows
  [NASA-TM-84049]   N82-11046
COMPUTER DESIGN
  Bridging the gap from aircraft to space computers
  [AIAA 81-2142]   A82-10101
  Airborne associative processor /ASPRO/ --- for
    early warning radar surveillance, command, and
    control applications
  [AIAA 81-2145]   A82-10104
COMPUTER GRAPHICS
  Integration of computer graphics design with
    analytical models --- for aircraft design
  [AIAA 81-2134]   A82-10096
  Improving the MLS through enhanced cockpit displays
                                     A82-10649
  Solution to the hidden-line problem
                                     A82-12803
COMPUTER PROGRAMS
  The Space Shuttle vehicle checkout involving
    flight avionics software
  [AIAA 81-2141]   A82-10100
  Controlling the software/hardware interface for
    the validation of avionics systems --- in flight
    control systems
  [AIAA 81-2159]   A82-10116
  The certification of digital systems
                                     A82-11940
  Digital avionics systems - The RAF experience
                                     A82-11941
  Flight test results of the model simulation
    controller for the HFB 320 for in-flight
    simulation of the A310 airbus
  [ESA-TT-660]   N82-10107
  Computation of high Reynolds number
    internal/external flows
  [NASA-TM-84049]   N82-11046
  Integrated analysis of engine
  [NASA-TM-82713]   N82-11491
  Structural analysis computer programs for rigid
    multicomponent pavement structures with
    discontinuities, WESLIQID and WESLAYER. Report
    1: Program development and numerical presentations
  [AD-A104545]   N82-11498
COMPUTER STORAGE DEVICES
  Memory requirements for future navigation systems
                                     A82-12637
COMPUTER SYSTEMS DESIGN
  KC-135 Avionics Modernization Hot Bench
  [AIAA 81-2105]   A82-10081
  Synchronous fault-tolerant flight control systems
  [AIAA 81-2109]   A82-10083
  Navigation task partitioning in
    distributed-processing avionics systems
                                     A82-10646
COMPUTER SYSTEMS SIMULATION
  Performance analysis of enroute air traffic
    control computers in the National Airspace System
  [AIAA 81-2203]   A82-10140
COMPUTERIZED DESIGN
  Integration of computer graphics design with
    analytical models --- for aircraft design
  [AIAA 81-2134]   A82-10096
  Solution to the hidden-line problem
                                     A82-12803
  Multi-variable analysis and design techniques
  [AGARD-LS-117]   N82-10048
  Characteristic and principal gains and phases and
    their use as multivariable control design tools
    --- generalizing Nyquist and root-locus diagram
    techniques
                                     N82-10050
  LQG multivariable design tools
                                     N82-10054
  The automatic matrix force method and techniques
    for handling more complex computations with
    given computer capacity
                                     N82-10994
COMPUTERIZED SIMULATION
  A new thermal and trajectory model for high
    altitude balloons
  [AIAA PAPER 81-1926]   A82-10411
  Ideal and simulated performance of an aircraft in
    the terrain following mission
                                     A82-11302
  Application of numerical modeling to gas turbine
    combustor development problems
                                     A82-12118

CONCRETE STRUCTURES
  Structural analysis computer programs for rigid
    multicomponent pavement structures with
    discontinuities, WESLIQID and WESLAYER. Report
    1: Program development and numerical presentations
  [AD-A104545]   N82-11498
CONFERENCES
  Test Pilots' Aviation Safety Workshop, U.S. Naval
    Postgraduate School, Monterey, CA, February
    25-28, 1981, Proceedings
                                     A82-10500
  Digital avionics - Promise and practice;
    Proceedings of the Joint Symposium, London,
    England, March 20, 1980
                                     A82-11934
  Emerging technologies in aerospace structures,
    design, structural dynamics and materials;
    Proceedings of the Aerospace Conference, San
    Francisco, CA, August 13-15, 1980
                                     A82-12026
  Powder metallurgy superalloys - Aerospace
    materials for the 1980's; Proceedings of the
    Conference, Zurich, Switzerland, November 18-20,
    1980. Volume 1
                                     A82-12495
  National Aerospace Meeting, Trevose, PA, April
    8-10, 1981, Proceedings
                                     A82-12626
  Kevlar composites; Proceedings of the Symposium,
    El Segundo, CA, December 2, 1980
                                     A82-12646
  The Shock and Vibration Digest, volume 13, no. 9
  [AD-A105062]   N82-10421
CONGRESSIONAL REPORTS
  Spin recovery training --- licensing requirement
  [GPO-66-020]   N82-10022
  Airport and Airway Improvement Act of 1981, part 1
  [GPO-76-241-PT-1]   N82-10062
CONSTRUCTION
  Development and construction of pilot ejector
    seats in Germany from 1938-1945
  [DFVLR-FB-81-04]   N82-10026
  A CFRP taileron for the Tornado: Construction and
    production --- horizontal stabilizer
  [MBB-FE-212/KFK/PUB/2]   N82-10035
CONTROL BOARDS
  Electronic master monitor and advisory display
    system, human engineering summary report
  [AD-A104244]   N82-11065
CONTROL EQUIPMENT
  Considerations and applications for the use of
    fluidics in aerospace controls
                                     A82-12087
  Management of redundancy in flight control systems
    using optimal decision theory
                                     N82-11084
CONTROL STABILITY
  Characteristic and principal gains and phases and
    their use as multivariable control design tools
    --- generalizing Nyquist and root-locus diagram
    techniques
                                     N82-10050
  Design of high integrity multivariable control
    systems
                                     N82-10055
CONTROL SURFACES
  On the kernel function collocation method in
    steady subsonic flow for wing with control
    surfaces
                                     N82-12023
CONTROL THEORY
  Design considerations for the direct digital
    control of dry-tuned gyroscope
                                     A82-11933
  Control of electromechanical actuator elements for
    flight vehicles --- Russian book
                                     A82-12170
  Theory and applications of optimal control in
    aerospace systems
  [AGARD-AG-251]   N82-11073
  An introduction to stochasic optimal control theory
                                     N82-11076
CONTROLLABILITY
  Theoretical investigation of the influence of
    spoiler dynamics on the handling qualities of an
    aircraft with direct lift control
  [ESA-TT-681]   N82-10036

CONTROLLERS
    Multi-variable analysis and design techniques
    [AGARD-LS-117]   N82-10048
    The need for multivariable design and analysis
      techniques
                                                  N82-10049
    Feedback and minimax sensitivity
                                                  N82-10058
    Development of multivariable controllers for
      aircraft turbine engines
                                                  N82-11087
COOLING
    End losses in turbine cascades with porous cooling
                                                  A82-11434
COOLING SYSTEMS
    Design challenges of high performance aircraft POD
      EOCM cooling systems ---
      Electro-Optical/Countermeasure
    [ASME PAPER 81-ENAS-6]   A82-10894
CORES
    New molding method of three-dimensional hollow
      photoelastic model and centrifugal stress
      analysis of air cooled turbine blade model
    [NAL-TR-427T]   N82-11067
CORRELATION
    Hard limited approaches to correlation velocity
      sensing
                                                  A82-12636
CORROSION PREVENTION
    A protective additive for jet fuels
                                                  A82-12022
COST REDUCTION
    Variable speed constant frequency /VSCF/
      electrical system cuts cost of ownership
                                                  A82-11719
    ACMA - Fact or fantasy --- Advanced
      Civilian/Military Aircraft
                                                  A82-12048
    Cost reduction in air transportation --- energy
      conservation
    [SNIAS-811-150-101]   N82-10025
    FAA misses opportunities to discontinue or reduce
      operating hours of some airport traffic control
      towers
    [PB81-224214]   N82-11049
COWLINGS
    Low speed testing of the inlets designed for a
      tamden-fan V/STOL nacelle --- conducted in the
      Lewis 10 by 10 foot wind tunnel
    [NASA-TM-82728]   N82-11042
CRACK PROPAGATION
    Acoustic emission - An emerging technology for
      assessing fatigue damage in aircraft structure
                                                  A82-11149
    Crack growth evaluation of a method to convert
      real-time loads history to a simplified
      engineering spectra --- for aircraft structural
      analysis
                                                  A82-12043
    Fractographic determination of fatigue crack
      growth rates in aircraft components
                                                  A82-12697
CRITICAL FLOW
    Aerodynamic calculations and design of subcritical
      aerofoils
                                                  N82-10983
CRITICAL LOADING
    Impact-initiated damage thresholds in composites
                                                  A82-12028
CROSS FLOW
    A numerical three-dimensional turbulent simulation
      of a subsonic VSTOL jet in a cross-flow using a
      finite element algorithm
    [AD-A104514]   N82-11055
    Amplified crossflow disturbances in the laminar
      boundary layer on swept wings with suction
    [NASA-TP-1902]   N82-11391
CRYOGENIC WIND TUNNELS
    Design predictions for noise control in the
      cryogenic National Transonic Facility
                                                  A82-12025
CYCLIC LOADS
    Fatigue substantiation of non-linear structures
                                                  A82-11224

D

DAMAGE ASSESSMENT
    Acoustic emission - An emerging technology for
      assessing fatigue damage in aircraft structure
                                                  A82-11149
DAMPING
    New estimation method for flutter or divergence
      boundary from random responses at subcritical
      speeds
    [NAL-TR-667T]   N82-11034
DATA ACQUISITION
    A microprocessor-based data acquisition system for
      stall/spin research
    [AIAA 81-2177]   A82-10126
    FAA developing new collision avoidance, data
      acquisition and transmission systems
                                                  A82-10396
DATA TRANSMISSION
    FAA developing new collision avoidance, data
      acquisition and transmission systems
                                                  A82-10396
    Electronic master monitor and advisory display
      system, data transmission study
    [AD-A104243]   N82-11064
DC 9 AIRCRAFT
    Fuel conservation - DC-9 series 20/30/40
                                                  A82-12563
DECELERATION
    Limiting payload deceleration during ground impact
    [AIAA PAPER 81-1918]   A82-10404
DECISION MAKING
    Management of redundancy in flight control systems
      using optimal decision theory
                                                  N82-11084
DEICERS
    Rotorcraft icing: Status and prospects
    [AGARD-AR-166]   N82-11056
    Ice protection system technology
                                                  N82-11060
DEICING
    Icing tunnel test of a glycol-exuding porous
      leading edge ice protection system on a general
      aviation airfoil --- conducted in the Lewis
      Research Center icing research tunnel
    [NASA-CR-165444]   N82-10021
DELTA WINGS
    Formation of triangular-element stiffness matrix
      using sliding interpolation
                                                  A82-11464
    Increasing the lift:drag ratio of a flat delta wing
                                                  A82-11899
DESIGN ANALYSIS
    Development of new lifting parachute designs with
      increased trim angle
    [AIAA PAPER 81-1921]   A82-10407
    Optimization of the principal design parameters of
      a passenger aircraft
                                                  A82-10816
    Design analysis of high temperature transparent
      windshields for high-performance aircraft
    [ASME PAPER 81-ENAS-5]   A82-10893
    Parachute technology under pressure
                                                  A82-12804
DIESEL ENGINES
    Lightweight diesel engine designs for commuter
      type aircraft
    [NASA-CR-165470]   N82-11068
DIFFUSION ELECTRODES
    Unsolved problems of nickel cadmium batteries
                                                  A82-11725
DIGITAL COMPUTERS
    Aircraft digital input controlled hydraulic
      actuation and control system
    [AD-A104263]   N82-11072
DIGITAL RADAR SYSTEMS
    The evolution of airborne weather avoidance radar
      toward a calibrated remote rain gauge using REACT
      --- Rain Echo Attenuation Compensation Hardware
                                                  A82-10225
DIGITAL SIMULATION
    Real-time, on-line digital simulation of optimum
      maneuvers of supersonic aircraft
    [AIAA 81-2178]   A82-10127

ELECTRIC CHARGE
Electrical ground testing of aircraft antistatic
protection
A82-10822

ELECTRIC CONTROL
Control of electromechanical actuator elements for
flight vehicles --- Russian book
A82-12170

ELECTRIC EQUIPMENT TESTS
High voltage surge and partial discharge test to
evaluate aerospace equipment parts
A82-11740

ELECTRIC FIELDS
Application of numerical methods to the
calculation of electrostatic fields in aircraft
fuel tanks
[AD-A103270]   N82-10033

ELECTRIC GENERATORS
A hidden advantage of permanent magnet electrical
generating systems
A82-11720

ELECTRIC POWER SUPPLIES
Applications of finite element method in aerospace
power systems design
A82-11717
Advanced aircraft electric power system
A82-11718
Variable speed constant frequency /VSCF/
electrical system cuts cost of ownership
A82-11719
High voltage surge and partial discharge test to
evaluate aerospace equipment parts
A82-11740

ELECTRICAL RESISTIVITY
Electrical ground testing of aircraft antistatic
protection
A82-10822

ELECTRO-OPTICS
Design challenges of high performance aircraft POD
EOCM cooling systems ---
Electro-Optical/Countermeasure
[ASME PAPER 81-ENAS-6]   A82-10894
Optical sensors for displacement measurement
A82-11407

ELECTROMAGNETIC FIELDS
Antenna theory and design --- Book
A82-12323

ELECTROMAGNETIC NOISE
Tangential sensitivity of EW receivers
A82-11020

ELECTROMAGNETIC PULSES
System safety program plan --- electromagnetic
pulse testing of the A-7E aircraft
[AD-A104557]   N82-11354

ELECTROMECHANICAL DEVICES
Control of electromechanical actuator elements for
flight vehicles --- Russian book
A82-12170

ELECTRONIC AIRCRAFT
Design challenges of high performance aircraft POD
EOCM cooling systems ---
Electro-Optical/Countermeasure
[ASME PAPER 81-ENAS-6]   A82-10894

ELECTRONIC CONTROL
Advanced aircraft electrical system control
technology demonstrator. Phase 1: Requirements
analysis and conceptual design
[AD-A103922]   N82-10326

ELECTRONIC COUNTERMEASURES
Design challenges of high performance aircraft POD
EOCM cooling systems ---
Electro-Optical/Countermeasure
[ASME PAPER 81-ENAS-6]   A82-10894

ELECTRONIC TRANSDUCERS
Outsider's look at flight instrumentation
[DE81-025409]   N82-11066

ELECTRONIC WARFARE
Digital avionics systems - The RAF experience
A82-11941

ELECTROSTATICS
Application of numerical methods to the
calculation of electrostatic fields in aircraft
fuel tanks
[AD-A103270]   N82-10033

ENERGY CONSERVATION
Fuel conservation - DC-9 series 20/30/40
A82-12563

Cost reduction in air transportation --- energy
conservation
[SNIAS-811-150-101]   N82-10025

ENERGY CONSUMPTION
Characteristics and trends of energy consumption
in transport missions with aircraft and surface
vehicles
A82-10495
Towards minimum power for environmental control in
transport aircraft
[ASME PAPER 81-ENAS-4]   A82-10892

ENERGY CONVERSION EFFICIENCY
A hidden advantage of permanent magnet electrical
generating systems
A82-11720

ENGINE CONTROL
Helicopter engine technology - With particular
reference to the Rolls-Royce Gem engine
A82-10304
The digital civil aircraft
A82-11938

ENGINE COOLANTS
Air-film cooling returns to ramjets
[ASME PAPER 81-ENAS-8]   A82-10896
End losses in turbine cascades with porous cooling
A82-11434
The enhancement of heat exchange in channels /2nd
revised and enlarged edition/ --- Russian book
A82-12222

ENGINE DESIGN
Helicopter engine technology - With particular
reference to the Rolls-Royce Gem engine
A82-10304
Design considerations for duty cycle, life and
reliability of small limited life engines
[AIAA PAPER 81-1402]   A82-10465
Basic problem of aircraft gasturbine engine
analytic design. II
A82-11463
Thermal expansion accommodation in a jet engine
frame
A82-11999
Propulsion study for Small Transport Aircraft
Technology (STAT)
[NASA-CR-165499]   N82-10037
Propulsion study for Small Transport Aircraft
Technology (STAT), Appendix B
[NASA-CR-165499-APP-B]   N82-10038
Lightweight diesel engine designs for commuter
type aircraft
[NASA-CR-165470]   N82-11068
Development of multivariable controllers for
aircraft turbine engines
N82-11087
Integrated analysis of engine
[NASA-TM-82713]   N82-11491

ENGINE INLETS
A summary of V/STOL inlet analysis methods
[NASA-TM-82725]   N82-11043

ENGINE MONITORING INSTRUMENTS
Commercial EMS considerations for small gas
turbine engines --- automated engine monitoring
systems
A82-12449
Further application and development of an engine
usage/life monitoring system for military services
A82-12450

ENGINE NOISE
Rotor wake characteristics relevant to
rotor-stator interaction noise generation
[AIAA PAPER 81-2031]   A82-10456

ENGINE PARTS
Superalloy powder engine components; controls
employed to assure high quality hardware
A82-12499
Initial experimental research into the response of
turbojet engine compressors to distortion of
intake pressure
N82-11006

ENGINE STARTERS
60 KVA ADP permanent magnet VSCF starter generator
system - Generator system performance
characteristics
A82-11721

ENGINE TESTS
History of flight testing the L-1011 TriStar jet
transport. II - Testing highlights since initial
certification of the L-1011-1
A82-12049

FIELD THEORY (PHYSICS)
Antenna theory and design --- Book
                                                A82-12323
FIGHTER AIRCRAFT
Analysis of augmented aircraft flying qualities
   through application of the Neal-Smith criterion
   [AIAA PAPER 81-1776]   A82-10462
Closed loop environmental control systems for
   fighter aircraft
   [ASME PAPER 81-ENAS-2]   A82-10890
Dynamic response of aircraft structure to gun
   shock loads
                                                A82-11314
The case for a defensive air-to-air fighter
                                                A82-12801
FILM COOLING
Air-film cooling returns to ramjets
   [ASME PAPER 81-ENAS-8]   A82-10896
FINITE DIFFERENCE THEORY
Finite difference computation of the steady
   transonic potential flow around airplanes
                                                N82-10981
FINITE ELEMENT METHOD
Applications of finite element method in aerospace
   power systems design
                                                A82-11717
Application of numerical methods to the
   calculation of electrostatic fields in aircraft
   fuel tanks
   [AD-A103270]   N82-10033
Calculation of natural modes of vibration for
   rotor blades by the finite element method
   [DFVLR-FB-81-07]   N82-10452
Structural analysis of fuselages with cutouts by
   finite element method
                                                N82-10995
Structural analysis computer programs for rigid
   multicomponent pavement structures with
   discontinuities, WESLIQID and WESLAYER. Report
   1: Program development and numerical presentations
   [AD-A104545]   N82-11498
FIRE PREVENTION
Rheological behavior of progressively
   shear-thickening solutions --- aircraft fuel
   polymer additives for fire protection in
   survivable crashes
                                                A82-11177
FLEXIBILITY
The effects of flexibility on the steady-state
   performance of small ribbon parachute models
   [AIAA PAPER 81-1923]   A82-10408
FLEXIBLE SPACECRAFT
Control design of flexible spacecraft
                                                N82-11081
FLIGHT CHARACTERISTICS
Analysis of augmented aircraft flying qualities
   through application of the Neal-Smith criterion
   [AIAA PAPER 81-1776]   A82-10462
Wings in the sun - The evolution of Solar Challenger
                                                A82-12694
FLIGHT CONTROL
KC-135 Avionics Modernization Hot Bench
   [AIAA 81-2105]   A82-10081
Synchronous fault-tolerant flight control systems
   [AIAA 81-2109]   A82-10083
The Space Shuttle vehicle checkout involving
   flight avionics software
   [AIAA 81-2141]   A82-10100
High-efficiency hydraulic power transfer units for
   multisystem aircraft
                                                A82-10853
Developments in boundary layer Thrust Vector Control
                                                A82-10855
Control of electromechanical actuator elements for
   flight vehicles --- Russian book
                                                A82-12170
The integrated inertial sensor assembly /IISA/ - A
   redundant strapdown system for advanced aircraft
   navigation and flight control functions
                                                A82-12642
Development and evaluation of automatic landing
   control laws for light wing loading STOL aircraft
   [NASA-CR-166160]   N82-10043
Flight trajectory control investigation
   [AD-A104542]   N82-11048
Electronic master monitor and advisory display
   system, human engineering summary report
   [AD-A104244]   N82-11065

