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1979
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); Sections II and III are comprised of subject, author, contract number and report number indexes.

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

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

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

Betty Sherwood, Compiler
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SECTION 1

PUBLICATIONS
FORMAL REPORTS

N79-10842 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA
A description of the airport area, its current transportation capabilities, and recommendations for future access planning are presented. For individual titles, see N78-10943 through N78-10948.

N79-10897 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TECHNOLOGICAL CHANGE AND PRODUCTIVITY GROWTH IN THE AIR TRANSPORT INDUSTRY
Nathan Rosenberg (Stanford Univ., Calif.), Alexander Thompson (Stanford Univ., Calif.), and Steven E. Belsey Sep. 1978 101 p refs (NASA-TM-78505; A-7514) Avail: NTIS HC A06/MF A01 CSCL 02A
The progress of the civil air transport industry in the United States was examined in the light of a proposal of Enos who, after examining the growth of the petroleum industry, divided that phenomenon into two phases, the alpha and the beta; that is, the invention, first development and production, and the improvement phase. The civil air transport industry developed along similar lines with the technological progress coming in waves, each wave encompassing several new technological advances while retaining the best of the old ones. At the same time the productivity of the transport aircraft as expressed by the product of the aircraft velocity and the passenger capacity increased sufficiently to allow the direct operating cost in cents per passenger mile to continually decrease with each successive aircraft development.

N79-11964 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES COLLABORATIVE STUDY OF COSMIC-RAY NEUTRONS. 2. LOW- AND MID-LATITUDE FLIGHTS
Progress of the study of cosmic ray neutrons is described. Data obtained aboard flights from Hawaii at altitudes of 41,000 and 45,000 feet and in the range of geomagnetic latitude 17 N less than or equal to lambda less than or equal to 21 N are reported. Preliminary estimates of neutron spectra are made.

N79-15887 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HUMAN NEUROLOGICAL DEVELOPMENT: PAST, PRESENT AND FUTURE
Neurological development is considered as the major human potential. Vision, vestibular function, intelligence, and nutrition are discussed as well as the treatment of neurological disfunctions, coma, and convulsive seizures. For individual titles, see N78-15888 through N78-15889.

N79-15883 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VISUAL SIMULATION REQUIREMENTS AND HARDWARE
John C. Dusterberry In AGARD Piloted Aircraft Environ. Simulation Tech. Oct. 1978 7 p refs or primary document see N78-15973 07-09)
Requirements for an out-of-the-cockpit visual simulation system can easily lead to a set of system specifications which are clearly beyond the visual scene that can be produced by current technology. Therefore, the requirements of any proposed system must be assessed in light of the expected simulated aircraft and missions, experiments on pilot response, and available image generation and display hardware. A review is made of some of the recent experiments, and the results are related to aircraft and missions with particular emphasis on research and development simulators. Recent visual simulation hardware is considered in light of extending the range of applications of piloted aircraft simulators, and a method of design approach is proposed.

G.Y.

NASA CONTRACTOR REPORTS

X78-10063# Public Service Consultants, Seattle, Wash
NOTICE Available to U.S. Government Agencies and Their Contractors

Three alternative rate structures other than the traditional average rate to all Central Valley Project commercial power customers are reviewed. Under the recommended rate structure C, customers who purchase only project-generated power would pay the project supply charges. Those customers requiring power over and above the amount available to them from the project would pay dual charges. Tentative rates for rate structure C are 1.18 kW/mo demand charge and 3.60 mills kWh energy charge for project supply. For purchase supply, the demand charge is 2.40 kW/month and 13.92 energy charge. A R H

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


An attempt is made to provide an overview of activities going on in NASA from aeronautics to manned space flight, to exploration of other planets. Some of the spin-offs of NASA research related to the medical profession are described. The discussion focuses on the Space Shuttle, the unmanned spacecraft Seasat program, the exploration of other planets in the solar system, a water-cooled helmet, and some breakthroughs in medical diagnostic instrumentation. S.D.
NASA developed technologies were used to tackle problems associated with safety, transportation, industry, manufacturing, construction, and state and local governments. Aerospace programs were responsible for more innovations for the benefit of mankind than those brought about by either major wars, or peacetime programs. Briefly outlined are some innovations for manned space flight, satellite surveillance applications, and pollution monitoring techniques.

This bibliography lists 786 formal NASA publications, journal articles, books, chapters of books, patents, and contractor reports which appeared during 1977 or which were not included in previous annual bibliographies. Citations are arranged by directorate, type of publication, and author. Each NASA report is identified by a technical report and accession number to facilitate ordering. An author index is provided.

NASA CONTRACTOR REPORTS

Suggested Approach for Establishing a Rehabilitation Engineering Information Service for the State of California
Lo F. Christy, Gail Kelton-Fogg, Ruth Linsk, and Cynthia Vehlkamp

An ever expanding body of rehabilitation engineering technology is developing in this country, but it rarely reaches the people for whom it is intended. The increasing concern of state and federal departments of rehabilitation for this technology lag was the stimulus for a series of problem-solving workshops held in California during 1977. As a result of the workshops, the recommendation emerged that the California Department of Rehabilitation take the lead in the development of a coordinated delivery system that would eventually serve the entire state and be a model for similar systems across the nation.

G.Y.
APPROACHES IN A POWERED-LIFT STOL AIRCRAFT DISPLAYS DURING PILOTED CURVED DECELERATING FLIGHT EXPERIENCE WITH ADVANCED CONTROLS AND ISSUES IDENTIFIED IN THE COURSE OF THIS FLIGHT INVESTIGATION ARE AUTHORITY LIMITATIONS PREVENTING THE SYSTEM FROM EXCEEDING POWERPLANT AND SAS CONFIGURATION TRIM AS INFLUENCED BY ATMOSPHERIC EFFECTS AND TASKS, SUCH AS THOSE ASSOCIATED WITH MONITORING AND ADJUSTING COMPUTING CAPABILITY WITH THE LOWER FREQUENCY CONTROL-RELATED DECELERATING APPROACH PROFILES IT WAS FOUND TO BE PARTICULARLY REPRESENTATIVE OF SIMILARLY DEMANDING OPERATIONAL TASKS THAT ARE IMPORTANT TO ASSIST THE PILOT THROUGH USE OF THE FLIGHT DIRECTOR FOR A FLIGHT EXPERIMENT CONDUCTED TO ASSESS THE FEASIBILITY OF FLIGHT EXPERIENCE WITH ADVANCED CONTROLS AND DISPLAYS DURING PILOTED CURVED DECELERATING APPROACHES IN A POWERED-LIFT STOL AIRCRAFT W S HINDSON (NATL AERON. ESTAB. OTTAWA) AND G H HARDY SEP 1978 14 P REFS (NASA-TM-78527; A-7625) AVAIL. NTIS HC A02/MF A01 CSCL 01 D THE CONTROL, DISPLAY, AND PROCEDURAL FEATURES ARE DESCRIBED FOR A FLIGHT EXPERIMENT CONDUCTED TO ASSESS THE FEASIBILITY OF PILOTED STOL APPROACHES ALONG PREDEFINED, STEEP, CURVED, AND DECELERATING APPROACH PROFILES. IT WAS FOUND TO BE PARTICULARLY IMPORTANT TO ASSIST THE PILOT THROUGH USE OF THE FLIGHT DIRECTOR COMPUTING CAPABILITY WITH THE LOWER FREQUENCY CONTROL-RELATED TASKS, SUCH AS THOSE ASSOCIATED WITH MONITORING AND ADJUSTING CONFIGURATION TRIM AS INFLUENCED BY ATMOSPHERIC EFFECTS, AND PREVENTING THE SYSTEM FROM EXCEEDING POWERPLANT AND SAS AUTHORITY LIMITATIONS. MANY OF THE TECHNICAL AND PILOT RELATED ISSUES IDENTIFIED IN THE COURSE OF THIS FLIGHT INVESTIGATION ARE REPRESENTATIVE OF SIMILARLY DEMANDING OPERATIONAL TASKS THAT ARE THOUGHT TO BE POSSIBLE ONLY THROUGH THE USE OF SOPHISTICATED CONTROL AND DISPLAY SYSTEMS.

AERONAUTICS AND FLIGHT SYSTEMS

FORMAL REPORTS


N78-10064# NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AMES RESEARCH CENTER, MOFFETT FIELD, CALIF. FLIGHT EXPERIENCE WITH ADVANCED CONTROLS AND DISPLAYS DURING PILOTED CURVED DECELERATING APPROACHES IN A POWERED-LIFT STOL AIRCRAFT W S HINDSON (NATL AERON. ESTAB. OTTAWA) AND G H HARDY SEP 1978 14 P REFS (NASA-TM-78527; A-7625) AVAIL. NTIS HC A02/MF A01 CSCL 01 D THE CONTROL, DISPLAY, AND PROCEDURAL FEATURES ARE DESCRIBED FOR A FLIGHT EXPERIMENT CONDUCTED TO ASSESS THE FEASIBILITY OF PILOTED STOL APPROACHES ALONG PREDEFINED, STEEP, CURVED, AND DECELERATING APPROACH PROFILES. IT WAS FOUND TO BE PARTICULARLY IMPORTANT TO ASSIST THE PILOT THROUGH USE OF THE FLIGHT DIRECTOR COMPUTING CAPABILITY WITH THE LOWER FREQUENCY CONTROL-RELATED TASKS, SUCH AS THOSE ASSOCIATED WITH MONITORING AND ADJUSTING CONFIGURATION TRIM AS INFLUENCED BY ATMOSPHERIC EFFECTS, AND PREVENTING THE SYSTEM FROM EXCEEDING POWERPLANT AND SAS AUTHORITY LIMITATIONS. MANY OF THE TECHNICAL AND PILOT RELATED ISSUES IDENTIFIED IN THE COURSE OF THIS FLIGHT INVESTIGATION ARE REPRESENTATIVE OF SIMILARLY DEMANDING OPERATIONAL TASKS THAT ARE THOUGHT TO BE POSSIBLE ONLY THROUGH THE USE OF SOPHISTICATED CONTROL AND DISPLAY SYSTEMS.

N79-10034# NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AMES RESEARCH CENTER, MOFFETT FIELD, CALIF. AN OVERVIEW OF THE QUIET SHORT-HAUL RESEARCH AIRCRAFT PROGRAM MICHAEL D. SHOWLIN AND JOHN A. COCHRANE NOV 1978 41 P REFS (NASA-TM-78545; A-7672) AVAIL. NTIS HC A03/MF A01 CSCL 01 C AN OVERVIEW OF THE QUIET SHORT-HAUL RESEARCH AIRCRAFT (QRSA) PROGRAM IS PRESENTED, WITH SPECIAL EMPHASIS ON ITS PROPULSION AND ACOUSTIC ASPECTS. A DESCRIPTION OF THE NASA TECHNICAL PARTICIPATION IN THE PROGRAM INCLUDING WIND TUNNEL TESTING, ENGINE GROUND TESTS, AND ADVANCED AIRCRAFT SIMULATION IS GIVEN. THE AIRCRAFT AND ITS SYSTEMS ARE DESCRIBED AND MEASURED PERFORMANCE WHERE AVAILABLE IS COMPARED TO PROGRAM GOALS. PRELIMINARY DATA INDICATE THAT ADDITIONAL RESEARCH AND DEVELOPMENT ARE NEEDED IN SOME AREAS OF WHICH ACOUSTICS IS AN EXAMPLE. SOME OF THESE ADDITIONAL RESEARCH AREAS AND POTENTIAL EXPERIMENTS USING THE QRSA TO DEVELOP THE TECHNOLOGY ARE DISCUSSED. THE CONCEPT OF THE QRSA AS A NATIONAL FLIGHT RESEARCH FACILITY IS EXPLAINED.

N78-12013# NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AMES RESEARCH CENTER, MOFFETT FIELD, CALIF. APPLICATION OF SHOCK TUBES TO TRANSonic AIRFOIL TESTING AT HIGH REYNOLDS NUMBERS WILLIAM J. COOK (IOWA STATE UNIV.), MICHAEL J. CHANEY (IOWA STATE UNIV.), LEROY L. PRESLEY, AND GARY T. CHAPMAN NOV 1978 69 P REFS (NASA-TP-1268; A-6855) AVAIL. NTIS HC A04/MF A01 CSCL 01 A PERFORMANCE ANALYSIS OF A GAS-DRIVEN SHOCK TUBE SHOWS THAT TRANSONIC AIRFOIL FLOWS WITH CHORD REYNOLDS NUMBERS OF THE ORDER OF 100 MILLION CAN BE PRODUCED, WITH LIMITATIONS BEING IMPOSED BY THE STRUCTURAL INTEGRITY OF THE FACILITY OR THE MODEL. A STUDY OF FLOW DEVELOPMENT OVER A SIMPLE CIRCULAR ARC AIRFOIL AT ZERO ANGLE OF ATTACK WAS CARRIED OUT IN A SHOCK TUBE AT LOW AND INTERMEDIATE REYNOLDS NUMBERS TO ASSESS THE TESTING TECHNIQUE. RESULTS OBTAINED FROM SCHRIEGER PHOTOGRAPHY AND AIRFOIL PRESSURE MEASUREMENTS SHOW THAT TRANSONIC FLOWS SIMILAR TO THOSE PRODUCED FOR THE SAME AIRFOIL IN A WIND TUNNEL CAN BE GENERATED WITHIN THE AVAILABLE TESTING TIME IN A SHOCK TUBE WITH PROPERLY CONTOURED TEST SECTION WALLS.

N78-12018# NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AMES RESEARCH CENTER, MOFFETT FIELD, CALIF. EXPERIMENTAL INVESTIGATION OF WING FIN CONFIGURATIONS FOR ALLEVIATION OF VORTEX VIABLES OF AIRCRAFT VERNON J. RОСАW NOV 1978 38 P REFS (NASA-TM-78520; A-7593) AVAIL. NTIS HC A03/MF A01 CSCL 01 A A VARIETY OF FIN CONFIGURATIONS WERE TESTED ON A MODEL OF THE BOEING B747 IN 40 BY 80 FOOT WIND TUNNELS. THE TEST RESULTS CONFIRMD THAT A REDUCTION IN WAKE ROLLING MOMENT WAS Brought ABOUT BY THE VORTEX SHED BY THE FINS SO THAT A WIDE RANGE OF DESIGNS CAN BE USED TO ACHIEVE WAKE ALLEVIATION. IT WAS ALSO FOUND THAT THE REDUCTION IN WAKE-INDUCED ROLLING MOMENTS WAS ESPECIALLY SENSITIVE TO THE LOCATION OF THE SMALLER FINS ON THE WING AND THAT THE PENALTIES IN LIFT AND DRAG CAN PROBABLY BE MADE NEGIGIBLE BY PROPER FIN DESIGN.


Author
A simulation was performed to examine the wake patterns of an axial flow turbine and its effect on the wind tunnel. The simulations were compared with experimental data up to 40 degrees angle of attack. Results indicated good agreement with experimental data up to 40 degrees angle of attack.

Author
Data are presented that show the effects of visual and motion during cueing on pilot performance during takeoffs with engine failures. Four groups of USAF pilots flew a simulated KC-135 using four different cueing systems. The basic of these systems was of the instrument-only type. Visual scene simulation and/or motion simulation was added to produce the other systems. Learning curves, mean performance, and subjective data are examined. The results show that the addition of visual cueing results in significant improvement in pilot performance, but the combined use of visual and motion cueing results in far better performance.

The study involved a pilot-in-the-loop analysis of several system concepts and a simulator experiment to evaluate those concepts showing promise. A system was ultimately configured which yielded reasonable compromises in controllability, status information content, and the ability to regulate safety margins at some expense of the allowable low speed flight path envelope.

Author

N79-14330*/ National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

BI-DIRECTIONAL, BURIED-WIRE SKIN-FRICTION GAGE

A compact, nonobtrusive, bi-directional, skin-friction gage was developed to measure the mean shear stress beneath a three-dimensional boundary layer. The gage works by measuring the heat flux from two orthogonal wires embedded in the surface. Such a gage was constructed and its characteristics were determined for different angles of yaw in a calibration experiment in subsonic flow with a Preston tube used as a standard. Sample gages were then used in a fully three-dimensional turbulent boundary layer on a circular cone at high relative incidence, where there were regimes of favorable and adverse pressure gradients and three-dimensional separation. Both the direction and magnitude of shear friction were then obtained on the cone surface.

Author

N79-19064*/ National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

NEW NASA-AMES WIND-TUNNEL TECHNIQUES FOR STUDYING AIRPLANE SPIN AND TWO-DIMENSIONAL UNSTABLE AERODYNAMICS
Gerald N. Malcolm and Sanford S Davis In AGARD Dyn. Stability Parameters Nov. 1978 12 p refs (For primary document see N79-15061 06-08) Avail: NTIS HC A99/MF AO1 CSCL 01C

Two new wind tunnel test apparatuses were developed at NASA-Ames Research Center. The first is a rotary-balance apparatus to be used in the Ames 12-Foot Pressure Tunnel for investigating the effects of Reynolds number, spin rate, and angle of attack on the aerodynamics of fighter and general aviation aircraft in a steady spin motion. The second apparatus provides capability for oscillating a large two dimensional wing (0.5 m chord, 1.35 m span) instrumented with steady and unsteady pressure transducers in the Ames 11 x 11 ft. Transonic Wind Tunnel. A complete description of both apparatuses, their capabilities, and some typical wind tunnel results are presented.

G.Y.

N79-19814*/ National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

A SAFETY MARGIN AND FLIGHT REFERENCE SYSTEM AND DISPLAY FOR POWEDED-LIFT AIRCRAFT

A study was conducted to explore the feasibility of a safety margin and flight reference system for those powered-lift aircraft which require a backside piloting technique. The main objective was to display multiple safety margin criteria as a single variable which could be tracked both manually and automatically and which could be monitored in order to derive safety margin status.

J.M.S
Algorithms were developed that attempt to identify which sensor in a tetrad configuration has experienced a step failure. An algorithm also described that provides a measure of the confidence with which the correct identification was made. Experimental results are presented from real-time tests conducted on a three-axis motion facility utilizing an ortho-skew tetrad strapdown inertial sensor package. The effects of prediction errors and of quantization on correct failure identification are discussed as well as an algorithm for detecting second failures through prediction.

A.R.H.


An advanced structure for automatic flight control logic for powered-lift aircraft operating in terminal areas is under investigation at Ames Research Center. This structure is based on acceleration control, acceleration commands are constructed as the sum of acceleration on the reference trajectory and a corrective feedback acceleration to regulate path tracking errors. The control element of the structure, termed a Trimmap, uses a model of the aircraft aerodynamic and engine forces to calculate the control settings required to generate the acceleration commands. This report describes the design criteria for the Trimmap and derives a Trimmap model for Ames experimental augmentor wing jet STOL research aircraft. Author


An efficient algorithm for airfoil optimization is presented. The algorithm utilizes approximation concepts to reduce the number of aerodynamic analyses required to reach the optimum design. Examples are presented and compared with previous results. Optimization efficiency improvements of more than a factor of 2 are demonstrated. Improvements in efficiency are demonstrated when analysis data obtained in previous designs are utilized. The method is a general optimization procedure and is not limited to this application. The method is intended for application to a wide range of engineering design problems. S.E.G.


The inertial dynamics of a fully articulated stiff rotor blade are derived with emphasis on equations that facilitate an organized programming approach for simulation applications. The model for the derivation includes hinge offset and six degrees of freedom for the rotor shaft. Results are compared with the flapping and lead-lag equations currently used in the Rotor Systems Research Aircraft simulation model and differences are analyzed. Author


Simultaneous measurements were made of the upset responses encountered by an instrumented Learjet probe aircraft behind a Boeing 747 vortex-generating aircraft. The vortex-induced angular accelerations experienced could be predicted within 30% by a mathematical upset response model when the characteristics of the wake were well represented by the vortex model. The vortex model used in the present study adequately represented the wake flow field when the vortices dissipated symmetrically and only one vortex pair existed in the wake. L.S.


The measurement capabilities of laser velocimetry and holographic interferometry in transonic airfoil testing were demonstrated. Presented are representative results obtained with these two nonintrusive techniques on a 15.24 cm chord airfoil section. These results include the density field about the airfoil, flow angles in the inviscid flow and viscous flow properties including the turbulent Reynolds stresses. The accuracies of the density fields obtained by interferometry were verified from comparisons with surface pressure and laser velocimeter measurements. L.S.


An apparatus for experimental research into unsteady transonic flows is described. The apparatus, as installed in the NASA Ames 11 by 11 Foot Transonic Wind Tunnel, can impart full two-degree-of-freedom motion at reduced frequencies to 0.3, oscillatory amplitudes to 5.2 degs, mean angles to 12 degs, Mach numbers to 1.4 and Reynolds numbers to 12x10. The test wing is fully instrumented for dynamic waveform measurements and the data can be acquired, processed, and displayed in real-time with a new computational data acquisition system. Following a description of the apparatus, sample data from a recently completed test program is presented. L.S.


The five basic elements of the two-dimensional airfoil research program at Ames Research Center are illustrated. These elements are experimental, theoretical (including computational), validation, design optimization, and aircraft interaction. Each area is briefly discussed. J.M.S.
F


Two theoretical methods are presented for optimizing multi-element airfoils to obtain maximum lift. The analyses assume that the shapes of the various high lift elements are fixed. The objective of the design procedures is then to determine the optimum location and/or deflection of the leading and trailing edge devices. The first analysis determines the optimum horizontal and vertical location and the deflection of a leading edge slat. The structure of the flow field is established by iteratively coupling potential flow and boundary layer analysis. This design procedure does not require that flow separation effects be modeled. The second analysis determines the slat and flap deflection required to maximize the lift of a three element airfoil. This approach requires that the effects of flow separation from one or more of the airfoil elements be taken into account. The theoretical results are in good agreement with results of a wind tunnel test used to corroborate the predicted optimum slat and flap positions.

J.M.S.


An application of numerical optimization to the design of advanced airfoils for transonic aircraft showed that low-drag sections were developed for a given design Mach number without an accompanying drag increase at lower Mach numbers. This is achieved by imposing a constraint on the drag coefficient at an off-design Mach number while minimizing the drag coefficient at the design Mach number. This multiple-design-point numerical optimization has been implemented with the use of airfoil shape functions which permit a wide range of attainable profiles during the optimization process. Analytical data for the starting airfoil shape, a single design-point optimized shape, and a double design-point optimized shape are presented. Experimental data obtained in the NASA Ames two-by-two-foot wind tunnel are also presented and discussed.

L.S.


Control-display requirements for helicopters conducting decelerating approaches in the terminal area under instrument meteorological conditions were surveyed. The programs are organized on the basis of the control augmentation concepts that were considered, and the results are summarized and compared. Nine control-display combinations are hypothesized as possible candidates for future ground and in-flight investigation. Specific guidelines for the guidance relationship, control characteristics, and display presentation concepts are given.


Available: NTIS HC A23/MF A01 CSCL 01A

Three-dimensional flow separations about a 5 degree (semiapex angle, theta sub C) long, circular cone up to moderately high relative incidence, alpha/theta sub C approximately 5, were studied in the Mach number range 0.3 < M sub C < 1.8. The cone was tested in the Ames 1.8 by 1.8 m wind tunnel at Reynolds numbers, R sub L infinity, based on the cone length, L, from 4.5 times 10^6 to the 6.0 power to 13.5 times 10^6 to the 6.0 power, under nominally zero heat transfer conditions. Overall forces and mean surface pressures were compared with earlier measurements. Supportive three-dimensional laser velocimeter measurements of mean and fluctuating velocity in a slightly asymmetric vortex wake about a slender tangent ogive cylinder at incidence having respective nose and overall body fineness ratios of 3.5 and 12, are included.

G.Y.


A method is presented for computing normal force and pitching moment coefficients for slender bodies of circular and noncircular cross section alone and with lifting surfaces. A semianalytical term representing viscous separation crossflow is added to a term representing potential-theory crossflow. For bodies of revolution, computed aerodynamic characteristics agree with measured results for investigated free-stream Mach numbers from 0.6 to 2.9 and for angles of attack from 0 deg to 180 deg. For bodies of elliptic cross section, measured results are predicted well over the investigated Mach number range from 0.6 to 2.0 and the angle range from 0 deg to 60 deg. For all bodies the predictions are best at supersonic Mach numbers. For body-wing and body-wing-tail configurations, measured normal force coefficients, and centers are predicted at the upper test Mach number of 2.0. As the Mach number is decreased to 0.6, the agreement for the normal force coefficients rapidly deteriorates. When model flow-separation and vortex patterns are asymmetric, undesirable side forces are usually measured on the models at subsonic Mach numbers and, especially, the side-force coefficients decrease or vanish with increase in Mach number. decrease in nose fineness ratio, nose blunting, and flattening of body cross section.

M.M.


The effects of angle of attack on supersonic mixed compression inlet performance at four different locations about a hypothetical forebody are given. A computational method to predict optimum inlet location, orientation, and centerbody control surface design and off-design performance is described. The effects of inlet location and a forward canard on the angle-of-attack performance of a normal shock inlet at transonic speeds were studied. Proper integration of inlet location and a forward canard can enhance the angle-of-attack performance of a normal shock inlet. Two lower lip treatments for improving the angle-of-attack performance of rectangular inlets at transonic speeds are discussed.

M.M.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF A LARGE-SCALE VTOL LIFT-FAN TRANSPORT MODEL
Kiyoshi Aoyagi Apr. 1979 72 p refs (NASA-TM-78560; A-7734) Avail. NTIS HC AO4/MF A01 CSCL 01A

An investigation was conducted in the NASA-Ames 40 by 80 Foot Wind Tunnel to determine the aerodynamic characteristics of a large-scale, VTOL lift fan jet transport model. The model had two lift fans at the forward portion of the fuselage, a lift fan at each wing tip, and two lift/cruise fans at the aft portion of the fuselage. All fans were driven by tip turbines using T-58 gas generators. Results were obtained for several lift fan, exit vane deflections and lift/cruise fan thrust deflections are zero sideslip. Three component longitudinal data are presented at several fan tip speed ratios. A limited amount of six component data were obtained with asymmetric vane settings. All of the data were obtained without a horizontal tail. Downwash angles at a typical tail location are also presented.

A SIMPLIFIED ROTOR SYSTEM MATHEMATICAL MODEL FOR PILOTED FLIGHT DYNAMICS SIMULATION

The model was developed for real-time pilot-in-the-loop investigation of helicopter flying qualities. The mathematical model included the tip-path plane dynamics and several primary rotor design parameters, such as flapping hinge restraint, flapping hinge offset, blade Lock number, and pitch-flap coupling. The model was used in several exploratory studies of the flying qualities of helicopters with a variety of rotor systems. The basic assumptions used and the major steps involved in the development of the set of equations listed are described. The equations consisted of the tip-path plane dynamic equation, the equations for the main rotor forces and moments, and the equation for control phasing required to achieve decoupling in pitch and roll due to cyclic inputs.

INTERFERENCE EFFECTS OF AIRCRAFT COMPONENTS ON THE LOCAL BLADE ANGLE OF ATTACK OF A WING-MOUNTED PROPELLER

The aerodynamic interference effects on a propeller operating in the presence of different wing-body-nacelle combinations was studied. The unsteady blade angle of attack variation with azimuth angle by varying the pitch and yaw of the nacelle was minimized. Results indicate for the particular configuration of interest the minimum blade angle of attack variation occurred with the nacelle pitched downward 4.5 deg and yawed inward 3.0 deg.

FUEL-CONSERVATIVE GUIDANCE SYSTEM FOR POWER-ED-LIFT AIRCRAFT

A concept for automatic terminal area guidance, comprising two modes of operation, was developed and evaluated in flight tests. In the predictive mode, fuel efficient approach trajectories are synthesized in fast time. In the tracking mode, the synthesized trajectories are reconstructed and tracked automatically. An energy rate performance model derived from the lift, drag, and propulsion system characteristics of the aircraft is used in the synthesis algorithm. The method optimizes the trajectory for the initial aircraft position and wind and temperature profiles encountered during each landing approach. The design theory and the results of simulations and flight tests using the Augmentor Wing Jet STOL Research Aircraft are described.
CONTROL OF FOREBODY THREE-DIMENSIONAL FLOW SEPARATIONS


Some experiments involving the development of the turbulent symmetric vortex flow about the lee side of a 5 deg semicircle conical forebody at high relative incidence are discussed. The cone was immersed in a Mach 0.6 airstream at a Reynolds number of 13.5 million based on the 1.4 m axial length of the cone. Novel means of controlling the degree of asymmetry using blowing very close to the nose were investigated. Small amounts of air injected normally or tangentially to the cone surface, on one side of the leeward meridian and beneath the vortex farther from the wall, were effective in biasing the asymmetry. With this reorientation of the forebody vortexes, the amplitude of the side force could be reduced to the point where its direction was reversed. This phenomenon could be obtained either by changing the blowing rate at constant incidence or by changing incidence at constant blowing rate. Normal injection was more effective than tangential injection. An organized and stable flow structure emerged with the jet vortexes positioned above the forebody vortexes. M.M.M.

