1978 Ames Research Center Publications: A Continuing Bibliography
1978

Ames Research Center Publications: A Continuing Bibliography
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.

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Betty Sherwood, Compiler
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## SECTION II – INDEXES

### INDEXES

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SECTION I

PUBLICATIONS
Tions for improvement are presented and discussed. Problems that are subject to solutions which are expectations, anxiety over flight departure and lack of information, are proportionately minor inconvenience magnified out of all proportions. In the argument of the report, it was found that there is no major airport access problem. The San Francisco Bay Area planning center is sponsored in part by DOT (Contract NAS9-8814) and ref Stanford-NASA-ASEE Summer Faculty Fellowship Program (Stanford Univ. Calif). Jarir Dajani, ed. (Stanford Univ., Calif.) and J Lloyd Jones May 1978, 300 p refs. Stanford-NASA-ASEE Summer Faculty Fellowship Program on Engineering System Design held at Moffett Field, Calif., 1977 (NASA-CR-2044, A-7347) Available 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 inconveniences 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. Author

NASA CONTRACTOR REPORTS


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 inconveniences 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. Author

FORMAL REPORTS

N78-29993 A Operations Research, Inc., Silver Spring, Md. PHASE 1: DEFINITION OF INTERCITY TRANSPORTATION COMPARISON FRAMEWORK. VOLUME 1: SUMMARY Final Report 19 Jul 1978 42 p refs (Contract NAS9-8915) (NASA-CR-152152-Vol-1. ORI-TR-1298-Vol-2) Available NTIS HC A03/MF A01 CSCL 13F 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 illustrate 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. Author R.H.

N78-29996 A Econergy Inc., Los Angeles, Calif. A STUDY OF CHARACTERISTICS OF INTERCITY TRANSPORTATION SYSTEMS. PHASE 1: DEFINITION OF TRANSPORTATION COMPARISON METHODOLOGY Executive Summary J. Malley English, Jeffrey L. Smith, and Melvin W. Lifson Aug 1978, 42 p. Sponsored in part by DOT (Contract NAS9-8914) (NASA-CR-152153-2) Available NTIS HC A03/MF A01 CSCL 13F The objectives of this 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 . Author G Y

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

A78-36722 A Space industrialization - Education, K. M. Jolls (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-70495; A-7348) 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 O.075-SCALE F-15 AIRPLANE MODEL AT HIGH ANGLES OF ATTACK AND SIDESLIP
(NASA-TM-X-62380) Avail. NTIS HC AO5/MF A01 CSCL 01A

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 characteristics at subsonic attitudes for Reynolds numbers from 1.48 to 16.4 million per meter (0.45 to 5.0 million per foot) Angles of attack ranged 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 nozzle inlet ramps 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 at 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 

N78-17995# 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 AO2/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 A11/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 layouts 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
Mau-Huang Chen (Oregon Univ., Eugene), Bernd Czernemann (Oregon Univ., Eugene), Michio Aoyagi, and Hans Mark (Department of the Air Force, Washington, D.C.) [1978] 28 p refs

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 Edenborough (Textron Bell Helicopter, Fort Worth, Tex.), and Kenneth G. Wernicke In AGARD Rotorcraft Design Jan 1978 9 p refs
(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 together with potential usefulness in both military and civil missions are discussed

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 N78-19778 10-59) Avail. NTIS HC A22/MF A01 CSCL 09B

While faster computers will be needed to make solution of the Navier-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 VISCOUS 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

N78-20174# 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 62 p refs (NASA-TP-1179; A-7217) Avail NTIS HC A04/MF A01 CSCL 22B

The longitudinal static 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 rectilinear 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 NAS2-8399) (NASA-TM-78473; A-7356) 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

N78-21094# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif. EFFECT OF HIGH LIFT FLAP SYSTEMS ON THE CONCEPTUAL DESIGN OF A 1986 SHORT-HAUL COMMERCIAL STOL TILT ROTOR TRANSPORT Michael A. Shovlin and Bruno J. Gambucci Apr. 1978 29 p refs (NASA-TM-78474; A-7364) Avail NTIS HC A03/MF A01 CSCL 01C

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 psi) and 1197 (25 psf) newtons per square meter, respectively, while the wing and disc loading of this concept were 5746 (120 psi) 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 included improved reliability with essentially reduced maintenance and better landing 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
N78-22025* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

NOURSPEED AERODYNAMIC CHARACTERISTICS OF A 0.08-SCALE 17-Ft AIRPLANE MODEL AT HIGH ANGLES OF ATTACK AND SIDESLIP


Data were obtained with and without the noise boom and with several strake configurations; also, data were obtained for various control surface deflections. Analysis of the results revealed that selected strake configurations adequately provided low Reynolds number simulation of the high Reynolds number characteristics. The addition of the boom in general tended to reduce the Reynolds number effects.

Author

N78-22754# Massachusetts Inst of Tech., Cambridge Electronics Systems Lab

GENERALIZATION OF HUFFMAN CODING TO MINIMIZE THE PROBABILITY OF BUFFER OVERFLOW


An algorithm is given to find a prefix code that minmizes the value of the moment generating function of its codeword length distribution for a given positive argument. This algorithm is used in an iterative way to yield a code that maximizes the rate of decay of the probability of buffer length increases.

Author (GRAI)

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 A32/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 minimize the arc distance to fly between initial and final conditions subject to constraints on the minimum turning radius.

Author

N78-28151*# 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 AIRPLANE

Richard F. Vomasko, Robert C. Inns, Brian E. Swan (Canadian Armed Forces, Ottawa), and Seth W. Grossmith (Canadian Dept of Transport, Ottawa) Jun 1977 147 p refs (NASA-TP-1254, A-7246) Avail NTIS HC A07/MF A01 CSCL 01C

The stability, control, and handing qualities of an augmented jet flap STOL airplane 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 incorporated 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 lb (74,000 and 47,000 kg). 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
operating range of 85 to 160 knots was observed; when the SAS is functioning. With the SAS operating, poor turn coordination and spiral instability are primary deficiencies contributing to marginal handling qualities in the landing approach. The powered elevator control system enhanced the controllability in pitch, particularly in the landing flare and stall recovery. Author


The step input and sinusoidal response characteristics of a pneumatically driven computer controlled G-Seat are examined in this study. The response data show that this system can be modeled as a first order system with an 0.06 sec time lag and a 0.53 sec time constant. Author


The fundamentals of the cost/performance management system used in the procurement of two tilt rotor aircraft for a joint NASA/Army research project are discussed. The contractor's reporting system and the GPO's analyses are presented. The use of this type of reporting system is recommended. Recommendations concerning the use of like systems on future projects are included. Author


The use of an array processor as a computational element in rotorcraft real-time simulation is studied. A multiloop scheme was considered in which the rotor would loop over its calculations, a number of times while the remainder of the model cycle once on a host computer. To prove that such a method would realistically simulate rotorcraft, a FORTRAN program was constructed to simulate a typical host-array processor computing configuration. The multiloop scheme of an expanded rotor model which included appropriate kinematic equations, resulted in an accurate and stable simulation. Author

N78-28059* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif. WING ANALYSIS USING A TRANSONIC POTENTIAL FLOW COMPUTATIONAL METHOD P A Hanne (McDonnell Douglas Corp, Long Beach, Calif) and R M Hicks Jun 1978 60 p refs (NASA-TM-78464: A-7308) Avail NTIS HC A04/MF A01 CSCL 01A

The ability of the method to compute wing transonic performance was determined by comparing computed results with both experimental data and results computed by other theoretical procedures. Both pressure distributions and aerodynamic forces were examined and indicated that the method is a significant improvement in transonic wing analysis capability. In particular, the computational method generally calculated the correct development of three-dimensional pressure distributions from subcritical to transonic conditions. Compiled, multiple shocked flows observed experimentally were reproduced computationally. The ability to identify the effects of design modifications was demonstrated in terms of pressure distributions and shock drag characteristics. G G


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 rag-well, 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 meters high by 2.4 meters wide by 15.2 meters long. The main problem areas are identified as container jacks, floor jacks, leveling system and expansion system. The specific causes of the problems are identified and solutions to the problems are proposed. Author (GRA)


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


A relatively simple, consistent, and reasonable methodology for performing cost-benefit analysis 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 market, manufacturer costs and return on investment, aircraft price, airline costs and return on investment versus aircraft price and passenger yield, and potential system benefits-fuel savings, cost savings, and new revenue. 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 this research on short-haul transportation studies on air transportation energy efficiency improvements 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 studies are included. The potential fuel savings and cost savings for advanced turboprop aircraft appear substantial, particularly at shorter ranges.

J.M.S.

A comparison was made of two contrasting G-seat cueing schemes. The G-seat, an aircraft simulation subsystem, created aircraft acceleration cues via seat contour changes. Of the two cueing schemes tested, one was designed to create skin pressure cues and the other was designed to create body position cues. Each cueing scheme was tested and evaluated subjectively by five pilots regarding its ability to cue the appropriate accelerations in each of four simple maneuvers: a pullout, a pushover, an S-turn maneuver, and a thrusting maneuver. A divergence of pilot opinion occurred, revealing that the perception and acceptance of G-seat stimuli is a function only of angle of attack range of 0 to 180 degrees. However, above about 20 degrees, the section characteristics were assumed to be functions only of angle of attack. A computer program is presented which evaluates the equations for a range of Mach numbers and angles of attack. Calculated results for the NASA 23012 airfoil section were compared with experimental data.

J.M.A

A comparison was made of two contrasting G-seat cueing schemes. The G-seat, an aircraft simulation subsystem, created aircraft acceleration cues via seat contour changes. Of the two cueing schemes tested, one was designed to create skin pressure cues and the other was designed to create body position cues. Each cueing scheme was tested and evaluated subjectively by five pilots regarding its ability to cue the appropriate accelerations in each of four simple maneuvers: a pullout, a pushover, an S-turn maneuver, and a thrusting maneuver. A divergence of pilot opinion occurred, revealing that the perception and acceptance of G-seat stimuli is a highly individualistic phenomenon. The creation of one acceptable G-seat cueing scheme was, therefore, deemed to be quite difficult.

L.S.

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. Downstream of the merger point, the vorticity was found to be independent of the downstream distance for radii smaller than r/b = 0.05.
For larger radii, the vorticity depended on the distance from the wing. Upstream of the merger, a multiceell 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 Mahbool Akhter Nov. 1977 59 p refs

(NASA-CR-152083) Avail NTIS HC A04/MF A01 CSCL 09E

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


Jaw S. Dajani Nov 1977 34 p refs

(Grant NoG-2205) (NASA-CR-155356) Avail 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 transportaion 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

N78-17061§ Raman Aeronautics Research and Engineering, Inc., Palo Alto, Calif

**AN ANALYSIS OF THE ROTOR BLADE STRESSES OF THE THREE STAGE COMPRESSOR OF THE AMES RESEARCH CENTER 11- BY 11-FOOT TRANSONIC WIND TUNNEL** Final Report

Jules B. Dods, Jr. Nov. 1977 147 p refs

(Contract NAS2-9112) (NASA-CR-152083) Avail NTIS HC A07/MF A01 CSCL 20E

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

N78-17062§ 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 NAS2-9640) (NASA-CR-152072, D-190-22888-1) Avail 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 diffusion cause 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 asymmetric 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 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) Avail NTIS HC A13/MF A01 CSCL 01C

MCAIR recently completed a conceptual design study to define modifications approaches to, and derive planning prices for the conversion of a two place Harmer, 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

N78-19481# Mathematical Sciences Northwest, Inc., Bellevue, Wash

**STUDY, OPTIMIZATION, AND DESIGN OF A LASER HEAT ENGINE** Final Report

12 Jan. 1978 160 p refs

(NASA-CR-152104, MSNW-78-1082-1) Avail NTIS HC A08/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 (50 percent or better) continuous operation in space. The best laser heat engine 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
F

N78-19069* Ford Aerospace and Industrial Co., Santa Monica, Calif.
A SOLUTION TO THE SURFACE INTERSECTION PROBLEM
Final Report
H G. Temer 29 Nov. 1977 50 p
(Contract NAS2-9580) (NASA-CR-152116; MDC-J7789) Avail NTIS
HC AO3/MF A01 CSCL 12A

An application-independent geometric model wherein a database 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.

N78-21092* Northwestem Univ. Evanston, Ill Transportation Center
FACTORS AFFECTING THE RETIREMENT OF COMMERCIAL TRANSPORT JET AIRCRAFT Progress Report
Frank A. Spencer and Joseph A. Swanson 15 Feb 1978 205 p refs
(Contract NasG-2149) (NASA-CR-152115, PR-2) Avail NTIS HC A10/MF A01 CSCL 01C

A brief historical background of the technology and economics of aircraft replacement and retirement in the prejet era is presented to see whether useful insights can be obtained applicable to the jet era. Significant differences between the two periods were demonstrated. Current technological and operational economic perspectives were investigated in detail. Some conclusions are drawn to aircraft retirement policies.

N78-20136* Lockheed-California Co., Burbank
(Contract NAS2-9374) (NASA-CR-152079-Vol-1; LR-28200-Vol-1) Avail NTIS
HC A09/MF A01 CSCL 01C

A rotorcraft small perturbation linear model is described. Rotor flap, inplane and feathering degrees of freedom, as well as control and augmentation systems are defined in addition to the classical vehicle six degrees of freedom. The primary application was intended to be an analytic tool to assess the body. The modeling method retained the higher frequency response properties which aided in evaluating control and stability augmentation systems.

N78-20137* Lockheed-California Co., Burbank
(Contract NAS2-9374) (NASA-CR-152079-Vol-2; LR-28200-Vol-2) Avail NTIS
HC A05/MF A01 CSCL 01C

A computer program used to process the equations is presented, and a full description of equation implementation is given. The model was implemented in the IBM 360 and CDC series computer systems.