Design considerations for optimal flight control
   systems
                                                N82-11077
Design techniques for mutlivariable flight control
   systems
                                                N82-11078
Practical design and realization of a digital
   adaptive flight control system
                                                N82-11079
Control law design for transport aircraft flight
   tasks
                                                N82-11080
Management of redundancy in flight control systems
   using optimal decision theory
                                                N82-11084
FLIGHT CREWS
The all digital military aircraft
                                                A82-11937
FLIGHT HAZARDS
Downbursts and microbursts - An aviation hazard
   --- downdrafts beneath thunderstorms
                                                A82-10214
Airborne weather radar and severe weather
   penetration
                                                A82-10219
FLIGHT INSTRUMENTS
In-situ calibration of flight heat transfer
   instrumentation
   [ASME PAPER 81-ENAS-13]   A82-10901
FLIGHT MECHANICS
On the question of trailing airplane motion
                                                A82-11470
FLIGHT OPTIMIZATION
Real-time, on-line digital simulation of optimum
   maneuvers of supersonic aircraft
   [AIAA 81-2178]   A82-10127
Helicopter icing spray system - Improvements and
   flight experience
                                                A82-12696
Optimum climb and descent trajectories for airline
   missions
                                                N82-11082
FLIGHT PATHS
Optimal flight paths for winged, supersonic flight
   vehicles - Extension to the case where thrust
   can be vectored
                                                A82-10310
FLIGHT SAFETY
Applications of conventional and Doppler radars
   for aviation safety
                                                A82-10215
Detection and display of wind shear and turbulence
                                                A82-10222
Test Pilots' Aviation Safety Workshop, U.S. Naval
   Postgraduate School, Monterey, CA, February
   25-28, 1981, Proceedings
                                                A82-10500
Relationships between naval aviation safety and
   pilot flight experience
                                                A82-11031
A proposed flight safety program for the Korean
   Air Force
   [AD-A102373]   N82-10023
FLIGHT SIMULATION
Real-time, on-line digital simulation of optimum
   maneuvers of supersonic aircraft
   [AIAA 81-2178]   A82-10127
Comparison of simulation and experimental data for
   a gliding parachute in dynamic flight
   [AIAA PAPER 81-1924]   A82-10409
Ideal and simulated performance of an aircraft in
   the terrain following mission
                                                A82-11302
Fatigue life of lugs under service loading - Test
   results and predictions
                                                A82-11685
FLIGHT TEST INSTRUMENTS
Outsider's look at flight instrumentation
   [DE81-025409]   N82-11066
FLIGHT TESTS
HiMAT onboard flight computer system architecture
   and qualification
   [AIAA 81-2107]   A82-10082
A microprocessor-based data acquisition system for
   stall/spin research
   [AIAA 81-2177]   A82-10126

The constricted rigging line trials technique for
assessing the opening characteristics of
parachutes
[AIAA PAPER 81-1932]   A82-10413
Inflatable system for fast deployment of
parachutes at low altitudes from slow moving
aircraft or stationary supports
[AIAA PAPER 81-1953]   A82-10428
Dynamic response of aircraft structure to gun
shock loads
                                            A82-11314
History of flight testing the L-1011 TriStar jet
transport. II - Testing highlights since initial
certification of the L-1011-1
                                            A82-12049
FAA acceptance tests on the NAVSTAR GPS Z-Set
receiver
                                            A82-12639
Ring Laser Gyro Navigator /RLGN/ flight test results
                                            A82-12644
Flight test results of the model simulation
controller for the HFB 320 for in-flight
simulation of the A310 airbus
[ESA-TT-660]   N82-10107

FLIGHT TRAINING
Spin recovery training --- licensing requirement
[GPO-66-020]   N82-10022

FLOORS
Evaluation of the acoustic measurement capability
of the NASA Langley V/STOL wind tunnel open test
section with acoustically absorbent ceiling and
floor treatments
[NASA-CR-165796]   N82-10059

FLOQUET THEOREM
On computing Floquet transition matrices of
rotorcraft
                                            A82-11225
Numerical treatment of helicopter rotor stability
problems
                                            A82-12045

FLOW DISTORTION
On evaluating the influence of local disruptions
of flow over trailing edge and leading edge
flaps from the data of wind tunnel tests of a
rectangular wing segment
                                            A82-11465
Amplified crossflow disturbances in the laminar
boundary layer on swept wings with suction
[NASA-TP-1902]   N82-11391

FLOW DISTRIBUTION
On the prediction of swirling flowfields found in
axisymmetric combustor geometries
                                            A82-12120
Second order approximation theory of an arbitrary
aerofoil in compressible potential flow
                                            N82-10982
An aerodynamic design method for transonic axial
flow compressor stage
                                            N82-10984
A comparison of theoretical and experimental
pressure distributions for two advanced fighter
wings
[NASA-TM-81331]   N82-11054

FLOW EQUATIONS
Computation of high Reynolds number
internal/external flows
[NASA-TM-84049]   N82-11046

FLOW GEOMETRY
Thermal and flow analysis of a convection,
air-cooled ceramic coated porous metal concept
for turbine vanes
[ASME PAPER 81-HT-48]   A82-10952

FLOW VISUALIZATION
Experimental study of subsonic and transonic flows
past a wing
                                            A82-10363
Effects of vortex flaps on the low-speed
aerodynamic characteristics of an arrow wing
[NASA-TP-1914]   N82-11013

FLOWMETERS
Advanced fuel flowmeter for future naval aircraft
[AD-A104364]   N82-11063

FLUID DYNAMICS
V/STOL aircraft and fluid dynamics
[NASA-TM-81328]   N82-10029

FLUID POWER
Fluid power technology for the '80s --- Book
                                            A82-10851

FLUIDIC CIRCUITS
Considerations and applications for the use of
fluidics in aerospace controls
                                            A82-12087

FLUTTER
New estimation method for flutter or divergence
boundary from random responses at subcritical
speeds
[NAL-TR-667T]   N82-11034

FLUTTER ANALYSIS
Experimental study of empennage snap-through
vibrations
                                            A82-11471
An influence coefficient method for the
application of the modal technique to wing
flutter suppression of the DAST ARW-1 wing
[NASA-CR-165772]   N82-11070

FLY BY WIRE CONTROL
Flight test results of the model simulation
controller for the HFB 320 for in-flight
simulation of the A310 airbus
[ESA-TT-660]   N82-10107

FLYING PLATFORMS
Parametric study of microwave-powered
high-altitude airplane platforms designed for
linear flight
[NASA-TP-1918]   N82-11050

FLYWHEELS
Low maintenance hydraulic accumulator
[AD-A103947]   N82-10034

FOREBODIES
Reductions in parachute drag due to forebody wake
effects
[AIAA PAPER 81-1939]   A82-10417

FOREIGN BODIES
Coupled fluid/structure response predictions for
soft body impact of airfoil configurations ---
ice and bird impact on aircraft engines
                                            A82-12039

FOSSIL FUELS
Baseline data on utilization of low-grade fuels in
gas turbine applications. Volume 3: Emissions
evaluation
[DE81-903764]   N82-10254

FOUNDATIONS
Design of airport pavements for expansive soils
[AD-A104660]   N82-11313

FRACTOGRAPHY
Fractographic determination of fatigue crack
growth rates in aircraft components
                                            A82-12697

FRACTURE STRENGTH
The application of improved aluminium alloys and
steels in aircraft structures
                                            A82-10305

FRAMES
Thermal expansion accommodation in a jet engine
frame
                                            A82-11999

FREE FLOW
Multiple-scale turbulence modeling of free
turbulent flows
[ASME PAPER 81-FE-20]   A82-10934

FREON
Air-freon integrated environmental conditioning
system for trainer subsonic aircraft
[ASME PAPER 81-ENAS-33]   A82-10920

FREQUENCY STABILITY
60 KVA ADP permanent magnet VSCF starter generator
system - Generator system performance
characteristics
                                            A82-11721

FRONTS (METEOROLOGY)
Gust front structure observed by Doppler radar
                                            A82-10223

FUEL CONSUMPTION
Helicopter engine technology - With particular
reference to the Rolls-Royce Gem engine
                                            A82-10304
Characteristics and trends of energy consumption
in transport missions with aircraft and surface
vehicles
                                            A82-10495
A hidden advantage of permanent magnet electrical
generating systems
                                            A82-11720
Fuel conservation - DC-9 series 20/30/40
                                            A82-12563

FUEL CORROSION
A protective additive for jet fuels
A82-12022

FUEL GAGES
Advanced fuel flowmeter for future naval aircraft
[AD-A104364] N82-11063

FUEL PRODUCTION
Fuel for future transport aircraft
[ASME PAPER 81-HT-80] A82-10965

FUEL SPRAYS
The dispersion of drop sizes in gas turbine fuel
nozzle sprays
A82-12107

FUEL TANKS
Application of numerical methods to the
calculation of electrostatic fields in aircraft
fuel tanks
[AD-A103270] N82-10033

FUSELAGES
Experimental modal analysis of the fuselage panels
of an Aero Commander aircraft
[NASA-CR-165750] N82-10028
Structural analysis of fuselages with cutouts by
finite element method
N82-10995

G

GAS COOLING
A new method of cooling turbine vanes
N82-11027

GAS FLOW
Theoretical investigations and experimental
researches for higher subsonic two-dimensional
compressor cascade
N82-11024

GAS TEMPERATURE
Study of reingestion of exhaust gases with
different initial temperature in a reversed
turbojet engine
A82-11444

GAS TURBINE ENGINES
Design considerations for duty cycle, life and
reliability of small limited life engines
[AIAA PAPER 81-1402] A82-10465
A new APU for medium place aircraft environmental
control systems
[ASME PAPER 81-ENAS-1] A82-10889
End losses in turbine cascades with porous cooling
A82-11434
Basic problem of aircraft gasturbine engine
analytic design. II
A82-11463
The CIVIC - A concept in vortex induced
combustion. II
[ASME PAPER 81-GT-12] A82-11997
Thermal expansion accommodation in a jet engine
frame
A82-11999
The dispersion of drop sizes in gas turbine fuel
nozzle sprays
A82-12107
Application of numerical modeling to gas turbine
combustor development problems
A82-12118
Validation studies of turbulence and combustion
models for aircraft gas turbine combustors
A82-12267
Commercial EMS considerations for small gas
turbine engines --- automated engine monitoring
systems
A82-12449
Further application and development of an engine
usage/life monitoring system for military services
A82-12450
Superclean superalloy powders by the rotating
electrode process
A82-12496
Lineup of the LM-series aircraft-derivative gas
turbines
A82-12560
Development of low modulus material for use in
ceramic gas path seal applications
[NASA-CR-165469] N82-10039
Baseline data on utilization of low-grade fuels in
gas turbine applications. Volume 3: Emissions
evaluation
[DE81-903764] N82-10254

A new method of cooling turbine vanes
N82-11027

GAUSS EQUATION
LQG-based multivariable design: Frequency domain
interpretation
N82-10053
LQG multivariable design tools
N82-10054

GENERAL AVIATION AIRCRAFT
A new APU for medium place aircraft environmental
control systems
[ASME PAPER 81-ENAS-1] A82-10889
Icing tunnel test of a glycol-exuding porous
leading edge ice protection system on a general
aviation airfoil --- conducted in the Lewis
Research Center icing research tunnel
[NASA-CR-165444] N82-10021
General aviation aircraft antennas for the global
positioning system
[NASA-TM-83212] N82-11339

GEOMETRY
A solution to the static geometry problem for
JTIDS relative navigation
A82-12634
The statistical theory of radio direction finding
[AD-A104156] N82-10027
A geometric approach to multivariable control
system synthesis
N82-10056
Aerodynamic calculations and design of subcritical
aerofoils
N82-10983

GLASS FIBER REINFORCED PLASTICS
On the use of carbon composites in slat and
stabilizer construction
A82-11468

GLIDING
Comparison of simulation and experimental data for
a gliding parachute in dynamic flight
[AIAA PAPER 81-1924] A82-10409

GLOBAL POSITIONING SYSTEM
National Aerospace Meeting, Trevose, PA, April
8-10, 1981, Proceedings
A82-12626
Satellite geometry considerations for low cost GPS
user equipment
A82-12630
FAA acceptance tests on the NAVSTAR GPS Z-Set
receiver
A82-12639
A navigation systems planning model
A82-12640
Integrated satellite navigation and strapdown
attitude and heading reference systems for civil
air carriers
A82-12643
General aviation aircraft antennas for the global
positioning system
[NASA-TM-83212] N82-11339

GROUND BASED CONTROL
HiMAT onboard flight computer system architecture
and qualification
[AIAA 81-2107] A82-10082

GROUND TESTS
Electrical ground testing of aircraft antistatic
protection
A82-10822

GUATEMALA
Radar mapping, archaeology, and ancient land use
in the Maya lowlands
[NASA-CR-164931] N82-11514

GUIDANCE SENSORS
The integrated inertial sensor assembly /IISA/ - A
redundant strapdown system for advanced aircraft
navigation and flight control functions
A82-12642

GUNFIRE
Dynamic response of aircraft structure to gun
shock loads
A82-11314

GUST LOADS
Crack growth evaluation of a method to convert
real-time loads history to a simplified
engineering spectra --- for aircraft structural
analysis
A82-12043
Aeroacoustic theory for noncompact wing-gust
interaction
[PDRL-81-7] N82-11071

GUSTS
Gust front structure observed by Doppler radar
                                                    A82-10223

GYROCOMPASSES
Fast and accurate gyrocompass using strapdown
    tuned rotor gyros as a solution to combat
    helicopters navigation problems
                                                    A82-11927

GYROSCOPES
Problems relating to the classical rate-gyro
                                                    A82-10497
Design and development of a low cost servoed rate
    gyro for unmanned aircraft
                                                    A82-11932

GYROSTABILIZERS
Synthesis of system for evaluating gyrostabilizer
    state with unknown disturbances
                                                    A82-11469

H

HARDWARE
Controlling the software/hardware interface for
    the validation of avionics systems --- in flight
    control systems
    [AIAA 81-2159]   A82-10116

HEAD-UP DISPLAYS
Study and development of an integrated head-up
    display
    [AD-A104337]   N82-11062

HEAT EXCHANGERS
The enhancement of heat exchange in channels /2nd
    revised and enlarged edition/ --- Russian book
                                                    A82-12222
A new method of cooling turbine vanes
                                                    N82-11027

HEAT RESISTANT ALLOYS
Powder metallurgy superalloys - Aerospace
    materials for the 1980's; Proceedings of the
    Conference, Zurich, Switzerland, November 18-20,
    1980. Volume 1
                                                    A82-12495
Superclean superalloy powders by the rotating
    electrode process
                                                    A82-12496
Superalloy turbine components - Which is the
    superior manufacturing process, as-HIP, HIP plus
    Isoforge, or 'gatorizing' of extrusion
    consolidated billet
                                                    A82-12497
Superalloy powder engine components; controls
    employed to assure high quality hardware
                                                    A82-12499

HEAT TRANSFER
In-situ calibration of flight heat transfer
    instrumentation
    [ASME PAPER 81-ENAS-13]   A82-10901
Thermal and flow analysis of a convection,
    air-cooled ceramic coated porous metal concept
    for turbine vanes
    [ASME PAPER 81-HT-48]   A82-10952
Results of experimental study of heat transfer to
    turbine blades with porous cooling
                                                    A82-11446

HEAT TRANSMISSION
The enhancement of heat exchange in channels /2nd
    revised and enlarged edition/ --- Russian book
                                                    A82-12222

HEATING EQUIPMENT
Ice protection system technology
                                                    N82-11060
Experimental study of fuel heating at low
    temperatures in a wing tank model, volume 1
    [NASA-CR-165391]   N82-11224

HELICOPTER CONTROL
Electronic master monitor and advisory display
    system, data transmission study
    [AD-A104243]   N82-11064
Electronic master monitor and advisory display
    system, human engineering summary report
    [AD-A104244]   N82-11065

HELICOPTER DESIGN
An investigation of a stoppable helicopter rotor
    with circulation control --- ames 40 by 80 foot
    wind tunnel
    [NASA-TM-81218]   N82-10030

HELICOPTER ENGINES
Helicopter engine technology - With particular
    reference to the Rolls-Royce Gem engine
                                                    A82-10304

HELICOPTER PERFORMANCE
Helicopter rotor trailing edge noise
    [AIAA PAPER 81-2001]   A82-10455
Numerical treatment of helicopter rotor stability
    problems
                                                    A82-12045
Helicopter icing spray system - Improvements and
    flight experience
                                                    A82-12696

HELICOPTERS
Model helicopter rotor impulsive noise
                                                    A82-11300
A comprehensive bibliography of literature on
    helicopter noise technology
    [AD-A103331]   N82-10812
Rotorcraft icing: Status and prospects
    [AGARD-AR-166]   N82-11056
Helicopter rotor trailing edge noise --- noise
    prediction
    [NASA-CR-3470]   N82-11859

HFB-320 AIRCRAFT
System identification of the longitudinal motion
    of the DFVLR HFB 320 research aircraft with
    particular consideration of control surface
    effectiveness
    [ESA-TT-666]   N82-10045
Flight test results of the model simulation
    controller for the HFB 320 for in-flight
    simulation of the A310 airbus
    [ESA-TT-660]   N82-10107

HIGH ALTITUDE BALLOONS
A new thermal and trajectory model for high
    altitude balloons
    [AIAA PAPER 81-1926]   A82-10411

HIGH POLYMERS
Rheological behavior of progressively
    shear-thickening solutions --- aircraft fuel
    polymer additives for fire protection in
    survivable crashes
                                                    A82-11177

HIGH STRENGTH STEELS
The application of improved aluminium alloys and
    steels in aircraft structures
                                                    A82-10305

HIGH TEMPERATURE RESEARCH
Adaptation of a turbine test facility to
    high-temperature research
    [RAE-LIB-TRANS-2064]   N82-11089

HIGH VOLTAGES
High voltage surge and partial discharge test to
    evaluate aerospace equipment parts
                                                    A82-11740

HONEYCOMB STRUCTURES
Light aircraft structural design in non-metallics
    - Use of composite honeycomb for light aircraft
                                                    A82-10308

HORIZONTAL FLIGHT
Analysis of augmented aircraft flying qualities
    through application of the Neal-Smith criterion
    [AIAA PAPER 81-1776]   A82-10462
Parametric study of microwave-powered
    high-altitude airplane platforms designed for
    linear flight
    [NASA-TP-1918]   N82-11050

HORIZONTAL TAIL SURFACES
A CFRP taileron for the Tornado: Construction and
    production --- horizontal stabilizer
    [MBB-PB-212/KFK/PUB/2]   N82-10035

HUBS
Development of the Triflex rotor head
                                                    A82-11222

HUMAN FACTORS ENGINEERING
Electronic master monitor and advisory display
    system, human engineering summary report
    [AD-A104244]   N82-11065

HUMAN PERFORMANCE
Relationships between naval aviation safety and
    pilot flight experience
                                                    A82-11031

HUMAN REACTIONS
Effects of aircraft noise on the equilibrium of
    airport residents: Testing and utilization of a
    new methodology
    [NASA-TM-76628]   N82-11636

HYDRAULIC CONTROL
    High-efficiency hydraulic power transfer units for
        multisystem aircraft
                                                    A82-10853
HYDRAULIC EQUIPMENT
    Fluid power technology for the '80s --- Book
                                                    A82-10851
    Low maintenance hydraulic accumulator
        [AD-A103947]   N82-10034
    Aircraft digital input controlled hydraulic
        actuation and control system
        [AD-A104263]   N82-11072
HYDROCARBON FUEL PRODUCTION
    Jet fuel from carbon
                                                    A82-12021
    Jet fuel locks to shale oil: The 1980 technology
        review
        [AD-A104414]   N82-11228
HYDROGEN FUELS
    Fuel for future transport aircraft
        [ASME PAPER 81-HT-80]   A82-10965
HYDROGENATION
    Jet fuel from carbon
                                                    A82-12021

I

ICE FORMATION
    Helicopter icing spray system - Improvements and
        flight experience
                                                    A82-12696
    Selected bibliography of NACA-NASA aircraft icing
        publications
        [NASA-TM-81651]   N82-11053
    Rotorcraft icing: Status and prospects
        [AGARD-AR-166]   N82-11056
    Operational environment, meteorological conditions
        and weather forecasting
                                                    N82-11057
    Technology base for icing instrumentation and
        mathematical modelling
                                                    N82-11058
    Facilities for development and clearance
                                                    N82-11059
    Ice protection system technology
                                                    N82-11060
    Proposed standard requirements and procedures for
        icing clearance
                                                    N82-11061
ICE PREVENTION
    Icing tunnel test of a glycol-exuding porous
        leading edge ice protection system on a general
        aviation airfoil --- conducted in the Lewis
        Research Center icing research tunnel
        [NASA-CR-165444]   N82-10021
    Icing tunnel tests of a composite porous leading
        edge for use with a liquid anti-ice system ---
        Lewis icing research tunnel
        [NASA-CR-164966]   N82-11052
    Selected bibliography of NACA-NASA aircraft icing
        publications
        [NASA-TM-81651]   N82-11053
IMAGE ENHANCEMENT
    Solution to the hidden-line problem
                                                    A82-12803
IMPACT ACCELERATION
    Limiting payload deceleration during ground impact
        [AIAA PAPER 81-1918]   A82-10404
IMPACT DAMAGE
    Impact-initiated damage thresholds in composites
                                                    A82-12028
IMPACT LOADS
    Coupled fluid/structure response predictions for
        soft body impact of airfoil configurations ---
        ice and bird impact on aircraft engines
                                                    A82-12039
IMPACT RESISTANCE
    Seven years experience with Kevlar-49 in the
        Lockheed L-1011 Tristar
                                                    A82-12647
IMPACT TESTS
    Air bag impact attenuation system for the AQM-34V
        remote piloted vehicle
        [AIAA PAPER 81-1917]   A82-10403
IN-FLIGHT MONITORING
    Performance analysis of enroute air traffic
        control computers in the National Airspace System
        [AIAA 81-2203]   A82-10140

