1978

Ames Research Center Publications: A Continuing Bibliography

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FOREWORD


The Bibliography is divided into two sections: Section I contains citations and abstracts of published works listed by directorate, type of publication (NASA formal report, NASA contractor report, journal article, meeting paper, book or chapter of a book, and patents); Section II is comprised of subject, author, contract number and report number indexes.

Information for ordering publications cited may be obtained by referring to NASA’s STAR, LSTAR, and IAA. The NASA unlimited reports are available in either hard copy or microfiche through the National Technical Information Service (NTIS), Springfield, VA 22151, or through the Government Printing Office (GPO), Washington, D.C. 20402. Items identified with an X accession number are often limited or classified and available only to certain individuals or organizations. These documents must be ordered from the NASA center or from the institution which produced them. Patents are available through the Commissioner of Patents, U.S. Patent Office, Washington, D.C. 20231.

The Library Branch Staff is available to advise Ames requestors which form, ARC 80 “Library Resource Request” or ARC 81 “Published Material Request,” should be used to order copies of published works from either the Ames Technical Library, 202-3, extension 5157, or the Life Sciences Library, 239-13, extension 5387.

Because this edition of *Ames Research Center Publications: A Continuing Bibliography* is the first to be based upon the indexing services of STAR, LSTAR, and IAA, some published work may not be included. If this is the case, send two copies of the published work to Betty Sherwood, 202-3, and the citation will appear in the next annual bibliography.

Betty Sherwood, Compiler
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SECTION I

PUBLICATIONS
OFFICE OF THE DIRECTOR

FORMAL REPORTS

N78-26152# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA
(NASA-CR-2044, A-7347) Avail NTIS HC A13/MF A01 CSCL 09E

A multidisciplinary systems analysis of airport access to the major airports of the San Francisco Bay Area was made. Basically, it was found that there is no major airport access problem. The argument of the report is that commonly perceived airport access problems are either minor inconvenience magnified out of proportion by a combination of the traveler's unreasonable expectations, anxiety over flight departure and lack of information, or not subject to solutions which do not consider the entire urban transit system. Nine specific conclusions and recommendations for improvement are presented and discussed.

NASA CONTRACTOR REPORTS

N78-10946# Pepperdine Univ., Los Angeles, Calif School of Business and Management
WHO SHOULD CONDUCT AERONAUTICAL R AND D FOR THE FEDERAL GOVERNMENT?
H. Harvey Album Aug 1977 219 p refs (Grant NaG-2159)
(NASA-CR-152021) Avail NTIS HC A10/MF A01 CSCL 05A

It was found that Government laboratories, and especially NASA laboratories should be the prime national producers of applied research in aeronautics. American aeronautics needs the new stimulus of markedly increased outputs of broad-based innovative research from NASA laboratories more than it needs most of the technology advancement and development-oriented programs currently underway in these laboratories. The Government should use manufacturing companies for the vast bulk of development and most technology advancement. However, the Government will have to implement programs to encourage the transfer of full information on technology and research advances from the companies that do this work for the Government, to competing companies. Universities should be the primary sources of basic research. Service R&D companies and non-profit R&D institutions provide valuable, specialized, supplementary technical capabilities and other unique attributes, which together span the entire spectrum of aeronautical R&D.

N78-29993# Operations Research, Inc., Silver Spring, Md
PHASE 1: DEFINITION OF INTERCITY TRANSPORTATION COMPARISON FRAMEWORK. VOLUME 1: SUMMARY

A unified framework for comparing intercity passenger and freight transportation systems is presented. Composite measures for cost, service/demand, energy, and environmental impact were determined. A set of 14 basic measures were articulated to form the foundation for computing the composite measures. A parameter dependency diagram, constructed to explicitly interrelate the composite and basic measures is discussed. Ground rules and methodology for developing the values of the basic measures are provided and the use of the framework with existing cost and service data is illustrated for various freight systems.

N78-29996# Econergy Inc., Los Angeles, Calif
A STUDY OF CHARACTERISTICS OF INTERCITY TRANSPORTATION SYSTEMS. PHASE 1. DEFINITION OF TRANSPORTATION COMPARISON METHODOLOGY

The objectives of the study are (1) to determine a unified methodological framework for the comparison of intercity passenger and freight transportation systems, (2) to review the attributes of existing and future transportation systems for the purpose of establishing measures of comparison. These objectives were made more specific to include (1) development of a methodology for comparing long term transportation trends arising from implementation of various R&D programs, (2) definition of value functions and attribute weightings needed for further transportation goals.

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

A78-36722* Space industrialization - Education. K. M. Juels (NASA, Ames Research Center, Moffett Field, Calif.) in: The industrialization of space, Proceedings of the Twenty-third Annual
The components of an educational system based on, and perhaps enhanced by, space industrialization communications technology are considered. Satellite technology has introduced a synoptic distribution system for various transmittable educational media. The cost of communications satellite distribution for educational programming has been high. It has, therefore, been proposed to utilize Space Shuttle related technology and Large Space Structures (LSS) to construct a system with a quantum advancement in communication capability and a quantum reduction in user cost. LSS for communications purposes have three basic advantages for both developed and emerging nations, including the ability to distribute signals over wide geographic areas, the reduced cost of satellite communications systems versus installation of land based systems, and the ability of a communication satellite system to create instant educational networks.
ADMINISTRATION

FORMAL REPORTS

N78-27042*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
AMES RESEARCH CENTER PUBLICATIONS-1976
Betty Sherwood May 1978 168 p. refs
(NASA-TM-78493; A-7340) Avail. NTIS HC A08/MF A01
CSCL 058

Bibliography of the publications of Ames Research Center authors and contractors, which appeared in formal NASA publications, journal articles, books, chapters of books, patents, and contractor reports Covers 1976 Author-
AERONAUTICS AND FLIGHT SYSTEMS

FORMAL REPORTS

N78-10019*#/ National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif
LOW SPEED AERODYNAMIC CHARACTERISTICS OF AN 0.075-SCALE F-15 AIRPLANE MODEL AT HIGH ANGLES OF ATTACK AND SIDESlip
An 0.075 scale model representative of the F-15 airplane was tested in the Ames 12 foot pressure wind tunnel at a Mach number of 0.16 to determine static longitudinal and lateral directional characteristics at low attitudes for Reynolds numbers from 1.48 to 16.4 million per meter (0.45 to 5.0 million per foot) Angles of attack ranging from 0 to -90 deg and from -40 deg to -80 deg while angles of sideslip were varied from -20 deg to +30 deg Data were obtained for nacelle inlet ramp angles of 0 to 11 deg with the left and right stabilators deflected 0, -25 deg, and differentially 5 deg and -5 deg The normal pointed nose and two alternate nose shapes were also tested along with several configurations of external stores Analysis of the results indicate that at higher Reynolds numbers there is a slightly greater tendency to spin inverted than to lower Reynolds numbers Use of a hemispherical nose in place of the normal pointed nose provided an over correction in simulating yawing moment effects at high Reynolds numbers

N78-17990*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
TWO-DIMENSIONAL TRANSONIC TESTING WITH SPLITTER PLATES
Sanford Davis and Bodapati Sanyanarayana Feb 1978 24 p refs (NASA-TP-1153 A-7221) Avail NTIS HC A02/MF A01 CSCL 01A
The use of splitter plates for two dimensional transonic testing in wind tunnels was investigated on a 12% biconvex aerofoil section over the Mach number range 0.6 to 1.0 Measured pressure distributions were compared to transonic theory and to other experiments, including an investigation in the same facility without splitter plates The results of the experiment show the best agreement with theory over the entire transonic Mach number range

N78-18380*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
PHENOMENOLOGICAL ASPECTS OF QUASI-STATIONARY CONTROLLED AND UNCONTROLLED THREE-DIMENSIONAL FLOW SEPARATIONS
David J Peake In AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb 1978 52 p refs (For availability see N78-18375 09-34) Avail NTIS HC A15/MF A01 CSCL 20D
Interest in three dimensional flow separation is linked closely with wings of high leading edge sweep and bodies of fineness ratio operating at large angles of incidence or yaw, that are typical of many high-speed aircraft and missile layout The quasi-steady three dimensional separated flows about practical flight vehicles are discussed as well as the general character of the three dimensional attached boundary layer, the concept of limiting streamlines, and the present understanding of the physics of three dimensional separation and reattachment The advantages of swept, sharp edges that generate controlled (or fixed) three dimensional flow separations on a vehicle because of the qualitatively unchanging flow field developed throughout the range of flight conditions are promoted in preference to allowing for uncontrolled (or unfixed) separations

N78-18882*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
EXCHANGE AND RELAXATION EFFECTS IN LOW-ENERGY RADIATIONLESS TRANSITIONS
The effect on low-energy atomic inner-shell Coster-Kronig and super Coster-Kronig transitions that is produced by relaxation and by exchange between the continuum electron and bound electrons was examined and illustrated by specific calculations for transitions that deexcite the 3p vacancy state of Zn Taking exchange and relaxation into account is found to reduce, but not to eliminate the discrepancies between theoretical rates and measurements

N78-19142*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
EVALUATION OF THE TILT ROTOR CONCEPT: THE XV-15'S ROLE
James H Brown, Jr, H Kipling Edensorough (Textron Bell Helicopter, Fort Worth, Tex,), and Kenneth G Wernicke In AGARD Rotorcraft Design Jan 1978 9 p refs in cooperation with Army Air Mobility Res and Develop Lab, Moffett Field, Calif (For availability see N78-19126 10-05) Avail NTIS HC A15/MF A01 CSCL 01C
The need for an aircraft combining the efficient vertical takeoff and landing capability of a helicopter with the efficient high speed characteristics of a fixed wing turboprop is examined The ability of the tilt rotor concept to fill this requirement is examined The effect on low-energy atomic inner-shell Coster-Kronig and super Coster-Kronig transitions that is produced by relaxation and by exchange between the continuum electron and bound electrons was examined and illustrated by specific calculations for transitions that deexcite the 3p vacancy state of Zn Taking exchange and relaxation into account is found to reduce, but not to eliminate the discrepancies between theoretical rates and measurements

N78-19788*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
FUTURE REQUIREMENTS AND ROLES OF COMPUTERS IN AERODYNAMICS
Thomas J Gregory In its Future Computer Requirements for Computational Aerodynamics Feb 1978 p 102-107 (For availability see N78-19758 10-59) Avail NTIS HC A22/MF A01 CSCL 09B
While faster computers will be needed to make solution of the Naver-Stokes equations practical and useful, most all of
the other aerodynamic solution techniques can benefit from faster computers. There is a wide variety of computational and measurement techniques, the prospect of more powerful computers permits extension and an enhancement across all aerodynamic methods, including wind-tunnel measurement. It is expected that, as in the past, a blend of methods will be used to predict aircraft aerodynamics in the future. These will include methods based on solution of the Navier-Stokes equations and the potential flow equations as well as those based on empirical and measured results. The primary flows of interest in aircraft aerodynamics are identified, the predictive methods currently in use and/or under development are reviewed and two of these methods are analyzed in terms of the computational resources needed to improve their usefulness and practicality. 

Author

N78-19794* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. COMPUTING VISCIOUS FLOWS: J. D. Murphy In Its Future Computer Requirements for Computational Aerodynamics Feb. 1978 p 209-220 refs (For availability see N78-19778 10-59) Avail NTIS HC A22/MF A01 CSCL 20D

Although the goals and techniques of computational aerodynamics and computational fluid dynamics differ, advancement in the physical and mathematical aspects of the latter are required for progress in aerodynamic computation. The most attractive approach is the use of hybrid methods where both the equations treated and the solution algorithms reflect the local character of the flow. A working general turbulence model that is only peripherally related to the availability of large fast computers would provide a significant breakthrough in computational aerodynamics. There is no unanimity of opinion as to what may be the optimum algorithm or family of algorithms in the next decade. While it is premature to develop an optimum processor, such a machine dedicated to study the structure of solutions to the three-dimensional time-dependent Navier-Stokes equations and to the computability of turbulence would be very valuable.

A.R.H.


Flight test results of minimum autorotative descent rate are compared with calculations based on the minimum power required for steady level flight. Empirical correction factors are derived that account for differences in energy dissipation between these two flight conditions. A method is also presented for estimating the minimum power coefficient for level flight for any helicopter for use in the empirical estimation procedure of autorotative descent rate.

Author

N78-20176* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. STATIC AND DYNAMIC STABILITY ANALYSIS OF THE SPACE SHUTTLE VEHICLE-ORBITER Wei J. Chyu, Ralph K. Cavin (Texas A and M Univ., College Station), and Larry L. Erickson Mar. 1978 82 p refs (NASA-TP-1179; A-7217) Avail NTIS HC A04/MF A01 CSCL 22B

The longitudinal state and dynamic stability of a Space Shuttle Vehicle-Orbiter (SSV Orbiter) model is analyzed using the FLEXSTAB computer program. Nonlinear effects are accounted for by application of a correction technique in the FLEXSTAB system; the technique incorporates experimental force and pressure data into the linear aerodynamic theory. A flexible Orbiter model is treated in the static stability analysis for the flight conditions of Mach number 0.9 for retrolinear flight (1 g) and for a pull-up maneuver (2.5 g) at an altitude of 15-24 km. Static stability parameters and structural deformations of the Orbiter are calculated at trim conditions for the dynamic stability analysis, and the characteristics of damping in pitch are investigated for a Mach number range of 0.3 to 1.2. The calculated results for both the static and dynamic stabilities are compared with the available experimental data.

Author

N78-20917* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. COMPARISON OF MEASURED AND CALCULATED HELICOPTER ROTOR IMPULSIVE NOISE Wayne Johnson and Albert Lee (Beam Eng., Inc.) Mar. 1978 29 p refs (Contract NAS2-83999) (NASA-TM-78473; A-7365) Avail NTIS HC A03/MF A01 CSCL 20A

The thickness noise theory is discussed. Two full-scale rotors were tested in a wind tunnel with several tips involving changes in chord, thickness, and sweep. Impulsive noise data reduction procedures used are described. The calculated and measured impulsive noise peak pressures as a function of advancing tip Mach number are compared, showing good correlation for all rotors considered.

Author


The performances of a derivative concept of a 1985 STOL tilt rotor transport, and of a second concept having a complex mechanical flap system similar to a short field 8737 aircraft were compared for a 370 kilometer (200 nautical mile) short haul mission. The flap system of the latter allowed lift to be shifted from the rotor system to the wing, permitting a 26 percent reduction in dynamic component weight, while also permitting the use of a smaller wing. The wing and disc loading of this concept were 5746 (120 psf) and 1915 (40 psf) newtons per square meter, respectively, while the wing and disc loading of the derivative concept were 4788 (100 psf) and 1197 (25 psf) newtons per square meter, respectively. The high-lift wing tilt rotor showed slightly improved fuel usage over its entire operating range and about 5 to 8 percent improvement in direct operating costs, resulting from its improved cruise efficiency and reduced weight. Other advantages include improved reliability with decreased mission maintenance and better ride quality.

Author

N78-21159* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. A NOTE ON MULTICYCLIC CONTROL BY SWASHPLATE OSCILLATION James C. Biggers and John L. McCleod, III Apr. 1978 11 p refs (NASA-TM-78475; A-7367) Avail NTIS HC A02/MF A01 CSCL 01C

It was shown that for two, three, or four bladed rotors, simple oscillation of the nonrotating swashplate controls can produce prescribed blade pitch schedules of the sort which were suggested for vibration alleviation. Equations were given which relate the swashplate motions to the resulting blade pitch schedules.

Author
The optimal control of a degree-of-freedom moving-base simulator is considered. The quasi-optimal control method due to Friedland was utilized. The problem, in broad terms, was to determine a control law for moving the simulator cab so that its motion would: (1) best approximate the desired aircraft response, and (2) not exceed the limited translational capability of the simulator. A variety of optimal responses were obtained by the method which emphasized different features of the response which were thought to be important in motion perception. Examples of such results are given, and the considerations important in such evaluations by experienced flight personnel are discussed.

Author: Elwood C. Stewart

N78-22025* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

OPTIMAL CONTROL OF A MOVING-BASE SIMULATOR

Elwood C. Stewart In NASA, Washington Fourth Inter-Center Control Systems Conf Jan 1978 p 253-259 refs (For availability see N78-23010 13-99) Avail NTIS HC A02/MF A01 CSCL 14B

The optimal control of a degree-of-freedom moving-base simulator is considered. The quasi-optimal control method due to Friedland was utilized. The problem, in broad terms, was to determine a control law for moving the simulator cab so that its motion would: (1) best approximate the desired aircraft response, and (2) not exceed the limited translational capability of the simulator. A variety of optimal responses were obtained by the method which emphasized different features of the response which were thought to be important in motion perception. Examples of such results are given, and the considerations important in such evaluations by experienced flight personnel are discussed.

Author: Elwood C. Stewart

N78-23100* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

OPTIMAL GUIDANCE AND CONTROL FOR INVESTIGATING AIRCRAFT NOISE-IMPACT REDUCTION

Elwood C. Stewart and Thomas M. Carlson May 1978 58 p refs (NASA-TP-1237, A-7121) Avail NTIS HC A04/MF A01 CSCL 01C

A methodology for investigating the reduction of community noise impact is reported. This report is concerned with the development of two models to provide data a guidance generator and an aircraft control generator suitable for various current and advanced types of aircraft. The guidance generator produces the commanded path information from inputs chosen by an operator from a graphic display of a land-use map of the terminal area. The guidance generator also produces smoothing at the junctions of straight-line paths. The aircraft control generator determines the optimal set of the available controls such that the aircraft will follow the commanded path. The solutions for the control functions are given and shown to be dependent on the class of aircraft to be considered, that is, whether the thrust vector is rotatable and whether the thrust vector affects the aerodynamic forces. For the class of aircraft possessing a rotatable thrust vector, the solution is redundant; this redundancy is removed by the additional condition that the noise impact be minimized from both the guidance generator and the aircraft control generator is used by the footpath program to construct the noise footprint.

Author: Elwood C. Stewart and Thomas M. Carlson

N78-23016* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

OPTIMUM HORIZONTAL GUIDANCE TECHNIQUES FOR AIRCRAFT

Heinz Erzberger and Homer Q. Lee In NASA, Washington Fourth Inter-Center Control Systems Conf Jan 1978 p 175-184 refs (For availability see N78-23010 13-99) Avail NTIS HC A02/MF A01 CSCL 17G

Some problems of automatic guidance of an aircraft in the horizontal plane are described. The horizontal guidance tasks, such as a flight control system should be capable of performing were identified as being of three types: guiding the aircraft from any initial location and initial heading to (1) any final location and heading, (2) intercept and fly along a line of specified direction, and (3) a final location with arbitrary final heading. Guidance problems such as capturing an ILS beam at a specified point on the beam, intercepting a VOR radial, and point-to-point navigation can be formulated in terms of these problems. The guidance laws maximize the arc distance to fly between initial and final conditions subject to constraints on the minimum turning radius.

Author: Homer Q. Lee

N78-26133* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

TRAJECTORY MODULE OF THE NASA AMES RESEARCH CENTER AIRCRAFT SYNTHESIS PROGRAM ACSYNT

Michael E. Tauber and John A Paterson Jul 1978 73 p refs (NASA-TP-78438, A-7214) Avail NTIS HC A04/MF A01 CSCL 01C

A program was developed to calculate trajectories for both military and commercial aircraft for use in the aircraft synthesis program, ACSYNT. The function of the trajectory module was to calculate the changes in the vehicle's flight conditions and weight, as fuel is consumed, during the flying of one or more missions. The trajectory calculations started with a takeoff, followed by up to 12 phases chosen from among the following: climb, cruise, acceleration, combat, loiter, descent, and paths. In addition, a balanced field length was computed. The emphasis was on relatively simple formulations and analytic expressions suitable for rapid computation since a prescribed trajectory had to be calculated many times in the process of converging an aircraft design, or finding an optimum configuration. The trajectory module consists of about 2500 cards and operational on a CDC 7600 computer.

Author: Michael E. Tauber and John A Paterson

N78-26151* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

A FLIGHT INVESTIGATION OF THE STABILITY, CONTROL, AND HANDLING QUALITIES OF AN AUGMENTED JET FLAP STOL AIRCRAFT

Richard F. Vomaske, Robert C. Inns, Brian E. Swan (Canadian Armed Forces, Ottawa), and Seth W. Grossmith (Canadian Dept of Transport, Ottawa) Jun 1978 147 p refs (NASA-TP-1254, A-7246) Avail NTIS HC A07/MF A01 CSCL 01C

The stability, control, and handling qualities of an augmented jet flap STOL aircraft are presented. The airplane is an extensively modified de Havilland Buffalo military transport. The modified airplane has two fan-jet engines which provide vectorable thrust and compressed air for the augmentor jet flap and Boundary-Layer Control (BLC). The augmentor and BLC air is cross ducted to minimize asymmetric moments produced when one engine is inoperative. The modifications incorporate in the airplane include a Stability Augmentation System (SAS), a powered elevator, and a powered lateral control system. The test gross weight of the airplane was between 165.000 and 200.000 N (37.000 and 47.000 lb) Stability, control, and handling qualities are presented for the airspeed range of 40 to 180 knots. The lateral-directional handling qualities are considered satisfactory for the normal
shocked flows observed experimentally were reproduced computationally. The ability to identify the effects of design modifications was demonstrated both in terms of pressure distributions and shock drag characteristics.

G G.

N78-28278# Army Natick Research and Development Command
MOSS ACCORDION SHELTER HARDWARE ANALYSIS
Predrag Shopovalch and Franklin Barca
Feb 1978 37 p reffs
[DA Proj L77-62723-A-42701]
(AD-A035382. NATICK/TR-78/001) Avail. NTIS
HC A03/MF A01 CSCL 13/13

This report presents the results of an investigation into some of the hardware difficulties experienced with the accordion shelter during field tests. The accordion shelter is a prototype rigid-wall, general purpose, expandable military shelter. In the closed, transportation configuration the shelter serves as its own shipping container and conforms to the dimensional and strength requirements of the International Organization for Standardization Type IC freight container. In the habitation mode the container expands from both sides to form an enclosed, environmentally controlled, lighted shelter approximately 2.4 metres high by 2.4 metres wide by 1.52 metres long. The main problem areas are identified as container jacks, floor jacks, leveling systems, and expansion system. The specific causes of the problems are identified and solutions to the problems are proposed.

Author (GRA)

N78-28402# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.
PHENOMENOLOGICAL ASPECTS OF QUASI-STATIONARY
CONTROLLED AND UNCONTROLLED THREE-
DIMENSIONAL FLOW SEPARATIONS
David J. Peake
In AGARD Three Dimensional and Unsteady
Separation at High Reynolds No. Feb 1978 52 p reffs
(For primary document see N78-28397 19-34)
Avail NTIS HC A11/MF A01 CSCL 20/D

Quasi-steady three dimensional separated flows about bodies of large fineness ratio operating at large angles of incidence or yaw are discussed. The general character of the three dimensional attached boundary layer, the concept of limiting streamlines, and the physics of three dimensional separation and reattachment are among the factors considered. Specific examples are given. The advantages of swept, sharp edges that generate controlled (or fixed) three dimensional flow separations on a vehicle, due to the qualitatively unchanging flow field developed throughout the range of flight conditions, are emphasized.

J M S

N78-28060# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.
A METHODOLOGY FOR THE ANALYSIS OF THE BENEFITS AND
COSTS FOR AERONAUTICAL RESEARCH AND TECHNOLOGY
CBS
Louis J. Williams
H. Hoy, and Joseph L. Anderson
In NASA Langley Res Center CTOL Transport Technol., 1978
1978 p 871-884 reffs (For primary document see N78-28048
20-01)
Avail. NTIS HC A18/MF A01 CSCL 05A

A relatively simple, consistent, and reasonable methodology for performing cost-benefit analyses which can be used to justify and explain investments in aeronautical research and technology is presented. The elements of this methodology (labeled ABC-ART for the Analysis of the Benefits and Costs of Aeronautical Research and Technology) include estimation of aircraft markets, manufacturer costs, development costs, and return on investment versus aircraft price, airline costs and return on investment versus aircraft price and passenger yield, and potential system benefits - fuel savings, cost savings, and net revenues. The application of this methodology is explained using the introduction of an advanced turboprop powered transport aircraft in the medium range market in 1978 as an example.

J M S
The results of the reduced energy for commercial air transportation studies on air transportation energy efficiency improvement alternatives are reviewed along with subsequent design studies of advanced turboprop powered transport aircraft. The application of this research to short-haul transportation is discussed. The results of several recent turboprop aircraft design are included. The potential fuel savings and cost savings for advanced turboprop aircraft appear substantial, particularly at shorter ranges.

Author.

The merger of two corotating vortices was studied with a laser velocimeter designed to measure the two cross-stream components of velocity. Measurements were made at several downstream distances in the vortex wake shed by two semispan wings mounted on the wind-tunnel walls. The velocity data provided well-defined contours of crossflow velocity, stream function, and vorticity for a variety of test conditions.

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For larger radii, the vorticity depended on the distance from the wing. Upstream of the merge, a multicell vorticity pattern was found. Author

NASA CONTRACTOR REPORTS

N78-13766** Stanford Univ., Calif. Joint Inst for Aeronautics and Acoustics

MULTI-CALCULATION RATE SIMULATIONS Final Report
J. David Powell and Mahboob Akhtar Nov. 1977 59 p refs
(Grant NaG-2250) NASA CR-155355) Available NTIS HC A04/MF A01 CSCL 08C

It is common in real-time simulations of large aerospace systems to separate the high and low frequency subsystems within the simulation and perform the integrations of the subsystems at different calculation rates. This is done to strike a balance between accuracy of calculation and capacity of the digital computer. Questions arising as to the accuracy of this structure compared to single calculation rates were studied using a linear aircraft model. Also investigated were interactions arising to cause errors worse than those expected. Problems are specifically identified and guidelines are given for selection of sample rates for multiple rate simulations. Author

N78-14016** Stanford Univ., Calif. Dept of Civil Engineering

Janu S. Dajani Nov. 1977 34 p refs
(Grant NaG-2203) NASA CR-155356) Available NTIS HC A03/MF A01 CSCL 01C

The role of air cargo in the current transportation system in the United States is explored. Methods for assessing the future role of this mode of transportation include the use of continuous-time recursive systems modeling for the simulation of different components of the air freight system, as well as for the development of alternative future scenarios which may result from different policy actions. A basic conceptual framework for conducting such a dynamic simulation is presented within the context of the air freight industry. Some research needs are identified and recommended for further research. The benefits, limitations, pitfalls, and problems usually associated with large-scale systems models are examined. Author


Julius E. Dods, Jr. Nov. 1977 147 p refs
(Contract NAS2-9112) NASA CR-152083) Available NTIS HC A07/MF A01 CSCL 2dE

The static and dynamic rotor blade stresses of the three stage compressor were measured. Data are presented in terms of total blade stress for the complete operational range of compressor speeds and tunnel total pressures. Modal frequencies and variations with tunnel conditions were measured. Phase angles and coherences between various gage combinations are also presented. Recommendations for improvements are given for future rotor blade experimental investigations. Author

N78-17082** Boeing Co., Seattle, Wash.

LOW SPEED TEST OF A HIGH-BYPASS-RATIO PROPULSION SYSTEM WITH AN ASYMMETRIC INLET DESIGNED FOR A TILT-NACELLE V/STOL AIRPLANE
J. Syberg Jan. 1978 115 p refs
(Contract NAS2-8640) NASA CR-152072. 180-22888-1) Available NTIS HC A06/MF A01 CSCL 21E

A large-scale model of a tilt-cruise fan inlet designed for a tilt nacelle V/STOL airplane was tested with a high bypass ratio turbofan. Testing was conducted at low freestream velocities with inlet angles of attack ranging from 0 deg to 120 deg. The operating limits for the nacelle were found to be related to inlet boundary layer separation. Small separations originating in the inlet diffuser caused little or no performance degradation. However, at sufficiently severe freestream conditions, the separation changes abruptly to a lip separation. This change is associated with a significant reduction in nacelle net thrust as well as a sharp increase in fan blade vibratory stresses. Consequently, the onset of lip separation is regarded as the nacelle operating limit. The test verified that the symmetric inlet design will provide high performance and stable operation at the design forward speed and angle of attack conditions. At some of these, however, operation near the lower end of the design inlet airflow range is not feasible due to the occurrence of lip separation. Author

N78-19094** McDonnell Douglas Corp., St. Louis, Mo.

CONCEPTUAL DESIGN STUDY OF A HARRIER V/STOL RESEARCH AIRCRAFT
(Contract NAS2-9748) NASA CR-152086) Available NTIS HC A13/MF A01 CSCL 01C

MCAIR recently completed a conceptual design study to define modification approaches to, and derive planning prices for the conversion of a twin-place Harrier to a V/STOL control, display and guidance research aircraft. Control concepts such as rate damping, attitude stabilization, velocity command, and cockpit controllers are to be demonstrated. Display formats will also be investigated, and landing, navigation, and guidance systems flight tested. The rear cockpit is modified such that it can be quickly adapted to faithfully simulate the controls, displays and handling qualities of a Type A or Type B V/STOL. The safety pilot always has take command capability. The modifications studied fall into two categories: basic modifications and optional modifications. Technical descriptions of the basic modifications and of the optional modifications are presented. The modification plan and schedule as well as the test plan and schedule are presented. The failure mode and effects analysis, aircraft performance, aircraft weight, and aircraft support are discussed. Author


STUDY, OPTIMIZATION, AND DESIGN OF A LASER HEAT ENGINE Final Report
12 Jan. 1978 160 p refs
(Contract NAS2-9686) NASA CR-152104, MSNW-78-1082-1) Available NTIS HC A03/MF A01 CSCL 20E

Laser heat engine concepts, proposed for satellite applications, were analyzed to determine which engine concepts best meet the requirements of high efficiency (80 percent or better) continuous operation in space. The best laser heat engines for a near-term experimental demonstration, selected on the basis of high overall operating efficiency, high power-to-weight characteristics, and availability of the required technology, is an Otto/Diesel cycle piston engine using a diamond window to admit CO2 laser radiation. The technology with the greatest promise of scaling to megawatt power levels in the long term is the energy exchanger/gas turbine combination. Author
An application-independent geometric model within a data base framework should support the use of Boolean operators which allow the user to construct a complex model by appropriately combining a series of simple models. The use of these operators leads to the concept of implicitly and explicitly defined surfaces. With an explicitly defined model, the surface area may be computed by simply summing the surface areas of the bounding surfaces. For an implicitly defined model, the surface area computation must deal with active and inactive regions. Because the surface intersection problem involves four unknowns and its solution is a space curve, the parametric coordinates of each surface must be determined as a function of the arc length. Various subproblems involved in the general intersection problem are discussed, and the mathematical basis for their solution is presented along with a program written in FORTRAN IV for implementation on the IBM 370 TSO system.