N78-20918* Beam Engineering, Inc., Sunnyvale, Calif.
ACOUSTICAL EFFECTS OF BLADE TIP SHAPE CHANGES ON A FULL SCALE HELICOPTER ROTOR IN A WIND TUNNEL
Albert Lee Apr 1978 59 p refs
(Contract NAS2-9398) (NASA-CR-152082) Avail NTIS HC A04/MF A01 CSCL 20A

Four tip shapes were tested. They were rectangular, swept, tapered, and sweep-tapered. The measured data covered a wide range of operating conditions. The range of advancing tip Mach numbers were between 0.72 to 0.96, and the advance ratios were from 0.2 to 0.375. At low and moderate advancing tip Mach number, the data in the dbA scale appear to indicate the swept tip is the quietest, swept tapered the second, tapered third and rectangular the most noisy. Above an advancing tip Mach number of about 0.85, a distinct acoustical pulse can be observed, which dominates the acoustic waveform. The pulse shape is symmetric at moderate tip Mach number, changing to a sawtooth shape at high advancing tip Mach numbers. Based on the amplitude of the impulsive noise, it appears the swept-tapered tip is the quietest, tapered tips the second, swept taper third and square tip the most noisy. The data presented in this report should be useful as data bases for modelling and evaluating helicopter impulsive noise.

USE OF LEANING VANES IN A TWO STAGE FAN
S V R Rao and R V Digumarti Nov 1975 53 p refs
(Contract NAS2-6612) (NASA-CR-152066; LR-28283) Avail NTIS
HC A06/MF A01 CSCL 01C

The use of leaning 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.

N78-21161* Princeton Univ., N J Instrumentation and Control Lab
OPTIMAL CONTROL THEORY (OWEM) APPLIED TO A HELICOPTER IN THE HOVER AND APPROACH PHASE
Gerard J. Bonn and Tadao Kari Jan 1976 289 p refs
(Contract NAS2-7187) (NASA-CR-152134; Rept-1205) Avail NTIS
HC A13/MF A01 CSCL 01C

A major difficulty in the practical application of linear-quadratic regulator theory is how to choose the weighting matrices in quadratic cost functions. The control system design with optimal weighting matrices was applied to a helicopter in the hover and approach phase. The weighting matrices were calculated to cover...
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 Clinic

GENERATION OF A MONODISPERSED AEROSOL
Final Report
Helma Scherck Miles Mikasa, and Ralph Devencen Jun 1974 61 p ref
(Contract NAS2-8143) NASA CR-152133) Avail 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) sampling 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) atomizers, (4) dispersion, (5) particles -- optics, size analysis, (6) smoke -- generators, density measurements; (7) sprays, (8) wind tunnels -- visualization. Author

N78-22071* Systems Technology, Inc., Hawthorne, Calif

DEVELOPMENT OF AUTOMATIC AND MANUAL FLIGHT DIRECTOR LANDING SYSTEMS FOR THE XV-15 TILT ROTOR AIRCRAFT IN HELICOPTER MODE
(Contract NAS2-9352) NASA CR-152040, TR-1092-1) Avail 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 landing, 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 analysis for the system, are used to develop the approach monitoring criteria. The autorotation and flight director guidance equations are programmed for the VSTOLAND 1819B digital computer. The system design dispersion data developed through analysis and the 1819B digital computer program are verified and refined using the fixed-base, man-in-the-loop XV-15 VSTOLAND simulation. Author

N78-22074* Boeing Commercial Airplane Co, Seattle, Wash

APPLICATION OF ADVANCED TECHNOLOGIES TO SMALL SHORT-HAUL AIRCRAFT
Recent Final Report
(Contract NAS2-9508) NASA CR-152089, D5-46320) Avail NTIS HC A15/MF A01 CSCL 01C

The results of a preliminary design study which investigates the use of selected advanced technologies to achieve low cost design for small (SO 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 airframe 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 16% -- a major cost reduction. With further development, test verification and optimization achievable weight saving is also achievable. Other advanced technology items which showed significant gains are as follows. (1) advanced turboprop reduced block fuel by 16-30% depending on range, (2) configuration revisions (vôi-tail) empennage cost reduction of 25%; (3) leading-edge flaps additional 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. Federseal Feb 1978 44 p ref
(Contract NAS2-9176) NASA CR-152091, NR78H-10) Avail 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 1.1 to 1.2 and at nozzle deflections from cruise (0 deg) to VTOL (90 deg). The nozzle thrust performance was in good agreement with small scale VTOL thrust coefficients. Configurations with increased nozzle size 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 tip driven fan was the most probable cause of the discrepancy. Author

N78-25057* Nielsen Engineering and Research, Inc, Mountain View, Calif

HIGH ANGLE CANARD MISSILE TEST IN THE AMES 11-Foot Transonic Wind Tunnel
Richard G. Schwind Jun 1978 81 p ref
(Contract NAS2-9211) NASA CR-2993, NEAR-TR-134) Avail 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 tails 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 20 deg to 50 deg and 0 deg to 45 deg roll. Canard deflection angles between 0 deg and 15 deg were tested. Exploratory vapor screen flow visualization testing was also performed. Sample force and moment data are reported along with observations from the vapor screen tests. Author

N78-25078* Kansas Univ Center for Research Inc, Lawrence

A STUDY OF COMMUTER AIRPLANE DESIGN OPTIMIZATION Status Report
Bob Van Kappel, Hans Eysink, Jim Hamrner, Kevin Hawley, Paul Maredith and J. Roskinson 12 May 1978 457 p ref
(Grant NSG-2145) NASA CR-157210, KU-FRL-313-5; SR-4) Avail NTIS HC A20/MF A01 CSCL 01C

The feasibility of the general aviation synthesis program (GASP) was enhanced by the development of separate computer...
The intensity of the acoustic signal is shown to be quite sensitive to lift and acoustic signal due to blade/vortex interaction. The investigated and numerical results are presented for the unsteady distribution for the directivity, frequency spectrum, and transient signal of linear unsteady aerodynamic theory, and expressions are derived for a theoretical model for blade/vortex interaction. Unsteady the acoustic signal is investigated. The analysis is based on a relationship between vortex structure and the intensity of a noise due to interaction with the vortex trailed from another blade. (Grant NsG-2142)

The Ribner formulation of the generation of aerodynamic sound is coupled with predictions of second-order velocity correlations and integral scale to estimate the sound radiated from several complicated jet flows. In particular, it is shown that the sound radiated from a cold swirling jet is greater than from its nonswirling equal thrust counterpart. The noise radiated from the flow field of a multiblade suppressor was estimated from the flow field of a multiblade suppressor was estimated and compared with an equal thrust diameter Gaussian jet. It is shown that the multiblade concept is indeed quieter. Author

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 expressing 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 load. A few cases of tip load 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


Two methods are investigated for alleviating wall interference effects in a shock tube test section intended for testing two-dimensional transonic airfoils. The first method involves contouring the test section walls to match approximate streamlines in the flow. Contours are matched to each airfoil tested to produce results close to those obtained in a conventional wind tunnel. Data from a previous study and the present study for two different airfoils demonstrate that useful results are obtained in a shock tube using a test section with contoured walls. The second method involves use of a fixed-geometry slotted-wall test section to allow automatic flow compensation for various airfoils. The slotted-wall test section developed exhibited the desired performance characteristics in the approximate Mach number range 0.82 to 0.89. as evidenced by good agreement obtained between shock tube and wind tunnel results for several airfoil flows. G G

APPlICATION OF SECOND-ORDER TURBULENT MODELING TO THE PREDICTION OF RADIATED AERODYNAMIC SOUND Alan J. Bifflam and Joel E. Harsh Jun 1978 76 p refs (Contract NASA-8632) (NASA-CR-2994) Available NTIS HC A05/AF A01 CSCL 200

The Ribner formulation of the generation of aerodynamic sound is coupled with predictions of second-order velocity correlations and integral scale to estimate the sound radiated from several complicated jet flows. In particular, it is shown that the sound radiated from a cold swirling jet is greater than from its nonswirling equal thrust counterpart. The noise radiated from the flow field of a multiblade suppressor was estimated from the flow field of a multiblade suppressor was estimated and compared with an equal thrust diameter Gaussian jet. It is shown that the multiblade concept is indeed quieter. Author

AN INVESTIGATION OF SHORT HAUL AIR TRANSPORTATION IN THE SOUTHEASTERN UNITED STATES The specific objectives of the study are numerous. First, an attempt is made to characterize the travel patterns in the study region, both in terms of origin destination patterns, and connecting and through trip patterns. Second, the structure of the air service in the region is characterized in an attempt to develop an understanding of the evolution of the short haul air transportation network. Finally, a look is taken at the socio-economic environment of Atlanta and the region in order to seek an explanation for the historic evolution of short


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A method is described for solving the linearized supersonic flow over planar wings using panels bounded by two families of Mach lines. Polynomial distributions of source and doublet strength lead to simple, closed-form solutions for the aerodynamic influence coefficients, and a nearly triangular matrix yields rapid solutions for the singularity parameters. The source method was found to be accurate and stable both for analysis and design boundary conditions. Similar results were obtained with the doublet method for analysis boundary conditions on the portion of the wing downstream of the supersonic leading edge, but instabilities in the solution occurred for the portion containing a portion of the subsonic leading edge. Research on the method was discontinued before this difficulty was resolved. Author


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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 timeframe. The baseline prop-fan configuration was designed for efficient cruise operation at 0.8 Mach number and 10,600 ft altitude. The design blade tip speed is 244 m/s and the design power loading is 301 kW/KW squared.


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 mission 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.


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 options 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.


An abstract technology assessment format, capable of generalized evaluation over a hierarchy of city sizes, shapes and modal transportation technology characteristics, using unit cost and impact data is presented. The formal analytic model used is Markovian decision theory. The analyst is not required to know or explore the historical data characteristics of the system 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.


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 for 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 first generation aircraft which could be used in the experiment are established. An estimate is made of overall program costs.


The structural response to aerodynamic buffet during moderate to high-g maneuvers at subsonic and transonic speeds was investigated. The investigation was 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.

SUBSONIC AND TRANSONIC SPEEDS PHASE 2: F-111A

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.

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 Dunkmyr 1978 286 p refs (Contract NAS2-70911) (NASA-CR-152114) Avail NTIS HC A13/MF A01 CSDL 01C

Power spectral density (PSD) data for all of the flight points examined during the Phase 2 flight data analysis 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.

N78-33876** Nielsen Engineering and Research, Inc., Mountain View, Calif
PROPAGATION OF SOUND THROUGH A SHEARED FLOW

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 jets. 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 deemed to be most useful and practical.

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


A reduced-order version of the one-on-one aerial combat problem is studied as a pursuit-evasion differential game. The coplaniar motion takes place at given speeds and given maximum available turn rates, and is described by three state equations which are equivalent to the range, bearing, and heading of one aircraft relative to the other. The purpose of the study is to determine those relative geometries from which either aircraft can be guaranteed a win, regardless of the maneuver strategies of the other. Termination is specified by the tail-chase geometry, at which time the roles of pursuer and evader are known. The roles are found in general, together with the associated optimal turn maneuvers, by solution of the differential game of kind. For the numerical parameters chosen, neither aircraft can win from the majority of possible initial conditions if the other turns optimally in certain critical geometries.


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, 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 such as new pilot displays and controls along with a microcomputer control complex (MCC). Reasons for which the ADAS achieves increased avionics capability are mentioned, including overall system integration through the MCC and pilot orientation from navigation map display.


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 particularly cost-effective approach to the attainment of adequate speed for this extremely demanding application is to employ a large minicomputer acting as host and controller for a special-purpose digital 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 array 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.


A unique miniature pressure sensor system consisting of an array of fifty integrated sensor pressure transducers with integral electronic logic and switching is described. Solid state processing of the piezoresistive element is combined with hybrid microelectronics to produce a very small, dense (80 cc displacement), 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.


Some new 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 (AWJSRA) is designed based on Linear Quadratic (LQ) theory and the results developed in this paper. The variation of the error bounds to changes
in the weighting matrices in the LSQ design is studied by computer simulations, and appropriate weighting matrices are chosen to obtain a reasonable error bound for variations in the system matrix and at the same time meet the practical constraints for the flare maneuver of the AWJSRA. Results from the computer simulation of a satisfactory autopilot design for the flare control of the AWJSRA are presented (Author)


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. Compressibility effects are modeled by second-order perturbation techniques. Computed 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 (Author)


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 wings’ 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 found to be independent of the downstream distance for small radii, and at large radii was dependent on the distance from the wing rather than from the merger point. Upstream of the merger point a multicellular vortex pattern was shown (Author)


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 structures in both the Eulerian and Lagrangian frames are 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 (Author)


Three-dimensional laser velocimeter measurements have been made of the wake vortices of a slender tangent ogive body which had nose and body fineness rates of 3.5 and 12, respectively. Data were obtained for an angle of attack to sense angle ratio of 2.3 at a free stream Mach number of 0.6 and unit Reynolds number of 2 million/ft². 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 (Author)


In support of the NASA wake vortex alleviation program, measurements were made of the influences of a ground plane on vortex trajectories and velocity profiles within lift-generated wakes. The wakes were generated by towing 0.61-m (2-ft) span models of two jumbo jets under 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 caused modifications in the vortex trajectories, but did not alter vortex interactions and merging patterns in these 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 (Author)


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 level of the sound that is radiated into the forward arc and a large reduction of the sound that is radiated into the rearward arc. The analysis also shows the same trend 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 consisting of increased jet noise with increasing jet temperature (Author)


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

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 flared 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 aeroelastic 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 predicted 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 transcendent small disturbances 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 place sit along the positive x-axis. The boundary data consist of Neumann data, continuity restrictions, the kutta condition, and the form of the asymptotic 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 major technological improvement and development. The increased capabilities are providing new opportunities for support of the aircraft development process. The development of faster digital computers, improved visual displays, better motion simulators, 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 forecaster 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, aero- dynamic 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 aerodynamic effects. The technique allows the experimentalist to stroboscopically '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 devised 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 150 mm) containing a combination redox electrode plus 18 ml of lauryl tryptose broth and positioned in a 35°C water bath.
A78-31336 * # Fuel-saving potential of Mach 0.8 twin engine prop-fan transports F. J. Davenport (Boeing Commercial Airplane Co., Seattle, Wash.), In: Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3-4, 1977, Proceedings. 12-09) Ottawa, Canadian Aeronautics and Space Institute, 1978, p. 1-1 to 5-19 Contract No. NASA-9104. The fuel saving and economic potentials of the prop-fan high-speed propeller concept have been evaluated for two-engine commercial transport airplanes designed for 3330 km 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)