Commercial EMS considerations for small gas
    turbine engines --- automated engine monitoring
    systems
                                                    A82-12449
Further application and development of an engine
    usage/life monitoring system for military services
                                                    A82-12450
Electronic master monitor and advisory display
    system, data transmission study
    [AD-A104243]   N82-11064
Electronic master monitor and advisory display
    system, human engineering summary report
    [AD-A104244]   N82-11065
INCOMPRESSIBLE FLOW
    Theoretical analysis of parachute inflation
        including fluid kinetics
        [AIAA PAPER 81-1925]   A82-10410
    Second order approximation theory of an arbitrary
        aerofoil in compressible potential flow
                                                    N82-10982
INCOMPRESSIBLE FLUIDS
    Calculation of aerodynamic characteristics of jet
        flapped airplane
                                                    A82-11459
INDEXES (DOCUMENTATION)
    NASA Authorization, 1982: Index
        [GPO-84-713]   N82-10959
INERTIAL NAVIGATION
    Synthesis of system for evaluating gyrostabilizer
        state with unknown disturbances
                                                    A82-11469
    Ring Laser Gyro Navigator /RLGN/ flight test results
                                                    A82-12644
INERTIAL REFERENCE SYSTEMS
    Integrated satellite navigation and strapdown
        attitude and heading reference systems for civil
        air carriers
                                                    A82-12643
INFLATABLE STRUCTURES
    Inflatable system for fast deployment of
        parachutes at low altitudes from slow moving
        aircraft or stationary supports
        [AIAA PAPER 81-1953]   A82-10428
INFLATING
    Theoretical analysis of parachute inflation
        including fluid kinetics
        [AIAA PAPER 81-1925]   A82-10410
    The constricted rigging line trials technique for
        assessing the opening characteristics of
        parachutes
        [AIAA PAPER 81-1932]   A82-10413
    Stress measurements in a ribbon parachute canopy
        during inflation and at steady state
        [AIAA PAPER 81-1944]   A82-10420
INJECTORS
    One reason for the onset of high-frequency
        self-excited oscillations --- in combustion
        chambers of aircraft engines
                                                    A82-11448
INLET FLOW
    A theoretical analysis of the stream surface of
        revolution with supersonic inlet flow in a
        transonic axial compressor
                                                    N82-11025
    A summary of V/STOL inlet analysis methods
        [NASA-TM-82725]   N82-11043
INLET PRESSURE
    Initial experimental research into the response of
        turbojet engine compressors to distortion of
        intake pressure
                                                    N82-11006
    A preliminary experimental investigation of the
        response of a turbojet engine to inlet pressure
        distortion
                                                    N82-11007
INSPECTION
    Mathematical model for the maintenance program of
        modern jet aircraft --- crack detection;
        inspection intervals
        [DFVLR-FB-81-14]   N82-10002
INSTRUMENT LANDING SYSTEMS
    Discrete address beacon, navigation and landing
        system
                                                    A82-10650
INTAKE SYSTEMS
    Initial experimental research into the response of
        turbojet engine compressors to distortion of
        intake pressure
                                                    N82-11006

INTEGRAL EQUATIONS
    A study on numerical method for evaluating
        spanwise integral in subsonic lifting-surface
        theory
        [NAL-TR-661T]   N82-11035
INTELLIGENCE
    Interoperability testing of decentralized command,
        control, communications and intelligence /C3I/
        systems
        [AIAA 81-2205]   A82-10143
INTERPOLATION
    Feedback and minimax sensitivity
                                                N82-10058
INVERSIONS
    The net-skirt to a parachute canopy as a device to
        prevent inversion
        [AIAA PAPER 81-1927]   A82-10412
INVISCID FLOW
    Theoretical analysis of parachute inflation
        including fluid kinetics
        [AIAA PAPER 81-1925]   A82-10410
    The arbitrary quasi-orthogonal surface method for
        computing three-dimensional flow in turbine
        machinery. 2. Calculation of the
        three-dimensional flow with the S sub 1-surface
        twisted
                                                N82-11015

J

JAGUAR AIRCRAFT
    Digital avionics systems - The RAF experience
                                                A82-11941
JET AIRCRAFT
    Calculation of aerodynamic characteristics of jet
        flapped airplane
                                                A82-11459
    History of flight testing the L-1011 TriStar jet
        transport. II - Testing highlights since initial
        certification of the L-1011-1
                                                A82-12049
JET AIRCRAFT NOISE
    SEL and EPNL noise duration coefficients for the
        747 and T-38 aircraft
        [NASA-TM-83214]   N82-11860
JET ENGINE FUELS
    Fuel for future transport aircraft
        [ASME PAPER 81-HT-80]   A82-10965
    Jet fuel from carbon
                                                A82-12021
    A protective additive for jet fuels
                                                A82-12022
    Experimental study of fuel heating at low
        temperatures in a wing tank model, volume 1
        [NASA-CR-165391]   N82-11224
    Jet fuel locks to shale oil: The 1980 technology
        review
        [AD-A104414]   N82-11228
    An assessment of the use of antimisting fuel in
        turbofan engines
        [NASA-CR-165258]   N82-11230
JET ENGINES
    Thermal expansion accommodation in a jet engine
        frame
                                                A82-11999
    Coupled fluid/structure response predictions for
        soft body impact of airfoil configurations ---
        ice and bird impact on aircraft engines
                                                A82-12039
JET FLAPS
    Calculation of aerodynamic characteristics of jet
        flapped airplane
                                                A82-11459
JET IMPINGEMENT
    Study of reingestion of exhaust gases with
        different initial temperature in a reversed
        turbojet engine
                                                A82-11444
JET VANES
    Effects of vane/blade ratio and spacing on fan noise
        [AIAA PAPER 81-2033]   A82-10457

K

KERNEL FUNCTIONS
    On the kernel function collocation method in
        steady subsonic flow for wing with control
        surfaces
                                                N82-12023

KEVLAR (TRADEMARK)
    Kevlar composites: Proceedings of the Symposium,
        El Segundo, CA, December 2, 1980
                                                A82-12646
    Seven years experience with Kevlar-49 in the
        Lockheed L-1011 Tristar
                                                A82-12647
KINEMATICS
    Analytical determination of undercarriage
        retraction kinematics
                                                A82-10364
KOREA
    A proposed flight safety program for the Korean
        Air Force
        [AD-A102373]   N82-10023

L

L-1011 AIRCRAFT
    History of flight testing the L-1011 TriStar jet
        transport. II - Testing highlights since initial
        certification of the L-1011-1
                                                A82-12049
    Seven years experience with Kevlar-49 in the
        Lockheed L-1011 Tristar
                                                A82-12647
LAMINAR BOUNDARY LAYER
    Amplified crossflow disturbances in the laminar
        boundary layer on swept wings with suction
        [NASA-TP-1902]   N82-11391
LAMINAR FLOW
    On low-speed wind tunnels with deformable boundaries
                                                A82-11462
LAMINATES
    Impact-initiated damage thresholds in composites
                                                A82-12028
LAND USE
    Radar mapping, archaeology, and ancient land use
        in the Maya lowlands
        [NASA-CR-164931]   N82-11514
LANDING AIDS
    Comparative study of flare control laws
        [NASA-CR-164903]   N82-10032
LANDING GEAR
    The possibility of using deformable rubber
        components in landing gear
                                                A82-10496
LASER GYROSCOPES
    Ring Laser Gyro Navigator /RLGN/ flight test results
                                                A82-12644
LATERAL CONTROL
    Procedures and analysis techniques for determining
        static air minimum control speeds
                                                A82-12564
LEAD ACID BATTERIES
    Sealed lead-acid batteries for aircraft applications
                                                A82-11716
LEADING EDGE SLATS
    On evaluating the influence of local disruptions
        of flow over trailing edge and leading edge
        flaps from the data of wind tunnel tests of a
        rectangular wing segment
                                                A82-11465
    On the use of carbon composites in slat and
        stabilizer construction
                                                A82-11468
LEADING EDGES
    Icing tunnel test of a glycol-exuding porous
        leading edge ice protection system on a general
        aviation airfoil --- conducted in the Lewis
        Research Center icing research tunnel
        [NASA-CR-165444]   N82-10021
    Icing tunnel tests of a composite porous leading
        edge for use with a liquid anti-ice system ---
        Lewis icing research tunnel
        [NASA-CR-164966]   N82-11052
LICENSING
    Spin recovery training --- licensing requirement
        [GPO-66-020]   N82-10022
LIFE CYCLE COSTS
    Closed loop environmental control systems for
        fighter aircraft
        [ASME PAPER 81-ENAS-2]   A82-10890
    Variable speed constant frequency /VSCF/
        electrical system cuts cost of ownership
                                                A82-11719
    A hidden advantage of permanent magnet electrical
        generating systems
                                                A82-11720

LIFE SUPPORT SYSTEMS
Air supply system bite for Boeing 767 airplane ---
Built-In-Test-Equipment
[ASME PAPER 81-ENAS-7]   A82-10895
LIFT
A study on numerical method for evaluating
spanwise integral in subsonic lifting-surface
theory
[NAL-TR-661T]   N82-11035
LIFT AUGMENTATION
An investigation of a stoppable helicopter rotor
with circulation control --- ames 40 by 80 foot
wind tunnel
[NASA-TM-81218]   N82-10030
LIFT DRAG RATIO
A modular asymmetric parachute for wind tunnel
testing
[AIAA PAPER 81-1933]   A82-10414
Increasing the lift:drag ratio of a flat delta wing
                                        A82-11899
LIFTING BODIES
Development of new lifting parachute designs with
increased trim angle
[AIAA PAPER 81-1921]   A82-10407
A modular asymmetric parachute for wind tunnel
testing
[AIAA PAPER 81-1933]   A82-10414
LIGHT AIRCRAFT
Some possibilities for composite light aircraft
construction
                                        A82-10307
Light aircraft structural design in non-metallics
- Use of composite honeycomb for light aircraft
                                        A82-10308
The possibility of using deformable rubber
components in landing gear
                                        A82-10496
Experimental modal analysis of the fuselage panels
of an Aero Commander aircraft
[NASA-CR-165750]   N82-10028
LIGHTNING
Lightning effects on aircraft and composites.
Literature study on lightning strikes and
protection --- advanced composite materials
[FOA-C-20388-F9]   N82-10024
LINEAR EQUATIONS
LQG-based multivariable design: Frequency domain
interpretation
                                        N82-10053
LQG multivariable design tools
                                        N82-10054
LINEAR SYSTEMS
Limitations on achievable performance of
multivariable feedback systems
                                        N82-10052
Design of high integrity multivariable control
systems
                                        N82-10055
A geometric approach to multivariable control
system synthesis
                                        N82-10056
Multivariables design: The optimization of
approximate inverses
                                        N82-10057
Feedback and minimax sensitivity
                                        N82-10058
Theory of stochastic optimal control some basic
notions
                                        N82-11075
LIQUID HYDROGEN
Fuel for future transport aircraft
[ASME PAPER 81-HT-80]   A82-10965
LOAD TESTS
Fatigue life of lugs under service loading - Test
results and predictions
                                        A82-11685
LONGITUDINAL CONTROL
System identification of the longitudinal motion
of the DFVLR HFB 320 research aircraft with
particular consideration of control surface
effectiveness
[ESA-TT-666]   N82-10045
LONGITUDINAL STABILITY
Active control elements on the transonic wing of
the Airbus A-300 (ACTTA A). Airbus A-300 with
reduced longitudinal stability (ACTTA-C) ---
advanced control transonic transport aircraft
(ACCTA); design considerations
                                        N82-10044

LOOPS
The need for multivariable design and analysis
techniques
                                        N82-10049
Multivariable design techniques based on singular
value generalizations of classical control
                                        N82-10051
Limitations on achievable performance of
multivariable feedback systems
                                        N82-10052
LQG-based multivariable design: Frequency domain
interpretation
                                        N82-10053
LQG multivariable design tools
                                        N82-10054
Design of high integrity multivariable control
systems
                                        N82-10055
LOW ALTITUDE
Inflatable system for fast deployment of
parachutes at low altitudes from slow moving
aircraft or stationary supports
[AIAA PAPER 81-1953]   A82-10428
LOW SPEED STABILITY
Effects of vortex flaps on the low-speed
aerodynamic characteristics of an arrow wing
[NASA-TP-1914]   N82-11013
Wind-tunnel results for a modified
17-percent-thick low-speed airfoil section
[NASA-TP-1919]   N82-11033
LOW SPEED WIND TUNNELS
On low-speed wind tunnels with deformable boundaries
                                        A82-11462
On evaluating the influence of local disruptions
of flow over trailing edge and leading edge
flaps from the data of wind tunnel tests of a
rectangular wing segment
                                        A82-11465
LOW TEMPERATURE ENVIRONMENTS
Experimental study of fuel heating at low
temperatures in a wing tank model, volume 1
[NASA-CR-165391]   N82-11224
LUGS
Fatigue life of lugs under service loading - Test
results and predictions
                                        A82-11685

M

MAGNETS
A hidden advantage of permanent magnet electrical
generating systems
                                        A82-11720
60 KVA ADP permanent magnet VSCF starter generator
system - Generator system performance
characteristics
                                        A82-11721
MAN MACHINE SYSTEMS
Improving the MLS through enhanced cockpit displays
                                        A82-10649
MANUAL CONTROL
Improving the MLS through enhanced cockpit displays
                                        A82-10649
Control law design for transport aircraft flight
tasks
                                        N82-11080
MASS DISTRIBUTION
Experimental determination of parachute apparent
mass and its significance in predicting dynamic
stability
[AIAA PAPER 81-1920]   A82-10406
MATCHING
Strong matching method for computing transonic
viscous flows including wakes and separations -
Lifting airfoils
                                        A82-10821
MATERIALS TESTS
The possibility of using deformable rubber
components in landing gear
                                        A82-10496
MATHEMATICAL MODELS
A mathematical model of an over-sea airborne UHF
radio link
                                        A82-11406
Validation studies of turbulence and combustion
models for aircraft gas turbine combustors
                                        A82-12267

Outsider's look at flight instrumentation
[DE81-025409]   N82-11066
MOLDS
New molding method of three-dimensional hollow
photoelastic model and centrifugal stress
analysis of air cooled turbine blade model
[NAL-TR-427T]   N82-11067
MONOPLANES
Analytical determination of undercarriage
retraction kinematics
                                       A82-10364
MRCA AIRCRAFT
A CFRP taileron for the Tornado: Construction and
production --- horizontal stabilizer
[MBB-FE-212/KPK/PUB/2]   N82-10035
MULTIENGINE VEHICLES
Procedures and analysis techniques for determining
static air minimum control speeds
                                       A82-12564
MULTIPROCESSING (COMPUTERS)
Airborne associative processor /ASPRO/ --- for
early warning radar surveillance, command, and
control applications
[AIAA 81-2145]   A82-10104
Navigation task partitioning in
distributed-processing avionics systems
                                       A82-10646

N

NACELLES
Low speed testing of the inlets designed for a
tamden-fan V/STOL nacelle --- conducted in the
Lewis 10 by 10 foot wind tunnel
[NASA-TM-82728]   N82-11042
NASA PROGRAMS
NASA Authorization, 1982: Index
[GPO-84-713]   N82-10959
NATIONAL AIRSPACE UTILIZATION SYSTEM
Performance analysis of enroute air traffic
control computers in the National Airspace System
[AIAA 81-2203]   A82-10140
NATIONAL AVIATION SYSTEM
Airport and Airway Improvement Act of 1981, part 1
[GPO-76-241-PT-1]   N82-10062
NAVIER-STOKES EQUATION
Computation of high Reynolds number
internal/external flows
[NASA-TM-84049]   N82-11046
NAVIGATION
Flight trajectory control investigation
[AD-A104542]   N82-11048
An overview of optimal control in aerospace systems
                                       N82-11074
NAVIGATION AIDS
Three navigation systems and their costs of
acquiring remote sensing data
                                       A82-10049
NAVSTAR SATELLITES
FAA acceptance tests on the NAVSTAR GPS Z-Set
receiver
                                       A82-12639
NETS
The net-skirt to a parachute canopy as a device to
prevent inversion
[AIAA PAPER 81-1927]   A82-10412
NETWORK CONTROL
A solution to the static geometry problem for
JTIDS relative navigation
                                       A82-12634
NICKEL CADMIUM BATTERIES
Unsolved problems of nickel cadmium batteries
                                       A82-11725
NOISE GENERATORS
Rotor wake characteristics relevant to
rotor-stator interaction noise generation
[AIAA PAPER 81-2031]   A82-10456
A comprehensive bibliography of literature on
helicopter noise technology
[AD-A103331]   N82-10812
NOISE MEASUREMENT
Model helicopter rotor impulsive noise
                                       A82-11300
SEL and EPNL noise duration coefficients for the
747 and T-38 aircraft
[NASA-TM-83214]   N82-11860

NOISE POLLUTION
A comprehensive bibliography of literature on
helicopter noise technology
[AD-A103331]   N82-10812
Effects of aircraft noise on the equilibrium of
airport residents: Testing and utilization of a
new methodology
[NASA-TM-76628]   N82-11636
NOISE PREDICTION (AIRCRAFT)
Helicopter rotor trailing edge noise
[AIAA PAPER 81-2001]   A82-10455
Rotor wake characteristics relevant to
rotor-stator interaction noise generation
[AIAA PAPER 81-2031]   A82-10456
Effects of vane/blade ratio and spacing on fan noise
[AIAA PAPER 81-2033]   A82-10457
Helicopter rotor trailing edge noise --- noise
prediction
[NASA-CR-3470]   N82-11859
NOISE REDUCTION
'Quiet please' --- aircraft hydraulic systems
noise reduction
                                       A82-10854
Design predictions for noise control in the
cryogenic National Transonic Facility
                                       A82-12025
Experimental modal analysis of the fuselage panels
of an Aero Commander aircraft
[NASA-CR-165750]   N82-10028
Comparative study of flare control laws
[NASA-CR-164903]   N82-10032
A comprehensive bibliography of literature on
helicopter noise technology
[AD-A103331]   N82-10812
NOISE SPECTRA
SEL and EPNL noise duration coefficients for the
747 and T-38 aircraft
[NASA-TM-83214]   N82-11860
NONLINEAR SYSTEMS
Fatigue substantiation of non-linear structures
                                       A82-11224
A geometric approach to multivariable control
system synthesis
                                       N82-10056
Theory of stochastic optimal control some basic
notions
                                       N82-11075
Application of nonlinear systems inverses to
automatic flight control design: System
concepts and flight evaluations
                                       N82-11083
NOZZLE DESIGN
Developments in boundary layer Thrust Vector Control
                                       A82-10855
NUMERICAL ANALYSIS
The use of the Weber method for
minicomputer-assisted numerical analysis of
airfoils
                                       A82-10362
Numerical treatment of helicopter rotor stability
problems
                                       A82-12045
Procedures and analysis techniques for determining
static air minimum control speeds
                                       A82-12564
The need for multivariable design and analysis
techniques
                                       N82-10049
NUMERICAL FLOW VISUALIZATION
A numerical three-dimensional turbulent simulation
of a subsonic VSTOL jet in a cross-flow using a
finite element algorithm
[AD-A104514]   N82-11055
NYQUIST DIAGRAM
Characteristic and principal gains and phases and
their use as multivariable control design tools
--- generalizing Nyquist and root-locus diagram
techniques
                                       N82-10050

O

OH-58 HELICOPTER
Composite main rotor tubular braided
                                       A82-10547
OMEGA NAVIGATION SYSTEM
Omega station 10.2 kHz signal selection made easy
                                       A82-12638

On the prediction of swirling flowfields found in
axisymmetric combustor geometries
                                           A82-12120
Parametric study of microwave-powered
high-altitude airplane platforms designed for
linear flight
[NASA-TP-1918]   N82-11050
PERFORMANCE TESTS
Interoperability testing of decentralized command,
control, communications and intelligence /C3I/
systems
[AIAA 81-2205]   A82-10143
Air bag impact attenuation system for the AQM-34V
remote piloted vehicle
[AIAA PAPER 81-1917]   A82-10403
Aerodynamics and performance of cruciform
parachute canopies
[AIAA PAPER 81-1919]   A82-10405
The constricted rigging line trials technique for
assessing the opening characteristics of
parachutes
[AIAA PAPER 81-1932]   A82-10413
High-efficiency hydraulic power transfer units for
multisystem aircraft
                                           A82-10853
The certification of digital systems
                                           A82-11940
FAA acceptance tests on the NAVSTAR GPS Z-Set
receiver
                                           A82-12639
PERTURBATION THEORY
Synthesis of system for evaluating gyrostabilizer
state with unknown disturbances
                                           A82-11469
PHOTOELASTICITY
New molding method of three-dimensional hollow
photoelastic model and centrifugal stress
analysis of air cooled turbine blade model
[NAL-TR-427T]   N82-11067
PILOT TRAINING
Spin recovery training --- licensing requirement
[GPO-66-020]   N82-10022
PILOTS (PERSONNEL)
Development and construction of pilot ejector
seats in Germany from 1938-1945
[DFVLR-FB-81-04]   N82-10026
PISTON ENGINES
The CIVIC - A concept in vortex induced
combustion. II
[ASME PAPER 81-GT-12]   A82-11997
PLANETARY BOUNDARY LAYER
Multiple Doppler radar observations of PBL structure
                                           A82-10292
PLANING
A navigation systems planning model
                                           A82-12640
PLASMA SPRAYING
Thermal-barrier-coated turbine blade study
[NASA-CR-165351]   N82-10040
PLASTIC AIRCRAFT STRUCTURES
On the use of carbon composites in slat and
stabilizer construction
                                           A82-11468
Seven years experience with Kevlar-49 in the
Lockheed L-1011 Tristar
                                           A82-12647
PLOTTING
Multivariable design techniques based on singular
value generalizations of classical control
                                           N82-10051
PNEUMATIC EQUIPMENT
A new APU for medium place aircraft environmental
control systems
[ASME PAPER 81-ENAS-1]   A82-10889
Towards minimum power for environmental control in
transport aircraft
[ASME PAPER 81-ENAS-4]   A82-10892
Air supply system bite for Boeing 767 airplane ---
Built-In-Test-Equipment
[ASME PAPER 81-ENAS-7]   A82-10895
POLLUTION CONTROL
Baseline data on utilization of low-grade fuels in
gas turbine applications. Volume 3: Emissions
evaluation
[DE81-903764]   N82-10254
POLYETHER RESINS
Polyurethane foams for aircraft shock mounts. 3:
Vibration damping by polyether foams
[AD-A104496]   N82-11212