AERODYNAMICS OF A TILT-NACELLE V/STOL PROPULSION SYSTEM


Tests were performed in the Ames 40 by 80 Foot Wind Tunnel on a large-scale, tilt-nacelle V/STOL propulsion system to determine its aerodynamic characteristics. Unpowered nacelle aerodynamics and power induced effects over an angle of attack range from 0 to 105 deg are presented. It is shown that: (1) the characteristics of the unpowered nacelle can be estimated with annular airfoil data, (2) the power-induced effects on the nacelle aerodynamics are significant, and (3) pitching moment can be correlated with lift and thrust. S.E.S.

A COMPARISON OF THE V/STOL HANDLING QUALITIES OF THE VAX-1918 WITH THE REQUIREMENTS OF AGARD REPORT 877 AND MIL-F-83300

Seth B. Anderson Jul. 1979 38 p refs (NASA-TP-1494; A-7117) Avail. NTIS HC A03/MF A01 CSCL 01C

The handling qualities of the VAX-1918 VTO aircraft are compared with current V/STOL handling qualities requirements. The aircraft handling qualities were superior to other V/STOL fighter aircraft. Several deficiencies which would seriously affect shipboard V/STOL operation include: (1) poor hovering precision; (2) inadequate mechanical control characteristics; (3) nonlinear pitch and roll responses; (4) an uncommanded movement of the height control lever; (5) low pitch control sensitivity; (6) excessive dihedral effect; and (7) inadequate overall thrust response. The attitude command control system resulted in reduced pilot workload during hover and low speed flight. S.E.S.

LEADING EDGE SLAT OPTIMIZATION FOR MAXIMUM AIRFOIL LIFT


A numerical procedure for determining the position (horizontal location, vertical location, and deflection) of a leading edge slat that maximizes the lift of multielement airfoils is presented. The structure of the flow field is calculated by iteratively coupling potential flow and boundary layer analysis. This aerodynamic calculation is combined with a constrained function minimization analysis to determine the position of a leading edge slat so that the suction peak on the nose of the main airfoil is minimized. The slat position is constrained by the numerical procedure to ensure an attached boundary layer on the upper surface of the slat and to ensure negligible interaction between the slat wake and the boundary layer on the upper surface of the main airfoil. The highest angle attack at which this optimized slat position can maintain attached flow on the main airfoil defines the optimum slat position for maximum lift. The design method is demonstrated for an airfoil equipped with a leading-edge slat and a trailing edge, single-slotted flap. The theoretical results are compared with experimental data, obtained in the Ames 40 by 80 Foot Wind Tunnel, to verify experimentally the predicted slat position for maximum lift. The experimentally optimized slat position is in good agreement with the theoretical prediction, indicating that the theoretical procedure is a feasible design method. Author

EARTH WINDS, FLOW QUALITY, AND THE MINIMUM-PROTECTION INLET TREATMENT FOR THE NASA AMES 80- By 120-FOOT WIND TUNNEL COMPUTER PROGRAM

The effect of the external wind on the quality of the flow in the test section was studied. The flow quality achievable with the complex treatment as well as that with the planned minimum treatment system is discussed. A scale model coupled with on-site wind measurements demonstrated that the minimum treatment system can provide adequate test conditions in the presence of the prevailing local winds, and that test programs will not be significantly affected by adverse wind effects on the test section flow quality.

S.E.S.

N79-37499* "National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN EXAMINATION OF A GROUP-VELOCITY CRITERION FOR THE BREAKDOWN OF AN IDEALIZED VORTEX FLOW


The phenomenon of vortex breakdown is believed to be associated with a finite amplitude wave that has become trapped at the critical or breakdown location. The conditions at which the propagating waves become trapped at a certain axial location were examined by use of a group-velocity criterion implied by Landahl's general theory of wave trapping. An ideal vortex having constant vorticity and uniform axial velocity at the inlet of a slowly diverging duct was studied. The linear wave propagation analysis is applied to the base flow at several axial stations for various values of the ratio of swirl velocity to axial velocity at the inlet of the divergent duct, assuming a locally parallel flow. The dispersion relations and hence the group velocities of both the symmetric (n = 0) and asymmetric modes (n = + or - 1) were investigated. The existence of a critical state in the flow (at which the group velocity vanishes), and its relationship to the stagnation point on the axis of the duct and to the occurrence of an irregular singularity in the equations governing wave propagation in the flow field are discussed. S.E.S.

N79-29144* "National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AERODYNAMIC CHARACTERISTICS OF A LARGE-SCALE SEMISPAN MODEL WITH A SWEEPT WING AND AN AUGMENTED JET FLAP WITH HYPERMIXING NOZZLES

Thomas N. Aiken, Michael D. Falarski, and David G. Koenin Jul. 1979 87 p refs (NASA-TM-73236; A-7013) Available: NTIS HC A05/MF A01 CSCL 01A

The aerodynamic characteristics of the augmentor wing concept with hypermixing primary nozzles were investigated. A large-she scale semispan model in the Ames 40- by 80-Foot Wind Tunnel and Static Test Facility was used. The trailing-edge augmentor flap systems occupied 65% of the span and consisted of two fixed pivot flaps. The nozzle system consisted of hypermixing, lobe-mercury nozzles, and BLC slot nozzles at the forward inlet, both as ends of the throat, and at the aft flap. The entire wing leading edge was fitted with a 10% chord slot and a blowing slot. Outboard of the flap was a blown aileron. The model was tested statically and at forward speed. Primary parameters and their ranges included angle of attack from -12 to 32 degrees, flap angles of 20, 30, 45, 60, and 70 degrees, and deflection and diffusion area ratios from 1.16 to 2.22. Thrust coefficients ranged from 0 to 2.73, while nozzle pressure ratios varied from 1.0 to 2.34 Reynolds number per foot varied from 0 to 1.4 million. Analysis of the data indicated a maximum static gross augmentation of 1.53 at a flap angle of 45 degrees. Analysis also indicated that the configuration was an efficient powered lift device and that the net thrust was comparable with augmentor wings of similar static performance. Performance at forward speed was best at a diffusion area ratio of 1.37. K.L.

N79-29465* "National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A GROUP-VELOCITY CRITERION FOR BREAKDOWN OF VORTEX FLOW: AN APPLICATION TO MEASURED INLET PROFILES


Vortex flows exhibiting breakdown in a slightly divergent duct were measured. The slowly varying vortex flow field downstream of the entrance and upstream of the breakdown region is obtained numerically by using the inviscid quasi-cylindrical approximation. In these calculations, the Failer and Lebovich's experimental data were used as the starting conditions at the entrance of the duct. The group velocity of the axisymmetric mode for the asymmetric mode (n = 0) and the asymmetric modes (n = + or - 1 and n = + or - 2) are calculated for the entrance conditions. For the theoretically predicted slowly varying flow downstream of the duct, the net thrust was 45% of the profiles and of the n = 0 and n = + or - 1 modes are presented. It was concluded that the flows which subsequently undergo vortex breakdown are all predicted to be supercritical and stable to infinitesimal inviscid disturbances, including the axisymmetric as well as the nonsymmetric perturbations. M.M.M.
A low cost inertial navigation system (INS) concept is described for flight missions characterized by moderate accelerations and limited attitude variations. These missions involve general aviation aircraft, helicopters, or remotely piloted vehicles. The significance of the moderate acceleration and limited attitude is reviewed with respect to platform mechanization and instrumentation. A hybrid mechanization, partially gimbaled and partially strapdown, is presented. The INS is implemented by an unbalanced two axis gimbal system and controlled by a two degree of freedom gyro. The INS provides locally level two axis acceleration information along with pitch and roll measurements. Heading information is provided by a second gyro mounted in the inner gimbal. The system error model is equivalent to that of a conventional platform with a tilt error determined by the integral of the gyro drift rate and an equivalent accelerometer type errors are also cancelled. Rapid gyro-compensating, implemented with opened gimbal control loops, and a strapdown procedure provides calibration of gyro drift rate biases.

A.W.H.

N79-33167 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WINDB-TUNNEL INVESTIGATION OF A LARGE-SCALE V/STOL AIRCRAFT MODEL WITH WING ROOT AND WING THRUST AUGMENTORS
Kiyoshi Aoyagi and Thomas N. Aiken. Sep. 1979 60 p refs (NASA-TM-78589; A-78231). NTIS HC A04/MF A01 CSCL 01A
Tests were conducted in the Ames 40 by 80 foot wind tunnel to determine the aerodynamic characteristics of a large-scale V/STOL aircraft model with thrust augmentors. The model had a double-delta wing of aspect ratio 1.85 with augmentors located in the wing root and the wing trailing edge. The supply air for the augmentor primary nozzles was provided by the YJ-97 turbojet engine. The airflow was apportioned approximately 74 percent to the wing root augmentor and 24 percent to wing augmentor. Results were obtained at several trailing-edge flap deflections with the nozzle jet-momentum coefficients ranging from 0 to 7. Three-component longitudinal data are presented with the augmentor operating with and without the horizontal tail. A limited amount of six-component data are also presented.

Author

STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL/FIGHTER/ATTACK AIRCRAFT: HORIZONTAL ATTITUDE CONCEPT Final Report
A horizontal attitude VSTOL (HAVSTOL) supersonic fighter attack aircraft powered by RALS turbofan propulsion system is analyzed. Reaction control for subaerodynamic flight is obtained in pitch and yaw from the RALS and roll from wingtip jets powered by bleed air from the RALS duct. Emphasis is placed on the development of aerodynamic characteristics and the identification of aerodynamic uncertainties. A wind tunnel program is shown to resolve some of the uncertainties. Aerodynamic data developed are static characteristics about all axes, control effectiveness, drag, propulsion induced effects and reaction control characteristics.

G.Y.

NASA CONTRACTOR REPORTS
N79-10106 General Dynamics/Fort Worth, Tex.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT, VOLUME 1 Final Report, 1 Nov. 1977 - 31 May 1978
An assessment was made of the aerodynamic uncertainties associated with the design of a cold-deck environment VSTOL fighter/attack aircraft utilizing jet-diffuser ejectors for
vertical lift and vectored-engine-over-wing blowing for supercircular dynamic performance. Aerodynamic uncertainties were determined as those associated with the constraints which size the aircraft to a specified set of requirements. A wind tunnel model and test programs are recommended for resolving these uncertainties. G. G.

N79-10028f Northrop Corp., Hawthorne, Calif.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT, VERTICAL ATTITUDE CONCEPT Final Report, Nov. 1977 - May 1978
H. A. Gerhardt and W. S. Chen May 1978 253 p refs Sponsored in part by the David Taylor Naval Ship Research and Development Center, Bethesda, Md.
(Contract NAS9-8771)
(NASA-CR-152131) Avail: NTIS HC A12/MF A01 CSCL 01A
The aerodynamic technology for a vertical attitude VSTOL (VATOL) supersonic fighter/attack aircraft was studied. The selected configuration features a tailless clipped delta wing with leading-edge extension (LEX), maneuvering flaps, top-side inlet, twin dry engines and vectoring nozzles. A relaxed static stability is employed in conjunction with the maneuvering flaps to optimize transonic performance and minimize supersonic trim drag. Control for subsonic dynamic flight is obtained by gallimiding the nozzles in combination with wing tip jets. Emphasis is placed on the development of aerodynamic characteristics and the identification of aerodynamic uncertainties. A wind tunnel test program is proposed to resolve these uncertainties and ascertain the feasibility of the concept. Ship interfaces, flight control integration, crew station concepts, advanced weapons, avionics, and materials are discussed. G. Y.

N79-10027f Grumman Aerospace Corp., Bethpage, N.Y.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT Final Report, 1 Nov. 1977 - 23 May 1978
(Contract NAS9-8771)
(NASA-CR-152129) PDR 623-24) Avail: NTIS HC A09/MF A01 CSCL 01A
Vertical short takeoff/aircraft capability, supersonic dynamic capability, and transonic agility were investigated for the development of Fighter/attack aircraft to be accommodated on ships smaller than present aircraft carriers. Topics covered include: (1) description of viable V/STOL fighter/attack configuration (a high wing, close-coupled canard, twin-engine, control configured aircraft) which meets or exceeds specified levels of vehicle performance; (2) estimates of vehicle aerodynamic characteristics and the methodology utilized to generate them; (3) description of propulsion system characteristics and vehicle mass properties; (4) identification of areas of aerodynamic uncertainty; and (5) a test program to investigate the areas of aerodynamic uncertainty in the conventional flight mode. A. R. H.

N79-10028f Vought Corp., Dallas, Tex.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT, PHASE 1 Final Report, Nov. 1977 - May 1978
Herbert H. Driggers May 1978 182 p refs Sponsored in part by David Taylor Naval Ship Research and Development Center, Bethesda, Md.
(Contract NAS9-8772)
(NASA-CR-152132) Rep. 2-31200/BCR-79 Avail: NTIS HC A08/MF A01 CSCL 01A

A conceptual design study was performed of a vertical attitude takeoff and landing (VATOL) fighter/attack aircraft. The configuration has a close-coupled canard-delta wing, side two-dimensional ramp inlets, and two augmented turbofan engines with thrust vectoring capability. Performance and sensitivity to objective requirements were calculated. Aerodynamic characteristics were estimated based on contractor and NASA wind tunnel data. Computer simulations of VATOL transitions were performed. Successful transitions can be made, even with series post-stall instabilities, if reaction controls are properly phased. Principal aerodynamic uncertainties identified were post-stall aerodynamics, transonic aerodynamics with thrust vectoring and inlet performance in VATOL transition. A wind tunnel research program was recommended to resolve the aerodynamic uncertainties. Author

IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
Paul F. Flanagan Sep. 1978 49 p refs
(Contract NAS9-9400)
(NASA-CR-152187) Avail: NTIS HC A03/MF A01 CSCL 17G
The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmenter wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing minimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software. J. M. S.

N79-12064f AVCON Aviation Consultants, Boulder, Colo.
OPERATIONAL REQUIREMENTS FOR FLIGHT CONTROL AND NAVIGATION SYSTEMS FOR SHORT HAUL TRANSPORT AIRCRAFT
John A. Morrison May 1978 94 p refs
(Contract NAS9-9028)
(NASA-CR-152208) Avail: NTIS HC A05/MF A01 CSCL 17G
To provide a background for evaluating advanced STOL systems concepts, a number of short haul and STOL airline operations in the United States and one operation in Canada were studied. A study of flight director operational procedures for an advanced STOL research airplane, the Augmented Wing Jet STOL Research Airplane, was conducted using the STOLAND simulation facility located at the Ames Change to the advanced digital flight control system (STOLAND) installed in the Augmentor Wing Airplanes are proposed to improve the mode sequencing to simplify pilot procedures and reduce pilot workload. S. B. S.

A STUDY OF KEY FEATURES OF THE RAE ATMOSPHERIC TURBULENCE MODEL
Wayne F. Jewell and Robert K. Helfrey Oct. 1978 84 p refs
(Contract NAS9-9942)
(NASA-CR-152194) STI-TR-1126-1 Avail: NTIS HC A05/MF A01 CSCL 048
A complex atmospheric turbulence model for use in aircraft simulation is analyzed in terms of its temporal, spectral, and statistical characteristics. First, a direct comparison was made between cases of the RAE model and the more conventional Dryden turbulence model. Next the control parameters of the RAE model were systematically varied and the effects noted. The RAE model was found to possess a high degree of flexibility in its characteristics, but the individual control parameters are cross-coupled in terms of their effect on various measures of intensity, bandwidth, and probability distribution. G. G.
A METHOD FOR PREDICTING FULL SCALE BUFFET RESPONSE WITH RIGID WIND TUNNEL MODEL FLUCTUATING PRESSURE DATA. VOLUME 2: POWER SPECTRAL DENSITIES FOR METHOD ASSESSMENT

Adles M. Cunningham, Jr., David B. Benene, Darlene Watts, and Paul G. Waner. Nov. 1978 239 p refs
(Contract NAS2-7081) Avail NTIS HC A07

A METHOD FOR PREDICTING FULL SCALE BUFFET RESPONSE WITH RIGID WIND TUNNEL MODEL FLUCTUATING PRESSURE DATA. VOLUME 1: PREDICTION METHOD DEVELOPMENT AND ASSESSMENT

Adles M. Cunningham, Jr., David B. Benene, Darlene Watts, and Paul G. Waner. Nov. 1978 147 p refs
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Adles M. Cunningham, Jr., David B. Benene, Darlene Watts, and Paul G. Waner. Nov. 1978 147 p refs
(Contract NAS2-7081)

General Dynamics/Fort Worth, Tex.
validity, fidelity, and deficiencies. Future prospects are discussed and technology projections are made.

Author


HUMAN OPERATOR IDENTIFICATION MODEL AND RELATED COMPUTER PROGRAMS Final Report
K. M. Keeler and J. N. Mohr Dec. 1978 146 p
(Contract NAS2-2754)
(NASA-CR-152237) Avail: NTIS HC A07/MF A01 CSCL 0SH

Four computer programs which provide computational assistance in the analysis of man/machine systems are reported. The programs are: (1) Modified Transfer Function Program (TF); (2) Time Varying Response Program (TVRP); (3) Optimal Simulation Program (TVOP); and (4) Linear Identification Program (SCIDNT). The TV program converts the time domain state variable system representation to frequency domain transfer function system representation. The TVSR program computes time histories of the input/output responses of the human operator model. The TVOP program is an optimal simulation program and is similar to TVSR in that it produces time histories of system states associated with an operator in the loop system. The differences between the two programs are presented. The SCIDNT program is an open loop identification code which operates on the simulated data from TVOP or TVSR or real operator data from motion simulators.

G.Y.

N79-18711*# Computer Sciences Corp., Mountain View, Calif.

THE EFFECT OF A VISUAL/MOTION DISPLAY MISMATCH IN A SINGLE AXIS COMPENSATORY TRACKING TASK

(Contract NAS2-7806)
Avail: NTIS HC A20/MF A01 CSCL 0SJ

The frequency response of visual systems is typically unity from 0 to 20 rad/sec, while that of motion systems typically falls off in the vicinity of 6 rad/sec. The question arises as to what effect, if any, such a difference in servomechanism performance has upon the simulation. Is pilot performance reduced by the conflict between displays? Would a more realistic simulation occur if the visual servomechanisms were degraded to match the motion servomechanisms? Does the pilot perform and use the higher frequency information present in the visual display? The purpose of the experiment is to take a step forward toward answering these questions. Work already in the literature which is relevant is outlined. A description is then given of an experiment used to check for the effects of a difference in the performance of the visual and motion servomechanisms (the experiment uses a single-axis, compensatory, roll-tracking task). The results of the experiment are then presented and analyzed.

L.S.

N79-17801*# Lockheed-Georgia Co., Burbank

Richard C. Feagin and William D. Morrison Dec. 1978 177 p refs
(Contract NAS2-8612)
Avail: NTIS HC A09/MF A01 CSCL 01A

An empirical drag correlation technique was developed from analysis of 19 subsonic and supersonic military aircraft and 15 advanced or supercritical airfoil configurations which can be applied in conceptual and advanced aircraft design activities. The Delta Method may be used for estimating the clean wing drag polar for cruise and maneuver conditions up to buffet onset, and to approximately Mach 2.0. This technique incorporates a unique capability of predicting the off-design performance of advanced or supercritical airfoil sections. The buffet onset limit may also be estimated. The method is applicable to wind tunnel models as well as to full scale configurations. This technique has been converted into a computer code for use on the IBM 360 and CDC 7600 computer facilities at NASA AMES. Results obtained using this method to predict known aircraft characteristics are good and agreement can be obtained within a degree of accuracy judged to be sufficient for the initial process of preliminary design.

F.O.S.

N78-18972*# University of Southern Illinois, Carbondale. Dept. of Electrical Sciences and Systems Engineering.

GASP-PL/I SIMULATION OF INTEGRATED AVIONIC SYSTEM PROCESSOR ARCHITECTURES M.S. Thesis
Glen A. Brent Sep. 1978 274 p refs
(Grant NAG-2228)
Avail: NTIS HC A12/MF A01 CSCL 01D

A development study sponsored by NASA was completed in July 1977 which proposed a complete integration of all aircraft instrumentation into a single modular system. Instead of using the current single-function aircraft instruments, computers compiled and displayed inflight information for the pilot. A processor architecture called the Team Architecture was proposed. This is a hardware/software approach to high-reliability computer systems. A follow-up study of the proposed Team Architecture is reported. GASP-PL/I simulation models are used to evaluate the operating characteristics of the Team Architecture. The problem, model development, simulation programs and results are length are presented. Also included are program input formats, outputs and listings.

G.Y.


FLAP-LAG-TORSION FLUTTER ANALYSIS OF A CONSTANT LIFE ROTOR

Indarjit Chopra Jan. 1979 42 p
(Grant NAG-2317)
Avail: NTIS HC A03/MF A01 CSCL 01C

The constant lift rotor (CLR) employs a control input of pitch moment to several airfoil sections which are free to pivot on a continuous spar, allowing them to change their pitch to obtain the desired lift. A flap-lag-torsion flutter analysis of a constant lift rotor blade in hover was developed. The blade model assumes rigid body flap and lead-lag motions at the root hinge and each strip undergoes an independent torsional motion. The results are presented in terms of root locus plots of complex eigenvalues as a function of thrust. The effects of several parameters (including structural damping, center of gravity and elastic axis offset from aerodynamic center, compressibility of pitch-lag and pitch flap coupling) on the blade dynamics are examined. With a suitable combination of lag damping and pitch-flap coupling, it is possible to design a constant lift rotor blade free from flutter instability.

Author

N79-20140*# Spectron Development Labs., Inc., Costa Mesa, Calif.

FEASIBILITY STUDY OF TRANSIT PHOTON CORRELATION ANEMOMETER FOR AMES RESEARCH CENTER UNITARY WIND TUNNEL PLAN Final Report
W. T. Mayo, Jr. and A. E. Smart 7 Feb. 1979 86 p refs
(Grant NASA-2238)
Avail: NTIS HC A05/MF A01 CSCL 148

A laser transit anemometer measured a two-dimensional vector velocity, using the transit time of scattering particles between two focused and parallel laser beams. The objectives were: (1) the determination of the concentration levels and light scattering efficiencies of naturally occurring, submicron particles in the NASA/Ames unitary wind tunnel and (2) the evaluation based on these measured data of a laser transit anemometer with digital correlation processing for nonintrusive velocity measurement in this facility. The evaluation criteria were the speeds at which point velocity measurements could be realized with this technique (as determined from computer simulations) for given accuracy requirements.

J.A.M.
APPLICATIONS OF ALGEBRAIC GEOMETRY IN SYSTEM THEORY. Interim Report.
(Grant NsG-2245 Contract NO001475 C 5648 Grant AF-AFOSR-1616 78)
NASA-CR-158408 AD-A082770 AFOSR-78-184-TPI: Avail NTIS HC A03/AF01 CSCL 12A

System theory is concerned with the modeling and analysis of phenomena both natural and man-made. It is a discipline whose formal beginnings go back at least to Watt and Maxwell and much of its motivation stems from engineering problems. Before World War II, a system design and analysis were primarily an art. During and after the war technical attempts at complex variable theory were developed and applied primarily to single output systems represented by a rational function, called the transfer function. The theory of servomechanisms developed rapidly from the end of the war to the early fifties and time-domain methods were applied. The representation of transfer functions via linear, constant-coefficient, differential equations led to a renewed interest in so-called state space methods. The rapid development of the theory followed and continues today. However, the increasing complexity of the engineering and economic problems considered required greater mathematical sophistication.

AN ANALYSIS OF SHORT HAUL AIR PASSENGER DEMAND. VOLUME 2 Final Report.
Terry P. Blumer and William M. Swan 1978 132 p refs
(Grant NsG-2129 NASA-CR-152157 Avail NTIS HC A07/MF A01 CSCL OSC

Several demand models for short haul air travel are proposed and calibrated on pooled data. The models are designed to predict demand and analyze some of the motivating phenomena behind demand generation. In particular, an attempt is made to include the effects of competing modes and of alternate destinations. The results support three conclusions: (1) the auto mode is the air mode's major competitor; (2) trip time is an overriding factor in intermodal competition, with air fare at its present level appearing unimportant to the typical short haul air traveler; and (3) distance appears to be a demand generating variable and therefore, must be considered very carefully for any intercity demand model. It may be the cause of the wide range of fare elasticities reported by researchers over the past 15 years. A behavioral demand model is proposed and calibrated. It combines the travel generating effects of income and population, the effects of modal split, the sensitivity of travel to price and time, and the effect of alternative destinations satisfying the trip purpose.

EVALUATION OF THE DISCRETE VORTEX WAKE CROSS FLOW MODEL USING VECTOR COMPUTERS. PART 1:
THEORY AND APPLICATION. Jan 1979 102 p refs 2 Vol.
Contrac NAS2-9579 (NASA-CR-152270 TRW-30584-8001-RU-00-Pt-I: Avail NTIS HC A06/MF A01 CSCL 01A

The current program had the objective to modify a discrete vortex wake model to efficiently compute the aerodynamic forces and moments on high fineness ratio bodies (i.e., approximately 10.0). The approach is to increase computational efficiency by restructuring the program to take advantage of new computer vector software and by developing new algorithms when vector software is not efficiently used. An efficient program was written and substantial savings achieved. Several test cases were run for fineness ratios up to f = 16.0 and angles of attack up to 50 degrees.

EVALUATION OF THE DISCRETE VORTEX WAKE CROSS FLOW MODEL USING VECTOR COMPUTERS. PART 2:
USER'S MANUAL FOR DIVORCE. F. D. Dellenbaugh and J. F. Vitz Jan. 1979 70 p refs 2 Vol
(Contract NAS2-9579) NASA-CR-152271 TRW-30584-8002-RU-00-Pt-2: Avail NTIS HC A04/MF A01 CSCL 01A

The users manual for the Discrete Vortex Cross Flow Evaluater (DIVORCE) computer program is presented. DIVORCE was developed in FORTRAN 4 for the CDC 6600 and CDC 7600 machines. Optimal calls to a NASA vector subroutine package are provided for use with the CDC 7600.

N79-22052*# Massachusetts Inst. of Tech. Cambridge Dept. of Aeronautics and Astronautics.
AN ANALYSIS OF LONG AND MEDIUM-HAUL AIR PASSENGER DEMAND. VOLUME 1 Final Report.
Steven E. Eriksen 1978 75 p refs
(Grant NsG-2129) NASA-CR-152156 Avail NTIS HC A04/MF A01 CSCL OSC

A basic model was developed which is a two equation pair

N79-22064*# Massachusetts Inst. of Tech. Cambridge Dept. of Aeronautics and Astronautics.
AN ECONOMIC MODEL OF THE MANUFACTURERS' AIRCRAFT PRODUCTION AND AIRLINE EARNINGS
POTENTIAL. VOLUME 3 Final Report.
James T. Kneafsey and Richard M. Hill 1978 185 p refs
(Grant NsG-2129) NASA-CR-152158 Avail NTIS HC A09/MF A01 CSCL OSC

A behavioral explanation of the process of technological change in the U. S. aircraft manufacturing and airline industries is presented. The model indicates the principal factors which influence the aircraft (airframe) manufacturers in researching, developing, constructing and promoting new aircraft technology, and the financial requirements which determine the delivery of new aircraft to the domestic trunk airlines. Following specification and calibration of the model, the types and numbers of new aircraft were estimated historically for each airlines fleet. Examples of possible applications of the model to forecasting an individual airline's future fleet also are provided. The functional form of the model is a composite which was derived from several preceding econometric models developed on the foundations of the economics of innovation, and represents an important contribution to the improved understanding of the economic and financial requirements for aircraft selection and production. The model's primary application will be to forecast the future types and numbers of new aircraft required for each domestic airline's fleet.