The advantages of a propfan powered aircraft for the commercial air transportation system were assessed by the comparison with an equivalent turbofan transport. Comparisons were accomplished on the basis of fuel utilization and operating costs, as well as aircraft weight and size. Advantages of the propfan aircraft, concerning fuel utilization and operating costs, were accomplished on the basis of fuel utilization and operational advantages. (2) revised mission profiles (longer design range and reduction in; and cruise speed), and (3) utilization of alternate and advanced technology engines.

The use of leaping vanes for tone noise reduction was examined in terms of their application in a typical two-stage high pressure ratio fan. In particular for stages designed with outlet guide vanes and zero swirl between stages, leaning the vanes of the first stage stator was studied, since increasing the number of vanes and the gap between stages do not provide the desired advantage. It was shown that noise reduction at higher harmonics of blade passing frequency can be obtained by leaning the vanes.

A major difficulty was to establish the required acoustic data. A method was developed for the calculation of the necessary data. The method was based on the measurement of the sound pressure level at various locations around the engine. The results were then used to predict the noise level at other locations.

The design of the propfan engine was also influenced by the need to minimize the noise level. This was achieved by using a combination of techniques, including the use of a low-noise fan and the addition of acoustic liners within the engine casing.

A detailed analysis of the noise propagation was performed in order to determine the specific noise sources and the propagation mechanisms. The results were used to optimize the engine design and the acoustic treatment of the engine.
extremize the closed loop total system damping subject to constraints on the determinants. The extremization is really a minimization of the effects of disturbances, and interpreted as a compromise between the generalized system accuracy and the generalized system response speed. The trade-off between the accuracy and the response speed is adjusted by a single parameter, the ratio of determinants. By this approach an objective measure can be obtained for the design of a control system. The measure is to be determined by the system requirements. Author

N78-21445* Harvey Mudd Coll, Claremont, Calif Engineering Cmd
GENERATION OF A MONODISPERSED AEROSOL Final Report Helma Schenck Miles Mikasa, and Ralph DeVencos Jun 1974 61 p refs
Contract NAS2-8143
NASA-CR-152133
(Available) NTIS HC A04/MF A01 CSCL 20E
The identity and laboratory test methods for the generation of a monodispersed aerosol are reported on, and are subjected to the following constraints and parameters. (1) size distribution, (2) specific gravity, (3) scattering properties, (4) costs, (5) production. The procedure called for the collection of information from the literature, commercial available products, and experts working in the field. The following topics were investigated: (1) aerosols, (2) air pollution -- analysis, (3) atomization, (4) dispersion, (5) particles -- optics, size analysis, (6) smoke -- generators, density measurements; (7) sprays, (8) wind tunnels -- visualization. Author

Contract NAS2-9352
NASA-CR-152040, TR-1092-1 (Available) NTIS HC A12/MF A01 CSCL 01E
The objective of this effort is to determine IFR approach path and touchdown dispersions for manual and automatic XV-15 tilt rotor landings, and to develop missed approach criteria. Only helicopter mode XV-15 operation is considered. The analysis and design sections develop the automatic and flight director guidance equations for decelerating curved and straight-in approaches into a typical VTOL landing site equipped with an MLS navigation aid. These design systems satisfy all known pilot-centered guidance and control requirements for this flying task. Performance data, obtained from nonstationary covariance propagation for a random excitation of the system, are used to develop and the approach monitoring systems. The manual and flight director guidance equations are programmed for the VSTOLAND XV19B digital computer. The design dispersion data developed through analysis and the XV19B digital computer program are verified and refined using the fixed-base, man-in-the-loop XV-15 VSTOLAND simulation. Author

Contract NAS2-9352
NASA-CR-152089, D5-45320 (Available) NTIS HC A15/MF A01 CSCL 01C
The results of a preliminary design study which investigates the use of selected advanced technologies to achieve lower cost, design for small (150-passenger), short haul (50 to 1000 mile) transports are reported. The largest single item in the cost of manufacturing an airplane of this type is labor. A careful examination of advanced technology to airplane structure was performed since one of the most labor-intensive parts of the airplane is structures. Also, preliminary investigation of advanced aerodynamics, flight controls, ride control and gust load alleviation systems, aircraft systems and turbo-prop propulsion systems was performed. The most beneficial advanced technology examined was bonded aluminum primary structure. The use of this structure in large wing panels and body sections resulted in a greatly reduced number of parts and fasteners and therefore, labor hours. The resultant cost of assembled airplane structure was reduced by 40% and the total airplane manufacturing cost by 15% -- a major cost reduction. With further development, test verification and optimization achievable weight savings is also achievable. Other advanced technology items which showed significant gains are as follows: (1) advanced turboprop-reduced block fuel by 15-30% depending on range, (2) configuration revisions (v-stall)-empennage cost reduction of 25%; (3) leading-edge flap addition weight reduction of 2500 pounds. Author

N78-22100* Rockwell International Corp., Columbus, Ohio Aircraft Div.
STATIC TESTS OF A LARGE SCALE SWIVEL NOZZLE THRUST DEFLECTOR John F. Federalski Feb 1978 44 p refs
Contract NAS2-9176
NASA-CR-152091, NR78H-10 (Available) NTIS HC A03/MF A01 CSCL 21E
Tests were conducted on a swivel nozzle thrust deflector installed on a 91 centimeter (36 inch) low pressure ratio tip turbine fan. Fan power was supplied by a J-85 hot gas generator. The configuration was typical of a vertical/short takeoff and landing (V/STOL) aircraft propulsion system employing lift cruise fans. The performance data were compared to results obtained on an 0.15 scale cold flow model. Data were obtained at fan pressure ratios from 1.0 to 1.2 and at nozzle deflections from 0 (deg) to VTOL (90 deg). The nozzle thrust performance was in good agreement with small scale VTOL thrust coefficients. Configurations with increased nozzle and showed lower performance. Fan operation was routine and nozzle rotation caused no circumferential distortions of the fan exit flow. Nozzle flow characteristics did not repeat small scale model results. Measured flow coefficients were smaller on the large scale test. It was concluded that lack of simulation of pressure and temperature profiles of the tips driven fan was the most probable cause of the discrepancy. Author

Contract NAS2-9211
NASA-CR-2993, NEAR-TR-134 (Available) NTIS HC A05/MF A01 CSCL 01A
Four blunted ogive-cylinder missile models with a length-to-diameter ratio of 10:4 were tested at transonic speeds and large angles of attack. The configurations are body, body with tail panels, body with canards, and body with canards and tails. Forces and moments from the entire model and each of the eight fins were measured over the pitch range of 0 deg to 50 deg and 0 deg to 45 deg roll. Canard deflection angles between 0 deg and 15 deg were tested. Exploratory vacuum flow visualization testing was also performed. Sample force and moment data are reported along with observations of the vacuum screen tests. Author

Grant NSG-2145
The usability of the general aviation synthesis program (GASP) was enhanced by the development of separate computer
changes in tip vortex structure. Author intensity of the acoustic signal is shown to be quite sensitive to the velocity profile in the trailing vortex from the spanwise for the directivity. frequency spectrum, and transient signal of linear unsteady aerodynamic theory, and expressions are derived the acoustic signal is investigated. The analysis is based on a relationship between vortex structure and the intensity of (Grant NsG-2142) Thomas L Wolf and Sheila  

NOISE DUE TO BLADE/VORTEX INTERACTION

A potential cause of helicopter impulsive noise, commonly called blade slap, is the unsteady lift fluctuation on a rotor blade due to interaction with the vortex trailed from another blade. The relationship between vortex structure and the intensity of the acoustic signal is investigated. The analysis is based on a theoretical model for blade/vortex interaction. Unsteady lift on the blades due to blade/vortex interaction is calculated using linear unsteady aerodynamic theory, and expressions are derived for the directivity, frequency spectrum, and transient signal of the radiated noise. An inviscid rollup model is used to calculate the velocity profile in the trailing vortex from the spanwise distribution of blade tip loading. A few cases of tip loading are investigated, and numerical results are presented for the unsteady lift and acoustic signal due to blade/vortex interaction. The intensity of the acoustic signal is shown to be quite sensitive to changes in tip vortex structure. Author
The Kalman filter provides improved estimates of the aircraft position and velocity as compared with estimates from more standard complementary filters. The onboard computer implementation requirements to achieve this improved performance are discussed.

N78-27128[†] Hamilton Standard, Windsor Locks, Conn PROP-FAN DATA SUPPORT STUDY Final Report

Updated parametric prop-fan data packages are presented and the rationale used in developing the new prop-fan data is detailed. These data represent Hamilton Standard's projections of prop-fan characteristics for aircraft that are expected to be in-service in the 1985 to 1990 time frame. The basic prop-fan configuration was designed for efficient cruise operation at 0.8 Mach number and 10,668 ft altitude. The design blade tip speed is 244 m/s and the design power loading is 301 kW/M squared.

N78-28089[‡] Goeham Associates, Thousand Oaks, Calif STUDY TO DETERMINE OPERATIONAL AND PERFORMANCE CRITERIA FOR STOL AIRCRAFT OPERATING IN LOW VISIBILITY CONDITIONS
John A. Goeham May 1978 63 p ref (Contract NAS2-8780) (NASA-CR-152164) Avail NTIS HC A04/MF A01 CSCL 01C

The operational and performance criteria for civil CTOL passenger-carrying airplanes landing in low visibilities depend upon the characteristics of the airplane, the nature and use of the ground and airborne guidance and control systems, and the geometry and lighting of the landing field. Based upon these criteria, FAA advisory circulars, airplane and equipment design characteristics, and airline operational and maintenance procedures were formulated. The documents are selected, described and discussed in relationship to the potential low weather minimum operation of STOL aircraft. An attempt is made to identify fundamental differences between CTOL and STOL aircraft characteristics which could impact upon existing CTOL documentation. Further study and/or flight experiments are recommended.

Lonne E. Haeftner 31 Mar 1978 37 p ref (Grant NsG-2170) (NASA-CR-152154-1) Avail NTIS HC A03/MF A01 CSCL 05C

The benefits and costs that would result from an intra-regional air service operation in the San Francisco Bay area were determined by utilizing an iterative statistical decision model to evaluate combinations of commuter airport sites and surface transportation facilities in conjunction with service by a given commuter aircraft type in light of area regional growth alternatives and peak and off-peak regional travel patterns. The model evaluates such transportation option with respect to criteria of airline profitability, public acceptance, and public and private non-user costs. In so doing, it incorporates information on modal split, peak and off-peak use of the air commuter fleet, terminal and airport costs, development costs and uses of land in proximity to the airport sites, regional population shifts, and induced zonal shifts in travel demand. The model is multimodal in its analytic capability, and performs exhaustive sensitivity analysis.

N78-28989[¶] Washington Univ., Seattle Dept. of Civil Engineering A TECHNOLOGY ASSESSMENT OF TRANSPORTATION SYSTEM INVESTMENTS
Lonne E. Haeftner 31 Mar 1978 206 p ref (Grant NsG-2170) (NASA-CR-152154-2) Avail NTIS HC A10/MF A01 CSCL 05C

An abstract technology assessment format, capable of generating estimates over a hierarchy of city sizes, shapes and modes of transportation technology characteristics, using unit cost and impact data is presented. The formal analytic model used is the Markovian decision theory. The analyst is not required to know or to explore the historical data characteristics of the problem in depth and can, therefore, rapidly examine sensitivities and boundaries of rational or optimal transportation investments. This examination may occur over a group of similar or different regions, and may draw significant conclusions about the mix of transportation technology investments most likely needed and capable of compatible operation.

N78-30070[∥] Aeronautical Research Foundation, Cambridge, Mass. REQUIREMENTS FOR REGIONAL SHORT-HAUL AIR SERVICE AND THE DEFINITION OF A FLIGHT PROGRAM TO DETERMINE NEIGHBORHOOD REACTIONS TO SMALL TRANSPORT AIRCRAFT

An evaluation of the current status and future requirements of an intraregional short haul air service is given. A brief definition of the different types of short haul air service is given. This is followed by a historical review of previous attempts to develop short haul air service in high density urban areas and an assessment of the current status. The requirements for intraregional air service, the need for economic and environmental viability, and the need for a flight research program are defined. A detailed outline of a research program that would determine urban community reaction to frequent operations of small transport aircraft is also given. Both the operation of such an experiment in a specific region (San Francisco Bay area) and the necessary design modifications of an existing fixed wing aircraft which could be used in the experiment are established. An estimate is made of overall program costs.

N78-33113[‡] General Dynamics/Fort Worth, Tex AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS: PHASE 1: F-111A FLIGHT DATA ANALYSIS, VOLUME 1: SUMMARY OF TECHNICAL APPROACH, RESULTS AND CONCLUSIONS

The structural response to aerodynamic buffet during moderate to high-g maneuvers at subsonic and transonic speeds was investigated. The investigation is reported in three volumes. This volume presents a summary of the investigation with a complete description of the technical approach, description of the aircraft, its instrumentation, the data reduction procedures, results, and conclusion.

N78-33117[∥] General Dynamics/Fort Worth, Tex AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS: PHASE 2: F-111A FLIGHT DATA ANALYSIS, VOLUME 2: PLOTTED POWER SPECTRA
David B Benepe, Atlee M. Cunningham, Jr., Sam Taylor, Jr., and W. David Dunmyer 1978 724 p ref (Contract NAS2-7091)
PLotted power spectra for all of the flight points examined during the Phase 2 flight data analysis are presented. Detailed descriptions of the aircraft, the flight instrumentation and the analysis techniques are given. Measured and calculated vibration mode frequencies are also presented to assist in further interpretation of the PSD data.

G.Y.

N78-33118# General Dynamics/Fort Worth, Tex
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS. PHASE 2: F-111A FLIGHT DATA ANALYSIS. VOLUME 3: TABULATED POWER SPECTRA
David B. Benepe, Atlee M. Cunningham, Jr., Sam Traylor, Jr., and W. David Dunmyer 1978 286 p refs (Contract NAS2-7091)
(NASA-CR-152114) Avail. NTIS HC A13/MF A01 CSCL 01C

Power spectral density (PSD) data for all of the flight points examined during the Phase 2 flight data analyses are presented in tabular form. Detailed descriptions of the aircraft, the flight instrumentation and the analysis techniques are given. Measured and calculated vibration mode frequencies are also presented to assist in further interpretation of the PSD data.

G.Y.

N78-33876# Nilsen Engineering and Research, Inc., Mountain View, Calif
(NASA-CR-152185, NEAR-TR-171) Avail. NTIS HC A05/MF A01 CSCL 20A

Sound generated in a moving fluid must propagate through a shear layer in order to be measured by a fixed instrument. These propagation effects were evaluated for noise sources typically associated with angle and co-flowing subsonic jets and for subsonical flow over airfoils in such cases. The techniques for describing acoustic propagation fall into two categories, geometric acoustics and wave acoustics. Geometric acoustics is most convenient and accurate for high frequency sound. In the frequency range of interest to the present study (greater than 150 Hz), the geometric acoustics approach was determined to be most useful and practical.

G.G.

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

A78-10455# / /
Two different geometrically similar airfoils are studied. The geometry of one of the airfoils is designed for a canard/delta aircraft. The other geometry is designed for a configuration with a canard and a tail wing. The two geometries are studied for a range of angles of attack and flap deflections. The results are presented in tabular form.


Objectives and functions of the Advanced Digital Avionics System (ADAS) for general aviation are outlined with particular reference to navigation, flight control, engine management, ATC surveillance, flight management, communications, and the pilot controls and displays. The resulting ADAS design comprises the selection of off-the-shelf avionics to be integrated with ADAS-unique elements including new aircraft displays and controls along with a microcomputer control complex (MCC). Revisions for which the ADAS achieves increased avionics capability are mentioned, including overall system integration through the MCC and pilot orientation from navigation map display.

S.D.


This paper describes some of the results of a study directed to the specification and procurement of a new cockpit simulator for an advanced class of helicopters. A part of the study was the definition of a challenging benchmark problem, and detailed analyses of it were made to assess the suitability of a variety of simulation techniques. The analyses showed that a particular cost-effective approach to the attainment of adequate speed for this extremely demanding application is to employ a large, microprocessor-based host and controller for a special-purpose peripheral processor. Various realizations of such peripheral processors, all employing state-of-the-art electronic circuitry and a high degree of parallelism and pipelining, are available or under development. The types of peripheral processors - array processors, simulation-oriented processors, and arrays of processing elements are analyzed and compared. They are particularly promising approaches which should be suitable for high-speed simulations of all kinds, the cockpit simulator being a case in point. (Author)


A unique miniature pressure sensor system consisting of an array of fifty integrated pressure sensors translates with integral electronic logic and switching a described. Solid state processing of the piezoresistive array is combined with hybrid microelectronics to produce a very small, dense (300 cc displaced), high reliability pressure measuring system. Application to high speed data acquisition, energy conservation in wind tunnels and flight test is discussed. Test data are presented typifying system performance. (Author)


Some results concerning robustness and asymptotic properties of error bounds of a linear quadratic feedback design are applied to an aircraft control problem. An autopilot for the flaps control of the Augmentor Wing Jet STOL Research Aircraft (A78JSRA) is based on Linear Quadratic (LQ) theory and the results are developed in this paper. The variation of the error bounds to changes

This paper discusses the application of three-dimensional computational transonic flow methods to several different types of transport wing designs. The purpose of these applications is to evaluate the basic accuracy and limitations associated with such numerical methods. The use of such computational methods for practical engineering problems can only be justified after favorable evaluations are completed. The paper summarizes a study of both the small-disturbance and the full potential technique for computing three-dimensional transonic flows. Computed three-dimensional results are compared to both experimental measurements and theoretical results. Comparisons are made not only of pressure distributions but also of lift and drag forces. Transonic drag rise characteristics are compared. Three-dimensional pressure distributions and aerodynamic forces, computed from the full potential solution, compare reasonably well with experimental results for a wide range of configurations and flow conditions.


The merger of two vortices was studied with a laser velocimeter designed to measure the two cross-stream components of velocity. Measurements were made at several downstream distances in the vortex wake shed by two semispan wings mounted on the wing tunnel walls. The velocity data provided well defined contours of cross-flow velocity, stream function and vorticity. Downstream of the merger point the vorticity was shown to be independent of the downstream distance for small radii, and at larger radii was dependent on the distance from the wing rather than from the merger point. Upstream of the merger point a multicell vortex pattern was shown.


A combined surface hot film and laser velocimeter measurement technique, used to obtain new information on the mean, constant phase-averaged and turbulent structure of time-dependent flow fields, is described. Data obtained in a cylinder wake are presented, and its structure in both the Eulerian and Lagrangian frames is discussed. Turbulence data obtained by conventional and conditional averaging of the velocity fluctuations are also presented. These data provide details of the small- and large-scale contributions to the total turbulent field.


Three-dimensional laser velocimeter measurements have been made of the wake vortices of a slender tangent ogive body which had nose and body fineness ratios of 3.5 and 12, respectively. Data were obtained for an angle of attack to semincircle angle ratio of 2.3 at a free stream Mach number of 0.6 and unit Reynolds number of 2 million/ft. Details of the mean flow field are presented and features of the turbulent and unsteady nature of the vortex flow fields are discussed. Problems associated with obtaining meaningful vortex measurements in high-speed flows are addressed.


In support of the NASA wake vortex alleviation program, measurements were made of the influences of a ground plane on vortex trajectories and vortex frequencies within lift-generated wakes. The wakes were generated by towing 0.61-m (2-ft) span models of two jumbo jets under water in a ship model basin. The models were configured with landing flaps and flight spoilers to investigate the wake characteristics of these aircraft in ground effect at simulated full-scale distances of 19 m (62 ft) to 116 m (380 ft) above the ground. The ground plane modifications in the vortex trajectories but did not alter vortex interactions and merging patterns in the multiple vortex wakes. Some distortions in vortex vertical (tangential) velocity profiles were recorded as a result of vortex lateral motions and vortex interactions with the viscous boundary layer on the ground plane, however, maximum tangential velocities remained unchanged.


The effects of flight on noise radiation from convecting quadrupoles in a jet flow are examined. The analysis shows that as flight velocity increases there is a steady increase in the radiation from the sound that is radiated into the rearward arc. The analysis also shows the same trends when there is a reduction in the exhaust velocity with, however, a further rise in amplification in the forward quadrant and a drop in attenuation in the aft quadrant. Finally, it is concluded that there is a transmission effect to enhance the sound radiation by a density ratio which increases with increasing jet temperature.


This paper presents two new techniques for frequency domain identification of linear system parameters. The first technique uses the instrumental variables approach. The frequency domain formulation allows for a considerable insight into the selection of efficient and convergent instrumental variables. The new maximum likelihood formulation affords a more adequate numerical solution and provides a way to select parameter starting values in the gradient based optimization method.

The paper deals with the problem of expressing the robustness (stability) property of a linear quadratic state feedback (LQSF) design quantitatively in terms of bounds on the perturbations (modeling errors or parameter variations) in the system matrices so that the closed-loop system remains stable. Nonlinear time-varying and linear time-invariant perturbations are considered. The only computation required in obtaining a measure of the robustness of an LQSF design is to determine the eigenvalues of two symmetric matrices determined when solving the algebraic Riccati equation corresponding to the LQSF design problem. Results are applied to a complex dynamic system consisting of the flare control of a STOL aircraft. The design of the flare control is formulated as an LQSF tracking problem.

SD


This paper demonstrates a numerical technique for canard-wing shape optimization at two operating conditions. For purposes of simplicity, a mean surface wing paneling code is employed for the aerodynamic calculations. The optimization procedures are based on the method of feasible directions. The shape functions for describing the thickness, camber, and twist are based on polynomial representations. The primary design requirements imposed restrictions on the canard and wing volumes and on the lift coefficients at the operating conditions. Results indicate that significant improvements in minimum drag and lift-to-drag ratio are possible with reasonable aircraft geometries. Calculations were done for supersonic speeds with Mach numbers ranging from 1 to 6. Planforms were mainly of a delta shape with aspect ratio of 1.

(Author)


For certain types of noise control problems, where transducers cannot be mounted on suspected sources, valuable information can often be obtained by comparing the coherence and phase data measured between two closely spaced microphones with analytical models deduced from the physics of the problem. However, the application of such analysis techniques must be pursued with care, particularly when the measurements are made in a reverberant area. A simple illustration is presented where the acoustic field in the test section of a wind tunnel is evaluated by modeling the field as a combination of diffuse noise due to the boundary layer turbulence in the test section and propagating noise generated by the tunnel fan and possible flow disturbances outside the test section. The coherence and phase between two closely spaced microphones in the tunnel test section are plotted for various ratios of diffuse to propagating noise contributions and compared to actual measurements under several different tunnel operating conditions. (Author)


The uniqueness of the first-order lifting-line connection to the two-dimensional transverse small disturbance potential for the flow past a lifting, three-dimensional, large-aspect-ratio wing is proved. The correction is the solution of a linear equation of mixed type in the plane along the positive x-axis. The boundary data consist of Neumann data, continuity restrictions, the Kutta condition, and the form of the asymptote behavior at infinity. The zeroth-order flow is assumed to be shock-free, and hence the correction is shock-free. P.T.H.


Flight simulation, both ground and in-flight, is experiencing a noticeable technological improvement and growth. The increased capabilities are providing new opportunities for support of the aircraft development process. The development of faster digital computers, improved display hardware, better motion systems, and increased interest in simulation fidelity has improved the ground simulator to the point where it accomplishes a major portion of the aircraft development before work on the flight article begins. The efficiency of the ground simulator as a forerunner for the flight testing phase is becoming well established. In-flight simulation is properly being used to bridge the gap between the ground simulator and the flight test article. Simulation provides the vital link between analysis, aerodynamic tests, and subsystem tests and the flight test article. This paper describes the latest advances in flight simulation and its increasing role in the aircraft development process. (Author)


A self-synchronizing schlieren flow visualization technique has been developed to study unsteady periodic flows which may result from aerelastic effects. The technique allows the experimentalist to 'freeze' the streak line pattern at any phase in one period of the motion by driving the schlieren light source with an electronically processed synchronizing signal that is derived by measuring a periodic flow variable with a convenient sensor. Results for the visualization of the near-wake behind an oscillating airfoil at low speeds which show an ordered series of discrete vortices and a curious short-wavelength wake disturbance are examined. Results are also presented for edge tone sound generation. (Author)


The paper describes the design and capabilities of a compact multichannel electrochemical unit devoted to detect and automatically indicate detection time length of bacteria. By connecting this unit to a strip-chart recorder, a permanent record is obtained of the end points and growth curves for each of eight channels. The experimental setup utilizing the multichannel unit consists of a test tube (25 by 160 mm) containing a combination rod electrode plus 18 ml of lauryl tryptose broth and positioned in a 35C water bath.
Leads from the electrodes are connected to the multichannel unit, which in turn is connected to a strip-chart recorder. After addition of 2.6 ml of medium to the test tubes, depression of the push-button starter activates the electronics, timer, and indicator light for each channel. The multichannel unit is employed to test tenfold dilutions of various members of the Enterobacteriaceae group, and a typical dose-response curve is presented. S.D.


The fuel saving and economic potentials of the prop-fan high-speed propeller concept have been evaluated for twin-engine commercial transport airplanes designed for 3333 mi range, 100 passengers, and Mach 0.8 cruise. A fuel saving of 9.7% at the design range was estimated for a prop-fan aircraft having wing-mounted engines, while a 5.8% saving was estimated for a design having the engines mounted on the aft body. The fuel savings and cost were found to be sensitive to the propeller noise level and to aerodynamic drag effects due to wingslipstream interaction. Uncertainties in these effects could change the fuel savings as much as plus or minus 50%. A modest improvement in direct operating cost was estimated for the wing-mounted prop-fan at current fuel prices. (Author)


An advanced rotation-balanced apparatus has been developed for the Ames 12-ft pressure tunnel to study the effects of spin rate, angles of attack and sideslip, and, particularly, Reynolds number on the aerodynamics of fighter and general aviation aircraft in a steady spin. Angles of attack to 100 deg and sideslip to 30 deg are possible with spin rates to 42 rad/sec (400 rpm) and Reynolds numbers to 30 million/m on fighter models with wingspans that are typically 0.7 m. A complete description of the new rotation-balanced apparatus, the sting/balance/model assembly, and the operational capabilities is given. (Author)


A buried wire gage for measuring wall shear stress in fluid flow was studied and further developed. Several methods of making this relatively new type of gage were examined to arrive at a successful technique that is well-suited for wind-tunnel testing. A series of measurements was made to demonstrate the adequacy of a two-point calibration procedure for these gages. The buried wire gage is also demonstrated to be ideally suited for quantitative measurement of wall shear stress in wind-tunnel testing. (Author)


A belt-type moving ground equipment, used for ground-effect simulation in STOL and VTOL tests, can be inexpensive and easily set up, especially in larger tunnels. In most cases such difficulties may be avoided by employing tangential blowing at the ground surface, from a single slot. The paper reviews several powered model tests using both moving ground and tangential blowing and describes the slot configuration, and the test techniques which were developed. Ground skin friction is monitored to set blowing levels and no model-dependent calculations are needed. It is also shown that application to center-tunnel testing can delay tunnel flow breakdown very considerably. (Author)


Mach number scaling laws are derived for the rotational and the high-frequency broadband noise from helicopter rotors. The rotational scaling law is obtained directly from the theory of Lowson and Oliverhead (1969) by exploiting the properties of the commutant terms in the expression for the complex Fourier coefficients of sound radiated from a rotor at a fixed source. The scaling law for the high-frequency broadband noise is obtained by assuming that the noise sources are acoustically compact and computing the instantaneous pressure due to an element on an airfoil where vortices are shed. Experimental results on the correlation lengths for stationary airfoils are extended to rotating airfoils. On the assumption that the correlation length varies as the boundary layer displacement thickness, it is found that the Mach number scaling law contains a factor of Mach number raised to the exponent 5/8. Both scaling laws were verified by model tests. P.T.H


An algorithm for computing transonic lifting line theory without shocks is presented. The numerical procedure relies on the two-dimensional analyses developed to solve inviscid flow equations for slender airfoils. From a series of solutions to two dimensional problems in which span effects appear parametrically, the three-dimensional potential field characteristic is obtained. Numerical results are given for a lifting wing with an elliptic (spanwise) distribution of chord and a NACA-0012 cross section at a freestream Mach number of 0.5 and an angle of attack of 2 deg are assumed. J M B

Throughout the aircraft development process flight simulators are used to evaluate design concepts, handling qualities, and operational procedures. A modern flight research simulator comprises a cockpit equipped with flight instruments and controls, subsystems to provide visual, motion, and other flight cues, and a digital computer. REPLAY is a computer program which enables a user to reproduce the multidimensional flight cues for an entire simulation 'run.' Attention is given to simulation fidelity improvement, simulation data recovery, simulation quality assurance, and aircraft systems research. It is pointed out that each of the applications discussed supports aircraft research by improving the realism, efficiency, or reliability of the simulation facility.


A dual-loop model of the human controller in single-axis compensatory tracking tasks is introduced. This model postulates an inner-loop closure that involves feeding back that portion of controlled element output rate that is due to control activity. A novel feature of the model is the explicit appearance of the human's internal representation of the manipulator-controlled element dynamics. It is demonstrated that the model can produce controller describing functions that closely approximate controlled element dynamics. It is further pointed out that the model can be used to produce controller descriptions functions that closely approximate those measured in four laboratory tracking tasks in which the controlled element dynamics vary considerably in terms of ease of control. An empirically derived expression for the normalized error-relevant spectrum is introduced.


We consider the numerical solution of a class of integral equations arising in the determination of the compressible flow about a thin airfoil in a ventilated wind tunnel. The integral equations are of the first kind with kernels having a Cauchy singularity. Using appropriately chosen Hilbert spaces, it is shown that the kernel gives rise to a mapping which is the sum of a unitary operator and a compact operator. Thus, it is concluded that the problem to be studied is in terms of an equivalent integral equation of the second kind. A convergent numerical algorithm for its solution is derived by using Gel'kof's method. It is shown that this algorithm is numerically equivalent to Blund's collocation method, which is then used as the method of computation. Extensive numerical calculations are presented establishing the validity of the theory.