POLYURETHANE FOAM
Polyurethane foams for aircraft shock mounts. 3:
Vibration damping by polyether foams
[AD-A104496]   N82-11212
POROUS MATERIALS
Development of low modulus material for use in
ceramic gas path seal applications
[NASA-CR-165469]   N82-10039
Icing tunnel tests of a composite porous leading
edge for use with a liquid anti-ice system ---
Lewis icing research tunnel
[NASA-CR-164966]   N82-11052
POROUS WALLS
Thermal and flow analysis of a convection,
air-cooled ceramic coated porous metal concept
for turbine vanes
[ASME PAPER 81-HT-48]   A82-10952
End losses in turbine cascades with porous cooling
                                           A82-11434
Results of experimental study of heat transfer to
turbine blades with porous cooling
                                           A82-11446
POSITION (LOCATION)
A solution to the static geometry problem for
JTIDS relative navigation
                                           A82-12634
The statistical theory of radio direction finding
[AD-A104156]   N82-10027
POTENTIAL FLOW
Finite difference computation of the steady
transonic potential flow around airplanes
                                           N82-10981
Second order approximation theory of an arbitrary
aerofoil in compressible potential flow
                                           N82-10982
Aerodynamic calculations and design of subcritical
aerofoils
                                           N82-10983
POWDER METALLURGY
Powder metallurgy superalloys - Aerospace
materials for the 1980's; Proceedings of the
Conference, Zurich, Switzerland, November 18-20,
1980. Volume 1
                                           A82-12495
Superclean superalloy powders by the rotating
electrode process
                                           A82-12496
Superalloy turbine components - Which is the
superior manufacturing process, as-HIP, HIP plus
Isoforge, or 'gatorizing' of extrusion
consolidated billet.
                                           A82-12497
Superalloy powder engine components; controls
employed to assure high quality hardware
                                           A82-12499
POWER EFFICIENCY
Helicopter engine technology - With particular
reference to the Rolls-Royce Gem engine
                                           A82-10304
60 KVA ADP permanent magnet VSCF starter generator
system - Generator system performance
characteristics
                                           A82-11721
PRECIPITATION (METEOROLOGY)
The evolution of airborne weather avoidance radar
toward a calibrated remote rain gauge using REACT
--- Rain Echo Attenuation Compensation Hardware
                                           A82-10225
PREDICTION ANALYSIS TECHNIQUES
A new thermal and trajectory model for high
altitude balloons
[AIAA PAPER 81-1926]   A82-10411
PRESSURE DISTRIBUTION
The use of the Weber method for
minicomputer-assisted numerical analysis of
airfoils
                                           A82-10362
Aerodynamic calculations and design of subcritical
aerofoils
                                           N82-10983
Initial experimental research into the response of
turbojet engine compressors to distortion of
intake pressure
                                           N82-11006
A preliminary experimental investigation of the
response of a turbojet engine to inlet pressure
distortion
                                           N82-11007

A comparison of theoretical and experimental
pressure distributions for two advanced fighter
wings
[NASA-TM-81331]   N82-11054
PRESSURE OSCILLATIONS
One reason for the onset of high-frequency
self-excited oscillations --- in combustion
chambers of aircraft engines
                                              A82-11448
PRESSURE REDUCTION
Thermal and flow analysis of a convection,
air-cooled ceramic coated porous metal concept
for turbine vanes
[ASME PAPER 81-HT-48]   A82-10952
PRESSURIZED CABINS
Air supply system bite for Boeing 767 airplane ---
Built-In-Test-Equipment
[ASME PAPER 81-ENAS-7]   A82-10895
PROBABILITY THEORY
Extending the limits of reliability theory --- Book
                                              A82-12318
PROCEDURES
Proposed standard requirements and procedures for
icing clearance
                                              N82-11061
PRODUCT DEVELOPMENT
Study and development of an integrated head-up
display
[AD-A104337]   N82-11062
Integrated analysis of engine
[NASA-TM-82713]   N82-11491
PRODUCTION ENGINEERING
Automated Paint and Process Line /APPL/ --- for
aircraft production
[AIAA 81-2166]   A82-10120
Development of aircraft production engineering
discipline at IIT, Bombay
                                              A82-11317
A CFRP taileron for the Tornado: Construction and
production --- horizontal stabilizer
[MBB-FE-212/KPK/PUB/2]   N82-10035
PROGRAM VERIFICATION (COMPUTERS)
The Space Shuttle vehicle checkout involving
flight avionics software
[AIAA 81-2141]   A82-10100
PROJECT MANAGEMENT
Implementation of AVRADCOM MM&T --- for military
aircraft parts production engineering
                                              A82-10545
PROPELLER FANS
Propfan installation aerodynamics of a
supercritical swept wing transport configuration
[AIAA PAPER 81-1563]   A82-10466
PROPULSIVE EFFICIENCY
Quiet short-haul research aircraft familiarization
document, revision 1
[NASA-TM-81298]   N82-10031
Propulsion study for Small Transport Aircraft
Technology (STAT), Appendix B
[NASA-CR-165499-APP-B]   N82-10038
PROTECTIVE COATINGS
Thermal-barrier-coated turbine blade study
[NASA-CR-165351]   N82-10040
PROTUBERANCES
Aircraft excrescence drag
[AGARD-AG-264]   N82-10020
PUMPS
High-efficiency hydraulic power transfer units for
multisystem aircraft
                                              A82-10853

Q

QUADRATIC EQUATIONS
LQG-based multivariable design: Frequency domain
interpretation
                                              N82-10053
LQG multivariable design tools
                                              N82-10054
QUIET ENGINE PROGRAM
Quiet short-haul research aircraft familiarization
document, revision 1
[NASA-TM-81298]   N82-10031

R

RADAR ATTENUATION
The evolution of airborne weather avoidance radar
toward a calibrated remote rain gauge using REACT
--- Rain Echo Attenuation Compensation Hardware
                                              A82-10225
RADAR DATA
Description of the meteorological research radar
system aboard NOAA/Research Facilities Center
WP-3D aircraft
                                              A82-10217
RADAR DETECTION
Instrumented aircraft verification of clear-air
radar detection of low-level wind shear
                                              A82-10221
RADAR MAPS
Radar mapping, archaeology, and ancient land use
in the Maya lowlands
[NASA-CR-164931]   N82-11514
RADAR MEASUREMENT
Multiple Doppler radar observations of PBL structure
                                              A82-10292
RADAR TARGETS
Synthetic aperture radar target simulator
[NASA-CASE-NPO-15024-1]   N82-10286
RADAR TRACKING
Hard limited approaches to correlation velocity
sensing
                                              A82-12636
RADIANT FLUX DENSITY
Determination of vertical profiles of aerosol size
spectra from aircraft radiative flux
measurements. II - The effect of particle
nonsphericity
                                              A82-12149
RADIO DIRECTION FINDERS
The statistical theory of radio direction finding
[AD-A104156]   N82-10027
RADIO NAVIGATION
Omega station 10.2 kHz signal selection made easy
                                              A82-12638
FAA acceptance tests on the NAVSTAR GPS Z-Set
receiver
                                              A82-12639
RADIO RECEIVERS
Tangential sensitivity of EW receivers
                                              A82-11020
FAA acceptance tests on the NAVSTAR GPS Z-Set
receiver
                                              A82-12639
RADIO RELAY SYSTEMS
A mathematical model of an over-sea airborne UHF
radio link
                                              A82-11406
RADIO TRACKING
The statistical theory of radio direction finding
[AD-A104156]   N82-10027
RAIN
Airborne weather radar and severe weather
penetration
                                              A82-10219
RAIN GAGES
The evolution of airborne weather avoidance radar
toward a calibrated remote rain gauge using REACT
--- Rain Echo Attenuation Compensation Hardware
                                              A82-10225
RAMJET ENGINES
Air-film cooling returns to ramjets
[ASME PAPER 81-ENAS-8]   A82-10896
An investigation of the combustion process in
solid fuel ramjets
[AD-A104603]   N82-11232
REAL TIME OPERATION
Real-time, on-line digital simulation of optimum
maneuvers of supersonic aircraft
[AIAA 81-2178]   A82-10127
RECIRCULATIVE FLUID FLOW
On the prediction of swirling flowfields found in
axisymmetric combustor geometries
                                              A82-12120
RECOVERY PARACHUTES
Development of a nylon-Kevlar recovery system for
the CL-289 /AN/USD 502/ surveillance drone
[AIAA PAPER 81-1952]   A82-10427

RECTANGULAR PLATES
Response of nonlinear aircraft structural panels
to high intensity noise
A82-12041
RECTANGULAR WINGS
On evaluating the influence of local disruptions
of flow over trailing edge and leading edge
flaps from the data of wind tunnel tests of a
rectangular wing segment
A82-11465
Experimental investigations of the separated flow
around a rectangular wing --- in a wind tunnel
[DFVLR-FB-81-12]   N82-10017
REDUNDANCY
Management of redundancy in flight control systems
using optimal decision theory
N82-11084
REGISTERS
Air-breathing engine test facilities register
[AGARD-AG-269]   N82-10063
REGRESSION ANALYSIS
Determination of airplane model structure from
flight data by using modified stepwise regression
[NASA-TP-1916]   N82-10041
Estimation of airplane stability and control
derivatives from large amplitude longitudinal
maneuvers
[NASA-TM-83185]   N82-10042
RELIABILITY ANALYSIS
Extending the limits of reliability theory --- Book
A82-12318
REMOTE SENSING
Three navigation systems and their costs of
acquiring remote sensing data
A82-10049
REMOTELY PILOTED VEHICLES
HiMAT onboard flight computer system architecture
and qualification
[AIAA 81-2107]   A82-10082
Air bag impact attenuation system for the AQM-34V
remote piloted vehicle
[AIAA PAPER 81-1917]   A82-10403
Design and development of a low cost servoed rate
gyro for unmanned aircraft
A82-11932
Parametric study of microwave-powered
high-altitude airplane platforms designed for
linear flight
[NASA-TP-1918]   N82-11050
RENE 95
Superalloy powder engine components; controls
employed to assure high quality hardware
A82-12499
RESCUE OPERATIONS
SARSAT applications
A82-12698
RESEARCH AND DEVELOPMENT
Development and construction of pilot ejector
seats in Germany from 1938-1945
[DFVLR-FB-81-04]   N82-10026
RESEARCH FACILITIES
Description of the meteorological research radar
system aboard NOAA/Research Facilities Center
WP-3D aircraft
A82-10217
RESIDENTIAL AREAS
Effects of aircraft noise on the equilibrium of
airport residents: Testing and utilization of a
new methodology
[NASA-TM-76628]   N82-11636
RESOLUTION
Study and development of an integrated head-up
display
[AD-A104337]   N82-11062
RESONANT FREQUENCIES
Calculation of natural modes of vibration for
rotor blades by the finite element method
[DFVLR-FB-81-07]   N82-10452
RETRACTABLE EQUIPMENT
Analytical determination of undercarriage
retraction kinematics
A82-10364
REYNOLDS NUMBER
Computation of high Reynolds number
internal/external flows
[NASA-TM-84049]   N82-11046

RHEOLOGY
Rheological behavior of progressively
shear-thickening solutions --- aircraft fuel
polymer additives for fire protection in
survivable crashes
A82-11177
RIBBON PARACHUTES
The effects of flexibility on the steady-state
performance of small ribbon parachute models
[AIAA PAPER 81-1923]   A82-10408
Stress measurements in a ribbon parachute canopy
during inflation and at steady state
[AIAA PAPER 81-1944]   A82-10420
RIGID ROTORS
Development of the Triflex rotor head
A82-11222
RING LASERS
Ring Laser Gyro Navigator /RLGN/ flight test results
A82-12644
ROBUSTNESS (MATHEMATICS)
Limitations on achievable performance of
multivariable feedback systems
N82-10052
ROCKET ENGINES
The enhancement of heat exchange in channels /2nd
revised and enlarged edition/ --- Russian book
A82-12222
ROCKET NOZZLES
Developments in boundary layer Thrust Vector Control
A82-10855
ROCKET-BORNE INSTRUMENTS
Limiting payload deceleration during ground impact
[AIAA PAPER 81-1918]   A82-10404
ROTARY GYROSCOPES
Fast and accurate gyrocompass using strapdown
tuned rotor gyros as a solution to combat
helicopters navigation problems
A82-11927
Design considerations for the direct digital
control of dry-tuned gyroscope
A82-11933
ROTARY WING AIRCRAFT
On computing Floquet transition matrices of
rotorcraft
A82-11225
ROTARY WINGS
Helicopter rotor trailing edge noise
[AIAA PAPER 81-2001]   A82-10455
Composite main rotor tubular braided
A82-10547
Model helicopter rotor impulsive noise
A82-11300
Numerical treatment of helicopter rotor stability
problems
A82-12045
Standard tests of a research model rotor in a wind
tunnel, including model similarity ---
calculations compared with measurements
[BMVG-FBWT-79-16]   N82-10016
Rotorcraft icing: Status and prospects
[AGARD-AR-166]   N82-11056
Operational environment, meteorological conditions
and weather forecasting
N82-11057
Technology base for icing instrumentation and
mathematical modelling
N82-11058
Facilities for development and clearance
N82-11059
Ice protection system technology
N82-11060
Proposed standard requirements and procedures for
icing clearance
N82-11061
Aeroacoustic theory for noncompact wing-gust
interaction
[FDRL-81-7]   N82-11071
Helicopter rotor trailing edge noise --- noise
prediction
[NASA-CR-3470]   N82-11859
ROTATING BODIES
The Shock and Vibration Digest, volume 13, no. 9
[AD-A105062]   N82-10421
ROTATING FLUIDS
A theoretical analysis of the stream surface of
revolution with supersonic inlet flow in a
transonic axial compressor
N82-11025

SOLAR POWERED AIRCRAFT
    Wings in the sun - The evolution of Solar Challenger
                                                A82-12694
SOLID ELECTRODES
    Unsolved problems of nickel cadmium batteries
                                                A82-11725
SOLID PROPELLANT COMBUSTION
    An investigation of the combustion process in
    solid fuel ramjets
    [AD-A104603]   N82-11232
SOLID PROPELLANTS
    An investigation of the combustion process in
    solid fuel ramjets
    [AD-A104603]   N82-11232
SONOBUOYS
    Aeroballistic characteristics of sonobuoy
    parachute decelerators limited to a length of
    three feet
    [AIAA PAPER 81-1950]   A82-10425
SOUND PRESSURE
    Evaluation of the acoustic measurement capability
    of the NASA Langley V/STOL wind tunnel open test
    section with acoustically absorbent ceiling and
    floor treatments
    [NASA-CR-165796]   N82-10059
SOUND TRANSMISSION
    Experimental modal analysis of the fuselage panels
    of an Aero Commander aircraft
    [NASA-CR-165750]   N82-10028
SPACE NAVIGATION
    National Aerospace Meeting, Trevose, PA, April
    8-10, 1981, Proceedings
                                                A82-12626
    Memory requirements for future navigation systems
                                                A82-12637
SPACE SHUTTLES
    The Space Shuttle vehicle checkout involving
    flight avionics software
    [AIAA 81-2141]   A82-10100
    Use of Space Shuttle technology in conventional
    aircraft
    [AIAA 81-2176]   A82-10125
SPACE VEHICLE CHECKOUT PROGRAM
    The Space Shuttle vehicle checkout involving
    flight avionics software
    [AIAA 81-2141]   A82-10100
SPACECRAFT CONSTRUCTION MATERIALS
    Powder metallurgy superalloys - Aerospace
    materials for the 1980's; Proceedings of the
    Conference, Zurich, Switzerland, November 18-20,
    1980. Volume 1
                                                A82-12495
SPACECRAFT CONTROL
    Synthesis of system for evaluating gyrostabilizer
    state with unknown disturbances
                                                A82-11469
SPACECRAFT DESIGN
    Control design of flexible spacecraft
                                                N82-11081
SPACECRAFT ELECTRONIC EQUIPMENT
    Bridging the gap from aircraft to space computers
    [AIAA 81-2142]   A82-10101
SPANWISE BLOWING
    A study on numerical method for evaluating
    spanwise integral in subsonic lifting-surface
    theory
    [NAL-TR-661T]   N82-11035
SPEED CONTROL
    Procedures and analysis techniques for determining
    static air minimum control speeds
                                                A82-12564
SPIN DYNAMICS
    A microprocessor-based data acquisition system for
    stall/spin research
    [AIAA 81-2177]   A82-10126
SPOILERS
    Theoretical investigation of the influence of
    spoiler dynamics on the handling qualities of an
    aircraft with direct lift control
    [ESA-TT-681]   N82-10036
    Development and evaluation of automatic landing
    control laws for light wing loading STOL aircraft
    [NASA-CR-166160]   N82-10043
    System identification of the longitudinal motion
    of the DFVLR HFB 320 research aircraft with
    particular consideration of control surface
    effectiveness
    [ESA-TT-666]   N82-10045

SPRAY NOZZLES
    The dispersion of drop sizes in gas turbine fuel
    nozzle sprays
                                                A82-12107
    Helicopter icing spray system - Improvements and
    flight experience
                                                A82-12696
STABILIZERS (AGENTS)
    On the use of carbon composites in slat and
    stabilizer construction
                                                A82-11468
STANDARDS
    Rotorcraft icing: Status and prospects
    [AGARD-AR-166]   N82-11056
    Proposed standard requirements and procedures for
    icing clearance
                                                N82-11061
STATE VECTORS
    Synthesis of system for evaluating gyrostabilizer
    state with unknown disturbances
                                                A82-11469
STEADY FLOW
    Finite difference computation of the steady
    transonic potential flow around airplanes
                                                N82-10981
STEADY STATE
    The effects of flexibility on the steady-state
    performance of small ribbon parachute models
    [AIAA PAPER 81-1923]   A82-10408
STIFFNESS MATRIX
    Formation of triangular-element stiffness matrix
    using sliding interpolation
                                                A82-11464
    An influence coefficient method for the
    application of the modal technique to wing
    flutter suppression of the DAST ARW-1 wing
    [NASA-CR-165772]   N82-11070
STOCHASTIC PROCESSES
    Synthesis of system for evaluating gyrostabilizer
    stat. with unknown disturbances
                                                A82-11469
    Theory of stochastic optimal control some basic
    notions
                                                N82-11075
    An introduction to stochasic optimal control theory
                                                N82-11076
STORAGE BATTERIES
    New separators for battery systems
                                                A82-11715
STORMS (METEOROLOGY)
    Applications of conventional and Doppler radars
    for aviation safety
                                                A82-10215
STRAPDOWN INERTIAL GUIDANCE
    Past and accurate gyrocompass using strapdown
    tuned rotor gyros as a solution to combat
    helicopters navigation problems
                                                A82-11927
    Design considerations for the direct digital
    control of dry-tuned gyroscope
                                                A82-11933
    Simulation study of a hybrid strapdown attitude
    and heading reference system
                                                A82-12641
    The integrated inertial sensor assembly /IISA/ - A
    redundant strapdown system for advanced aircraft
    navigation and flight control functions
                                                A82-12642
    Integrated satellite navigation and strapdown
    attitude and heading reference systems for civil
    air carriers
                                                A82-12643
STREAM FUNCTIONS (FLUIDS)
    An aerodynamic design method for transonic axial
    flow compressor stage
                                                N82-10984
STRESS ANALYSIS
    Lineup of the IM-series aircraft-derivative gas
    turbines
                                                A82-12560
    New molding method of three-dimensional hollow
    photoelastic model and centrifugal stress
    analysis of air cooled turbine blade model
    [NAL-TR-427T]   N82-11067
STRESS CORROSION CRACKING
    The application of improved aluminium alloys and
    steels in aircraft structures
                                                A82-10305