A R. H.
To quantify the installed performance of high speed (M = 0.8) turboprop propulsion systems, an experimental program designed to assess the magnitude of the aerodynamic interference of a propeller slipstream on a supercritical wing has been conducted. The test was conducted in the NASA Ames 14-foot wind tunnel. An ejector-nacelle propeller slipstream simulator was used to produce a slipstream with characteristics typical of advanced propellers presently being investigated. A supercritical wing-body configuration was used to evaluate the interference effects. A traversing total pressure rake was used to make flow field measurements behind the wing and to calibrate the slipstream simulator. The results indicated that the interference drag amounted to an increase of ten counts or about 3% of the wing-body drag for a two engine configuration at the nominal propeller operating conditions. However, at the higher swirl angles (11 deg vs. 7 deg nominally) the interference drag was favorable by about the same magnitude.

Author

N79-38008 § McDonnell Aircraft Co., St. Louis, Mo.
THRUST AND MASS FLOW CHARACTERISTICS OF FOUR 38 INCH DIAMETER TIP TURBINE FAN THRUST VECTORIZING SYSTEMS IN AND OUT OF GROUND EFFECT
(Contract NAS2-9690) (NASA-CR-152239) MDC-A5704
Avail: NTIS HC AO6/MF AO1 CSDL 21E

The calibration tests carried out on the propulsion system components of a 70 percent scale, powered model of a NASA 3-fan V/STOL aircraft configuration are described. The three X3/6B/T5B turboprop fan units used in the large scale powered model were tested on an isolated basis over a range of ground heights from H/D = 1.02 to infinity. A higher pressure ratio LF336/J85 fan unit was tested over a range of ground heights from 1.55 to infinity. The results of the test program demonstrated that: (1) the thrust and mass flow performance of the X376B/T5B nose lift unit is essentially constant for H/D variations down to 1.55; at H/D = 1.02 back pressurization of the fan exit occurs and is accompanied by an increase in thrust of five percent; (2) a change in nose fan exit hub shape from flat plate to hemispherical produces no significant difference in loavered lift nozzle performance for height variations from H/D = 1.02 to infinity; (3) operation of the nose lift nozzle at the higher fan pressure ratio generated by the LF336/J85 fan system causes no significant change in ground proximity performance down to an H/D of 1.55, the lowest height tested with this unit; and (4) the performance of the left and right X376B/T5B lift/cruise units in the vertical lift mode remains unchanged, within plus or minus two percent for the range of ground heights from H/D = 1.02 to infinity.

J.M.S.
A WIND-TUNNEL INVESTIGATION OF TILT-ROTOR GUST ALLEVIATION SYSTEMS
Norman D. Ham and H. Philip Whitaker
Jan. 1978 140 p refs
(Contract NAS2-7282)
(NASA-CR-152264; ASRL-TR-174-7) Avail: NTIS HC A07/MF A01 CSCL O1C
The alleviation of the effects of gusts on tilt rotor aircraft by means of active control systems was investigated. The gust generator, the derivation of the equations of motion of the rotor wing combination, the correlation of these equations with the results of wind tunnel model tests, the use of the equations to design various gust alleviating active control systems, and the testing and evaluation of these control systems by means of wind tunnel model tests were developed.

INVESTIGATION OF A LASER DOPPLER VELOCIMETER SYSTEM TO MEASURE THE FLOW FIELD AROUND A LARGE SCALE V/STOL AIRCRAFT IN GROUND EFFECT
Andrew D. Zalay, Melvin R. Brashers, Archie J. Jordan, Kenneth R. Shridcr, and Carl D. Vought
May 1979 76 p refs Document includes a microfiche supplement
(Contract NAS2-8959)
(NASA-CR-152212; LMSC-HREC-TR-DS68) Avail: NTIS HC E04/MF A01 CSCL 14B
The flow field measured around a hovering 70 percent scale vertical takeoff and landing (V/STOL) aircraft model is described. The velocity measurements were conducted with a ground based laser Doppler velocimeter. The remote sensing instrumentation and experimental tests of the velocity surveys are discussed. The distribution of vertical velocity in the fan jet and fountain, the radial velocity in the wall jet and the horizontal velocity along the aircraft underside are presented for different engine rpms and aircraft height above ground. Results show that it is feasible to use a mobile laser Doppler velocimeter to measure the flow field generated by a large scale V/STOL aircraft operating in ground effect.

H. C. Curtiss, Jr., T. Komatsuzaki, and J. J. Traybar
Jul. 1979 178 p refs
(Grant NsG-2095; Contract DAAG29-76-C-00271)
The influence of single loop feedbacks to improve the stability of the system are considered. Reduced order dynamic models are employed where appropriate to promote physical insight. The influence of fuselage freedom on the aeroelastic stability, and the influence of the airframe flexibility on the low frequency modes of motion relevant to the stability and control characteristics of the vehicle were examined.

V. R. Stewart
May 1979 118 p
(Contract NAS2-8982)
(NASA-CR-152348; NR79H-12-Vol-2) Avail: NTIS HC A21/MF A01 CSCL O1A
The following test results are appended: (1) wind tunnel data, (2) static thrust stand data, and (3) fan calibration data

Krishnaswamy S. Alavamudan and Wesley L. Harris
Jan. 1978 158 p refs Submitted for publication
(Grant NsG-2095; Contract DAAG29-76-C-00271)
A simplified Mach number scaling law is obtained for rotational and broadband noise components of a model helicopter rotor. The broadband noise sources are further classified into low frequency and high frequency components. The scaling laws are based on the geometric and performance parameters of the rotor and characteristics of the flow field. The existing theory of Lowson and Oillerhead is used deriving the conventional sixth power law for the rotational noise of geometrically similar blades operating in similar flow environments. The knowledge of unsteady aerodynamics was exploited to yield analytical formulation for the low frequency broadband radiation. The ambiguous state of the art regarding the origin and nature of high frequency broadband noise does not permit such a straightforward scaling law for this frequency regime. Vortices are assumed to be shed at unknown Strouhal frequency and the scaling law is derived by simply integrating the blade sectional velocity over the span. The MIT 5 x 7 1/2 foot anechoic wind tunnel was used to perform experiments at controlled flow environment. Turbulence was generated at the inlet of the tunnel and simultaneous measurements of acoustic and turbulence signals were made. The experimentally obtained results are compared with the computed intensities and spectra of rotational noise, low frequency broadband noise and high frequency broadband noise from model rotors.

AN IN-FLIGHT SIMULATOR INVESTIGATION OF ROLL AND YAW CONTROL POWER REQUIREMENTS FOR STOL APPROACH AND LANDING: DEVELOPMENT OF CAPABILITY AND PRELIMINARY RESULTS
D. R. Ellis and S. C. Raisinghani
Apr. 1979 44 p refs
(Contract NAS2-7350)
(NASA-CR-152307; MAE-1422) Avail: NTIS HC A03/MF A01 CSCL O1C
A six-degree-of-freedom variable-respond research aircraft was used to determine the minimum lateral-directional control power required for desirable and acceptable levels of handling qualities for the STOL landing approach task in a variety of simulated atmospheric disturbance conditions for a range of lateral-directional response characteristics. Topics covered include the in-flight simulator, crosswind simulation, turbulence simulation, test configurations, and evaluation procedures. Conclusions based on a limited testing of simulated STOL transport configurations flown to touchdown out of 6 deg. 75 kt MLS approaches, usually with a sidestep maneuver are discussed. A.R.H

N79-30138#* Rail Co, Baltimore, Md.
MAINTENANCE COST STUDY OF ROTARY WING AIRCRAFT, PHASE 2 Interim Report
Aug. 1978 34 p
(Contract NASA-2143)
(NASA-CR-152291) Avail: NTIS HC A03/ MF A01 CSCL 02A
The Navy's maintenance and materials management data base was used in a study to determine the feasibility of predicting unscheduled maintenance costs for the dynamic systems of military rotary wing aircraft. The major operational and design variables were identified and the direct maintenance man hours per flight hour were obtained by step-wise multiple regression analysis. Five nonmilitary helicopter users were contacted to supply data on which variables were important factors in civil applications. These uses included offshore oil exploration and support, police and fire department rescue and enforcement, logging and heavy equipment movement, and U.S. Army military operations. The equations developed were highly effective in predicting unscheduled direct maintenance man hours per flying hours for military aircraft, but less effective for commercial or public service helicopters, probably because of the longer mission durations and the much higher utilization of civil users. A.R.H

UNSTEADY FLOW MODEL FOR CIRCULATION-CONTROL AIRFOILS
Balusu M. Rao Jun. 1979 28 p refs
(Contract NASA-10132)
(NASA-CR-152301) Avail: NTIS HC A03/ MF A01 CSCL 01A
An analysis and a numerical lifting surface method are developed for predicting the unsteady airloads on two-dimensional circulation control airfoils in incompressible flow. The analysis and the computer program are validated by correlating the computed unsteady airloads with test data and also with other theoretical solutions. Additionally, a mathematical model for predicting the bending-torsion flutter of a two-dimensional airfoil (a reference section of a wing or rotor blade) and a computer program using an iterative scheme are developed. The flutter program has a provision for using the CC airflow programs or the Theodorsen hard flap solution to compute the unsteady lift and moment used in the flutter equations. The adopted mathematical model and the iterative scheme are used to perform a flutter analysis of a typical CC rotor blade reference section. The program seems to work well within the basic assumption of the incompressible flow. Author

N79-30193#* Massachusetts Inst of Tech., Cambridge Lab for Information and Decision Systems
VTOL CONTROLS FOR SHIPBOARD LANDING M.B. The problem of landing a VTOL aircraft on a small ship in rough seas using an automatic controller is examined. The controller design uses the linear quadratic Gaussian results of modern control theory. Linear time invariant dynamic models are developed for the aircraft, ship, and waves motions. A hover controller commands the aircraft to track position and orientation of the ship deck using only low levels of control power. Commands for this task are generated by the solution of the steady state linear quadratic gaussian regulator problem. Analytical performance and control requirement tradeoffs are obtained. A landing controller commands the aircraft from stationary hover along a smooth, low free speed trajectory, to a touchdown on a predicted crest of ship motion. The design problem is formulated and solved as an approximate finite-time linear quadratic stochastic regulator. Performance and control results are found by Monte Carlo simulations. K.L

N79-31195#* Lockheed-Georgia Co., Marietta
CORRELATION OF DATA RELATED TO SHOCK-INDUCED TRAILING-EDGE SEPARATION AND EXTRAPOLATION TO FLIGHT REYNOLDS NUMBER
J. F. Cahill and P. C. Connor Washington NASA Sep. 1979 82 p refs
(Contract NASA-9331)
(NASA-CR-3178) Avail: NTIS HC A05/ MF A01 CSCL 01C
Pressure data from a number of previous wind tunnel and flight investigations of high speed transport wings were analyzed with the intent of developing a procedure for extrapolating low Reynolds number data to flight conditions. These analyses produced a correlation of the development of trailing-edge separation resulting from increases in Mach number and/or angle of attack and show that scale effects on this correlated separation development and the resulting shock location changes fall into a regular and apparently universal pattern. Further studies appear warranted to refine the correlation through a detailed consideration of boundary layer characteristics, and to evaluate scale effects on supercritical wings. Author

A COMPILATION AND ANALYSIS OF HELICOPTER HANDLING QUALITIES DATA, VOLUME 2: DATA ANALYSIS
Robert K. Haffley Aug. 1979 176 p refs
(Contract NASA-9344)
A compilation and an analysis of helicopter handling qualities data are presented. Multiloop manual control methods are used to analyze the descriptive data, stability derivatives, and transfer functions for a six degrees of freedom, quasi static model. A compensatory loop structure is applied to coupled longitudinal and lateral and directional equations in such a way that key handling qualities features are examined directly. A.W.H

N79-32218#* Lockheed-Georgia Co., Marietta
ESTIMATION OF TUNNEL BLOCKAGE FROM WALL PRESSURE SIGNATURES: A REVIEW AND DATA CORRELATION
J. E. Hackett, D. J. Wilks, and D. E. Lilley Mar. 1979 170 p refs
(Contract NASA-9883)
(NASA-CR-152241) Avail: NTIS HC A08/ MF A01 CSCL 14B
A method is described for estimating low speed wind tunnel blockage, including model volume, bubble separation and viscous wake effects. A tunnelcraft source/sink is derived from measured wall pressure signatures using fast algorithms to solve the inverse problem in three dimensions. Blockage may then be computed throughout the test volume. Correlations using scaled models or tests in two tunnels were made in all cases. In many cases model reference area exceeded 10% of the tunnel cross-sectional area. Good correlations were obtained regarding model surface pressures, lift drag and pitching moment. It is shown that blockage-induced velocity variations...
across the test section are relatively unimportant but axis gradients should be considered when model size is determined.

AN ANALYSIS OF PROP-FAN/ARIFRAME AERODYNAMIC INTEGRATION Final Report
M. L. Docter, C. W. Clay, and C. F. Watson
Oct. 1978 78 p
(Contract NAS2-9104) Unclassified report


Potential flow analytical techniques were used to study aerodynamic integration of the prop-fan propulsion concept with advanced, subsonic, commercial transport airframes. Three basic configurations were defined and analyzed: (1) wing-mounted prop-fan at a cruise Mach number of 0.8, (2) wing-mounted prop-fan in a low-speed configuration, and (3) aft-mounted prop-fan at a cruise Mach number of 0.8. S. B. S.

X79-10018# RAND Corp., Santa Monica, Calif.
PREDICTING COST/RELIABILITY/MAINTAINABILITY OF ADVANCED GENERAL AVIONICS EQUIPMENT
M. R. Davis, M. Kamins, and W. E. Mooz
Jun. 1978 130 p
(Contract NAS2-9450)
(NASA-CR-152149; RAND/WN-10233-NASA)


Practical problems experienced by industry and user groups in predicting the cost, reliability, and maintainability of avionics for general aviation aircraft are reviewed. The advantages and limitation of different modeling approaches for cost and reliability estimates are discussed as well as the special problems caused by the lack of historical data on maintenance costs. Suggestions are offered on how NASA might proceed in assessing these factors in the absence of reliable generalized predictive models.

A. R. H.

X79-10021# Computer Sciences Corp., El Segundo, Calif.
ELECTRONIC FOG GENERATOR FOR FLIGHT SIMULATION
Elmer E. Moots and Marry Chase
Jul. 1978 25 p
(Contract NAS2-9741)
(NASA-CR-152265)


At NASA/Ames Research Center, a color television monitor is located at the windscreen of a flight simulator to present the pilot's visual flight display. A Fog Generator blends an electronically generated high-altitude blue sky, fog, haze, or cloud representation with the pilot's visual display. The result is a reliable, repeatable, computer-controlled visual scene, which adds to the realism of simulated flight.

L. S.

X79-10101# Systems Technology, Inc., Hawthorne, Calif.
SIMULATION MODEL OF CESSNA 402-B Final Report
Sep. 1977 Jul. 1978
Roger H. Hoh, David G. Mitchell, and Thomas T. Myers
Jul. 1978 138 p
(Contract NAS2-9735)
(NASA-CR-152176; TR-1112-1)


A simulation model for the NASA Cessna 402B was developed. The aerodynamic data were generated by adjusting full scale wind tunnel data from a similar configuration (Cessna 310) using analytical and empirical techniques. Lift and drag estimates were adjusted based on performance data obtained from flight test. Asymmetric thrust effects were not modeled. The engine model was based on data obtained from the manufacturer and flight test measurements. The longitudinal control system model included the bobweight and downspring effects, as well as coulomb friction. Aileron and rudder friction and breakout forces were also included in the model. The Cessna 402B Navomatic autopilot was given in simulation block diagram form.

J. A. M.

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


Fuel-conservative procedures have been investigated using real-time air traffic control simulations linked to two piloted simulators. The fuel-conservative procedures studied were profile descents and two types of landing approaches. The investigation determined the effect of these procedures on the ATC system and terminal area capacity. It examined the mixing of aircraft executing fuel-conservative approaches with those executing conventional approaches. The results indicate a systems fuel savings for the landing approaches under all tested conditions except at, or near, maximum system capacity. Also, there is a fuel savings and reduced controller workload for the profile descent procedures.

(Author)

Conference sponsored by the American Helicopter Society and NASA, Moffett Field, Calif., U.S. Army Air Mobility Research and Development Laboratory, 1978. 211 p. 310.00. (For individual items see A79-10904 to A79-10921)

Work on advanced concepts for helicopter designs is reported. Emphasis is on use of advanced composites, damage-tolerant design, and load calculations. Topics covered include structural design flight maneuver loads using PDP-10 flight dynamics model, use of 3-D finite element analysis in design of helicopter mechanical components, damage-tolerant design of the YUH-61A main rotor system, survivability of helicopters to rotor blade ballistic damage, development of a multilobular spar composite main rotor blade, and a bearingless main rotor structural design approach using advanced composites.

J. H.

The paper presents a method for calculating the torsional stiffness of a bearingless rotor system. Simple analyses of the torque required to produce axial deformation in a uniformly twisted flexure, nonuniform torsion of members of symmetrical open cross section without applied axial loading, and the rigidity effects of axial tension on the flexure are performed. From these analyses, the constants in the expression for torque to twist a bearingless rotor blade flexure that is axially loaded by the blade centrifugal force are calculated. P.T.H.


The paper reviews the potential benefits available from composite structures for military aircraft and discusses those issues which must ultimately be considered in establishing realistic design criteria and related operational concepts. The interrelationships among operational damage, repair limitation, and overall aircraft operational effectiveness and maintenance support costs are discussed along with how each of these issues might affect design requirements. P.T.H.


Three low radar cross section (LRCS) fuselage configurations were developed with the current UH-60A as a baseline, and several structural concepts were developed for these configurations and analyzed with respect to their effect on weight, cost, fail-safety, and maintainability. The effects on weight and cost of using advanced materials in the configurations were also evaluated. P.T.H.


The results are presented of a research and development program directed at the evaluation of NASTRAN for the efficient finite element analysis of three-dimensional mechanical components commonly found in helicopter structures. The procedures developed during this study were used for the NASTRAN analysis of the C.H-53A/D rotating swashplate. Comparison of the NASTRAN results for the stresses with experimental results demonstrate that excellent accuracy can be obtained with NASTRAN. (Author)


The author gives a report on what current trends in Soviet helicopter design are, as judged from the contents of the book 'Helicopters' by T. Ischenko et al. The optimization criteria that Soviet designers appear to be concerned with are (1) weight and transport effectiveness, (2) an economic integration of functional, producible, and operational effectiveness, and (3) general economic effect of total cost of all machines of a given type on the economy. Most attention in the review is directed at the studies of maximization of useful load. P.T.H.


This paper presents the results of research conducted on adhesively bonded sheet metal laminate construction to increase ballistic damage tolerance. Test results are presented that show ballistic damage reduced by factors of 3:1 for 7.62mm and 4:1 for 12.7mm armor piercing projectile impact on laminated aluminum specimens. Modes of failure for monolithic and laminated structures are presented and discussed. Analysis of the test results shows a reduction of ballistic damage effects of 5:1 laminate-to-monolithic, with potential for even greater gains. Reduced lateral ballistic damage and increased residual static strength, both compared to monolithic structures, combine to give the desired improvement in post-ballistic damage strength. (Author)


This paper describes a program to investigate the survivability of helicopters to rotor blade ballistic damage. The ballistic threat used in the investigation was the 23mm HEI-T. Ballistic damage to the
One of the main design goals for the YAH-64 helicopter was the practicality of employing composite structures in the construction of high-energy-absorbing landing gear components. This concept used graphite epoxy as a structural material to fabricate the trailing arm of the main landing gear of the Hughes YAH-64 helicopter by wet filament winding (WFW). The graphite arm was successfully tested, demonstrating the practicality of employing composite structures in the construction of high-energy-absorbing landing gear components.


This report covers work performed on the advanced helicopter landing gear program. The objectives of the program were to design, fabricate, and test a wheel-type advanced main landing gear concept possessing high-energy-absorbing characteristics for helicopters in the 15,000-pound class. These objectives were achieved by formulating design criteria through a data search, choosing the most cost-effective composite material, and by design analysis, selecting the most promising landing gear concept. This concept used graphite epoxy as a structural material to fabricate the trailing arm of the main landing gear of the Hughes YAH-64 helicopter by wet filament winding (WFW). The graphite arm was successfully tested, demonstrating the practicality of employing composite structures in the construction of high-energy-absorbing landing gear components.
A79-18100 # Transonic flow about a two-dimensional airfoil

Flow fields measurements are presented for a symmetrical NACA 64A010 airfoil section at transonic conditions. Measurements were obtained for three angles of attack with the free-stream Mach number fixed at 0.8. The cases studied included a weak shock wave/boundary layer interaction, an interaction of medium strength with mild separation, and an interaction of sufficient strength to produce a shock-induced stall situation. Two nondiagnostic optical techniques, laser velocimetry and holographic interferometry, were used to characterize the flows. The results include Mach number contours and flow angle distributions in the inviscid flow regions, and turbulent flow properties, including the turbulent Reynolds stresses, of the upper surface viscous layers, and of the shear. The turbulent flow measurements reveal that the turbulence fluctuations attain equilibrium with the local mean flow much faster than previously expected. (Author)


Analytic techniques were applied to study the effect on the performance of the nonlifting advancing blade when the outboard 5% of the blade is modified to reduce drag. The tip modifications consisted of reducing airfoil thickness, sweepback, and planform taper. The reductions in instantaneous drag and torque were calculated for tip speed ratios from about 0.19 to 0.30, corresponding to advancing blade tip Mach numbers of 0.855 to 0.936, respectively. Approximations required in the analysis introduce uncertainties into the computed values of drag and torque; however, the differences in the quantities should be a reasonably accurate measure of the effect of changing tip geometry. For example, at the highest tip speed, instantaneous drag and torque were reduced by 20% and 24%, respectively, for tip sweep of 40 deg on a blade using a NACA 0010 airfoil and by comparable amounts for 30-deg sweep on a blade having a NACA 0012 airfoil section. The present method should prove to be a useful, inexpensive technique for identifying promising configurations for additional study and testing. (Author)

A test of a full-scale helicopter rotor was conducted in the NASA Ames Research Center 40 by 80-Foot Wind Tunnel to investigate performance characteristics of rotors with various tip geometries. Four blade tip geometries were investigated: rectangular, trapezoidal, swept rectangular, and swept trapezoidal. The investigation was accomplished over an advance ratio range of 0.2 to 0.375 and an advancing blade Mach number range from 0.72 up to 0.97. On a power basis, the best overall tip geometry was the swept trapezoidal configuration. (Author)


A stability and control augmentation system (SCAS) was designed based on a set of comprehensive performance criteria. Linear optimal control theory was applied to determine appropriate feedback gains for the stability augmentation system (SAS). The helicopter was represented by six-degree-of-freedom rigid body equations of motion. The SAS gains were used as weightings for state and control variables. The ratio of these factors was employed as a parameter for SAS analysis and values of the feedback gains were selected on this basis to satisfy three of the performance criteria for full and partial state feedback systems. A least squares design method was used to determine the stability augmentation system (CAS) cross feed gains to satisfy the remaining seven performance criteria. The SCAS gains were then evaluated by nine degree-of-freedom equations which include flapping motion and conclusions drawn concerning the necessity of including the pitch/rolling and roll/regressing modes in SCAS analyses. (Author)


A piloted simulation study assessed various levels of stability and control augmentation designed to improve the handling qualities of several helicopters in nap-of-the-earth (NOE) flight. Five basic single rotor helicopters - one teetering, two articulated, and two hingless - which were found to have a variety of major deficiencies in a previous fixed-based simulator study were selected as baseline configurations. The stability and control augmentation systems (SCAS) include simple control augmentation systems (CAS) to decouple pitch and yaw responses due to collective input and to quicken the pitch and roll control responses; SCAS of rate command type designed to optimize the sensitivity and damping and to decouple the pitch-roll due to aircraft angular rate; and attitude command type SCAS. Pilot ratings and commentary are presented as well as performance data related to the task. SCAS control usage and their gain levels associated with specific rotor type are also discussed. (Author)


The paper reviews the special design criteria which apply to power management in a tilt-rotor aircraft. These include the need for accurate and fast control of rpm and thrust, while accounting for the dynamic interactions between rotor systems caused by cross-shafting and aircraft lateral/directional response. The power management system is also required to provide acceptable high speed sensitivity to longitudinal turbulence. It is shown that the criteria can best be met using a single governor adjusting the collective pitch by an amount proportional to a combination of the average rpm and the integral of the average rpm of the two rotors. This system is evaluated and compared with other candidate systems in hover and cruise flight. (Author)


Results of wind tunnel testing of a multi-cyclic controllable twist rotor at several flight conditions and advance ratios of 0.22 and 0.33 are evaluated. It is found that blade flatplate bending moments and root control actuator loads (fixed system) can be reduced with multi-cyclic control. Flatwise and flapping with concurrent 83% reductions in control loads were predicted. Analysis of profile power changes indicates a decrease in profile power coefficient of 0.00016, corresponding to a loss of 0.12 sq m of equivalent drag area.


The results of a theoretical investigation of the flap-lag-torsion stability of circulation controlled rotors in hover are presented. Stability boundaries are presented as a function of thrust and lag frequency, at several levels of blowing coefficient, for flap frequencies of 1.1 rev and 1.8 rev. The effects of several parameters on the blade flap-lag stability are examined, including structural damping, structural coupling, pitch-lag and pitch-flap coupling, and the blade feathering motion. The trailing edge blowing can have a major impact on the blade aeroelastic stability, which should be considered in the rotor design. The implications of these results for the current CCR and X-Wing rotorcraft designs are considered. (Author)


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The paper briefly reviews the role of helicopter systems in the provision of airport access services to evaluate the potential for the future development of such services in major metropolitan areas in the United States. The evaluation is based on a computer simulation of potential helicopter system proposed for 20 metropolitan areas. The simulation provides two indicators that are used to gauge the extent of the feasibility of developing successful systems in these areas: (1) the cost per seat mile, and (2) the break-even number of passengers, expressed as a percentage of total air travelers. It is found that a few metropolitan areas presently have the potential of marginally supporting intra-urban helicopter airport access service. The access systems offer a viable alternative for air passengers placing a high value on their time, and provides the opportunity for better integrating the air transportation service of multiple airports in a given urban region.

S.D.


The recent technical developments in the field of rotorcraft and powered-lift research, with primary emphasis on the compound helicopter and the augmentor thrust approaches to vertical flight. The last several years have seen significant developments in the state of the art through the combined use of wind tunnels, simulators, and research aircraft. The results of several representative studies are discussed to demonstrate the improvements that have been made in several of the important vehicle-related parameters. The prospect for further advances is also discussed.

B.J.


After a brief description of the Rotor Systems Research Aircraft (RSRA), the paper reviews their flight capabilities and limitations. A favorable assessment is given to the expected research capabilities of the RSRA. The structural limitations should not significantly constrain the flight envelope for research operations; the handling qualities, though not optimum, are within the parameters originally predicted; and there are no fundamental dynamics problems. Although the accuracy of the force and moment measurement system has not yet been quantified by calibration, it is expected to be acceptable after calibration.

B.J.

A79-18751 # Interaction of a strong blast wave with a free surface. A. Falade (NASA, Ames Research Center, Moffett Field; California, University, Berkeley, Calif.) and M. Holt (California, University, Berkeley, Calif.). Physics of Fluids, vol. 21, Oct. 1978, p. 1702-1708. 8 refs.

When a point source explosion is initiated at the ocean surface, the shock propagated into the water is reflected at the surface as a centered expansion wave. The solution in the neighborhood of the interaction point is obtained by writing the equations of motion in the appropriate similarity variables and then changing the independent variables to polar coordinates based at the interaction point. From the zero-order solution of the resulting equations the slopes of boundaries at the interaction point are obtained. A first-order perturbation of this solution provides more accurate representation of the flow variables and the curvature of the shock surface near the interaction point.

(Author)

A79-18752 # Surface waves generated by shallow underwater explosions. A. Falade (NASA, Ames Research Center, Moffett Field; California, University, Berkeley, Calif.) and M. Holt (California, University, Berkeley, Calif.). Physics of Fluids, vol. 21, Oct. 1978, p. 1709-1716. 14 refs.