Single and multiple trailing vortices shed from semi-span wings and a transport model in a wind tunnel were studied by means of a laser-volcimeter, hot-wire anemometer, and a trailing model incorporating a 6-component force balance. Velocity profile and turbulence data from the laser-volcimeter and hot-wire anemometer are presented, and the effects of the Betz inverse circulation loop - lift and rolling moment measurements on the following model are compared with those predicted from the flow field measurements.


The application of the incompressible three-dimensional momentum integral equation to a finite wing is reviewed. The objective is to interpret the resulting equations in a way that suggests an alternate experimental method for determining the spanwise distribution of lift. Consideration is given to constraints that must be placed on the shape of the velocity wake of the wing to provide the familiar relationship between lift and bound vorticity. A novel technique is then presented for obtaining, from behind the wing, the spanwise lift distribution from velocity surveys that are made only a short distance above and below the wing trailing edge. The necessary formalism is developed to use these measured values to obtain the actual spanwise loading, using an example of a horseshoe vortex model to account for the unmmeasured portion of the downward (or upward) momentum. The results of a numerical simulation are presented for a typical loading distribution. The technique is then verified experimentally using laser velocimeter data for the flow field around a model wing.


Hot-wire measurements have been made in the boundary layer, the separated region, and the near wake for flow past an NACA 4412 airfoil at maximum lift. The Reynolds number based on chord was about 1,500,000. The hot-wire instrument was mounted on the end of a rotating arm. A digital computer was used to control synchronized sampling of hot-wire data at closely spaced points along the probe arc. Ensembles of data were obtained at several thousand locations in the flow field. The data include cross-wind, two components of mean velocity, and twelve mean values for double, triple, and quadruple products of velocity fluctuations. The data are available on punched cards in raw form and also after use of smoothing and interpolation routines to obtain values on a fine rectangular grid aligned with the airfoil chord. The data are displayed in the paper as contour plots.


Inlet and nacelle static pressures were measured on a 0.55-scale model of the Quiet Short-Haul Research Airplane (OSRA) in the Ames Research Center's 40- by 80 Foot Wind Tunnel. This model is powered by four JT-15D engines located above the wing with closely spaced adjacent nacelles. A fifth JT-15D engine in the fuselage provides boundary-layer control air. Each inlet was instrumented with four to eight rows of axial pressure taps located between X/R approximately plus one. The test simulated a broad range of aircraft.
operating conditions, including engine-out, with lift coefficients from 0.9 to 10.0. Results indicate that the inlet perform well under most operating conditions with little interaction between inlets when the aircraft is moving. Potential problem areas identified are high sideslip angle during approach and an interaction effect between adjacent inlets with high mass flows in static conditions. (Author)


In the present paper, a new mathematical model of inlet turbulence is developed by application of basic fluid dynamics and statistical concepts. The model provides an understanding of the turbulent inlet flow as well as a means of describing the flow in quantitative terms. Specifically, the maximum instantaneous distortion produced by inlet unsteady flow can be estimated by the simple measurement of rms data. Practical application of these techniques leads to a data/acquisition/reduction system that is at least one, and maybe two, orders of magnitude less expensive than conventional methods. Each data point can be reduced in terms of the mean strength of the turbulent vortices. By storing these two features (the rms is readily available at the mean flow, and the statistical information), the maximal instantaneous distortion can be reconstructed for other distortion factors at any time subsequent to the test. V.P.


The viscous/potential flow past angle element and multielement airfoils is studied theoretically and experimentally. A computerized analysis, based on iteratively coupled potential-flow and boundary-layer analysis, is used to predict the flow field of the airfoil. The method yields detailed characteristics of conventional laminar and turbulent boundary layers, turbulent wakes, and confluent boundary layers. The viscous flows are analyzed with a method that uses finite-difference solutions of the boundary-layer equations. Reynolds stress in the boundary layers and wakes is simulated with eddy viscosity models for the various flow zones. The viscous calculations are carried into the wake of the airfoil where the drag is found from the defect in the wake momentum. (Author)


It is noted that the stability properties of available galaxy models are not consistent with observations based on observation and that axisymmetric disk systems with velocity dispersions like those of the Galaxy display major changes in form on a dynamical time scale. A report is given on a series of numerical experiments carried out as part of a systematic search for purely self-consistent disk galaxy models that might undergo little change over the time of several galactic rotations. The stability problem is reviewed, the method and calculations used are described, and initial conditions are outlined. The problem of estimating growth rates is discussed, and growth rates are evaluated for various disturbances. Experimental results are presented concerning growths of axisymmetric disturbances in "cold" systems as well as disturbances with m = 1, 2, and 3. It is found that m = 2 disturbances are the most violent and should dominate when in the steady flow; but that m = 1, 2 disturbances are inhibited when m values are allowed. F.G.M.


Lower stratospheric air trajectories entering the region over Alaska at the approximately 125 mb level during late May, 1975 indicate a substantial shift in the geographical source regions for the air masses present during that time. This shift coincides with an approximately 25% decrease in the observed halocarbon mixing ratios at the 125 mb level as determined from a daily sequence of halocarbon profiles. Since the halocarbon species measured are essentially chemically inactive at this level, the observed variation is linked to the changing meteorological pattern. (Author)


Even today, stall/spin accidents involving general aviation aircraft account for more fatal and serious injuries than any other kind of accident. The classic stall/spin accident is one in which the pilot stalls the aircraft at too low an altitude to affect recovery. The primary investigation in the stall/spin is given to human factors considerations, although it is recognized that factors such as flight training are also very important aspects of the total problem. A review of some 70 years of flight indicates that incorporation of the proper combination of aerodynamic parameters to provide good stall/spin avoidance has permitted remained an elusive goal for designers of general aviation aircraft. G.R.


Because fixed missile bases have become increasingly vulnerable to strategic nuclear attack, an air-mobile missile system is proposed whereby ICBMs can be launched from the hold of large subsonic aircraft following a missile-assisted supersonic dash of the aircraft to a safe distance from their base (about 50 km). Three major categories of aircraft design are presented: stager, which employs vertical take-off and a single solid rocket booster similar to that used on the Space Shuttle, and an internally-carried reusable liquid rocket engines, and alternative concepts, some using horizontal take-off with duct-burning afterburners. Attention is given to the economics of maintaining ICBMs airborne during an alert (about $600 million for each flight alert, exclusive of acquisition costs). The chief advantages of the system lie in its reduced vulnerability to surprise attack, because it can be launched on warning, and, in the possibility for recall of the aircraft if the warning proves to be a false alarm. D.M.W.


An airborne clear-air turbulence detector is being flight-tested on board NASA's C-141 and Learjet aircraft. The device is an infrared (IR) sensor in the water vapor band and is designed to detect changes in vapor concentrations associated with turbulence in shear conditions. Warnings of about 5 min have been demonstrated at flight altitudes from 9.1 to 13.7 km (30,000 to 45,000 ft). Encounter predictions were obtained 80% of the time, and false
alarms were given about 6% of the time. Several simple algorithms were studied for use as signal output analyzers and for alert triggering. (Author)


Results are reported for a series of disk-galaxy simulations carried out as part of a systematic search for disk-galaxy models that show little change over the time of several galactic rotations. Systems in a given fixed external field, such as might be provided by a massive halo, are considered. The analysis performed in terms of two parameters: the fraction of the total mass that resides in the active disk and the velocity dispersion in the active disk. The amount of halo mass required to stabilize a disk with a given velocity dispersion is investigated along with the question of whether any amount of halo mass can stabilize a completely "cold" disk galaxy. The experimental results are quoted as growth rates estimated from plots of the amplitudes of Fourier analyses of the density in each of a set of narrow annuli, and systematic trends in the dependence of growth rates on the adjustable parameters are examined. It is shown that a massive inert halo contributes to the stability of disk-galaxy models, but some velocity dispersion is required.


A pressure scale model of Northrop F-5B was tested in NASA Ames Research Center Eleven-Foot Transonic Tunnel to simulate the wing rock oscillations in a transonic maneuver. For this purpose, a flexible model support device was designed and fabricated which allowed the model to oscillate in roll at the scaled wing rock frequency. Two tunnel entries were performed to acquire the pressure (steady state and fluctuating) and response data when the model was held fixed and when it was excited by flow to oscillate in roll. Based on these data, a limit cycle mechanism was identified which supplied energy to the aircraft model and caused the Dutch roll type oscillations, commonly called wing rock. The major origin of the fluctuating pressures which contributed to the limit cycle was traced to the wing surface leading edge stall and the subsequent lift recovery. For coupled wing rock oscillations, the energy balance between the pressure work input and the energy consumed by the model aerodynamic and mechanical damping was formulated and numerical data presented. (Author)


The Quiet Short-Haul Research Aircraft (QSRA) is a new research aircraft which NASA will use as a flight-test facility for advanced flight experiments in terminal area operations. The data resulting from the QSRA flight research program will be used by the U.S. aircraft industry to establish design criteria and by regulatory agencies to establish certification criteria for advanced STOL aircraft. The total funding for the QSRA was established at $29 million in January 1974. Attention is given to an aircraft description, wind-tunnel results, simulation, predicted aircraft performance, initial airworthiness flight tests, design configuration studies, and training studies.


The program described was initiated in 1973 to provide the critical information for the design of an advanced avionics system suitable for general aviation. Emphasis is on the use of data buing, distributed microsensors, shared electronic displays and pilot entry devices, innovative low-cost sensors, and improved functional characteristics. Design considerations include cost, reliability, maintainability, and modularity. V.P.


The paper summarizes several studies to develop aerodynamic technology for high performance VSTOL aircraft anticipated after 1980. A contracted study jointly sponsored by NASA-Ames and David Taylor Naval Ship Research and Development Center is emphasized. Four contractors analyzed two vertical-attitude and three horizontal-attitude takeoff and landing concepts with gross weights ranging from about 10433 kg (33,000 lb) to 17236 kg (38,000 lb). The aircraft have supersonic capability, high maneuver performance (sustained load factor 2.2 at Mach 0.6, 3048 m (10,000 ft) and a 4536 kg (10,000-lb) STO overload capability. The contractors have estimated the aerodynamics and identified aerodynamic uncertainties associated with their concept. Example uncertainties relate to propulsion-induced flows, canard-wing interactions, and top inlets Wind-tunnel research programs were proposed to investigate these uncertainties. (Author)


Lifting line theory is applied to describe the flow about a lifting wing at transonic speeds. The method extends that of Van Dyke (1975), in which lifting line theory is viewed as a singular perturbation problem, to transonic flows. Inner and outer expansions as the aspect ratio approaches infinity of the transonic small disturbance equations are found. It is shown that the solutions match asymptotically. A boundary value problem is formulated which describes the first aspect ratio correction to the two dimensional cross sectional transonic flow. The theory is especially applicable to wings of similar cross-sections. (Author)


An approach to one-on-one air-combat analysis is described which employs discrete gaming of a parameterized model featuring choice between several closed-loop control policies. A preference-ordering formulation due to Fazio is applied to rational choice between outcomes: win, loss, mutual capture, purposeful disregard, draw. Approximate optimization is provided by an active-cell scheme similar to Fazio's obtained by a "backing up" process similar to that of Kopp. The approach is designed primarily for short duration duals with large empty weight. Some illustrative computations are presented for an example modeled using constant-speed vehicles and very rough estimation of energy shifts. (Author)

February 18, 1978

Ground-based flight simulation contributes greatly to the development of new aircraft and flight management systems and will be especially important in improving the performance, safety, and environmental characteristics of future civil and military V/STOL aircraft. This paper describes existing simulation facilities at Ames Research Center and discusses their capabilities and limitations for V/STOL aircraft investigations. Simulation requirements for NASA research and support of OOD programs are also discussed, including technology development for advanced rotorcraft and civil and military V/STOL aircraft. Current efforts and future plans are described for the upgrading of Ames simulation facilities to meet those requirements. Recent advances in equipment technology and operational methodology are shown to provide significantly improved simulation fidelity through better motion and visual cues and faster system response to pilot inputs.
S

flow regimes. Authorate data correlations were developed for the laminar and turbulent
in the laminar and transitional flow regimes. Empirical heating
models. Author

photogeology and field studies of aeolian processes on Earth
laboratory results on studies of aeolian processes, and
into three broad categories

DARY-LAYER TRANSITION AND HEAT TRANSFER
George E. E. Effects

N78-13492##
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
ABSTRACTS FOR THE PLANETARY GEOLOGY FIELD
CONFERENCE ON AEOLIAN PROCESSES
Ronald Gleeley, ed (Arizona State Univ) and David Black, ed
Jan 1978 63 p refs
CSCL 089

The Planetary Geology Field Conference on Aeolian Processes
was organized at the request of the Planetary Geology Program
office of the National Aeronautics and Space Administration
to bring together geologists working on aeolian problems on earth
and planetologists concerned with similar problems on the planets.
Abstracts of papers presented at the conference are arranged
herein by alphabetical order of the senior author. Papers fall
into three broad categories: (1) Viking Orbiter and Viking Lander
results on aeolian processes and/or landforms on Mars, (2)
laboratory results on studies of aeolian processes, and (3)
photogeology and field studies of aeolian processes on earth

N78-16326##
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
EFFECTS OF MASS ADDITION ON BLUNT-BODY BOUNDARY-LAYER TRANSITION AND HEAT TRANSFER
George E. Kaatman Jan 1978 67 p refs
(NASA-TP-1139, A-7169) Avail NTIS HC A04/MF A01
CSCL 20D

The model bodies tested at Mach number 7 32 were
hemispheres, blunt cones, and spherical segments. The mass
addition consisted of air ejected through porous forward surfaces
of the models. The experimental data consisted of heat transfer
measurements from which boundary layer transitions were
deduced. The data verified various applicable boundary layer codes
in the laminar and transitional flow regimes. Empirical heating
rate data correlations were developed for the laminar and turbulent
flow regimes. Author

N78-18386##
Naval Civil Engineering Lab., Port Hueneme, Calif
CABLE STRUMMING SUPPRESSION
Technical Note
Apr. - Jun. 1976
B. E. Hafen and D. J. Meggitt Sep 1977 107 p refs
(YFS2556801) (AD-A047992, ECOM-4542-Pt-2) Avail NTIS
HC A03/MF A01 CSCL 09/S

This report presents a consolidation of existing data on various
devices used to suppress vortex-induced motions of cables and
and hair, and ribbon flexible fairings and helical ridges. In general, the available data show that all of
these methods do, in fact, suppress vortex-induced vibrations to
a greater or lesser degree. However, because of the diverse
ways in which suppression effectiveness has been measured,
comparisons among different types of devices are difficult to
make; criteria for such comparisons are suggested. Relatively
few measurements of the effects of strumming suppression devices
on the drag of a cable or cylinder have been reported. The
available data indicate that a large drag penalty may be incurred
by use of such devices, depending on the configuration
employed. Author (GRA)

N78-18399##
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
STATUS AND FUTURE PROSPECTS OF USING NUMERICAL METHODS TO STUDY COMPLEX FLOWS AT HIGH REYNOLDS NUMBERS
Robert W. McCormack In AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb 1978 14 p refs (For availability see N78-18375 09-34) Avail NTIS HC A11/MF A01 CSCL 20D

The Navier-Stokes equations adequately describe aerodynamic
flows at standard atmospheric temperatures and pressures. If
these equations could be efficiently solved, there would be no
need for experimental tests to design flight vehicles or other
aerodynamic devices. Although much progress has been made toward the solution of complex unsteady two-dimensional and steady three-dimensional separated flows and have recently made some dramatic improvements in developing numerical methods, the calculation of flow fields past complete aircraft configurations at flight Reynolds numbers are far beyond our reach, perhaps as long as a decade away. 

Airfoil and aircraft configurations at flight Reynolds numbers are far beyond our reach, perhaps as long as a decade away. The solution of the three-dimensional Reynolds averaged Navier-Stokes equations in a short time to be practical for design purposes will require 40 times the power of current supercomputers. However, it is feasible to construct a special purpose processor that will meet these requirements to enhance the nation's aerodynamic design capability in the 1980's. Author

**References**


A three segment, 15-foot boom mechanism was designed to deploy magnetometers from the Pioneer Venus orbiter spacecraft. The stowage mechanism is designed to contain the magnetometers during launch and to deploy them in orbit by centrifugal force upon pyrotechnic release. Unique gaps in epoxy boom segments are used for a lightweight design sufficient strength to withstand a 7.5 g orbital acceleration, while extending with the payload. The extended boom is described along with test methods developed for qualification in a one g field. Author


The scope of any aerodynamic configuration proposing to embrace a range of possible maneuvers is shown to be determined by nonlinear effects. The problem is examined in two dimensions, and the nonlinear aerodynamic effects are found to be significant in the adjacent flows about the aircraft's possible maneuvers. The results suggest a favorable conclusion regarding the role of dynamic stability experiments in flight dynamics studies. Author

N78-19775# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. COMPUTATIONAL AERODYNAMICS AND THE NUMERICAL AERODYNAMIC SIMULATION FACILITY. Victor L. Peterson, In its Future Computer Requirements for Computational Aerodynamics. Feb. 1978 5-30 p. (For availability see N78-19778 10-59) Available by NTIS HC A22/MF A01 CSCL 09B

Technical and economic reasons for accelerating the maturation of the discipline of computational aerodynamics include the cost of conducting the experiments required to provide the empirical data base for new aeroviscoelastic vehicles and the limitations of test facilities (Reynolds number, wall and support interferences, aerelastic distortions, real-gas effects, etc), for simulating the full-scale vehicle environment. General purpose computers do not have the necessary capability for the next stage of development. Solution of the three-dimensional Reynolds averaged Navier-Stokes equations in a short time to be practical for design purposes will require 40 times the power of current supercomputers. However, it is feasible to construct a special purpose processor that will meet these requirements to enhance the nation's aerodynamic design capability in the 1980's. Author


The future requirements for constructing codes that can be used to compute three-dimensional flows about aerodynamic shapes should be assessed in light of the constraints imposed by future computer architectures and the reality of usable algorithms that can provide practical three-dimensional simulations. On the hardware side, vector processing is inevitable in order to meet the CPU speeds required. To cope with three-dimensional geometries, massive data bases with fetch/store conflicts and transposition problems are inevitable. On the software side, codes must be prepared that: (1) can be adapted to complex geometries, (2) can take full advantage of the locations of laminar and turbulent boundary layer separation, and (3) will converge rapidly to sufficiently accurate solutions. Author


The Burroughs Corporation solution to the problem of numerical aerodynamic simulation consists of computer system designed to meet an effective throughput of one billion floating point operations per second for three-dimensional Navier-Stokes codes. In order to fully appreciate the design, its features, and subtleties, the methodology of the study which evolved this solution and the impact on the processor architecture evolution are described as well as details of the baseline design. Author


The state of the art of relevant technologies, of systems and processor architectures, and the measurable computational requirements of the two existing Navier-Stokes solution programs were assessed by Control Data Corporation to determine the
best approach for designing a system for aerodynamic simulation. Standard parts and components were used to identify the support processing system, which is composed of commercially available equipment and software. Technological achievements in large scale integration technology and system organization of subcomponents borrowed from the STAR-100D project were used in the design of the Navier-Stokes solver. A R H

N78-19797* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

MODELING OF THE REYNOLDS STRESSES c02
Morris W. Rubinson In Its Future Computer Requirements for Computational Aerodynamics Feb 1978 p 239-247 (For availability see N78-19778 10-59) Avail NTIS HC A22/MF A01 CSCL 01A

In their most general form, the Reynolds averaged conservation equations result from ensemble or time averages of the instantaneous Navier-Stokes equations or their compressible counterparts. These averaging processes are significant. The averaging processes must exceed the periods identified with the largest time scales of the turbulence, and yet be shorter than the characteristic times of the flow field. With these equations, long period variations in the flow fields are determined, provided initial conditions are known. The average dependent variables are sufficient to be resolvable by finite difference techniques consistent with the size and speed of modern computers.

N78-20186* Martin Marietta Aerospace, Denver, Colo

FLUID INTERACTION WITH SPINNING TOROIDAL TANKS D A. Fester and J E. Anderson In ESA Attitude Control of Space Vehicles Technol and Dyn Probl Assoc. with the Presence of Liquids Det 1977 p 77-86 refs (For availability see N78-20178 11-18) Contract NAS2-7489 Avail. NTIS HC A10/MF A01 CSCL 01B

An experimental study was conducted to evaluate propellant behavior in spinning toroidal tanks that could be used in a small-scale swirl system of an advanced outer-planer Pioneer orbiter. Information on propellant slosh and settling and on ullage orientation and stability was obtained. The aspects of axial acceleration, spin rate, spin-rate change, and spacecraft wobble, both singly and in combination, were evaluated using a one-eighth scale transparent tank in one-g and low-g environments. Liquid loadings ranged from 5% to 96% full. The impact of a surface tension acquisition device was assessed by comparison with bare-tank results. The testing simulated the behavior of the fluid in the liquid and in the toroidal tank. The experimental data for monomethylhydrazine and monomethylhydrazine propellants. Results are presented that indicate that no major fluid behavior problems would be encountered with any of the four propellants in the toroidal tanks of a spin-stabilized orbiter spacecraft. Author

N78-21193* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif


The state of contaminant molecules, the deposition rate on key surfaces, and the heat transfer rate were estimated by use of a zeroth-order approximation. Optical surfaces of infrared telescopes cooled to about 20 K should be considered to be covered with at least several deposition layers of condensible molecules without any contamination controls. The effectiveness of the purge gas method of contamination controls was discussed. This method attempts to drive condensible molecules from the telescope tube by impacts with a purge gas in the telescope tube. For this technique to be sufficiently effective, the pressure of the purge gas must be slightly more than 2 x 100000 torr. The influence caused by interactions of the purged gas with the particulate contaminants was found to slightly increase the resident times of the particulate contaminants within the telescope field of view. Author

N78-21214* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.


Fires resistivity studies were conducted on a wide range of candidate nonmetallic materials being considered for the construction of improved fire resistant aircraft passenger seats. These materials were evaluated on the basis of FAA airworthiness burn and smoke generation rates, colorfastness, limiting oxygen index, and animal toxicity tests. Physical, mechanical, and aesthetic properties were also assessed. Candidate seat materials that have significantly improved thermal response to various thermal loads corresponding to reasonable fire threats as they relate to in-flight fire situations, are identified. Author

N78-21215* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.


Classical trajectory calculations are presented for the reaction CIO + O yields CI + O2, a reaction which is an important step in the chlorine-catalyzed destruction of ozone which is thought to occur in the 220 and 1000 K. The calculated rate constant is 4.36 x 10 to the minus 11th power exp (-191/T) cm molecule (-1) /times (-1) and its value at 200 K is 2.8 plus or minus 10 to the minus 11th power cm molecule (-1) /times (-1) about a factor of 2 lower than recent experimental data. The empirical potential energy surface used in the calculations was constructed to fit experimental data for CIO, O2 and ClO molecules. Other important features of this potential surface such as the barrier to reaction, were varied systematically and calculations were performed for a range of conditions to determine the best theoretical rate constants. Results demonstrate the utility of classical trajectory methods for determining activation energies and other kinetic data for important atmospheric reactions. Author

N78-21407* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

ON THE PERIOD OF THE COHERENT STRUCTURE IN BOUNDARY LAYERS AT LARGE REYNOLDS NUMBERS M A. Badri Narayanan and Joseph G Maran April 1978 23 p refs (NASA-TM-78477; A-7380) Avail NTIS HC A02/MF A01 CSCL 20D

The period of the large coherent structure in a subsonic, compressible, turbulent boundary layer was determined using the autocorrelation of the velocity and pressure fluctuations for Reynolds numbers between 5000 and 35000. In low Reynolds number flows the overall correlation period scaled with the outer variables — namely, the free stream velocity and the boundary layer thickness. Author

N78-21450* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.


By means of torsion tests performed on test specimens of the same material having a minimum of two different cross sections (flat sheet of different widths), the effective in-plane (G13) and out-of-plane (G23) shear moduli were determined for...
two composite materials of uniaxial and angle ply fiber orientations. Test specimens were 16 in (nominal 2 mm) thick, 100 in in length, and in widths of 6.3, 9.5, 12.6, and 15.8 mm. Torsion tests were run under controlled deflection (constant angle of twist) using an electro-hydraulic servohydraulic testing system, and out-of-plane shear module tests were calculated from an equation derived in the theory of elasticity which relates applied torque, the torsional angle of twist, the specimen width/thickness ratio, and the ratio of the two shear moduli G13/G23. Results demonstrate that torsional shear modulus, G23 as well as G13, can be determined by simple torsion tests of flat specimens of rectangular cross section. Neither the uniaxial nor angleply composite material were transversely isotropic.

N78-22086# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**DYNAMIC STALL OF AN OSCILLATING AIRFOIL**


Avail NTIS HC A09/MF A01 CSCL 01A.

Unsteady separated boundary layers and wakes were studied by investigating flow past an oscillating airfoil in which part models the retreating blade stall on the helicopters. The Navier-Stokes equations in terms of the vorticity and stream function were solved for an airfoil to determine the flow field around a modified NACA 0012 airfoil. After a fully developed flow was determined at zero incidence, the airfoil was oscillated through a high angle of attack range from 0° to 25°. The computed streamlines during this pitch-up motion were in qualitative agreement with the trajectories of air bubbles observed in water tunnel experiments conducted with a NACA 0012 airfoil under the same conditions. During the pitch-down motion of the airfoil, the computed flow patterns cannot be compared with the experiments because the trajectories of air bubbles intersect.

Author

N78-24000# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**A REVIEW OF NASA-SPONSORED TECHNOLOGY ASSESSMENT PROJECTS**


Recent technology assessment studies sponsored by NASA are reviewed and a summary of the technical results as well as a critique of the methodologies are presented. The reviews include assessment of lighter-than-air technology, technology assessment of portable energy RDT&P, technology assessment of future intercity passenger transportation systems, and technology assessment of space disposal of radioactive nuclear waste. The use of workshops has been introduced as a unique element of some of these assessments. Also included in this report is a brief synopsis of a method of quantifying opinions obtained through such group interactions. Representative of the current technology assessments these studies cover a broad range of socio-political factors and issues in greater depth than previously considered in NASA sponsored studies. In addition to the lessons learned through the conduct of these studies, a few suggestions for improving the effectiveness of future technology assessments are provided.

Author

N78-24860# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**LAGRANGIAN COMPUTATION OF INVISCID COMPRESSIBLE FLOWS**


A Lagrangian method is developed to solve the Euler equations of gas dynamics. The solution of the equations is obtained by a numerical computation with the well-known Flux-Corrected-Transport (FCT) numerical method. This procedure is modified so that the boundary treatment is accurate and relatively simple. Shock waves and other flow discontinuities are captured monotonically without any type of fitting procedures. The Lagrangian method is applied so that the problem of mesh generation is completely avoided. The method is applicable to all Mach numbers except the low subsonic range where compressibility effects are small. The method is applied to a one-dimensional Riemann problem (shock tube) and to a two-dimensional supersonic channel flow with reflecting shock waves.

Author

N78-25017# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**ENGINEERING TESTS OF THE 141 TELESCOPE**


Data on image quality, chopper performance, and the closed-loop operation of the 91 cm telescope of the Kuiper Airborne Observatory which were obtained in September 1977 are presented.

Author

N78-26101# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**CALCULATION OF SUPERSONIC VISCOUS FLOW OVER DELTA WINGS WITH SHARP SUBSONIC LEADING EDGES**


Two complementary procedures were developed to calculate the viscous supersonic flow over conical shapes at large angles of attack, with application to cones and delta wings. In the first approach the flow is assumed to be sonic and the governing equations are solved and a one-dimensional finite-difference algorithm. In the second method the parabolized Navier-Stokes equations are solved with a space-marching implicit noniterative finite-difference algorithm. This latter approach is not restricted to conical shapes and provides a large improvement in computational efficiency over published methods. Results from the two procedures agree very well with each other and with available experimental data.

Author

N78-26106# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**COMPUTATIONAL WING OPTIMIZATION AND COMPARISONS WITH EXPERIMENT FOR A SEMI-SPAN WING MODEL**


A computational wing optimization procedure was developed and verified by an experimental investigation of a semi-span variable camber wing model in the NASA Ames Research Center 14 foot transonic wind tunnel. The Bailey-Ballhaus transonic potential flow analysis and Woodward-Carnuth linear theory codes were linked to Vanderplaats constrained minimization routine to optimize model configurations at several subsonic and transonic design points. The 35 deg swept wing is characterized by multi-segmented leading and trailing edge flaps whose large lines are swept relative to the leading and trailing edges of the wing. By varying deflection angles of the flap segments, camber and twist distribution can be optimized for different design conditions. Results indicate that numerical optimization can be both an effective and efficient design tool. The optimized configurations had as good or better lift to drag ratios at the design points as the best designs previously tested during an extensive parametric study.