A78-32338 * # The shock tube as a device for testing transonic airfoils at high Reynolds numbers. W. J. Cook (Iowa State University of Science and Technology, Ames, Iowa), L. L. Presley, and G. T. Chapman (NASA, Ames Research Center, Aerodynamics Research Branch, Moffett Field, Calif.) In: Aerodynamic Testing Conference, 10th, San Diego, Calif., April 19-21, 1978, Technical Papers (A78-3225/12-09) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 33-39, 16 refs (Grant No. Nig-2-152). A performance analysis of gas-driven shock tubes shows that transonic airfoil flows with chord Reynolds numbers in the range of 100 million can be generated behind the primary shock in a large shock tube. A study of flow over simple airfoils has been carried out at low and intermediate Reynolds numbers to assess the testing technique. Results obtained from schlieren photos and airfoil pressure measurements show that steady transonic flows similar to those observed for the airfoils in wind tunnels can be generated within the available testing time in a shock tube with either properly-contoured test section walls or a properly-designed slotted-well test section. The study indicates that the shock tube is a useful facility for studying two-dimensional high Reynolds number transonic airfoil flows. (Author)

A78-32353 * # Buried wire gage for wall shear stress measurements V. S. Munby and W. C. Rose (NASA, Ames Research Center, Moffett Field, Calif.) In: 10th AIAA Aerodynamic Testing Conference, 10th, San Diego, Calif., April 19-21, 1978, Technical Papers (A78-3225/12-09) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 203-212 16 refs (AIAA 78-279). 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)

A78-32388 * # Moving ground simulation by tangential blowing J. E. Hackett and R. A. Boles (Lockheed-Georgia Co., Marietta, Ga.). In: Aerodynamic Testing Conference, 10th, San Diego, Calif., April 19-21, 1978, Technical Papers. (A78-32326/12-09) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 390-395, 9 refs. Contracts No. NASA-6990; No NASA-9745; No NASA-9165 (AIAA 78-814). Belt-type moving ground equipment, used for ground-effect simulation in STOL and VTOL tests, can be inconvenient and costly, 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)

A78-32386 * # New rotation-balance apparatus for measuring airplane spin aerodynamics in the wind tunnel. G. N. Malcolm (NASA, Ames Research Center, Moffett Field, Calif.). In: AIAA Project Paper (NAS2-9155) (AIAA78-814) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 455-502, 7 refs (AIAA 78-835). An advanced rotation-balance 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 angles of sideslip to 30 deg. are possible with spin rates to 42 radians (400 rpm.) and Reynolds numbers to 30 million on fighter models with wing spans that are typical of 0.7 m. A complete description of the new rotation-balance apparatus, the sting/balance/model assembly, and the operational capabilities is given. (Author)

A78-35271 * A simplified Mach number scaling law for helicopter rotor noise K. S. Araveesudan, A. Lee, and W. L. Harris (MIT, Cambridge, Mass.). Journal of Sound and Vibration, vol. 57, Apr 22, 1978, p 555-570, 17 refs. Grants No. DAAAG29-C-027, No. NGS-2065. 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 Ollerhead (1969) by exploiting the properties of the invariant terms in the expression for the complex Fourier coefficients of sound radiation from a rotating 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. (Author)
applications discussed supports aircraft systems research by improving 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 systems 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 feedback 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. The sensor inputs to the human controller are assumed to be system error and control force. The former can be sensed via visual, aural, or tactile displays, whereas the latter is assumed to be sensed in kinesthesis. A set of general adaptive characteristics for the model is hypothesized, including a method for selecting simplified internal models of the manipulator-controlled element dynamics. It is demonstrated that the model can produce controller describing 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 remnant 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 allows the problem to be studied in terms of an equivalent integral equation of the second kind. A convergent numerical algorithm for its solution is derived by using Gelerkin'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.


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 character of the vortex wake of the wing to provide the familiar relationship between lift and bound vortex. A novel technique is then presented for obtaining, from behind the wing, the spanwise lift distribution from velocity surveys that are made over only a short distance above and below the wing trailing edge. The necessary formalism is developed to use the measured values to obtain the actual span loading by using an equivalent single horseshoe vortex model to account for the unmeasured portion of the downward (or upward) moment. The results of a numerical simulation are presented for a typical loading distribution. This 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 flying-hot-wire is a hot-wire probe 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 arm. Ensembles of data were obtained at several thousand locations in the flow field. The data include measurements of two components of mean velocity and twelve mean 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 General Short-Haul Research Aircraft (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 about 0.5 and 1. The tests simulated a broad range of aircraft flow conditions.
operating conditions, including engine-out, with lift coefficients from 0.9 to 10.0. Results indicate that the inlets perform well under most operating conditions with little interaction between inlets when the aircraft is moving. Potential problem areas identified are high side sleep 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 parameters (the ratio of velocity to the unsteady flow with the steady state 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 an 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 various flow zones. These calculations are carried into the wake of the airfoil where the drag is found from the deflection in the wake momentum. (Author)


It is noted that the stability properties of available galaxy models are not consistent with assumptions 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 methods 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 virulent and should dominate when all other unstable flows are already present but that the most rapidly growing disturbances are inhibited when m values are allowed. F.G.M.


Lower stratospheric aurora trajectories entering the region over Alaska at the approximately 125 mb level during late May, 1978 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 study is given to stall/spin considerations, although it is recognized that human factors and pilot 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 a reduced in terms of the mean performance of the aircraft or from their base (about $600 million for each fleet 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.


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 m). Three major categories of vehicle design are presented: stowed, which employs a vertical take-off and a single solid rocket booster similar to that used on the Space Shuttle, unstaged, which employs vertical take-off and four internally-carried reusable liquid rocket engines, and alternative concepts, some using horizontal take-off with duct-burning afterburners. Attention is given to the economies of maintaining 200 ICBMs airborne during an alert (about $60 million for each fleet 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 is 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.

(F.G.M.)


A pressure scale model of Northrop F-8A was tested in NASA Ames Research Center Eleven-Foot Transonic Tunneld 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 normal 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 light tests, design configuration studies, and training studies.

(Author)


The program described was initiated in 1975 to provide the critical information for the design of an advanced avionics system suitable for general aviation. Emphasis is on the use of data bus ing, 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 1043 kg (23,000 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 for short-duration duels between craft with large-envelope weaponry. Some illustrative computations are presented for an example modeled using constant-speed vehicles and very rough estimation of energy shifts.

(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 Falco is applied to rational choice between outcomes: win, loss, mutual capture, purposeful disengagement, draw. Approximate optimization is provided by an active-cell scheme similar to Falco's obtained by a 'backing up' process similar to that of Kopp. The approach is designed primarily for short-duration duals with large-envelope weaponry. Some illustrative computations are presented for example modeled using constant-speed vehicles and very rough estimation of energy shifts.

(Author)
A wing leading-edge modification has been developed, applicable at present to single-engine, light aircraft, which produces stabilizing vortices at stall and beyond. These vortices have the effect of fixing the stall pattern of the wing such that the various portions of the wing upper surface stall nearly symmetrically. The lift coefficient produced is essentially constant to very high angles of attack above the stall angle of the unmodified wing. It is hypothesized that these characteristics will help prevent inadvertent spin entry after a stall. Results are presented from recent large-scale wind-tunnel tests of a complete light aircraft, both with and without the modification.

**Author**


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 OCD 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.

**Author**


A 10W-Boole free-piston Stirling engine was powered remotely by a CO2 laser for long periods of time. The engine ran on both continuous-wave and pulse laser input. The working fluid was helium doped with small quantities of sulfur hexafluoride, SF6. The CO2 radiation was absorbed by the vibrational modes of the sulfur hexafluoride, which in turn transferred the energy to the helium to drive the engine. Electrical energy was obtained from a linear alternator attached to the piston of the engine. Engine pressures, volumes, and temperatures were measured to determine engine performance. It was found that the pulse radiation mode was more efficient than the continuous-wave mode. An analysis of the engine heat consumption indicated that heat losses around the cylinder and the window used to transmit the beam into the engine accounted for nearly half the energy input. The overall efficiency, that is, electrical output to laser input, was approximately 0.76%. However, this experiment was not designed for high efficiency but only to demonstrate the concept of a laser-driven engine. Based on this experiment, the engine could be modified to achieve efficiencies of perhaps 25-30%.

**Author**

FLOW REGIMES Author

deduce the models. Laboratory results on studies of aeolian processes, and results on aeolian processes and/or into three broad categories herein

Abstracts

JAN

measurements from which boundary layer transitions were added consisted of air elected through porous forward surfaces 20D (NASA-TP-1139. A-7169)

EFFECTS Ames Research Center. Moffett Field. Calif

N78-16326 National Aeronautics and Space Administration Ames Research Center. Moffett Field. Calif

ABSTRACTS FOR THE PLANETARY GEOLOGY FIELD CONFERENCE ON AEOLIAN PROCESSES Ronald Greeley, ed (Arizona State Univ) and David Black, ed Jan 1978 63 p refs

(A)7455: A-7278) Avail NTIS HC A04/MF A01 CSCL 08G

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) paleogeology and field studies of aeolian processes on Earth

Author

N78-16334 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 Kaatari Jan 1978 67 p refs

(NASA-TP-1139, A-7169) Avail NTIS HC A04/MF A01 CSCL 22B

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 model. 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 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

N78-18274 Army Electronics Command Fort Monmouth. N J Communications/ADP Lab


C M. DeSantis Oct 1977 43 p refs


This report is Part II of a three part series of reports investigating small antennas, their bandwidth and efficiency capabilities. Reviews and brief outlines of techniques published in the literature over the past 10-20 years, for broadening antennas are provided in this report. Experimental results from measurements of the Goubau antenna, a low-profile antenna (=0.05 lambda at the lowest operating frequency) are presented to show that this antenna possesses an octave bandwidth, regarding both impedance and radiation characteristics. Numerical results for some top-loaded structures are presented and matching network element variations are determined in order to estimate the bandwidth. It is shown that approximately 2:1 and approximately 4:1 increases in bandwidth are achieved when top-loading is applied to the stub and the loop antenna, respectively, and an L-network is used for tuning and matching. It is concluded that there may be several small but broadband antenna configurations possible from a clever (but as yet unknown) combination of the ideas and techniques presented in this report

Author [GRA]
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. They await substantial progress in devising accurate and efficient numerical methods, in understanding and modeling the physics of turbulence, and in developing reliable and powerful computer hardware.

Author

N78-15029”Hughes Aircraft Co. Culver City, Calif.

MAGNETOMETER DEPLOYMENT MECHANISM FOR PIONEER VENUS


N78-19068”National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

THE ROLE OF TIME-HISTORY EFFECTS IN THE FORMULATION OF THE AERDYNAMICS OF AIRCRAFT DYNAMICS

Murray Tobak and Lewis B. Schiff Mar 1978 12 p refs Proposed for Presentation at the AGARD Symp. on Dyn. Athens, Greece. 22-24 May 1978

(NASA-TM-78471- A-7282) Avail. NTIS HC A02/ MF A01 CSCL 01

The scope of any aerodynamic formulation proposing to embrace a range of possible maneuvers is shown to be determined principally by the extent to which the aerodynamic indicial response is allowed to depend on the past motion. Starting from the linearized formulation, in which the indicial response is independent of the past motion, two successively more comprehensive statements about the dependence on the past motion are assigned to the indicial response: (1) dependence only on the recent past and (2) dependence additionally on a characteristic feature of the distant past. The first enables the rational introduction of nonlinear effects and accommodates a description of the rate dependence of aerodynamic phenomena characteristic of airfoils in low speed dynamic stall; the second permits a description of the double valued aerodynamic behavior characteristic of certain kinds of aircraft stall. An aerodynamic formulation based on the second statement, automatically embracing the first, may be sufficiently comprehensive to include a large part of the aircraft's possible maneuvers. The results suggest a favorable conclusion regarding the role of dynamic stability experiments in flight dynamics studies.

Author

N78-19779”National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

COMPUTATIONAL AERODYNAMICS AND THE NUMERICAL AERODYNAMIC SIMULATION FACILITY

Victor I. Petrin In Its Future Computer Requirements for Computational Aerodynamics Feb 1978 p 5-30 (For availability see N78-19779 10-59)

Author

N78-19781”National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

THREE-DIMENSIONAL COMPUTATIONAL AERODYNAMICS IN THE 1980'S

Harold Lomax In Its Future Computer Requirements for Computational Aerodynamics Feb 1978 p 33-38 (For availability see N78-19778 10-59)

Author


NUMERICAL AERODYNAMICS SIMULATION FACILITY PRELIMINARY STUDY, EXECUTIVE SUMMARY

Final Report Apr 1978 (For availability see N78-19782 05-55)

A01 CSCL 09B

The Burroughs Corporation solution to the problem of numeric aerodynamic simulation consists of a computing 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

N78-19783”Control Data Corp., Minneapolis, Minn.

PRELIMINARY STUDY FOR A NUMERICAL AERODYNAMIC SIMULATION FACILITY Summary Report Apr 1978 (For availability see N78-19778 10-59)

A01 CSCL 09B

The state of the art of relevant technologies, of systems and processor architecture, and the measurable computational requirements of the two existing Navier-Stokes solution programs were assessed by Control Data Corporation to determine the
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-100C project were used in the design of the Navier-Stokes solver.

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

**MODELING OF THE REYNOLDS STRESSES**
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 CSQL 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. For these averaging processes to be consistent, the averaging time period 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, the long period variations in the flow fields are deterministic, provided initial conditions are known. The average dependent variables are sufficiently smooth to be resolvable by finite difference techniques consistent with the size and speed of modern computers.

**N78-20168**
Martin Marietta Aerospace, Denver, Colo.

**FLUID INTERACTION WITH SPINNING TOROIDAL TANKS**
D. A. Foster and J. E. Anderson
In *ESA Attitude Control of Space Vehicles Technol and Dyn Profil Assoc.* (For availability see N78-20178 11-18) Avail NTIS HC A10/MF A01 CSQL 22B

An experimental study was conducted to evaluate propellant behavior in spinning toroidal tanks that could be used in a repatriation system of an advanced outer-planetary Pioneer orbiter. Information on propellant slosh and settling and on ullage orientation and stability was obtained. The effects 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 fluorohydrazine and nitroxane propellants. Results 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.