Surface water waves generated by surface and near surface point explosions are calculated. Taking the impulse distribution imparted at the water surface by the explosion as the overriding mechanism for transferring energy of the explosive to surface wave motion, the linearized theory of Kranzer and Keller is used to obtain the wave displacement in the far field. The impulse distribution is obtained by integrating the pressure wave over an appropriate time interval on a horizontal surface just beneath the undisturbed water surface. For surface explosions, a modified form of the similarity method first used by Collins and Holt is used to obtain the flow field. In the case of submerged explosions, the flow field is estimated by making necessary modifications to Sedov's similarity solution to account for the venting that accompanies the interaction of the leading (blast) wave with the ocean surface. Surface waves generated by a charge at six depths of placement (0.15 m, 0.30 m, 0.61 m, 0.91 m, 1.37 m, 3.05 m) are considered in addition to surface explosions. The results seem to support the existence of an upper critical depth phenomenon (of the type already established for chemical explosions) for point (nuclear) explosions.

(Author)


Internal flow problems with supersonic entrance conditions and subsonic exit conditions are studied. The suitability of applying the transonic small disturbance theory to internal flows is examined and found to be very limited. The full inviscid equations in nonconservative form are solved by relaxation. Jump conditions which conserve mass and normal momentum are applied explicitly at shock waves. This method is suitable for solving flows which include supersonic-subsonic shock waves nearly normal to the streamlines.

(Author)

A numerical minimization scheme is used in conjunction with two-dimensional and three-dimensional inviscid transonic flow analysis codes to provide procedures for wing leading edge aerodynamic design. The procedures are demonstrated in the design of a new leading edge to improve C-141 cruise performance. For the high aspect ratio moderately swept C-141 wing, the 2-D procedure is shown to yield results which are in close agreement with those obtained using the 3-D technique. Although the 2-D approach uses much less computation time than the 3-D technique, the latter requires fewer manhours than the former. Comparisons of predicted and wind tunnel measured performance improvements are presented which verify the design procedures. (Author)

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A survey of the U.S. aerospace industry in late 1977 suggests that there will be an increasing use of computer-aided prediction-design technology (CFD Tech) in the aircraft development process but that, overall, only a modest reduction in wind-tunnel test requirements from the current level is expected in the period through 1995. Opinions were received from key spokesmen in 23 of the 26 solicited major companies or corporate divisions involved in the design and manufacture of nonrotary wing aircraft. Development programs for nine types of aircraft-related to test phases and wind-tunnel size and speed range were considered. M.L.


A study of the blown flap/jet flap analogy has been undertaken. Analytical predictions were made using both improved lifting line and optimized vortex lattice models for the jet flap. Results were compared with experimental data for three propulsive lift systems: the jet augmented flap, the externally blown flap, and the upper surface blown flap. Force increments due to changes in geometry and jet parameters were well approximated in most cases, although the absolute values of the aerodynamic forces were usually underestimated. The relatively simple jet flap models gave performance predictions of accuracy comparable to more complex analyses. (Author)

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Classical unsteady thin airfoil theory fails for low frequencies at the subsonic freestream Mach number, because of the formation of a shock wave that shields the forward region of the airfoil from far generated disturbances. In the present paper, the classical thin airfoil theory is modified to account for the presence and induced motion of such shocks. The modification consists of taking the steady local Mach number to be a simple step discontinuity, normal to the undisturbed flow, separating two uniform regions. Predicted regions are shown to correlate well both with the experiment and finite difference calculations. V.P.

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admitted by a high-aspect-ratio swept wing of practical interest are analyzed by solving a perturbation problem and matching its solution to that of an outer flow. The latter is identified with a linear solution involving a lifting line, but the centerline of the planform is not required to be straight and unyawed. The existence of a similarity in the three-dimensional flow structure for a certain oblique-wing geometry is demonstrated, along with a solution to the reduced problem in a high-subcritical case.


A noniterative, implicit, space-marching, finite-difference algorithm is developed for the steady thin-layer Navier-Stokes equations in conservation-law form. The numerical algorithm is applicable to steady supersonic viscous flow over bodies of arbitrary shape. In addition, the same code can be used to compute supersonic inviscid flow or three-dimensional boundary layers. Computed results from two-dimensional and three-dimensional versions of the numerical algorithm are in good agreement with those obtained from more costly time-marching techniques.


A practical procedure for the optimum design of transonic wings is demonstrated. The procedure uses an optimization program based on the method of feasible directions coupled with an aerodynamic analysis program which solves the three-dimensional potential equation for supersonic through transonic flow. Two new wings for the A-7 aircraft were designed by using the optimization procedure to achieve specified surface pressure distributions. The new wings, along with the existing A-7 wing, were tested in the Ames 11-foot transonic wind tunnel. The experimental data show that all of the performance goals were met.


The structure of a laminar, rectangular wall jet developing from an initially parabolic velocity profile was investigated with measurements of the mean and fluctuating velocity field, and with Schlieren flow visualization. The effects on mean and fluctuating velocity fields of changes in the jet Reynolds number over the range of from 0 to 4800, and of various wall lengths ranging from 0 to 312 jet widths were studied. For a given wall length and Reynolds number, disturbances in the flow field were regular and periodic, and of a constant frequency in a large region of the flow field. Small, self-excited disturbances at the nozzle exit were observed to grow exponentially with downstream distance, and roll up to form a convecting array of discrete vortices. For certain values of wall length and jet speed, discrete audible tones were detected, and appeared to be associated with an enhancement of the regularity and stability of the vortex array.


The flight dynamics of a hovering helicopter with a circulation-controlled rotor are analyzed. The influence of the rotor blowing coefficient on the calculated eigenvalues of the helicopter motion is examined for a range of values of the rotor lift, and the blade flapping frequency. The control characteristics of a helicopter with a circulation-controlled rotor are discussed. The principal effect of the blowing is a reduction in the rotor speed stability derivative. Above a critical level of blowing coefficient, which depends on the flap frequency and rotor lift, negative speed stability is produced and the dynamic characteristics of the helicopter are altered. Handling qualities of a helicopter with negative speed stability are probably unacceptable without a stability augmentation system.


Configuration and results of a wind tunnel test of the aerodynamic interactions between propeller slippstream and a supercritical wing at transonic Mach numbers are discussed. The test was conducted over a free-stream Mach number range from 0.7 to 0.84, with the slippstream simulator and the wing-body model installed in the tunnel. The angle of attack and the spanwise lift coefficients were varied from 1 to 3 deg and from 0.4 to 0.7 deg respectively, while the slippstream swirl angle was varied from 0 to 11 deg with an upwash on the inboard side of the wing. It was found that at a free-stream Mach number of 0.84, an incremental drag results for 7 deg of swirl and a slippstream Mach number of 0.87 indicated a penalty equivalent to a 0.242 loss in propeller efficiency, whereas at 11 deg the drag increment was favorable. Swirl had significant effects on the chordwise pressure distributions of the inboard section of the wing within the slippstream. Neither surface nor wake pressures showed signs of significant flow separation induced by the slippstream.


In this paper we describe a method for approximating a waveform by a spline. The method is quite efficient, as the data are processed sequentially. The basis of the approach is to view the approximation problem as a question of estimation of a polynomial in noise, with the possibility of abrupt changes in the highest derivative. This allows us to bring several powerful statistical signal processing tools into play. We also present some initial results on the application of our technique to the processing of electrocardiograms, where the knot locations themselves may be some of the most important pieces of diagnostic information.
Acoustic data were obtained during a full-scale test of the XV-15 Tilt Rotor Research Aircraft in the Ames 40- by 80-Foot Wind Tunnel. The XV-15 has two 25-ft-diameter, three-bladed rotors at the tips of a 32-ft span wing. The rotors are used as lifting rotors, compared with existing theoretical predictions which include wind-change in rotor-disk angle of attack in the helicopter configuration. The noise level was found to be sensitive to change in rotor-disk angle of attack in the helicopter configuration. Much higher noise levels and harmonic contents were found in the helicopter mode than in the airplane mode. The measurements are compared with existing theoretical predictions which include wind-tunnel wall reflections.


The static and dynamic response of a 0.5-m-chord airfoil were measured in the NASA-Ames 11- by 11-Foot Transonic Wind Tunnel. The effects of mean angle of attack, Reynolds number, oscillation mode, and frequency were investigated over a range of subsonic and transonic Mach numbers. Unsteady pressure distributions and loads on an oscillating NACA 64A010 airfoil are discussed. The unsteady pressure distributions are compared with classical subsonic theory and with newer unsteady aerodynamic codes. The experimental data are also used to assess the validity of linear and modal superposition in the transonic-flow regime. (Author)


A theoretical study has been made of the effects of flight on noise from dual-flow coaxial jets. The theory is based on an instability free, vortex sheet flow model. It is shown that the flight effects are more favorable (and hence produce less forward-arc amplification) for coaxial jets than for single-stream jets. Further, the theory predicts that, like the single-stream jet case, flight effects induce noise amplification in the forward quadrant and attenuation in the aft quadrant and have virtually no effect at 90 deg to the jet axis, where theta is the angle between the directions of conversion and emission at the retarded time. Amplification in the forward quadrant diminishes as the inner flow velocity increases and becomes optimum when the outer-to-inner velocity ratio is about 0.5. The theory also shows that the higher the outer-to-inner area ratio, the lower the forward-arc amplification due to flight. (Author)


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Twice during the spring of 1978, the two steel-plate 'flex-walls' that form the variable-geometry nozzle of the 11-by 11-foot tunnel at Ames Research Center experienced a severe dynamic instability. Both walls fluttered in the fundamental beam-bending mode and experienced stress approaching the yield strength of the material. Both flutter incidents occurred at Mach numbers of about 1.15. The tunnel, operational for 24 years, had no history of such an instability. The cause of these flutter incidents, the steps taken to prevent a recurrence, and the requalification of the facility are described. (Author)


Relationship between Randomdec analysis and conventional methods of analysis such as Fourier and modal analysis are shown. The Randomdec signature is described in terms of the Fourier amplitude coefficients. Using this result, the effect of filtering the time history is shown. For a linear, two mode model, signatures are compared to the free response of the system subjected to different initial conditions to show the relationship of displacement and acceleration signatures to the physical system. Detection and location of flaws is also discussed. (Author)


As part of a program to investigate the fluctuating pressure distribution and response behavior of a fighter aircraft in transonic maneuver, an F-5A scale model has previously been tested in an 11-by 11-foot transonic wind tunnel. The model, with a number of static and dynamic pressure transducers imbedded in the lifting surfaces was tested at various angles of attack up to 16 deg. In this paper, test results of particular interest to wake flow and horizontal tail buffet are described. It is shown that the dynamic pressure data on the tail surface at the specified flight conditions serve to determine the location of the dynamic loads. They also influence the control performance of the aircraft under maneuver conditions where buffet is encountered. The data presented demonstrate a number of contributing factors that affect the tail dynamic pressures in the transonic regime. S.D.


The problem of determining unsteady airloads on a thin, three-dimensional, planar wing oscillating with infinitesimal amplitude in a transonic flow is considered. The flow is assumed to be governed by the transonic small disturbance equation. The unsteady disturbance is taken to be a small perturbation superposed on a given steady mean flowfield. The equations governing the unsteady field, allowing for induced oscillations of any embedded shocks, are obtained. The linearization is shown to fail, locally, at the intersection of a shock with the wing surface, although the failure has little influence on the sectional characteristics of the wing. (Author)


The paper outlines the nonlinear dynamic analysis of an isolated three-degree flap-lag-feather wind turbine blade under a gravity field and with shear flow. Lagrange's equations are used to derive the nonlinear equations of motion of blade for arbitrarily large angular deflections. The limit cycle analysis for forced oscillations and the determination of the principal parametric resonance of the blade due to periodic forces from the gravity field and wind shear are performed using the harmonic balance method. Results are obtained first for a two-degree flap-lag blade, then the effect of the third degree of freedom (feather) is studied. The self-excited flutter solutions are obtained for a uniform wind and with gravity forces neglected. The effects of several parameters on the blade stability are examined, including coning angle, structural damping, Lock number, and feather frequency. The limit cycle flutter solution of a typical configuration shows a substantial nonlinear softening spring behavior. S.D.


New results on the realization of finite-dimensional, discrete-time, internally bioaffine systems are presented in this paper. The external behavior of such systems is described by multiaffine functions and the state space is constructed via Nerode equivalence relations. We prove that the state space is an affine space. An algorithm which amounts to choosing a frame for the affine space is presented. Our algorithm reduces in the linear and bilinear case to a generalization of algorithms existing in the literature. Explicit existence criteria for span-canonical realizations as well as an affine isomorphism theorem are given. (Author)


When performing tracking tasks which involve demanding controlled elements such as those with K²-squared dynamics, the human operator often develops discrete or pulsive control outputs. A dual-loop model of the human operator is discussed, the dominant adaptive feature of which is the explicit appearance of an internal model of the manipulator-controlled element dynamics in an inner feedback loop. Using this model, a rationale for pulsive control behavior is offered which is based upon the assumption that the human attempts to reduce the computational burden associated with time integration of sensory inputs. It is shown that such time integration is a natural consequence of having an internal representation of the K²-squared-controlled element dynamics in the dual-loop model. A digital simulation is discussed in which a modified form of the dual-loop model is shown to be capable of producing pulsive control behavior qualitatively comparable to that obtained in experiment. (Author)


A program initiated within NASA has emphasized the use of a data bus, microprocessors, electronic displays and data entry devices.
for general aviation. A Demonstration Advanced Avionics System (DAAS) capable of evaluating critical and promising elements of an integrating system that will perform the functions of (1) automated guidance and navigation; (2) flight planning; (3) weight and balance performance computations; (4) monitoring and warning; and (5) storage of normal and emergency check lists and operational limitations is described. Consideration is given to two major parts of the DAAS instrument panel: the integrated data control center and an electronic horizontal situation indicator, and to the system architecture. The system is to be installed in the Ames Research Center’s Cessna 402B in the latter part of 1980; engineering flight testing will begin in the first part of 1981.

V.T.


A split-film anemometer has been adapted for measurement of highly turbulent intermittently reversing flows in regions of local separation around airfoils and flaps. Analog signals from the split-film anemometer are fed directly to a mini-computer for processing and analysis. Mean velocity magnitude and direction, intermittency of reversal, turbulence intensity and histograms of the velocity are obtained as outputs of the system. (Author)


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


A theoretical model is presented of the effects of forward velocity of an aircraft at arbitrary subsonic speed on sound radiated from convecting mono-pole and dipole sources embedded in the jet flow. It is found that with increasing forward velocity there is a steadily increasing amplification (over the static case) of the sound radiated into the forward arc and a large reduction of the sound which is radiated into the rearward arc. The same trend is also shown to result 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. B.J.


Configurations of software and hardware in a no-critical-element team architecture are under study for future general aviation aircraft avionics. The team integrated avionics system, based on microprocessors, can monitor and partially interpret all flight instrument data, engine parameters, and navigation information faster than a human pilot. Simulation programs based on an event-oriented simulation language are being used to design team architectures.

J.M.B.


This report presents a viscous-inviscid calculation method for the prediction of turbulent incompressible flows in diffusers with small regions of stall. Integral turbulent boundary layer equations (BLE) are used to provide boundary conditions for a finite difference representation of the inviscid core. The BLE are applied at the floating displacement-thickness line, resulting in a simultaneous set of nonlinear block tridiagonal equations which are solved iteratively using a successive line-relaxation technique. Results of the method have been applied to calculate the performance of a variety of asymmetric stalled diffusers. (Author)


The results of a study directed toward compilation of a theoretical and experimental data base covering inlet/airframe and nozzle/afterbody integration are described, with the major emphasis on the evaluation of the adequacy for preliminary design purposes of the data base for afterbody/airframe interference effects. Prediction methods that exist for afterbody/airframe interference effects are evaluated with respect to the requirements of breadth, ease of application and accuracy that are important for preliminary design. (Author)


The application of the laser Doppler anemometer (LDA) to unsteady flows is discussed with respect to necessary features of the signal processor, properties of the optical system, and the character of the flow under investigation. The discussion of signal processors includes consideration of frequency trackers, counter-type processors, particle properties, data rates, and statistics. Secondly, detection prohibitions for an optical system are viewed with respect to spatial resolution. Finally, the total velocity field is decomposed into its subfields and the feasibility of, criteria for, and possible types of conditional sampling are defined. Several reported LDA experiments using conditional sampling are presented to demonstrate the different techniques that may be used. (Author)

Ames Research Center has under way a program to develop the technology for using turbine-powered jet engine simulators as a test technique for simulating installed jet engine characteristics in small-scale wind-tunnel models of complete VSTOL fighter configurations. The program consists of three key elements: (1) static testing SN9003 prototype turbine engine simulator (MAPS), (2) the development of the Propulsion Simulator Calibration Laboratory at Ames, and (3) the design, fabrication, and testing of a twin-engine 'closely coupled' VSTOL fighter wind-tunnel model. The model will use the Compact Multi-mission Propulsion Simulator (CMAPS) and will also be tested in flow-through and jet-effects modes to assess the effect of simultaneous inlet and nozzle flow simulation. This paper includes a description of the planned effort and anticipated future tasks.

A79-40080 #

A79-40760 #


This paper describes the design and performance of the Quiet Short-Haul Research Aircraft (QSR4) propulsion system. A discussion of the mixed-flow boundary layer control (BLC) system, which uses high and low pressure engine bleed air, is included. This system clearly affected propulsion system performance, particularly engine acceleration characteristics, requiring an integration of BLC system and powerplant controls. Funding limitations for the QSR4 Project prevented extensive full-scale testing and systems mockups, resulting in a high reliance on small-scale tests and analytical techniques. Ground tests of the actual aircraft systems showed that the extrapolation of small-scale tests and analytical techniques were in good agreement with measured full-scale results.

A79-41135 #

A79-34023 #


Relativistic calculations of radiative transition rates to L-subshell vacancy states in selected atoms with Z in the 70-96 range have been performed. The Auger and Coster-Kronig transition probabilities are calculated from perturbation theory, assuming frozen orbitals, in the Dirac-Hartree-Slater approach. Transition rates, fluorescence yields, and Coster-Kronig yields are compared with nonrelativistic theoretical results and with experiment. Relativisty is found to affect the L-subshell Auger widths by 10-25% and individual transition rates to certain j configurations by as much as 40% at Z = 80. The widths of L-subshell vacancy states and the L-subshell transition rates are much better with experiment than earlier nonrelativistic theoretical values.

A79-45334 #


An inviscid, nonconservative, three-dimensional potential flow code has been developed for computing the quasi-steady flow about an isolated lifting rotor blade. Calculations from the code were compared with chordwise pressure measurements obtained in a wind tunnel on a nonlifting rotor at transonic tip speeds at advance ratios from 0.40 to 0.55. The overall agreement between theoretical calculations and experiment was good. To illustrate the capability of the program, the flow about a hypothetical lifting rotor blade having twist, airfoil thickness taper, and a 20 deg sweepback tip was analyzed at azimuthal positions of 60, 90, and 120 deg for an advance ratio of 0.342. A typical run on a CDC 7600 computer required about 5 min for one rotor position at transonic tip speeds.

A79-42800 #


Fuel-conservative procedures have been investigated using real-time traffic control simulations linked to two piloted simulators. The fuel-conservative procedures studied were profile descents and two types of landing approaches, delayed flap and IATA. The investigation determined the effect of these procedures on the ATC system operation. It examined the mixing of aircraft executing fuel-conservative approaches with those executing conventional approaches. The most difficult approach type mix of traffic was found to be 50% conventional and 50% delayed flap. However, for the test scenario chosen, arrival rates of at least 30 aircraft per hour were feasible and resulted in a net average fuel savings, even for the most difficult mix. Also, there is a fuel savings and reduced controller workload for the profile descent procedures.

A79-42059 #


Scalar density fluctuations were measured nonintrusively in the shear layer of a 5.08 cm (2 in.) cold air jet using a crossed-beam schlieren method. Two statistics, covariance and three-dimensional spectrum function, were estimated for an exit Mach number range of 0.3 to 0.91. The density fluctuation intensity, integral scale, and eddy convection speed were calculated and compared to available data where possible. Spectra were found to change significantly in shape becoming less peaked between 3 and 9 jet diameters downstream from the orifice, but they consistently exhibited a 5/3 power law decay at 3, 6, and 9 diameters for frequencies above the peak.

A79-42059 #
This paper reviews research and operational test programs that have dealt with control and display requirements for helicopters performing decelerating approaches in the terminal area under instrument flight conditions. A survey of literature concentrating on flight programs resulted in approximately 50 applicable references which were summarized and classified according to the type of stability/control augmentation that was emphasized. On this basis, display information requirements for each control system type were hypothesized consistent with documented results of these programs. Nine control-display combinations that appear to warrant further ground simulation and flight testing are defined and discussed. 

(Author)


The objective of this study was to explore the performance of a VTOL aircraft landing approach navigation system that receives data (1) from either a microwave scanning beam (MSB) or a radar-transponder (R-T) landing guidance system, and (2) information datalinked from an aviation facility ship. State-of-the-art low-cost-aided inertial techniques and variable gain filters were used in the assumed navigation system. Compensation for ship motion was accomplished by a landing pad deviation vector concept that is a measure of the landing pad's deviation from its calm sea location. The results show that the landing guidance concepts were successful in meeting all of the current Navy navigation error specifications, provided that vector magnitude of the allowable error, rather than the error in each axis, is a permissible interpretation of acceptable performance. The success of these concepts, however, is strongly dependent on the distance measuring equipment bias. In addition, the 'best possible' closed-loop tracking performance achievable with the assumed point-mass VTOL aircraft guidance concept is demonstrated. 

(Author)


A concept for automatic terminal-area guidance, comprising two modes of operation, has been developed and evaluated in flight tests. In the first or predictive mode, fuel-efficient approach trajectories are synthesized in fast time. In the second or tracking mode, the synthesized trajectories are reconstructed and tracked automatically. An energy rate performance model derived from the lift, drag, and propulsion-system characteristics of the aircraft is used in the synthesis algorithm. The method optimizes the trajectory for the initial aircraft position and wind and temperature profiles encountered during each landing approach. The paper describes the design theory and discusses the results of simulations and flight tests using the Augmentor Wing Jet STOL Research Aircraft. 

(Author)


A compensatory tracking model of the human pilot is offered which attempts to provide a more realistic representation of the human's signal processing structure than that which is exhibited by pilot models currently in use. Two features of the model distinguish it from other representations of the human pilot. First, proprioceptive information from the control stick or manipulator constitutes one of the major feedback paths in the model, providing feedback of vehicle output rate due to control activity. Implicit in this feedback loop is a model of the vehicle dynamics which is valid in and beyond the region of crossover. Second, error-rate information is continuously derived and independently but intermittently controlled. An output injected remnant model is offered and qualitatively justified on the basis of providing a measure of the effect of inaccuracies such as time variations in the pilot's internal model of the controlled element dynamics. The data from experimental tracking tasks involving five different controlled element dynamics and one nonideal viewing condition were matched with model generated describing functions and remnant power spectral densities. 

(Author)


The results of single-pilot instrument flight rules (SPIFR) experiments conducted on the NASA-Ames V/STOLAND simulator are presented. Several factors having a significant impact on requirements for helicopter SPIFR decelerating, steep approaches to landing are considered: (1) approach weather conditions, (2) flight path geometry, (3) deceleration guidance law, (4) level of stability and command augmentation, (5) cockpit display sophistication, (6) accuracy of navigation aids, and (7) help lighting and visual aids. Particular emphasis is placed on the relative effects of deceleration profile, control augmentation, and flight director parameters on pilot performance, workload, and opinion rating. Problems associated with the development of a pilot acceptance analytical methodology are outlined. 

V.T.


Results of experimental studies on viscous cross-flow over circular cylinders for Reynolds numbers from 0.15 x 10 to the 6th to 10.9 x 10 to the 6th at Mach numbers of less than 0.3 are presented and compared with previous research and theory. Results presented include the variation of static cross-flow drag coefficients with both Reynolds number and ratio of surface roughness to model diameter, the variation of Strouhal number with Reynolds number and the dynamic variation of surface static pressure coefficients with both angular position around the cylinder and Reynolds number. The effects of end plates on flow around two-dimensional bluff bodies and of tunnel blockage on drag measurements are also discussed. 

(Author)

The effect of the walls of a wind tunnel on the subsonic, two-dimensional flow past airfoils at high angles of attack is studied by an axisymmetric flow model. The model consisted of a circular-arc bump affixed to a straight circular cylinder aligned with the flow direction. Measurements of the mean velocity, turbulence intensity, and Reynolds shear stress profiles were made in the separated flow. These data revealed the dramatic changes in the shear stress levels as the flow passed from the interaction through to reattachment. Information on the behavior of the turbulence reaction to the imposed pressure gradients, as presented in this investigation, will be required for the development of the turbulence models used in predicting nonequilibrium turbulent flow fields. (Author)


The results of an experimental investigation of shock-induced stall and leading-edge stall on a 640A010 airfoil section are presented. Advanced nonintrusive techniques - laser velocimetry, holographic interferometry, and burried-wire anemometry - were used to characterize the inviscid and viscous flow regions. The measurements include Mach contours of the inviscid flow regions, and mean velocity, flow direction and Reynolds shear stress profiles in the separated regions. The experimental observations of this study are relevant to efforts to improve surface pressure prediction methods for airfoils at or near stall. (Author)


The effect of the walls of a wind tunnel on the subsonic, two-dimensional flow past airfoils at high angles of attack is studied theoretically and experimentally. The computerized analysis, which is based on iteratively coupled potential-flow, boundary-layer, and separated-flow analyses, includes determining the effect of viscosity and flow separation on the airfoil/wall interaction. Predictions of the effects of wind-tunnel wall on the lift of airfoils are compared with wall corrections based on inviscid image analyses, and with experimental data. These comparisons are made for airfoils that are large relative to the size of the test section of the wind tunnel. It is shown that the inviscid image modeling of the wind-tunnel interaction becomes inaccurate at lift coefficients near maximum lift or when the airfoil/wall interaction is particularly strong. It is also shown that the present method of analysis (which includes boundary-layer and flow-separation effects) will provide accurate wind-tunnel wall corrections for lift coefficients up to maximum lift. (Author)


The intensities of L-shell Auger and Coster-Kronig transitions in heavy atoms have been calculated relativistically. A detailed comparison is made with measured Auger spectra of Pt and U. The pertinent transition energies were computed from relativistic wave functions with inclusion of the Breit interaction, self-energy, a vacuum-polarization correction, and complete atomic relaxation. Multiple splitting is found to contribute Auger electrons from certain transitions among several levels. The analysis leads to reassignment of a number of lines in the measured spectra. Lines originally identified as L3-L3N1 in the U spectrum are shown to arise from M4,5 Auger transitions instead. (Author)


The paper reviews the V/STOL aircraft designs pursued by industry from 1971 to 1978, with emphasis on the 1975-1978 period. Consideration is given to those designs pertaining to vertical-attitude and horizontal-attitude V/STOL types. These are divided into such concepts as tilting jet engine, lift/cruise engine, lift engine, lift/cruise fan, ejector augmentor, tilt rotor, stowed rotor, and rotor vang. B.J.


Tests were made in the NASA Ames 40 by 80 Foot Wind Tunnel of a wing semispan with a nacelle (no propeller) from a typical, general aviation twin-engine aircraft. Measurements were made of the effect on drag of the cooling air flow through the nacelle. Experimental observations of this study are relevant to efforts to improve surface pressure prediction methods for airfoils at or near stall. (Author)

The paper considers the design of fault-tolerant controllers that may endow systems with dynamic reliability. Results for jump linear quadratic Gaussian control problems are extended to include random jump costs, trajectory discontinuities, and a simple case of non-Markovian noise transitions. B.J.