J. M. S.
throughout the flow field. Documentation includes both mean and fluctuating profiles documented at a single Reynolds number. This experimental

for Reynolds numbers from

MCOMPRESSIBLE

GRADIENT AND

EXPERIMENTAL

and the other with a severe pressure gradient. Applications to transonic flow problems

Author

ON IMPROVING THE ITERATIVE CONVERGENCE PROPERTIES OF AN IMPLICIT APPROXIMATE-FACTORIZATION FINITE DIFFERENCE ALGORITHM


Avail NTIS HC A06/MF A01 CSCL 12A

The iterative convergence properties of an approximate-factorization implicit finite-difference algorithm are analyzed both theoretically and numerically. Modifications to the base algorithm were made to remove the inconsistency in the original implementation of artificial dissipation. In this way, the steady-state solution became independent of the time-step, and much larger time-steps can be used stably. To accelerate the iterative convergence, large time-steps and a cyclic sequence of time-steps were used. For a model transonic flow problem governed by the Euler equations, convergence was achieved with 10 times fewer time-steps using the modified differencing scheme. A particular form of instability due to variable coefficients is also analyzed. Author

N78-26795*§ National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

ON IMPROVING THE ITERATIVE CONVERGENCE PROPERTIES OF AN IMPLICIT APPROXIMATE-FACTORIZATION FINITE DIFFERENCE ALGORITHM


Avail NTIS HC A06/MF A01 CSCL 12A

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N78-28410*§ National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

STATUS AND FUTURE PROSPECTS OF USING NUMERICAL METHODS TO STUDY COMPLEX FLOWS AT HIGH REYNOLDS NUMBERS

Robert W. MacCormack in AGARD Three Dimensional and Unsteady Separation at High Reynolds Nos. Feb 1978 2 p

Primary document see N78-28397 19-34

Avail NTIS HC A11/MF A01 CSCL 20D

The calculation of flow fields past aircraft configuration at flight Reynolds numbers is considered. Progress in devising accurate and efficient numerical methods, in understanding and modeling the physics of turbulence, and in developing reliable and powerful computer hardware is discussed. Emphasis is placed on efficient solutions to the Navier-Stokes equations J M S

N78-28239‡ National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

SOLUTION OF TRANSSONIC FLOWS BY AN INTEGRAL-DIFFERENTIAL EQUATION METHOD


Avail NTIS HC A03/MF A01 CSCL 20D

Solutions of steady transonic flow past a two-dimensional airfoil are obtained from a singular integral-differential equation which involves a tangential derivative of the perturbation velocity potential. Subcritical flows are solved by taking central differences everywhere. For supercritical flows with shocks, central differences are taken in subsonic flow regions and backward differences in supersonic flow regions. The method is applied to a nonslipping parabolic-airfoil and to a lifting NASA 0012 airfoil. Results compare favorably with those of finite-difference schemes. Author

N78-28067‡ National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

WIND TUNNEL INVESTIGATION OF COMPUTATIONALLY OPTIMIZED VARIABLE CAMBER WING CONFIGURATIONS

E. G. Waggoner (Vought Corp., Dallas), H. P. Haney (Vought Corp., Dallas), and W. F. Balhaus Jun 1978 140 p


Avail NTIS HC A07/MF A01 CSCL 01A

An experimental investigation was performed in the NASA Ames Research Center 14 foot transonic wind tunnel to determine aerodynamic characteristics for several optimized configurations of a variable camber wing model. Camber and twist distributions which were computationally defined using both subsonic and transonic potential flow analysis codes linked to an optimization technique were verified. The 35 deg swept wing was characterized by multi-segmented leading and trailing edge flaps whose hinge lines are swept relative to the leading and trailing edges of the wing. The deflection angles of the flap segments could be varied so that the stability of chromium in the temperature range from 880 K to 1040 K was determined by employing a dynamic gas-solid equilibration technique. The solid chromium sulfate was equilibrated in a gas stream of controlled SO3 potential. Thermogravimetric and differential thermal analyses were used to follow the decomposition of chromium sulfate X-ray diffraction analysis indicated that the decomposition product was crystalline. The mutual solubility between Cr2O3 and C2O3 was negligible. Over the temperature range investigated, the decomposition pressure were significantly high so that chromium sulfate is not expected to form on commercial alloys containing chromium when exposed to gaseous environments containing oxygen and sulfur (such as those encountered in coal gasification). K T Jacob (Lawrence Berkeley Lab, Berkeley, Calif.,) Bhogeswara R. and Howard G. Nelson Jul 1978 21 p refs (NASA-TM-78504, A-7506)

Avail NTIS HC A02/MF A01 CSCL 07D

N78-28149‡ National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

ON THE POSSIBILITY OF NEGATIVE ACTIVATION ENERGIES IN BIMOLECULAR REACTIONS


Avail NTIS HC A03/MF A01 CSCL 09C

The temperature dependence of the rate constants for model
reacting systems was studied to understand some recent experimental measurements which imply the existence of negative activation energies. A collision theory model and classical trajectory calculations are used to demonstrate that the reaction probability can vary inversely with collision energy for bimolecular reactions occurring on attractive potential energy surfaces. However, this is not a sufficient condition to ensure that the rate constant has a negative temperature dependence. On the basis of these calculations, it seems unlikely that a true bimolecular reaction between neutral molecules will have a negative activation energy.

A R H

N78-29436* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

SYSTEM OPTIMIZATION OF GASDYNAMIC LASERS, COMPUTER PROGRAM USER'S MANUAL
L J Otten III, R C Saunders, III, and S J Morris (Langley Research Center, Hampton, Va.) April 1978 49 p refs
NASA/TM-73193, A-0905 Avail NTIS HC AO2/MF AO1 CSCL 20E

The user's manual for a computer program that performs system optimization of gasdynamic lasers is provided. Detailed input/output data are CDC 7680/6800 computers using a dialect of FORTRAN. Sample input/output data are provided to verify correct program operation along with a program listing.

A R H

N78-29451* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

TORQUING PRELOAD IN A LUBRICATED BOLT
H Lee Stiegmeier, Aug 1978 14 p refs
NASA-TM-78501, A-7503 Avail NTIS HC AO2/MF AO1 CSCL 131

The tension preload obtained by torquing a 7/8 in diam UNC high strength bolt was determined for lubricated and dry conditions. Consequent preload with a variation of -4 or -3% was obtained when the bolt head area was lubricated prior to each torquing application. Preload tensions nearly 70% greater than the value predicted with the commonly used formula occurred with the lubricated bolt. A reduction to 29% of the initial preload was observed during 50 torque applications without relubrication. Little evidence of wear was noted after 203 cycles of tightening.

Author

N78-30149* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

NASA/ESA CV-990 SPACELAB SIMULATION (ASSESS 2)
Jul 1977 47 p Prepared in cooperation with ESA Paris
NASA-TM-79748 Avail NTIS HC AO3/MF AO1 CSCL 22A

Cost effective techniques for addressing management and operational activities on Spacelab were identified and analyzed during a ten day NASA/ESA cooperative mission with payload and flight responsibilities handled by the organization assigned. Topics discussed include (1) management concepts and interface relationships, (2) experiment selection, (3) hardware development, (4) payload integration and checkout, (5) selection and training of mission specialists and payload specialists, (6) mission control center/payload operations control center interactions with ground and flight problems, (7) real time interaction during flight between principal investigators and the mission specialists/payload specialist flight crew, and (8) retrieval of scientific data and its analysis.

A R H

N78-30774* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

AN ASSESSMENT OF THE EFFECT OF SUPERSONIC AIRCRAFT OPERATIONS ON THE STRATOSPHERIC OZONE CONTENT
I G Popoff, R C Whitten, R P Turek (R and D Associates, Monro del Rey, Calif), and L A Capone (San Jose State Univ Calif) Aug 1978 60 p refs

- An assessment of the potential effect on stratospheric ozone

A R H

of an advanced supersonic transport operation is presented. This assessment, which is the basis of NASA's desire for an up-to-date evaluation to guide programs for the development of supersonic technology and improved aircraft engine designs, uses the most recent chemical reaction rate data from the results of the present assessment. It appears that realistic fleet sizes should not cause concern with regard to the depletion of the total ozone overburden. For example, the NOx emissions of one type designed to cruise at 20 km altitude will cause the ozone overburden to increase by 0.03% to 0.12%, depending upon vertical transport. These ozone changes can be compared with the predictions of a 1.74% ozone decrease (for 100 large SSTs flying at 20 km) made in 1974 by the FAA's Climate Impact Assessment Program.

Author

N78-31030* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

PIioneer 10 OBSERVATION OF THE SOLAR WIND PROTON TEMPERATURE HELIOCENTRIC GRADIENT
J D Mihalov and J H Wolfe, Aug 1978 15 p refs
NASA-TM-78515 A-7579 Avail NTIS HC AO2/MF AO1 CSCL 03B

Solar wind isotropic proton temperatures measured at 12.2 AU heliocentric distance by the Ames plasma analyzer aboard Pioneer 10 are presented as consecutive averages over three Carrington solar rotations and discussed. The weighted least-squares fit of average temperature to heliocentric radial distance, R, yields the power law R sup 12. These average proton temperatures are not correlated as well with Pioneer 10 heliocentric radial distance (R sup 2) as are the corresponding average Znuck sunspot numbers R sub z (R). Consequently, it is difficult to isolate the spatial gradient in the Pioneer 10 solar wind proton temperatures using that data alone.

Author

N78-31508* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif

HIGH ALTITUDE PERSPECTIVE
1978 33 p Original contains color illustrations
NASA-SP-427 Avail NTIS MF AO1; SCF HC $1.60 CSCL 14E

The capabilities of the NASA Ames Center U-2 aircraft for research or experimental programs are described for such areas as Earth resources inventories, remote sensing data interpretation, electronic sensor research and development, satellite investigation support, stratospheric gas studies, and astronomy and astrophysics. The availability of this aircraft on a cost-reimbursable basis for use in high-altitude investigations that cannot be performed by the private sector is discussed.

A R H

N78-32029* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

CRUSTAL EVOLUTION INFERRED FROM APOLLO MAGNETIC MEASUREMENTS
(Grant NSG-2082) NASA-TM-78524, A-760B Avail NTIS HC AO3/MF AO1 CSCL 03B

Magnetic field and solar wind plasma density measurements were analyzed to determine the scale size characteristics of remanent fields at the Apollo 12, 15, and 16 landing sites. Theoretical model calculations of the field-plasma interaction, involving diffusion of the remanent field into the solar plasma, were compared to the data. The information provided by all these experiments shows that remanent fields over most of the lunar surface are characterized by spatial variations as small as a few kilometers. Large regions (50 to 100 km) of the lunar crust were probably uniformly magnetized during early crustal evolution. Bombardment and subsequent gardening of the upper layers of these magnetized regions left randomly oriented. smaller layers of these magnetized regions left randomly oriented. smaller...
The operation of an automated procedure is detailed which maximizes the signal from a detector by pointing the telescope at an astronomical source.

The production of an optimized design of key elements of the candidate facility was the primary objective of this report. This was accomplished by effort in the following tasks: (1) to further develop and describe the function description of the custom hardware; (2) to delineate trade-off areas between performance, reliability, availability, serviceability, and programmbility; (3) to develop metrics and models for validation of the system performance; (4) to conduct a functional simulation of the system design, and (5) to develop the software specifications to include a user level high level programing language and instruction set and outline the operation system requirements.

**NASA CONTRACTOR REPORTS**

**N78-39050**
Burroughs Corp., Paoli, Pa
**NUMERICAL AERODYNAMIC SIMULATION FACILITY PRELIMINARY STUDY EXTENSION EXECUTIVE SUMMARY Final Report**
Feb 1978 273 p (Contract NAS2-9456)
(NASA-CR-152017) NTIS HC A02/MF A01 CSCL 01A

The production of an optimized design of key elements of the candidate facility was the primary objective of this report. This was accomplished by effort in the following tasks: (1) to further develop and describe the function description of the custom hardware; (2) to delineate trade-off areas between performance, reliability, availability, serviceability, and programmbility; (3) to develop metrics and models for validation of the system's performance; (4) to conduct a functional simulation of the system design, and (5) to develop the software specifications to include a user level high level programing language and instruction set and outline the operation system requirements.

**N78-10411**
Sierra Research, Inc., Richland, Wash
**STUDY OF A HIGH PERFORMANCE EVAPORATIVE HEAT TRANSFER SURFACE Final Report**
Elric W Saasik and R H Hamesaki 27 May 1977 82 p (Contract NAS2-9120)
(NASA-CR-152008) NTIS HC A05/MF A01 CSCL 200

An evaporative surface is described for heat pipes and other two-phase heat transfer applications that consists of a hybrid composition of V-grooves and capillary wicking. Characteristics of the surface include both a high heat transfer coefficient and high heat flux capability relative to conventional open-faced screw thread surfaces. With a groove density of 12.6 cm/1 and ammonia working fluid, heat transfer coefficients in the range of 1 to 2 W/sq cm have been measured along with maximum heat flux densities in excess of 20 W/sq cm. A peak heat transfer coefficient in excess of 2.3 W/sq cm was measured with a 37.6 cm/h hybrid surface.

**N78-39051**
Burroughs Corp., Paoli, Pa
**NUMERICAL AERODYNAMIC SIMULATION FACILITY PRELIMINARY STUDY EXTENSION Final Report**
Feb 1978 273 p (Contract NAS2-9456)
(NASA-CR-152017) NTIS HC A02/MF A01 CSCL 01A
Functional requirements and preliminary design data were identified for use in the design of all system components and in the construction of a facility to perform aerodynamic simulation for materials design. A skeleton structure of specifications for the flow model processor and monitor, the operating system, and the language and its compiler is presented. 

\[\text{Author}\]

N78-21223# Douglas Aircraft Co Inc, Long Beach Calif
(NASA-CR-151951: MDC-J7471) Avail. NTIS HC A05/MF A01 CSDL 110

The objective of the test was to assess fire containment and fire extinguishment in the cargo by reducing the ventilation through the cargo compartment. Parameters which were measured included ignition time, burnthrough time, and physical damage to the cargo liner, composition of selected combustible gases, temperature-time histories, heat flux, and detector response. The ignitor load was made of a typical cargo consisting of filled cardboard cartons occupying 50% of the compartment volume. The ignition load was made of a typical cargo consisting of filled cardboard cartons occupying 50% of the compartment volume.

\[\text{Author}\]

N78-22000# Santa Barbara Research Center, Goleta Calif
CONTINUED DEVELOPMENT OF DOPED-GERMANIUM PHOTOCONDUCTORS FOR ASTRONOMICAL OBSERVATIONS AT WAVELENGTHS FROM 30 TO 120 MICROMETERS Final Technical Report
P R Bratt, N N Lewis, and L E Long 24 Apr 1978 61 p refs (Contract NAS2-8599)
(NASA-CR-152125) Avail. NTIS HC A04/MF A01 CSDL 03A

The development of doped-germanium detectors which have optimized performance in the 30- to 120-μm wavelength range is discussed. Topics covered include the growth and evaluation of Ge0.75Ga0.25 and GeB5 crystals, procedures for the fabrication and testing of detectors, irradiation effects, detector responsivity, and resistance measurements through MOSFET. Test data are presented in graphs and charts.

\[\text{Author}\]

N78-23117# Marvex Corp, Saratoga, Calif
NASA/esa CV-890 SPACECAB SIMULATION (ASSESS) 2 Final Report
D R Mathiowak, J M Andrews, and J F Heeres 22 Jan 1978 193 p refs (Contract NAS2-9514)
(NASA-CR-152122) Avail. NTIS HC A09/MF A01 CSDL 22A

To test the validity of the ARC approach to Spacelab several missions simulating aspects of Spacelab operations have been conducted as part of the ASSESS Program. Each mission was designed to evaluate potential Shuttle/Spacelab concepts in increasing detail. For this mission, emphasis was placed on development and exercise of management techniques. The simulation provided data and experiences for the development of Spacelab 1 which will be launched in 1981.

\[\text{Author}\]

N78-28994# Operations Research, Inc, Silver Spring, Md
PHASE I, DEFINITION OF INTERCITY TRANSPORTATION COMPARISON FRAMEWORK VOLUME 2: METHODOLOGY Final Report
9 Jul 1978 251 p refs (Contract NAS2-9815)

Categories of cost and service measures that will appropriately define the characteristics of all intercity transportation systems were established. Previous methods of comparing transportation systems were reviewed. Specific comparison variables, applicable to all modes were defined, and the functional relationships by which these variables are interdependent were explored. A framework by which the set of variables may be employed for comparison of data from the individual systems was constructed.

\[\text{Author}\]

N78-29146# Martin Marietta Aerospace, Denver Colo.
EXPERIMENTAL INVESTIGATION OF CONTAMINATION PREVENTION TECHNIQUES TO CRYOGENIC SURFACES ON BOARD ORBITING SPACECRAFT
A M Hetrick, R O Rantanan, E B Ross, and J F Fossheimnt Aug 1978 56 p refs (Contract NAS2-8116)
(NASA-CR-152171, MCR-78-578) Avail. NTIS HC A05/MF A01 CSDL 22B

Within the simulation limitations of on-orbit conditions it was demonstrated that a helium purge system could be an effective method for reducing the incoming flux of contaminant species. Although a generalized purge system was employed in conjunction with basic telescope components, the simulation provided data that could be used for further modeling and design of a specific helium injection system. Experimental telescope pressures required for 90% attenuation appeared to be slightly higher (factor of 2 to 5). Cooling the helium purge gas and telescope components from 300 to 140 K had no measurable effect on stopping efficiency of a given mass flow of helium from the diffuser injectors.

\[\text{Author}\]

N78-32991# National Aeronautics and Space Administration
ACCELERATION AND HEATING OF THE SOLAR WIND
Aron Barnes in JPL A Close-up of the Sun 1 Sep 1978 334-344 refs (For primary document see N78-32984 23-92)
Avail. NTIS HC A25/MF A01 CSDL 03B

Some of the competing theories of solar wind acceleration and heating are reviewed, and the observations that are required to distinguish among them are discussed. In most cases what is required is measurement of plasma velocity and temperature and magnetic field, as near the sun as possible and certainly inside 20 solar radii. Another critical aspect of this question is determining whether a turbulent envelope exists in this inner region, and if so, defining its properties. Plasma and magnetic observations from the proposed Solar Probe mission would thus yield a quantum jump in our understanding of the dynamics of the solar wind.

\[\text{Author}\]

N78-33127# McDonnell-Douglas Astronautics Co, St Louis, Mo
PIONEER JUPITER ORBITER PROBE MISSION 1980
PROBE DESCRIPTION
R E DeFrees 8 Nov 1974 51 p refs (Contract NAS2-9877)
(NASA-CR-137591) Avail. NTIS HC A04/MF A01 CSDL 22A

The adaptation of the Saturn-Uranus Atmospheric Entry Probe (SUAP) to a Jupiter entry probe is summarized. This report is extracted from a comprehensive study of Jupiter missions, atmospheric model definitions, and probe subsystem alternatives.

\[\text{Author}\]

N78-33379# TRW Defense and Space Systems Group
EXTENDED DEVELOPMENT OF VARIABLE CONDUCTANCE HEAT PIPES
Final Report
D Antonuk, D K Edwards, and E L Luedke Sep 1978 56 p

\[\text{Author}\]
physical Journal, Part Elliot, R G. French, the Martian atmosphere were obtained for both the immersion and along the basal scarp, the basal plains, the relative ages Observations Temperature, pressure, and number-density profiles of into account the shield of Olympus-Mons, mass movement features with the 91-cm telescope aboard NASA's NsG-7126 NGR-33-010-082, NSF The structure and extinction - A78-1097 Occultation of Epsilon Geminorum by Mars 1 temperature Possible implications of rotational distribution was thermalized, but the corresponding line shape of the absorption lines in the 2 Pi 0 transitions of OH using a CW tunable laser it was found that the rotational distribution was thermalized, but the corresponding rotational temperature was much lower than the translational temperature Possible implications of these results are discussed (Author).

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


A simultaneous determination of the rotational and translational temperatures of OH(2 Pi) in a water-vapor discharge is reported. These temperatures were determined by measuring the strength and fine line of the absorption lines in the 2 Pi (v = 0) - 2 Sigma(+)(v = 0) transitions of OH using a CW tunable laser. It was found that the rotational distribution was thermalized, but the corresponding rotational temperature was much lower than the translational temperature. Possible implications of these results are discussed (Author).


The occultation of Epsilon Geminorum by Mars on April 8, 1976, was observed at three wavelengths and 4-mi time resolution with the 91-cm telescope aboard NASA's G. P. Kuiper Airborne Observatory. Temperature, pressure, and number-density profiles of the Martian atmosphere were obtained for both the immersion and emersion events. Within the altitude range 50-80 km above the mean surface, the mean temperature is about 145 K, and the profiles exhibit wavelike structures with a peak-to-peak amplitude of 35 K and a vertical scale of about 20 km. The ratio of the refraction of the atmosphere at 4500 A and 7500 A is consistent with the atmospheric composition measured by Viking 1. From the "central flash" - a bright feature in the light curve midway between immersion and emersion - an optical depth at 4500 A of 3.3 ± 0.1 per km atm (about 0.2 per equivalent Martian air mass) is found for the atmosphere above 25 km above the mean surface near the south polar region. This large value and its weak wavelength dependence rule out Rayleigh scattering as the principal cause of the observed extinction (Author).


A summary is presented of the results of some new observations on Martian volcanic features made from the Viking orbiters. Most of these observations are concerned with the Tharsis and Alba regions. The youth, size, and style of the volcanic features in these areas render them particularly susceptible to analysis. Excellent coverage was also acquired of Apollinaris Patera. It has many features of the Tharsis shields, with a cliff around its circumference and a large central caldera. Olympus Mons and its vicinity are examined, taking into account the shield of Olympus-Mons, mass movement features along the basal scarp, the basal plains, the relative ages of Olympus Mons and the basal plains, and grooved terrain. (G.R.)

The observed bow shock encounters at Mercury, Venus and Mars are least square fit using the same technique so that their sizes and shapes can be intercompared. The shock front of Mercury most resembles the terrestrial shock in shape, and the shock stand off distance is consistent with the observed moment. The shapes of the Venus and Mars shock fronts more resemble each other than the earth's and the stand off distances are consistent with direct interaction of the solar wind with the ionosphere on the dayside. The Venus shock is closer to the planet than the Mars shock suggesting more absorption of the solar wind at Venus. (Author)


A simple closed loop control system has been developed to maintain the gas pressure in the-window proportional counters during rocket flights. This system permits convenient external control of detector pressure and system flushing rate. The control system is activated at launch with the sealing of a reference volume at the existing system pressure. In-flight control to plus or minus 2 torr at a working pressure of 760 torr has been achieved on six rocket flights. (Author)


A theoretical study indicating that vortex rings at moderate Reynolds numbers are unstable to azimuthal bending waves is presented. Only the case of a thin vortex ring with a core of constant vorticity in an inviscid flow is examined. The disturbance flow and the mean flow of the vortex ring are derived as asymptotic solutions near the core. The stability analysis is developed completely for a certain class of bending waves that are unstable on a line filament in the presence of strain. The vortex ring is found to be always unstable for at least two wavenumbers for which waves on a line filament of the same vorticity distribution would not rotate. Published experimental results are cited to support these conclusions. J M B


Time ordered diagrammatic representations are shown to precisely define and to simplify calculations of radiative perturbations to the density matrix. Nonlinear optical susceptibilities are exemplified by that of CARS, can be obtained by simple propagator rules. An interpretation of transient Raman scattering in terms of time ordered contributions is also discussed. (Author)


The collisionless dissociation of SF6 has been studied using simultaneous irradiation by two frequencies from a CO2 laser which are both nearly resonant with the SF6a3 absorption band. It was found that the dissociation was enhanced, and occurred over a wider frequency range, than for single frequency dissociation. No threshold effect was observed for a weak resonant and a much higher energy field pumping slightly off-resonance. For such two frequency irradiation, the peak in the dissociation curve was found to be shifted to lower frequencies with respect to that for single frequency dissociation. (Author)


A general problem of image data compression is discussed briefly with attention given to the use of Karhunen-Loeve transforms, suboptimal systems, and block quantization. A survey is then conducted encompassing the four categories of adaptive systems: (1) adaptive transform coding (adaptive sampling, adaptive quantization, etc), (2) adaptive predictive coding (adaptive delta modulation, adaptive PCM encoding, etc), (3) adaptive cluster coding (blob algorithms and the multispectral cluster coding technique), and (4) adaptive entropy coding. B J

A78-16180 * Effect of a nonconstant C/m-alpha/h on the stability of rolling aircraft. B Davari (NASA, Ames Research Center, Moffett Field, California, University, Berkeley, Calif.) and E V. Lattas (California, University, Berkeley, Calif.) Journal of Aircraft, vol 14, Dec 1977, p. 1169-1174. 15 refs Grant No NGR-05-003-051.

An analytical study is carried out of the behavior of modern high-speed aircraft of materially slender configurations in maneuvers involving large rates of roll. Inertia cross-coupling, as well as a linear variation of longitudinal static stability (C/m-alpha/h) with angle of attack, are considered. The steady-state solutions of the non-linear equations of motion, based on principal inertia axes, are studied to obtain useful information on the response behavior of the state variables during roll maneuvers. It is shown that, in addition to the critical values of aileron deflection that have been previously found to limit a steady-state roll with constant longitudinal static stability, there can be two new critical values introduced by a linear decrease of the absolute value of longitudinal static stability with angle of attack. For aileron deflections near these critical values, the response of the aircraft exhibits violent oscillations and dangerous peak loads, due to the cross-coupled motion accompanying a roll maneuver. These critical values define a new range of aileron deflections in which no steady-state roll is possible. (Author)

A78-16454 * Quantum mechanical theory of a structured atom-diatom collision system - A + BC1/2Sigma, P L DeVries (Rochester, University, Rochester, N Y) and T F George Journal of Chemical Physics, vol. 67, Aug 15, 1977, p. 1293-1301 23 refs NSF Grant No. CHE-75-06775-A01. Contract No F4620-74-C-0073, Grant No NSG-2198.

The problem of a 2- state atom colliding with a singlet sigma state diatom, which involves multiple potential surfaces, is investigated. Within a diabatic representation for the electronic degrees of

The transonic 3-D inviscid small-perturbation solution of Bailey and Ballhaus is combined with a finite-difference solution for Prandtl's boundary-layer equations in order to include viscous effects. The inviscid-velocity interaction is modeled by means of the displacement surface, which can be thought of as the effective body surface seen by the inviscid flow. Displacement thickness, lift, and pressure distributions resulting from the combined solution are presented for transonic flows about the RAE 101 A wing and a Lockheed transport wing, both at small angles of attack. The influence of changing arbitrarily the start of transition on the displacement surface and lift is discussed for the RAE wing flows.

(Author)


Absorption of OH was measured using a CW tunable laser. Results indicate that this technique, when combined with frequency modulation, promises a sensitivity of 100,000 molecules/cm for OH monitoring in the atmosphere

(Author)


The reported study had been conducted to determine the feasibility of developing toroidal tanks for an auxiliary propulsion system that could be integrated into a Pioneer spin-stabilized spacecraft. The system evaluated consisted of two toroidal tanks equipped with surface tension devices. One tank is intended for nitrogen tetroxide, the other for monomethylhydrazine. The study included the design of a propellant system concept that could satisfy the requirements of a spinning tank. It was found that an oxidizer tank spin rate of 76 rpm and a fuel tank spin rate of 110 rpm would be required to produce liquid loss from the acquisition system during spacecraft operation. An investigation showed that toroidal tanks can be fabricated with present technology using either titanium or aluminum alloys. The preferred material would be titanium because of its significantly higher strength.

G.R.


Pioneer 11 flew by Jupiter in December 1974 and obtained several hundred images of the planet. It is presently targeted for encounter with Saturn in 1979. The imaging photopolarimeter recorded spin-scan images with high photometric accuracy. It also recorded polarimetric and zodiacal-light data. Careful design of the instrument resulted in excellent performance in the jovian radiation environment. Imaging data were displayed to maintain the proper shape of the planet. Color images were made by synthesizing green data from red and blue data. Pictures created from Pioneer 11 imaging data show complex detail within the Red Spot, as well as indications of flow around it. Bright spots with trailing plumes are seen in the Equatorial Zone. The North Polar Region is devoid of belt structure, but numerous irregular clouds are seen in red light. The Galilean satellites were imaged with a resolution of several hundred kilometers.

(Author)


The numerical procedures previously developed for computing nonlinear and time-linearized small-perturbation unsteady transonic flows are briefly reviewed, and the effects of unsteady modes of motion on two-dimensional transonic flows are evaluated. The numerical procedure used comprises an alternating-direction implicit scheme and treats shock waves as discontinuities in the flow. Comparison of the time-linearized results with fully nonlinear calculations delineates their range of applicability. The unsteady behavior due to harmonic pitching and flap oscillations of an NACA 63-212 is also examined.

S. D.


A method is described for determining the radial diffusion coefficient from observed satellite effects of the inner Jovian satellites on the energetic particle fluxes. The method is based on data from L values which are significantly removed from the actual sweeping region. With regard to the large-losses to the protons at lo's L shell, it is suggested that in addition to satellite sweepup, the losses may be associated with an enhanced precipitation due to resonant interaction with non-cyclotron waves near lo's orbit. It is noted that such additional loss mechanisms may also apply to electrons, and that such losses may significantly affect the estimated diffusion coefficient.

S. C. S.


In connection with a need for more definitive information concerning the composition of Phobos in a study of its origin, an ultraviolet-visible-infrared reflectance spectrum of the Martian satellite was compiled from the Mariner 9 ultraviolet spectrometer, Viking lander imaging, and ground-based photometric data. The probable surface composition of Phobos was deduced by comparing the obtained spectrum with the spectra of asteroids of known composition. The considered data show that the reflectivity of Phobos is flat from 1100 to 400 nm but decreases sharply in the ultraviolet to about 1 percent at 212 nm. The reflectance spectrum is similar to the spectra of asteroids Ceres and Pallas which were found to have surface compositions similar to that of carbonaceous chondrites. It is concluded that the surface composition of Phobos is also similar to that of carbonaceous chondrites. The results of the investigation point to different modes of origin for Mars and Phobos.

G. R.

A78-18875 * Multicolor observations of Phobos with the Viking lander cameras - Evidence for a carbonaceous chondrite composition. J. B. Pollack, D. Crotta (NASA, Ames Research Center, Theoretical and Planetary Studies Branch, Moffett Field, California.)

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The reflectivity of Phobos has been determined in the spectral region from 0.4 to 1.1 micrometers from images taken with a Viking lander camera. The reflectivity curve is flat in this spectral interval and the geometric albedo equals 0.05 \pm 0.01. These results, together with Phobos's reflectivity spectrum in the ultraviolet, are compared with laboratory spectra of carbonaceous chondrites and basals. The spectra of carbonaceous chondrites are consistent with the observations, whereas the basalt spectra are not. These findings raise the possibility that Phobos may be a captured object rather than a natural satellite of Mars.


Robertson's expression for the velocity-dependent effect of solar radiation on the motion of small particles is difficult because of its dependence on relativistic considerations, and it is also deficient in that it assumes perfectly absorbing particles. The present paper gives a heuristic derivation of the Poynting-Robertson effect. Robertson's expression for perfectly absorbing particles is obtained but on a much simpler physical basis, and an expression is also obtained for a particle that in general scatters, transmits, and absorbs light. Some numerical results on the solar radiation forces felt by small particles of cosmochemically important compositions are given.


The generation of carbon monoxide from polymethyl methacrylate and polyethylene, and of hydrogen chloride from polyvinyl chloride, was calculated. Calculations were made for various amounts of polymer evolving gaseous products into a 60 cm \( \times \) compartment.