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

**THEORETICAL CONTAMINATION OF CRYOGENIC SATELITE TELESCOPES**

The state of contaminant molecules, the deposition rate on key surfaces, and the heat transfer rate were estimated by the 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 more than 2 x 10<sup>-6</sup> torr. The influence caused by interactions of the purge gas with the particulate contaminants was found to slightly increase the resident times of the particulate contaminants within the telescope field of view.

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

**FIRE RESISTIVITY AND TOXICITY STUDIES OF CANDIDATE AIRCRAFT PASSENGER SEAT MATERIALS**

Fire 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 tests, 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.

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

**CALCULATED RATE CONSTANTS FOR THE REACTION ClO + O YIELDS CI + O2 BETWEEN 220 AND 1000 DEG K**
Richard L. Jaffee Apr 1976 69 p refs (For publication see NASA-TM-78483, A-6613) Avail NTIS HC A04/MF A01 CSQL 07D

Classical trajectory calculations are presented for the reaction ClO + O yields Cl + 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<sup>-11</sup> to the minus 11th power exp (-191/T) cu cm molecule x (1-0.01). Its value at 200 K is 2.6 plus or minus 10 to the 11th power cu cm molecule x (1-0.01) 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 ClO, O2 and ClOO 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.

**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**

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 5,000 and 35,000. In low Reynolds number flows the overall correlation period scaled with the outer variables - namely, the free stream velocity and the boundary layer thickness.

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

**SIMPLE TORSION TEST FOR SHEAR MODULI DETERMINATION OF ORTHOTROPIC COMPOSITES**

By means of torsion testing 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 angleply fiber orientations. Test specimens were 16 plies (nominal 2 mm) thick, 100 mm in length, and in widths of 6.5, 9.5, 12.6, and 15.8 mm. Torsion tests were run under controlled deflection (constant angle of twist) using an electrohydraulic servocontrolled test system. In-plane and out-of-plane shear moduli 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 modulus G13/G23. Results demonstrate that torsional shear moduli, 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.

Author

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

DYNAMIC STALL OF AN OSCILLATING AIRFOIL
Unnqel B Mehta (Stanford Univ., Calif.) In AGARD Unsteady Aerodynamics Feb 1978 32 p refs Sponsored in part by ARMDL (For availability see N78-22033 13-02) (Contract NCA2-0746-002; Grant NSG-2253)

Available NTIS HC A09/MF A01 CSCL 01A

Unsteady separated boundary layers and wakes were studied by investigating flow past an oscillating airfoil in which parts of the airfoil are retracted to allow the transverse motion of the airfoil. The Naver-Stokes equations of motion for viscous flow were solved 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 in pitch through an angle of attack range from 0 deg to 20 deg. The computed streamlines during this pitch-up motion are 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

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A REVIEW OF NASA-SPONSORED TECHNOLOGY ASSESSMENT PROJECTS

Recent technology assessments 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 assessments 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 is an effort to provide a broad range of socioeconomic 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

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LAGRANGIAN COMPUTATION OF INVISICID COMRESSIBLE 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 procedure. The Lagrangian method is employed 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

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ENGINEERING TESTS OF THE C-141 TELESCOPE
Edwin F Erickson and Donald W Strecker
May 1978 9 p (NASA-TM-78467, A-7323) Available NTIS HC A02/MF A01 CSCL 20F

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

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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 conical and the governing equations are solved as a time-marching explicit finite-difference algorithm. In the second approach the parabolized Navier-Stokes equations are solved with a space-marching implicit noniterative finite-difference algorithm. The 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

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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-Carnsloop linear theory code 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
N78-28391** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

SOLUTION OF TRANSONIC FLOWS BY AN INTEGRAL-DIFFERENTIAL EQUATION METHOD


Solutions of steady transonic flow past a two-dimensional airfoil are obtained from a singular integro-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 supersonic flow regions and backward differences in subsonic flow regions. The method is applied to a nonlifting parabolic-arc airfoil and to a lifting NASA 0012 airfoil. Results compare favorably with those of finite-difference schemes.

Author

N78-286795** 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


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

N78-286796** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

TECHNIQUES FOR CORRECTING APPROXIMATE FINITE DIFFERENCE SOLUTIONS


A method of correcting finite-difference solutions for the effect of truncation error or the use of an approximate basic equation is presented. Applications to transonic flow problems are described and examples are given.

Author

N78-283919** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

AN EXPERIMENTAL DOCUMENTATION OF PRESSURE GRADIENT AND REYNOLDS NUMBER EFFECTS ON COMPRESSIBLE TURBULENT BOUNDARY LAYERS


Attached supersonic turbulent boundary layers with a wide range of adverse pressure gradient strengths are investigated for Reynolds numbers from 11.7 x 1 million to 3.14 x 1 million. Surface pressure and surface sheave measurements were obtained for six flow fields over the entire Reynolds number range. In addition two flow fields - one with a moderate pressure gradient and the other with a severe pressure gradient - are thoroughly documented at a single Reynolds number. This experimental documentation includes both mean and fluctuating profiles throughout the flow field, and is sufficient to define the complete flow field, including the upstream undisturbed flow region.

Author

N78-281713** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

STABILITY OF CHROMIUM (III) SULFATE IN ATMOSPHERES CONTAINING OXYGEN AND SULFUR


The stability of chromium sulfate in the temperature range from 880 K to 1040 K was determined by employing a dynamic gas-solid equilibration technique. The solid chromium oxide was equilibrated in a gas stream of controlled SO2 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 C2O3 and that the mutual solubility between Cr2(SO4)3 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).

Author

N78-284109** 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


The calculation of flow fields past aircraft configuration at high 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.

N78-29067** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

WIND TUNNEL INVESTIGATION OF COMPUTATIONALLY OPTIMIZED VARIABLE CAMBER WING CONFIGURATIONS


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 multisegmented 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 therefore allowing the possibility of optimizing the camber and twist distribution for a given design condition. The test configurations were designed using potential flow analysis codes linked to a constrained minimization technique. Camber and twist distributions were optimized at lift coefficients of 0.2, 0.4, and 0.6 for Mach numbers of 0.6 and 0.9.

N78-29149** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

ON THE POSSIBILITY OF NEGATIVE ACTIVATION ENERGIES IN BIMOLECULAR REACTIONS


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

The user's manual for a computer program that performs system optimization of gasdynamic lasers is provided. Detailed input/output data are CDC 7600/8600 computers using a dialect of FORTRAN. Sample input/output data are provided to verify correct program operation along with a program listing. A R Y

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

TORQUING PRELOAD IN A LUBRICATED BOLT

The tension preload obtained by torquing a 7/8 in diam UNC high strength bolt was determined for lubricated and dry conditions. Consistent preload with a variation of 7 - 3% was obtained when the bolt head area was lubricated prior to each torque application. Preload tensions nearly 70% greater than the value predicted with the commonly used formula occurred with the lubricated bolt. A reduction in 39% 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


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 for early Spacelabs. 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

- An assessment of the potential effect on stratospheric ozone

of an advanced supersonic transport operations is presented. This assessment, which was conducted because 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 would appear that realistic fleet sizes should not cause concern with regard to the depletion of the total ozone burden. For example, the NOx emission 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 which vertical transport is used. These ozone changes can be compared with the predictions of a 1.74% ozone decrease (for 100 Large SST's 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

PIONEER 10 OBSERVATION OF THE SOLAR WIND PROTON TEMPERATURE HELIOCENTRIC GRADIENT

Solar wind isotropic proton temperatures as measured out to 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^n = d where average proton temperatures are not correlated as well with Pioneer 10's heliocentric radial distance (R = 52). 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 A01; SCD 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, 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

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 scale (5 to 10 km) magnetic sources. The larger scale size fields of magnitude approximately 0.1 gammas are measured by the orbiting subsatellite experiments and the small scales sized remnant fields of magnitude approximately 100 gammas are measured by the surface experiments. Author

27
**N78-32856** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**PEAKER: AN AUTOMATIC BORESIGHT PEAKING ROUTINE FOR THE C-141 TELESCOPE**

Edwin F. Erickson, Kevin Krischunas (Informatics, Inc., Palo Alto, Calif), and Thomas Matheson (Informatics, Inc., Palo Alto, Calif.) Sep 1978 8 p

(NASA-TM-78516, A-7584) Avail NTIS HC A02/MF A01 C5CL 20F

The operation of an automated procedure is detailed which maximizes the signal from a detector by positioning the telescope at an astronomical source.

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**N78-32947** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**OPTIMIZING INDIUM ANTIMONIDE (InSb) DETECTORS FOR LOW BACKGROUND OPERATION**

Richard T. Treffers Sep 1978 18 p refs

(NCA2-0R050-606) (NASA-TM-73273 A-7149) Avail NTIS HC A02/MF A01 C5CL 03A

The various noise sources that affect InSb detectors (and similar volatile devices) are discussed and calculated. Methods are given for measuring detector resistance photon loading detector and amplifier capacitance, amplifier frequency response, amplifier noise, and quantum efficiency. A photovoltaic InSb detector with increased sensitivity in the 1 to 5 mu region is described.

A R H

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**N78-34014** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**ARE THE STRATOSPHERIC DUST PARTICLES METEOR ABLATION DEBRIS OR INTERPLANETARY DUST?**

Maxwell B. Blanchard and Frank T. Kyte (San Jose State Univ., Calif.) Aug 1978 50 p refs

(NASA-TM-78507, A-7524) Avail NTIS HC A02/MF A01 C5CL 03B

Natural and laboratory created fusion crusts and debris from artificial meteor samples were used to develop criteria for recognizing meteor ablation debris in a collection of 5 to 50 micron particles from the stratosphere. These laboratory studies indicate that meteor ablation surfaces from nickel-iron meteoroids produce spheres containing taenite, wuestite, magnetite, and hematite. These same studies also indicate that ablation debris from chondritic meteoroids produce spheres and fragmentary debris. The spheres may be either sulfide rich, containing zoned olivine, magnetite, and glass, or sulfide rich, containing iron oxides (e.g., magnetite, wuestite) and iron sulfides (e.g., pyrrhotitepentlandite). The fragmentary debris may be: finer material, aggregates of olivine, magnetite, pyroxene, and occasionally pyrrhotite (derived from the meteorite matrix) or individual olivine and pyroxene grains (derived from meteorite inclusions).

A R H

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**N78-34021** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

**METEOR ABLATION SPHERES FROM DEEP-SEA SEDIMENTS**

M. B. Blanchard and D. E. Brownlee (California Inst of Technology, Pasadena), T. E. Burch, P. W. Hodge (Washington Univ., Seattle), and F. T. Kyte (San Jose State Univ., Calif.) Sep 1978 45 p refs

(NASA-TM-78510, A-7549) Avail NTIS HC A03/MF A01 C5CL 03B

Spheres from mid-Pacific abyssal plains (0 to 500,000 yrs old) formed from particles that completely melted and subsequently recrystallized as they separated from their meteoroid bodies, consisting of nickel-iron meteoroids and magnetite. The Fe-Ni spheres were produced during ablation of Fe and metal-rich silicate meteoroids. The glassy spheres are considerably more Fe-rich than the silicate spheres. They consist of magnetite and an Fe glass which is relatively low in Si. Bulk compositions and melt grains are useful for determining the parent meteoroid compositions for the silicate spheres. Bulk analyses of recrystallized spheres show that volatile elemental abundances are similar to chondrite abundances. Analysis of melt grains identified high temperature minerals associated with a fine-grained, low temperature, volatile-rich matrix. The obvious candidates for parent meteoroids of this type of silicate sphere is a carbonaceous chondrate.

A R H

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**NASA CONTRACTOR REPORTS**

**N78-10411** Sigma Research, Inc., Richland, Wash.

**STUDY OF A HIGH PERFORMANCE EVAPORATIVE HEAT TRANSFER SURFACE** Final Report

Elvin W. Sasaki and R. H. Hamasaki 27 May 1977 82 p refs

(Contract NAS5-8120) (NASA-CR-152008) Avail NTIS HC A05/MF A01 C5CL 20D

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 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 23 W/sq cm was measured with a 27 W/sq cm hybrid surface.

Author

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**N78-19950** Burroughs Corp., Paoli, Pa.

**NUMERICAL AERODYNAMIC SIMULATION FACILITY PRELIMINARY STUDY EXTENSION EXECUTIVE SUMMARY** Final Report

Feb 1978 117 p

(Contract NAS2-9456) (NASA-CR-152106) Avail NTIS HC A02/MF A01 C5CL 01A

An optimized functional design of key elements of the Numerical Aerodynamic Simulation Facility was investigated. The following tasks were performed and are discussed: (1) develop, optimize, and describe the functional description of the custom hardware, (2) delineate trade-off areas between performance, reliability, availability, serviceability, and programmability, (3) develop metrics and models for validation of the candidate system's performance, (4) conduct a functional simulation of the system design, (5) perform a reliability analysis of the system design, and (6) develop the software specifications to include a user level high level programming language, a correspondence between the programming language and instruction set, and outline the operation system requirements.

Author

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**N78-19951** Burroughs Corp., Paoli, Pa.

**NUMERICAL AERODYNAMIC SIMULATION FACILITY PRELIMINARY STUDY EXTENSION** Final Report

Feb 1978 273 p

(Contract NAS2-9456) (NASA-CR-152107) Avail NTIS HC A12/MF A01 C5CL 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/optimize and describe the function description of the custom hardware; (2) to delineate trade-off areas between performance, reliability, availability, serviceability, and programmability; (3) to develop metrics and models for validation of the candidate system's performance; (4) to conduct a functional simulation of the system design; (5) to perform a reliability analysis of the system design; and (6) to develop the software specifications to include a user level high level programming language, a correspondence between the programming language and instruction set, and outline the operation system requirements.

Author

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**N78-19695** Control Data Corp., St Paul, Minn. Research and Advanced Design Lab.