It is found that under mild assumptions, feedback system stability can be concluded if one can 'topologically separate' the infinite-dimensional function space containing the system's dynamical input-output relations into two regions, one region containing the dynamical input-output relation of the 'feedforward' element of the system and the other region containing the dynamical output-input relation of the 'feedback' element. Nonlinear system stability criteria of both the input-output type and the state-space (Ljapunov) type are interpreted in this context. The abstract generality and conceptual simplicity afforded by the topological separation perspective clarifies some of the basic issues underlying stability theory and serves to suggest improvements in existing stability criteria. A generalization of Zames' (1968) conic-relation stability criterion is proved, laying the foundation for improved multivariable generalizations of the frequency-domain circle stability criterion for nonlinear systems. (Author)


The problem of determining the linear time-invariant compensator of a specified dimension which minimizes the asymptotic expected value of a quadratic form in the state variables of a linear stochastic system of arbitrary order is considered. It is shown that under appropriate assumptions, the solution of this problem can be interpreted as a minimum-order observer-based or dual observer-based compensator for an optimally aggregated model of the plant. (Author)


The isospectral deformation of a Sturm-Liouville equation is extended to general linear time-varying systems and a method is described for determining the resulting nonlinear partial differential equations. Consideration is given to (1) isospectral deformation of I/O systems with boundary value conditions and (2) the spectral vector bundles attached to linear time-varying systems. B.J.


It is noted that linear systems, depending on parameters, can occur in diverse situations including families of rational solutions to the Korteweg-de Vries equation or to the finite Toda lattice. The inverse scattering method used by Moser (1975) to obtain canonical coordinates for the finite homogeneous Toda lattice can be used for the synthesis of RC networks. It is concluded that the multivariable RC setting is ideal for the analysis of the periodic Toda lattice. B.J.


The second law of thermodynamics is studied from the point of view of stochastic control theory. We find that the feedback control laws which are of interest are those which depend only on average values, and not on sample path behavior. We are led to a criterion which, when satisfied, permits one to assign a temperature to a stochastic system in such a way as to have Carnot cycles be the optimal trajectories of optimal control problems. Entropy is also defined and we are able to prove an equipartition of energy theorem using this definition of temperature. Our formulation allows one to treat irreversibility in a quite natural and completely precise way. (Author)


It is shown that the space of sequences of length n which have an extrapolation of Mcmillan degree k, and no extrapolations of lower McMillan degree can be given the structure of a differentiable manifold. This approach makes the proof of certain known results on the partial realization problem quite straightforward and makes it possible to establish some important new results as well. A key tool is the fact, proven here, that the set of n by a real Hankel matrices of rank r is a manifold with r+1 connected components. (Author)


A coefficient assignability theorem is presented for systems defined over a commutative ring with 1. The conditions examined include all the general results on coefficient assignability available in the literature. It is concluded that the proposed technique is not effective for the case of the weaker property of pole placement when it is assumed that the commutative ring is a PID. Morse's well-known theorem seems to be the best result available for this situation. B.J.

Measurements of the transonic flow about a two-dimensional airfoil have been made with holographic interferometry and laser velocimetry. Qualitative data obtained with the interferometer are compared to the laser velocimeter and surface pressure measurements to evaluate the accuracy of the technique. Good agreement in the results confirms the two-dimensionality of the flow and the potential of the interferometer in making unsteady transonic flow measurements in the future. (Author)


A laser velocimeter has been used to study the flow surrounding a 2.13-m diameter, two-bladed, teetering model-scale helicopter rotor operating in the hover condition. The rotor system employed interchangeable blade tips over the outer 25% radius. A conventional rectangular planform and an experimental ogee tip shape were studied. The radial distribution of the blade circulation was obtained by measuring the velocity tangent to a closed rectangular contour around the airfoil section at a number of radial locations. A relationship between local circulation and bound vorticity is invoked to obtain the sectional lifting properties of the blade. The tip vortex-induced velocity was also measured immediately behind the generating blade and immediately before the encounter with the following blade. The mutual influences between blade loading, shed vorticity, and the structure of the encountered vortex are quantified by the results presented and are discussed comparatively for the rectangular and ogee planforms. The experimental loading for the rectangular tip is also compared with predictions of existing rotor analysis. (Author)


An exploratory piloted simulation was conducted to investigate the effects of the characteristics of helicopter flight control systems on instrument flight handling qualities. This joint FAA/NASA study was motivated by the need to improve instrument flight capability. A near-term objective is to assist in updating the airworthiness criteria for helicopter instrument flight. The experiment consisted of variations of single-rotor helicopter types and levels of stability and control augmentation systems (SCAS). These configurations were evaluated during an omniangle approach task under visual and instrument flight conditions. The levels of SCAS design included a simple rate damping system, collective decoupling plus rate damping, and an attitude command system with collective decoupling. A limited evaluation of stick force versus airspeed stability was accomplished. Some problems were experienced with control system maneuverings which had a detrimental effect on longitudinal stability. Pilot ratings, pilot commentary, and performance data related to the task are presented. (Author)


Airborne weather and mapping radar is a near-term, economical method of providing 'self-contained' navigation information for approaches to offshore oil rigs and its use has been rapidly expanding in recent years. A joint NASA/FAA flight test investigation of helicopter IFR approaches to offshore oil rigs in the Gulf of Mexico was initiated in June 1978 and conducted under contract to Air Logistics. Approximately 120 approaches were flown in a Bell 212 helicopter by 15 operational pilots during the months of August and September 1978. The purpose of the tests was to collect data to (1) support development of advanced radar flight director concepts by NASA and (2) aid the establishment of Terminal Instrument Procedures (TERPS) criteria by the FAA. The flight test objectives were to develop airborne radar approach procedures, measure tracking errors, determine acceptable weather minimums, and determine pilot acceptability. Data obtained will contribute significantly to improved helicopter airborne radar approach capability and to the support of exploration, development, and utilization of the Nation's offshore oil supplies. (Author)


The XV-15 Tilt Rotor Research Aircraft Project involves design, fabrication, and flight testing of two aircraft. This program is currently in the test phase for concept evaluation and substantiation of design. As part of this evaluation, one of the aircraft was tested in the NASA Ames 40-by-80-foot wind tunnel. The status of testing to date and some of the results of the wind tunnel and flight tests are presented. (Author)


Aircraft No. 2 is presently in the midst of flight envelope expansion. Noise and safety design goals have been demonstrated; preliminary results indicate that performance and component life goals may also be met. Hovering power indicates a standard hover ceiling of 7,000 feet. After 18.0 hours of flight, a true airspeed of 207 knots has been reached. The go-around speed is 300 knots cruise speed. So far, XV-15 flight tests indicate no reason why the tilt rotor concept should not fulfill its promise to provide a major step forward in air vehicle flexibility and in rotary wing performance. (Author)


The effect of nozzle spacing on ground interference forces was investigated for a two jet V/STOL aircraft design. The need for
information on the effect of jet spacing arises because of the tradeoff between mechanical complexity, which calls for close spacing, and roll control moments, which call for wider spacing. The ground interference forces on a two jet V/STOL aircraft model were measured for a range of nozzle spacings. Interference forces showed a complicated behavior with nozzle spacing, fuselage geometry, and height above ground. For some conditions a slight change in nozzle spacing resulted in a fourfold change in the interference force from 3% to 12% of the basic jet thrust. An understanding of the observed aircraft force behavior was developed using detailed measurements of the upwash flow properties, along with force and pressure measurements on a series of two-dimensional fuselage representations.

V. P.


Ardema (1974) has formally linearized the two-point bound value problem arising from a general optimal control problem, and has reviewed the known stability properties of such a linear system. In the present paper, Ardema's results are applied to the minimum time-to-climb problem. The linearized zeroth-order boundary layer equations of the problem are derived and solved.

V. P.


This study compares the results from different parameter identification methods used to determine longitudinal aircraft characteristics from flight data. In general, these comparisons have found that the estimated short-period dynamics (natural frequency, damping, transfer functions) are only weakly affected by the type of identification method; however, the estimated aerodynamic coefficients may be strongly affected by the type of identification method. The estimated values for aerodynamic coefficients were found to depend upon the type of mesh model and type of test data used with each of the identification methods. The use of complete mesh models and the use of long data lengths, combining both steady and nonsteady motion, are shown to provide aerodynamic coefficient values that compare favorably with the results from other testing methods such as steady-state flight and full-scale wind-tunnel experiments.


Singular perturbation techniques are studied for dealing with singular arc problems by analyzing a relatively low-order but otherwise general system. This system encompasses many flight mechanics problems including Goddard's problem and a version of the minimum time-to-climb problem. Boundary layer solutions are constructed which are stable and reach the outer solution in a finite time. A uniformly valid composite solution is then formed from the reduced and boundary layer solutions. The value of the approximate solution is that it is relatively easy to obtain and does not involve singular arcs. To illustrate the utility of the results, the technique is used to obtain an approximate solution of a simplified version of the aircraft minimum time-to-climb problem.

V. T.


Operational efficiency and mission reliability are key capabilities which will impact the future use of helicopters in the civil segment and areas where flight control/avionics research can play a major role. The present paper reviews flight control/avionics system needs for each major area of civil helicopter use. Technology requirements to meet civil needs are discussed. The review points out the need for the development of all-weather flight control concepts and the validation of cost effective active control/fly-by-wire/fly-by-light system concepts with modular architecture which can be tailored to specific mission requirements.

B. J.

PATENTS

N79-17847* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. CONSTANT LIFE ROTOR FOR A HEAVIER THAN AIR CRAFT Patent


US Patent Application

N79-33177* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AUTONOMOUS NAVIGATION SYSTEM Patent Application

Shmuel J. Merhev, inventor (to NASA) National Research Council.
A low cost autonomous navigation system which disposes with accelerometers used in the conventional gimbaled and strapdown inertial systems is described. The navigation system provides longitudinal and lateral vehicular specific force measurements in the locally level plane irrespective of the vehicle pitch, roll, and yaw motions. The navigation system provides longitudinal and lateral velocities in locally level geography coordinates along with vehicle position, altitude and attitude information. The system minimizes the number of sensors and system complexity, thus reducing errors, while providing a rapid method of north calibration. The system is composed of an unbalanced, pendulous, two axis gimbal system with a two degree of freedom leveling gyroscope and a heading gyroscope.

A.W.H.
S

configurations that contain both compressible and viscous effects. The capability is the ability to simulate flows about three-dimensional airfoils. The linear transonic perturbation integral equation previously derived for nonlifting airfoils is formulated for lifting cases. In order to treat shock wave motions, a strained coordinate system is used in which the shock location is invariant. The tangency boundary conditions are either formulated using the thin airfoil approximation or by using the analytic continuation concept. A direct numerical solution to this equation is derived in contrast to the iterative scheme initially used, and results of both lifting and nonlifting examples indicate that the method is satisfactory. 

A fatigue failure criterion applicable to composite materials is developed and applied to predict the fatigue behavior of graphite/epoxy laminates with particular emphasis on the influence of temperature. Tensile stress-strain curves and tension-tension fatigue curves for various unidirectional, angle ply and symmetrically balanced laminates were developed at test temperatures of 25° C, 74° C, and 114° C. For most laminates a reduction in fatigue strength and fatigue strength is observed with increasing temperature. This reduction appeared more severe in fatigue loading than in static tensile loading and most severe where the shear stress in the lamina is the dominate failure mode. Through an analytical formulation of shifting functions for the influences of temperature, all fatigue data are shown to be capable of being reduced to a single reference curve at some temperature. Examples are given which demonstrate the capability of the fatigue failure criterion to predict failure of complex symmetrically balanced laminates from relevant parameters obtained from the observed behavior of unidirectional and angle-ply laminates.

A study of the available methods for transonic airfoil and wing design indicates that the most powerful technique is the numerical optimization method. However, the computer time for this method is relatively large because of the amount of computation required in the searches during optimization. The optimization method requires that base and calibration solutions be computed to determine a minimum drag direction. The design space is then computationally searched in this direction. It is these searches that dominate the computation time. A recent similarity theory allows certain transonic flows to be calculated rapidly from the base and calibration solutions. In this paper the application of the similarity theory to design problems is examined with the object of at least partially eliminating the costly searches of the design optimization method. An example of an airfoil design is presented.

Author

N78-10080© National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif

AN EXTENSION OF A STABILITY TO ALTERNATING DIRECTION IMPLICIT METHODS
(NASA-TM-78537, A-7814) Avail NTIS HC A03/MF A01 CSCL 12A

An alternating direction implicit (ADI) scheme was constructed by the method of approximate factorization. An A-stable linear multistep method (LMM) was used to integrate a model two-dimensional hyperbolic-parabolic partial differential equation. Sufficient conditions for the A-stability of the LMM were determined by applying the theory of positive real functions to reduce the stability analysis of the partial differential equations to a simple algebraic test. A linear test equation for partial differential equations is defined and then used to analyze the stability of approximate factorization schemes. An ADI method for the three-dimensional heat equation is also presented.

Author
FILMS IN HIGH-M210 FLOWS USING HOT WIRES AND HOT FILMS

At high speed wind tunnel flows because it is typically subjected to large dynamic loads, a hot wire has a limited life in high speed wind tunnel flows. However, the fluctuation sensitivities of such probes are reduced because of various factors, leading to erroneous results. This paper describes the results of tests on some sensors in both subsonic and supersonic boundary-layer flows. A simple technique to determine dynamic calibration correction factors for the sensitivities is also presented. Author

THE ROLE OF TIME-HISTORY EFFECTS IN THE FORMULATION OF THE AERODYNAMICS OF AIRCRAFT DYNAMICS
Murray Tobak and Lewis B. Schiff /In AGARD Dyn Stability Parameters. Nov 1978 10 p refs (For primary document see N79-15081 06-08) Avail NTIS HC A99/MF A01

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-dependent 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
N79-15187# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLASH-FIRE PROPENSITY AND HEAT-RELEASE RATE STUDIES OF IMPROVED FIRE RESISTANT MATERIALS
Twenty-six improved fire resistant materials were tested for flash-fire propensity and heat release rate properties. The tests were conducted to obtain a descriptive index based on the production of ignitable gases during the thermal degradation process and on the response of the materials under a specific heat load. Author

N79-15999# Massachusetts Inst. of Tech., Cambridge, Dept. of Aeronautics and Astronautics.
VISUALLY INDUCED MOTION IN FLIGHT SIMULATION
Lawrence R. Young. In A GARD Piloted Aircraft E nviron. Simulation Tech. Oct. 1978 8 p refs (For primary document see N79-15973 07-08) (Grant NoG-2236, Contract F38615-76-C-0039) Avail. NTIS HC A14/MF A01 CSCL 01E
Visually induced yaw (circlewarming) resulting from a moving wide field presentation, and its interaction with vestibular yaw cues generated by base motion is discussed. A model is presented for the interaction between visual and motion cues in which the visual field is divided into the high frequency utilization of vestibular cues and the low frequency use of visual cues to support sustained angular velocity. The implications for fixed and moving base flight simulator design are discussed. Similar considerations apply to visually induced linear velocity (linearwarming) and interaction of m"ments in the fore-aft direction are noted. Visually induced pitch and roll are discussed and modeled in terms of conflict between the visually induced motion and the information regarding attitude based upon graviceptor signals. S.E.S

N79-16489# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMPLIFIED METHOD FOR CALCULATING THE ATMOSPHERIC HEATING RATE BY ABSORPTION OF SOLAR RADIATION IN THE STRATOSPHERE AND MESOSPHERE
Calculations of the atmospheric heating rate by absorption of solar radiation by O3, H2O, and CO2 are reported. The method needs only seven parameters for each molecule and is particularly useful for heating calculations in the dimensional global circulation models below 80 km. Applying the formula to the observed distributions of O3, H2O, and CO2 produces reasonable circulation models below 80 km. The amount of limb darkening produced by these models leads to an occultation radius of approximately 2700 km. Author

N79-16708# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHYSICAL PROPERTIES OF AEROSOLS IN TITAN'S ATMOSPHERE AS DEDUCED FROM VISIBLE OBSERVATIONS
Kathy Rages and James B. Pollack In JPL The Saturn System Dec. 1978 149-160 p refs (For primary document see N79-16758 07-91) Avail. NTIS HC A18/MF A01 CSCL 03B
Analysis of the absolute value of Titan's albedo and its variation with increasing phase angle has yielded constraints on the optical properties and average particle size of the aerosol responsible for the scattering of visible light. The real index of refraction of the scattering material lies within the range 1.5 approximately less than n approximately less than 2.0 and the average particle size is somewhere between 0.2 micrometer and 0.4 micrometer. The amount of limb darkening produced by these models leads to an occultation radius of approximately 2700 km. Author

N79-16780# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OUTER PLANET PROBE MISSIONS, DESIGNS AND SCIENCE
Lawrence Colin In JPL The Saturn System Dec. 1978 p 361-378 (For primary document see N79-16758 07-91) Avail. NTIS HC A18/MF A01 CSCL 03B
The similarities and differences of atmosphere entry probe mission designs and sciences appropriate to certain solar system objects are reviewed. Candidate payloads for Saturn and Titan probes are suggested. Significant supporting research and technology efforts are required to develop mission-pertinent technology for probe exploration of the Saturnian system. G.G

N79-16800# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUPERCRITICAL FLOW ABOUT A THICK CIRCULAR-ARC AIRFOIL
John B. McDevitt Jan. 1979 84 p refs
TRANSIENT SHUTDOWN ANALYSIS OF LOW LIQUID BLOCKAGE DIODES were considered to be the most attractive.

The supercritical flow about a biconvex circular-arc airfoil is being thoroughly documented at Ames Research Center in order to provide experimental test cases suitable for guiding and evaluating current and future computer codes. The effects of angle of attack, effects of leading and trailing-edge splitter plates, additional unsteady pressure fluctuation (buffeting) measurements and glow-field shadowgraphs, and application of an oil film technique to display separated-wake streamlines were studied. Computed and measured pressure distributions for steady and unsteady flows, using a recent computer code representative of current methodology, are compared. It was found that the numerical solutions are often fundamentally incorrect in that only strong (shock-polar terminology) shocks are captured, whereas experimentally, both strong and weak shock waves appear.

S. E. S.

N79-16918* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECT OF MOISTURE ON THE FATIGUE BEHAVIOR OF GRAPHITE/EPoxy COMPOSITE LAMINATES

S. V. Ramani (Virginia Polytechnic Inst. and State Univ., Blacksburg) and H. G. Nelson Jan 1979 49 p refs

The form of the moisture distribution in the specimen (gradient and flat profile) was considered to establish the influence of accelerated moisture conditioning on fatigue behavior. For the gradient specimens having an average moisture content of 1.4 percent, fatigue life was reduced by a factor of 8 at all stress levels investigated. Corresponding reduction in fatigue life for the flat moisture profile specimens at the same average moisture content was comparatively smaller, being about a factor of 5 from the value in dry specimens. X-ray radiographic analysis of damage accumulation in compression-compression fatigue revealed interlaminar cracking to be the dominant mode of failure responsible for the observed enhanced cyclic degradation of moisture-conditioned specimens. This finding was corroborated by the observed systematic reduction in interlaminar shear strength as a function of moisture content, which, in turn, increased the propensity for delamination under cyclic compressive loads. Residual strength measurements on cycled specimens indicated significant strength reductions at long lives, particularly in moisture conditioned specimens.

J. A. M.

N79-18287* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TRANSIENT SHUTDOWN ANALYSIS OF LOW-TEMPERATURE THERMAL DIODES

Richard L. Williams Mar 1979 21 p refs

The various thermal diodes available for use in cryogenic systems are described. Two diode types, liquid-trap and liquid-blockage diodes, were considered to be the most attractive, and thermal models were constructed to predict their behavior in the reverse mode. The diodes, which are of similar size and throughput, were also examined experimentally in a parallel test setup under nominally identical conditions. Their characteristics were ascertained in terms of forward-mode and reverse-mode conductances, shutdown times and energies, and recovery to forward-mode operation with ethane as the working fluid in the temperature range 170 K to 220 K. Results show that the liquid-blockage diode is the quicker of the two diodes to shutdown from the forward mode (8 min as opposed to 10 min).

However, the liquid-blockage diode has a larger reverse-mode conductance which results in a greater overall evaporator temperature rise. The importance of the relative size and heat inputs to the condenser/reservoir configuration of the liquid-blockage and the liquid-trap configuration for the liquid-trap diode are demonstrated. Also included are data which show the susceptibility of the diodes to recovery to forward-mode operation. Guidelines for the choice of a particular diode for an actual application are given.

J. M. S.

N79-18297* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TIME-DEPENDENT LOCAL DENSITY MEASUREMENTS IN UNSTeadY FLOWS

R. L. McKenzie, D. J. Monson, and R. J. Exberger Feb 1979 21 p refs

A laser-induced fluorescence technique for measuring the relative time-dependent density fluctuations in unsteady or turbulent flows is demonstrated. Using a 1.5-W continuous-wave Kr(+/2) laser, measurements have been obtained in 0.1-mm-diameter by 1-mm-long sampling volumes in a Mach 3 flow of N2 seeded with biacetyl vapor. A signal amplitude resolution of 2% was achieved for a detection frequency bandwidth of 10 kHz. The measurement uncertainty was found to be dominated by noise behavior as photon statistics for signal-to-noise ratios have been characterized for a wide range of detection frequency bandwidths that encompasses those of interest in supersonic turbulence measurements.

Author

N79-18946* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SOME RECENT PROGRESS IN TRANSONIC FLOW COMPUTATION


Although the development of a finite difference relaxation procedure to solve the steady form of equations of motion gave birth to the study of computational transonic aerodynamics and considerable progress has been made using the small disturbance theory, no general analytical solution method yet exists for transonic flows that include three dimensional unsteady, and viscous effects. Two techniques are described which are useful in computational transonic aerodynamics applications. The finite volume method simplifies the application of boundary conditions without introducing the construction associated with small disturbance theory. Governing equations are solved in a body-oriented and shock-oriented mesh network. Only the volume and surface normal directions of the volume elements must be known. The other method, configuration design by numerical optimization, can be used by aircraft designers to develop configurations that satisfy specific geometric performance constraints. Two examples of airfoil design by numerical optimization are presented.

A. R. H.

N79-18952* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STATUS AND PROSPECTS OF COMPUTATIONAL FLUID DYNAMICS


The use and limitations on using computational aerodynamics in approximating inviscid linear, inviscid nonlinear, viscous time averaged, and viscous time dependent flow past airfoils, wings, and aircraft is reviewed. The current status of two- and three-dimensional time averaged Navier-Stokes equation is discussed and possible applications for the 1980 and 1985 to 1990 period is projected for three-dimensional applications.

A. R. H.

N79-189018* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OUTER PLANETS PROBE TESTING

J. A. Smithkamp (McDonnell Douglas Astronautics Co. St. Louis, Mo.), M. G. Grote (McDonnell Douglas Astronautics Co., St. Louis, Mo.), and T. M. Edwards In NASA. Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 65-83 (For primary document see N79-18013 10-12)
**ADVANCES IN LOCAL AREA. MESOSCALE MODELING**


A sophisticated one dimensional physical-chemical model of the formation and evolution of stratospheric aerosols was used to predict the size and number concentration of the stratospheric aerosols as functions of time and altitude following a large volcanic eruption: increased addition of carbonyl sulfide (OCS) or sulfur dioxide (SO2) to the troposphere; increased supersonic aircraft (SST) flights in the stratosphere; and, large numbers of space shuttle (SS) flights through the stratosphere. A radiative-convective one dimensional climate sensitivity study, using the results of the aerosol formation model, was performed to assess the ground level climatic significance of these perturbations to the stratospheric aerosol layer. Volcanic eruptions and large OCS or SO2 increases could cause significant climatic changes. Currently projected SS launches and moderate fleets of SST's are unlikely to upset the stratospheric aerosol layer enough to significantly impact climate. J.M.S.

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**APPLICATION OF A COUPLED AEROSOL : RADIOACTIVE TRANSFER MODEL TO CLIMATE STUDIES OF AEROSOLS**


A sophisticated one dimensional physical-chemical model of the formation and evolution of stratospheric aerosols was used to predict the size and number concentration of the stratospheric aerosols as functions of time and altitude following a large volcanic eruption: increased addition of carbonyl sulfide (OCS) or sulfur dioxide (SO2) to the troposphere; increased supersonic aircraft (SST) flights in the stratosphere; and, large numbers of space shuttle (SS) flights through the stratosphere. A radiative-convective one dimensional climate sensitivity study, using the results of the aerosol formation model, was performed to assess the ground level climatic significance of these perturbations to the stratospheric aerosol layer. Volcanic eruptions and large OCS or SO2 increases could cause significant climatic changes. Currently projected SS launches and moderate fleets of SST's are unlikely to upset the stratospheric aerosol layer enough to significantly impact climate. J.M.S.

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**COMPUTATION OF TURBULENT NEAR WAKE FOR ASYMMETRIC AIRFOILS**


A numerical procedure for studying the turbulent near wake of two dimensional airfoil sections is presented. The Reynolds Navier-Stokes equations were written for flow about bodies of arbitrary geometry and solved on an arbitrary nonuniform curvilinear computational mesh. Eddy viscosity and Reynolds stress turbulence transport models are considered. Specific examples are shown for airfoil section by using an algebraic viscosity model with streamwise relaxation and the interactive Reynolds stress model. S.E.S.

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**DETERMINATION OF THE TELLURIC WATER VAPOR ABSORPTION CORRECTION FOR ASTRONOMICAL DATA OBTAINED FROM THE KUPER AIRBORNE OBSERVATORY**


The amount of telluric water vapor along the line of sight of the Kuiper Airborne Observatory telescope as obtained concomitantly on 23 flights is compared with the NASA-Ames Michelson interferometer and with the NOAA-Boulder radiometer. A strong correlation between the two determinations exists. and a method for computing the atmospheric transmission for a given radiometer reading is established. G.Y.

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**EXPERIMENTS ON THE LARGE-SCALE STRUCTURE OF TURBULENCE IN THE NEAR-JET REGION**


The near region of an axisymmetric, turbulent jet was
investigated. Turbulence quantities, as well as mean velocities, were measured between 3 and 23 diam away from the nozzle. The mean velocity profiles were similar over most of this distance, whereas the turbulence quantities were far from equilibrium conditions. Across the jet, the rate of large-scale turbulence varied considerably; however, a Strouhal number based on local velocity, the diameter of the jet, and the frequency of the large-scale turbulent oscillation remained relatively constant. The formation of the initial instability waves and the pairing of the vortices were examined. Turbulent fluctuations were observed only downstream of the pairing process. Author

N78-21368‡ Hughes Aircraft Co., Culver City, Calif.
DEPLOYMENT MECHANISMS ON PIONEER VENUS PROBES
Deployment mechanisms were developed to position scientific instruments during probe descent into the Venus atmosphere. Each mechanism includes a provision for pyrotechnic release of the anchoring fixtures for deployment, an active damper using a shunted dc motor. The deployment time requirement is under 2 seconds, and the deployment shock must be less than 100 g's. The mechanism is completely dry lubricated and constructed mainly of titanium for high strength and high temperature stability. The mechanism was qualified for descent decelerations up to 565 g's and for instrument alignment up to 940 F. The mechanism requirements, the hardware design details, the analytical simulations, and the qualification testing are described. J.M.S.