STRESS MEASUREMENT
   Stress measurements in a ribbon parachute canopy
   during inflation and at steady state
   [AIAA PAPER 81-1944]   A82-10420
   Stress measurements in bias constructed parachute
   canopies during inflation and at steady-state
   [AIAA PAPER 81-1945]   A82-10421
STRUCTURAL ANALYSIS
   Formation of triangular-element stiffness matrix
   using sliding interpolation
                                                     A82-11464
   Crack growth evaluation of a method to convert
   real-time loads history to a simplified
   engineering spectra --- for aircraft structural
   analysis
                                                     A82-12043
   Mathematical model for the maintenance program of
   modern jet aircraft --- crack detection;
   inspection intervals
   [DFVLR-FB-81-14]   N82-10002
   Structural analysis of fuselages with cutouts by
   finite element method
                                                     N82-10995
   Matrix analysis of wings
                                                     N82-10998
   Integrated analysis of engine
   [NASA-TM-82713]   N82-11491
   Structural analysis computer programs for rigid
   multicomponent pavement structures with
   discontinuities, WESLIQID and WESLAYER. Report
   1: Program development and numerical presentations
   [AD-A104545]   N82-11498
STRUCTURAL DESIGN
   Light aircraft structural design in non-metallics
   - Use of composite honeycomb for light aircraft
                                                     A82-10308
   Emerging technologies in aerospace structures,
   design, structural dynamics and materials;
   Proceedings of the Aerospace Conference, San
   Francisco, CA, August 13-15, 1980
                                                     A82-12026
   Determination of airplane model structure from
   flight data by using modified stepwise regression
   [NASA-TP-1916]   N82-10041
   Control design of flexible spacecraft
                                                     N82-11081
   Design of airport pavements for expansive soils
   [AD-A104660]   N82-11313
STRUCTURAL FAILURE
   A note on fatal aircraft accidents involving metal
   fatigue
                                                     A82-11400
STRUCTURAL INFLUENCE COEFFICIENTS
   An influence coefficient method for the
   application of the modal technique to wing
   flutter suppression of the DAST ARW-1 wing
   [NASA-CR-165772]   N82-11070
STRUCTURAL RELIABILITY
   Lineup of the IM-series aircraft-derivative gas
   turbines
                                                     A82-12560
STRUCTURAL STABILITY
   An influence coefficient method for the
   application of the modal technique to wing
   flutter suppression of the DAST ARW-1 wing
   [NASA-CR-165772]   N82-11070
STRUCTURAL STRAIN
   Optical sensors for displacement measurement
                                                     A82-11407
STRUCTURAL VIBRATION
   Helicopter engine technology - With particular
   reference to the Rolls-Royce Gem engine
                                                     A82-10304
   Lineup of the IM-series aircraft-derivative gas
   turbines
                                                     A82-12560
   New estimation method for flutter or divergence
   boundary from random responses at subcritical
   speeds
   [NAL-TR-667T]   N82-11034
SUBSONIC AIRCRAFT
   Air-freon integrated environmental conditioning
   system for trainer subsonic aircraft
   [ASME PAPER 81-ENAS-33]   A82-10920
SUBSONIC FLOW
   The use of the Weber method for
   minicomputer-assisted numerical analysis of
   airfoils
                                                     A82-10362

   Experimental study of subsonic and transonic flows
   past a wing
                                                     A82-10363
   Nonlinear prediction of subsonic aerodynamic loads
   on wings and bodies at high angles of attack
                                                     A82-11359
   Theoretical investigations and experimental
   researches for higher subsonic two-dimensional
   compressor cascade
                                                     N82-11024
   Aeroacoustic theory for noncompact wing-gust
   interaction
   [FDRL-81-7]   N82-11071
   On the kernel function collocation method in
   steady subsonic flow for wing with control
   surfaces
                                                     N82-12023
SUBSONIC WIND TUNNELS
   Subsonic cascade wind tunnel tests using a
   compressor configuration of DCA blades
   [AD-A104597]   N82-11069
SUCTION
   Amplified crossflow disturbances in the laminar
   boundary layer on swept wings with suction
   [NASA-TP-1902]   N82-11391
SUPERCRITICAL WINGS
   Propfan installation aerodynamics of a
   supercritical swept wing transport configuration
   [AIAA PAPER 81-1563]   A82-10466
   A comparison of theoretical and experimental
   pressure distributions for two advanced fighter
   wings
   [NASA-TM-81331]   N82-11054
SUPERSONIC AIRCRAFT
   Real-time, on-line digital simulation of optimum
   maneuvers of supersonic aircraft
   [AIAA 81-2178]   A82-10127
SUPERSONIC COMBUSTION RAMJET ENGINES
   Multiple-scale turbulence modeling of free
   turbulent flows
   [ASME PAPER 81-FE-20]   A82-10934
SUPERSONIC FLIGHT
   Optimal flight paths for winged, supersonic flight
   vehicles - Extension to the case where thrust
   can be vectored
                                                     A82-10310
SUPERSONIC INLETS
   A theoretical analysis of the stream surface of
   revolution with supersonic inlet flow in a
   transonic axial compressor
                                                     N82-11025
SUPERSONIC JET FLOW
   Multiple-scale turbulence modeling of free
   turbulent flows
   [ASME PAPER 81-FE-20]   A82-10934
SUPERSONIC SPEEDS
   The principles and methods for shaping the wing
   root regions of a wing-body combination at
   transonic and lower supersonic speeds
                                                     N82-11016
SURFACE LAYERS
   Results of experimental study of heat transfer to
   turbine blades with porous cooling
                                                     A82-11446
SURFACE PROPERTIES
   Design of airport pavements for expansive soils
   [AD-A104660]   N82-11313
SURFACE VEHICLES
   Characteristics and trends of energy consumption
   in transport missions with aircraft and surface
   vehicles
                                                     A82-10495
SURFACES
   A study on numerical method for evaluating
   spanwise integral in subsonic lifting-surface
   theory
   [NAL-TR-661T]   N82-11035
SURGES
   High voltage surge and partial discharge test to
   evaluate aerospace equipment parts
                                                     A82-11740
SURVEILLANCE RADAR
   Airborne associative processor /ASPRO/ --- for
   early warning radar surveillance, command, and
   control applications
   [AIAA 81-2145]   A82-10104

THERMAL PROTECTION
    The Shock and Vibration Digest, volume 13, no. 9
    [AD-A105062]   N82-10421
THERMAL RESISTANCE
    Design analysis of high temperature transparent
    windshields for high performance aircraft
    [ASME PAPER 81-ENAS-5]   A82-10893
    Thermal-barrier-coated turbine blade study
    [NASA-CR-165351]   N82-10040
THERMAL SIMULATION
    A new thermal and trajectory model for high
    altitude balloons
    [AIAA PAPER 81-1926]   A82-10411
THERMOCOUPLES
    In-situ calibration of flight heat transfer
    instrumentation
    [ASME PAPER 81-ENAS-13]   A82-10901
THERMODYNAMIC PROPERTIES
    Basic problem of aircraft gasturbine engine
    analytic design. II
                                               A82-11463
THREE DIMENSIONAL FLOW
    Acta mechanica sinica
    [AD-A105184]   N82-11014
    The arbitrary quasi-orthogonal surface method for
    computing three-dimensional flow in turbine
    machinery. 2. Calculation of the
    three-dimensional flow with the S sub 1-surface
    twisted
                                               N82-11015
    A theoretical analysis of the stream surface of
    revolution with supersonic inlet flow in a
    transonic axial compressor
                                               N82-11025
    A numerical three-dimensional turbulent simulation
    of a subsonic VSTOL jet in a cross-flow using a
    finite element algorithm
    [AD-A104514]   N82-11055
    Aeroacoustic theory for noncompact wing-gust
    interaction
    [PDRL-81-7]   N82-11071
THREE DIMENSIONAL MOTION
    On the question of trailing airplane motion
                                               A82-11470
THRUST CONTROL
    V/STOL aircraft and fluid dynamics
    [NASA-TM-81328]   N82-10029
THRUST REVERSAL
    Study of reingestion of exhaust gases with
    different initial temperature in a reversed
    turbojet engine
                                               A82-11444
THRUST VECTOR CONTROL
    Optimal flight paths for winged, supersonic flight
    vehicles - Extension to the case where thrust
    can be vectored
                                               A82-10310
    Developments in boundary layer Thrust Vector Control
                                               A82-10855
TIME
    SEL and EPNL noise duration coefficients for the
    747 and T-38 aircraft
    [NASA-TM-83214]   N82-11860
TIME LAG
    Hard limited approaches to correlation velocity
    sensing
                                               A82-12636
TIME OPTIMAL CONTROL
    LQG-based multivariable design: Frequency domain
    interpretation
                                               N82-10053
TITANIUM ALLOYS
    Sophisticated aircraft structure developments -
    Combat aeroplanes
                                               A82-10309
TOUCHDOWN
    Comparative study of flare control laws
    [NASA-CR-164903]   N82-10032
TRACKING RADAR
    Synthetic aperture radar target simulator
    [NASA-CASE-NPO-15024-1]   N82-10286
TRADEOFFS
    Active control elements on the transonic wing of
    the Airbus A-300 (ACTTA A). Airbus A-300 with
    reduced longitudinal stability (ACTTA-C) ---
    advanced control transonic transport aircraft
    (ACCTA); design considerations
                                               N82-10044

TRAILING EDGES
    Helicopter rotor trailing edge noise
    [AIAA PAPER 81-2001]   A82-10455
    Aircraft wing trailing-edge noise
    [NASA-CR-164952]   N82-11039
    Helicopter rotor trailing edge noise --- noise
    prediction
    [NASA-CR-3470]   N82-11859
TRAILING-EDGE FLAPS
    On evaluating the influence of local disruptions
    of flow over trailing edge and leading edge
    flaps from the data of wind tunnel tests of a
    rectangular wing segment
                                               A82-11465
    System identification of the longitudinal motion
    of the DFVLR HFB 320 research aircraft with
    particular consideration of control surface
    effectiveness
    [ESA-TT-666]   N82-10045
TRAINING AIRCRAFT
    Air-freon integrated environmental conditioning
    system for trainer subsonic aircraft
    [ASME PAPER 81-ENAS-33]   A82-10920
TRAJECTORY ANALYSIS
    A new thermal and trajectory model for high
    altitude balloons
    [AIAA PAPER 81-1926]   A82-10411
TRAJECTORY CONTROL
    Flight trajectory control investigation
    [AD-A104542]   N82-11048
    Optimum climb and descent trajectories for airline
    missions
                                               N82-11082
TRAJECTORY OPTIMIZATION
    Optimal flight paths for winged, supersonic flight
    vehicles - Extension to the case where thrust
    can be vectored
                                               A82-10310
TRANSFER FUNCTIONS
    Limitations on achievable performance of
    multivariable feedback systems
                                               N82-10052
TRANSONIC COMPRESSORS
    A theoretical analysis of the stream surface of
    revolution with supersonic inlet flow in a
    transonic axial compressor
                                               N82-11025
TRANSONIC FLOW
    Experimental study of subsonic and transonic flows
    past a wing
                                               A82-10363
    Strong matching method for computing transonic
    viscous flows including wakes and separations -
    Lifting airfoils
                                               A82-10821
    Finite difference computation of the steady
    transonic potential flow around airplanes
                                               N82-10981
    A comparison of theoretical and experimental
    pressure distributions for two advanced fighter
    wings
    [NASA-TM-81331]   N82-11054
TRANSONIC SPEED
    The principles and methods for shaping the wing
    root regions of a wing-body combination at
    transonic and lower supersonic speeds
                                               N82-11016
TRANSONIC WIND TUNNELS
    Design predictions for noise control in the
    cryogenic National Transonic Facility
                                               A82-12025
TRANSPONDERS
    Threat Alert and Collision Avoidance System (TCAS)
    Symposium
    [AD-A104563]   N82-11047
TRANSPORT AIRCRAFT
    Propfan installation aerodynamics of a
    supercritical swept wing transport configuration
    [AIAA PAPER 81-1563]   A82-10466
    Characteristics and trends of energy consumption
    in transport missions with aircraft and surface
    vehicles
                                               A82-10495
    Towards minimum power for environmental control in
    transport aircraft
    [ASME PAPER 81-ENAS-4]   A82-10892
    Fuel for future transport aircraft
    [ASME PAPER 81-HT-80]   A82-10965

History of flight testing the L-1011 TriStar jet
transport. II - Testing highlights since initial
certification of the L-1011-1
A82-12049
Theoretical investigation of the influence of
spoiler dynamics on the handling qualities of an
aircraft with direct lift control
[ESA-TT-681] N82-10036
Propulsion study for Small Transport Aircraft
Technology (STAT)
[NASA-CR-165499] N82-10037
Propulsion study for Small Transport Aircraft
Technology (STAT), Appendix B
[NASA-CR-165499-APP-B] N82-10038
Control law design for transport aircraft flight
tasks
N82-11080
TRAPEZOIDAL WINGS
Experimental study of subsonic and transonic flows
past a wing
A82-10363
TUBE HEAT EXCHANGERS
The enhancement of heat exchange in channels /2nd
revised and enlarged edition/ --- Russian book
A82-12222
TURBINE BLADES
Thermal and flow analysis of a convection,
air-cooled ceramic coated porous metal concept
for turbine vanes
[ASME PAPER 81-HT-48] A82-10952
End losses in turbine cascades with porous cooling
A82-11434
Results of experimental study of heat transfer to
turbine blades with porous cooling
A82-11446
Thermal-barrier-coated turbine blade study
[NASA-CR-165351] N82-10040
A new method of cooling turbine vanes
N82-11027
New molding method of three-dimensional hollow
photoelastic model and centrifugal stress
analysis of air cooled turbine blade model
[NAL-TR-427T] N82-11067
TURBINE ENGINES
Superalloy turbine components - Which is the
superior manufacturing process, as-HIP, HIP plus
Isoforge, or 'gatorizing' of extrusion
consolidated billet
A82-12497
Superalloy powder engine components; controls
employed to assure high quality hardware
A82-12499
Development of multivariable controllers for
aircraft turbine engines
N82-11087
TURBOCOMPRESSORS
Wind tunnel tests on airfoils in tandem cascade
A82-10987
An aerodynamic design method for transonic axial
flow compressor stage
N82-10984
Initial experimental research into the response of
turbojet engine compressors to distortion of
intake pressure
N82-11006
An experimental investigation of the rotating
stall, surge and wake behind the rotor for a
single stage axial compressor
N82-11008
A theoretical analysis of the stream surface of
revolution with supersonic inlet flow in a
transonic axial compressor
N82-11025
TURBOFAN ENGINES
Rotor wake characteristics relevant to
rotor-stator interaction noise generation
[AIAA PAPER 81-2031] A82-10456
Application of numerical modeling to gas turbine
combustor development problems
A82-12118
An assessment of the use of antimisting fuel in
turbofan engines
[NASA-CR-165258] N82-11230
TURBOJET ENGINES
Study of reingestion of exhaust gases with
different initial temperature in a reversed
turbojet engine
A82-11444

Initial experimental research into the response of
turbojet engine compressors to distortion of
intake pressure
N82-11006
A preliminary experimental investigation of the
response of a turbojet engine to inlet pressure
distortion
N82-11007
TURBOMACHINE BLADES
Calculation of natural modes of vibration for
rotor blades by the finite element method
[DFVLR-FB-81-07] N82-10452
TURBOMACHINERY
Acta mechanica sinica
[AD-A105184] N82-11014
The arbitrary quasi-orthogonal surface method for
computing three-dimensional flow in turbine
machinery. 2. Calculation of the
three-dimensional flow with the S sub 1-surface
twisted
N82-11015
TURBOPROP ENGINES
Propulsion study for Small Transport Aircraft
Technology (STAT)
[NASA-CR-165499] N82-10037
TURBULENT BOUNDARY LAYER
Theoretical investigations and experimental
researches for higher subsonic two-dimensional
compressor cascade
N82-11024
TURBULENT FLOW
Multiple-scale turbulence modeling of free
turbulent flows
[ASME PAPER 81-FE-20] A82-10934
On the prediction of swirling flowfields found in
axisymmetric combustor geometries
A82-12120
Validation studies of turbulence and combustion
models for aircraft gas turbine combustors
A82-12267
A new method of cooling turbine vanes
N82-11027
Wind-tunnel results for a modified
17-percent-thick low-speed airfoil section
[NASA-TP-1919] N82-11033
A numerical three-dimensional turbulent simulation
of a subsonic VSTOL jet in a cross-flow using a
finite element algorithm
[AD-A104514] N82-11055
TURBULENT WAKES
Reductions in parachute drag due to forebody wake
effects
[AIAA PAPER 81-1939] A82-10417
Rotor wake characteristics relevant to
rotor-stator interaction noise generation
[AIAA PAPER 81-2031] A82-10456
TWO DIMENSIONAL FLOW
Control laws for adaptive wind tunnels
A82-10985
An aerodynamic design method for transonic axial
flow compressor stage
N82-10984
Theoretical investigations and experimental
researches for higher subsonic two-dimensional
compressor cascade
N82-11024

U

UH-1 HELICOPTER
Helicopter icing spray system - Improvements and
flight experience
A82-12696
ULTRAHIGH FREQUENCIES
A mathematical model of an over-sea airborne UHF
radio link
A82-11406
UNDERCARRIAGES
Analytical determination of undercarriage
retraction kinematics
A82-10364
UNSTEADY FLOW
An experimental investigation of the rotating
stall, surge and wake behind the rotor for a
single stage axial compressor
N82-11008

UPPER SURFACE BLOWING

UPPER SURFACE BLOWING
Quiet short-haul research aircraft familiarization
document, revision 1
[NASA-TM-81298]   N82-10031

V

V/STOL AIRCRAFT
V/STOL aircraft and fluid dynamics
[NASA-TM-81328]   N82-10029
Low speed testing of the inlets designed for a
tamden-fan V/STOL nacelle --- conducted in the
Lewis 10 by 10 foot wind tunnel
[NASA-TM-82728]   N82-11042
A summary of V/STOL inlet analysis methods
[NASA-TM-82725]   N82-11043
A numerical three-dimensional turbulent simulation
of a subsonic VSTOL jet in a cross-flow using a
finite element algorithm
[AD-A104514]   N82-11055
VARIABILITY
Characteristic and principal gains and phases and
their use as multivariable control design tools
--- generalizing Nyquist and root-locus diagram
techniques
                                                   N82-10050
Multivariable design techniques based on singular
value generalizations of classical control
                                                   N82-10051
VELOCITY DISTRIBUTION
Aerodynamic calculations and design of subcritical
aerofoils
                                                   N82-10983
VELOCITY MEASUREMENT
Hard limited approaches to correlation velocity
sensing
                                                   A82-12636
VERTICAL AIR CURRENTS
Downbursts and microbursts - An aviation hazard
--- downdrafts beneath thunderstorms
                                                   A82-10214
VERTICAL DISTRIBUTION
Determination of vertical profiles of aerosol size
spectra from aircraft radiative flux
measurements. II - The effect of particle
nonsphericity
                                                   A82-12149
VERY LOW FREQUENCIES
Omega station 10.2 kHz signal selection made easy
                                                   A82-12638
VIBRATION DAMPING
'Quiet please' --- aircraft hydraulic systems
noise reduction
                                                   A82-10854
Polyurethane foams for aircraft shock mounts. 3:
Vibration damping by polyether foams
[AD-A104496]   N82-11212
VIBRATION EFFECTS
The Shock and Vibration Digest, volume 13, no. 9
[AD-A105062]   N82-10421
VIBRATION ISOLATORS
The possibility of using deformable rubber
components in landing gear
                                                   A82-10496
Polyurethane foams for aircraft shock mounts. 3:
Vibration damping by polyether foams
[AD-A104496]   N82-11212
VIBRATION MODE
Applications of finite element method in aerospace
power systems design
                                                   A82-11717
Calculation of natural modes of vibration for
rotor blades by the finite element method
[DFVLR-FB-81-07]   N82-10452
VIBRATION TESTS
The Shock and Vibration Digest, volume 13, no. 9
[AD-A105062]   N82-10421
VIBRATORY LOADS
Lineup of the IM-series aircraft-derivative gas
turbines
                                                   A82-12560
VIDEO EQUIPMENT
Tangential sensitivity of EW receivers
                                                   A82-11020
VISCOUS FLOW
Strong matching method for computing transonic
viscous flows including wakes and separations -
Lifting airfoils
                                                   A82-10821

VORTEX FLAPS
Effects of vortex flaps on the low-speed
aerodynamic characteristics of an arrow wing
[NASA-TP-1914]   N82-11013
VORTICES
Increasing the lift:drag ratio of a flat delta wing
                                                   A82-11899
The CIVIC - A concept in vortex induced
combustion. II
[ASME PAPER 81-GT-12]   A82-11997