**PRELIMINARY STUDY FOR A NUMERICAL AERODYNAMIC SIMULATION FACILITY. PHASE 1: EXTENSION**

Feb 1978 434 p refs

(Contract NAS2-8457) (NASA-CR-152108) Avail NTIS HC A19/MF A01 C5CL 01A

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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 an aircraft design. A skeleton structure of specifications for the flow model processor and monitor, the operating system, and the language and its compiler is presented. A R H


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. A R H


The development of doped-germanium detectors which have optimized performance in the 30- to 120-mu m wavelength range and are capable of achieving the objectives of the infrared astronomical satellite (IRAS) space mission is discussed. Topics covered include the growth and evaluation of Ge Ga and Ge Be crystals, procedures for the fabrication and testing of detectors, irradiance calculations, detector responsivity, and resistance measurements through MOSFET. Test data are presented in graphs and charts. A R H


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 planned for Spacelab using management participants from NASA and ESA who have responsibilities for Spacelab 1 which will be launched in 1981. A R H


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. A R H


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 jet. A R H

N78-32991# National Aeronautics and Space Administration. Ames Research Center. Moffett Field Calif ACCELERATION AND HEATING OF THE SOLAR WIND Aaron Barnes JPL A Close-up of the Sun 1 Sep 1978 96 p refs (For primary document see N78-32894 23-92) Avail NTIS HC A25/MF A01 CSCL 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. A R H


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


A R H

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A high-capacity vapor-modulated heat pipe was designed and tested in 1977. A program was undertaken to use the aforementioned heat pipe to study protection from freezing-point failure increase control sensitivity, and transient behavior under a wide range of operating conditions in order to determine the full performance-potential of the heat pipe. A new concept, based on the vapor-induced-dry-out principle, was developed for passive feedback temperature control as a heat pipe diode. This report documents this work and describes (1) the experimental and theoretical investigation of the performance of the vapor-modulated heat pipe, and (2) the design, fabrication and test of the heat pipe diode.

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


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 the 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 basin scarp, the basin plains, the relative ages of Olympus Mons and the basin plains, and grooved terrain. G.R.
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 SF6 ν3 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.


The 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 DPCM encoding, etc.), (3) adaptive cluster coding (blob algorithms and the multispectral cluster coding technique), and (4) adaptive entropy coding B.J.


An analytical study is carried out of the behavior of modern high-speed aircraft of inertial 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) with angle of attack, are considered. The steady-state solutions of the nonlinear 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 critical values of aileron deflection which 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. These critical values are now defined by a new range of aileron deflections, in which no steady-state roll is possible.

A78-14651 * Diagrammatic evaluation of the density operator for nonlinear optical calculations S Y Yee, T K Gustafson (California, University, Berkeley, Calif.), S A. J. Drust, and J. P. E. Taran (ONERA, Châtillon-sous-Bagneux, Hauts de-Seine, France), Optics Communications, vol 23, Oct 1977, p. 1-7 11 refs NSF Grant No. ENG-72-09860-A01, Grants No DANC04-76-C-0055, No NoG-2151

Time ordered diagrammatic representations are shown to precisely define and to simplify calculations of radiative perturbations to the density matrix. Nonlinear optical susceptibilities, here 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)

A78-14654 * Quantum mechanical theory of a structured atom-diatom collision system - A + BC/SCDF, P L DeVries (Rochester, University, Rochester, N Y.) and T. F. George (Rochester, University, Rochester, N Y.) Journal of Chemical Physics, vol. 67, Aug 15, 1977, p. 1293-1301 23 refs NSF Grant No. CHE-75-00775-A01, Contract No. FG4520-74-C-0073, Grant No. NoG-2198

The problem of a 2+2 state atom colliding with an 830g sigma state diatom, which involves multiple potential surfaces, is investigated. Within a diabatic representation for the electronic degrees of
freedom (plus spin-orbit interaction), coupled scattering equations are derived in both space-fixed and body-fixed coordinate systems. Coefficients, analogous to Percival-Scott coefficients, are obtained. Approximations to the exact equations, including angular momenta decoupling approximations, are discussed for both the space-fixed and body-fixed formalisms.


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-vascous 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 definition 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. (Author)


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 1975. The imaging photometer 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 about it. Bright spots with trailing plumes are seen in the Equatorial Zone. The North Polar Region is devoid of belt structure, but numerous irregular cells 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 unsteadiness 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 NASA airlor is also examined. (Author)


A method is derived 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 Io'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 ion cyclotron waves near Io'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. (Author)


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 showed that the reflectivity of Phobos is flat from 1100 to 4000 nm but decreases sharply in the ultraviolet to about 1 percent at 212 nm. The reflectance spectrum is similar to the spectra of carbonaceous 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. (Author)

A78-18875*  Multicolor observations of Phobos with the Viking lander cameras. Evidence for a carbonaceous chondrite composition. J. B. Pollack, D. Colburn (NASA, A. Research Center, Theoretical and Planetary Studies Branch, Moffett Field, Calif.)
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 + α - 0.01. These results, together with Phobos's reflectivity spectrum in the ultraviolet, are compared with laboratory spectra of carbonaceous chondrites and basalt. 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.

(Author)


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 cosmochronically important compositions are given.

P T H

A78-13835* - The prediction of toxic atmospheres from decomposing polymers. A Buchler and C J Hilado (San Francisco University, San Francisco, Calif.). Journal of Fire and Flammability. vol 8, Oct 1977, p 476 483 6 refs Grants No Nsg-2038; No Nsg-2164

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 compartment.

(Author)


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 best of these events, occultations by rings alpha and delta 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.

(Author)


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 small 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.

(Author)


The basic integral equations for a harmonically oscillating airfoil in a transonic flow with shock waves are derived, the reduced frequency is assumed to be small. The problem associated with shock wave motion are 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.

(Author)


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-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 SO radiation properties on the surface heating is examined.

(Author)


A detailed investigation of attached supercritical turbulent boundary layers over an extensive range of Reynolds numbers [12 x 10 to the 6th to 9 x 10 to the 7th] is presented. Experimental measurements were obtained for adverse pressure gradient 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 velocity fluctuation 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 relaxing length model for predicting the Reynolds number and pressure gradient effects. However, some details of the turbulent fluctuations as well as the exact Reynolds number trends indicated by the data were not accurately predicted with any of the turbulence models considered.

(Author)


An algebraic turbulence model for two- and three-dimensional separated flows is specified that avoids 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 conditions 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 Galtuny (Westinghouse Research and Development Center, Pittsburgh, Pa.) Journal of Chemical Physics, vol. 67, Dec. 15, 1977, p. 5676-5687, 29 refs. Contract No. NAS9-9185 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 kinetic 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 cycles. One of these is the complete conversion, possible 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 here to await experimental verification. (Author) A78-22575 * Computational wing optimization and wind tunnel test of a semi-span model H P. Haney, E. G Waggoner (Vought Corp., Dallas, Texas), 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, Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan. 16-18, 1978, Paper 78-102. p. 7, 13 refs. 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 Vandegrift’s constrained minimization routine was used to optimize test configurations at 0° 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 intense laser radiation. J. H Lundell and R. R. Dickel (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 78-139, 8 p., 15 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. MacCormack (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 agreement is obtained between the present results and experimental measurements for the case of a wedge with an angle of 6.6 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 interactions, the plateau pressure, and the peak heat transfer are closely predicted for all cases. The high heat transfer near the axillar corner is due to the thinning of the boundary layer and inflexion 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 subjected to sudden transverse strain. H. Higuchi (Dynamics Technology, Inc., Torrance, Calif.) and W. W. Rubesin (NASA, Ames Research Center, Moffett Field, Calif.) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan. 16-18, 1978, Paper 78-201. 20 p., 12 refs. 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-strengthened 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. Prakas (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 hypersonic 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 quadrillion to 100 quadrillion 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. Reflective 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. Hilgenma (Grumman Aerospace Corp., Bethpage, N.Y.). American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan. 16-18, 1978, Paper 78-252. 3 p., Contract No. NASA-866444. 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 13.7 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 were used to identify N2O, CH4, O3 and other trace constituents and to derive stratospheric column densities (molecules/cm2). (Author)


A78-23903 * Generation of a parallel X-ray beam and its use for testing collimators. J. H. Underwood (Aerospace Corp., Los Angeles, Calif.). Space Science Instrumentation, vol. 3, Nov. 1977, p. 259-270. 15 refs. Contracts No. NAS2-8864, No. F04701-76-C-0076. 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, so that it may be used as a glancing incidence X-ray or extreme ultraviolet optical element. The desired match is obtained 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 to be used for the testing of space payloads using geometric (McGrath) collimators is 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 invert equal increments of altitude (as opposed to time) in order to predict the noise quality of the occultation. Numerical results are given for a noisy isothermal light curve, with special attention to error analysis. (Author)


A78-23903 * Generation of a parallel X-ray beam and its use for testing collimators. J. H. Underwood (Aerospace Corp., Los Angeles, Calif.). Space Science Instrumentation, vol. 3, Nov. 1977, p. 259-270. 15 refs. Contracts No. NAS2-8864, No. F04701-76-C-0076. 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, so that it may be used as a glancing incidence X-ray or extreme ultraviolet optical element. The desired match is obtained 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 to be used for the testing of space payloads using geometric (McGrath) collimators is described and laboratory results presented. (Author)

A78-23904 * Analysis of stellar occultation data: Effects of photon noise and metal condensation. R. G. French, J. L. Elliot, and P. J. Gierasch (Cornell University, Ithaca, N.Y.). Icarus, vol. 33, Jan. 1978, p. 186-202. 16 refs. Grants No. NGL-33-010-086, No. Ngs-7125, No. Ngs-7174. 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 invert equal increments of altitude (as opposed to time) in order to predict the noise quality of the occultation. Numerical results are given for a noisy isothermal light curve, with special attention to error analysis. (Author)
latitude from about 7 deg N in the Intertropical Convergence Zone to about 79 deg N. The results suggest the importance of meridional transport and mixing in the stratosphere in accounting, at least in part, for the observed profile variation with latitude. The contamination by C2F2CO, C2F2CO2, CH2O, and SF6 were also detected but their mixing ratios were small and no accurate standards were prepared for them.

B. J.


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. Details for future observations of Saturn's rings are reviewed, such as the variation in their radial reflectivity as a function of the tilt of the ring plane.

S.C.S.


A microprint accelerator has been devised for micrometeoroid 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 charged by ion bombardment in high vacuum. The vertical accelerator has four drift tubes, each initially at a high negative voltage. After injection of the projectiles, each tube is grounded in turn at a time determined by the voltage and charge/mass ratio to give four acceleration stages with a total voltage equivalent to about 1 MV. B. J.


The stars Alpha Aur (G6 III + G0 III), Alpha Boo (K2 III), Alpha Ori (M1-M2 Ib-II), Alpha Sco (M1.5 Ib), 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 lie 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 makes renewed efforts to detect water bands in early M stars highly desirable. (Author)


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- to 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)


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)


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.


Pioneer 11 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 (IARs). It is found that in close vicinity to IARs, 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 IARs, 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 in the interplanetary medium.

SCS

A78-28350


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.

A78-4613


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.

SCS

A78-27744


A78-28906


A new metal-oxide-metal device (Ni:Si-O-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, 539, and 0.6328 microns. Similar devices with 10 to the 6th 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 broadband detector and mixer, and might in the future be a basic element of broadband amplifiers and oscillators.

A78-29469


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 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 saturation of adsorption has no influence, in contrast to the room temperature behavior.

A78-29532


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.

A78-29684


(For abstract see issue 14, p. 2455, Accession no. A77-32699)
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 19, 1976 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 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.

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 inertia effects) is spun at several rates about an 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 that the side force observed occurs under bulk 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 vortices producing 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-based residuals. The system has been operated successfully in U-2 aircraft flown from NASA-Ames at Moffett Field, Calif. (Author)

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 form coefficient matrices. This reduces the computation time of several implicit and semilImplicit schemes. Extensions of the basic approach to other areas are suggested.


A quantitative assessment is made of the long-term risk of earth reencounter 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 spectrum 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 0002-006. Proportionately smaller risk attaches 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 in order to determine the steady-state response of disks of gas to rotating barlike perturbations. Two types of barlike perturbations are considered: radial distortions in the axisymmetric gravitational field of the disk, and heterogeneous prolate 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 orbit topology. The gas response to barlike perturbations also depends on the relative strength and the effective axial ratio of the bar. In these calculations, low values bars produce offset shocks in the central disk region as well as for inhomogeneous spheroidal perturbations. The Planckian (or near-Planckian) spectral form for the microwave radiation provides a crucial test, failed by such cosmologies.

A79-34307 *

Low energy ionizing collisions between N$_2$ and CO beam molecules and CO, N$_2$, NO, CH$_4$, and CO$_2$ target molecules N. G. Utterback (TRW, Inc., Redondo Beach, Calif.), and B. Van Zyl (Denver University, Denver, Colo.). *Journal of Chemical Physics*, vol. 68, Mar. 15, 1978, p. 2742-2752. 18 refs Contracts No. NAS2-4824; No. DA-01-021-AMC-113592.

Absolute total negative charge production cross sections for N$_2$ + CO, CO + N$_2$, CO + CO, N$_2$ + NO, N$_2$ + CH$_4$, and N$_2$ + CO$_2$ collisions are reported, and simple models of collisions are discussed. The cross sections were measured to within about 1 eV of their thresholds. Specific reaction channels were investigated by referring to mass spectrometric identification of the products ions scattered in the forward direction, and these product ion identifications were used to explain characteristic structures in the total charge production cross sections in the near-threshold region. The extent of the importance of dissociative ionization and 'simple' ionization in the studied collisions at low energy is considered, and charge transfer cross sections for (CO)$_2$ + CO, (CO)$_2$ + CH$_4$, and N$_2$ + CH$_4$ are presented.

A78-34352 *


An approximate technique for diurnally time-averaging atmospheric photochemical-dynamical models which eliminates the need for a detailed numerical resolution of sunrise and sunset transitions is developed. The scheme is equivalent to scaling certain chemical rate constants and photodissociation coefficients by appropriate aeronomical factors. To calculate the scaling factors, diurnal variations are parameterized with a step-function behavior, assuming that each species has a constant day-time and night-time concentration whose ratio can be determined by analyzing the chemical interactions occurring after sunset. The solution accounts for the effects of key time reactions on the 24 h average value of species abundances, and on the average daily rates of the catalytic processes consuming ozone in the stratosphere. The accuracy of the technique is demonstrated by comparing its predictions to those of a full diurnal simulation; typically, the precision is better than 10% by contrast, it is shown that the use of some other well-known computational schemes can result in significantly larger predictive errors.