Approximate signal-to-noise ratios are calculated for 12 stellar occultations by the rings of Uranus during 1977-1980. Four of the stars are apparently bright enough to permit observation of the epsilon ring occultations with a large telescope. For the rest of these events, occultations by rings alpha, delta, and epsilon should also be observable with a large telescope and epsilon ring occultations should be detectable with smaller telescopes. Formulas for the signal-to-noise ratios are given to aid potential observers in evaluating the quality of the results they expect to obtain with their own photometric equipment.


An implicit finite difference procedure for unsteady three-dimensional flow capable of handling arbitrary geometry through the use of general coordinate transformations is described. Viscous effects are optionally incorporated with a "thin layer" approximation of the Navier-Stokes equations. An implicit approximate factorization technique is employed so that the grid sizes required for spatial accuracy and viscous resolution do not impose stringent stability limitations. Results obtained from the program include transonic inviscid and laminar-turbulent solutions about simple body configurations. Comparisons with existing theories and experiments are made. Numerical accuracy and the effect of three dimensional coordinate singularities are also discussed.


The basic integral equations for a harmonically oscillating aerofoil in a transonic flow with shock waves are derived, the reduced frequency is assumed to be small. The problem associated with shock wave motion is treated using a strained coordinate system. The integral equation is linear and consists of both line integrals and surface integrals over the flow field which are evaluated by quadrature. This leads to a set of linear algebraic equations that can be solved directly. The shock motion is obtained explicitly by enforcing the condition that the flow is continuous except at a shock wave. Results obtained for both lifting and nonlifting oscillatory flows agree satisfactorily with other accurate results.


Solutions are presented for the stagnation-region shock-layer equations, including radiative transfer with spectral lines and silica ablation during Jovian entry. Results for variations of entry angle, sphere-to-cone configuration, and atmospheric model are given. The effect of silica ablation on the radiative and convective surface heating is correlated with the ratio of the wall to free-stream mass flux. Correlations are also given for spectral distributions. The effect of newly obtained SiO radiation properties on the surface heating is examined.


A detailed investigation of attached supersonic turbulent boundary layers over an extensive range of Reynolds numbers [12 x 10 to the 6th] to 6 x 10 to the 6th] is presented. Experimental measurements were obtained for adverse pressure gradients ranging in magnitude from those of previous investigations to those approaching separation. The measurements include mean values of surface pressure and skin-friction, mean-flow profiles, and profiles of the three turbulent flow turbulence components and turbulent shear stress. Numerical solutions, employing three turbulence models of various degrees of complexity have been compared with the details of the measured flow fields. Generally, it was found that the more sophisticated turbulence models are superior to a mixing length model for predicting the Reynolds number and pressure gradient effects. However, some details of the turbulent fluctuations are not predicted. The exact Reynolds number trends indicated by the data were not accurately predicted with any of the turbulence models considered.


An algebraic turbulence model for two- and three-dimensional separated flows is specified and the necessity for finding the
flow over an airfoil. Separation and reattachment points from
numerical Navier-Stokes solutions agree with experiment within one
boundary-layer thickness. Use of law-of-the-wall boundary condi-
tions does not alter the predictions significantly. Applications of the
model to other cases are contained in companion papers. (Author)

A78-21624 * Thermodynamic processes induced by coherent
radiation M. Gartsuny (Westinghouse Research and Development

It is shown by quantum statistics that under certain stated
conditions the entropy of coherent radiation is zero and it is still
negligible for multimode laser operation. This makes possible gas
processes which, to a small extent, have already been observed or even utilized, but which can be greatly enhanced by an
optimized choice of molecular structures and radiation conditions.

Radiative cooling of gases is discussed in detail. The conditions for
maximum heat withdrawal are derived, and it is proposed that the
processes of cooling and relaxation heating can be sufficiently
separated in time to achieve certain effects and thermodynamic
effects. One of these is the complete conversion, in principle,
of coherent radiation into work. This concept is based on a heat
pump process followed by heat-to-work conversion, the heat rejected being just equal to that withdrawn by radiation. The conditions for complete conversion turn out to be the same as for maximum heat
withdrawal. The feasibility of these processes depends on the degree
to which practical conditions can be met, and on the validity of
certain assumptions which have to await experimental verification.

(Author)

A78-22575 * Computational wing optimization and wind

tunnel test of semi-span model H. P. Haney, E. G. Waggoner
(Vought Corp., Dallas, Tex.), and W. F. Ballhaus (NASA, Ames
Research Center, Computational Fluid Dynamics Branch, U.S. Army,
Air Mobility Research and Development Laboratory, Moffett Field, Calif.). American Institute of Aeronautics and Astronautics, Aero-
space Sciences Meeting, 16th, Huntsville, Ala. Jan. 16-18, 1978,

A computational transonic wing design procedure has been
developed and verified by a wind tunnel test of a variable camber
semi-span wing model. The Bailey-Ballhaus transonic potential flow
analysis code linked to Vanderplaat's constrained minimization
routine was used to optimize test configurations at 0.9 Mach number.
Based on wind tunnel test results, computationally optimized
designs were as efficient as the best configurations determined
by previous parametric testing and performed better at off-design
points. Wind tunnel wing pressures agreed well with predictions from
the improved Bailey-Ballhaus code at moderate Cl's. Computational
optimization was shown to be an effective transonic wing design
tool.

(Author)

A78-22589 * The response of heat shield materials to in
Research Center, Entry Technology Branch, Moffett Field, Calif.).
American Institute of Aeronautics and Astronautics, Aerospace
Sciences Meeting, 16th, Huntsville, Al. Jan. 16-18, 1978, Paper
78-119, 9 p., 14 refs.

Experimental results for the response of ATJ graphite, Carbitex
100, and carbon phenolic to intense continuous-wave laser radiation are presented. Both penetration and mass loss test techniques are
used and compared. The results are also compared with a simple
ablation theory applicable to laser irradiation. Reasons for the
disparity between experiment and theory, and applicability of the
results to other heating situations, such as planetary entry, are
discussed. (Author)

A78-22591 * Numerical solution of a three-dimensional
shock wave and turbulent boundary-layer interaction. C. M. Hung
and R. W. McCormack (NASA, Ames Research Center, Moffett
Field, Calif.). American Institute of Aeronautics and Astronautics,
Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan. 16-18, 1978,
Paper 78-161, 10 p., 21 refs.

A rapid numerical scheme is used to solve the complete
mass-averaged Navier-Stokes equations for supersonic turbulent flow
over a three-dimensional compression corner. A simple eddy viscosity
model is developed, and the interaction of a swept shock wave and a
three-dimensional turbulent boundary-layer is studied. Good agree-
ment is obtained between the present results and experimental
measurements for the case of a wedge with an angle of 6 deg on a
flat-plate sidewall. For the case of a 12-deg wedge angle, the
computed results do not show the existence of a peak pressure found
experimentally. However, the range of interaction, the plateau
pressure, and the peak heat transfer are closely predicted for all
cases. The high heat transfer near the axial corner is due to the
thinning of the boundary layer and inflow of fresh high-momentum
fluid. The heat transfer is relieved through pressure reduction and
boundary-layer thickening. (Author)

A78-22595 * Behavior of a turbulent boundary layer sub-
ject to sudden transverse strain. M. Higuchi (Dynamic
Technology, Inc., Torrance, Calif.) and M. W. Rubesin (NASA, Ames
Research Center, Moffett Field, Calif.). American Institute of
Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th,

Data from two experiments on the development of the
components of the Reynolds stress tensor after a sudden application of
transverse strain are compared. Computations were based on four
different turbulence models: a first-order mixing length model, a
second-order two-equation eddy viscosity model, and two second-
order Reynolds stress models. The second-order models do not
produce dramatic improvements over the simple mixing length
model. The Reynolds stress models still need development to
represent the physics of shear-strained turbulence well. Finally, it
is demonstrated that the assumption of a scalar eddy viscosity, often
used in engineering calculations of three-dimensional boundary
layers, is quite reasonable. (Author)

A78-22602 * Shock-tube studies of atomic silicon emission
in the spectral range 180 to 300 nm. S. G. Prakash (Stanford
University, Stanford, Calif.) and C. Park (NASA, Ames Research
Center, Entry Technology Branch, Moffett Field, Calif.). American
Institute of Aeronautics and Astronautics, Aerospace Sciences
Meeting, 16th, Huntsville, Ala., Jan. 16-18, 1978, Paper 78-234. 10
p., 17 refs. Grant No. NGL-2085

Emission spectroscopy of shock-heated atomic silicon was
performed in the spectral range 180 to 300 nm, in an environment
simulating the ablation layer expected around a jovian entry probe
with a silica heat shield. From the spectra obtained at temperatures
from 6000 to 10,000 K and electron number densities from 1
cubed to 1000 cubed per cm, the Lorentzian line-widths were
determined. The results showed that silicon lines are broadened
significantly by both electrons (Stark broadening) and hydrogen
atoms (Van der Waals broadening), and the combined line-widths are
much larger than previously assumed. From the data, the Stark and
the Van der Waals line-widths were determined for 34 silicon lines.
Radiative transport through a typical shock layer was computed
using the new line-width data. The computations showed that silicon
emission in the hot region is large, but it is mostly absorbed in the
colder region adjacent to the wall. (Author)

A78-22606 * Airborne infrared interferometric observations
and analysis of stratospheric trace constituents. L. L. Smith and T.
Hilgen (Graham Aerospace Corp., Bethpage, N.Y.). American
Institute of Aeronautics and Astronautics, Aerospace Sciences
Contract No. NAS2-6664

Infrared interferometric observations of key trace constituents
of the stratosphere have been obtained. The NASA Lear Airborne
Observatory with the Grumman airborne interferometer system was
flown in the lower stratosphere at an altitude of 20 km to obtain
transmission spectra in the 2800-6000 cm region at a resolution
of 2.5 cm using the moon as a source. An atmospheric modeling
program and the AFGL line parameter atlas are used to identify
N2O, CH4, O3 and other trace constituents and to derive strato-
spheric column densities (molecules/cm2). (Author)
A78-22608 * Numerical results are given for a noisy isothermal of altitude (as opposed to time) in order to predict the noise quality number density profiles for the atmosphere of Mars are derived from motion about photon noise and initial conditions. R.G. French, J. C. Vigner, and J. C. Tannenhill (Iowa State University of Science and Technology, Ames, Iowa) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 15th, Huntsville, Ala., Jan 16-18, 1978, Paper 79-200. 11 p. 11 refs

A time-accurate finite-difference Navier-Stokes code has been used to calculate the viscous flow over a severely indented blunt body in a supersonic stream. An algebraic turbulence model is used and the results are compared with experimental data from wind-tunnel tests. Qualitative agreement is obtained for the surface pressure distribution and flow-field structure, including the sequestered bubble in the indented region. However, uncertainties still exist in the heating calculations, which are attributed to the turbulence model. For both laminar and turbulent calculations, the flow exhibits a fundamental unsteady character at a frequency of about 50 kHz.

(Author)


A technique is described, by which a glass strip may be bent to match any curve of large radius of curvature, to a high degree of accuracy. The curved strip may be used in a linear laser beam of X-rays to form an X-ray collimator. A particular case, that of a parabola for use as a laboratory X-ray collimator, is considered in detail. The analysis predicts that a collimation of one or two arc seconds should be obtainable in practice, with simple and inexpensive apparatus. A prototype collimator is used for the testing of space payloads using geometric (McGrath) collimators described and laboratory results presented (Author)


It is proposed that the thermal velocity of a single atom could be measured in real time using a laser time-of-flight velocimeter (LTV) operating on the principle of laser resonance fluorescence. Theoretical data are presented for several atomic species that have resonances within the range of available dye laser systems. It is shown that measurements in the subsonic region are feasible. The atoms could be either in vacuum or in a buffer gas. Measurements in the transonic and supersonic regions are feasible. The atoms could be measured by applying the optimum combination of end couples and by varying the cross-sectional moment of inertia along the length of the strip. A particular case, that of a parabola for use as a laboratory X-ray collimator, is considered in detail. The analysis predicts that a collimation of one or two arc seconds should be obtainable in practice, with simple and inexpensive apparatus. A prototype collimator is used for the testing of space payloads using geometric (McGrath) collimators described and laboratory results presented (Author)


An occultation light curve can be analyzed to provide information about a planetary atmosphere: temperature, pressure, and number density profiles for the atmosphere of Mars are derived from a series of boundary layer equations, which write to solve the equation for altitude (as opposed to time) in order to predict the noise quality of the occultation. Numerical results are given for a noisy isotherm light curve, with special attention to error analysis (Author)


Asbestos reinforcing fiber in an automotive friction material was replaced by an experimental ingredient having better thermal stability, and the effects on wear and friction were studied. A friction materials test machine (SAE J661a) was used to determine friction and wear, under constant energy output conditions, as a function of temperature between 121 and 343 C (250 and 650 F) When potassium tinate fiber replaced one half of the asbestos in a standard commercial lining, with a 40 percent upward adjustment of phenolic resin content, wear above 204 C (400 F) was improved by 40% and friction by 30%. Tests on a full-scale inertial dynamometer supported the findings of the sample dynamometer tests. It was demonstrated that the potassium tinate fiber contributes directly to the improvement in wear and friction (Author)

A78-23543 * Thermal structure of the primitive ionosphere. O. Ashihara (Tokyo, University, Tokyo, Japan), M. Shimizu (NASA, Ames Research Center, Moffett Field, Calif.; Tokyo, University, Tokyo, Japan), and T. Shimaizumi (NASA, Ames Research Center, Moffett Field, Calif.). Journal of Geophysical Research, vol. 83, Jan 1, 1978, p 191-194. 16 refs

Exospheric neutral and electron temperatures have been estimated for the primitive upper atmosphere and ionosphere with various oxygen content in the scheme of our previous model (Shimizu and Shimazu, 1976). The exospheric neutral temperature has been shown to be reduced, even without the change of oxygen content, justifying our previous assumption for the temperature variation, while the exospheric electron temperature has been found to be quite sensitive to the compositional change, mainly owing to the strong dependence of electron density on the oxygen concentration

(Author)

A78-23576 * Quantum mechanical theory of collisional ionization in the presence of intense laser radiation. J. C. Bellum (Rochester, University, Rochester, N.Y.) and T. F. George, Journal of Chemical Physics, vol. 68, Jan 1, 1978, p 134-144. 64 refs NSF Grant No. CHE-75-06775-A01; Contracts No. F44620-74-C-0073, No. F46620-73-C-0036, Grant No. NsG-2198

The paper presents a quantum mechanical formalism for treating ionizing collisions occurring in the presence of an intense laser field. Both the intense laser radiation and the internal electronic continuum states associated with the emitted electrons are rigorously taken into account by combining approximations with expansions in terms of electronic-field representations for the quasi-molecule-plus-photon system. The procedure leads to a coupled-channel description of the heavy-particle dynamics which involves effective electronic-field potential surfaces and continua. It is suggested that laser-influenced ionizing collisions can be studied to verify the effects of intense laser radiation on realistic collisional processes. Calculations procedures for electronic transition dipole matrix elements between discrete and continuum electronic states are outlined (Author)

Consideration is given to the development of theories concerning the rings of Saturn. Particular attention is given to ring structure, noting its thinness, the separations between rings, and observed variations in brightness. Data gathered via infrared, radio, and radar techniques are described in terms of ring particle composition and size. Hypotheses about ring origin and evolution are outlined, including the tidal disruption model, calculations of Saturn’s gravitational contraction history, grazing, and meteoroid bombardment. Prospects for future observations of Saturn’s rings are reviewed, such as the variation in their radar reflectivity as a function of the tilt of the ring plane. (S.C.S.)

A78-25264 * Microparticle accelerator of unique design J. P. Vedder (NASA, Ames Research Center, Moffett Field, Calif.) *Review of Scientific Instruments, vol 49, Jan, 1978, p 1-7. 23 refs. A micro-particle accelerator has been devised for micrometer-sized impact and cratering simulation; the device produces high-velocity (0.5-15 km/sec), micrometer-sized projectiles of any cohesive material. In the source, an electrodynamic levitator, single particles are ionized and accelerated in high vacuum. The vertical acceleration stages with a total voltage equivalent to about 1 MeV are used to give four acceleration stages with a total voltage equivalent to about 1 MV. (B.J.)

A78-26070 * Dynamic MHD modeling of the solar wind disturbances during the August 1972 events. M. Dryer, Z. K. Smith (NGAA, Space Environment Laboratory, Boulder, Colo.), R. S. Stenoffson (Alabama, University, Huntsville, Ala.), E. J. Smith (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), J. H. Wolfe, J. D. Mihalov (NASA, Ames Research Center, Moffett Field, Calif.), P. Rosnau (New York University, New York, N.Y.), and C. Candela. *Journal of Geophysical Research, vol 83, Feb 1, 1978, p 532-540. 26 refs. Grant No. AF-APOSR-76-2881. A time-dependent one-dimensional MHD theoretical model is tested by using plasma and magnetic field observations of Pioneer 9 and Pioneer 10 during the August 1972 events on the sun and in the interplanetary medium. These spacecraft were nearly aligned along a common heliocentric radius during these events, considered now to be the most spectacular and best-documented events during solar cycle 20. The observations of Pioneer 9 at 0.78 AU were used as input for the theoretical model. The plasma and magnetic field forcing functions were superimposed upon a preexisting ambient solar wind at this inner boundary, and the response was simulated as far as 8 AU. The simulated output at 2.2 AU is compared directly with the Pioneer 10 observations at 2.2 AU. Qualitative comparison is good, although several limitations of the one-dimensional theory are noted. (Author)

A78-2595 * Airborne photometric observations between 1.25 and 3.25 microns of late-type stars. H. L. Nord, S. G. Olofsson (Stockholm Observatory, Saltsjobaden, Sweden), and G. C. Augustin (NASA, Ames Research Center, Astrophysics Branch, Moffett Field, Calif.) *Astronomical Journal, vol 83, Feb 1978, p 188-193. 30 refs. Swedish Board for Space Activities Grant No. DR-1145. The stars Alpha Aur (G5 III + B0 III), Alpha Boo (K2 III), and Alpha Ori (M1-M2 Ia+Ib), Alpha Sco (M1.5 Iab), Mu Gem (M3 III), and Alpha Her (M5 Ib-II) have been observed using interference filters in five photometric bands between 1.25 and 3.25 microns during seven flights with NASA’s Lear Jet Infrared Observatory. The filters were designed to measure molecular features, primarily from CN and CO, and continuum fluxes. By calibrating the photometer in the laboratory against a stabilized blackbody source, relative flux curves have been derived. The energy distributions and the strength of molecular features are discussed. The most interesting result obtained is that the fluxes from Mu Gem and Alpha Her in the filter centered at 3.25 microns seem to be depressed by at least some tenths of a magnitude. Tentatively this depression is proposed to be due to the wings of the two vibration-rotation bands (about 2.7 microns) of hot water vapor. Since water vapor is an important opacity source and its abundance is a sensitive C/O indicator, the proposed interpretation may renew efforts to detect water bands in early M stars highly desirable. (Author)

A78-25676 * Saturn’s rings. Particle composition and size distribution as constrained by microwave observations. I - Radar observations. J. H. Cuzzi and J. B. Pollack (NASA, Ames Research Center, Space Science Div, Moffett Field, Calif.) *Icarus, vol 35, Feb 1978, p 233-262. 84 refs. The radar backscattering characteristics of compositional and structural models of Saturn’s rings are calculated and compared with observations of the absolute value, wavelength dependence, and degree of depolarization of the rings’ radar cross section (reflectivity). The doubling method is used to calculate reflectivities for systems that are many particles thick using optical depths derived from observations at visible wavelengths if the rings are many particles thick, irregular centimeter-scale meter-sized particles composed primarily of water ice attain sufficiently high albedos and scattering efficiencies to explain the radar observations. In that case, the wavelength independence of radar reflectivity implies the existence of a broad particle size distribution; a narrower size distribution is also a possibility. Particles of primarily silicate composition are ruled out by the radar observations. Purely metallic particles may not be ruled out on the basis of existing radar observations. A monolayer of very large ice ‘particles’ that exhibit multiple internal scattering may not yet be ruled out. (Author)

A78-25989 * The interplanetary modulation and transport of Jovian electrons. F. Conlon (Chicago, University, Chicago, III.) *Journal of Geophysical Research, vol 83, Feb, 1978, p 541-552. 29 refs Contract No NASS-6553, Grant No. NGL-14-001-006. Based on simultaneous measurements by Pioneer 11 of the 3-6 MeV Jovian electron flux, interplanetary magnetic field magnitude, and solar wind speed, the interplanetary transport of energetic particles is studied. It is found that corotating interaction regions (CIR’s) greatly inhibit electron transport across the average field direction. Cross-field transport is also influenced by the degree of compression of the solar wind since CIR’s are areas of compressed solar wind plasma. The propagation of Jovian electrons is studied by a model that includes the effects of CIR’s. The model tests whether or not the three-dimensional connection-diffusion theory adequately describes the cross-field transport of electrons. The model is also valid for Jovian electron observations from earth-orbiting satellites. The model may be further applied to 1 AU from the sun where it is found that the cross-field diffusion of electrons explains why Jovian electrons are detected at the earth even during periods when the interplanetary magnetic field does not connect the earth directly to Jupiter. (S.C.S.)

A78-26081 * Energetic protons associated with interplanetary active regions 1.5 AU from the sun. M. E. Pesch, J. A. Van Allen, and C. K. Goertz (Iowa, University, Iowa City, Iowa.) *Journal of Geophysical Research, vol 83, Feb, 1. 1978, p 555-562. 36 refs. Contract No. NASS-0553. Pioneer II has yielded data on approximately 100 energetic proton events at heliocentric distances between 1 and 2 AU. Measurements of absolute intensities, anisotropies, and crude energy...
spectra are studied in connection with interplanetary active regions (IAR's). It is found that in close vicinity to IAR's, the number of events observed per unit time interval is 10 times greater than in other areas of interplanetary space, and that the frequency of events has a maximum at plus or minus 5 hours of the time IAR edges are crossed. It is also noted that events in IAR vicinity have greater particle densities, softer energy spectra, and smaller time widths than other events. For many events associated with IAR's, particle anisotropies correspond to the net flow of particles along the interplanetary magnetic field toward the sun. This suggests that a mechanism in MHD shocks is responsible for local acceleration of the interplanetary medium.


The generalized Galerkin method (or the method of integral relations) is applied to the type of problem described by quasilinear parabolic equations. As an example the problem of nonlinear transient slab diffusion with a general reservoir boundary condition is worked out. The integral relations are given for an arbitrary number of strips, and solutions using up to seven strips have been obtained in order to investigate the convergence of the method.

A78-27749 * The co-adsorption of copper and oxygen on a tungsten 100 plane-type surface. E. Bauer (Clausthal, Technische Universität, Clausthal-Zellerfeld, West Germany), H. Poppe (NASA, Ames Research Center, Moffett Field, Calif.) Grant No. NsG-2198; Contract No. F44620-74-R-0073.

The co-adsorption of Cu on O2 and a W 100 plane-type surface is studied by Auger electron spectroscopy, thermal desorption, low energy electron diffraction and by work function change measurements. It is shown that the presence of Cu on the surface initially decreases the sticking coefficient of O2. For longer oxygen exposures and for higher adsorption temperatures, the coverage of preadsorbed oxygen reaches values larger than those on the clean surface for the same O2 exposure. Except at the highest values and temperatures of the coverage of preadsorbed oxygen, the sticking coefficient for copper is unity and is independent of the oxygen coverage in the range studied. Co-adsorption at room temperatures does not produce any long range order while co-adsorption at elevated temperature leads to ordered structures. The saturation coverage of the two dimensional co-adsorbate at 800 K is given by a relation. The work function is a complicated function of the coverage of preadsorbed oxygen and the coverage of preadsorbed Cu and is determined predominantly by the temperature at which oxygen is adsorbed. At high temperatures the sequence of adsorption has no influence, in contrast to the room temperature behavior.


Two simple assumptions regarding the ratios of the strengths of the field contributions of the multipole moments of the terrestrial magnetic field at its effective source depth are used to examine the consistency between the apparent source depths for the magnetic fields of Mercury and Jupiter and the present understanding of their interior structure. Both fields are consistent with the present understanding. However, the comparison would be facilitated by further measurements of the magnetic fields at both planets, especially at Mercury.


Electronic-field representation is proposed as a technique for laser-assisted chemistry. Specifically, it is shown that several field-assisted chemical processes can be described in terms of mixed matter-field quantum states and their associated energies. The technique may be used to analyze the effects exerted by an intense laser on both bound and unbound molecular systems, and to investigate other field-induced effects including multiphoton processes, emission, and photodissociation.


A new metal-oxide-metal device (Ni-NiO-Ni), Edge MOM which is stable, reproducibly fabricated, and with a 10 to the -10th sq cm tunneling area is presented. Performing detection experiments, the device's nonlinear I-V characteristic is shown to be invariant at audio frequencies, 106, 3 39, and 0.6328 microns. Similar devices with 100 to the -8th sq cm tunneling area perform as well as the Edge MOM's in the visible and the near-infrared range, but deteriorate in performance at the 10-micron range. A dominant competing effect is a thermal-induced signal, which increases with frequency and temperature. Coupling mechanisms at the various regimes are investigated. The device can serve as a broad-band detector and mixer, and might in the future be a base element of broad-band amplifiers and oscillators.


Calculations have been made to determine the effects of atmospheric drag and gravity on impact ejecta trajectories on Venus, Mars, and earth. The equations of motion were numerically integrated for a broad range of body sizes, initial velocities, and initial elevation angles. A dimensionless parameter was found from approximate analytic solutions which correlated the ejecta range, final impact angle, and final impact velocity for all three planets.


(For abstract see issue 14, p. 2453, Accession no. A77-29899)

Coupled time-dependent continuity-momentum and energy balance equations for the Venus ionosphere were simultaneously solved for CO2(+), O2(+), O(+), He(+), and H(+) densities and electron and ion temperatures for an altitude range of 120-500 km. Values of the solar zenith angle varied from 0 deg (subsolar point) to 90 deg (terminator). The calculations include the horizontal bulk transport of ions by neutral winds but not the horizontal diffusion. The two-stream photoelectron transport method was used to find the heating rates for the ambient electrons. Different boundary conditions were considered, and a nightside ionosphere was calculated. The results of these model calculations are in good agreement with measurements in the region of maximum electron density. Characteristics of topside and nightside densities and temperatures are discussed.

M. L.


An apparent solar-flare-generated shock wave detected by Pioneer 10 at 9.7 AU on April 9, 1978 is discussed. The shock wave may be correlated with a radio emission burst from Jupiter not associated with Io (March 30). The fact that solar flares observed on March 20 were at the central meridian with respect to Jupiter and Pioneer 10 and the fact that solar activity was very low before March 20 contribute to the argument that a shock wave had propagated to the region of the spacecraft.

J. M. B.


It is shown that correlation currents arising from the superposition of pairs of states on distinct sides of a potential barrier in metal-barrier-metal structures can result in inelastic tunneling through the emission of surface plasmons. Net gain of an externally excited plasmon field is possible.


Results are presented for an experimental study in which a 10 deg half-angle pointed cone model 57.9 cm long and made of magnesium (for lightness and minimization of inertial effects) is spun at several rates about its axis of symmetry. The model is spun in both directions, but most of the data presented are for the counterclockwise rotation. The resulting side force is recorded on an oscillograph. It is shown, however, that the side force observed occurs under well-defined conditions of spin about the longitudinal axis, and that the general shape of the side-force curve with roll position does not depend strongly on spin rate. However, the peak-to-peak value of side force decreases substantially with spin rate, suggesting that the vortices produced by the side force require a significant amount of time to change position and/or strength.


A 33-GHz airborne radiometer system has been developed to map large angular scale variations in the temperature of the 3 K cosmic background radiation. A ferrite circulator switches a room-temperature mixer between two antennas pointing 60 deg apart in the sky. In 40 min of observing, the radiometer can measure the anisotropy of the microwave background with an accuracy of plus or minus 1 mK, or about 1 part in 3000 of 3 K. The apparatus is flown in a U-2 jet to 20 km altitude where 33-GHz thermal microwave emission from the atmosphere is at a low level. A second radiometer, tuned to 54 GHz near oxygen emission lines, monitors spurious signals from residual atmospheric radiation. The antennas, which have an extremely low side-lobe response of less than -65 dB past 80 deg, reject anisotropic radiation from the earth's surface.

Periodic interchange of the antenna positions and reversal of the aircraft's flight direction cancel equipment-basedalmblances. The system has been operated successfully in U-2 aircraft flown from NASA-Ames at Moffett Field, Calif.


Although the Navier-Stokes equations describe most flows of interest in aerodynamics, the inviscid conservation law equations may be used for small regions with viscous forces. Thus, Euler equations and several three-accurate finite difference procedures, explicit and implicit, are discussed. Although implicit techniques require more computational work, they permit larger time steps to be taken without instability. It is noted that the Jacobian matrices for Euler equations in conservation-law form have certain eigenvalue-eigenvector properties which may be used to construct conservative-coefficient matrices. This reduces the computation time of several implicit and semisplit scheme extensions. Extensions of the basic approach to other areas are suggested.

S. C. S.


A qualitative assessment is made of the long-term risk of earth reentry and reentry associated with aborted disposal of hazardous material in the space environment. Numerical results are presented for 10 candidate disposal options covering a broad range of disposal destinations and deployment propulsion systems. Based on representative models of system failure, the probability that a single payload will return and collide with earth within a period of 250,000 years is found to lie in the range 0.002-0.006. Proporionately smaller risk attacts to shorter time intervals. Risk critical factors related to trajectory geometry and system reliability are identified as possible mechanisms of hazard reduction.