W

WALL FLOW
Control laws for adaptive wind tunnels
                                                   A82-10985
WARNING SYSTEMS
An airport wind shear detection and warning system
using Doppler radar
                                                   A82-10220
Threat Alert and Collision Avoidance System (TCAS)
Symposium
[AD-A104563]   N82-11047
WAVE DIFFRACTION
Acta mechanica sinica
[AD-A105184]   N82-11014
WAVE REFLECTION
Acta mechanica sinica
[AD-A105184]   N82-11014
WEAPON SYSTEMS
Quantification of the thermal environment for
externally carried aircraft stores and ordnance
                                                   A82-12100
WEATHER FORECASTING
Operational environment, meteorological conditions
and weather forecasting
                                                   N82-11057
WIND DIRECTION
Gust front structure observed by Doppler radar
                                                   A82-10223
WIND MEASUREMENT
Detection and display of wind shear and turbulence
                                                   A82-10222
WIND SHEAR
An airport wind shear detection and warning system
using Doppler radar
                                                   A82-10220
Instrumented aircraft verification of clear-air
radar detection of low-level wind shear
                                                   A82-10221
Detection and display of wind shear and turbulence
                                                   A82-10222
Comparative study of flare control laws
[NASA-CR-164903]   N82-10032
WIND TUNNEL DRIVES
Design predictions for noise control in the
cryogenic National Transonic Facility
                                                   A82-12025
WIND TUNNEL TESTS
A modular asymmetric parachute for wind tunnel
testing
[AIAA PAPER 81-1933]   A82-10414
Stress measurements in a ribbon parachute canopy
during inflation and at steady state
[AIAA PAPER 81-1944]   A82-10420
Wind tunnel tests on airfoils in tandem cascade
                                                   A82-10987
Standard tests of a research model rotor in a wind
tunnel, including model similarity ---
calculations compared with measurements
[BMVG-FBWT-79-16]   N82-10016
Experimental investigations of the separated flow
around a rectangular wing --- in a wind tunnel
[DFVLR-FB-81-12]   N82-10017
Effects of vortex flaps on the low-speed
aerodynamic characteristics of an arrow wing
[NASA-TP-1914]   N82-11013
Wind-tunnel results for a modified
17-percent-thick low-speed airfoil section
[NASA-TP-1919]   N82-11033
Icing tunnel tests of a composite porous leading
edge for use with a liquid anti-ice system ---
Lewis icing research tunnel
[NASA-CR-164966]   N82-11052
Subsonic cascade wind tunnel tests using a
compressor configuration of DCA blades
[AD-A104597]   N82-11069

Helicopter rotor trailing edge noise --- noise
   prediction
   [NASA-CR-3470]   N82-11859
WIND TUNNEL WALLS
   Control laws for adaptive wind tunnels
                                            A82-10985
   On low-speed wind tunnels with deformable boundaries
                                            A82-11462
WIND TUNNELS
   Evaluation of the acoustic measurement capability
      of the NASA Langley V/STOL wind tunnel open test
      section with acoustically absorbent ceiling and
      floor treatments
   [NASA-CR-165796]   N82-10059
WIND VELOCITY
   Gust front structure observed by Doppler radar
                                            A82-10223
WINDSHIELDS
   Design analysis of high temperature transparent
      windshields for high performance aircraft
   [ASME PAPER 81-ENAS-5]   A82-10893
WING FLAPS
   Increasing the lift:drag ratio of a flat delta wing
                                            A82-11899
WING FLOW METHOD TESTS
   Experimental study of subsonic and transonic flows
      past a wing
                                            A82-10363
WING LOADING
   Nonlinear prediction of subsonic aerodynamic loads
      on wings and bodies at high angles of attack
                                            A82-11359
   On the question of trailing airplane motion
                                            A82-11470
   A study on numerical method for evaluating
      spanwise integral in subsonic lifting-surface
      theory
   [NAL-TR-661T]   N82-11035
   Aeroacoustic theory for noncompact wing-gust
      interaction
   [PDRL-81-7]   N82-11071
WING OSCILLATIONS
   Experimental study of empennage snap-through
      vibrations
                                            A82-11471
WING PANELS
   Formation of triangular-element stiffness matrix
      using sliding interpolation
                                            A82-11464
WING PROFILES
   An influence coefficient method for the
      application of the modal technique to wing
      flutter suppression of the DAST ARW-1 wing
   [NASA-CR-165772]   N82-11070
WING ROOTS
   Acta mechanica sinica
   [AD-A105184]   N82-11014
   The principles and methods for shaping the wing
      root regions of a wing-body combination at
      transonic and lower supersonic speeds
                                            N82-11016
WING TANKS
   Experimental study of fuel heating at low
      temperatures in a wing tank model, volume 1
   [NASA-CR-165391]   N82-11224
WINGS
   Aircraft wing trailing-edge noise
   [NASA-CR-164952]   N82-11039
   On the kernel function collocation method in
      steady subsonic flow for wing with control
      surfaces
                                            N82-12023

X

X WING ROTORS
   An investigation of a stoppable helicopter rotor
      with circulation control --- ames 40 by 80 foot
      wind tunnel
   [NASA-TM-81218]   N82-10030

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing

| PERSONAL AUTHOR |

ADAMS, R. E. W.
Radar mapping, archaeology, and ancient land use
in the Maya lowlands
[NASA-CR-164931]   N82-11514

| TITLE | | REPORT NUMBER | | NASA ACCESSION NUMBER |
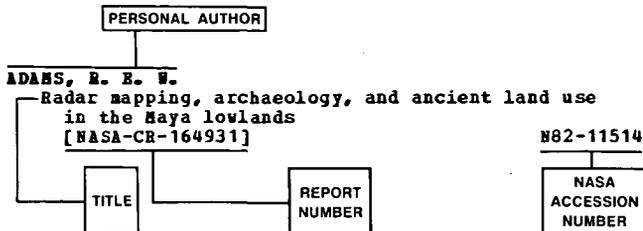
Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The accession number is located beneath and to the right of the title, e.g., N82-11514. Under any one author's name the accession numbers are arranged in sequence with the *IAA* accession numbers appearing first.

A

ADAM, V.
Control law design for transport aircraft flight
tasks
N82-11080
ADAMS, R. E. W.
Radar mapping, archaeology, and ancient land use
in the Maya lowlands
[NASA-CR-164931]   N82-11514
AGLIULLIN, I. N.
Basic problem of aircraft gasturbine engine
analytic design. II
A82-11463
AKENTEV, V. G.
Calculation of aerodynamic characteristics of jet
flapped airplane
A82-11459
AKHTER, H. H.
Development of multivariable controllers for
aircraft turbine engines
N82-11087
AKHTIAMOV, Z. V.
Study of reingestion of exhaust gases with
different initial temperature in a reversed
turbojet engine
A82-11444
ALBRIGHT, A. E.
Icing tunnel test of a glycol-exuding porous
leading edge ice protection system on a general
aviation airfoil
[NASA-CR-165444]   N82-10021
ALLRAMSEDER, E.
Standard tests of a research model rotor in a wind
tunnel, including model similarity
[BMVG-FBWT-79-16]   N82-10016
ALM, A.
Lightning effects on aircraft and composites.
Literature study on lightning strikes and
protection
[FOA-C-20388-F9]   N82-10024
AMIER, R. K.
Helicopter rotor trailing edge noise
[NASA-CR-3470]   N82-11859
AMIET, R. K.
Helicopter rotor trailing edge noise
[AIAA PAPER 81-2001]   A82-10455
ANDERSON, S. B.
V/STOL aircraft and fluid dynamics
[NASA-TM-81328]   N82-10029

ANDO, Y.
New estimation method for flutter or divergence
boundary from random responses at subcritical
speeds
[NAL-TR-667T]   N82-11034
ANDRIANO, H.
Air-freon integrated environmental conditioning
system for trainer subsonic aircraft
[ASME PAPER 81-ENAS-33]   A82-10920
ARCHDEACON, J. L.
KC-135 Avionics Modernization Hot Bench
[AIAA 81-2105]   A82-10081
ARIPULIN, A. C.
Jet fuel from carbon
A82-12021
ASHER, P.
A solution to the static geometry problem for
JTIDS relative navigation
A82-12634
ATKINSON, G. P.
Air supply system bite for Boeing 767 airplane
[ASME PAPER 81-ENAS-7]   A82-10895

B

BABISH, C. A., III
Design analysis of high temperature transparent
windshields for high performance aircraft
[ASME PAPER 81-ENAS-5]   A82-10893
BACHMAN, K. L.
Ring Laser Gyro Navigator /RLGN/ flight test results
A82-12644
BAILEY, C. D.
Acoustic emission - An emerging technology for
assessing fatigue damage in aircraft structure
A82-11149
BAILEY, R. E.
Analysis of augmented aircraft flying qualities
through application of the Neal-Smith criterion
[AIAA PAPER 81-1776]   A82-10462
BAKER, A. J.
A numerical three-dimensional turbulent simulation
of a subsonic VSTOL jet in a cross-flow using a
finite element algorithm
[AD-A104514]   N82-11055
BALASUBRAMANIAN, T. S.
Numerical treatment of helicopter rotor stability
problems
A82-12045
BALBUKH, V. V.
Control of electromechanical actuator elements for
flight vehicles
A82-12170
BALLARD, J. D.
An investigation of a stoppable helicopter rotor
with circulation control
[NASA-TM-81218]   N82-10030
BALOMBIN, J. R.
Rotor wake characteristics relevant to
rotor-stator interaction noise generation
[AIAA PAPER 81-2031]   A82-10456
BARBE, I.
Quantification of the thermal environment for
externally carried aircraft stores and ordnance
A82-12100
BATTERSON, J. G.
Determination of airplane model structure from
flight data by using modified stepwise regression
[NASA-TP-1916]   N82-10041
Estimation of airplane stability and control
derivatives from large amplitude longitudinal
maneuvers
[NASA-TM-83185]   N82-10042

CHEN, C.
Superalloy turbine components - Which is the
superior manufacturing process, as-HIP, HIP plus
Isoforge, or 'gatorizing' of extrusion
consolidated billet
                                                    A82-12497
CHIA, F. I.
The principles and methods for shaping the wing
root regions of a wing-body combination at
transonic and lower supersonic speeds
                                                    N82-11016
CHOU, Y. T.
Structural analysis computer programs for rigid
multicomponent pavement structures with
discontinuities, WESLIQID and WESLAYER. Report
1: Program development and numerical presentations
[AD-A104545]   N82-11498
CICOLANI, L.
Application of nonlinear systems inverses to
automatic flight control design: System
concepts and flight evaluations
                                                    N82-11083
CINA, F. S.
Subsonic cascade wind tunnel tests using a
compressor configuration of DCA blades
[AD-A104597]   N82-11069
CLARK, J. F.
The evolution of airborne weather avoidance radar
toward a calibrated remote rain gauge using REACT
                                                    A82-10225
CLINE, M. C.
Computation of high Reynolds number
internal/external flows
[NASA-TM-84049]   N82-11046
COCKRELL, D. J.
Aerodynamics and performance of cruciform
parachute canopies
[AIAA PAPER 81-1919]   A82-10405
Experimental determination of parachute apparent
mass and its significance in predicting dynamic
stability
[AIAA PAPER 81-1920]   A82-10406
COUTS, W. H.
Superalloy turbine components - Which is the
superior manufacturing process, as-HIP, HIP plus
Isoforge, or 'gatorizing' of extrusion
consolidated billet
                                                    A82-12497
COWLEY, M.
Wings in the sun - The evolution of Solar Challenger
                                                    A82-12694
COX, S. K.
Determination of vertical profiles of aerosol size
spectra from aircraft radiative flux
measurements. II - The effect of particle
nonsphericity
                                                    A82-12149
COYNE, J.
Superalloy turbine components - Which is the
superior manufacturing process, as-HIP, HIP plus
Isoforge, or 'gatorizing' of extrusion
consolidated billet
                                                    A82-12497
COYNE, J. E.
Superalloy powder engine components: controls
employed to assure high quality hardware
                                                    A82-12499
CROLL, R. H.
A modular asymmetric parachute for wind tunnel
testing
[AIAA PAPER 81-1933]   A82-10414
CROW, R. P.
Discrete address beacon, navigation and landing
system
                                                    A82-10650
CULBERT, T. P.
Radar mapping, archaeology, and ancient land use
in the Maya lowlands
[NASA-CR-164931]   N82-11514
CZYZEWSKI, K.
The use of the Weber method for
minicomputer-assisted numerical analysis of
airfoils
                                                    A82-10362

D

DAGENHART, J. R.
Amplified crossflow disturbances in the laminar
boundary layer on swept wings with suction
[NASA-TP-1902]   N82-11391
DAGOSTINO, V.
New separators for battery systems
                                                    A82-11715
DAINTY, R. V.
Fractographic determination of fatigue crack
growth rates in aircraft components
                                                    A82-12697
DEGANI, O.
Development and evaluation of automatic landing
control laws for light wing loading STOL aircraft
[NASA-CR-166160]   N82-10043
DEGUEST, P.
Adaptation of a turbine test facility to
high-temperature research
[RAE-LIB-TRANS-2064]   N82-11089
DEHOPF, R. L.
Development of multivariable controllers for
aircraft turbine engines
                                                    N82-11087
DESARO, R.
An assessment of the use of antimisting fuel in
turbofan engines
[NASA-CR-165258]   N82-11230
DEZIDERREV, S. G.
Results of experimental study of heat transfer to
turbine blades with porous cooling
                                                    A82-11446
DI-YI, T.
Initial experimental research into the response of
turbojet engine compressors to distortion of
intake pressure
                                                    N82-11006
A preliminary experimental investigation of the
response of a turbojet engine to inlet pressure
distortion
                                                    N82-11007
DIEQIAN, W.
Finite difference computation of the steady
transonic potential flow around airplanes
                                                    N82-10981
DIGIACINTO, T.
Airborne associative processor /ASPRO/
[AIAA 81-2145]   A82-10104
DIPASQUO, M. S.
The integrated inertial sensor assembly /IISA/ - A
redundant strapdown system for advanced aircraft
navigation and flight control functions
                                                    A82-12642
DONALDSON, R. J., JR.
Gust front structure observed by Doppler radar
                                                    A82-10223
DOVIAK, R. J.
An airport wind shear detection and warning system
using Doppler radar
                                                    A82-10220
Instrumented aircraft verification of clear-air
radar detection of low-level wind shear
                                                    A82-10221
DOWELL, E. H.
Control laws for adaptive wind tunnels
                                                    A82-10985
DOYLE, J. C.
Multivariable design techniques based on singular
value generalizations of classical control
                                                    N82-10051
Limitations on achievable performance of
multivariable feedback systems
                                                    N82-10052
DREITSER, G. A.
The enhancement of heat exchange in channels /2nd
revised and enlarged edition/
                                                    A82-12222
DUFFY, J. V.
Polyurethane foams for aircraft shock mounts. 3:
Vibration damping by polyether foams
[AD-A104496]   N82-11212
DUGRANBUT, J. D.
Description of the meteorological research radar
system aboard NOAA/Research Facilities Center
WP-3D aircraft
                                                    A82-10217

DUNBAR, W. G.
  High voltage surge and partial discharge test to
    evaluate aerospace equipment parts
                                        A82-11740
DUNN, G. L.
  Advanced aircraft electrical system control
    technology demonstrator. Phase 1: Requirements
    analysis and conceptual design
    [AD-A103922]   N82-10326

E

EARLE, R. V.
  Propulsion study for Small Transport Aircraft
    Technology (STAT)
    [NASA-CR-165499]   N82-10037
EARLS, M. R.
  HiMAT onboard flight computer system architecture
    and qualification
    [AIAA 81-2107]   A82-10082
EATON, H. E.
  Development of low modulus material for use in
    ceramic gas path seal applications
    [NASA-CR-165469]   N82-10039
EISWIRTH, E. A.
  In-situ calibration of flight heat transfer
    instrumentation
    [ASME PAPER 81-ENAS-13]   A82-10901
ELMORE, K. L.
  An airport wind shear detection and warning system
    using Doppler radar
                                        A82-10220
  Instrumented aircraft verification of clear-air
    radar detection of low-level wind shear
                                        A82-10221
ENGBLOM, J. J.
  Coupled fluid/structure response predictions for
    soft body impact of airfoil configurations
                                        A82-12039
EPIPANOV, V. M.
  End losses in turbine cascades with porous cooling
                                        A82-11434
EPPEL, J. C.
  Quiet short-haul research aircraft familiarization
    document, revision 1
    [NASA-TM-81298]   N82-10031
ERNSTOFF, M. N.
  Study and development of an integrated head-up
    display
    [AD-A104337]   N82-11062
ERZBERGER, H.
  Optimum climb and descent trajectories for airline
    missions
                                        N82-11082
ESPOSITO, R. J.
  FAA acceptance tests on the NAVSTAR GPS Z-Set
    receiver
                                        A82-12639
EVERETT, W. H.
  Superalloy powder engine components; controls
    employed to assure high quality hardware
                                        A82-12499

F

FABRIS, G.
  Multiple-scale turbulence modeling of free
    turbulent flows
    [ASME PAPER 81-FE-20]   A82-10934
FANGYHAN, Z.
  An aerodynamic design method for transonic axial
    flow compressor stage
                                        N82-10984
FEDORAK, R.
  Memory requirements for future navigation systems
                                        A82-12637
FEIDA, F.
  An aerodynamic design method for transonic axial
    flow compressor stage
                                        N82-10984
FEINREICH, B.
  Development and evaluation of automatic landing
    control laws for light wing loading STOL aircraft
    [NASA-CR-166160]   N82-10043
FERKO, R. J.
  Crack growth evaluation of a method to convert
    real-time loads history to a simplified
    engineering spectra
                                        A82-12043

FIORENTINO, A.
  An assessment of the use of antimisting fuel in
    turbofan engines
    [NASA-CR-165258]   N82-11230
FITZGERALD, R. E.
  Developments in boundary layer Thrust Vector Control
                                        A82-10855
FITZSIMONS, R. D.
  How large should a commuter transport be
    [AIAA PAPER 81-1732]   A82-10463
FORSYTH, T. J.
  An investigation of a stoppable helicopter rotor
    with circulation control
    [NASA-TM-81218]   N82-10030
FRANCIS, B. A.
  Feedback and minimax sensitivity
                                        N82-10058
FRANCOIS, J.
  Adaptation of a turbine test facility to
    high-temperature research
    [RAE-LIB-TRANS-2064]   N82-11089
  Effects of aircraft noise on the equilibrium of
    airport residents: Testing and utilization of a
    new methodology
    [NASA-TM-76628]   N82-11636
FRANZ, T.
  An assessment of the use of antimisting fuel in
    turbofan engines
    [NASA-CR-165258]   N82-11230
FREYMANN, R.
  A method for determination of the aeroelastic
    behavior of aircraft with active control systems
    [DFVLR-FB-81-05]   N82-10047
FROST, W.
  An airport wind shear detection and warning system
    using Doppler radar
                                        A82-10220
FU-QUN, C.
  Initial experimental research into the response of
    turbojet engine compressors to distortion of
    intake pressure
                                        N82-11006
  A preliminary experimental investigation of the
    response of a turbojet engine to inlet pressure
    distortion
                                        N82-11007
FUJITA, T. T.
  Downbursts and microbursts - An aviation hazard
                                        A82-10214

G

GABRIELLI, G.
  Characteristics and trends of energy consumption
    in transport missions with aircraft and surface
    vehicles
                                        A82-10495
GALDA, K. H.
  Mathematical model for the maintenance program of
    modern jet aircraft
    [DFVLR-FB-81-14]   N82-10002
GAONKAR, G. H.
  On computing Floquet transition matrices of
    rotorcraft
                                        A82-11225
GARRARD, W. L.
  The effects of flexibility on the steady-state
    performance of small ribbon parachute models
    [AIAA PAPER 81-1923]   A82-10408
  Stress measurements in a ribbon parachute canopy
    during inflation and at steady state
    [AIAA PAPER 81-1944]   A82-10420
  Stress measurements in bias constructed parachute
    canopies during inflation and at steady-state
    [AIAA PAPER 81-1945]   A82-10421
GARRETT, W. A.
  ACMA - Fact or fantasy
                                        A82-12048
GATINEAU, R. J.
  History of flight testing the L-1011 TriStar jet
    transport. II - Testing highlights since initial
    certification of the L-1011-1
                                        A82-12049
GEISLER, D.
  Experimental modal analysis of the fuselage panels
    of an Aero Commander aircraft
    [NASA-CR-165750]   N82-10028

GERSHTEIN, M. I.
Experimental study of empennage snap-through
vibrations
A82-11471

GEVAERT, G.
Development and evaluation of automatic landing
control laws for light wing loading STOL aircraft
[NASA-CR-166160]   N82-10043

GILIAZOV, N. SH.
Study of reingestion of exhaust gases with
different initial temperature in a reversed
turbojet engine
A82-11444

GILL, P. R.
Design considerations for optimal flight control
systems
N82-11077

GILL, J. C.
Propulsion study for Small Transport Aircraft
Technology (STAT)
[NASA-CR-165499]   N82-10037

GILBRATH, N. C.
General aviation aircraft antennas for the global
positioning system
[NASA-TM-83212]   N82-11339

GIRARD, L. A., JR.
Air bag impact attenuation system for the AQM-34V
remote piloted vehicle
[AIAA PAPER 81-1917]   A82-10403

GLIEBE, P. R.
Effects of vane/blade ratio and spacing on fan noise
[AIAA PAPER 81-2033]   A82-10457

GOETTING, H. C.
Mathematical model for the maintenance program of
modern jet aircraft
[DFVLR-PB-81-14]   N82-10002

GOLDBERG, H.
Extending the limits of reliability theory
A82-12318

GOLDSTEIN, R. M.
Synthetic aperture radar target simulator
[NASA-CASE-NPO-15024-1]   N82-10286