A79-34050 *


Iron and nickel-iron samples subjected to treatment by an arched plasma of ionized air were used to model meteor ablation. The artificial ablation debris and fusion craters were compared to the fusion craters 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 the artificially produced samples. Fractionation of less volatile elements was also noted.

A79-34657 *


Corelican counters on the Pioneer 10 and 11 spacecraft, capable of detecting alpha particles and protons with energies up to 480 MeV, and neutrinos and electrons with energies up to 6 MeV, have yielded data on cosmic ray anisotropies during periods of low solar activity. Observations from Pioneer 11 place east-west anisotropy at 0.41 plus or minus 0.11%, and the north-south anisotropy at near zero. Pioneer 10 results show east-west anisotropies of approximately 0.59 plus or minus 0.18%, and the north-south component at 0.25 plus or minus 0.08%. It is noted that the Pioneer 10 observations were obtained at the 6 AU range, while those from Pioneer 11 originated closer to the sun (1.1 to 2.7 AU). Attention is given to the ratio of the perpendicular to parallel components of the diffusion coefficient, and to the large north-south anisotropy reported by Pioneer 10, an effect due possibly to gradient drift, and to an additional streaming independent of the magnetic field polarity.

M.L.

A79-34662 *

Semiempirical theory of unimolecular dissociation induced by a laser field. J. M. Yuan (Rochester University, Rochester, N.Y.) and T. F. George, *Journal of Chemical Physics*, vol. 68, Apr. 1, 1978, p. 3040-3052. 72 refs. NSF Grant No. CHE-75-05775-A01; Contracts No. F44620-74-C-0073; No. F49620-74-C-0073; Grant No. NSG-2189.

A semiclassical trajectory theory of direct photodissociation in a laser field is developed in which photon absorption and dissociation are treated in a unified fashion. This is achieved by visualizing nuclear dynamics as a representative particle moving on an electronic-field surface. Methods are devised for calculating dissociation rates and probabilities by Monte Carlo selection of initial conditions and integration of classical trajectories on these surfaces. This unified theory reduces to the golden rule expression in the weak-field and short-time limits, and predicts nonlinear behavior, i.e., breakdown of the golden rule expression in intense fields. Field strengths above which lowest-order perturbation theory fails to work have been estimated for some systems. Useful physical insights provided by the electronic-field representation have been illustrated. Intense field effects are discussed which are amenable to experimental observation. The semiclassical methods used here are also applicable to multiple-surface dynamics in field-free unimolecular and biomolecular reactions.

A79-35403 *


Nitric oxide and ozone concentrations in the lower stratosphere have been measured from a high-altitude research aircraft using in situ measuring techniques. Results of ground-geophysical surveys are presented along with predictions of two two-dimensional stratospheric models. Meridional and zonal data were obtained in June
The sheet contains text discussing various topics, including:

- An investigation of a cryogenic thermal diode in the context of arterial heat pipes.
- A description of a re-entrant groove hydrogen heat pipe with a specific design.
- A study on jet pump assisted arterial heat pipe and its applications.
- A discussion on the industrialization of space technology and its implications.

The text references various studies and publications, and mentions specific research topics, including heat pipe technology, cryogenic thermal diodes, and arterial heat pipes. Some of the references are to technical papers and conference proceedings, indicating a thorough exploration of the subject matter.

Large-scale self-consistent-field plus configuration-interaction calculations have been performed for the 3Pi u 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 theoretical treatment agrees with the values of Danley and Nicholls (1974). Based on the data for C2 and another molecule, it is suggested that C1 calculations using Hartree-Fock quality Slater basis sets produce highly reliable transition moments.


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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 changes in the probe heatshield shape is included in a computerized technique designed for rapid assessment of the effect of probe initial shape on heatshield mass loss. Results obtained indicate the importance of trajectory and heating distribution coupling with probe shape and mass change.


In a study of rigidity-independent coronal propagation processes, data on the azimuthal variation of the solar proton/alpha-particle ratio were obtained. Sources for the data include statistical analyses of events observed by Heos-2, a comparative study of events recorded by both Heos-2 and Pioneer-10 and -11, and a multiday survey of individual events observed by Heos-2 and Pioneer-10. The statistical investigation of Heos-2 events reveals an increase of the lower value of the proton/alpha-particle ratio away from the well-connected region. The data from one or two spacecraft connected at different heliographic latitudes indicates no azimuthal dependence of the proton/alpha-particle ratio. All the data appear to suggest rigidity-independent propagation or escape processes.


The ablation of carbonaceous materials in a hydrogen-telium 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. These data are discussed 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 carbonphenolic somewhat less accurately.


The indicial 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 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.


The thermal control system developed for the Large Atmospheric Probe of the Pioneer Venus Multiprobe Mission is described. The scope of the thermal control task requires maintaining the probe internal equipment shelf temperatures within a nonoperating range of -40 to 122 F and an operating range of -4 to 122 F during three different mission phases. 1) preparation, the transit phase of the mission when the probe is attached to the Multiprobe spacecraft bus, 2) post-separation, the free-flight cruise phase of the mission following release from the bus, and 3) descent, the phase of the mission from entry equipment turn-on to impact on the Venus surface. Thermal control for these phases is achieved by a combination of passive thermal finishes on the probe exterior surfaces and heaters mounted on the equipment shelves. Verification of the adequacy of the total thermal design to meet all mission requirements has been completed.


The indicial 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 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 zodiacal 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 zodiacal light is the only source of information about the integrated properties of the whole ensemble of interstellar 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 zodiacal light arises from two independent physical processes related to the scattering of solar continuum radiation by interstellar dust and to thermal emission which arises from solar radiation that is absorbed by interstellar dust and reemitted mainly at infrared wavelengths. Attention is given to observational parameters of zodiacal light, the methods of observation, errors and absolute calibration, and the observed characteristics of zodiacal light.


The 1.7- 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 inorganic 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, HC2H is presented, and the relative contributions of C3, HCN, and CH2 are presented. Spectra of two other carbon stars, TX Psc and S Cap, are presented for comparison.


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NO, HNO3, and CO levels and air temperature were measured as a function of latitude in the 10 to 21 km region of the stratosphere, and the sum of odd nitrogen, equal to NO + N2O + HNO3, was calculated and compared with model predictions (N2O 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 ratios and model predictions agree within 2/3 of the factor at both 20 and 40 deg N. and show excellent agreement for latitudinal dependence.


Direct real-time gas chromatographic measurements of CF2C12, CFC13, CCI4, and N2O 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 CF2C12 and CFC13 between the Northern and Southern Hemispheres, but no differences were noted for CCI4 and N2O. 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 wide 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 endemic craters. These possibilities are examined for statistics of 28 different regions. In contrast to most other studies, crater diameters were compared with diameter-frequency distributions for different regions. In contrast to most other studies, crater diameters were compared with diameter-frequency distributions for different regions.

A78-41805 ° An evaluation of several compressible turbulent boundary-layer models - Effects of pressure gradient and Reynolds number C. C. Horstman, M. I. Kussey, 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. Comparisons 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 10^5 to the 6th to 31 x 10^5 to the 6th). These experiments included measurements of surface pressure and skin friction for adverse pressure gradients ranging from 0.04 to 0.07 and different Reynolds numbers 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. Vegas 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 speed. 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)

A78-41865 ° A detailed study of attached and separated compression corner flowfields in high Reynolds number supersonic flow G. S. Settles, T. J. Fitzpatrick, and S. M. Bogdonoff (Princeton University, Princeton, N.J.) American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1167. 10 p. 21 refs. Contract No. F44620-75-C-0080, Grant No. NSG-2114. 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 otherwise would 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 free-stream 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 Schramm's (1977) that assumed 10% oxygen. Major reactions in 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 provide only a modest amount of fluid for a comparatively brief 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. M.L.


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 Pb and Sn were grown in situ in an electron beam in a vacuum chamber 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 analogues. 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. V.P.


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 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 ionosphere 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 ion gas. Utterly different dayglow intensities were calculated, and it is anticipated that: a) the kR of CO2-related emission features such as the CO Cameron bands will be observed. B) Nightside ionosphere calculations were made assuming the precipitation of energetic electrons as an ionization source, and the intensities of some of the resulting emission features are calculated. M.L.


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 do not yield a claim of direct evidence for the hypothesis of recirculation of energetic particles in the Jovian magnetosphere. It is suggested that neglect of 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 advances in 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 continuous 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. The claimed to 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 angle of attack undergoing a combined spinning and coning motion. The code takes into account the asymmetries 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 Schiff and Tobak. Comparison is also made with the 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 forces 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 interference 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 range, and an expression is derived for the energetic
electron system response to fluctuations about the limiting flux
value.

S C S

A78-45575 * The relative free resistance of select thermo-
plastic materials D. A. Kourtides and J. A. Parkor (NASA, Ames
Research Center, Moffett Field, Calif.), Plastic Design and Pro-
isessing, April 1978, p 11-19 refs.

The relative thermal stability, flammability, and related thermo-
chemical 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, poly-
phenylene oxide, and polystyrene. Candidate thermoplastic materials
evaluated include: polyvinylidene fluoride, polyvinylchloride homopoly-
mer, phenolphthalein polycarbonate, polystyrene, polyvinyl fluoride,
polyethylene, polypropylene, polyethylene terephthalate, polycarbonate-
ized poly(dimethylsiloxane) block polymer, chlorinated polyvinylchloride
homopolymer, phenolphthalein polycarbonate, polyethylene-chloroprene,
acrylonitrile butadiene styrene, and polystyrene. Candidate ther-
moset materials evaluated include: 9,9-bis(4-hydroxyphenyl)fluorene,
vinylidene fluoride, and polystyrene. Candidate thermoset materials
evaluated include: 9,9-bis(4-hydroxyphenyl)fluorene, vinylidene fluoride,
and polystyrene. Candidate thermoset materials evaluated include:
9,9-bis(4-hydroxyphenyl)fluorene, vinylidene fluoride, and polystyrene.

S C S

A78-45583 * Semirigorous bounds for the dipole moments
and transition moments of the LIM 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.

Semirigorous error limits for the dipole moments and transition
moments of LIM at R = 3.015 bohr 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) semirigorous expression for the lower bound to the
overlap between the approximate and the true wavefunctions is
applied to the calculation. The semirigorous 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.

S C S

A78-46380 * The numerical solution of viscous flows at
high Reynolds number. R W MacCormack (NASA, Ames Research
Center, Computational Fluid Dynamics Branch, Moffett Field, Calif.)
In Heat Transfer and Fluid Mechanics Institute, Meeting, 26th,

A review is presented of implicit and hybrid methods applicable
to solving viscous flows at high Reynolds numbers. Flows within
axially symmetric 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-hemisphere cylinders at angle of attack have been
examined. Reynolds numbers as high as 10 to the 9th power have
been used.

S C S

A78-46575 * Entry dynamics performance predictions for
Pioneer Venus probes. R D McCoy (General Electric Co., Re-Entry
and Environmental Systems Div., Philadelphia, Pa.) In Atmospheric
Flight Mechanics Conference, Palo Alto, Calif., August 7-9, 1978,
Technical Papers (A78-46526 20 68) New York, American Institute
of Aeronautics and Astronautics, Inc., 1978, p 286-293. 8 refs
Contract No. NAS2-8300 (AIAA 78-1370)

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

S C S

A78-47273 * A short history of Pulkovo Observatory, K.
Krčina (NASA, Ames Research Center, Moffett Field, Calif.)

A78-48112 * The radii of Uranian rings alpha, beta, gamma,
delta, epsilon, eta, zeta, and theta from their occultations of SAO
158887. J. L. Elliott, E. Durham (Cornell University, Ithaca, N Y),
L. H. Wasserman, R. L. Millis (Lowell Observatory, Flagstaff, Ariz),
and J. Churms (South African Astronomical Observatory, Observa-
1978, p 880-892. 30 refs. NSF Grant No. AST-76-14932, Grants
No. NGS-2174, No NGR-03-001-001

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
collinear in a coplaner. A solution obtained under the assumption that the ring

collides with the plane of the satellite orbit is adopted which yields
radii of 44,484 km for ring alpha, 45,799 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 mean rings. The mean radii estimated
for the other rings are 47,323 km for ring ets, 42,653 km for ring 4,
42,360 km for ring 5, and 41,980 km for ring 6.

F. G. M.

A78-46291 * The spiral field inhibition of thermal conduc-
tion in two-fluid solar wind models. S. Nerney and A. Barnes (NASA,
Ames Research Center, Space Sciences Div., Moffett Field, Calif.)

The paper reports on two-fluid models which indicate the
inhibition of thermal conduction by the spiraling interplanetary field
to determine whether any of the major conclusions obtained by
Nerney and Barnes (1977) needs to be modified. Comparisons with
straight line models reveal that for most base conditions, the primary
effect of the inhibition of thermal conduction is the bottling-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
cut from T Tauri stars, cannot be driven by thermal conduction.

The conclusions of Nerney and Barnes remain essentially unchanged.

S D

A78-48425 * Intensities, self-broadening, and broadening by
Ar and N2 for the 301/111-000 band of CO2 measured at different
temperatures. C. B. Suarez and F. P. Valero (NASA, Ames
Research Center, Moffett Field, Calif.) Journal of Molecular Spectroscopy,

A78-48335 * Experimental temperature distribution and
heat load characteristics of rotating heat pipes. T. C. Daniels
(Swarase, University College, Swansea, Wales) and R. J. Williams
NASA, Ames Research Center, Moffett Field, Calif.), International
Experimental results show conclusively that the presence of a small quantity of a noncondensable gas (NCG) 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 NCG and the ratio of the molecular weight of the working fluid to that of the NCG 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.