A78-32467 Bar-driven spiral waves in disk galaxies. J. M. Huntley (NASA, Ames Research Center, Moffett Field, Calif., Virginia University, Charlottesville, Va.), R. H. Sanders (Pittsburgh University, Pittsburgh, Pa.), and W. W. Roberts, Jr. (Virginia, ...
The response of rotating disks of gas to barlike perturbations in galactic gravitational fields is investigated. In particular, two-dimensional time-dependent numerical hydrodynamical calculations have been performed to determine the steady-state response of disks of gas to rotating barlike perturbations. Two types of barlike perturbations are considered: ovals and distortions in the axisymmetric gravitational field of the disk, and heterogeneous protocluster spheroids. The calculations reveal that in the absence of gaseous self-gravity, a viscous differentially rotating disk of gas responds to a rotating barlike perturbation by forming a central gas bar with two trailing spiral waves. The local phase of the gas response is primarily a function of the number and spacing of the principal resonances in the disk. This result may be understood in terms of particle orbitology. (Author)

Iron and nickel-iron samples subjected to treatment by an arc-heated plasma of neutral gas were used to model meteor ablation. The artificial ablation debris and fusion crusts were compared to the fusion crusts of three natural iron meteorites and to magnetic spheres from deep-sea manganese nodules. An outer discontinuous crust of magnetic and vesicular, followed by an unoxidized metallic zone, was observed in two artificially produced samples. Formation of less volatile elements was also noted.

A method was developed for evaluation and prediction of effects of oxidation of the graphite substrate on structural properties of Reinforced Carbon-Carbon (RCC) thermal protection material. Test specimens of RCC material were exposed to successive periods of convective heating in a plasma-paint facility to simulate the chemical reactions of Shuttle atmospheric entry. After each period of testing, the test specimen mass loss and performance in a nondestructive flexure test were determined. A computational model of the RCC specimen was developed for the NASA Structural Analysis (NASTRAN) program and validated by comparison of calculated and experimental results of flexure tests. The elastic modulus and ultimate loads in tension and compression were then computed for various levels of substrate oxidation. (Author)


A UHV technique is presented for evaluating the adsorption-desorption properties of UHV vapor-deposited metal particles supported on insulating substrates. Desorption studies of CO from particulate and continuous Pd films supported on mica were performed. The desorption results indicate that the CO desorption energies from the deposited metals are much lower than those from bulk single crystals, two desorption states exist for the vapor-deposited films; and the lower energy desorption peak of the vapor-deposited films is coverage dependent. Possible reasons for the difference between previously reported CO desorption studies on bulk substrates and the present results are discussed. (Author)


Apparent lethal concentrations for 50 per cent of the test animals within a 30-min exposure period (ALC/50) were determined for seventeen samples of polymeric materials, using the screening test method. The materials evaluated included resin-glass composites, film composites, and miscellaneous resins. ALC(50) values, based on weight of original sample charged, ranged from 24 to 110 mg/l. Modified phenolic resins seemed to exhibit less toxicity than the baselines epoxy resins. Among the film composites evaluated, only flame modified polyvinyl fluoride appeared to exhibit less toxicity than the baseline polyvinyl fluoride film. (Author)


A prototype of orbiting reflectors, SOLARES, has been studied as a possible means of providing terrestrial power with a space system of minimum mass and complexity. The key impact that such a system...
providing continuous and slightly concentrated radiation, makes on
the economic viability of solar farming is demonstrated. New
developments in solar sailing are incorporated to reduce mirror mass
and transportation cost. The system is compatible with incremental
implementation and continual expansion to produce the world's
power needs. Key technology, environmental, and economic issues
and payoffs are identified. SOLARES appears to be economically
superior to other advanced, and even conventional, energy systems
and could be scaled to completely abate our fossil fuel usage for
power generation. (Author)

A78-36770, A78-37270, A78-36776, A78-37275, A78-37276, A78-36775, A78-37275


Large-scale self-consistent-field plus configuration-interaction calculations have been performed for the 3Pi and 3Pi g states of C2. The theoretical potential curves are in good agreement with those found by a Klein-Dunham analysis of measured molecular constants in terms of shape and excitation energy. The sum of the squares of the theoretical transition moments between the two states is 2.44 bohrs, which agrees with the results of shock tube measurements. The variation in the sum of the squares of the theoretical moments with internuclear separation agrees with the values of Danylewych and Nicholls (1974). Based on the data for C2 and other molecules, it is suggested that CI calculations using Hartree-Fock quality Slater basis sets produce highly reliable transition moments.

A78-36809


A78-37270


The effect of initial probe heatshield shape on the total probe mass loss during jovian entry is considered. Modification of the aerothermal environment and probe entry trajectory due to a change in probe heatshield shape is included. A computerized technique designed for rapid assessment of the effect of probe initial shape on heatshield mass loss has been developed. Results obtained indicate the importance of trajectory and heating distribution coupling with probe shape and mass change.

A78-37273


The ablation of carbonaceous materials in a hydrogen-nitrogen stream has been simulated using a charring materials ablator code. These results are compared with the first ablation data to be obtained from the Ames-NASA Giant Planet Pilot Facility. Test stream conditions and ablation effects on convective and radiative heat transfer are discussed since these parameters constitute important input data to the numerical simulation. Graphite ablation was predicted to within 10 to 20%, and carbon phenolic somewhat less accurately.

A78-37272


The indication method for calculating flutter derivatives for two-dimensional airfoils at transonic speeds is discussed, with particular attention given to the effect of a moving shock on the flow variables in the indicial method. An expression for the pressure coefficient is developed on the basis of an explicit treatment of the shock motion, the pressure distribution may then be calculated for general oscillations through use of the indicial method. Explicit inclusion of the shock motion is not necessary if only the lift and pitching moment coefficients are desired.

J. M. B.

The most striking feature of the night sky in the tropics is the zodiocal light, which appears as a cone in the west after sunset and in the east before sunrise. It is caused by sunlight scattered or absorbed by particles in the interplanetary medium. The zodiocal light is the only source of information about the integrated properties of the whole ensemble of interplanetary dust. The brightness and polarization in different directions and at different colors can provide information on the optical properties and spatial distribution of the scattering particles. The zodiocal light arises from two independent physical processes related to the scattering of solar continuum radiation by interplanetary dust and to thermal emission which arises from solar radiation that is absorbed by interplanetary dust and reemitted mainly at infrared wavelengths. Attention is given to observational parameters of zodiocal light, the methods of observation, errors and absolute calibration, and the observed characteristics of zodiocal light.

G.R.


The 1.2- to 5.6-micron spectrum of the carbon star Y CVn is presented and discussed. The observations were made from the Kulper Airborne Observatory at an altitude of 12.5 km, thereby avoiding most of the absorption due to terrestrial water vapor. Comparison of Y CVn near 5 microns with laboratory spectra provides possible evidence for the presence of the linear acyclic molecule C3 For the first time in a carbon star the clearly formed band heads of the CN red system between 1.2 and 2.3 microns are observed. Corroborative evidence for the presence of the molecules HCN and CH2 is presented, and the relative contributions of C3, HCN, and CH2 to the 3-micron absorption band are discussed. Spectra of other two carbon stars, TX Psc and S Cap, are presented for comparison.


The heat transfer to the stagnation point of an ablating carbonaceous heat shield, where both the gas-phase boundary layer and the heterogeneous surface reactions are not in chemical equilibrium, is examined. Specifically, the nonequilibrium changes in the mass fraction profiles of carbon species calculated for frozen flow are studied. A set of equations describing the steady-state, nonequilibrium laminar boundary layer in the axisymmetric stagnation region, over an ablating graphite surface, is solved, with allowance for the effects of finite rate of carbon vaporization P.T.H.

A78-41074 * On the modulation of the Jovian decametric radiation by lo. I. - Acceleration of charged particles R. A. Smith (Paris, Observatoire, Meudon, Hauts-de-Seine, France) and C. K Goertz (Iowa, University, Iowa City, Iowa). Journal of Geophysical Research, vol. 83, June 1, 1978, p. 2017-2027 29 refs. Research supported by the National Research Council, Centre National de la Recherche Scientifique, and Délegation Générale à la Recherche Scientifique et Technique; NSF Grant No. ATM-72-01282, Contracts No. NAS5-5603; No. NAS5-6553.

A steady-state analysis of the current circuit between Io and the Jovian atmosphere is performed, assuming that the current is carried by electrons accelerated through potential double layers in the Io flux tube. The circuit analysis indicates that electrons may be accelerated up to energies of several hundred keV. Several problems associated with the formation of double layers are also discussed. The parallel potential drops decouple the flux tube from the satellite's orbital motion.


NO, HNO3, and O3 levels and air temperature were measured as a function of latitude in the 18 to 21 km region of the stratosphere, and the sum of odd nitrogen, equal to NO + NO2 + HNO3, was calculated and compared with model predictions (NO2 values were inferred from photochemical equilibrium characteristics.) The data show that NO measurements generally exhibit good agreement with model predictions for low and midlatitudes but poor agreement at high latitudes. The experimental sum of odd nitrogen mixing ratio and model predictions agree within a factor of 2-1/2 or better at both 20 and 40 deg N, and show excellent agreement for latitudinal dependence.

M.L.


Direct real-time gas chromatographic measurements of CF2Cl2, CFC13, CCl4, and N20 were made at latitudes from 74 deg N to 62 deg S aboard a NASA Convair 990 as part of the 1978 NASA CV-300 Latitude Survey Mission between Alaska and New Zealand. A difference was found in the average mixing ratios of CF2Cl2 and CFC13 between the Northern and Southern Hemispheres, but no differences were noted for CCl4 and N20. The results support some of the previous studies of interhemispheric tropospheric gradients and suggest the lack of any significant tropospheric sinks.


Relative toxicity data on the pyrolysis products of a variety of thermoplastic and thermoset polymers are presented. The data are presented in terms of time to incapacitation and time to death with a fixed sample weight of 10 g, and in terms of the apparent lethal concentration required to produce 50 percent mortality within a fixed exposure period of 30 min.


Some of the waste variations in the crater-size distributions in lunar photography and in the resulting statistics were interpreted as different degradation rates on different surfaces, different scaling laws in different targets, and a possible population of endogenic craters. These possibilities are reexamined for statistics of 26 different regions. In contrast to most other studies, crater diameters
as small as 5 m were measured from enlarged Lunar Orbiter framelets. According to the results of the reported analysis, the different crater distribution types appear to be most consistent with the hypotheses of differential degradation and a superposed crater population. Differential degradation can account for the low-level of equilibrium in incompetent materials such as ejecta deposits, mantle deposits, and deep regoliths where scaling law changes and catastrophic processes introduce contradictions with other observations.

G R


A78-41826 * An implicit algorithm for the conservative transonic full potential equation using an arbitrary mesh T. L. Holst (NASA, Ames Research Center, Moffett Field, Calif.) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1113 13 p 10 refs A new, implicit approximate factorization (AF) algorithm designed to solve the conservative full-potential equation for the transonic flow past arbitrary airfoils has been developed. The new algorithm uses an upward bias of the density coefficient to provide stability in supersonic regions. This allows the simple two- and three-band matrix form of the AF scheme to be retained over the entire flow field, even in regions of supersonic flow. A numerical transformation is used to establish an arbitrary body-fitted finite-difference mesh. Axial pressure distributions have been computed and are in good agreement with independent results. (Author)


The primary objective of the reported investigation is the computational verification of the experimental results obtained by Satas and Daywitt (1978). Two existing computer codes were used to compute the supersonic flow field surrounding the external axial corner. For the inviscid and turbulent flow results, the steady, three-dimensional implicit code of Pulliam and Steger (1978) was used. For the laminar flow results, the unsteady, two-dimensional explicit procedure of Vigneron et al. (1977) was employed. Inviscid solutions for a symmetric configuration with a rounded corner were also obtained in both single and triple surface crossflow stagnation point flows, depending on the corner radius. Numerical results obtained for the same symmetric configuration tested experimentally show the crossflow in the vicinity of the corner to be away from the corner and thus in agreement with the experimental oil flow results.

G R

A78-41841 * Calculation of supersonic viscous flow over delta wings with sharp subsonic leading edges. Y. C. Vigneron, J. C. Tannehill (NASA, Ames Research Center, Moffett Field, Calif., Iowa State University of Science and Technology, Ames, Iowa), and J. V. Rakich (NASA, Ames Research Center, Moffett Field, Calif.) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1137 20 p. 32 refs Research supported by the Iowa State University of Science and Technology; Grant No. NGR-18-002-038

Two complementary procedures have been developed to calculate the viscous supersonic flow over conical shapes at large angles of attack, with application to cones and delta wings. In the first approach, the flow is assumed to be conical and the governing equations are solved at a given Reynolds number with a time-marching explicit finite-difference algorithm. In the second method the parabolized Navier-Stokes equations are solved with a space-marching implicit noniterative finite-difference algorithm. This latter approach is not restricted to conical shapes and provides a large improvement in computational efficiency over published methods. Results from the two procedures agree very well with each other and with available experimental data. (Author)

A78-41858 * An evaluation of several compressible turbulent boundary-layer models. Effects of pressure gradient and Reynolds number on the behavior of supersonic turbulent boundary-layer flows. C. C. Horstman and M. I. Kustoe, and M. J. Lanfranco (NASA, Ames Research Center, Moffett Field, Calif.) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1160 11 p. 12 refs Comparison, employing several turbulence models, are compared with a series of attached supersonic turbulent boundary-layer experiments over an extensive range of Reynolds numbers (11.7 x 10 to the 6th to 314 x 10 to the 6th). These experiments included measurements of surface pressure and skin friction for adverse pressure gradients ranging in magnitude from those of previous investigations to an order of magnitude greater. The turbulence models evaluated include algebraic and two-equation eddy-viscosity models and two full Reynolds stress models. In general all the models tested performed well independently of the magnitude of the pressure gradient or Reynolds number and could predict the measured skin friction for most cases with sufficient accuracy for engineering purposes. (Author)

A78-41863 * Comparison of multiequation turbulence models for several shock-separated boundary-layer interaction flows. J. R. Viegas and C. C. Horstman (NASA, Ames Research Center, Moffett Field, Calif.) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1165 21 p. 27 refs Several multiequation eddy viscosity models of turbulence are used with the Navier-Stokes equations to compute three classes of experimentally documented shock-separated turbulent boundary-layer flows. The types of flow studied are (1) a normal shock at transonic speeds in both a circular duct and a two-dimensional channel; (2) an incident oblique shock at supersonic speeds on a flat surface, and (3) a two-dimensional compression corner at supersonic speeds. Established zero-equation (algebraic), one-equation (kinetic energy), and two equation (kinetic energy plus length scale) turbulence models are each utilized to describe the Reynolds shear stress for the three classes of flows. These models are assessed by comparing the calculated values of skin friction, wall pressure distribution, velocity, Mach number, and turbulent kinetic energy profiles with experimental measurements. Of the models tested the two-equation model results gave the best overall agreement with the data. (Author)


An experimental study has been carried out to detail the interaction of a compressible turbulent boundary layer with shock waves of varying strengths. The interaction was produced by two-dimensional compression corners of 8, 16, 20, and 24 deg angles. The incoming boundary layer had an edge Mach number of 2.85 and
a Reynolds number of 1.7 million based on overall thickness. Detailed mean-flow and surface measurements are presented for the four corner angles. The 8 deg corner flow was found to be fully attached, while the 16 deg case was near incipient separation. Both the 20 deg and 24 deg corners produced significant flow separation regions. In the discussion of these results, emphasis is placed on the development of flowfield properties from attached to separated conditions. Comparisons made with a computational solution of the Navier-Stokes-equations show good agreement when the corner flow is not separated (Author).


An experimental investigation of the effect of tangential air injection, when the injection slot is located inside of what would otherwise have been the dead air zone in a separated flow, in controlling shock-induced turbulent boundary layer separation is presented. The experiments were carried out at a freestream Mach number of 2.5 in the separated flow induced by a compression corner with a 20 deg angle. The observations made were wall static pressures, pitot profiles, and schlieren visualizations of the flow. The results show that the present-location for injection is more effective in suppressing boundary-layer separation than the more conventional one, where the slot is located upstream of where separation would occur in the absence of injection. (Author)


Aerodynamic properties of artillery shell such as normal force and pitching moment reach peak values in a narrow transonic Mach number range. In order to compute these quantities, numerical techniques have been developed to obtain solutions to the three-dimensional transonic small disturbance equation about slender bodies at angle of attack. The computation is based on a plane relaxation technique involving Fourier transforms to partially decouple the three-dimensional difference equations. Particular care is taken to assure accurate solutions near corners found in shell designs. Computed surface pressures are compared to experimental measurements for circular arc and cone cylinder bodies which have been selected as test cases. Computed pitching moments are compared to range measurements for a typical projectile shape. (Author)


It is suggested that, if primitive Mars had a reducing-atmosphere composed mainly of methane, the atmosphere could be polymerized by solar ultraviolet radiation to produce higher hydrocarbons. These compounds, which would be low-viscosity liquids at present temperatures on Mars, could have contributed to the formation of channels. The Martian atmosphere model used in the analysis is similar to that of Shavack (1977) except that anomalous mass loss is not included. Major features of this early Martian atmosphere are examined, and the number densities of the lighter alkanes in the lower atmosphere of Mars are determined. Since the photochemical mechanism investigated here would produce only a modest amount of fluid for a comparatively short period of time (10-100 million years), liquid alkanes would not be the major factor in the formation of the channels, although their derivatives could contribute to the greenhouse effect or depress the freezing point of water. (Author)


An exploratory study, dealing with the preparation of well-defined particulate metal deposits that can be used in model studies of catalytic reactions, was performed. Small metal particles of Fe and Pb were grown in situ at junctions of microchannels by vapor deposition onto different phase of electron transparent alumina substrates. The results show that characteristic properties of the deposits, such as particle density, size distribution, habit, and orientation, are strongly dependent on the cleanliness, phase, and crystallographic orientation of the alumina substrate; also, the deposition conditions can be chosen in such a way as to reproducibly manipulate the overall deposit structure. (Author)


The present paper deals with the conditions of explosion or nuclear cratering required to simulate impact crater formation. Some planetary problems associated with three different aspects of crater formation are discussed, and solutions based on high-explosion data are proposed. Structures of impact craters and some selected explosion craters formed in layered media are examined and are related to the structure of lunar basins. The mode of ejection of material from impact craters is identified using explosion analogy. The ejection mode is shown to have important implications for the origin of material in crater and basin deposits. Equally important are the populations of secondary craters on lunar and planetary surfaces. (Author)


An experimental study is conducted on 12.5-mm-thick SAE 1020 steel (plain carbon steel) plate to assess hydrogen attack at room temperature after specimen exposure at 525 °C to hydrogen and a blend of hydrogen sulfide and hydrogen at a pressure of 3.5 MN/m² for exposure times up to 240 hr. The results are discussed in terms of tensile properties, fissure formation, and surface scales. It is shown that hydrogen attack from a high-purity hydrogen environment is severe, with the formation of numerous methane fissures and bubbles along with a significant reduction in the room-temperature tensile
yield and ultimate strengths. However, no hydrogen attack is observed in the hydrogen/hydrogen sulfide blend environment, i.e. no fissure or bubble formation occurred and the room-temperature tensile properties remained unchanged. It is suggested that the observed porous discontinuous scale of FeS acts as a barrier to hydrogen entry, thus reducing its effective equilibrium solubility in the iron lattice. Therefore, hydrogen attack should not occur in pressure-vessel steels used in many coal gasification processes. S.D.


The paper presents model calculations for the Cytherean nighttime and daytime ionosphere. It is shown how some of the proposed mechanisms can be tested with the aid of the Pioneer Venus observations scheduled for December 1978. Theoretical calculations of the energetics of the Cytherean airglow are performed, and it is concluded that the Project Venus measurements will find elevated ion and electron temperatures, resulting primarily from energy fluxes associated in some manner with the solar wind. According to this model, the energy flux will act directly on the ions. Ultraviolet dayglow intensities were calculated, and it is anticipated that hundreds of kR's of CO2-related emission features are calculated. M L

A78-44777 * Correction to ‘Recirculation of energetic particles in Jupiter's magnetosphere’. D D Sentman, J A Van Allen, and C. K. Goertz (Iowa, University, Iowa City, Iowa) Geophysical Research Letters, vol 5, July 1978, p 821, 822. 6 refs Navy-supported research, Contract No. NAS-5653

An error in Pioneer 11 data reduction software has, when present, caused a phase shift of 180 deg in the assignment of spacecraft roll angles. The corrected analysis of the pitch angle distributions of energetic particles in Jupiter's magnetosphere reveals significant proton anisotropies directed toward the planet in the southern hemisphere, contrary to the authors' (1975) original report. In the northern hemisphere, both proton and electron anisotropies are directed away from the planet, as reported previously. The revised data show that the claim of direct evidence for the hypothesis of recirculation of energetic particles in the Jovian magnetosphere is invalid. It is suggested that indirect evidence still supports the hypothesis, although the recirculation process must be weaker than originally envisioned and obscured by other processes. M L.


Advances in computational fluid dynamics are paced by simulation methodology and computer resources. Examples of three-dimensional fluid dynamic simulations are presented to illustrate recent developments in equation modeling and numerical methods and to point out the need for increased computer power. Electronic technology dictates that to fill this need, computers will be based on parallel processing principles. The identification of parallelism in three dimensions is illustrated by examining an implicit, approximate-factorization approach to the Navier-Stokes equations. Finally, two computer concepts aimed at satisfying the demands of the three dimensional Reynolds-averaged Navier-Stokes simulations are discussed. (Author)


A new method for the design of shock-free supersonic airfoils, wings, and three-dimensional configurations is described. Results illustrating this procedure in two and three dimensions are given. They include modifications to part of the upper surface of an NACA 64A410 airfoil that will maintain shock-free flow over a range of Mach numbers for a fixed lift coefficient, and the modifications required on part of the upper surface of a swept wing with an NACA 64A410 root section to achieve shock-free flow. While the results are given for inviscid flow, the same procedures can be employed iteratively with a boundary layer calculation in order to achieve shock-free viscous designs. With a shock-free pressure field the boundary layer calculation will be reliable and not complicated by the difficulties of shock-wave-boundary-layer interaction. (Author)


Computational results obtained with a parabolic Navier-Stokes marching code are presented for supersonic viscous flow past a pointed cone at an angle of attack undergoing a combined spinning and coning motion. The code takes into account the symmetries in the flow field resulting from the motion and computes the asymmetric shock shape, crossflow and streamwise shear, heat transfer, crossflow separation and vortex structure. The side force and moment are also computed. Reasonably good agreement is obtained with the side force measurements of Shiff and Tobok. Comparison is made also with the only available numerical inviscid analysis. It is found that the asymmetric pressure loads due to coning motion are much larger than all other viscous forces due to spin and coning, making viscous force negligible in the combined motion. (Author)


An implicit finite-difference method has been developed to compute two-dimensional turbulent, blunt body flows with an impinging shock wave. The full time-averaged Navier-Stokes equations are solved with algebraic eddy viscosity and turbulent Prandtl number models employed for shear stress and heat flux. The irregular-shaped bow shock is treated as a discontinuity across which the Rankine-Hugoniot equations are applied. A Type III turbulent shock interaction flow field has been computed and the numerical results compare favorably with existing experimental data. In addition, comparisons are made between the present implicit code and a previous explicit code. (Author)


A study is made of the amplitude and spectral extent of whistler mode noise in the inner magnetosphere of Jupiter. It is found that the "hat-shaped" pitch angle distributions of energetic electrons (21 and 31 MeV at L=3) are consistent with those predicted in the presence of a band-limited spectrum of whistler mode noise. The equatorial maximum linear growth rate of parallel propagating whistlers is consistent with those necessary to limit the energetic electron intensities by the whistler mode instability. It is noted that
the wave phase speeds before wave reflection can occur at high latitudes and that wave growth is limited to a disk-like region centered around the magnetic equator. The frequency extent of the whistler mode noise spectrum may be estimated by the range of frequencies maximally unstable to equatorial linear growth. A value is found for the spectral density of the broadband whistler mode noise necessary to balance radial diffusion of energetic electrons above the critical region, and an expression is derived for the energetic electron system response to fluctuations about the limiting flux value.


The relative thermal stability, flammability, and related thermomechanical properties of some thermoplastic materials currently used in aircraft interiors as well as of some candidate thermoplastics were investigated. Currently used materials that were evaluated include acrylonitrile butadiene styrene, bisphenol A polycarbonate, polyvinyl chloride, and polyvinyl fluoride. Candidate thermoplastic materials evaluated include: 9,9-bis-(4-hydroxyphenyl)fluorene polycarbonate-poly(1,4-diaminobenzene) block polymer, chlorinated polyvinyl chloride polymer, phenolphthalein polycarbonate, polyethersulfone, polyvinyl alcohol, polyvinyl fluoride.

A78-45893 * Semigrungey bounds for the dipole moments and transition moments of the LiH molecule S. R. Langhoff and D. P. Chong (NASA, Ames Research Center, Moffett Field, Calif.). Journal of Chemical Physics, vol 69, July 1, 1978, p. 194-199 42 refs

Semigrungey error limits for the dipole moments and transition moments of LiH at \( R = 3.015 \) a.u. are reported. Weinhold's formula for the upper and lower bounds to transition moments is extended to include transitions between states of the same symmetry, and Chong's (1978) semigrungey expression for the lower bound to the overlap between the approximate and the true wavefunctions is applied to the calculation. The semigrungey theory of Chong was also generalized in the sense that the zero-order wavefunction was allowed to contain many configuration state functions instead of just the Hartree-Fock or first natural configuration state function.


A review is presented of implicit and hybrid methods applicable to solving viscous flows at high Reynolds numbers. Flows within axisymmetric channels containing stationary shock waves, past blunt-nosed lifting airfoils, past sharp-nosed symmetric airfoils with buffet, past three-dimensional compression ramps with side walls, and past ogive- and hemispherically-angled at angle of attack have been examined. Reynolds numbers as high as 10 to the 9th power have been used.


The scientific experiments planned for the Pioneer Venus entry probe require that the probes provide a stable platform at a controlled roll rate throughout the atmospheric phase of the mission.

The 45-degree half-cone forebody common to both the small and large probe configurations provides a design which meets all stability and attitude requirements. The uncertainty in the dynamic stability parameter coupled with the possible variability of roll rate due to ablation induced roll torques could, however, result in slight angle of attack divergence in the transonic flight regime. Minimum roll rate requirements on the small probe are passively achieved by a vane mounted on the pressure-temperature sensing arm. The vane was sized to provide minimum dynamic disturbance.


All available timing data for the occultations of SAO 158887 on March 10, 1977, by the outer rings of Uranus are analyzed. Least-squares fits to the data are performed using a model which postulates that rings alpha, beta, gamma, and delta are circular and coplanar. A solution obtained under the assumption that the ring plane coincides with the plane of the satellite orbits is adopted which yields radii of 44,844 km for ring alpha, 45,796 km for ring beta, 47,746 km for ring gamma, and 48,423 km for ring delta. The uncertainties in these values are discussed along with the apparent shapes and inclinations of these main rings. The mean radii estimated for the other rings are 47,323 km for ring eta, 42,653 km for ring 4, 42,380 km for ring 5, and 41,880 km for ring 6.


The paper reports on two-field models which include the inhibition of thermal conduction by the spiraling interplanetary field to determine whether any of the major conclusions obtained by Neary and Barnes (1977) needs to be modified. Comparisons with straight field line models reveal that for most base conditions, the primary effect of the inhibition of thermal conduction is the buttoung-up of heat in the electrons as well as the quite different temperature profiles at a large heliocentric radius. The spiral field solutions show that coronal hole boundary conditions do not correspond to states of high-speed streams as observed at 1 AU. The two-fluid models suggest that the spiral field inhibition of thermal conduction in the equatorial plane will generate higher gas pressures in comparison with flows along the solar rotation axis (between 1 and 10 AU) in particular, massive outflows of stellar winds, such as outflow from T Tauri stars, cannot be driven by thermal conduction. The conclusions of Neary and Barnes remain essentially unchanged.


Experimental results show conclusively that the presence of a small quantity of a noncondensable gas (NGC) mixed with the working fluid has a considerable effect on the condensation process in a rotating heat pipe. The temperature distribution in the condenser shows the blanketing effect of the NGC and the ratio of the molecular weight of the working fluid to that of the NGC has a very definite effect on the shape of this distribution. Some of the effects are quite similar to the well-established data on stationary heat pipes.


Medium spectral resolution (20 kaysers) infrared measurements of the Martian disk made between 2500 and 5600 kaysers from the NASA Lear Airborne Observatory have been successfully compared with predictions derived from a model of the Martian soil and atmosphere. Modeling of the Martian atmosphere permitted the extraction of Martian soil reflectance in the CO2 bands centered at 3657 kaysers. Three Martian soil analogs previously considered acceptable - limonite, montmorillonite, and basalt - were analyzed to determine the optical complex indices of refraction in the same range as those of the airborne observables, for mathematical modeling. A characteristic surface particle size approximately 1 to 3 microns in diameter is indicated. It is concluded that the Martian soil surface near-infrared optical properties are consistent with a soil composition similar to montmorillonite or limonite, mixed with a basalt.


The evolution of a rotating massive cloud, starting at interstellar densities, continuing through a series of intermediate fragmentation stages, and ending with stellar multiple systems with components near the main sequence, is outlined. The scenario is based on results of two- and three-dimensional numerical hydrodynamical calculations of collapsing clouds. Transfer of spin angular momentum primarily into orbital motion is assumed to occur at each fragmentation stage. Expected initial conditions in the cloud lead to final fragments which have in many cases the masses and angular momenta approximate to observed main-sequence systems. Other points of comparison with observations are briefly noted.


Spectrophotometry of the classical Be star Gamma Cassiopeiae (14 microns, with about 2% spectral resolution) is presented. These data, together with existing broad-band observations, are accurately described by simple isothermal LTE models for the IR excess which differ from most previously published work in three ways: (1) hydrogenic bound-free emission is included; (2) a transition of the star by the shell is included, and (3) no assumption is made that the shell contribution is negligible in some bandspass. It is demonstrated that the bulk of the IR excess consists of hydrogenic bound-free and free-free emission from a shell of hot ionized hydrogen gas, although a small thermal component cannot be ruled out. The bound-free emission is strong, and the Balmer, Paschen, and Brackett discontinuities are correctly represented by the shell model with physical parameters as follows: a shell temperature of approximately 18,000 K, an optical depth (at 1 micron) of about 0.5, an electron density of approximately 1 trillion per cu cm, and a size of about 2 trillion cm. Phantom shells (i.e., ones which do not alter the observed spectrum of the underlying star) are discussed.