GOODMAN, A. W.
Sealed lead-acid batteries for aircraft applications
A82-11716

GOODRICK, T. F.
Comparison of simulation and experimental data for
a gliding parachute in dynamic flight
[AIAA PAPER 81-1924]   A82-10409

GOODWIN, W. V.
An investigation of the combustion process in
solid fuel ramjets
[AD-A104603]   N82-11232

GORLINE, G. A.
Implementation of AVRADCOM HH&T
A82-10545

GRIES, D. A.
Design considerations for duty cycle, life and
reliability of small limited life engines
[AIAA PAPER 81-1402]   A82-10465

GROSS, S.
Unsolved problems of nickel cadmium batteries
A82-11725

GRUZDEV, A. A.
On low-speed wind tunnels with deformable boundaries
A82-11462

GUENTHER, R.
A CPRP taileron for the Tornado: Construction and
production
[MBB-FE-212/KPK/PUB/2]   N82-10035

GULIAEV, V. V.
Calculation of aerodynamic characteristics of jet
flapped airplane
A82-11459

GUPTA, R. R.
Omega station 10.2 kHz signal selection made easy
A82-12638

GURIANOV, A. IA.
Experimental study of empennage snap-through
vibrations
A82-11471

GUSEVA, R. I.
On the use of carbon composites in slat and
stabilizer construction
A82-11468

GUSKOV, V. I.
End losses in turbine cascades with porous cooling
A82-11434

H

HALLIDAY, R.
Commercial EHS considerations for small gas
turbine engines
A82-12449

HANEY, H. P.
A comparison of theoretical and experimental
pressure distributions for two advanced fighter
wings
[NASA-TM-81331]   N82-11054

HARRIS, W. L.
Model helicopter rotor impulsive noise
A82-11300

HARSHA, P. T.
Multiple-scale turbulence modeling of free
turbulent flows
[ASME PAPER 81-FE-20]   A82-10934

HARTMANN, U.
Practical design and realization of a digital
adaptive flight control system
N82-11079

HARTMANN, W.
A CPRP taileron for the Tornado: Construction and
production
[MBB-FE-212/KPK/PUB/2]   N82-10035

HASHIMOTO, R.
New molding method of three-dimensional hollow
photoelastic model and centrifugal stress
analysis of air cooled turbine blade model
[NAL-TR-427T]   N82-11067

HAWKES, D. J.
The certification of digital systems
A82-11940

HAWLEY, D. L.
Three navigation systems and their costs of
acquiring remote sensing data
A82-10049

HEDGLEY, D. R.
Solution to the hidden-line problem
A82-12803

HELD, D. N.
Synthetic aperture radar target simulator
[NASA-CASE-NPO-15024-1]   N82-10286

HICKS, R. M.
A comparison of theoretical and experimental
pressure distributions for two advanced fighter
wings
[NASA-TM-81331]   N82-11054

HILDEBRAND, P. H.
Multiple Doppler radar observations of PBL structure
A82-10292

HILDEBRANT, R. V.
Variable speed constant frequency /VSCF/
electrical system cuts cost of ownership
A82-11719

HILL, W., JR.
The case for a defensive air-to-air fighter
A82-12801

HILLIG, W. B.
Thermal-barrier-coated turbine blade study
[NASA-CR-165351]   N82-10040

HODGSON, T. H.
Aircraft wing trailing-edge noise
[NASA-CR-164952]   N82-11039

HOLL, R.
Further application and development of an engine
usage/life monitoring system for military services
A82-12450

HOLLAND, R. L.
The statistical theory of radio direction finding
[AD-A104156]   N82-10027

HOLT, I. T.
Development of new lifting parachute designs with
increased trim angle
[AIAA PAPER 81-1921]   A82-10407

HONG-KUN, X.
A new method of cooling turbine vanes
N82-11027

HONG, Q.
Finite difference computation of the steady
transonic potential flow around airplanes
N82-10981

HOPKINS, J. J.
Integrated satellite navigation and strapdown
attitude and heading reference systems for civil
air carriers
A82-12643

HORN, W. J.
   A new thermal and trajectory model for high
   altitude balloons
   [AIAA PAPER 81-1926]   A82-10411
HUBBARD, J. E., JR.
   Model helicopter rotor impulsive noise
                                                 A82-11300
HUELSTER, D. S.
   Propulsion study for Small Transport Aircraft
   Technology (STAT)
   [NASA-CR-165499]   N82-10037
HUNTER, B. J.
   Digital avionics systems - The RAF experience
                                                 A82-11941
HWANG, D. P.
   A summary of V/STOL inlet analysis methods
   [NASA-TM-82725]   N82-11043

I

IARKHO, S. A.
   The enhancement of heat exchange in channels /2nd
   revised and enlarged edition/
                                                 A82-12222
ICHIKAWA, T.
   A study on numerical method for evaluating
   spanwise integral in subsonic lifting-surface
   theory
   [NAL-TR-661T]   N82-11035
ISAEV, V. V.
   On evaluating the influence of local disruptions
   of flow over trailing edge and leading edge
   flaps from the data of wind tunnel tests of a
   rectangular wing segment
                                                 A82-11465
IULIN, N. K.
   Jet fuel from carbon
                                                 A82-12021
ION, G. M.
   Optimization of the principal design parameters of
   a passenger aircraft
                                                 A82-10816
IVANOV, V. S.
   Basic problem of aircraft gasturbine engine
   analytic design. II
                                                 A82-11463

J

JACOB, K.
   Experimental investigations of the separated flow
   around a rectangular wing
   [DFVLR-FB-81-12]   N82-10017
JAIN, S. C.
   Superalloy powder engine components; controls
   employed to assure high quality hardware
                                                 A82-12499
JENSEN, R. S.
   Improving the MLS through enhanced cockpit displays
                                                 A82-10649
JIAPENG, L.
   An experimental investigation of the rotating
   stall, surge and wake behind the rotor for a
   single stage axial compressor
                                                 N82-11008
JIAN-ZHONG, X.
   A theoretical analysis of the stream surface of
   revolution with supersonic inlet flow in a
   transonic axial compressor
                                                 N82-11025
JIN-DI, Y.
   Initial experimental research into the response of
   turbojet engine compressors to distortion of
   intake pressure
                                                 N82-11006
   A preliminary experimental investigation of the
   response of a turbojet engine to inlet pressure
   distortion
                                                 N82-11007
JIN-LIANG, J.
   The arbitrary quasi-orthogonal surface method for
   computing three-dimensional flow in turbine
   machinery. 2. Calculation of the
   three-dimensional flow with the S sub 1-surface
   twisted
                                                 N82-11015

JIN-SHENG, Y.
   A theoretical analysis of the stream surface of
   revolution with supersonic inlet flow in a
   transonic axial compressor
                                                 N82-11025
JINQIAO, J.
   Matrix analysis of wings
                                                 N82-10998
JOHANSSON, R. S.
   Advanced fuel flowmeter for future naval aircraft
   [AD-A104364]   N82-11063
JOHNSON, D. W.
   Reductions in parachute drag due to forebody wake
   effects
   [AIAA PAPER 81-1939]   A82-10417
JONES, J. L.
   Aircraft excrescence drag
   [AGARD-AG-264]   N82-10020
JORGENSEN, D. S.
   Aerodynamics and performance of cruciform
   parachute canopies
   [AIAA PAPER 81-1919]   A82-10405
JUE-LIANG, Z.
   Initial experimental research into the response of
   turbojet engine compressors to distortion of
   intake pressure   N82-11006
   A preliminary experimental investigation of the
   response of a turbojet engine to inlet pressure
   distortion
                                                 N82-11007

K

KALININ, E. K.
   The enhancement of heat exchange in channels /2nd
   revised and enlarged edition/
                                                 A82-12222
KAMPE, R. F.
   Developments in boundary layer Thrust Vector Control
                                                 A82-10855
KANIA, W.
   Experimental study of subsonic and transonic flows
   past a wing
                                                 A82-10363
KANT, P.
   Theory and applications of optimal control in
   aerospace systems
   [AGARD-AG-251]   N82-11073
KANTOLA, R. A.
   Effects of vane/blade ratio and spacing on fan noise
   [AIAA PAPER 81-2033]   A82-10457
KARIMOVA, A. G.
   Results of experimental study of heat transfer to
   turbine blades with porous cooling
                                                 A82-11446
KARMARKER, J.
   Flight trajectory control investigation
   [AD-A104542]   N82-11048
KHAKIMULLIN, P. SH.
   Experimental study of empennage snap-through
   vibrations
                                                 A82-11471
KIESSLING, F.
   Calculation of natural modes of vibration for
   rotor blades by the finite element method
   [DFVLR-FB-81-07]   N82-10452
KIPP, H. W.
   In-situ calibration of flight heat transfer
   instrumentation
   [ASME PAPER 81-ENAS-13]   A82-10901
KLEIN, V.
   Determination of airplane model structure from
   flight data by using modified stepwise regression
   [NASA-TP-1916]   N82-10041
KLIMAS, P. C.
   A modular asymmetric parachute for wind tunnel
   testing
   [AIAA PAPER 81-1933]   A82-10414
KLUG, H. G.
   Active control elements on the transonic wing of
   the Airbus A-300 (ACTTA A). Airbus A-300 with
   reduced longitudinal stability (ACTTA-C)
                                                 N82-10044
KOHLMAN, D. L.
   Icing tunnel test of a glycol-exuding porous
   leading edge ice protection system on a general
   aviation airfoil
   [NASA-CR-165444]   N82-10021

Icing tunnel tests of a composite porous leading
   edge for use with a liquid anti-ice system
   [NASA-CR-164966]   N82-11052
KONDRATEV, K. IA.
   Determination of vertical profiles of aerosol size
   spectra from aircraft radiative flux
   measurements. II.- The effect of particle
   nonsphericity
                                         A82-12149
KONICKE, T. A.
   Stress measurements in a ribbon parachute canopy
   during inflation and at steady state
   [AIAA PAPER 81-1944]   A82-10420
   Stress measurements in bias constructed parachute
   canopies during inflation and at steady-state
   [AIAA PAPER 81-1945]   A82-10421
KORNEV, B. N.
   On the use of carbon composites in slat and
   stabilizer construction
                                         A82-11468
KOZHEVNIKOV, IU. V.
   Basic problem of aircraft gasturbine engine
   analytic design. II
                                         A82-11463
KREBS, V.
   Practical design and realization of a digital
   adaptive flight control system
                                         N82-11079
KRENGEL, J. H.
   Air-breathing engine test facilities register
   [AGARD-AG-269]   N82-10063
KRETH, J.
   Mathematical model for the maintenance program of
   modern jet aircraft
   [DFVLR-FB-81-14]   N82-10002
KRICHKO, A. A.
   Jet fuel from carbon
                                         A82-12021
KRZYSIAK, A.
   Experimental study of subsonic and transonic flows
   past a wing
                                         A82-10363
KSENOFONTOVA, E. N.
   On evaluating the influence of local disruptions
   of flow over trailing edge and leading edge
   flaps from the data of wind tunnel tests of a
   rectangular wing segment
                                         A82-11465
KUZNENKO, V. M.
   Optimization of the principal design parameters of
   a passenger aircraft
                                         A82-10816
KUZNETSOV, A. B.
   On evaluating the influence of local disruptions
   of flow over trailing edge and leading edge
   flaps from the data of wind tunnel tests of a
   rectangular wing segment
                                         A82-11465

L

LAGARDE, X.
   Fast and accurate gyrocompass using strapdown
   tuned rotor gyros as a solution to combat
   helicopters navigation problems
                                         A82-11927
LAHN, T. G.
   Controlling the software/hardware interface for
   the validation of avionics systems
   [AIAA 81-2159]   A82-10116
LANDEL, R. F.
   Rheological behavior of progressively
   shear-thickening solutions
                                         A82-11177
LANDER, H. R.
   Jet fuel locks to shale oil: The 1980 technology
   review
   [AD-A104414]   N82-11228
LANGE, H. H.
   Flight test results of the model simulation
   controller for the HFB 320 for in-flight
   simulation of the A310 airbus
   [ESA-TT-660]   N82-10107
LAPIN, V. P.
   A protective additive for jet fuels
                                         A82-12022

LARGE, E.
   Optimal flight paths for winged, supersonic flight
   vehicles - Extension to the case where thrust
   can be vectored
                                         A82-10310
LASSITER, W. S.
   Design predictions for noise control in the
   cryogenic National Transonic Facility
                                         A82-12025
LAVOIPIERRE, G.
   Fast and accurate gyrocompass using strapdown
   tuned rotor gyros as a solution to combat
   helicopters navigation problems
                                         A82-11927
LE BALLEUR, J. C.
   Strong matching method for computing transonic
   viscous flows including wakes and separations -
   Lifting airfoils
                                         A82-10821
LEBOT, Y.
   Adaptation of a turbine test facility to
   high-temperature research
   [RAE-LIB-TRANS-2064]   N82-11089
LEBOUC, P.
   Cost reduction in air transportation
   [SNIAS-811-150-101]   N82-10025
LEE, C. K.
   A proposed flight safety program for the Korean
   Air Force
   [AD-A102373]   N82-10023
LEE, J.
   New separators for battery systems
                                         A82-11715
LEE, J. T.
   Applications of conventional and Doppler radars
   for aviation safety
                                         A82-10215
LEES, P.
   Application of numerical methods to the
   calculation of electrostatic fields in aircraft
   fuel tanks
   [AD-A103270]   N82-10033
LEHMER, L.
   A CFRP taileron for the Tornado: Construction and
   production
   [MBB-FE-212/KFK/PUB/2]   N82-10035
LEONG, P. J.
   Advanced aircraft electrical system control
   technology demonstrator. Phase 1: Requirements
   analysis and conceptual design
   [AD-A103922]   N82-10326
LEPORSKII, A. A.
   Synthesis of system for evaluating gyrostabilizer
   state with unknown disturbances
                                         A82-11469
LEVASHOV, P. D.
   Formation of triangular-element stiffness matrix
   using sliding interpolation
                                         A82-11464
LEVIN, A. D.
   Propfan installation aerodynamics of a
   supercritical swept wing transport configuration
   [AIAA PAPER 81-1563]   A82-10466
LEWIS, D.
   Helicopter engine technology - With particular
   reference to the Rolls-Royce Gem engine
                                         A82-10304
LEYENDECKER, H.
   Control law design for transport aircraft flight
   tasks
                                         N82-11080
LIANG, D. F.
   Simulation study of a hybrid strapdown attitude
   and heading reference system
                                         A82-12641
LILLEY, D. G.
   On the prediction of swirling flowfields found in
   axisymmetric combustor geometries
                                         A82-12120
LIN, C.-F.
   Real-time, on-line digital simulation of optimum
   maneuvers of supersonic aircraft
   [AIAA 81-2178]   A82-10127
LLOBET, P.
   Fast and accurate gyrocompass using strapdown
   tuned rotor gyros as a solution to combat
   helicopters navigation problems
                                         A82-11927

LOEWENSTEIN, P.
    Superclean superalloy powders by the rotating
    electrode process
                                                A82-12496
LOKAI, V. I.
    Results of experimental study of heat transfer to
    turbine blades with porous cooling
                                                A82-11446
LUDWIG, D.
    Calculation of natural modes of vibration for
    rotor blades by the finite element method
    [DFVLR-FB-81-07]   N82-10452
LUKASZEWICZ, M.
    The use of the Weber method for
    minicomputer-assisted numerical analysis of
    airfoils
                                                A82-10362
LUND, T. J.
    Hard limited approaches to correlation velocity
    sensing
                                                A82-12636
LUNDY, A. S.
    Outsider's look at flight instrumentation
    [DE81-025409]   N82-11066
LUO, S.
    Nonlinear prediction of subsonic aerodynamic loads
    on wings and bodies at high angles of attack
                                                A82-11359
LYKOV, O. P.
    A protective additive for jet fuels
                                                A82-12022
LYNNWORTH, L. C.
    Advanced fuel flowmeter for future naval aircraft
    [AD-A104364]   N82-11063

M

MACFARLANE, A. G. J.
    Characteristic and principal gains and phases and
    their use as multivariable control design tools
                                                N82-10050
MANHARDT, P. D.
    A numerical three-dimensional turbulent simulation
    of a subsonic VSTOL jet in a cross-flow using a
    finite element algorithm
    [AD-A104514]   N82-11055
MANION, N. B.
    Automated Paint and Process Line /APPL/
    [AIAA 81-2166]   A82-10120
MANNINI, A.
    Air-freon integrated environmental conditioning
    system for trainer subsonic aircraft
    [ASME PAPER 81-ENAS-33]   A82-10920
MARCHIS, V.
    Air-freon integrated environmental conditioning
    system for trainer subsonic aircraft
    [ASME PAPER 81-ENAS-33]   A82-10920
MARKHAM, D. L.
    The dispersion of drop sizes in gas turbine fuel
    nozzle sprays
                                                A82-12107
MARTINEZ, R.
    Aeroacoustic theory for noncompact wing-gust
    interaction
    [PDRL-81-7]   N82-11071
MATIAZH, A. I.
    On evaluating the influence of local disruptions
    of flow over trailing edge and leading edge
    flaps from the data of wind tunnel tests of a
    rectangular wing segment
                                                A82-11465
MATSON, J. E.
    Advanced fuel flowmeter for future naval aircraft
    [AD-A104364]   N82-11063
MATSUSUE, K.
    New molding method of three-dimensional hollow
    photoelastic model and centrifugal stress
    analysis of air cooled turbine blade model
    [NAL-TR-427T]   N82-11067
MATSUZAKI, Y.
    New estimation method for flutter or divergence
    boundary from random responses at subcritical
    speeds
    [NAL-TR-667T]   N82-11034
MATTICK, A. A.
    Increasing the lift:drag ratio of a flat delta wing
                                                A82-11899

MAYER, J. T. B.
    The Space Shuttle vehicle checkout involving
    flight avionics software
    [AIAA 81-2141]   A82-10100
MAYER, N. J.
    The balloon and the airship technological heritage
    [AIAA PAPER 81-1912]   A82-10401
MCALLISTER, D.
    Application of numerical methods to the
    calculation of electrostatic fields in aircraft
    fuel tanks
    [AD-A103270]   N82-10033
MCCARTHY, J.
    An airport wind shear detection and warning system
    using Doppler radar
                                                A82-10220

    Instrumented aircraft verification of clear-air
    radar detection of low-level wind shear
                                                A82-10221
MCCLOUD, J. L., III
    An investigation of a stoppable helicopter rotor
    with circulation control
    [NASA-TM-81218]   N82-10030
MCDARMAID, D. S.
    The application of improved aluminium alloys and
    steels in aircraft structures
                                                A62-10305
MCGHEE, R. J.
    Wind-tunnel results for a modified
    17-percent-thick low-speed airfoil section
    [NASA-TP-1919]   N82-11033
MCGLADE, S. M.
    Optical sensors for displacement measurement
                                                A82-11407
MCKEEN, R. G.
    Design of airport pavements for expansive soils
    [AD-A104660]   N82-11313
MCKENZIE, D. R.
    Design and development of a low cost servoed rate
    gyro for unmanned aircraft
                                                A82-11932
MCLAUGHLIN, D. K.
    On the prediction of swirling flowfields found in
    axisymmetric combustor geometries
                                                A82-12120
MCPHERSON, W. R.
    SARSAT applications
                                                A82-12698
MCWILLIAM, B. N.
    Simulation study of a hybrid strapdown attitude
    and heading reference system
                                                A82-12641
MEHDI, I. S.
    Advanced aircraft electrical system control
    technology demonstrator. Phase 1: Requirements
    analysis and conceptual design
    [AD-A103922]   N82-10326
MEI, C.
    Response of nonlinear aircraft structural panels
    to high intensity noise
                                                A82-12041
MELUZOV, IU. V.
    Basic problem of aircraft gasturbine engine
    analytic design. II
                                                A82-11463
METCALF, J. I.
    Airborne weather radar and severe weather
    penetration
                                                A82-10219
MEYER, G.
    Application of nonlinear systems inverses to
    automatic flight control design: System
    concepts and flight evaluations
                                                N82-11083
MICHARD, J.
    Adaptation of a turbine test facility to
    high-temperature research
    [RAE-LIB-TRANS-2064]   N82-11089
MIKALEVICH, V. S.
    Optimization of the principal design parameters of
    a passenger aircraft
                                                A82-10816
MIKOLOWSKY, W. T.
    ACMA - Fact or fantasy
                                                A82-12048
MIKULLA, V.
    Standard tests of a research model rotor in a wind
    tunnel, including model similarity
    [BMVG-FBWT-79-16]   N82-10016