A78-49231


Medium spectral resolution (20 kayars) infrared measurements of the Martian disk made between 2500 and 5500 kayars 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 3557 and 3565 kayars. Three Martian soil analogs previously considered acceptable - limonite, montmorillonite, and basalts - were analyzed to determine the optical complex index of refraction in the same range as the airborne observatories. 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.

A78-49471

**Evolution of rotating interstellar clouds, III.** On the formation of multiple star (partly fixed) boundary conditions. The effects of linear viscous boundary layers is considered along with the role of thermal tides. (Authors)

A78-49476


Spectrophotometry of the classical Be star Gamma Cas (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) the attenuation of the star by the shell is included, and (3) no assumption is made that the shell contribution is negligible in some bands. 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: shell temperature of approximately 18,000 K, an optical depth of 1 micron, and an electron density of approximately 3.3 x 10^10 cm^-3. The theoretical results are compared to interferometric observations.

A78-49693


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) mechanical properties such as glass transition and melt temperature, (2) changes in polymer enthalpy by differential scanning calorimetry, (3) thermogravimetric analysis in an anaerobic 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: acrylic-rubber, butadiene-styrene, acrylonitrile-butadiene-styrene, bisphenol A polycarbonate, bisphenol fluorenone carbonate-dimethylsloxane block polymer, phenolphthalein-bisphenol A polycarbonate, phenolphthalein polycarbonate, polyether sulfone, polyphenylene oxide, polycrylonitrile, polystyrene, 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.

A78-50240


A reference model is proposed for the structure of the Mars atmosphere up to 100-km altitude. Based on Viking data, two models are described: (1) mean temperature structure, mean surface pressure, mean molecular weight and gas constant, and pressure and density profiles. Model profiles with Viking and Mars 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.

A78-50348

**Absence intensity measurements at different temperatures of the C-120/C-162 bands 30 0 1-0 0 0 and 30 0 2-0 0 0 of CO2.** F. J. Valero (NASA, Ames Research Center, Moffett Field, Calif.). Journal of Quantitative Spectroscopy and Radiative Transfer, vol 19, June 1978, p. 569-578. 13 refs.

A78-50349

**Measurement at different temperatures of absolute intensities, line half-widths, and broadening by Ar and N2 for the CO2 30 0 1-0 0 0 band of CO2.** P. J. Valero (NASA, Ames Research Center, Moffett Field, Calif.) and C. S. Suire (NASA, Ames Research Center, Moffett Field, Calif.). Journal of Quantitative Spectroscopy and Radiative Transfer, vol 19, June 1978, p. 579-580. 30 refs.

Vibration-rotation line intensities, self-broadening coefficients, and foregas-broadening (Ar and N2) coefficients were measured at 197, 233, and 248 K for the 30 0 1-0 0 0 band of CO2 at 6398 cm^-1. Values for the total band intensity, purely vibrational transition moment, and vibration-rotation interaction factor were deduced from the measurements.

A78-50398


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...
damping, Winkler foundation, constant axial tension, a concentrated mass, and an arbitrary forcing function are included in the analysis. No restriction is placed on the values of the parameters involved, and the solution presented here contains all cited previous solutions as special cases. (Author)


Tests of the thermo-electronic laser energy converter (TELEC) concept are reported. This device has been devised as a means to convert high-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%. (Author)


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 these controlling parameters - chemical composition, density, and velocity - are varied over a range around the values derived by Korolchukov et al. (1978) and Petrov and Stulov (1975). The calculation shows that at least 19 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 atmosphere. It is speculated that the nitric oxide produced by the event fertilized the area near the fall, causing the observed rapid plant growth. (Author)


This paper describes fire resistivity studies of a wide range of candidate nonmetallic materials for the construction of improved fire resistant aircraft seat materials. 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. (Author)


The work described was carried out to study the thermal rearrangements of two unsaturated diene polymers - 1,2-poly(cis-1,4-hexadiene) (CHD) and 1,2-poly(trans-1,4-hexadiene) (THD). It is shown that both CHD and THD have a predominately 1,5 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. V.P.


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 selected for simulation are reported, 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. M L


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 about 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. Electron 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. (Author)


Pioneer 10 vector helium magnetometer data acquired in 1972-1973 during Barths solar rotations 1896-1918 are used to investigate the radial dependences of the distant interplanetary magnetic field (IMF) between 1 and 5 AU. Least-square fits were determined for the radial dependences of the averages of the magnitudes of IMF components and total field and plane projection, 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 subcorresponding to a relatively low average solar wind velocity are reported.

M.L.


The MHD projects to test an MHD one-dimensional time-dependent model of corotating solar wind streams during the period from Sept. 30 to Nov. 25, 1973 is described. During this period, five or six corotating interaction regions streamed past the two spacecraft, and, as a result of multiple-spacecraft radial alignment and temporarily varying conditions at the solar wind source, the pattern predicted by the Steinolfson et al. (1975) model could be compared with observations. 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 to the formal extension of Arrhenius' law to reactions in turbulent flows is shown to be nonmeasurable in the case of a binary exchange reaction with a sufficiently high activation energy. A preliminary calculation predicts that the turbulent reaction rate is invariant in the Arrhenius form except for an equivalently 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 oxy-hydrogen mixtures is discussed in this light.


Photocatalytic, ionization, and gas sensors were used to detect the signatures from the radiant heat or flame of various aircraft materials. It was found that both ionization and photoelectric detectors alone appeared to be insensitive to pyrolysis and combustion products of many of the materials. P. T. H.

PATENTS


New 1,1,1-triaryl 2,2,2-trifluoroethanes in which the syl radicals carry one or more substituents, were prepared by condensing trifluoro antranilophones 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 h.


The 1,1,1-triaryl 2,2,2-trifluoroethanes in which the syl radicals have nitrogen containing substituents such as the aminol, nitrite, and aceticamide groups, were prepared by the acid catalyzed condensation of trifluoro antranilophones with aromatic substrates containing amino groups. The amino groups may then be converted to nitriles, acetamide, and other derivatives by standard procedures. The products obtained may be used as monomers or as crosslinking agents in polymer formation.


This invention relates to the use of metal salts of caprylic (octyl) acid for catalyzing the formation of imide linkages through the reaction of aromatic tetracarboxylic acid dihydrides with aromatic polycyanates. The preferred catalysts are stannous, ferric, and aluminum oxotates. The reaction can be carried out in one operation, i.e., by placing all the ingredients in a mold and heating at a suitable temperature to obtain a foamed product. Alternatively and preferably, a prepolymer is allowed to form between the reactants, with loss of carbon monoxide equal to about half the theoretical quantity that can be liberated by complete reaction of the ingredients. This prepolymer is then placed in a mold and heated to form the final polyamide foam product. The product has outstanding thermal and fire performance, as shown by burn-through time and flame spread characteristics.


An intumescent-ablator coating composition which contains the ammonium salt of 1,4-nitroaniline-2-sulfonic acid or 4,4-dimethylstilbene. Polymeric binder system and about 5 to 30% weight of an endothermic filter is reported. The filler has a decomposition temperature about or within the exothermic region of the intumescent agent.

Official Gazette of the U.S. Patent Office.
LOW DENSITY BISMALIMEIDE-CARBON MICROBALLOON COMPOSITES Patent Application
A process is described for constructing a composite laminate structure which exhibits a high resistance to heat and flame provide for superior structure for aircraft and submarine compartments. Composite laminate structures are prepared by the bismalimeide resin preimpregnation of a fiberglass cloth to form a face sheet which is bonded with a bismalimeide hot melt adhesive to a porous core structure. The core porosity is provided by a foam derived from a polyimide paper and bismalimeide-glass fiber which is filled with carbon microballoons. The carbon microballoons are prepared by pyrolyzing phenolic micro-balloons in the presence of boron, by adding a modified novolac resin to the prepolymer to fill the porous core structure. The porous core structure and face sheet are bonded to provide panel structures exhibiting increased mechanical capacities and lower oxygen limit values and smoke density values.
NASA

N78-28178 National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif. STRUCTURAL WOOD PANELS WITH IMPROVED FIRE RESISTANCE Patent Application
Wood paneling or other molded wood compositions are prepared from lignocellulosic particles such as finely divided wood chips, flour, or strands, by bonding such particles with 10 to 33% by weight of a modified novolac resin. The modified resin and a hardening agent such as hexamethylene tetramine are sprayed onto the particles and the mixture is heated to form the panel or other article and the prepolymer to form the adhesive.
NASA

N78-31232 National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif. POLYMERIC FOAMS FROM CROSS-LINKABLE POLY-N-ARYLENEBENZIMIDAZOLES Patent
Foamed cross-linked poly-N-arylenebenzimidazoles are prepared by mixing an organic tetraamine and an ortho substituted aromatic dicarboxylic acid anhydride in the presence of a blowing agent (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.
Official Gazette of the U.S Patent Office

N78-32189 National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif. FIBROUS REFRACTORY COMPOSITE INSULATION Patent Application
A process is described for constructing a composite laminate structure which exhibits a high resistance to heat and flame provide for superior structure for aircraft and submarine compartments. Composite laminate structures are prepared by the bismalimeide resin preimpregnation of a fiberglass cloth to form a face sheet which is bonded with a bismalimeide hot melt adhesive to a porous core structure. The core porosity is provided by a foam derived from a polyimide paper and bismalimeide-glass fiber which is filled with carbon microballoons. The carbon microballoons are prepared by pyrolyzing phenolic micro-balloons in the presence of boron, by adding a modified novolac resin to the prepolymer to fill the porous core structure. The porous core structure and face sheet are bonded to provide panel structures exhibiting increased mechanical capacities and lower oxygen limit values and smoke density values.
NASA

N78-32260 National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif. REACTION CURED GLASS AND GLASS COATINGS Patent
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 and mixtures with a reactive glass frit composed of a porous high silica borosilicate glass and boron oxide. The glassy composites of the present invention are useful as coatings on low density fibrous porous silica insulations used as heat shields 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 142°C (270°F).
Official Gazette of the U.S Patent Office

N78-32434 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. SPRAY COATING APPARATUS HAVING A ROTATABLE WORKPIECE HOLDER Patent Application
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 a second plane inclined at an angle to the horizontal plane. The workpiece is rotatable in both of two 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 removal of the loose 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 in the rotation of the workpiece relative to the spray station permit various faces of the workpiece to be sequentially coated into an orthogonal relationship to the spray station for uniform coating.

S

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LIFE SCIENCES

FORMAL REPORTS

N78-19446* 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 Cobeci (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 CSCL 02D

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 are included. The author treats the biological components as a farm, calculates the rates and fluxes for the components, and evaluates the formulation for mass-balance and other mathematical models of the dynamics of a closed ecological system.

Author

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

A BIBLIOGRAPHY ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE

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


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 ECOSYNTHESIS: AN APPROACH TO THE DESIGN OF CLOSED ECOSYSTEMS FOR USE IN SPACE

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 described 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
L.

along with problems in maintaining healthy specimens and bacteria and ultrastructurally. Problems in frog preparation were discussed.

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 Hamme Aug 1976 16 p Sponsored in part by DOT (NASA-TM-78512; HUD-1: A-7562) Avail NTIS HC A02/MF A01 CSCL 05A

Head-Up Display (HUD) concept for large commercial 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

N78-32076* 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 altitude alert signals and failure to reset the system were the commonest cause of altitude deviations related to the system. Cockpit crew distraction was the most frequent reason for these failures. It was noted by numerous reporters that the presence of altitude alert systems made them less aware of altitude deviations related to this system. Cockpit crew operating procedures during climb and descent may need to be adjusted. The altitude alerting signal approaching altitude has only a visual component. Project documentation and management responsibilities are outlined.

G G

NASA CONTRACTOR REPORTS

N78-10394* Pittsburgh Univ., Pa.

VESTIBULAR FUNCTION RESEARCH LAB


13 Oct 1977 25 p ref (Grant NSG-2197) (NASA-CR-154507) Avail 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 microthermisters 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 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.

ADVANCED SOLID ELECTROLYTE CELL FOR CO2 AND H20 ELECTROLYSIS Final Report


A solid electrolyte cell with improved sealing characteristics was examined. A tube cell was designed, developed, fabricated, and tested. Design concepts incorporated in the tube cell to improve its sealing capability included minimizing the number of seals per cell and using metal seals to lower temperature requirements. 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 two high temperature seals in the tube cell design represent a significant improvement over the ten high temperature precious metal seals required by the electrolyzer drum design. For the tube cell design the solid electrolyte was 8 mole percent yttria stabilized zirconium oxide slip cast into the shape of a tube with electrodes applied on the inside and outside surfaces.

Author

N78-22273* Life Systems, Inc.

TECHNOLOGY ADVANCEMENT OF THE ELECTROCHEMICAL CO2 CONCENTRATING PROCESS Annual Report


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 pCO2 levels below 400 Pa, increasing 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

N78-23746* Life Systems, Inc.

EVALUATION OF A SPACECRAFT NITROGEN GENERATOR Final Report


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. The reduced tankage and expendable 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 to provide the makeup nitrogen. The hydrazine will be used in the reduction of metabolic carbon dioxide.

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**Nitrogen Generation Concepts**

Author: John M Lehman, Robert K Heffley, and Warren F Clement

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**ABSTRACT**

Packaged computer-guided fault correction concepts to aid maintenance following fault detection were defined to aid maintenance following fault detection. The reduction of CO2 to O2 and CO in a silent electric discharge was studied. It was found that current alone (in the ionized plasma induced by the silent electric discharge) was responsible for the CO2 reduction process. Voltage and frequency were important in so far as they induced current in the plasma. Pressure and temperature were of minimum influence in the process. The large power consumption in the process was recognized as resulting from the low power factor of the reactor vessel which electrically behaved like a capacitor. The power factor was subsequently improved-by adding an inductive element-to make the reactor vessel capacitance part of a resonant circuit. It was found that the CO2 reduction process was most efficient in terms of power vs. reduction rate when a voltage was employed that was only slightly higher than that needed to induce the plasma.