The thermochemical and flammability characteristics of some typical thermoplastic materials currently in use and others being considered for use in aircraft interiors are described. The properties studied included (1) thermal mechanical properties such as glass transition and melt temperature, (2) changes in polymer enthalpy by differential scanning calorimetry, (3) thermogravimetric analysis in an anerobiotic and oxidative environment, (4) oxygen index, (5) smoke evolution, (6) relative toxicity of the volatile products of pyrolysis, and (7) selected physical properties. The generic polymers which were evaluated included polyacrylonitrile-butadiene-styrene, bisphenol-A polycarbonate, bisphenol fluorocarbone-carboxydimethyloxane block polymer, phenolphthalien-bisphenol-A polycarbonate, phenolphthalin polycarbonate, polyethylene terephthalate, polyethylene oxide, polyvinylidene chloride, chlorinated polyvinyl chloride homopolymer, polyvinyl fluoride, and polyvinylidene fluoride. Processing parameters including molding characteristics of some of the advanced polymers are described. Test results and relative rankings of some of the flammability, smoke and toxicity properties are presented.


A reference model is proposed for the structure of the Mars atmosphere up to 100-km altitude. Based on Viking data, the model incorporates the mean temperature structure, mean surface pressure, mean molecular weight and gas constant, and pressure and density profiles. Model profiles with Viking and Mars 6 data are compared, and attention is given to warm and cool models. The thermal boundary layer is considered along with the role of thermal tides.

A78-50488 * Absolute intensity measurements at different temperatures of the C-12/0-16/2 bands of 30 0 1 1-0 0 0 0 and 30 0 1 1-0 0 0 1/4-0 0 0 0 C. B. Suarez and F. P. J. Valero (NASA, Ames Research Center, Moffett Field, Calif.) Journal of Quantitative Spectroscopy and Radiative Transfer, vol. 20, June 1978, p. 579-587, 13 refs.


Vibration-rotation line intensities, self-broadening coefficients, and foreign-gas-broadening (Ar and N2) coefficients were measured at 197, 233, and 284 K for the 30 0 1 1-0 0 0 0 band of CO2 at 6348 cm. Values for the total band intensity, purely vibrational transition moment, and vibration-rotation interaction factor were deduced from the measurements.


An analytical solution is obtained for the problem of free and forced vibrations of a finite Euler-Bernoulli beam with arbitrary (partially fixed) boundary conditions. The effects of linear viscous...
Field, Calif.). M A Golub they relate various thermal loads corresponding to reasonable fire threats, as NAS2-7251; Grants No. NSG-7276; No. NSG-7295. seat materials that have significantly improved thermal response to aesthetic properties were also included in the evaluations. Candidate Propulsion Laboratory, Pasadena, the basis of Spieth A78-51838

Tests of the thermo electronic laser energy converter (TELEC) concept are reported. This device has been devised as a means to convert high-average-power laser radiation into electrical energy, a crucial element in any space laser power transmission scheme using the available high-power/efficiency infrared lasers. Theoretical calculations, based upon inverse bremsstrahlung absorption in a cesium plasma, indicate internal conversion efficiency up to 50% with an overall system efficiency of 42%. The experiments reported were made with a test cell designed to confirm the theoretical model rather than demonstrate efficiency: 10.6-micron laser-beam absorption was limited to about 0.001 of the incident beam by the short absorption region. Nevertheless, confirmatory results were obtained, and the conversion of absorbed radiation to electric power is estimated to be near 10%.


The nonequilibrium chemical processes of nitric oxide formation are computed for the wake of the Tunguska meteor of 1908. The wake characteristics are derived by carrying out an optically-thick radiation field analysis for ablation of the meteoroid. The wake flow field is approximated by a one-dimensional, well-stirred reactor model. Known characteristics of the Tunguska event are imposed as constraints, and three controlling parameters—chemical composition, density, and velocity—are varied over a range around the values derived by Korobelnikov et al. (1978) and Petrov and Stulov (1975). The calculation shows that at least 10 million tons of nitric oxide is produced between the altitudes of 10 and 50 km. The anomalous atmospheric phenomena following the event are attributed to the reactions involving nitric oxide thus produced and atmospheric ozone. It is speculated that the nitric oxide produced by the event fertilized the area near the fall, causing the observed increase in plant growth.


This paper describes fire resistivity studies of a wide range of candidate nonmetallic materials for the construction of improved fire resistant aircraft passenger seats. These materials were evaluated on the basis of FAA airworthiness burn and smoke generation tests, colorfastness, and animal toxicity tests. Physical, mechanical, and aesthetic properties were also included in the evaluations. Candidate seat materials that have significantly improved thermal response to various thermal loads corresponding to reasonable fire threats, as they relate to in-flight fire situations, are identified.


The work described was carried out to study the thermal rearrangements of two unsaturated diene polymers—1,2-poly(1,4-

hexadiene) (CHD) and 1,2-poly(trans-1,4-hexadiene) (THD). It is shown that both CHD and THD have a primarily 1,8 diene structure and seem to cyclize mainly by the (2 + 2) thermal cycloaddition of double bonds, and to a small extent also by sigmatropic rearrangement with hydrogen shift.


A planetary boundary layer model is described and used to simulate PBL phenomena including cloud formation and pollution transport in the San Francisco Bay Area. The effect of events in the PBL on air pollution is considered, and governing equations for the average momentum, potential temperature, water vapor mixing ratio, and air contaminants are presented. These equations are derived by integrating the basic equations vertically through the mixed layer. Characteristics of the day are used for simulation, and the results suggest that the diurnally cyclic features of the mesoscale motion, including clouds and air pollution, can be simulated in a readily interpretable way with the model.


Emission signals from Europa with wavelength below 800 A were detected by the Pioneer 10 ultraviolet photometer. In the present paper, improved procedures for data reduction are used to determine the spatial region as well as the intensity of the suggested emission sources. The observations indicate a cloud with a radius of about 1.5 Jupiter radii and an apparent brightness of approximately 10 rayleighs for a wavelength of 500 A. It is argued that neutral oxygen atoms, along with neutral hydrogen, are produced through dissociation of water ice on the surface of Europa by particle impact. Electronic impact ionization excitation of oxygen atoms in the resulting cloud then gives rise to the observed emission. The present source brightness and cloud radius results are used to estimate an oxygen column density of the order of 10 trillion per sq cm, while the density of atomic hydrogen is at most 100 billion per sq cm and 1 trillion per sq cm for molecular hydrogen.


Pioneer 10 vector helium magnetometer data acquired in 1972-1973 during Bartels solar rotations 1896-1918 are used to investigate the radial dependences of the distant interplanetary magnetic field (IMF) between 1 and 5 AU. Least-squares fits were determined for the radial dependences of the averages of the magnitudes of IMF components and total field and plane projections, and radial fits were prepared for the standard deviations of these variables over the solar rotation, one day, and three-hour intervals. The variation of the weighted averages of the radial component of the field with respect to the heliocentric distance, the variation of...
the tangential component of the field, and the characteristics of a subcomponent corresponding to a relatively low average solar wind velocity are reported.

M.L.


The results, in general, support the validity of the model, although the neglect of thermal energy exchange leads to incorrect values for the proton temperature. A detailed analysis of a stream is discussed.

M.L.


The indeterminacy inherent in the formal extension of Arrenius’ law to reactions in turbulent flow is shown to be surmountable in the case of a binary exchange reaction with a sufficiently high activation energy. An approximate calculation predicts that the turbulent reaction rate is invariant and equal to the Arrhenius form with an equivalent lowered activation energy. This is a reflection of turbulence-augmented molecular vigor, and causes an appreciable increase in the reaction rate. A similarity to the tunnel effect in quantum mechanics is indicated. The anomaly associated with the mild ignition of oxygen-hydrogen mixtures is discussed in this light.

(2) H.


Photoelectric, ionization, and gas sensors were used to detect the signature from the radiant heat or flame of various aircraft materials. It was found that both ionization and photoelectric detectors are about equally capable of detecting products of pyrolysis and combustion of synthetic polymers, especially those containing fire-retardant additives. Ionization detectors alone appeared to be sensitive to combustion products of sample cellulose materials. A gas sensor detector appeared to be insensitive to pyrolysis or combustion products of many of the materials. P. T. H.

PATTERNS

- A78-52154 * New 1,1-triaryl 2,2,2-trifluoro ethanes in which the syl radicals carry one or more substituents, were prepared by condensing trifluoroacetophenones with substituted aromatic compounds in the presence of catalytic quantities of trifluoro methyl sulfonic acid. The reaction can be carried out under reflux in toluene or, for strikingly better results in certain cases, reactants are simply stirred at room temperature for about 24 to 48 hours.

N.A.S.A.


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N.A.S.A.

A process is described for constructing a composite laminate structure which exhibits a high resistance to heat and flame resistance, and which provides increased strength and stiffness for use as a structural component. The process includes preparing a prepolymer which is then cured to form a prepolymer. The prepolymer is formed from an alkaryl ether or halide, sprayed onto the particles and the mix is hot pressed to form a prepolymer. The prepolymer is then baked at a temperature sufficient to complete polymerization and foaming of the reactants in another embodiment of the process, the reactants are heated to a temperature sufficient to complete polymerization and foaming of the reactants. The process is then cured at higher temperatures to complete foaming and polymerization.


Wood paneling or other molded wood compositions are prepared by igniting cellulose particles such as finely divided wood shavings, flour, or strands, by bonding such particles with 10 to 30% by weight of a modified novolac resin. The resin prepolymers and a hardening agent such as hexamethylene tetramine are sprayed onto the particles and the mix is hot pressed to form the panel or other articles and cure the prepolymer to form the composite. The process is from hard by ether or halide with a reactive frit composed of a porous high silica bonecrasate glass and boron oxide. The glassy composites of the present invention are useful as coatings on low density fibrous porous silca silica insulations used as heat shields and for articles such as reaction vessels that are subjected to high temperatures with rapid heating and cooling and that require resistance to temperature and repeated thermal shock at temperatures up to about 1482°C (2700°F). The invention relates to reaction cured glass and glass coatings prepared by reacting a compound selected from the group consisting of silicon tetraboride, silicon hexaboride, boron carbide, boron nitride, boron carbide, and boron nitride with a reactive glass frit composed of a a porous high silica bonecrasate glass and boron oxide. The glassy composites of the present invention are useful as coatings on low density fibrous porous silica silica insulations used as heat shields and for articles such as reaction vessels that are subjected to high temperatures with rapid heating and cooling and that require resistance to temperature and repeated thermal shock at temperatures up to about 1482°C (2700°F). Official Gazette of the U.S. Patent Office.


Foamed cross-linked poly-N-arylenebenzimidazoles are prepared by mixing an organic tetrasilane and an ortho substututed aromatic dicarboxylic acid anhydride in the presence of a blowing agent, and then heating the prepolymer to a temperature sufficient to complete polymerization and foaming of the reactants. In another embodiment of the process, the reactants are heated to form a prepolymer. The prepolymer is then cured at higher temperatures to complete foaming and polymerization.


A high temperature insulating material suitable for reusable reentry heat shielding was prepared from silica fibers and aluminosilicate fibers in a weight ratio ranging from 1:19 to 1:1, and about 0.5% to 30% boron oxide, based on the total fiber-weight. Aluminosilicate fibers and additional free boron oxide up to 30% limit may be substituted for the aluminosilicate fiber and boron oxide requirements. Small quantities of refractory opacifiers, such as silicon carbide, may be added. The composites are characterized by the absence of nonfibrous matrix.


The invention relates to reaction cured glass and glass coatings prepared by reacting a compound selected from the group consisting of silicon tetraboride, silicon hexaboride, other boron carbides, boron nitride, and mixtures with a reactive glass frit composed of a porous high silica bonecrasate glass and boron oxide. The glassy composites of the present invention are useful as coatings on low density fibrous porous silica silica insulations used as heat shields and for articles such as reaction vessels that are subjected to high temperatures with rapid heating and cooling and that require resistance to temperature and repeated thermal shock at temperatures up to about 1482°C (2700°F). Official Gazette of the U.S. Patent Office.


A spray coating apparatus is described for rotating a workpiece relative to a spray station to obtain a uniform coating of the workpiece. The apparatus for rotating the workpiece includes a base support with a rotatable stage for rotation in the horizontal plane and a rotatable stage for rotation in the second plane inclined at an angle to the horizontal plane. The workpiece is rotatable in both of these planes of rotation. The workpiece support is detachable from the first rotatable stage and the workpiece is readily detachable from the workpiece support to facilitate off-loading of the spray coated workpiece. The workpiece holder includes a spray guard extending around the periphery of the workpiece to shield that surface of the workpiece where no coating is desired. The two degrees of freedom provided at the rotation of the workpiece relative to the spray station permit the various aspects of the workpiece to be sequentially rotated into an orthogonal relationship to the spray station for uniform coating.
LIFE SCIENCES

FORMAL REPORTS

N78-10444* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

A COMPUTER PROGRAM FOR CALCULATING LAMINAR AND TURBULENT BOUNDARY LAYERS FOR TWO-DIMENSIONAL TIME-DEPENDENT FLOWS
Tuncer Cebeci (Calif State Univ, Long Beach) and Lawrence W Carr Mar 1978 62 p refs
(NASA-TM-78470, A-7340) Avail NTIS HC A04/MF A01 CSDL 20D

A computer program is described which provides solutions of two-dimensional equations appropriate to laminar and turbulent boundary layers for boundary conditions with an external flow which fluctuates in magnitude. The program is based on the numerical solution of the governing boundary layer equations by an efficient two point finite difference method. An eddy viscosity formulation was used to model the Reynolds shear stress term. The main features of the method are briefly described and instructions for the computer program with a listing are provided. Sample calculations to demonstrate its usage and capabilities for laminar and turbulent unsteady boundary layers with an external flow which fluctuates in magnitude are presented. Author

N78-21019* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

A BIBLIOGRAPHY ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE
Eugene F Mallove (Analytic SCI Corp., Reading, Mass), Mary M Connor, Robert L. Forward (Hughes Res Labs, Malibu, Calif.), and Zbigniew Paprotny (Cracovska, Poland) Mar. 1978 135 p refs
(NASA-RP-1021) Avail NTIS HC A07/MF A01 CSDL 05B

This report presents a uniform compilation of works dealing with the search for extraterrestrial intelligence. Entries are by first author with cross-reference by topic index and by periodical index. This bibliography updates earlier bibliographies on this general topic while concentrating on research related to listening for signals from extraterrestrial intelligence. Author

N78-25071* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Apr. - 30 Jun. 1977

Apr 1978 62 p Prepared in cooperation with Battelle Columbus Labs, Mountain View Calif

(NASA-TM-78478, A-7373 OR-5) Avail NTIS HC A04/MF A01 CSDL 02A

Reports describing various types of communication problems are presented along with summaries dealing with judgment and decision making. Concerns relating to the ground proximity warning system are summarized and several examples of true terrain proximity warnings are provided. An analytic study of reports relating to profile descents was performed. Problems were found to be associated with charting and graphic presentation of the descents with lack of uniformity of the descent procedures among facilities using them and with the flight crew workload engendered by profile descents, particularly when additional requirements are imposed by air traffic control during the execution of the profiles. A selection of alert bulletins and responses to them were reviewed. Author

N78-26740* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

SPACE ECO SYNTHESIS: AN APPROACH TO THE DESIGN OF CLOSED ECOSYSTEMS FOR USE IN SPACE
R D MacElyot and M M. Avemar (Califonnia Univ, at Berkeley) Jun 1978 41 p refs
(NASA-TM-78491) Avail NTIS HC A03/MF A01 CSDL 06K

The use of closed ecological systems for the regeneration of wastes, air and water is discussed. It is concluded that such systems, if they are to be used for the support of humans in space, will require extensive mechanical and physico-chemical support. The reason for this is that the buffering capacity available in small systems is inadequate, and that natural biological and physical regulatory mechanisms rapidly become inoperative. It is proposed that mathematical models of the dynamics of a closed ecological system may provide the best means of studying the initial problems of ecosystem closure. A conceptual and mathematical model of a closed ecosystem is presented which treats the biological components as a farm, calculates the rates of flow of elements through the system by mass-balance techniques and control theory postulates, and can evaluate the requirements for mechanical buffering activities. It is suggested that study of the closure of ecosystems can significantly aid in the establishment of general principles of ecological systems. Author

N78-28973* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif

CRITICAL REVIEW OF AMES LIFE SCIENCE PARTICIPATION IN SPACELAB MISSION DEVELOPMENT TEST 3: THE SMD 3 MANAGEMENT STUDY
Robert Helmsrech (Texas Univ., Austin), John Wilhelm (Texas Univ., Austin), Trenve A Tanner, Joen E. Sieber (Calif. State Univ., Hayward) and Susan Burgenbauch Jun 1978 84 p refs
(NASA-TM-78494, A-7471) Avail NTIS HC A05/MF A01 CSDL 05A

A management study was conducted to specify activities and problems encountered during the development of procedures for documentation and crew training on experiments, as well as during the design, integration and delivery of a life sciences experiment payload to Johnson Space Center for a 7 day simulation of a Spacelab mission. Conclusions and recommendations to project management for current and future Ames life sciences projects are included. Broader issues relevant to the conduct of future scientific missions under the constraints imposed by the environment of space are also addressed. Author
N78-28975* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
PROJECT PLAN FOR JOINT FAA/NASA HEAD-UP DISPLAY CONCEPT EVALUATION
R. F. Harris Aug 1976 16 p Sponsored in part by DOT (NASA-TM-78512) HUD-1 J-7562) Aval NTIS HC A02/MF A01 CSCL 06A
Head-Up Display (HUD) concept for large commercial turbojet transport aircraft is considered for its contribution to aviation safety in the form of improved performance during the approach and landing phase flight. The basic research areas represent fundamental questions that are still unresolved and which were considered important to the effective use of the HUD by pilots. Project documentation and management responsibilities are outlined. G G

N78-32075* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Jul - 30 Sep 1977
An analytical study of reports relating to cockpit altitude alert systems was performed. A recent change in the Federal Air Regulation permits the system to be modified so that the alerting signal approaching altitude has only a visual component. The auditory signal would continue to be heard if a deviation from an assigned altitude occurred. Failure to observe the audible alert signal and failure to reset the system were the commonest cause of altitude violations related to this system. Cockpit crew distraction was the most frequent reason for these failures. It was noted by numerous reporters that the presence of altitude alert system made them less aware of altitude deviations related to this system. Cockpit crew distraction was the most frequent reason for these failures. It was noted by numerous reporters that the presence of altitude alert system made them less aware of altitude awareness is discussed. Failures of crew coordination were also noted. It is suggested that although modification of the altitude alert system may be highly desirable in short-haul aircraft, it may not be desirable for long-haul aircraft in which cockpit workloads are much lower for long periods of time. In these cockpits, the aural alert approaching altitude is perceived as useful and helpful. If the system is to be modified, it appears that additional emphasis on altitude awareness during recurrent training will be necessary. It is also possible that fight crew operating procedures during climb and descent may need recurrent training will be necessary.

NASA CONTRACTOR REPORTS

N78-10864* Pittsburgh Univ. Pa Vestibular Function Research Lab.
15 Oct 1977 22 p ref (Grant NSG-2197) (NASA-CR-145407) Aval NTIS HC A02/MF A01 CSCL 09C
Vestibular neuron activity was examined by studying nerve stimulation and evoked response. A cooling element, applied to the nerve consisted of a silver hook through which a coolant fluid flowed. Temperature changes were recorded via microthermometers on an eight channel brush recorder, together with response. Diffusion of the cooling effect was measured, recovery time was assessed, and the nerve was then studied histologically and ultrastructurally. Problems in frog preparation were discussed along with problems in maintaining healthy specimens and bacteria controlled aquaria. Author

STUDY TO DESIGN AND DEVELOP REMOTE MANIPULATOR SYSTEMS Annual Report. 1 Aug 1976 - 30 Nov 1977
A description is given of part of a continuing effort both to develop models for and to augment the performance of humans controlling remote manipulators. The project plan calls for the performance of several standard tasks with a number of different manipulators and controls, and viewing conditions using an automated performance measuring system. In addition, the project plan calls for the development of a force reflecting joystick and supervisory display system. Author

N78-21236* Life Systems, Inc. Cleveland, Ohio
A solid electrolyte cell with improved sealing characteristics was examined. A tube cell was designed, developed, and tested. Design concepts incorporated in the tube cell to improve its sealing capability included minimizing the number of seals per cell and moving seals to lower temperature regions. The advanced tube cell design consists of one high temperature ceramic cement seal, one high temperature gasket seal, and three low temperature silicone elastomer seals. The high temperature seals in the tube cell design represent a significant improvement over the ten high temperature metal seals required by the electrolyzer drum design. For the tube cell design the solid electrolyte was B mole percent yttria stabilized zirconium oxide drop cast into the shape of a tube with electrodes applied on the inside and outside surfaces. Author

N78-22723* Life Systems, Inc., Cleveland, Ohio
The overall objectives of the present program are to: (1) improve the performance of the electrochemical CO2 removal technique by increasing CO2 removal efficiencies at pH levels below 4.0 Pa, increasing cell power output and broadening the tolerance of electrochemical cells for operation over wide ranges of cabin relative humidity, (2) design, fabricate, and assemble development hardware to continue the evolution of the electrochemical concentrating technique from the existing level to an advanced level able to efficiently meet the CO2 removal needs of a spacecraft air revitalization system (ARS), (3) develop and incorporate into the EDC the components and concepts that allow for the efficient integration of the electrochemical technique with other subsystems to form a spacecraft ARS, (4) combine ARS functions to enable the elimination of subsystem components and interfaces, and (5) demonstrate the integration concepts through actual operation of a functionally integrated ARS. Author

N78-23748* Life Systems, Inc., Cleveland, Ohio
A research and development program was successfully completed towards the development of a method of generating nitrogen for cabin leakage makeup aboard space vehicles. The
nitrogen generation concept used liquid hydrazine as the stored form of nitrogen. This reduced tankage and expendables weight associated with high pressure gaseous and cryogenic liquid nitrogen storage. The hydrazine was catalytically dissociated to yield a mixture of nitrogen and hydrogen. The latter was separated and stored. The hydrazine was catalytically dissociated to yield nitrogen and hydrogen. The latter was separated and stored. The hydrazine was catalytically dissociated to yield nitrogen and hydrogen. The latter was separated and stored.
toboons during periods of rest, moderate exercise, and extreme excitement. A description of the experiments hardware is presented, including artificial depressants phenylcyclidine hydrobromide, 0.5-1.0 mg/kg, and pentobarbital sodium, 15 mg/kg, and an ultrasonic telemetry flow meter. Results showed raised heart rate and arterial pressure coupled with a reduction of mesenteric and renal flows as the level of exercise was increased. These findings are compared with mesenteric and renal flows somewhat above control level, but relatively stable heart rate and arterial pressure, post-prandially. Attention is given to a quantitative analysis of the experimental results.

D M W

A78-22562 *  Responses of arterial and epiphyseal cartilage zones of developing xian radii to estrone treatment and a 2-G environment. J. A. Negulesco and T. Kosler (Ohio State University, Columbus, Ohio). **Aviation, Space, and Environmental Medicine, vol 49, Mar. 1978, p 489-494. 42 refs. Research supported by the Ohio State University, Contract No. NAS2-6834, Grant No. NIH-8409.

Histological measurements of radii from chickens exposed to estrone and hypergravity are reported. Female chicks at two weeks post-hatch were maintained for two weeks at earth gravity or 2 G with daily injections of 0.2 or 0.4 mg estrone. Animals were sacrificed after the last injection, and the radii were processed by described histological techniques. The results suggest that proximal and distal epiphyses of developing radii show different morphological responses to estrone and hypergravity.

M L


It is proposed that humans in automated systems will be asked to assume the role of troubleshooter or problem solver and that the problems which they will be asked to solve in such systems will not be amenable to rote solution. The design of visual displays for problem solving in such situations is considered, and the results of two experimental investigations of human problem solving performance in the diagnosis of faults in graphically displayed network problems are discussed. The effects of problem size, forced-pacing, computer aiding, and training are considered. Results indicate that human performance deviates from optimality as problem size increases. Forced-pacing appears to cause the human to adopt fairly brute force strategies, as compared to those adopted in self-paced situations. Computer aiding substantially lessens the number of mistaken diagnoses by performing the bookkeeping portions of the task.

(Author)


The left ventricular end-diastolic pressure-volume relationships in conscious dogs were studied. The ventricle was stressed to its limit in terms of myocardial preload in order to assess the extent of use of the Frank-Starling mechanism under these conditions. The preload was increased through volume loading with saline infusions, the provocation of global myocardial ischemia by constriction of the left main coronary artery, and infusion of methoxamine. While left ventricular end-diastolic pressure increased substantially in the reclining conscious animals, the left ventricular end-diastolic diameter did not increase, suggesting a minimum role for the Frank-Starling mechanism in this case.

J M B


Analytical techniques of improved sensitivity have revealed details of the concentrations and isotopic compositions of light elements for a comprehensive suite of samples from the Apollo 12 regolith. These samples show a wide spread in maturity, although maximum contents observed for solar wind elements are less than observed at other sites, possibly reflecting relative recency of craters at the Apollo 12 site. Isotopic composition of nitrogen is consistent with the idea that N-15N-14 in the solar wind has increased with time, at least a major part of this increase having occurred in the past 3.1 Gyr. Sulfur isotope systematics support a model in which sulfur is both added to the regolith, by meteoritic influx, and lost, by an isotopically selective process. Most soils from this site are heavily contaminated with terrestrial carbon.

(Author)


Experiments were conducted on six trained distance runners (21-23 yr) subjected to an eight-day dietary control at sea level, followed by an eight-day stay in an altitude chamber (2297-m altitude) and a four-day recovery at sea level. Fluid and electrolyte shifts during exercise at altitude were evaluated to gain insight into the mechanism of reduction in working capacity. The results are discussed in terms of resting fluid volumes and blood constituents, maximal exercise variables, and maximal fluid-electrolyte shifts. Since there are no significant changes in fluid balance or resting plasma volume (PV) at altitude, it is concluded that neither these nor the excessive PV shifts with exercise contribute to the reduction in maximal oxygen uptake at altitude. During altitude exposure the percent loss in PV is found to follow the percent reduction in maximal oxygen uptake; however, on the first day of recovery the percent change in PV remains depressed while maximal oxygen uptake returns to control levels.

S D

A78-37055 *  Stratospheric measurements of CF2Cl2 and N2O. B. J. Tyson, J. F. Veddar, J. C. Arvesen (NASA, Ames Research Center, Moffett Field, Calif.) and A. B. Brewer Geophysical Research Letters, vol 5, May 1978, p. 309-372 21 refs. Concentrated samples of stratospheric air were obtained at pressure altitudes of 13.3 km and 21.3 km aboard U-2 aircraft, and at 28.3 km and 36.9 km aboard a balloon platform. The moirng ratios of CF2Cl2 and N2O are reported for locations in California, Oregon, Texas, and Quebec, Canada. The observed mixing ratios compare within a factor of 2 to those reported by other investigators and show a more rapid decrease with altitude than predicted by a two-dimensional model.

(Author)


Utilizing elementary concepts from the theory of fuzzy sets as applied to decisionmaking in the task of troubleshooting graphically displayed networks. The performance of the model is compared to the results of two previously reported experimental studies. The ability of the model to represent human decisionmaking as a function of network size, forced-pacing, and computer aiding is considered.

(Author)

The three biological experiments on board the Viking Mars Lander are discussed. The gas exchange experiment provided periodic measurement of the composition and quantity of gases from Martian surface material, either in a humid or a wet nutrient sampling mode. The labeled release experiment demonstrated that adding a aqueous solution of dilute radioactive compounds to Martian material caused a rapid release of labeled gas. The results of the pyrolytic release experiment remain difficult to interpret. Data from the first two experiments suggest that oxidants (including H2O2 and iron(III) rather than ions may account for all the observed reactions.

J.M. B.

A78-41162 * Hormonal indices of tolerance to +Gz acceleration in female subjects J Vernikos-Danells, M F Dallman, P Forsham, A L Goodwin, and C S Leach (NASA, Ames Research Center, Biomedical Research Div, Moffett Field, California, University, San Francisco, Calif.; NASA, Johnston Space Center, Biomedical Research Div., Houston, Tex.). Aviation, Space, and Environmental Medicine, vol 49, July 1978, p 898-891. 17 refs

As a possible predictive test for screening Space Shuttle passengers, the secretion of the pituitary adrenal system and the adrenal medulla have been studied in conjunction with exposure to gravitational acceleration three times the normal level. The 12 female subjects in the test were divided into ambulatory and bedrest groups before bedrest, a high tolerance to centrifugation appeared to be noted after bedrest. The correlation between tolerance to centrifugation and 24-hour urinary epinephrine-to-norepinephrine ratios was not significant.

J.M. B.


Physiological criteria determining the design of the habitat for a space colony with 10,000 people are discussed. Centrifugally generated earth-normal gravity, maximum oxygen radiation dose standards less than or equal to 0.5 gray/year (obtained with passive shielding), and an atmosphere with reduced nitrogen partial pressures were established as design requirements for the habitat. However, further research is needed to determine whether humans experience adoptive adaptation to weightlessness and whether there are long-term effects of breathing various atmosphere mixtures and pressures.

J.M. B.

A78-42617 * Physiologic regulation of body energy storage G C Pitts (Virginia, University, Charlottesville, Va.) Metabolism, vol. 27, Apr 1978, p 469-478. 57 refs Grants No NGR47-005-213, No HDG-2225

Both new and published data (rats, mice, and human beings) on three parameters - fat mass, fat-free body mass (FFBM), and total body mass in some cases - evaluated. Steady state values of the parameters are analyzed for changes in response to specific perturbing agents and for their frequency distributions. Temporal sequences of values on individuals are examined for evidence of regulatory responses. The results lead to the hypothesis that the FFBM is regulated, but probably not as a unit, and that mass of fat is regulated with high priority near the extreme extremes but with a much lower priority in the mid-range. Properties and advantages of such a mechanism are discussed.

(Author)


A simulator study was undertaken to compare and evaluate the design features of the electronic displays for possible use in V/STOL aircraft. A combined transition display (Display A), a perspective display (Display B), and a hover display (Display C) were presented in a flight simulation to subject all the pilots to the same content and different display modes. The performance of the pilots was evaluated in terms of error rate, reaction time, and subjective impression of display quality. The results indicate that Display A provides the most useful information for the pilots, while Display C provides the least.