N78-21377‡ Hughes Aircraft Co., El Segundo, Calif.
MAGNETOMETER DEPLOYMENT MECHANISM FOR PIONEER VENUS
A new experimental sloop boom mechanism was developed to deploy magnetometers from the Pioneer Venus orbiter spanning shelf. The stowage mechanism is designed to contain the magnetometers during launch and to deploy these instruments by centrifugal force upon pyrotechnic release. Unique graphite epoxy boom segments are used for a lightweight design with sufficient strength to withstand a 7.5 g's orbit insertion force while extended. The detailed design is described, along with the test methods developed for qualification in a one-g field. Author

N78-21720‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE NASA-AMES RESEARCH CENTER STRATOSPHERIC AEROSOL MODEL. 1. PHYSICAL PROCESSES AND COMPUTATIONAL ANALOGES
Time-dependent one-dimensional model of the stratospheric sulfate aerosol layer is presented. In constructing the model, a wide range of basic physical and chemical processes are incorporated in order to avoid predetermined or biasing the model predictions. The simulation, which extends from the surface to an altitude of 68 km, includes the troposphere as a source of gases and condensation nuclei and as a sink for aerosol droplets. The size distribution of aerosol particles is resolved into 25 categories with particle radii increasing geometrically from 0.01 to 2.56 microns such that particle volume doubles between successive categories. Author

N78-21721‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
The NASA-AMES RESEARCH CENTER STRATOSPHERIC AEROSOL MODEL. 2. PHYSICAL PROCESSES AND COMPUTATIONAL ANALOGES
Time-dependent one-dimensional model of the stratospheric sulfate aerosol layer is presented. In constructing the model, a wide range of basic physical and chemical processes are incorporated in order to avoid predetermined or biasing the model predictions. The simulation, which extends from the surface to an altitude of 68 km, includes the troposphere as a source of gases and condensation nuclei and as a sink for aerosol droplets. The size distribution of aerosol particles is resolved into 25 categories with particle radii increasing geometrically from 0.01 to 2.56 microns such that particle volume doubles between successive categories. Author

N78-21962‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Electronic transition moments of seven C2 singlet and triplet band systems in the 0.2-1.2 micron spectral region were measured. The measurements were made in emission behind incident shock waves in C2H2-argon mixtures. Narrow bandpass radiometers were used to obtain absolute measurements of shock excited C2 radiation from which absolute electronic transition moments are calculated by synthetic spectrum analysis. New results are reported for the Balilik-Ramsay Phillips, Swih Deslandres-d’Azambuja, Fox-Herzberg, Mulliken, and Fremyork systems. Author

N78-21963‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
The viscosity and thermal conductivity coefficient are estimated for three models of the atmosphere of Jupiter: a heavy model consisting of 22% helium and 78% hydrogen, a nominal model consisting of 11% helium and 89% hydrogen, and a light model consisting of pure hydrogen. The effect of trace elements is neglected. Linearized approximations are used for the transport coefficients of the mixtures. These are found to be in almost constant ratio to the values for pure hydrogen, independent of temperature. Short Basic language programs for computing the coefficients are listed. Author

N78-21977‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FIELD MEASUREMENTS OF PENETRATOR SEISMIC COUPLING IN SEDIMENTARY AND VOLCANIC ROCKS Yoshio Natsamura (Texas Univ., Galveston), Mary V. Latham (Texas Univ., Galveston). Cliff Frolich (Texas Univ., Galveston). Maxwell B. Blanchard (Johnson Space Center, Houston, Tex.). and James
systems	 Author

EXECUTIVE SUMMARY

Find Report

PROGRAM IN THE STATE OF OHIO. VOLUME 1:

DEVELOPMENT OF A MULTI-DISCIPLINARY ENT$ USER
Dealandres-d'Azambula Fox-Herzberg Mulhken. and Freymork

current uniform land inventory was derived in part from LANDSAT
allocations models It was feasible to use LANDSAT data to
of LANDSAT data could lead to reasonably accu rate. useful land
comprised of various programs used to digitally store analyze
data The State hits the ability to convert processed land
investigate minerals, pollution lend use and resource inventory
information from LANDSAT to Ohio Capability Analysis Program
Paul E Baldridge Charles Weber, Gary Schaal (Ohio Dept of

Center. Sioux Falls. S D 57198 ERTS
Original photography may be purchased from the EROS Data
Laha.,. J McKeon (Ben Dix Aerospace Systems Dr y 1. and N.

performed to compare this observed signals in terms of power
spectral: density ratio, coherence, and phase difference. The
analyses indicate that seismometers deployed by penetrators
will be as well coupled to the ground as are seismometers
installed by conventional methods for the frequency range of
interest in earthquake seismology. A.R.H.

N78-22888# Ohio Dept. of Economic and Community Development. Columbus.

DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO. VOLUME 1:

EXECUTIVE SUMMARY Final Report
Paul E. Baldridge Charles Weber, Gary Schaal (Ohio Dept. of
Natural Resources), Carl Wilhelm (EPA), G. E. Wurzel (Battelle
Columbus Lab). J. G. Stephan (Battelle Columbus Labs), T. F.
Ebbert (Battelle Columbus Labs.). T. F. Ebbert (Battelle Columbus
Labs.), H. E. Smail (Battelle Columbus Labs.), J. McKeon (Ben Dix Aerospace Systems Div.), and N.
Schmidt, Principal Investigators (Bendix Aerospace Systems Div.)
Original photography may be purchased from the EROS Data
Center, Sioux Falls, S D. 57198 ERTS
(Contract NAS2-2399
(E79-10187. NASA-CR-158447) Avail. NTIS
HC A19/MF A01 CSCL 058

The author has identified the following significant results. A
current uniform land inventory was derived, in part, from LANDSAT
data. The State has the ability to convert processed land
information from LANDSAT to Ohio Capability Analysis Program
(OCAP). The OCAP is a computer information and mapping system
comprised of various programs used to digitally store, analyze, and
display land capability information. More accurate processing of
LANDSAT data could lead to reasonably accurate, useful land
allocations models. It was feasible to use LANDSAT data to
investigate minerals, pollution, land use, and resource inventory.
Deslandres-d'Azambula, Fox Herzberg, Mulliken, and Freymork
systems. Author

N78-22818# National Aeronautics and Space Administration. Ames Research Center, Moffett Field. Calif.

INTRODUCTORY ASSESSMENT OF ORBITING REFLECTIONS FOR TERRESTRIAL POWER GENERATION
Kenneth W Billman, William P. Gilbreath, and Stuart W. Bowen
Apr 1977 58 p. refs
CSCL 10A

The use of orbiting mirrors for providing energy to ground
conversion stations to produce electrical power is shown to be a
viable, cost effective and environmentally sound alternative to
satellite solar power stations and conventional power sources.
This is accomplished with the use of very light weight metal
coated polymeric films as mirrors which, after deployment at
800 km, are placed in operational orbit and controlled by solar
radiation pressure. Relations are developed showing the influence
of a number of parameters (mirror altitude, orbit inclination, period,
mirror size and number, and atmospheric effects) on the reflected
insolation that may be received by a ground spot as a function of
location Some attractive alternative uses of the reflection
are briefly discussed as a beneficial adjuncts to the system.

Author

N78-22989# National Aeronautics and Space Administration. Ames Research Center, Moffett Field. Calif.

INHOMOGENEOUS MODELS OF THE VENUS CLOUDS CONTAINING SULFUR
Sheldon M. Smith, James B. Pollack, Lawrence P. Giver, Jeffrey
H. Cuzzi, and Morris Podolak (Tel-Aviv Univ.) Apr. 1979 57 p.
refs
CSCL 038

Based on the suggestion that elemental sulfur is respon-
sible for the yellow color of Venus. calculations are
compared at 3.4 microns of the reflectivity phase function of
two sulfur containing inhomogeneous cloud models with that of
a homogeneous model measuring reflectivities with 25% or less total error, comparison of the model calculations
leads to a minimum detectable mass of sulfur equal to 7% of
the mass of sulfuric acid for the inhomogeneous drop model.
For the inhomogeneous cloud model the comparison leads to
a minimum detectable mass of sulfur between 17% and 38% of
the mass of the acid drops, depending upon the actual size of
the large particles. It is concluded that moderately accurate
3.4 microns reflectivity observations are capable of detecting
quite small amounts of elemental sulfur at the top of the Venus
clouds.

G.Y.

N78-22988# National Aeronautics and Space Administration. Ames Research Center, Moffett Field. Calif.

A NEW BASIS FOR THE DETERMINATION OF FRACTURE TOUGHNESS
S. Banerjee (India Inst. of Technol.) May 1979 49 p refs
(NASA-TM-78592: A-7837) Avail. NTIS HC A03/MF A01
CSCL 20K

A study is presented which shows that the growth of the plastic
zone and the constraint in a compact tension specimen
depends significantly on specimen width. The analysis permits
the estimation of the contribution of the growth of plastic zone
to the deviation from linearity. The contribution of the crack
growth to the deviation from linearity is evaluated from the
analysis of a typical R-curve data. A combination of these two
analyses enables one to define a very simple procedure for the
determination of fracture toughness. The fracture toughness is
defined as the stress intensity value at which the crack extension
starts. The good agreement between analytical results and
experimental KQ and KIC values determined over a wide range of
thicknesses, widths, and materials justifies the proposed
procedures. The KIC determined according to this procedure is
independent of specimen width and such a procedure enhances
the range of applicability of the K concept to a wider combination
of configurations and materials. Author

N78-22635# National Aeronautics and Space Administration. Ames Research Center, Moffett Field. Calif.

WILDLIFE MONITORING PROGRAM PLAN
Paul Sebesta and Roger Arno Apr 1979 233 p. refs
CSCL 06C

A plan for integrating the various requirements for wildlife
monitoring with modern aerospace technology is presented. This
plan is responsive to user needs, recognizes legal requirements,
and is based on an evolutionary growth from domestic animals
and larger animals to smaller, more scarce and remote species.
The basis for animal study selection was made from the 1973
Santa Cruz Summer Study on Wildlife Monitoring. As techniques
are developed the monitoring and management tasks will be
interfaced with and eventually operated by the user agencies.
Field efforts, aircraft and satellites, will be supplemented by
laboratory investigations. Sixty percent of the effort will be in
hardware research and development (satellite technology,
microminiaturization) and the rest for gathering and interpreting
data.

Author
N79-23909\# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN IMPLICIT ALGORITHM FOR THE CONSERVATIVE, TRANSSONIC FULL-POTENTIAL EQUATION WITH EFFECTIVE
ROTATING DIFFERENCING
Terry L. Holst and John Albert (Santa Clara Univ., Calif.) Apr. 1979 37 p refs (Contract NAS7-100-885-003)
(NASA-TM-78570) Avail: NTIS HC A03/MF A01 CSCL 01A
A new differencing scheme for the conservative full potential equation which effectively simulates rotated differencing is presented. The scheme was implemented by an appropriate upwind bias of the density coefficient along coordinate directions. A fast, fully implicit, approximate factorization iteration scheme was then used to solve the resulting difference equations. Solutions for a number of traditionally difficult transonic airfoil test cases are presented. J.A.M.

N79-25068\# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED RADIATION FROM THE SPACE SHUTTLE CONTAMINANT ENVIRONMENT c18
The space shuttle contaminant environment consisting of molecules and particles originating on the Shuttle is considered. The molecules come from outgassing, cabin leakage, flash evaporators and other man-controlled vents, and rocket exhaust. Particles are thought to come from abrasion, ablation of surfaces, dust trapped in cracks, dust from vents and cabin leaks, ice particles from improper venting, and droplets of unburned fuel. The effect of the infrared radiation from molecules and particles on a sensitive infrared telescope is emphasized. Infrared spectrum of H2O and CO2 at fairly high resolution is discussed along with the spectrum and sighting frequency of particles spalled by micrometeoroids. J.M.S.

N79-25542\# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VOXET THEORY SIMULATION OF THREE-DIMENSIONAL SPOT-LIKE DISTURBANCES IN A LAMINAR BOUNDARY LAYER
(NASA-TM-78579: A-7789) Avail: NTIS HC A02/MF A01 CSCL 20D
The growth of a turbulent spot in a laminar boundary layer as the spot evolves from a localized disturbance in the layer, is simulated numerically using a three-dimensional vortex filament description of the vorticity field. The filaments are marked with a sequence of node points which are tracked in a Lagrangian reference frame. Velocity computation is done by Biot-Savart integration. Although some discrepancies with experiment appear to exist in the near-wall region, the gross properties of the spot, including the velocities of the leading and trailing edges and the velocity perturbations away from the wall, are in good agreement with experiment. Author

N79-25981\# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED RECEIVERS FOR LOW BACKGROUND ASTROMONY: INCOHERENT DETECTORS AND COHERENT DEVICES FROM ONE MICROMETER TO ONE MILLIMETER Final Report:
The status of incoherent detectors and coherent receivers over the infrared wavelength range from one micrometer to one millimeter is described. General principles of infrared receivers are included, and photon detectors, bolometers, coherent receivers, and important supporting technologies are discussed, with emphasis on their suitability for low background astronomical applications. Broad recommendations are presented and specific opportunities are identified for development of improved devices. Author

N79-26718\# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE 1977 INTERTROPICAL CONVERGENCE ZONE EXPERIMENT
Data are presented from the 1977 Intertropical Convergence Zone (ITCZ) Experiment conducted in the Panama Canal Zone in July 1977. Measurements were made daily over a 16-day period when the ITCZ moved across the Canal Zone. Two aircraft (Learjet and U-2) flew daily and provided data from horizontal traverses at several altitudes to 21.3 km of ozone, temperature, pressure, water vapor, aerosols, fluorocarbons, methane, nitrous oxide, nitric oxide, and nitric acid. Balloonsoundes flown four times per day provided data on ozone, wind fields, pressure, temperature, and humidities to altitudes near 30 km. Rocketsondes provided daily data to altitudes near 69 km. Satellite photography provided detailed cloud information. Descriptions of individual experiments and detailed compilations of all results are provided. For individual titles, see N79-26716 through N79-26729.

N79-26717\# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPERATIONAL ACTIVITIES
William A. Page In its The 1977 Intertrop Convergence Zone Expt. Jun. 1979 p 5-12 (For primary document see N79-26715 17-47) Avail: NTIS HC A21/MF A01 CSCL 04B
A short description of the observational field program as carried out in the Canal Zone during July 1977 is presented. The people responsible for organizing the activity and those deployed to the Canal Zone, who were responsible for various aspects of the field activity (including the experiments) are listed. The ozone sondes balloon and rocketsonde launches and the aircraft flight track are shown. The daily activity schedule during the 16-day Intertropical Convergence Zone study is shown. The instrument configuration of the U-2 research aircraft used during the experiment is also shown. G.Y.

N79-26720\# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEASUREMENT OF NO AND O3 FROM AIRCRAFT: 1977 TROPICAL CONVERGENCE ZONE EXPERIMENT
As part of the Ames Research Center program to explore the nature of stratosphere-troposphere exchange processes occurring in the Intertropical Convergence Zone, simultaneous in situ measurements of nitric oxide and ozone mixing ratios were made with the Ames stratospheric air sampler SAS 2. The SAS 2 is a second-generation system; it employes four parallel sensors and was designed primarily for measurements at altitudes of 60,000 ft and above on the U-2 stratospheric research aircraft. The only modifications required for this study was the addition of an air sample flow restrictor. Data were obtained with the
TRACE CONSTITUENT MIXING RATIOS IN THE LOWER STRATOSPHERE DURING THE 1977 INTERTROPICAL CONVERGENCE ZONE EXPERIMENT


Minor constituents in the atmosphere can play an important role as tracers in studies of atmospheric transport and mixing. Simultaneous measurements of the vertical distribution of trace constituents in the troposphere and lower stratosphere were conducted in the region of the Intertropical Convergence Zone (ITCZ). An effort was made to measure the mixing ratios of selected trace constituents. A cryogenic sampling system on board a U-2 aircraft was used to acquire whole-air samples and to cryogenically collect samples at 13.7 to 21.3 km. Simultaneous tropospheric measurements using whole-air sampling canisters on board a Learjet aircraft were also carried out.

N79-28723* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INTERTROPICAL CONVERGENCE ZONE, PANAMA CANAL ZONE


To investigate whether injection sources of the stratospheric aerosol layer could be detected in the tropospheric stratosphere, an examination of the aerosol vertical and horizontal size distribution around the Intertropical Convergence Zone (ITCZ) at the Panama Canal Zone was performed during the summer of 1977. By comparing these data with similar measurements in temperate and polar regions, it was hoped to discover variations in particle size that would indicate whether a young aerosol is forming and entering the stratosphere at the ITCZ, where the aerosol matures, and finally, where it enters the troposphere. The methods used in the investigations and the results obtained from the analyses are described.

N79-28728* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PROPERTIES OF GRAPHITE-EPoxy COMPOSITES


The effects of moisture and temperature on unidirectional and multi-ply laminates of T300/934 and AS/3501 graphite-epoxy systems were investigated. Properties studied were static flexure strength, and flexure and torsion fatigue strengths at room temperature and at 74 C. Specimens with increased moisture content showed a reduced static flexure strength; water as the test environment had only a negligible influence. In flexure fatigue and torsion fatigue, the water environment caused somewhat reduced fatigue strengths at room temperature and significantly greater degradation in 74 C water. The failure mode in all cases was interfacial delamination.

N79-28716* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LIFE TESTING OF MALLORY CELLS


Tests were performed to assess the effects of storage time, storage temperature, vibration, discharge rate and temperature, and capacity of high-rate D size, lithium sulfur dioxide cells. Data from these tests are discussed.

N79-28860* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLUX VECTOR SPLITTING OF THE INVISID EQUATIONS

G.Y.
WITH APPLICATION TO FINITE DIFFERENCE METHODS
Joseph L. Bregger and R. F. Warming  
Jul. 1979 54 p. refs  
(NASA-TM-78605; A-7893)  
Avail. NTIS HC A04/MF A01  
CSCL 12A

The conservation-law form of the inviscid gasdynamic equations has the remarkable property that the nonlinear flux vectors are homogeneous functions of degree one. This property readily permits the splitting of flux vectors into subvectors by similarity transformations so that each subvector has associated with it a specified eigenvalue spectrum. As a consequence of flux vector splitting, new explicit and implicit dissipative finite-difference schemes are developed for first-order hyperbolic systems of equations. Appropriate one-sided spatial differences for each split flux vector are used throughout the computational field even if the flow is locally supersonic. The results of the preliminary numerical computations are included.

Author

N79-30146*# National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

INVESTIGATION OF THE ASYMMETRIC AERODYNAMIC  
CHARACTERISTICS OF CYLINDRICAL BODIES OF  
REVOLUTION WITH VARIATIONS IN NOSE GEOMETRY  
AND ROTATIONAL ORIENTATION AT ANGLES OF ATTACK  
TO 86 DEGREES AND MACH NUMBERS TO 2  
Robert L. Kruse, Earl R. Keener, Gary T. Chapman, and Gary  
Clauer (ARO, Inc., Moffett Field, Calif.)  
Sep. 1979 98 p  
(NASA-TM-78553; A-7840)  
Avail. NTIS HC A04/MF A01  
CSCL 01A

Wind-tunnel tests were conducted to investigate the side forces and yawing moments that can occur at high angles of attack and zero sideslip for cylindrical bodies of revolution. Two bodies having several tangent ogive forebodies with fineness ratios of 0.5, 1.5, 2.5, and 3.5 were tested. The forebodies with fineness ratios of 2.5 and 3.5 had several bluntnesses. The cylindrical afterbodies had fineness ratios of 7 and 13. The model components - tip, forebody, and afterbody - were tested in various rotational positions about their axes of symmetry. Most of the tests were conducted at a Mach number of 0.25, a Reynolds number of 0.32 x 10 to the 6th power, and with the afterbody that had a fineness ratio of 7 and with selected forebodies. The effect of Mach number was determined with the afterbody that had a fineness ratio of 13 and with selected forebodies at mach numbers from 0.25 to 2 at Reynolds number = 0.32 x 10 to the 6th power. Maximum angle of attack was 89 deg.

Author

N79-33567*# National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

ELECTRON AND X-RAY DIFFRACTION  
PURAMETERS IN ELECTRON AND X-RAY DIFFRACTION  
George Polkowski (LFE Corp., Richmond, Calif.)  
K. G. Smetters, and Neil H. Farlow  
Aug. 1979 57 p refs  
(NASA-TP-1528; A-7781)  
Avail. NTIS HC A04/MF A01  
CSCL 138

Ten programs for calculating cell parameters from single crystal electron diffraction patterns are presented. Most of the programs, written for use with a programmable desk calculator, are also applicable to X-ray diffraction work. The programs can be used to calculate d-spacings from electron diffraction plate measurements, and to determine cell data (including interplanar angles and zone angles) for all crystal systems. A program for rhombohedral-hexagonal conversions and one for matching crystal data from standards with apparent crystal parameters found in diffraction patterns are included. Because they allow rapid determination of data not present in X-ray listings or elsewhere in the literature, the programs facilitate identification of unknowns.

K.L.

N79-31165*# National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

CONFERENCE ON FIRE RESISTANT MATERIALS: A  
COMPILATION OF PRESENTATIONS AND PAPERS  
Demetrius A. Kourtides, ed. and Gerald A. Johnson, ed (Boeing  
Com. Airplane Co., Seattle, Wash.)  
Jul. 1979 287 p  
Conf. held in Seattle, 1-2 Mar. 1979  
(NASA-CP-2094; A-7884)  
Avail. NTIS HC A13/MF A01  
CSCL 01C

The proceedings of the NASA IRE Resistant Materials Engineering (FIREMEN) Program held at Boeing Commercial Airplane Company, Seattle, Washington, on March 1-2, 1979 are reported. The conference was to discuss the results of research by the National Aeronautics and Space Administration in the field of aircraft fire safety and fire-resistant materials. The program topics include the following: (1) large-scale testing; (2) fire toxicology; (3) polymeric materials; and (4) fire modeling. For individual titles see N79-31167 through N79-31183.

N79-31176*# National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

FIRE RESISTANT AIRCRAFT SEAT PROGRAM  
Larry A. Fewell In its Conf. on Fire Resistant Mater.  
Jul. 1979 p 135-166 (For primary document see N79-31166 22-03)  
Avail. NTIS HC A13/MF A01  
CSCL 01C

Foams, textiles, and thermoformable plastics were tested to determine which materials were fire retardant, and safe for aircraft passenger seats. Seat components investigated were the decorative fabric cover, slip covers, fire blocking layer, cushion reinforcement, and the cushioning layer.

F.O.S.

N79-31179*# National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

ADVANCED RESIN MATRICES FOR COMPOSITES  
Demetrius A. Kourtides In its Conf. on Fire Resistant Mater.  
Jul. 1979 p 223-238 (For primary document see N79-31166 22-03)  
Avail. NTIS HC A13/MF A01  
CSCL 01C

The selection criteria and the chemical structure of resin matrices are given along with the processing conditions for resins and laminates.

F.O.S.

N79-31363*# National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

THERMAL EXPANSION AND SWELLING OF CURED EPOXY  
RESIN USED IN GRAPHITE/EPOXY COMPOSITE  
Michael J. Adamson  
Sep. 1979 35 p refs  
(NASA-TM-78810; A-7819)  
Avail. NTIS HC A03/MF A01  
CSCL 11D

The thermal expansion and swelling of resin material as influenced by variations in temperature during moisture absorption is discussed. Comparison measurements using composites constructed of graphite fibers and each of two epoxy resin matrices are included. Polymer theory relative to these findings is discussed and modifications are proposed.

A.W.H.

N79-31528*# National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, Calif.

A NAVIER-STOKES FAST SOLVER FOR TURBULENT  
MODELING APPLICATIONS  
J. D. Murphy and M. W. Rubesin  
Aug. 1979 19 p refs  
Presented at AGARD Conf. on Turbulent Boundary Layers. Exp.  
Theory, and Modeling, Hague, 25-26 Sep 1979  
(NASA-TM-78612; A-7836)  
HC A02/MF A01  
CSCL 20D

A computer program for the solution of the steady Reynolds averaged incompressible Navier-Stokes equations that can accept a variety of turbulence closure models is described. The program is sufficiently accurate and economical to permit extensive comparisons with mean moment data from experiment and should provide a useful tool to the turbulence modeler because of the generality of the models which can be considered and the economy with which solutions can be obtained. Focus is on (1) one- and (2) two equation closure models and the computed results are compared with experiment and with results of boundary-layer
calculation using the same models. These comparisons show that flow parameters which are sufficiently severe to provide strong tests of higher order closure models are also sufficiently severe as to cast doubt on the results based on classical boundary-layer calculations. To demonstrate the accuracy and speed of the program, parametric studies are presented which show the effects of both purely numerical considerations such as mesh size, boundary location, etc., and physical consideration such as boundary conditions, etc. It is believed that the present computer code is more general than previously available fast solvers. No near-wall equilibrium assumptions have to be made, as both the mean flow and turbulence closure relations are integrated all the way to the wall.

A. R. H.

**N79-32152** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**LARGE EDDY SIMULATION OF TURBULENT CHANNEL FLOW: **

**ILLIA. 4 CALCULATION**

John Kim, Sep. 1979 21 p refs Presented at AGARD Symp. on Turbulent Boundary Layer, Experiment, Theory, nd Modelling, the Hague, Netherlands, 24-27 Sep. 1979 (NASA-TM-78619; A-7952) Avail: NTIS HC AO2/MF AO1 CSCL 02A

The three-dimensional time dependent equations of motion were numerically integrated for fully-developed turbulent channel flow. A large scale flow field was obtained directly from the solution of these equations, and small scale field motions were simulated through an eddy viscosity model. The calculations were carried out on the ILLIAC 4 computer. The computed flow patterns show that the wall layer consists of coherent structures of low speed and high speed streaks alternating in the spanwise direction. These structures were absent in the regions away from the wall. Hot spots, small localized regions of very large turbulent shear stress, were frequently observed. The profiles of the pressure velocity-gradient correlations show a significant transfer of energy from the normal to the spanwise component of turbulent kinetic energy in the immediate neighborhood of the wall (the splatting effect).

R. E. S.

**N79-32241** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**MINING AND BENEFICIATION OF LUNAR ORES**

Theodore E. Bunch, Richard J. Williams (NASA Johnson Space Center), David S. McKay (NASA Johnson Space Center), and David G. (RPA, Inc.) In Its Space Resources and Space Settlements 1979 p 275-288 refs (For primary document see N79-32225 23-12) Avail: NTIS MF AO1 SOD HC CSCL 03B

The beneficiation of lunar plagiolite and ilmenite ores to feedstock grade permits a rapid growth of the manufacturing economy by maximizing the production rate of metals and oxygen. A beneficiation scheme based on electrostatic and magnetic separation is preferred over conventional schemes. But such a scheme cannot be completely modeled because beneficiation processes are empirical and because some properties of lunar minerals have not been measured. To meet anticipated shipping and processing needs, the peak lunar mining rate will exceed 1000 tons/hr by the fifth year of operation. Such capabilities will be best obtained by automated mining vehicles and conveyor systems rather than trucks. It may be possible to extract about 40 kg of volatiles (60 percent H2O) by thermally processing the less than 20 micron ilmenite concentrate extracted from 130 tons of ilmenite ore. A thermodynamic analysis of an extraction process is presented.

Author

**N79-32285** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**RELEASE RATE CALORIMETRY OF MULTILAYERED MATERIALS FOR AIRCRAFT SEATS**


Multilayered samples of contemporary and improved fire resistant aircraft seat materials (fire cushion, decorative fabric, slip sheet, fire blocking layer, and cushion reinforcement layer) were evaluated for their rates of heat release and smoke generation. Top layers (decorative fabric, slip sheet, fire blocking, and cushion reinforcement) with glass fiber block cushion were evaluated to determine which materials based on their minimum contributions to the total heat release of the multilayered assembly may be added or deleted. Top layers exhibiting desirable burning profiles were combined with foam cushion materials. The smoke and heat release rates of multilayered seat materials were then measured at heat fluxes of 15 and 3.5 W/cm². Choices of contact and silicone adhesives for bundling multilayered assemblies were based on flammability, burn and smoke generation, animal toxicity tests, and thermal gravimetric analysis. Abrasion tests were conducted on the decorative fabric covering and slip sheet to ascertain service life and compatibility of layers.

Author

**N79-32433** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**DEVELOPMENTS IN THE COMPUTATION OF TURBULENT BOUNDARY LAYERS**


Computational techniques applicable to turbulent boundary layers are classified into solutions of Reynolds-averaged, equations, in which all the effects of the turbulence are modeled, and solutions of three-dimensional, time dependent Navier-Stokes equations, in which the large eddies are calculated and only the turbulence at scales smaller than the computational mesh spacings has to be modeled. Current computation costs place engineer computations in the first of these categories. Large eddy simulations are appropriate currently for special studies of the dynamical processes of turbulence in idealized flow fields. It is shown that the two methods are interrelated and that each can gain from advances in the other. The degree of success of a pair of increasingly complex Reynolds stress models to broaden their range of applicability is examined through comparisons with experimental data for a variety of flow conditions. An example of a large-eddy simulation is presented, compared with experimental results, and used to evaluate the models for pressure rate-of-strain correlations and dissipation in the Reynolds-averaged equations.

Author

**NASA CONTRACTOR REPORTS**

**N79-10144** Ultrasystems, Inc. Irvine, Calif.

**PREPARATION OF LINEAR HYDROXY SUBSTITUTED POLYPHOSPHAZENES**


The synthesis of partially hydroxy substituted phosphazene prepolymers amenable to processing into cellular, flexible polyurethane foams was investigated. Factors determined include (1) the environment of the hydroxyl group, (2) the ease of the hexachlorocyclotrim-phosphazene polymerization, (3) the nature of the nonreactive substituents, and (4) the mode of introduction of the hydroxyl entity. The specific approaches taken range the rationale of the selection made, and the results are discussed.