MILLS, J. E.
  Digital avionics: Promise and practice - An
  airlines experience in the field
                                          A82-11942
MIROMER, A.
  Limiting payload deceleration during ground impact
  [AIAA PAPER 81-1918]   A82-10404
MITCHELL, P.
  Bridging the gap from aircraft to space computers
  [AIAA 81-2142]   A82-10101
MOORE, J. F.
  The digital civil aircraft
                                          A82-11938
MORRIS, C. E. K., JR.
  Parametric study of microwave-powered
  high-altitude airplane platforms designed for
  linear flight
  [NASA-TP-1918]   N82-11050
MOSINA, L. I.
  A protective additive for jet fuels
                                          A82-12022
MUENSCHER, D.
  A contribution to the stabilization of flight
  vehicle parachute systems
  [ESA-TT-679]   N82-10046
MURDOCK, G. A.
  Hard limited approaches to correlation velocity
  sensing
                                          A82-12636
MURPHY, P. C.
  Determination of airplane model structure from
  flight data by using modified stepwise regression
  [NASA-TP-1916]   N82-10041
MURRI, D. G.
  Effects of vortex flaps on the low-speed
  aerodynamic characteristics of an arrow wing
  [NASA-TP-1914]   N82-11013
MYERS, A. F.
  HiMAT onboard flight computer system architecture
  and qualification
  [AIAA 81-2107]   A82-10082

N

NADKARNI, A. A.
  Comparative study of flare control laws
  [NASA-CR-164903]   N82-10032
NAGLE-ESHLEMAN, J.
  The Shock and Vibration Digest, volume 13, no. 9
  [AD-A105062]   N82-10421
NAIK, N. K.
  Development of aircraft production engineering
  discipline at IIT, Bombay
                                          A82-11317
NELSON, S. C.
  How large should a commuter transport be
  [AIAA PAPER 81-1732]   A82-10463
NGUYEN, T. H.
  Advanced fuel flowmeter for future naval aircraft
  [AD-A104364]   N82-11063
NIKIPOROVA, T. C.
  Jet fuel from carbon
                                          A82-12021
NOVAD, A. A.
  On the question of trailing airplane motion
                                          A82-11470
NOVAK, R. C.
  Development of low modulus material for use in
  ceramic gas path seal applications
  [NASA-CR-165469]   N82-10039

O

ONEILL, J. J.
  A hidden advantage of permanent magnet electrical
  generating systems
                                          A82-11720
ORZECHOWSKI, J. A.
  A numerical three-dimensional turbulent simulation
  of a subsonic VSTOL jet in a cross-flow using a
  finite element algorithm
  [AD-A104514]   N82-11055

P

PALM, L.
  Development of a nylon-Kevlar recovery system for
  the CL-289 /AN/USD 502/ surveillance drone
  [AIAA PAPER 81-1952]   A82-10427

PAPPE, N. P.
  Control of electromechanical actuator elements for
  flight vehicles
                                          A82-12170
PAPPE, V. P.
  Control of electromechanical actuator elements for
  flight vehicles
                                          A82-12170
PATERSON, J. H.
  Aircraft excrescence drag
  [AGARD-AG-264]   N82-10020
PATRICK, J. P.
  Air supply system bite for Boeing 767 airplane
  [ASME PAPER 81-ENAS-7]   A82-10895
PAVLOV, V. A.
  Experimental study of empennage snap-through
  vibrations
                                          A82-11471
PAVLOVSKII, V. P.
  One reason for the onset of high-frequency
  self-excited oscillations
                                          A82-11448
PEDERSEN, N. E.
  Advanced fuel flowmeter for future naval aircraft
  [AD-A104364]   N82-11063
PEEL, C. J.
  The application of improved aluminium alloys and
  steels in aircraft structures
                                          A82-10305
PENG, S. T. J.
  Rheological behavior of progressively
  shear-thickening solutions
                                          A82-11177
PETERSON, C. W.
  Reductions in parachute drag due to forebody wake
  effects
  [AIAA PAPER 81-1939]   A82-10417
PETROV, B. I.
  Control of electromechanical actuator elements for
  flight vehicles
                                          A82-12170
PIERREPONT, D.
  Towards minimum power for environmental control in
  transport aircraft
  [ASME PAPER 81-ENAS-4]   A82-10892
PINES, S.
  An influence coefficient method for the
  application of the modal technique to wing
  flutter suppression of the DAST ARW-1 wing
  [NASA-CR-165772]   N82-11070
PLESS, W. M.
  Acoustic emission - An emerging technology for
  assessing fatigue damage in aircraft structure
                                          A82-11149
POPE, R. E.
  The need for multivariable design and analysis
  techniques
                                          N82-10049
PRASAD, D. S. S.
  On computing Floquet transition matrices of
  rotorcraft
                                          A82-11225
PRASAD, U. R.
  Ideal and simulated performance of an aircraft in
  the terrain following mission
                                          A82-11302
PRATT, S.
  LQG multivariable design tools
                                          N82-10054
PRESS, J.
  Performance analysis of enroute air traffic
  control computers in the National Airspace System
  [AIAA 81-2203]   A82-10140
PRINZ, R.
  Mathematical model for the maintenance program of
  modern jet aircraft
  [DFVLR-FB-81-14]   N82-10002
PUCHKOV, V. A.
  Jet fuel from carbon
                                          A82-12021
PURI, S. N.
  Design considerations for the direct digital
  control of dry-tuned gyroscope
                                          A82-11933
PURVIS, J. W.
  Theoretical analysis of parachute inflation
  including fluid kinetics
  [AIAA PAPER 81-1925]   A82-10410

Q

QI-XUN, L.
Initial experimental research into the response of
turbojet engine compressors to distortion of
intake pressure
                                                    N82-11006
A preliminary experimental investigation of the
response of a turbojet engine to inlet pressure
distortion
                                                    N82-11007
QINGXIONG, Y.
The automatic matrix force method and techniques
for handling more complex computations with
given computer capacity
                                                    N82-10994

R

RAGHUNATHAN, S.
Wind tunnel tests on airfoils in tandem cascade
                                                    A82-10987
RAGSDALE, W. A.
Use of Space Shuttle technology in conventional
aircraft
[AIAA 81-2176]   A82-10125
RAJPAUL, V. K.
Closed loop environmental control systems for
fighter aircraft
[ASME PAPER 81-ENAS-2]   A82-10890
RAJU, P. N.
Dynamic response of aircraft structure to gun
shock loads
                                                    A82-11314
RANG, E. R.
Controlling the software/hardware interface for
the validation of avionics systems
[AIAA 81-2159]   A82-10116
RANGAIAH, V. P.
Dynamic response of aircraft structure to gun
shock loads
                                                    A82-11314
RAYMOND, E. T.
Aircraft digital input controlled hydraulic
actuation and control system
[AD-A104263]   N82-11072
REED, E. A.
Parachute technology under pressure
                                                    A82-12804
REID, D. B.
Simulation study of a hybrid strapdown attitude
and heading reference system
                                                    A82-12641
REID, J. A. I.
Design aspects of non rigid airship envelopes
                                                    A82-10306
REINMANN, J. J.
Selected bibliography of NACA-NASA aircraft icing
publications
[NASA-TM-81651]   N82-11053
RHODE, D. L.
On the prediction of swirling flowfields found in
axisymmetric combustor geometries
                                                    A82-12120
RICCI, R. J.
Integration of computer graphics design with
analytical models
[AIAA 81-2134]   A82-10096
RICHARDSON, D.
F-5G Tigershark
                                                    A82-12775
RIES, E. G.
Interoperability testing of decentralized command,
control, communications and intelligence /C3I/
systems
[AIAA 81-2205]   A82-10143
RIX, O.
System identification of the longitudinal motion
of the DFVLR HFB 320 research aircraft with
particular consideration of control surface
effectiveness
[ESA-TT-666]   N82-10045
ROBERTS, L.
V/STOL aircraft and fluid dynamics
[NASA-TM-81328]   N82-10029
ROBERTS, W. B.
Air-film cooling returns to ramjets
[ASME PAPER 81-ENAS-8]   A82-10896

ROBINSON, C. W.
Aircraft digital input controlled hydraulic
actuation and control system
[AD-A104263]   N82-11072
ROCK, S. M.
Development of multivariable controllers for
aircraft turbine engines
                                                    N82-11087
RODGERS, C.
A new APU for medium place aircraft environmental
control systems
[ASME PAPER 81-ENAS-1]   A82-10889
ROEHM, R. P.
Superalloy turbine components - Which is the
superior manufacturing process, as-HIP, HIP plus
Isoforge, or 'gatorizing' of extrusion
consolidated billet
                                                    A82-12497
ROSENTHAL, Y.
Satellite geometry considerations for low cost GPS
user equipment
                                                    A82-12630
ROUGHTON, D.
The all digital military aircraft
                                                    A82-11937
RU-QUN, Y.
Theoretical investigations and experimental
researches for higher subsonic two-dimensional
compressor cascade
                                                    N82-11024
RUFF, S.
Development and construction of pilot ejector
seats in Germany from 1938-1945
[DFVLR-FB-81-04]   N82-10026
RUNZIANG, Z.
Matrix analysis of wings
                                                    N82-10998

S

SALIARIS, C.
A contribution to the stabilization of flight
vehicle parachute systems
[ESA-TT-679]   N82-10046
SALVIONI, L.
The possibility of using deformable rubber
components in landing gear
                                                    A82-10496
SASHEVSKII, V. V.
A protective additive for jet fuels
                                                    A82-12022
SASTRY, D.
On computing Floquet transition matrices of
rotorcraft
                                                    A82-11225
SCHAFER, H.
Quantification of the thermal environment for
externally carried aircraft stores and ordnance
                                                    A82-12100
SCHAFRANEK, D.
Theoretical investigation of the influence of
spoiler dynamics on the handling qualities of an
aircraft with direct lift control
[ESA-TT-681]   N82-10036
SCHLINKER, R. H.
Helicopter rotor trailing edge noise
[AIAA PAPER 81-2001]   A82-10455
Helicopter rotor trailing edge noise
[NASA-CR-3470]   N82-11859
SCHNEIDER, H. W.
Thermal expansion accommodation in a jet engine
frame
                                                    A82-11999
SCHWARTZ, A. C.
FAA developing new collision avoidance, data
acquisition and transmission systems
                                                    A82-10396
SCHWEICKART, D.
High voltage surge and partial discharge test to
evaluate aerospace equipment parts
                                                    A82-11740
SCHWEIKHARD, W. G.
Icing tunnel test of a glycol-exuding porous
leading edge ice protection system on a general
aviation airfoil
[NASA-CR-165444]   N82-10021
SEGREST, J. D.
Advanced aircraft electric power system
                                                    A82-11718

WEIDE, Z.
An experimental investigation of the rotating
stall, surge and wake behind the rotor for a
single stage axial compressor
N82-11008

WEISS, R.
A solution to the static geometry problem for
JTIDS relative navigation
A82-12634

WELCH, R. M.
Determination of vertical profiles of aerosol size
spectra from aircraft radiative flux
measurements. II - The effect of particle
nonsphericity
A82-12149

WELLS, N. A. J.
Wind tunnel tests on airfoils in tandem cascade
A82-10987

WEN-LAN, I.
Initial experimental research into the response of
turbojet engine compressors to distortion of
intake pressure
N82-11006
A preliminary experimental investigation of the
response of a turbojet engine to inlet pressure
distortion
N82-11007

WHITE, M.
Composite main rotor tubular braided
A82-10547

WIDDOWS, H. E.
A modular asymmetric parachute for wind tunnel
testing
[AIAA PAPER 81-1933]
A82-10414

WIDNALL, S. E.
Aeroacoustic theory for noncompact wing-gust
interaction
[PDRL-81-7]
N82-11071

WIEBE, W.
Fractographic determination of fatigue crack
growth rates in aircraft components
A82-12697

WILBUT, C. R.
KC-135 Avionics Modernization Hot Bench
[AIAA 81-2105]
A82-10081

WILK, K. E.
Applications of conventional and Doppler radars
for aviation safety
A82-10215

WILLARD, W. E.
Low maintenance hydraulic accumulator
[AD-A103947]
N82-10034

WILLIAMS, J. C.
Design of high integrity multivariable control
systems
N82-10055

WILLIAMS, R. C.
Low speed testing of the inlets designed for a
tamden-fan V/STOL nacelle
[NASA-TM-82728]
N82-11042

WILLSHIRE, W. L., JR.
SEL and EPNL noise duration coefficients for the
747 and T-38 aircraft
[NASA-TM-83214]
N82-11860

WILMOTH, R. G.
Computation of high Reynolds number
internal/external flows
[NASA-TM-84049]
N82-11046

WILSON, J.
Detection and display of wind shear and turbulence
A82-10222

WILSON, V. E.
Design analysis of high temperature transparent
windshields for high performance aircraft
[ASME PAPER 81-ENAS-5]
A82-10893

WONHAM, W. M.
A geometric approach to multivariable control
system synthesis
N82-10056

WOODLEY, G. E.
Light aircraft structural design in non-metallics
- Use of composite honeycomb for light aircraft
A82-10308

X

XIAO-KANG, X.
The arbitrary quasi-orthogonal surface method for
computing three-dimensional flow in turbine
machinery. 2. Calculation of the
three-dimensional flow with the S sub 1-surface
twisted
N82-11015

XIN-YUAN, W.
Initial experimental research into the response of
turbojet engine compressors to distortion of
intake pressure
N82-11006
A preliminary experimental investigation of the
response of a turbojet engine to inlet pressure
distortion
N82-11007

XINHAI, Z.
An aerodynamic design method for transonic axial
flow compressor stage
N82-10984

XUUNCHUN, T.
Structural analysis of fuselages with cutouts by
finite element method
N82-10995

Y

YAVUZ, T.
Experimental determination of parachute apparent
mass and its significance in predicting dynamic
stability
[AIAA PAPER 81-1920]
A82-10406

YBARRA, A. H.
Low speed testing of the inlets designed for a
tamden-fan V/STOL nacelle
[NASA-TM-82728]
N82-11042

YING, Z.
A theoretical analysis of the stream surface of
revolution with supersonic inlet flow in a
transonic axial compressor
N82-11025

YIP, L. P.
Effects of vortex flaps on the low-speed
aerodynamic characteristics of an arrow wing
[NASA-TP-1914]
N82-11013

YIULIU, C.
Matrix analysis of wings
N82-10998

YOSHIDA, T.
New molding method of three-dimensional hollow
photoelastic model and centrifugal stress
analysis of air cooled turbine blade model
[NAL-TR-427T]
N82-11067

YOUNG, A. D.
Aircraft excrescence drag
[AGARD-AG-264]
N82-10020

YU-MING, Z.
A new method of cooling turbine vanes
N82-11027

YUAN, X.
Matrix analysis of wings
N82-10998

YUWEN, Z.
Finite difference computation of the steady
transonic potential flow around airplanes
N82-10981

Z

ZAMES, G.
Multivariables design: The optimization of
approximate inverses
N82-10057
Feedback and minimax sensitivity
N82-10058

ZEBKER, H. A.
Synthetic aperture radar target simulator
[NASA-CASE-NPO-15024-1]
N82-10286

ZEMPOLICH, B. A.
Memory requirements for future navigation systems
A82-12637

ZHAO-YAN, Q.
Theoretical investigations and experimental
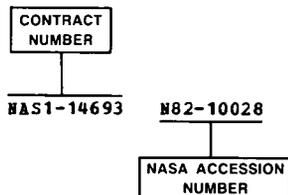researches for higher subsonic two-dimensional
compressor cascade
N82-11024

Typical Contract Number Index Listing


```
CONTRACT
NUMBER
   |
NAS1-14693    N82-10028
                  |
          NASA ACCESSION
             NUMBER
```

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.

AF PROJ. 2003	
	N82-11062
AF PROJ. 2301	
	N82-10033
AF PROJ. 2403	
	N82-11048
AF PROJ. 2480	
	N82-11228
AF PROJ. 3048	
	N82-10033
AF PROJ. 3145	
	N82-10034
	N82-10326
	N82-11072
AF-AFOSR-0223-80	
	N82-10033
DA PROJ. 1L2-62202-AH-85	
	N82-11064
	N82-11065
DA PROJ. 4A7-62719-AT-40	
	N82-11498
DAAG29-C-027	A82-11300
DAAK80-79-C-0270	
	N82-11064
	N82-11065
DE-AC04-76DP-00789	
	A82-10414
DNA001-80-C-0177	
	N82-11354
DTFA01-80-Y-10597	
	N82-10812
EPRI PROJ. 1079-3	
	N82-10254
F29601-76-C-0051	
	N82-11313
F33600-80-C-0473	
	A82-10081
F33615-68-C-3421	
	A82-10893
F33615-74-C-2037	
	A82-11721
F33615-76-C-1243	
	N82-11062
F33615-76-C-2088	
	N82-10034
F33615-77-C-2034	
	N82-11072
F33615-78-C-2200	
	A82-11721
F33615-78-C-3607	
	N82-11048
F33615-80-C-2004	
	N82-10326
F49620-79-C-0169	
	A82-12041
NAG3-71	N82-10021
	N82-11052
NAG3-74	A82-12120
NASW-3542	N82-11636
NAS1-14611	N82-10059
NAS1-14693	N82-10028
NAS1-15593	N82-11070
NAS1-15730	A82-10455
	N82-11859
NAS1-15988	A82-10934
NAS2-9410	N82-10043

NAS3-20643	A82-11999
NAS3-21727	N82-10040
NAS3-21977	N82-11224
NAS3-21995	N82-10037
	N82-10038
NAS3-22045	N82-11230
NAS3-22062	A82-10457
NAS3-22134	N82-10039
NAS3-22149	N82-11068
NAS4-2518	N82-11078
NAS6-3072	A82-10411
NAS7-100	A82-11177
	N82-10286
	N82-11514
NAS8-31377	A82-10220
	A82-10221
NAS8-33458	A82-10220
	A82-10221
NGR-14-001-008	
	A82-10214
NOAA-04-4-158-1	
	A82-10214
NSF ATM-74-03406-A02	
	A82-10220
	A82-10221
NSF ATM-76-24236	
	A82-10292
NSF ATM-77-22384	
	A82-12149
NSF ATM-78-01074	
	A82-10214
NSF ATM-78-05743	
	A82-12149
NSF ATM-78-12401	
	A82-10220
	A82-10221
NSF ECS-80-12-565	
	N82-10058
NSG-1296	A82-12028
NSG-1377	N82-11039
NSG-1480	N82-10032
NSG-2142	N82-11071
N00014-75-C-01444	
	N82-11078
N00024-81-C-5301	
	N82-10027
N62269-78-C-0069	
	N82-11063
N62269-79-C-0295	
	N82-11055
N62269-80-C-0146	
	A82-10646
W-7405-ENG-36	
	N82-11046
	N82-11066
500-42-62	N82-11043
505-31-33-05	N82-11033
505-31-41	N82-11054
505-32-03-01	N82-11860
505-32-42	N82-10039
505-34-13-02	N82-11339
505-34-33-06	N82-10041
	N82-10042
505-42-71	N82-10029
505-43-13-01	N82-11013
505-44-12	N82-10021

530-01-13-02	N82-11050
532-02-11	N82-10031
534-01-13-14	N82-11391

1. Report No. NASA SP-7037(145)	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AERONAUTICAL ENGINEERING A Continuing Bibliography (Supplement 145)		5. Report Date February 1982
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
		10. Work Unit No.
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D.C. 20546		11. Contract or Grant No.
		13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Bibliography lists 326 reports, articles, and other documents
introduced into the NASA scientific and technical information
system in January 1982.

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

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 104	22. Price* $5.00 HC

*For sale by the National Technical Information Service, Springfield, Virginia 22161

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC

NASA distributes its technical documents and bibliographic tools to eleven special libraries located in the organizations listed below. Each library is prepared to furnish the public such services as reference assistance, interlibrary loans, photocopy service, and assistance in obtaining copies of NASA documents for retention.

CALIFORNIA
University of California, Berkeley

COLORADO
University of Colorado, Boulder

DISTRICT OF COLUMBIA
Library of Congress

GEORGIA
Georgia Institute of Technology, Atlanta

ILLINOIS
The John Crerar Library, Chicago

MASSACHUSETTS
Massachusetts Institute of Technology, Cambridge

MISSOURI
Linda Hall Library, Kansas City

NEW YORK
Columbia University, New York

OKLAHOMA
University of Oklahoma, Bizzell Library

PENNSYLVANIA
Carnegie Library of Pittsburgh

WASHINGTON
University of Washington, Seattle

NASA publications (those indicated by an "*" following the accession number) are also received by the following public and free libraries:

CALIFORNIA
Los Angeles Public Library
San Diego Public Library

COLORADO
Denver Public Library

CONNECTICUT
Hartford Public Library

MARYLAND
Enoch Pratt Free Library, Baltimore

MASSACHUSETTS
Boston Public Library

MICHIGAN
Detroit Public Library

MINNESOTA
Minneapolis Public Library and Information
   Center

NEW JERSEY
Trenton Public Library

NEW YORK
Brooklyn Public Library
Buffalo and Erie County Public Library
Rochester Public Library
New York Public Library

OHIO
Akron Public Library
Cincinnati and Hamilton County Public Library
Cleveland Public Library
Dayton Public Library
Toledo and Lucas County Public Library

TEXAS
Dallas Public Library
Fort Worth Public Library

WASHINGTON
Seattle Public Library

WISCONSIN
Milwaukee Public Library

An extensive collection of NASA and NASA-sponsored documents and aerospace publications available to the public for reference purposes is maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. By virtue of arrangements other than with NASA, the British Library Lending Division also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy of microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from: ESA - Information Retrieval Service, European Space Agency, 8-10 rue Mario-Nikis, 75738 Paris CEDEX 15, France.

THIRD-CLASS BULK RATE

U.S.MAIL

NASA