P. T. H.


The preparation of a polymer for the Pioneer-Venus Large Probe Gas Chromatograph and another polymer for gas-chromatographic analysis of the Martian atmosphere is described. Technical-grade dichlorobenzene is used as a support and the polyethylene oxide is monomer for the preparation of polymer beads. The discussion covers monomeric preparation, polymerization apparatus, first-stage polymer beads, second-stage polymer beads, amino-polymer, columns and gas-chromatographic testing instrumentation used. The polymer for the Pioneer-Venus gas chromatograph is suitable for ammonia but not for amine analysis. However, the polymer for the analysis of the Martian atmosphere is a chemically derivatized aromatic polymer that is suitable for amine analysis. The two-stage polymerization produces a highly efficient polymer packing clearly superior to others prepared by adjusted dilution of the aqueous-organic suspension system.

S. D.


The preparation of a polymer for the Pioneer-Venus Large Probe Gas Chromatograph and another polymer for gas-chromatographic analysis of the Martian atmosphere is described. Technical-grade dichlorobenzene is used as a support and the polyethylene oxide is monomer for the preparation of polymer beads. The discussion covers monomeric preparation, polymerization apparatus, first-stage polymer beads, second-stage polymer beads, amino-polymer, columns and gas-chromatographic testing instrumentation used. The polymer for the Pioneer-Venus gas chromatograph is suitable for ammonia but not for amine analysis. However, the polymer for the analysis of the Martian atmosphere is a chemically derivatized aromatic polymer that is suitable for amine analysis. The two-stage polymerization produces a highly efficient polymer packing clearly superior to others prepared by adjusted dilution of the aqueous-organic suspension system.

S. D.


The paper describes the intrinsic UV fluorescence of bacteriorhodopsin in some detail and demonstrates the changes during the rapid cyclic reaction following light flashes. The result suggest that several tryptophan residues are exposed in the protein, among them one or more exposed to aqueous medium. The kinetics of the fluorescence changes coincide closely with events involving the retinal residue during the deprotonation and reconstitution of the Schiff base group.

S. D.

A78-48671 * Gravity as a biochemical determinant. S. M. Seegd (Hawaii University, Honolulu, Hawaii) COSPAR, Plenary Meeting, 21st, Innsbruck, Austria, May 29-June 10, 1978, Paper. 20 p. 67 refs Grant No NGR-12-001-063; Contracts No NASA-6624, No NAS2-8867.

Hypogravity effects on the biochemistry of living organisms are studied. The effects of the altered gravitational fields of the Moon and rotating platforms are considered. Changes due to the altered gravitational fields are compared with those due to changes in the environmental conditions of the laboratory. The results are surveyed, and it is concluded that it is feasible to perform sound physiological experiments on nonhuman primates in space habitats. The detrimental effects of zero gravity on human physiology are reviewed, and the necessity of providing artificial gravity, an acceptable atmosphere, and comfortable relative humidity and temperature in a space habitat is discussed. Consideration is also given to social organization and government, supply of food and water, and design criteria for space habitats. B J


Parameters of bone formation and resorption were measured in rats orbited for 19.5 days aboard the Soviet Cosmos 782 biological satellite. The most striking effects were on bone formation. During flight, rats formed significantly less periosteal bone than did control rats on the ground. An arrest line at both the periosteum and the endosteum of flight animals suggests that a complete cessation of bone growth occurred. During a 20-day postflight period, the defect in bone formation was corrected. No significant changes in bone resorption were observed. (Author)


Sensitivity and roundoff errors can seriously limit the application of recursive digital filters in practice, particularly when the filters have poles near z = e + 1. A filter structure, based on digital incremental computers is proposed, which has low sensitivity, good error characteristics, and simple hardware implementation for pole locations close to z = e + 1. Expressions for the roundoff errors are derived and compared to those for conventional structures. A design procedure is suggested to implement the new filter structure given the transfer function. Simulation results are presented. (Author)


This paper describes a computer model that was designed to investigate the conformation of molecules, macromolecules and subsequent complexes. Utilizing an advanced 3-D dynamic computer display system, the model is sufficiently versatile to accommodate a large variety of molecular input and to generate data for multiple purposes such as visual representation of conformational changes, and calculation of conformation and interaction energy. Molecules can be built on the basis of several levels of information. These include the specification of atomic coordinates and connectivities...
and the grouping of building blocks and duplicated substructures using symmetry rules found in crystals and polymers such as proteins and nucleic acids. Called AIMS (Ames Interactive Molecular Modeling System), the model is now being used to study pre-biotic molecular evolution toward life.

(Author)


The effect of soil sterilization by dry heat (0.08% relative humidity), gamma radiation, or both on soil phosphatase, urease, and decarboxylase activity was studied. Soil sterilized by a long exposure to dry heat at relatively low temperatures (eight weeks at 102.5°C) retained higher activities than did soil exposed to a higher temperature (two weeks at 124.5°C), while all activity was destroyed by four days at 148°C. Sterilization with 7.5 Mrads destroyed less activity than did heat sterilization. The effect of several individually nonsterilizing doses of heat radiation is described. M.L.


PATENTS

N78-14104* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

AUTOMATIC MULTIPLE-SAMPLE APPLICATOR AND ELECTROPHORESIS APPARATUS Patent


An apparatus for performing electrophoresis and a multiple-sample applicator is described. Electrophoresis is a physical process in which electrically charged molecules and colloidal particles, upon the application of a dc current, migrate along a gel or on a membrane that is wetted with an electrolyte. A multiple-sample applicator is provided which coats a novel tank cover to permit an operator either to depress a single button, thus causing multiple samples to be deposited on the gel or on the membrane simultaneously, or to depress one or more sample applicators separately by means of a separate button for each applicator. Official Gazette of the U.S. Patent Office

N78-18763* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

SPACESUIT MOBILITY JOINTS Patent Application

Hubert C. Vyukul, inventor (to NASA) Filed 3 Mar. 1978 45 p

N78-18765* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

SWEAT COLLECTION CAPSULE Patent Application


A sweat collection capsule permitting quantitative collection of sweat is described. The capsule was comprised of a frame held immobile on the skin, a closure secured to the frame and absorbent material located next to the skin in a cavity formed by the frame and the closure. The absorbent materials were removed from the device by removing the closure from the frame while the frame was held immobile on the skin.

N78-22720* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

CHELATE-MODIFIED POLYMERS FOR ATMOSPHERIC GAS CHROMATOGRAPHY Patent Application


New polymeric materials were developed to serve as the stationary phase in chromatographic columns. These materials consist of a crosslinked polymer matrix, e.g., a divinylbenzene polymer, into which was embedded an inorganic complexed ion or chelate, e.g., Colacan, which is H₂N-ethylenediamincyclobutyl (2) Organic nitrogenous bases, such as pyridine, may be incorporated into the chelate-polymer complexes to increase the chromatographic utility. Critical factors in obtaining satisfactory chromatographic performance from the polymer-chelate complexes are identified as (1) the nature and concentration of the nonpolar diluent, n-heptane and n-hexane being preferred, (2) completeness of crosslinking of the matrix (3) the chelate content of the complex, and (4) the nature and concentration of the coordinating organic base employed. NASA

N78-22725* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

TREAD DRUM FOR ANIMALS Patent


A device for exercising animals such as primate is described, which includes a cylindrical housing mounted for rotation about a horizontal axis of revolution and has a cylindrical treadway portion on which the animal treads while the drum is rotated by means of a motorized drive. The treadway portion of the drum includes an electrode structure with sectors being independently energizable by means of a commutator and source of potential so that an electrical shock station is created behind a running-in-place station on the moving treadmill. In this manner if the animal should fall behind its running station, it may be shocked by treading on the energized electrode structure. One end of the treadmill comprises a transparent well for unobstructed viewing of the animal being exercised. Official Gazette of the U.S. Patent Office

N78-31233* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

BORON TRIFLUORIDE COATINGS FOR THERMOPOLYESTRIC MATERIALS AND METHOD OF APPLYING SAME IN GLOW DISCHARGE Patent

Ronald Michael Kubacki, inventor (to NASA) (Bell and Howell, NASA)
Plastic surfaces can be improved physically and optically by treating them with a plasma of boron trifluoride. The trifluoride can be the sole reactant or be part of a mixture also containing an organic monomeric substance such as perfluorobutene-2 or an organosilane. The boron trifluoride-containing coating can also serve as an intermediate-coating between the plastic surface and a plasma deposited organic polymer.

Official Gazette of the U.S. Patent Office
RESEARCH SUPPORT

FORMAL REPORTS

N78-19808^ National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.
A SINGLE USER EFFICIENCY MEASURE FOR EVALUATION OF PARALLEL OR PIPELINE COMPUTER ARCHITECTURES
W P Jones In Its Future Computer Requirements for Computational Aerodynamics Feb 1978 p 383-371 (For availability see N78-19778 10-9)
Avail NTIS HC A23/MF A01 CSCL 08B
A precise statement of the relationship between sequential computation at one rate, parallel or pipeline computation at a much higher rate, the data movement rate between levels of memory, the fraction of inherently sequential operations or data that must be processed sequentially, the fraction of data to be moved that cannot be overlapped with computation, and the relative computational complexity of the algorithms for the two processes, scalar and vector, was developed. The relationship should be applied to the multiple processes that obtain in the employment of new or proposed supercomputers for computational aerodynamics. The relationship, an efficiency measure that the single user of the computer system perceives, argues strongly in favor of separating scalar and vector processes, sometimes referred to as loosely coupled processes, to achieve optimum use of hardware.

Author

N78-19901# California Univ., Los Angeles Dept of Physics
NON-LINEAR PARAMETRIC GENERATION OF SOUND BY RESONANT MODE CONVERSION Interim Report
Steven Lurie Garrett Dec 1977 201 p refs (Contract NAG3-75-C-0246) (AD-A049157, TR-39) Avail NTIS HC A10/MF A01 CSCL 20/1
When non-linear terms are included in the two fluid hydrodynamic description of superfluid helium-4, first sound and second sound are coupled. The interaction of two second sound waves to produce a propagating first sound wave is shown to occur at a specific angle which makes the point of intersection of the second sound waves travel at a speed of the first sound.
An experiment to observe this mode conversion process in a waveguide of rectangular cross-section is described. Measurements show that the resonant conversion occurs at the theoretically predicted frequency. The amplitude of the mode converted first sound is found to exhibit a quadratic dependence on the amplitude of the primary wave which is characteristic of a second order effect. A new application of the reciprocity calibration technique allowed an absolute calibration of the pressure microphones in situ. Absolute measurements of the coupling of first sound to second sound agree with theory. This agreement is a direct confirmation of the importance of the additional, intrinsically non-linear, Galilean invariant variable, in the thermohydrodynamics of superfluid helium. The theoretical formalism is applied to the parametric amplification of second sound by high intensity sound and the results are in disagreement with a previous calculation by Khokhlov and Puslina.

Author (GRA)

N78-23706^ National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
AN INDUCTIVELY POWERED TELEMETRY SYSTEM FOR TEMPERATURE, EKG, AND ACTIVITY MONITORING
Thomas B Fryer Gordon F Lund (San Jose State Univ Calif)

and Bill A, Williams (San Jose State Univ, Calif) May 1978 43 p refs (Grant N00014-75-C-0090)
(Avail NTIS HC A03/MF A01 CSCL 06B)
An implant telemetry system for the simultaneous monitoring of temperature, activity, and EKG from small animals, such as rats, was designed with the feature that instead of a battery the system is energized by an inductive field. A 250 kHz resonant coil surrounds the cage (30 x 30 x 20 cm) and provides the approximately 100 microamps of power required to operate the implant transmitter which allowing the animal unrestrained movement in the cage. The implant can also be battery operated if desired. RF transmission is in the 8-10 MHz band which allows the use of a simple, essentially single IC chip receiver.

Author

N78-24354# California Univ., Berkeley Dept of Chemical Engineering
STRESS-STRAIN BEHAVIOR OF SOME ACRYLIC GRADIENT POLYMERS
C F Jasso, S D Hong, and M Shen 10 Feb 1978 17 p refs
(Contract N00014-75-C-0095) (AD-A052617, TR-17) Avail NTIS HC A02/MF A01 CSCL 11/6
Multicomponent polymers whose structure or composition varies as a function of position in the sample are called gradient polymers. One way to prepare gradient polymers is to permit a guest monomer to diffuse into a host polymer network. The resulting profile of the diffusion gradient is fixed by polymerizing the monomer in situ. In this work we used 2-chloroethyl acrylate as the monomer and poly(methyl methacrylate) as the polymer matrix. Both gradient polymers and interpenetrating networks were prepared. It was found that the stress-strain behavior of gradient polymers is quite different from that of the interpenetrating networks of comparable composition. The former shows a yield point, and considerably enhanced fracture strain. The latter is essentially rubber in character. Possible mechanisms for the unique properties of gradient polymers are discussed.

Author (Gra)

N78-30862^ National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A DECODING PROCEDURE FOR THE REED-SOLOMON CODES
A decoding procedure is described for the (n,k) t-error correcting Reed-Solomon (RS) code, and an employment of the (31,15) RS code for the 14-TENEX central system. This code can be used for error correction in large archival memory systems. The principal features of the decoder are a Galois field arithmetic unit implemented by microprogramming a microprocessor, and syndrome calculation by using the g(x) encoding shift register. Complete decoding of the (31,15) code is expected to take less than 500 microseconds. The syndrome calculation is performed by hardware using the encoding shift register and a modified Chen search. The error location polynomial is computed by using Lin's table, which is an interpretation of Berlekamp's iterative algorithm. The error location numbers are calculated by using the Chen search. Finally, the error values are computed by using Forney's method.

Author (LS)

N78-19818# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.
POWERED TELEMETRY SYSTEM FOR MEASUREMENTS OF TEMPERATURE, EKG, AND ACTIVITY MONITORING
Steven Lurie Garrett Dec 1977 100 p refs (Contract N00014-75-C-0095)
(Avail NTIS HC A02/MF A01 CSCL 08B)
A powered telemetry system for small animals, such as rats, was designed with the feature that instead of a battery the system is energized by an inductive field. A 250 kHz resonant coil surrounds the cage (30 x 30 x 20 cm) and provides the approximately 100 microamps of power required to operate the implant transmitter which allowing the animal unrestrained movement in the cage. The implant can also be battery operated if desired. RF transmission is in the 8-10 MHz band which allows the use of a simple, essentially single IC chip receiver.

Author

N77-19906# California Univ. Berkeley Dept of Chemical Engineering
STRESS-STRAIN BEHAVIOR OF SOME ACRYLIC GRADIENT POLYMERS
C F Jasso, S D Hong, and M Shen 10 Feb 1978 17 p refs
(Contract N00014-75-C-0095) (AD-A052617, TR-17) Avail NTIS HC A02/MF A01 CSCL 11/6
Multicomponent polymers whose structure or composition varies as a function of position in the sample are called gradient polymers. One way to prepare gradient polymers is to permit a guest monomer to diffuse into a host polymer network. The resulting profile of the diffusion gradient is fixed by polymerizing the monomer in situ. In this work we used 2-chloroethyl acrylate as the monomer and poly(methyl methacrylate) as the polymer matrix. Both gradient polymers and interpenetrating networks were prepared. It was found that the stress-strain behavior of gradient polymers is quite different from that of the interpenetrating networks of comparable composition. The former shows a yield point, and considerably enhanced fracture strain. The latter is essentially rubber in character. Possible mechanisms for the unique properties of gradient polymers are discussed.

Author (Gra)
N78-33704# Informatics, FM Inc., Palo Alto, Calif.

X10: A FORTRAN DIRECT ACCESS DATA MANAGEMENT SYSTEM


(Contract NASA-6914) Avail: NTIS HC A12/MF A01 CSCL O9B

The X10 system is a set of subroutines that provide generalized data management capability for FORTRAN programs using a direct access file. Arrays of integer, real, double precision, and character data may be stored, each logical group of data identified by a unique matrix number. A matrix may be organized and stored as batches to reduce core requirements. Batches may be accessed randomly or sequentially. The file may be checkpointed and retained, allowing for restarts with stored values. The X10 subroutines operate on either IBM 360-370/OS/VS or DEC PDP-11/RSX computing systems.

G.G.

NASA CONTRACTOR REPORTS

N78-33715# Technology Development Corp. Sunnyvale, Calif.

THE ILLIAC IV MEMORY SYSTEM: CURRENT STATUS AND FUTURE POSSIBILITIES


The future needs of researchers who will use the Iliac were examined and the requirements they will place on the memory system were evaluated. Various alternatives to replacing critical memory components were considered with regard to cost, risk, system impact, software requirements, and implementation schedules. The current system, its performance and status, and the limitations it places on possible enhancements are discussed as well as the planned enhancements to the Iliac processor. After a brief technology survey, different implementations are presented for each system memory component. Three different memory systems are proposed to meet the identified needs of the Iliac user community. These three alternatives differ considerably with respect to storage capacity and accessing capabilities, but they all offer significant improvements over the current system. The proposed systems and their relative merits are analyzed.

A R.H.

PATENTS

N78-27425# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ROTARY LEVELING BASE PLATFORM Patent


A leveling apparatus for the precise adjustment of a scientific instrument is reported. A base member is provided having a hollow cylindrical shape. A table for supporting the instrument rests on the base and has a shaft portion extending below the table. The upper portion of the shaft fits tightly into the hollow portion of the base member whereas the lower portion of the shaft is machined to fit loosely. The lower portion of the shaft is provided with a groove. Adjusting screws are threaded through the hollow cylindrical portion and are adapted to enter the groove. By adjusting the screws, the lower portion of the shaft is moved in a vertical plane since the shaft is loosely fitted into the cylinder. The upper portion of the shaft which is tightly fitted into the upper end of the cylinder causes the cylinder to deform slightly providing a fulcrum point which allows the table to be leveled in response to the adjustment of the adjusting screws.

Official Gazette of the U.S. Patent Office

N78-33717# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MICRO-FLUID EXCHANGE COUPLING APPARATUS Patent Application


In a microfluid exchange apparatus for exchanging fluid with an organ, such as the trachea or a blood vessel of a small animal, a syringe needle is provided for penetrating the fluid conduit of the animal. The syringe needle is coupled to a plenum chamber having an inlet and outlet port. The plenum chamber is coupled to the syringe needle via the intermediacy of a standard quick disconnect coupling fitting. The plenum chamber is carried at the end of a drive rod which is coupled to a micrometer drive head. The micrometer drive head is slidably and pivotally coupled to a pedestal for adjusting the height and angle of inclination of the needle relative to a reference base support. The needle is positioned adjacent to the incised trachea or a blood vessel of a small animal and the micrometer drive head is operated for penetrating the fluid conduit of the animal.

NASA
The flight simulator for advanced aircraft at Ames Research Center was used to evaluate the flying qualities of a small jet transport and those of a derivative model of that airplane. Technical criteria that piloted simulations must meet to enable their increased use for demonstrating compliance with transport category aircraft airworthiness requirements were defined. Flying qualities data were obtained for numerous test configurations and conditions using conventional certification flight test procedures. These data correlated well with the basic airplane data from the manufacturer's certification test report. Analysis of the simulator data showed valid results in critical test cases, such as the demonstration of static longitudinal stability and minimum control speed, with confidence that all influencing and limiting factors were identified. An important aspect was the accurate simulation of the control force-feel qualities of the reversible flight control system. The simulator was judged to have duplicated actual flight results with a high degree of confidence.
U.S. ARMY RESEARCH AND TECHNOLOGY LABORATORIES
AND AEROMECHANICS LABORATORY

FORMAL REPORTS

N78-17000*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DYNAMIC STALL EXPERIMENTS ON THE NACA 0012 AIRFOIL

The flow over a NACA 0012 airfoil undergoing large oscillations in pitch was experimentally studied at a Reynolds number of 2.5 million and over a range of frequencies and amplitudes. Hot-wire probes and surface-pressure transducers were used to clarify the role of the laminar separation bubble, to delineate the growth and shedding of the stall vortex, and to quantify the resultant aerodynamic loads. In addition to the pressure distributions and normal force and pitching moment data that have often been obtained in previous investigations, estimates of the unsteady drag force during dynamic stall have been derived from the surface pressure measurements. Special characteristics of the pressure response, which are symptomatic of the occurrence and relative severity of moment stall, have also been examined. Author

N78-18043*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AEROMECHANICAL STABILITY OF HELICOPTERS WITH A BEARINGLESS MAIN ROTOR. PART 1: EQUATIONS OF MOTION

Equations of motion for a coupled rotor-body system were derived for the purpose of studying air and ground resonance characteristics of helicopters that have bearingless main rotors. For the fuselage, only four rigid body degrees of freedom are considered: longitudinal and lateral translations, pitch, and roll. The rotor is assumed to consist of three or more rigid blades. Each blade is joined to the hub by means of a flexible beam segment (flexbeam or strap). Pitch change is accomplished by twisting the flexbeam with the pitch-control system, the characteristics of which are variable. Thus, the analysis is capable of implicitly treating aerelastic couplings generated by the flexbeam elastic deflections, the pitch-control system, and the angular offsets of the blade and flexbeam. The linearized equations are written in the nonrotating system retaining only the cyclic rotor modes; thus, they comprise a system of homogeneous ordinary differential equations with constant coefficients. All contributions to the linearized perturbation equations from inertia, gravity, quasi-steady aerodynamics, and the flexbeam equilibrium deflections are retained exactly. Author

N78-18383*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SOME UNSTEADY SEPARATION PROBLEMS FOR SLENDER BODIES
W. J. McCroskey In AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 11 p. refs (For availability see N78-18375 09-34) Avail NTIS HC A11/MF A01 CSCL 20D

The development of reliable prediction techniques for engineering purposes requires a fundamental and detailed understanding of the unsteady flow fields on wings and rotating blades. Some of the peculiar features of unsteady separated flows that are not simple analogs or extensions of quasi-steady flows are discussed. These include the unsteady Kutta-Joukowski condition, dynamic stall on oscillating airfoils (with applications to helicopter rotor blades) and unsteady shock wave-boundary layer interactions. Author

N78-18387*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PREDICTION OF UNSTEADY SEPARATED FLOWS ON OSCILLATING AIRFOILS
W. J. McCroskey In AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 8 p. refs (For availability see N78-18375 09-34) Avail NTIS HC A11/MF A01 CSCL 20D

Calculating the flow around an airfoil undergoing dynamic stall is a task which has not yet been accomplished at high Reynolds numbers, although several approximate analytical methods have been proposed. The most promising of those methods seems to be either a combination of the discrete potential vortex and thin boundary layer approaches, or a significantly improved version of the strong viscous-inviscid interaction approach. The former may prove to be superior for low speed, high amplitude flows, but the latter seems likely to be more suitable for airfoils that operate under supercritical transonic flow conditions and for cases that do not penetrate deeply into stall. At the present time, the engineer who is faced with the need to predict the aerodynamic forces and moments on oscillating airfoils would be better advised to turn to one of the empirical correlation techniques, or perhaps to utilize more than one method and average the results in any event, these methods permit the essential features of dynamic stall to be described, even though further improvements are highly desirable. Future efforts will probably see more use made of the two-dimensional theoretical analyses, while experiments can be expected to play the major role in assessing the importance of the three-dimensional effects that are likely to be encountered in practice. Author

N78-19058*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INTRODUCTION TO UNSTEADY ASPECTS OF SEPARATION IN SUBSONIC AND TRANSONIC FLOW
W. J. McCroskey In AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 9 p. refs (For availability see N78-18375 09-34) Avail NTIS HC A11/MF A01 CSCL 20D

Almost any flow that separates will have some degree of unsteadiness. In some cases, the fluctuations will be almost complete stochastic; in others it will be highly organized; and in still others, it will be a combination of random and periodic components. Some peculiar unsteady phenomena are reviewed and several classes of flow problems are discussed. Flow visualization and pressure measurements are used to explore external flows past flat bodies, unsteady separation on slender bodies, and internal flows. Author
WATER-TUNNEL EXPERIMENTS ON AN OSCILLATING AIRFOIL AT RE EQUALS 21,000

Kenneth W. McAlester and Lawrence W. Carr

Mar 1979 84 p refs
(NASA-TM-78446. A-7232) Avail. NTIS HC A05/MF A01 CSCL 01A

Flow visualization experiments were performed in a water tunnel on a modified NACA 0012 airfoil undergoing large amplitude harmonic oscillations in pitch. Hydrogen bubbles were used to (1) create a conveniently colored and well preserved set of inviscid flow markers, and (2) to expose the succession of events occurring within the viscous domain during the onset of dynamic stall. Unsteady effects were shown to have an important influence on the progression of flow reversal along the airfoil surface prior to stall. A region of reversed flow underlying the free shear layer was found to momentarily exist over the entire upper surface without any appreciable disturbance of the inviscid-inviscid boundary. A flow protuberance was observed to develop near the leading edge while minor vortices evolve from an expanding instability of the free shear layer over the rear portion of the airfoil. The complete breakdown of this shear layer culminates in the successive formation of two dominant vortices. Author

INTRODUCTION TO UNSTEADY ASPECTS OF SEPARATION IN SUBSONIC AND TRANSONIC FLOW

W J McCroskey In AGARD Three Dimensional and Unsteady Separation at High Reynolds No Feb 1978 8 p refs For primary document see N78-28397 19-34

Avail NTIS HC A11/MF A01 CSCL 20D

Unsteady flow phenomena are reviewed with emphasis on separated flow in the subscale and transonic regimes. Specific topics discussed include external flows past bluff bodies, unsteady separation on slender bodies, and internal flows. J M S

PREDICTION OF UNSTEADY SEPARATED FLOWS ON OSCILLATING AIRFOILS

W J McCroskey In AGARD Three Dimensional and Unsteady Separation at High Reynolds No Feb 1978 8 p refs For primary document see N78-28397 19-34

Avail NTIS HC A11/MF A01 CSCL 20D

Techniques for calculating high Reynolds number flow around an airfoil undergoing dynamic stall are reviewed. Emphasis is placed on predicting the values of lift, drag, and pitching moments. Methods discussed include the discrete potential vortex method, thin boundary layer method, strong interaction between inviscid and viscous flows, and solutions to the Navier-Stokes equations. Empirical methods for estimating unsteady flow on oscillating airfoils are also discussed. These methods correlate force and moment data from wind tunnel tests to indicate the effects of various parameters, such as airfoil shape, Mach number, amplitude, and frequency of oscillatory oscillations, mean angle, and type of motion. J M S

HOVERING IMPULSIVE NOISE: SOME MEASURED AND CALCULATED RESULTS


Avail NTIS HC A17/MF A01 CSCL 20A

In-plane impulsive noise radiating from a hovering model rotor was measured in an anechoic environmental. The hover signature was compared with existing theoretical prediction models with previous forward flight experiments using the same model rotor. These hover tests showed good experimental consistency with forward flight measurements, both in pressure level, and waveform character, over the range of Mach numbers tested (0.8 to 1.0). Generally poor correlation, however, was confirmed with current linear theory prediction efforts. Failure to predict both the peak pressure levels and the shape was reported, especially with increasing tip Mach number. J M S

APPROXIMATE SOLUTION FOR THE FREE VIBRATIONS OF ROTATING UNIFORM CANTILEVER BEAMS


Approximate solutions are obtained for the uncoupled frequencies and modes of rotating uniform cantilever beams. The frequency approximations for flap bending, lead-lag bending, and torsion are simple expressions having errors of less than a few percent over the entire frequency range. These expressions provide a simple way of determining the relations between mass and stiffness parameters and the resultant frequencies and mode shapes of rotating uniform beams. Author

NASA CONTRACTOR REPORTS

THE DETERMINATION OF SOME REQUIREMENTS FOR A HELICOPTER FLIGHT SIMULATION FACILITY J B Snapecor Sep 1977 59 p refs
(Contract NAS2-9421) (NASA-CR-152066; A-7430) Avail NTIS HC A04/MF A01 CSCL 14B

Important requirements were defined for a flight simulation facility to support Army helicopter development. In particular, requirements associated with the visual and motion subsystems.
of the planned simulator were studied. The method used in the motion requirements study is presented together with the underlying assumptions and a description of the supporting data. Results are given in a form suitable for use in a preliminary design. Visual requirements associated with a television camera/model concept are related. The important parameters are described together with substantiating data and assumptions. Research recommendations are given.

Author

N78-19165#
Cincinnati Univ., Ohio Dept. of Aerospace Engineering and Applied Mechanics
W. Tabakoff Sep. 1975 56 p refs Sponsored in part by Army Air Mobility Res and Develop Lab (Contract NAS2-7850)
(NASA-CR-152105) Avail NTIS HC A04/MF A01 CSCL 21E
A two-dimensional finite difference numerical technique is presented to determine the temperature distribution in a solid blade of a radial turbine guide vane. A computer program is written in FORTRAN 4 for the IBM 370/165 computer. The computer results obtained from these programs have a similar behavior and trend as those obtained by experimental results.

Author

N78-33065#
Kaman Aerospace Corp., Bloomfield, Conn
THEORETICAL STUDY OF MULTICYCIC CONTROL OF A CONTROLLABLE TWIST ROTOR
A Z Lemnios and Frank K Dunn Apr. 1976 68 p refs (Contract NAS2-7738)
(NASA-CR-151959; R-1393) Avail NTIS HC A04/MF A01 CSCL 01E
Analytical studies were performed to ascertain the feasibility of reducing helicopter rotor induced 4/rev vibratory forces by means of multicyclic flap control input on a dual control, four bladed rotor system. The dual control consisted of a primary inboard pitch horn blade control and a secondary outboard flap control. Flap control was put in at frequencies greater than the rotor rotational speed.

Author

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


With increased turbine inlet temperatures, numerical methods of thermal and stress analysis are becoming more valuable in the design of air-cooled turbines. This paper presents a study of the stresses associated with different cooling patterns in a radial inflow turbine rotor. The finite element method is used in the stress calculations taking into consideration centrifugal, thermal, and aerodynamic loading. The effects of temperature distribution and the presence of internal cooling passages are discussed.

Author


With an overall goal of defining the needs and requirements for short-haul transport aircraft research and development, the objective of this paper is to determine the performance and noise impact of short-haul transport aircraft designed with an advanced turboprop propulsion system. This propulsion system features high-speed propellers that have more blades and reduced diameters. Aircraft are designed for short and medium field lengths; mission block fuel and direct operating costs (DOC) are used as performance measures. The propeller diameter was optimized to minimize DOC. Two methods are employed to estimate the weight of the acoustic treatment needed to reduce interior noise to an acceptable level. Results show decreasing gross weight, block fuel, DOC, engine size, and optimum propfan diameter with increasing field length. The choice of acoustic treatment method has a significant effect on the aircraft design.

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