A. R. H.
AIRCRAFT PASSENGER SEAT MATERIALS. PHASE 2 FMtd

that the fire was contained within the lavatory during the

characteristics of a Boeing 747 lavatory module Results showed

STISTICS. PHASE 1: FIRE CONTAINMENT TEST OF A WIDE

combinations representative of cushion configurations Teats were


HC AO4/MAF A01 CSCL 08G

ology. The resulting equation adds, to its equivalent of the first scheme, an integral of nonlinear convolution

in the frequency describing a role due to triple correlation of
direct energy-cascaling.

Author

30-minute test period with the door closed. The resistance of the
lavatory wall and ceiling panels and general lavatory
construction to burn-through under the test conditions was
demonstrated. Author

A unified formulation of computer-aided, multi-task, decision
making is presented. Strategy for the allocation of decision making
responsibility between human and computer is developed. The
plans of a flight management systems are studied. A model
based on the queueing theory was implemented. S.E.S.

Author
THE APPLICATION OF REMOTE SENSING TECHNOLOGY
infrared cluster the nonlocal infrared sources associated with
significantly to the dust hosting Neu CMC-2 dust column
4 It resolution The dominant features of the maps are a strong
OMC-1 and OMC 2 were mapped at 55 and 125 mm/mm
values considered. The major thrust of the measurements was
to determine lower atmosphere composition, even to trace constituents of one part per billion. Two types of
instrumentary were developed having the necessary accuracy to meet science objectives were considered and integrated into a deep probe
configuration. One deep probe configuration that resulted was identified
designed for a Saturn or Uranus mission. A second
N79-19095*/f Martin Marietta Corp., Denver, Colo.
STUDY OF ALTERNATIVE PROBE TECHNOLOGIES
Final Report
Dec. 1977 186 p refs
(Contract NAS2-9835)
N79-19962*/f Chicago Univ. III.
FAR INFRARED MAPS OF THE RIDGE BETWEEN OMC-1
AND OMC-2 Final Technical Report
(Grant NsG-2261)
N79-19875*/f California Univ., Berkeley.
AETHER DRIFT AND THE ISOTROPY OF THE UNIVERSE:
A MEASUREMENT OF ANISOTROPIES IN THE PRIMORDIAL
BLACK-BODY RADIATION Final Report, 1 Oct.
1977 - 30 Sep. 1978
Richard A. Muller 23 Feb. 1979 -6 p refs
(Grant NsG-2128)
N79-158129: SSL-SER-20-Issue-10. Avail: NTIS
HC A03/MF A01 CSCL 03B
This experiment detected and mapped the large-a-rtar-scale anisotropies in the 3 K primordial black-body radiation with a sensitivity of 2x.0001k and an angular resolution of about
10 degs. It measured the motion of the Earth with respect to the
distant matter of the Universe (Aether Drift), and probed the homogeneity and isotropy of the Universe (the Cosmological Principle). The experiment used two Dicke radiometers, one at 33 u,Jt to detect the cosmic anisotropy, and one at 54 GHz to
detect anisotropies in the residual oxygen above the detectors.
The system was installed in the NASA Ames Earth Survey
Aircraft (U-2), and operated successfully in a series of flights.

N79-21906*/f Grumman Aerospace Corp., Bethpage, N.Y.
AN ANALYSIS OF WATER IN GALACTIC INFRARED
SOURCES USING THE NASA LEAR AIRBORNE OBSER-
L euros L. Smith and Theodore Higeman Mar. 1979 6 p refs
(Contract NAS2-8664)
N79-158222: RM-884 Avail: NTIS HC A05/MF A01
CSCL 03A
The Michelson interferometer system on the NASA Lear Jet
Airborne Observatory is described as well as the data reduction
procedures. The objects observed (standard stars, M stars, a
nebula, planets, and the moon) are discussed and the observing
parameters are listed for each flight data. The spectra obtained
from these data flights are presented grouped by class of
object.
A.R.H.

MO. OPTIMIZED COST/PERFORMANCE DESIGN METHO-
DLOGY. VOLUME 2: DATA REVIEW AND ANALYSIS.
BOOK 5: COST c16
in Von Karman Inst. for Fluid Dyn. Technol. of Space Shuttle
Vehicles. Vol. 2 1970 208 p refs (For primary document see N79-
22130 13-12)
(Contract NAS2-5022)
Avail: NTIS HC A22/MF A01 CSCL 22B
The broad objectives of the study were to gather historical
cost and performance data; organize and analyze the data so
that cost estimating relationships could be developed, and evaluate
several system concepts for space logistics support. The primary
source of historical cost data was the Gemini and Saturn Programs
and cost estimating relationships drawn extensively on this
experience. A range of reuse concepts were evaluated and
optimized (least cost) concepts defined for a variety of program
options. These include variations in such things as crew size,
cargo capacity, program requirements, etc for either ballistic or
lifting body (M2-F2) entry vehicles.

N79-23568*/f Control Data Corp., Minneapolis, Minn. Research
and Advanced Design Lab
STUDIES OF STRATOSPHERIC Eddy TRANSPORT. 1: THE
EMERGED OZONE FLUX BY THE TRANSIENT EDDIES.
0-30 KM. 2: EDDY DIFFUSION COEFFICIENTS AND WIND
1978
94 p refs
(Contract NAS2-9578)
N79-158617: AD A065616, AFGL TR 78-0311. Avail: NTIS
HC A05/MF A01 CSCL 041
In Part I, ozonesonde data were matched with concomitant
rawinsonde data to provide direct determination of meridional
flux of ozone by transient eddies. Data are from about 25 stations in
eastern and western North America, western Europe, and
Japan. Results generally confirm the existence of significant
northward flux 10-18 km, in winter/spring; however, v's was of
significant equationward flux have been found at mid-latitudes,
10-16 km, over North America in winter/spring and at all latitudes,
10-18 km, over Japan in spring. Fluxes are typically small in
summer, as well as throughout the troposphere, and throughout
most of the middle stratosphere. Qualitative statements are made
concerning the relative importance of mean meridional and
are the data base used for the three components of the eddy diffusion matrix and circulation statistics. Horizontal diffusivities are obtained from the variance of the meridional wind and the meridional wind’s integral time scale. The present results are generally smaller than past estimates, presumably because temporal variations longer than a month were filtered out in the present study. Estimates of kx are based on the tentative assumption that the diffusivity is proportional to the slope of the isentropic surfaces.


Saturn’s largest moon, Titan, is a totally unique planetary body which is certain to yield exciting new phenomena. Current information is lacking in detail to distinguish between a thin methane rich atmosphere and a thick nitrogen rich atmosphere. Therefore, both the thin and thick atmospheric models were used for the study of various Titan probe classes described in this report. The technical requirements, conceptual design, science return, schedule, cost and mission implications of three probe classes that could be used for exploration of Titan are defined. The three probe classes were based on a wide range of exploration mission possibilities.

G Y


Re-entrant groove technology was extended to hydrogen heat pipes. Parametric analyses are presented which optimize the theoretical design while considering the limitations of state-of-the-art extrusion technology. The 0.063-56 aluminum extrusion is 14.6 mm OD with a wall thickness of 1.66 mm and contains 20 axial grooves which surround a central 9.3 mm diameter vapor core. Each axial groove is 0.775 mm diameter with a 0.33 mm opening. An excess vapor reservoir is provided at the evaporator to minimize the pressure containment hazard during ambient storage. Modifications to the basic re-entrant groove profile resulted in improved overall performance. While the maximum heat transport capacity decreased slightly to 103 w·m⁻¹ the static wicking height increased markedly to 4.5 cm. The heat pipe became operational between 20 and 30 K after a cooldown from 77 K without any difficulty. Steady state performance data taken over a 19 to 23 K temperature range indicated (1) maximum heat transport capacity of 5.4 w·m⁻¹, (2) static wicking height of 1.42 cm, and (3) overall heat pipe conductance of 1.7 watts/deg C.

A R H


A study to determine the feasibility of preparing ultrathin papers with a target weight of 3.5 g/sq m from polybenzimidazole (PBI) fibres was undertaken. Small hand sheets of target weight were fabricated. They were light brown, low density materials with sufficient strength to be readily handleable. Characterization of these sheets included strength, fold endurance, thermal gravimetric analysis in air and nitrogen and photonicrographs. Two different batches of PBI fibres were studied and differences in fabrication performance were noted. In neither case could target weight papers be prepared using conventional paper making techniques.

M M M


The Ames Research Center of NASA is engaged in the development and investigation of numerical methods and computer technologies to be employed in conjunction with physical experiments, particularly utilizing wind tunnels in the furtherance of the field of aircraft and aerodynamic body design. Several studies, aimed primarily at the areas of development and production of extremely high-speed computing facilities, were conducted. The studies focused on evaluating the aspects of feasibility, reliability, costs, and practicability of designing, constructing, and bringing into effect production of a special-purpose system. An executive summary of the activities for this project is presented in this volume.

G Y


A Numerical Aerodynamic Simulation Facility (NASA) was designed for the simulation of fluid flow around three-dimensional bodies, both in wind tunnel environments and in free space. The application of numerical simulation to this field of endeavor promised to yield economics in aerodynamic and aircraft body designs. A model for a NASA/FMP (Flow Model Processor) ensemble using a possible approach to meeting NASA goals is presented. The computer hardware and software are presented, along with the engine design and performance analysis and evaluation.

G Y


An FMP (Flow Model Processor) was designed for use in the Numerical Aerodynamic Simulation Facility (NASA). The NASA was developed to simulate fluid flow over three-dimensional bodies in wind tunnel environments and in free space. The facility is applicable to studying aerodynamic and aircraft body designs. The following general topics are discussed in this volume: (1) FMP functional computer specifications; (2) FMP instruction specification; (3) standard product system components; (4) loosely coupled network (LCN) specifications/descriptions; and (5) three appendices: performance of trunk allocation contention elimination (trace) method, LCN channel protocol and proposed LCN unified second level protocol.

S


There were three major issues examined in the feasibility study: First, the ability of the proposed system architecture to...
support the anticipated workload was evaluated. Second, the throughput of the computational engine (the flow model processor) was studied using real application programs. Third, the availability, reliability, and maintainability of the system were modeled. The evaluations were based on the baseline systems. The results show that the implementation of the Numerical Aerodynamic Simulation Facility, in the form considered, would indeed be a feasible project with an acceptable level of risk. The technology required (both hardware and software) either already exists or, in the case of a few parts, is expected to be announced this year.

R.E.S.

N79-28072** Burroughs Corp. Paoli, Pa.

There were three major issues examined in the feasibility study. First, the ability of the proposed system architecture to support the anticipated workload was evaluated. Second, the throughput of the computational engine (the flow model processor) was studied using real application programs. Third, the availability reliability, and maintainability of the system were modeled. The evaluations were based on the baseline systems. The results show that the implementation of the Numerical Aerodynamic Simulation Facility, in the form considered, would indeed be a feasible project with an acceptable level of risk. The technology required (both hardware and software) either already exists or, in the case of a few parts, is expected to be announced this year. Facets of the work described include the hardware configuration, soft ware, user language, and fault tolerance R.E.S.

N79-27044** Cornell Univ., Ithaca, N.Y. Dept. of Astronomy

Because observations of the Kleinmann-Low region of the Orion Nebula reveal significant polarization in the wavelength range from 13 to 18 microns, polarization at wavelengths greater than 15 micron were investigated. Far infrared polarization measurements were made of a number of sources using an instrument mounted at the bent cassegrain focus of the Kuiper Airborne Observatory 90 cm telescope. About two hours of data were obtained on the Orion Nebula on each of two flights. and more careful calibration on Jupiter (assumed to be unpolared) were obtained on both nights. The data on Orion and Jupiter for three filters are presented. Possible explanations are suggested for reconciling the high polarization observed by others in 1974 with the lower values obtained in this study.

A.R.H.

N79-27944** Rochester Univ., N.Y. Dept of Chemistry SEMICLASSICAL THEORY OF ELECTRONICALLY NONADIABATIC TRANSITIONS IN MOLECULAR COLLISION PROCESSES Ka S. Lam and Thomas F George 1979 83 p refs Presented at Proc. of the NATO Advanced Study Inst. on Semiclassical Methods in Scattering and Spectroscopy, 1979 (Grant NsG-2198, Contract F48620-78-C-0006; Grant NSF CHE-77-27826) (NASA CR-158776) Avail NTIS HC A05/MF A01 CSCL 01A

An introductory account of the semiclassical theory of the S-matrix for molecular collision processes is presented, with special emphasis on electronically nonadiabatic transitions. This theory is based on the incorporation of classical mechanics with quantum superposition, and in practice makes use of the analytic continuation of classical mechanics into the complex space of the energy domain. The relevant concepts of molecular scattering theory and related dynamical models are described and the formalism is developed and illustrated with simple examples - collinear collision of the A-BC type. The theory is then extended to include the effects of laser-induced nonadiabatic transitions. Two bound continuum processes collision ionization and collision-induced emission also smenable to the same general semiclassical treatment are discussed.

A.R.H.

N79-28470** Grumman Aerospace Corp., Bethpage, N.Y.

The development of spiral artery cryogenic thermal diode heat pipes was continued. Ethane was the working fluid and stainless steel the heat pipe material in all cases. The major tasks included: (1) building a liquid blockage (blocking orifice) thermal diode suitable for the HEPP space flight experiment; (2) building a liquid trap thermal diode engineering model; (3) retesting the original liquid blockage engineering model; and (4) investigating the startup dynamics of artery cryogenic thermal diode. An experimental investigation was also conducted into the wetting characteristics of ethane/stainless steel systems using a specially constructed chamber that permitted in situ observations.

G.Y.

N79-28643** Humboldt State Univ., Arcata, Calif. Center for Community Development

There are no autho.-identified significant results in this report.

N79-28710** United Technologies Research Center, East Hartford, Conn.

A space power system concept was evaluated which uses concentrated solar energy to heat a working fluid to temperatures as high as 4000 K. The high temperature working fluid could be used for efficient electric power production in advanced thermal or magnetohydrodynamic conversion cycles. Energy absorber configurations utilizing particles or cesium vapor absorber material were investigated. Results of detailed radiant heat transfer calculations indicated approximately 86 percent of the incident solar energy could be absorbed within a 12 cm dia flowing stream of gas borne carbon particles. Calculated total energy absorption in the cesium vapor seeded absorber configuration ranged from 34 percent to 64 percent of the incident solar energy. Solar flux concentration ratios of between approximately 3000 and 10,000 will be required to sustain absorber temperatures in the range from 3000 K to 4000 K.

F.O.S.
THE DIRECT NUMERICAL SIMULATIONS OF THE TUR-
BULENT WAKES OF AXIYMMETRIC BODIES Interim Report
James J. Riley and Ralph W. Metcalfe Mar. 1978 84 p refs
(Contract NASA-89855)
(NASA-CR-152282: RR-135) Avail NTIS HC AO6/MF AO1
CSC 014
Results of direct numerical simulations of turbulence are
compared with both laboratory data and self-similarity theory
for the case of the turbulent wakes of towed, axisymmetric bodies.
In general, the agreement of the simulation results with both
the laboratory data and the self-similarity theory is good, although
the comparisons are hampered by inadequate procedures for
initializing the numerical simulations.

N79-28333* McDonnell-Douglas Astronautics Co., St. Louis,
Mo.
DEVELOPMENT, FABRICATION AND TEST OF A HIGH
PURITY SILICA HEAT SHIELD Final Report
E. L. Russert, D. N. Oman, and M. S. Biggs Apr. 1978
120 p refs
(Contract NASA-89965)
(NASA-CR-152117) Avail NTIS HC AO6/MF AO1 CSC 07D
A highly reflective hyperpure (i.e. 25 ppm ion impurities) slip
casted fused silica heat shield material developed for planetary
entry probes was successfully scaled up. Process development
activities for slip casting large parts included green strength
improvements, casting slip preparation aggregate casting,
strength, reflectance, and subscale fabrication. Successful
fabrication of a one-half scale Saturn probe (shape and size)
heat shield was accomplished while maintaining the silica high
purity and reflectance through the scale-up process. However,
stress analysis of this original aggregate slip cast material indicated
a small margin of safety (IMS = -4%) using a factor of safety
of 1.25. An alternate hyperpure material formulation to increase
the strength and toughness for a greater safety margin was
evaluated. The alternate material incorporates short hyperpure
silica fibers into the casting slip. The best formulation evaluated
has a 50% by weight fiber addition resulting in an 80% increase
in flexural strength and a 170% increase in toughness over the
original aggregate slip cast materials with comparable reflec-
tance.

DEVELOPMENT OF AIRCRAFT LAVATORY COMPART-
MENTS WITH IMPROVED FIRE RESISTANCE CHARACTER-
ISTICS. PHASE 2: SANDWICH PANEL RESIN SYSTEM
DEVELOPMENT Final Report
refs
(Contract NASA-8700)
(NASA-CR-152120: D6-46839) Avail NTIS
HC A13/MF AO1 CSC 11D
A NASA-funded program is described which aims to develop
a resin system for use in the construction of lavatory wall panels.
sidewall panels, and ceiling panels possessing flammability, smoke
and gas emission and toxicity (FST) characteristics superior to
the existing epoxy resin. Candidate resins studied were phenolic
polyamide and bismaleimide. Based on the results of a series of
FST as well as mechanical and aesthetic property tests, a
phenolic resin was chosen as the superior material. Material
and process specifications covering the phenolic resin based
materials were prepared and a method of rating sandwich panel
performance was developed.

N79-33121* Stanford Univ., Calif. Guidance and Control Lab
CONTROL SYSTEM DESIGNS FOR THE SHUTTLE IN-
FRARED TELESCOPE FACILITY
J. David Powell, Eric K. Parsons, and Kenneth R. Lorell Oct
1979 59 p refs
(Grant NGe-2246)
(NASA-CR-162321) Avail NTIS HC AO4/MF AO1 CSC 03A
The stringent pointing and stability requirements of the Shuttle
Infrared and Telescope Facility (SITRF) are stressed as well as
the demands that infrared astronomy and the SITRF in particular
place on the design of the pointing system.

JOURNAL ARTICLES, BOOKS AND
CHAPTERS OF BOOKS

A79-10162* Enhanced solar energy options using earth-
Research Center, Moffett Field, Calif.), and S. W. Bowen (Beem
Engineering, Inc., Sunnyvale, Calif.). In: Intersociety Energy Conver-
A system of orbiting space reflectors is described, analyzed, and
shown to economically provide nearly continuous insulation to
preselected ground sites, producing benefits hitherto lacking in
conventional solar farms and leading to large reductions in energy
costs for such installations. Free-flying planar mirrors of about 1.0
km area shown to be optimum and can be made at under 75,000
m2 of surface, thus minimizing material needs and space transportation
costs. Models are developed for both the design of such mirrors and
for the analysis of expected ground insulation as a function of orbital
parameters, time, and site location. Various applications (agricul-
tural, solar-electric production, weather enhancement, etc.) are
described.

A79-10589* Experimentation investigation of contamination
prevention techniques for a cryogenically cooled telescope in
earth-orbit. M. A. Hetrick (Martin Marietta Aerospace, Denver,
Colo.) and C. C. Papaas (NASA, Ames Research Center, Moffett
Field, Calif.). In: Space Simulation Conference, 10th, Bethesda, Md.,
York, American Institute of Aeronautics and Astronautics, Inc.,
1978, p. 87-96. 12 refs. Contract No. NAS2-9816. (AIAA 78-1618)
A one-tenth scale model of the Shuttle Infrared Telescope
Facility (SITRF) was constructed to experimentally investigate the
feasibility of a helium purge system to reduce contamination on
cryogenic surfaces. The on-orbit ambient contaminant environment
was simulated with ion beams of N2(+) , O(+) and H2O(+) . Helium
was injected into the model telescope at the simulated plane of the
primary optics using two techniques: a) porous plug, b) nozzle.
Helium flow rates and telescope pressures were varied to determine
the purge effectiveness against potential contaminants. Based on the
subscale results, a 90% reduction is observed in 0, N2, and H2O at the primary
optics of the SITRF can be obtained using 20 K helium with a
pressure of 0.0001 torr and a flow rate of less than 0.1 g/s.

A79-10624* Steady-state vortex-line density in turbulent
He II counterflow. R. M. Ostremmer, W. M. Croman, R. J. Dunnelly
(Oregon University, Eugene, Ore.) and P. Kittel (NASA, Ames
Research Center, Moffett Field, Calif. Oregon University, Eugene,
12 refs. NSF Grant No. DMR 76-21814. Grant No. AF AFOSR
76-2890C
We have measured the steady state vortex-line density in
turbulent counterflow using a second sound burst technique as a
local probe. Contrary to the Vinen theory and previous assumptions,
we find substantial line density inhomogeneity and strong departures
from the predicted heat current dependence. Anomalous behavior of
the line density at higher heat currents provides evidence for a new
secondary flow state.

The Pioneer Venus program consists of two spacecraft: an orbiter and a multiprobe. Both will arrive at Venus in early December 1978. The orbiter will collect data on the upper atmosphere and fields and particles and will sense the clouds and surface remotely from a 75 deg inclined orbit. The multiprobe consists of a bus, three small probes, and a large probe. All five objects will enter the Venus atmosphere and will transmit data on its properties and fields and particles and will sense the clouds and surface.


It is noted that recent measurements of large values of the rate coefficient for the reaction NO + HO2 yields NO2 + OH lead to model predictions of excessive amounts of stratospheric ozone. This letter shows that a recent measurement of the rate coefficient (k2) for the reaction HO2 + O3 yields OH + 2O2 largely resolves these problems. A two-dimensional model of stratospheric ozone in models. A two-dimensional model of stratospheric ozone tracts is used to calculate the concentrations of 35 constituents; the results are compared with experimental measurements of ozone column densities. It is found that the model predictions of excess ozone abundances diminish significantly when the measured value of k2 is employed.

F.G.M.
be understood in the context of reasonable physical or chemical processes acting to alter a uniform initial solar isotopic composition. This situation changed in 1969 with the discovery by Black and emphasizing particularly the experimental evidence, possible causes was discovered by Clayton et al. (1973) A magnesium isotopic anomaly was discovered by Gray and Compston (1974), and Lee and Papanastassiou (1974). The three isotopic anomalies are discussed, emphasizing particularly the experimental evidence, possible causes for the observed isotopic composition and finally, possible implications of the three anomalies with regard to models of solar system formation and evolution.

The method of separation of variables is shown to make turbulent correlation equations of Karman-Howarth type tractable for shear turbulence as well as for turbulent profiles. A dispersion relationship between the wave number and the separation constant which has the dimension of a frequency is derived in support of experimental observations of wave or coherent structure of wall turbulence. (Author)


A number of adaptive data compression techniques are considered for reducing the bandwidth of multispectral data. They include adaptive transform coding, adaptive DPCM, adaptive cluster coding, and a hybrid method. The techniques are simulated and their performance in compressing the bandwidth of Landsat multispectral images is evaluated and compared using signal-to-noise ratio and classification consistency as fidelity criteria. (Author)


It is shown that a two-layer model of Titan's atmosphere is required in order to match laboratory data on methane absorption to ground-based IR observations of Titan. An excellent fit to the observations is obtained with a model where the dust in Titan's atmosphere is confined to a region containing 50 m-amm of methane and located above an atmosphere with 1.95 km-am of methane, with the amount of dust being the value required for an extinction optical depth of 5 at 0.5 micron. The surface reflectivity required by this model is about 40% to 50%, which is typical for both dirty snow and clouds. The possibility is discussed of distinguishing between two scenarios for the observed surface of Titan (a true surface or just cloud tops) on the basis of limb-darkening curves obtained at many wavelengths with an orbiting telescope or a flyby mission. F.G.M.


The heating of inflowing interstellar gas by solar electrons is calculated. In the present work it is assumed that the thermal energy...
of the electrons is constant with distance from the Sun and that the inflowing gas follows Keplerian trajectories, and the contours of constant temperature so obtained are given. At a heliocentric distance of 1 AU the estimated temperature is 500 K upwind and 2000 K downwind for hydrogen atoms, and is 240 K downwind and 100 K upwind for helium. (Author)


The forbidden-plus-intersystem resonance line ratio (G) for the heliumlike ion O VII is calculated, taking into account cascades, blended satellite lines, and radiative plus dielectric recombination. It is noted that G is of particular use for investigating radiative-transfer effects and nonequilibrium ionization in the solar corona and that the calculations are applicable to a low-density optically thin Maxwellian plasma. The temperature dependence of G is considered for the case of a steady-state equilibrium plasma, and the effect of departures from ionization equilibrium on G is examined. It is found that G is quite insensitive to temperature over the range from 600,000 to 6 million K for a steady-state plasma, but that recombinations may be suppressed or dominant, depending on the relative abundance of O VIII, for a plasma in which the state of ionization is not in equilibrium with the electron temperature. This latter effect is shown to be capable of causing large variations in G that are dependent on electron temperature. F.G.M.


The problem of resonance scattering of X-ray emission lines in the solar corona is investigated. For the resonance lines of some heliumlike ions, significant optical depths are reached over distances small compared with the size of typical coronal features. A general integral equation for the transfer of resonance-line radiation under coronal conditions is derived. This expression is in a form useful for modeling the complex three-dimensional temperature and density structure of coronal active regions. The transfer equation is then cast in a form illustrating the terms which give rise to the attenuation or enhancement of the resonance-line intensity. The source function for heliumlike oxygen (O VIII) under coronal conditions is computed and discussed in terms of the relative importance of scattering. (Author)


Line-of-sight gas velocities calculated from a numerical hydrodynamical model of a barred spiral galaxy are compared with the observations and models made by Peterson, Rubin, Ford, and Thonnard of the gas flow in NGC 5383. The hydrodynamical model provides a somewhat better fit to the observations of NGC 5383 than does their symmetric, warped-disk model. It is argued that the basic model appropriate to understanding the gas motions in barred spiral galaxies is not circular rotation but rather a characteristic elliptical pattern of flow. (Author)

A79-13751 • Asymmetric disturbances in a disk galaxy. R. H. Miller (NASA, Ames Research Center, Theoretical and Planetary Studies Branch, Moffett Field, Calif.). Chicago, University, Chicago. (Author)

Thermal anerobic uncatalyzed cyclizations and cis-trans isomerizations observed in unsaturated hydrocarbon polymers are surveyed. Three main types of cyclizations are described. Type I is a radical reaction which is caused by chain rupture and gives rise to six-membered rings, this reaction occurs during pyrolysis of polymers with double bonds in a 1,5- or 1,6-diene configuration. Type II is a (2 + 2) thermal cycloaddition of double bonds in certain polymers with a 1,6-diene structure, bicycloheptane structures result. Type III is an intramolecular ene reaction. Many polymers containing a double bond linking CH units display thermal cis-trans isomerization. The common activation energy is approximately 130 kJ/mol, and the initial rate constants are lower, for homologous polymers, the greater the separation of the carbon-carbon double bonds. M.L.


The paper describes the theory that underlies the model calculations which show that the far-infrared bands of ammonia are very sensitive to the ammonia distribution above the Jovian atmosphere. Observation of the J = 5 and J = 6 ammonia bands at moderate resolution might permit choice between a cold trap model or the irreversible uv photodestruction model for the ammonia distribution. The lack of prominent emission cores in the N2O rotation-inversion lines only implies that the mixing ratio is low. The ammonia is uniformly mixed if the inversion temperature is low but, at a higher inversion temperature, emission cores will be observed unless the photodissociation is extremely efficient down to at least the inversion layer. M.L.