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**REFERENCES**

Contract NAS2-9551

1. NASA-CR-152146, LMSC-D626407
2. NASA-CR-152100, ER-309-6
3. NASA-CR-152100, ER-309-6
4. NASA-CR-152100, ER-309-6
5. NASA-CR-152100, ER-309-6

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**RESULTS**

The results of an unmanned simulation and an analysis of wind shear hazard are presented. The study involved the application of mathematical models of four diverse passenger aircraft types ranging from a small STOL commuter aircraft to a jumbo jet and of pilot models appropriate to each flight situation. The hazard to each aircraft was evaluated for both approach and takeoff in three severe wind shear profiles. The effects of varying operational techniques and propulsion system features were investigated and explained with the aid of a simplified linear analysis. No direct correspondence was found between wind shear hazard and aircraft size or type per se. Instead, the main factors affecting sensitivity to wind shear were shown to be airspeed, flight path regulation, and trimmed regulation. Also, the shear dependency as modeled in the simulation was found to be important.
taboons during periods of rest, moderate exercise, and extreme exertion. A description of the experiments hardware is presented, including arterial depressants phenylcyclidine hydrochloride, 0.5-1.0 mg/kg, and pentobarbital sodium, 15 mg/kg, and an ultrasonic telemetry flow meter. Results showed rising 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-predominantly. Attention is given to a quantitative analysis of the experimental results.

D.M.W.

A78-29562 * Responses of articular and epiphyseal cartilage zones of developing avian radius to estrone and hypergravity are reported. Female chicks at two weeks post-hatch were exposed to estrone and hypergravity levels, but relatively stable heart rate and arterial pressure, post-predominantly. Attention is given to a quantitative analysis of the experimental results.


It is proposed that human 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 vision 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 crude force strategies, as compared to those adopted in self-paced problem solving in such situations. The results of two previously reported experimental studies of problem solving performance in a fault diagnosis task are compared with mesenteric and renal flows somewhat above control level, but relatively stable heart rate and arterial pressure, post-predominantly. Attention is given to a quantitative analysis of the experimental results.


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-15/N-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.

A78-36862 * Fluid-electrolyte shifts and maximal oxygen uptake in man at simulated altitude, 5270 M. J. E. Greenleaf, E. M. Barnauer, W. C. Adams, and L. Juhos (NASA, Ames Research Center, Laboratory of Human Environmental Physiology, Moffett Field, Calif., University, Davis, Calif.). Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology, vol 44, May 1978, p. 652-668. 53 refs. 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 (2277 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 exercise fluid-electrolyte shifts. Since there are no significant changes in fluid balance or netting 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.

The three biologic experiments on board the Viking Mars Landers are discussed. The gas exchange experiment provided periodic measurements of the composition and quantity of gases from Martian surface material, either in a humus or a wet nutrient sampling mode. The labeled release experiment demonstrated that adding an 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 oxide) rather than biota may account for all the observed reactions.

J. M. B.


As a possible predictive test for screening Space Shuttle astronauts, the secretion of the parathyroid, adrenal and gonadal hormones were 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 linked to increases in plasma ACTH and cortisol. This relationship did not hold 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 ionizing radiation dose standards less than or equal to 100 mrem/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 human experience comparable adaptation to weightlessness and whether there are long-term effects of breathing various atmospheric mixtures and pressures.

J. M. B.

A78-42817 * 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. NGR-74-005-213, No. NIG-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 - are 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 range extremes, with much lower priority in the mid-range. Properties and advantages of such a mechanism are discussed.

Author


The preparation of a polymer for the Pioneer-Venus Large Probe Gas Chromatograph and another polymer for gas-chromatographic analysis of the Jovian atmosphere is described. Technical-grade divinylbenzene is used as a reliable and economical source of 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 also suitable for ammonia but not for amine analysis. However, the polymer for the analysis of the Jovian 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 determines the changes during the rapid cyclic reaction following light flashes. The results suggest that several tryptophan residues are affected 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 reprotomation of the Schiff base group.

S. D.


A78-48671 * // Gravity as a biochemical determinant. S. M. Segal (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 NAS2-6624, No NAS2-8687.

Hyogravity effects on the biochemistry of living organisms are simulated along with the physiological, psychological, and aesthetic needs of the inhabitants of a space habitat. 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 governance, supply of food and water, and design criteria for space colonies.

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 = +1. A filter structure, based on digital incremental computers is proposed, which has low sensitivity, good error characteristics, and simple hardware implementation. 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 105.5 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 148.5 C. Sterilization with 7.5 Mrads destroyed less activity than did heat sterilization. The effect of several individually nonsterilizing doses of wet 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 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 US Patent Office

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

SPACESUIT MOBILITY JOINTS Patent Application


A spacesuit is presented having a wrist joint, shoulder joint, elbow joint, hip joint, and ankle joints. Each of the joints includes at least one pair of annuli supported for pivotal displacement about paralleling axes and a flexible, substantially impermeable diaphragm of a tubular configuration spanning the distance between the annuli and connected thereto in a hermetically sealed relationship. The diaphragm includes at least one rolling convolution having a crown disposed in a fixed relation with an axis about which one of the annuli pivots. The knee joint is constructed slightly different from the other joints. A curved tubular shell is disposed between two circular bellows. Cables are secured to the rings, shell, and bellows. The cables limit the motion of the bellows when the suit is pressurized. NASA

**N78-22720** 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 was removed from the device by removing the closure from the frame while the frame was held immobile on the skin. NASA

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

CHELATE-MODIFIED POLYMERS FOR ATMOSPHERIC GAS CHROMATOGRAPHY Patent Application


New polymer 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 organic complexed on or chelate, e.g., Co(acacen), which is H2N-ethylene-bis(N,N'-acetylacetamidomethyl)cobalt (2) Organic nitrogenous bases, such as pyridine, may be incorporated into the chelate-polymer complexes to increase their 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 ethylbenzene 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

**N78-27733** National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

TREAD DRUM FOR ANIMALS Patent


A device for exercising animals such as primates 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 treadway. In this manner if the animal should fall behind its running-in-place station, it may be shocked by treading on the energized electrode structure. One end of the tread drum comprises a transparent wall for unobstructed viewing of the animal being exercised. Official Gazette of the US Patent Office

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

BORON TRIFLUORIDE COATINGS FOR THERMOPLASTIC MATERIALS AND METHOD OF APPLYING SAME IN COLD DISCHARGE Patent

Ronald Michael Kubacki, inventor (to NASA) (Bell and Howell,...
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
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 10-59)

Avail NTIS HC A22/MF A01 CSCL 098

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 multirate processes that obtain in the employment of various new or proposed computer architectures 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 N00014-75-C-0246) (AD-A049187, 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 the speed of 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 thermo-hydrodynamics of superfluid helium. The theoretical formalism is applied to the parametric amplification of second sound by high intensity first sound and the results are in disagreement with a previous calculation by Khokhlov and Pashkina.

Author (GRA)

N78-19808# National Aeronautics and Space Administration

A single user efficiency measure for evaluation of parallel or pipeline computer architectures c60

W P Jones. In its Future Computer Requirements for Computational Aerodynamics Feb 1978 p 383-371 (For availability see N78-19778 10-59)

Avail NTIS HC A22/MF A01 CSCL 098

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 the animal unrestrained movement in the cage. This 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

N78-24364# California Univ., Berkeley Dept of Chemical Engineering

Temperature, EKG, and activity monitoring

Thomas B Fryer, Gordon F Lund (San Jose State Univ Calif)

A decoding procedure for the Reed-Solomon codes

Raymond C Lin Aug 1978 25 p refs (Contract N00014-75-C-0855) (AD-A052617, TR-17) Avail NTIS HC A02/MF A01 CSCL 11/6

A decoding procedure is described for the [n,k] t-error-correction Reed-Solomon (RS) code, and an implementation 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 galois 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)

N78-30862# National Aeronautics and Space Administration

A decoding procedure for the Reed-Solomon codes

Raymond C Lin Aug 1978 25 p refs (Contract N00014-75-C-0855) (AD-A052617, TR-17) Avail NTIS HC A02/MF A01 CSCL 11/6

A decoding procedure is described for the [n,k] t-error-correction Reed-Solomon (RS) code, and an implementation 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 galois 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)
NASA CONTRACTOR REPORTS

N78-33795* National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.

ANGLE DETECTOR Patent
Gilbert T Parra, inventor (to NASA) Issued 13 Jun. 1978 8 p
Filed 10 Nov 1976 Supersedes N77-11364 (15 - 02, p 0194)
(NASA-Case-ARC-11035-1, US-Patent-4,094,073,
US-Patent-Office CSCL 14B

An angle detector for determining a transducer's angular
disposition to a capacitive pickup element is described. The
transducer comprises a pendulum mounted inductive element
moving past the capacitive pickup element. The capacitive pickup
element divides the inductive element into two parts L sub 1 and
L sub 2 which form the arms of one side of an a-c bridge.
Two networks R sub 1 and R sub 2 having a plurality of binary
weighted resistors and an equal number of digitally controlled
switches for removing resistors from the networks form the arms
of the other side of the a-c bridge. A binary counter, controlled
by a phase detector, balances the bridge by adjusting the resistance
of R sub 1 and R sub 2. The binary output of the counter is
representative of the angle.

Official Gazette of the U S Patent Office


X10: A FORTRAN DIRECT ACCESS DATA MANAGEMENT
SYSTEM
David P. Roland In NASA Langley Res. Center Eng and Sci.
Data Management 1978 p 155-182 (For primary document see
N78-33778 24-61) (Contract NAS2-6914)
Avail NTIS HC A12/MF A01 CSCL 09B

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.

PATENTS

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

ROTARY LEVELING BASE PLATFORM Patent
Robert W Delaplane and Daniel L Mossolani, inventors (to
NASA) Issued 9 May 1978 5 p Filed 2 Nov. 1976 Supersedes
N77-10498 (15 - 01, p 0089)
(NASA-Case-ARC-10861-1; US-Patent-4,088,281;

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
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

N78-17004# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
DYNAMIC STALL EXPERIMENTS ON THE NACA 0012 AIRFOIL
Kenneth W. McAuliffe, Lawrence W. Carr, and William J McCroskey Jan 1978 168 p refs
(NASA-TP-1100; A-J098) Avail NTIS HC A08/MF A01 CSCL 01A

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
Dawley H Hodges Feb 1978 102 p refs Prepared in cooperation with Army Aviation Res and Develop Command, Moffett Field, Calif
(NASA-TM-78456; A-7301-PI-1) Avail NTIS HC A06/MF A01 CSCL 01C

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

N78-18381# 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 8 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 bluff bodies, unsteady separation on slender bodies, and internal flows.

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 interaction.

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 these 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

N78-19068# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

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WATER-TUNNEL EXPERIMENTS ON AN OSCILLATING AIRFOIL AT RE EQUALS 21,000

Kenneth W. McAlester and Lawrence W. Carr
Mar 1978 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 stained 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 a free shear layer was found to momentarily exist over the entire upper surface without any appreciable disturbance of the viscous-inviscid boundary. A flow protuberance was observed to develop downstream of the leading edge, while minor vortices evolve from the viscous-inviscid boundary. An expanding instability of the free shear layer over the rear portion of the airfoil completes the succession of two dominant vortices...

Author

N78-28404 L 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 No Feb 1978 8 p refs (For primary document see N78-28397 19-54) Avail NTIS HC A11/MF A01 CSCL 20D

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

J M S

N78-28405 L 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 No Feb 1978 11 p refs (For primary document see N78-28397 19-34) Avail NTIS HC A11/MF A01 CSCL 20D

The unsteady Kutta-Joukowski condition, dynamic stall on oscillating airfoils, and unsteady shock wave-boundary layer interaction are discussed. Emphasis is placed on developing reliable prediction techniques and suppression of unsteady separation on oscillating control surfaces, wings, and rotating blades to improve aerodynamic stability.

J M S

N78-28406 L 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 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, and the Vosker-Stocks equations. Empirical methods for estimating unsteady airfoils on oscillating airfoils are also described. 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 sinusoidal oscillations, mean angle, and type of motion.

J M S

N78-29044 L National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL INVESTIGATION OF HINGELESS HELICOPTER ROTOR-BODY STABILITY IN HOVER
William G. Bousman
Jun 1978 49 p refs Prepared in cooperation with US Army Aviation Research and Development Command, St. Louis, Mo. (NASA-TM-78489, AVRADCOM TR-78-171AM) Avail NTIS HC A03/MF A01 CSCL 02A

Model tests of a 1.62 m diameter rotor were performed to investigate the aeromechanical stability of coupled rotor-body systems in hover. Experimental measurements were made of model frequencies and damping over a wide range of rotor speeds. Good data were obtained for the frequencies of the rotor lead-lag regressing mode. The quality of the damping measurements of the body modes was poor due to nonlinear damping in the gimbal ball bearings. Simulated vacuum testing was performed using substitute blades of tantalum that reduced the effective lock number to 0.2% of the model scale value while keeping the blade inertia constant. The experimental data were compared with theoretical predictions and the correlation was in general very good.

Author

N78-32831 L National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
HOVERING IMPULSIVE NOISE: SOME MEASURED AND CALCULATED RESULTS
D. A. Boxwell

In-plane impulsive noise radiating from a hovering model rotor was measured in an anechoic environment. The hover acoustic 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 wavefront 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.

N78-32829 L National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
AN APPROXIMATE SOLUTION FOR THE FREE VIBRATIONS OF ROTATING UNIFORM CANTILEVER BEAMS
David A. Peters

Approximate solutions are obtained for the uncoupled frequencies and modes of rotating uniform cantilever beams. The frequency approximations for flab 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

N78-10117 L Systems Technology, Inc. Mountain View, Calif.
The Determination of Some Requirements for a Helicopter Flight Research Simulation Facility
J. B. Snamori

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* C. Cincinnati Univ. Ohio Dept. of Aerospace Engineering and Applied Mechanics


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


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. (Author)
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New rotation-balance apparatus for measuring airfoil lift, drag, and pitching-moment coefficients of airfoil sections

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**Subjects**

- **Chemisorption**
- **Molecular Spectra**
- **Adsorption Properties**

**References**

- Arie et al. (1987) - Implications of Pd particle size on CO chemisorption.
- Proceedings of the 7th International Conference on Catalysis, pp. 45-52.

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**Note:** This excerpt is a brief summary of a scientific study focusing on chemisorption processes. The detailed methodology and findings are outlined in the full manuscript, which is available for consultation.
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