Stratospheric sulfuric acid particles scatter and absorb sunlight and they scatter, absorb and emit terrestrial thermal radiation. These interactions play a role in the earth's radiation balance and therefore affect climate. The stratospheric aerosols are perturbed by volcanic injection of SO2 and ash, by aircraft injection of SO2, by rocket exhaust of AI2O3 and by tropospheric mixing of particles and pollutant SO2 and COS. In order to assess the effects of these perturbing processes on climate, the effects of the aerosols on the radiation balance must be understood and in order to understand the radiation effects the properties of the aerosols must be known. The discussion covers the aerosol's effect on the radiation balance. It is shown that the aerosol size distribution controls whether the aerosols will tend to warm or cool the earth's surface. Calculations of aerosol properties, including size distribution, for various perturbation sources are carried out on the basis of an aerosol model. Calculations are also presented of the climatic impact of perturbed aerosols due to volcanic eruptions and Space Shuttle flights. (Author)


Aerosol particle effects are often neglected in theoretical studies of stratospheric phenomena. In reality, the particulate matter normally found above the tropopause may influence the terrestrial radiation balance, catalyze heterogeneous chemical interactions, and serve as a tracer of atmospheric motions. The paper proposes a one-dimensional model of the stratospheric aerosol layer, and it is used to compare aerosol theory with observational data. The model considers gaseous sulfur photochemistry and the physical aerosol processes of nucleation, coagulation, sedimentation, and diffusion. Calculations of the effects on the aerosol layer of stratospheric injections of aluminum oxide particles by Space Shuttle engines and of sulfur dioxide molecules by volcanic activity are performed. The relation between measured aerosol variability and changes in stratospheric air temperatures and vertical transport rates are discussed. (Author)


Gases containing SiO, SiO2, SiH4, and Si2 were produced in the reflected-shock region of a shock tube by heating SiC4 + N2O + Ar and SiH4 + Ar mixtures with shock waves. Spectral absorption characteristics were measured in the 160-550 nm wavelength range and in the 2600-3600 K temperature range and compared to calculated values. The sums of the squares of electronic transition moments at equilibrium separation were derived. It was found that absorption by SiO2 and other known bands of SiO, SiH4, and Si2 were too weak to be measured. The cross section of absorption by a continuum, believed due to SiH, varied from 2.5 x 10 to the -17th sq cm at 280 nm to 1.6 x 10 to the -18th sq cm at 440 nm. S.C.S.


The capabilities of shock tubes used in stratospheric-related research are considered, and the results of three independent shock tube research projects are reported. The studies are concerned with the evaluation of stratospheric ozone depletion. In the first experiment, photoabsorption cross sections of Freon 11 and 12 at stratospheric temperatures were measured using rarefactive waves. In the second experiment, reaction-rate coefficients were determined from measurements made behind reflected shock waves. In the third experiment, electronic-transition moments of the O2 Schumann-Ruppe system and the A2P; x2P-system of ClO were deduced from intensity measurements made behind the incident shock. M.L.


High shock tube velocities simulating Jovian entry have been achieved with arc-driven operation using a method of tailoring electrical circuit-impedance to arc-plasma impedance. The concept of impedance matching also prescribes a requirement for minimum electrical capacitance. The technique of developing the strongest shock-generating capability for an arc-driven system with the least total energy is described. Several programs using the shock tube for developmental research in energy and industrial applications are outlined. (Author)

Possible effects of HOCI aeronomy in the terrestrial stratosphere are reexamined. Chemical kinetics data for HOCI are analyzed which are required in aeronomical studies, and the possible role of HOCI as a reservoir of atmospheric chlorine is evaluated. Chemical production and loss of HOCI in the stratosphere is considered, along with photolysis of HOCI and prospects for HOCI as an inert chlorine reservoir. It is shown that a recent theoretical calculation of the HOCI photodissociation cross section suggests this species as a possible significant reservoir of atmospheric chlorine, but that the theoretical calculations are in sharp disagreement with some experimental measurements. Laboratory and atmospheric experiments to clarify the uncertainties of HOCI aeronomy are proposed. F.G.M.


A new long-wavelength infrared test facility is being developed to conduct proof-of-performance tests of focal plane arrays for the Infrared Astronomical Satellite (IRAS) telescope. This facility is believed to be unique in that it will calibrate full-sized arrays designed for the 5-12-micron region of the IR spectrum under simulated flight conditions and at background levels as low as 8 million photons/cm²/sec. Most of the tests will be performed in a main test chamber which contains a liquid helium shroud, blackbody sources, an arrangement to simulate zodiacal background, and a spatial scanning optics. A noncontaminating high-vacuum pumping system will be used to evacuate the chamber prior to cooldown to prevent molecular deposition. All housekeeping and focal plane signal outputs are multiplexed, digitized, and transmitted on high-speed data links to a PDP-11/70 computer. The computer provides real-time displays on a color CRT terminal and stores data for subsequent reduction and hard copy output. An overview of the conceptual design and performance specifications of the test facility is given. (Author)


The full potential of infrared astronomy can be realized only through observations made with space-based telescopes cooled to cryogenic temperatures. The paper outlines the scientific mission, system description, and focal plane requirements for two cryogenic telescopes: the Infrared Astronomical Satellite (IRAS) and the Shuttle Infrared Telescope Facility (SIRTF). IRAS, a 60-cm superfluid-helium-cooled telescope system, will perform a one-year 8-120-micron IR sky survey; it will provide results of high reliability and sensitivity, produce the first complete survey data for the 30-120-micron region, and fill in missing portions (spectrally and spatially) of previous surveys short of 30 microns. Its focal plane assembly is being designed to approach background-limited performance with an array of 82 discrete detectors. The SIRTF design will allow detailed follow-up studies in the 1-1000-micron range with a 116-160-cm observatory-class instrument. The Shuttle sortie capability introduces the unique SIRTF concept of an easily refurbishable or replaceable focal plane instrument complement in an orbiting cryogenic telescope. S.D.


The limitations imposed on infrared detectors for SIRTF are quite different from those imposed on ground-based, balloon-borne, or aircraft-borne systems. The paper examines the limitations and provides performance predictions corresponding to SIRTF conditions. Detector parameters typical of an infrared camera are used. The detector size is taken to be of the order of the diffraction-limited spot, frequency response is taken to correspond to a fraction of a second or less than constant, and spectral definition is provided by multilayer dielectric filters, inductive or capacitive grids, intrinsic absorption, or a combination of these. A nominal 10-micron bandwidth is assumed. If discussion covers atmospheric absorption and emission, zodiacal dust radiance, Shuttle contaminants, telescope self-emission, charged particle radiation, dear environment detector performance, and trapped radiation effects. It is concluded that the SIRTF design and operating conditions will allow current and near-term state-of-the-art detectors to reach their performance limits with SIRTF at a temperature of 10-12 K. S.D.


The paper describes some of the development work on gallium-doped germanium (Ge:Ga) and beryllium-doped germanium (Ge:Be) photoconductive detectors for use in far-infrared astronomical observations from a space platform such as IRAS. The paper is concerned primarily with detector performance and is divided into two major parts. The first presents the operating principles of this type of detector, while the second presents measured performance data under low-background flux conditions. It is shown that high sensitivity can be obtained from Ge:Ga and Ge:Be detectors under low-background and low-temperature conditions of operation. These detectors are useful for astronomical observations in the far-infrared wavelength range 30-120 microns. Major conclusions of the work done so far are mentioned, including that detectors cut from the same crystal show reasonably good reproducibility of operating characteristics. S.D.

A79-16049 * Reynolds number influence on leeside flowfields of planar delta wings at supersonic speeds are presented. Wind tunnel experiments on two delta wing models with right and sharp leading edges at freestream Mach number of 2.5 and 3.5 and angle of attack between 1 deg and 12.5 deg were carried out. The cross-sectional shape was triangular and the relative height was 0.25. The flow types investigated were the left and right of the Stanbrook Squire boundary. Under leading edge separation conditions, the vortex position and intensity, and thus the suction pressure, vary with Re while the flow type remains nearly unchanged. In the region of separation with embedded shock, Re affects not only the shape of the separation bubble and pressure level near the leading edge but also the type of flow. At sufficiently high Re the flow type of separation with shock changes to one with shock-induced separation. P.T.H.

A system of orbiting reflectors termed "SOLARES" is proposed as a means of reducing the diurnal variation and increasing the average intensity of sunlight for terrestrial solar power systems. The paper discusses orbital considerations for the placement of the reflectors, potential applications, costs, and environmental and social effects.

P.T.H.


This paper takes a look at a number of schemes for converting radiant energy in space to useful energy for man. These schemes are possible alternatives to the currently most studied solar power satellite concept. Possible primary collection and conversion devices discussed include the space particle flux devices, solar windmills, photovoltaic devices, photochemical cells, photoemissive converters, heat engines, dielectric energy conversion, electrostatic generators, plasma solar collectors, and thermionic schemes. Transmission devices reviewed include lasers and masers.

P.T.H.


Based on expected advances in technology, the maximum system efficiency and minimum specific mass have been calculated for closed-cycle CO2 and CO2 electric-discharge laser (EDL's) and a direct solar-pumped laser in space. The efficiency calculations take into account losses from excitation gas heating, ducting frictional and turning losses, and the compressor efficiency. The mass calculations include the power source, radiator, compressor, fluids, ducting, laser channel, optics, and heat exchanger for all of the systems, and in addition the power conditioner for the EDL's and a focusing mirror for the solar pumped laser. The results show the major component masses in each system, show which is the lightest system, and provide the necessary criteria for solar pumped lasers to be lighter than the EDL's. Finally, the masses are compared with results from other studies for a closed-cycle CO2 gasdynamic laser (GDL) and the proposed microwave satellite solar power station (SSPS).

(Author)


The Thermo Electron Laser Energy Converter (TELEC) is a high-power density plasma device designed to convert a 0.6 micron CO2 laser beam into electric power. Electromagnetic radiation is absorbed in plasma electrons, creating a high-electron temperature. Energetic electrons diffuse from the plasma and strike two electrodes having different areas. The larger electrode collects more electrons and there is a net transport of current. An electromagnetic field is generated in the external circuit. A computer program has been designed to analyze TELEC performance allowing parametric variation for optimization. Values are presented for TELEC performance as a function of cesium pressure and for current density and efficiency as a function of output voltage. Efficiency is shown to increase with pressure, reaching a maximum over 45%.

S.C.S.


Laser heat engine concepts, proposed for satellite applications, are analyzed to determine which engine concept best meets the requirements of high efficiency (50 percent or better), continuous operation in space using near-term technology. The analysis of laser heat engines includes the thermodynamic cycle, engine design, power sources, collector/concentrator optics, receiving windows, absorbers, working fluids, electricity generation, and heat rejection. Specific engine concepts, optimized according to thermal efficiency, are rated by their technologically availability and scaling to higher powers. A near-term experimental demonstration of the laser heat engine concept appears feasible utilizing an Otto cycle powered by CO2 laser radiation coupled into the engine through a diamond window. Higher cycle temperature, higher efficiencies, and scalability to larger sizes appear to be achievable from a laser heat engine design based on the Brayton cycle and powered by a CO2 laser.

(Author)


The fabrication and application of metal-barrier metal tunneling junctions for radiative interactions are discussed. Particular attention is given to the photolithographic fabrication of small area devices and the coupling to such devices via surface plasmon waves which play an important role at infrared and optical frequencies. It has been shown that the junction electron tunneling currents can be strongly coupled to surface plasmon junction modes, and spontaneous and stimulated emission of the latter are possible as well as nonlinear interactions. Finally, results demonstrating the photo-excitation of electrons with subsequent tunneling induced by ultraviolet radiation and by optical excitation are given. It is estimated that quantum efficiencies of the order of 5% and higher are possible in the ultraviolet region.

(Author)


The present discussion deals with some theoretical aspects associated with the description of molecular rate processes in the presence of intense laser radiation, where the radiation actually interacts with the molecular dynamics. Whereas for weak and even moderately intense radiation, the absorption and stimulated emission of photons by a molecular system can be described by perturbative methods, for intense radiation, perturbation theory is usually not adequate. Limiting the analysis to the gas phase, an attempt is made to describe nonperturbative approaches applicable to the description of such processes (in the presence of intense laser radiation) as
electronic energy transfer in molecular (in particular atom-atom) collisions; collision-induced ionization and emission; and unimolecular dissociation.

V. P.


The shear moduli G13 and G23 for two different composites (AS3501 and T300/5209) of uniaxial and cross-ply fiber orientations were determined by torsion testing of flat specimens of rectangular cross section. Torsion tests were run under controlled angle of twist in an electro-hydraulic servo-controlled test system. Both laser and potentiometer methods of measuring the angle of twist were used. The in-plane shear modulus was calculated with a formula for transversely isotropic materials and a formula for orthotropic materials, while the out-of-plane shear modulus was calculated from the orthotropic material formula. Neither the uniaxial nor the angle-ply composite materials were studied in a transversely isotropic. The degree of anisotropy for the angle-ply materials was several times greater than that of the uniaxial composites. For specimens of uniaxial fiber orientation, the in-plans shear moduli could be calculated to a good approximation by using the isotropic formula and test machine deflection data.

P. T. H.


The research work described in the present paper was carried out to develop and evaluate thermal protection materials for application to the Space Shuttle and future programs. The philosophy, methodology of testing, and facilities are discussed which had to be developed in view of the new requirements placed on the thermal protection system, in particular the requirement of multiple flight capability.

V. P.


The described modification of a physiochemical fire model predicts physical effects in clothed humans exposed to elevated temperatures as well as gas and aerosol concentrations in the atmosphere of an aerospace vehicle. The modifications involve the reduction in aerosol concentrations caused by settling and some improvements in dealing with mass and heat transfer effects. Predicted skin temperatures are found to be within 2°C of experimental values for the cases studied, and model predictions of total body enthalpy seem to correlate with symptomology observed experimentally.

M. L.


A recently revised model of the stratosphere is used to show that a subsatelite enhancement in the ozone layer could accompany worldwide SST fleet operations and that water vapor may be an important factor in SST assessments. Revised rate coefficients for various ozone-destructing reactions are employed in calculations which indicate a slight increase in the total content of stratospheric ozone for modest-sized fleets of SSTs flying below about 25 km. It is found that water-vapor chemical reactions can negate in large part the NOx-induced ozone gains computed below 25 km and that increased use of nitrogen fertilizer might also enhance the ozone layer.

F. G. M.


The sum of the squares of the electronic transition moments for the (E 1 Sigma +) - (X 1 Sigma +) band system of SiO has been determined from absorption measurements conducted in the reflected-shock region of a shock tube. The test gas produced by shock-heating a mixture of SiO4, N2O, and Ar, and the spectra were recorded photographically in the 150-230-nm wavelength range. The values of the sum of the squares were determined by comparing the measured absorption spectra with those produced by a line-by-line synthetic spectrum calculation. The value so deduced at an r-centroid value of 3.0 bohr was 0.98 ± 0.10 atomic unit.

(F.G. M.


Theoretical results pertaining to internally excited translational-rotational energy relaxation in a spatially uniform diatomic gas far removed from rotdir boundaries are obtained by solving the Boltzmann equation by means of the Monte Carlo direct simulation method. The analysis is based on calculations involving three different types of initial conditions: equilibrium, nonequilibrium equipartition (i.e., equipartition is satisfied, but the distributions are perturbed), and nonequilibrium nonequipartition (i.e., both equipartition and the distributions are perturbed). Results of monatomic-gas simulations are also included to facilitate comparisons with the coupled translational-rotational relaxation simulations, and some simulations for a normal shock-wave structure are briefly examined. The results show that: (1) single-step transitions are the significant mechanisms of intermodal energy transfer; (2) rotational-translational rotational-translations are coupled most efficiently for low-lying states of rotationally excited molecules and least efficiently for highly rotationally excited molecules; and (3) relaxation occurs via a successive set of distributions that are not Maxwell-Boltzmann (non-isocal Maxwellian).

F. G. M.


Possible contributions of tidal heating to the thermal history of the moon are investigated, and conditions under which such heating would have been an important factor in the evolution of the moon are defined as precisely as possible within the bounds of the uncertainties. The tidal dissipation is defined as a function of position in the moon and of the earth-moon separation for a homogeneous incompressible moon. Results for the dissipation are given for eccentricities of zero and 0.055 as well as for the lunar obliquity as determined by the equilibrium Cassini states. Possible orbital resonances which interrupt the assumed simplified expansion of the lunar orbit are considered, along with radial variations in rigidity. The dissipation in a two-layer model moon with a molten inner core and an outer mantle with the moon's present rigidity is determined, and implications of the results for the role of tidal heating in the history of the moon are discussed.

F. G. M.


Results are reported for measurements of the S IV 10.5-micron and Ne II 12.8-micron IR emission lines at four positions in NGC 7027 and of the Ar III 9.0-micron line at one position in the same planetary nebula. Ionic abundances are calculated using the data obtained at one position and are combined with published optical data for other ionization states to obtain total elemental abundances. The S IV and Ne II line-intensity distributions are compared with an 8.1-GHz radio map of the nebula. The S IV distribution indicates a density of about 500,000 per cu cm, and the Ne II is found to be contained in low-ionization regions distributed inhomogeneously throughout the nebula. The total abundances relative to hydrogen are determined to be 0.000015 for S, 0.0000053 for Ne, and 0.0000007 for Ar; these abundances are shown to be within the range of published average values for planetary nebulae.


Numerical solutions of the time-averaged Navier-Stokes equations employing a simple eddy-viscosity model have been obtained for three dimensional turbulent flow fields at supersonic speeds. The computer results are compared with a series of experimental test flows describing the interaction of a swept shock wave with a turbulent boundary layer for various shock-wave strengths. Very good agreement is obtained between the computed and experimental surface and flow-field results. The computed flow fields are examined in detail to investigate the physics of this type of flow field. Questions concerning the existence of a vortex and the relationship between converging surface oeks and the resulting flow field are addressed.


The paper reports a numerical procedure developed for a two-dimensional azimuthal (or planar) invariant form of the thin-layer Navier-Stokes equations. Generalization of the governing equations is described, and the equations are solved with an implicit approximate factorization finite-difference scheme. Inviscid and viscous results are presented for both external and internal flows and for spinning and nonspinning bodies.


In the present paper, it is shown that numerical optimization is a powerful tool for designing transonic wings and airfoils. Nixon's (1978) similarity theory is extended to cover design optimization problems. Some ground rules for designing shock-free airfoils are proposed and their application is demonstrated by examples. Advantages which accrue from integrating similarity theory into the numerical optimization procedure are noted.


An implicit finite-difference computer code that uses a two-layer algebraic eddy-viscosity model and exact geometric specification of the airfoil has been used to simulate transonic airflow buzz. The calculated results, which were performed on both the Illiac IV parallel computer processor and the Control Data 7600 computer, are in essential agreement with the original expository wind-tunnel data taken in the Ames 16-Foot Wind Tunnel just after World War II. These results and a description of the pertinent numerical techniques are included.

In applying finite-difference techniques to flow field problems, the accuracy attained for a fixed number of node points can be improved using unequally-spaced node points. The distribution of these node points is chosen here by minimizing a measure of local truncation error with respect to the parameters which define a transformation between the computational space of equally-spaced node points and the physical space of unequally-spaced node points. The problem then becomes a nonlinear programming problem. Numerical results are presented for two one-dimensional problems: the Blasius boundary layer problem and the inviscid Burgers' equation.


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 given. (Author)


The Proza generalization of electrodynamics admits the possibility that the universe could possess a net electric charge uniformly distributed throughout space, while possessing no electric field. A general-relativistic model of cosmological expansion dominated by such a charged background has been calculated, and is consistent with present observational limits on the Hubble constant, the deceleration parameter, and the age of the universe. However, if this cosmology applied at the decay epoch, the very early expansion of the universe would have been too rapid for cosmological nucleosynthesis or thermalization of the background radiation to have occurred. Hence, domination of the present expansion by background charge appears to be incompatible with the 3-K background and big-bang production of light elements. If the present background charge density were sufficiently small (but not strictly zero), expansion from the epoch of nucleosynthesis would proceed according to the conventional scenario, but the energy due to the background charge would have dominated at some earlier epoch. This last possibility leads to equality of pressure and energy density in the primordial universe. (Author)


Because of the controversy over the value of the band strength for the nu-4 fundamental of CH4, equivalent widths of the R(0), R(1), and P(11, 11, 11) lines have been measured to compare with opposing views. The present measurements are consistent with the band strength of Ko and Varanasi (1977), who, on the basis of high-resolution line-strength measurements, propose an integrated band strength of 145 kaysers/(cm-ang).


For the in situ investigation of planetary atmospheres a small Mattauch-Herzog mass spectrometer has been developed. Its high-pressure performance has been improved by incorporating differential pumping between the ion source and the analyzing fields, shortening the path-length as well as increasing the extraction field in the ion source. In addition doubly ionized and dissociated ions are used for mass analysis. These measures make possible operation up to 0.01 millibars. Results of laboratory tests related to linearity, dynamic range, and mass resolution are presented, in particular for CO2.


The strength of unidirectional fibrous composite materials was measured as a function of the acoustic emission. Specimens of glass fibers and carbon fibers in an epoxy matrix were tested to fracture. Many of the specimens were with existing defects. It was shown, analytically and experimentally, that defective material starts to emit acoustic waves at a much lower stress level than nondefective material. It was found that for glass fiber material, the ultimate strength of the composite is proportional to the stress level for which a specific number of acoustic emission counts was reached. For carbon fiber material, this phenomenon is less pronounced. (Author)


The thermomechanical and flammability properties of some thermally stable polymers considered for use in aircraft interiors are described. The properties studied include: (1) thermomechanical properties such as glass transition and melt temperature, (2) dynamic thermomechanical analysis in anaerobic environment, (3) flammability properties such as oxygen index, flame spread, and smoke evolution; and (4) selected physical properties. The thermoplastic polymers evaluated included polylefin sulfide, polyarylene sulfone, 9,9-bis(4-hydroxyphenyl)fluorene, polycarbonate and poly(methyl methacrylate). The thermoset polymers evaluated included epoxy, bismaleimide, a modified phenolic and polyurethane melamine resin. These resins were primarily used in the fabrication of glass reinforced prepregs for the construction of experimental panels. Test results and relative rankings of some of the flammability parameters are presented and the relationship of the molecular structure, char yield, and flammability properties of these polymers are discussed. (Author)


Mie theory, which is generally used to describe the scattering behavior of particles at a certain wavelength, is only rigorously correct for spherical particles. A new semi-empirical method is formulated for treating the real scalar scattering behavior. A description is presented of a new semiempirical theory, based on simple physical principles and data obtained in laboratory measurements, which successfully reproduces the single scattering phase function for a wide range of particle shapes, sizes, and relative indices. (Author)

Data provided by recent spacecraft missions to Mars include determinations of the properties and effects of aerosols suspended in the Martian atmosphere. Comparison of alternative procedures used to remotely sense the aerosol properties as well as analyses of these measurements are described.


A one-dimensional photochemical model was used to estimate the consequences of 27-day, 11-year, 22-year, and several-hundred-year variations of ultraviolet solar radiation on the concentration of ozone and nitrogen dioxide, and a one-dimensional radiative-convective equilibrium model was used to assess the joint effect of the radiation and concentration variations on the global temperature structure. For the several-hundred-year variations, the ozone column density increases by about 17.5% from minimum to maximum solar UV flux. For this range of solar UV variations, the ozone column density fluctuations are small (about 7% in the annual mean). The full response is only a small fraction of the expected maximum response, which is less than one percent for the 27-day period. Climatic consequences of these results are briefly discussed.


Observations of secondary spectrophotometric standards in the wavelength range between 5840 and 10800 A. B. J. Taylor (NASA, Ames Research Center, Moffett Field; San Jose State University, San Jose, Calif.). Astronomical Journal, vol. 84, Jan. 1979, p. 96-100. 25 refs.


Detailed time-correlated gain, fluorescence, and laser energy measurements were used to obtain quantitative data on energy extraction efficiencies for a photoionization-stabilized self-sustained XeF laser. A current pulse of 25 nsec full width at half-maximum produced an 80-cm XeF plasma in NF3:Xe gas mixtures with a maximum output energy of 80 mJ. The results show that the maximum small-signal gain and the maximum specific output energy is proportional to the NF3 content of the gas mixture. This suggests that there is an optimal fractional utilization of the NF3 molecules in the discharge. Under high-gain conditions, 30-40% of the energy stored in XeF (at saturation) can be extracted in a gain-switched pulse. The output energy represents less than 1% of the input energy.
The self-consistent dynamical development of six stellar systems, started from rotating spherical configurations, has been studied by means of a fully three-dimensional n-body integration. The six models had different initial angular velocities and velocity dispersions. All settled down into prolate bars rotating about a short axis within two initial rotation periods. The bars are long-lived, robust, and stable. Bars are the natural form toward which rapidly rotating, uniform-density spheroids develop, instead of the flattened axisymmetric disks that had been expected. The early stages of each collapse are reasonably well described by a theoretical model according to which a collapse passes through a sequence of rigidly rotating, uniform-density spheroids. The first significant departures from spheroidal form were axisymmetric in all cases. Rings formed in some examples, sheets in others, with transition cases between these extremes. Nonaxisymmetric forms developed from these intermediate stages.

(Author)


Complicated three-dimensional viscous transonic flows about bodies at high angles of attack are solved on the Illiac IV computer. It is shown that certain approximate forms of the compressible Reynolds-averaged Navier-Stokes equations can be computed about realistic three-dimensional geometries with relative ease on the Illiac IV. The ease and efficiency with which this can be done depend on the approximations made in the basic equations, the choice of the numerical algorithm used for the solution, and the data-base system that controls the data management and identifies and manipulates the vectors. A pencil data-base system is found to be particularly suitable for the approximations and numerical method chosen to produce the results presented. In addition, some comparisons are periodicity in its cross-correlation. This result was attributed to the flat-topped, after-cambered shape of the supersonic airfoil section, which reduced the coupling between shock oscillations and lift fluctuations.

(Author)


Some past developments and current examples of computational aerodynamics are briefly reviewed. An assessment is made of the requirements on future computer memory, and speed imposed by advanced numerical simulations, giving emphasis to the Reynolds-averaged Navier-Stokes equations and to turbulent eddy-simulations. Experimental scales of turbulence structure are used to determine the mesh spacings required to adequately resolve turbulent energy and shear. Assessment is also made of the changing market environment for developing future large computers, and of the projections of micro-electronics memory and logic technology that affect future computer capability. From the two assessments, estimates are formed of the future time scale in which various advanced types of aerodynamic flow simulations could become feasible. Areas of research judged especially relevant to future developments are noted.

(Author)


The parabolic Navier-Stokes (PNS) marching finite-difference method is adapted to 3-D viscous flow over pointed ogive cylinders, and to turbulent flow over a cone. Ogive computations were performed using the new technique recently reported by Vigneron, Rakich, and Tannehill. Comparison is made with experiment and inviscid computations. The present results show that this method, which neglects part of the pressure gradient in the x-momentum equation, is nevertheless valid for flows with a strong favorable pressure gradient. In addition, turbulent separated flow over a cone has been computed using the older PNS code due to Iubard and Hellwell. It is found that one must freeze the turbulent eddy viscosity model upstream of 3-D separation to get agreement with experiment.

(Author)


This paper describes a procedure for the automatic iteration of an inverse boundary-layer technique to a prescribed pressure distribution in a separated flow. The technique is demonstrated by computation of two transonic airfoil flows and two externally generated shock boundary-layer interaction flows. These results are compared to experimental data, and to solutions of the full Navier-Stokes equations. These comparisons indicate that substantial savings can be obtained by applying methods like the present, in lieu of full Navier-Stokes methods, in nodal calculation schemes for design purposes. The optimization technique leading to convergence is described in detail and a table of typical computation time is presented.

(Author)


Absorption spectroscopy has been performed in the reflected shock region of a shock tube. Neoprene was shock-heated to produce a mixture, at around 4000 K, rich in C3 and C2H to simulate the ablation layer over the Jovian entry probe, and the spectral range from 140 to 700 nm was surveyed with an evacuated spectograph. The observed spectra were dominated by those of C2 and C3 and an unknown band at wavelengths below 300 nm. The unknown broadband absorption with a peak cross section of about 16 cm2/stokes was observed in the wavelength range from 550 to 700 nm. The unknown broadband absorption with a peak cross section of 10 times 10 at the minus 17 sq cm at around 170 nm was attributed tentatively to the C2H radical. A preliminary calculation showed that the newly found absorption band can arise from the stagnation point wall by about 12.5% in a typical flight condition.

(Author)


A scale model of the Jovian entry vehicle of 64.4 cm diameter is tested in an electric arc-driven shock tube while a sphere model of 5.4 cm diameter is tested in a combustion-driven shock tube and an electric arc-driven shock tunnel. The radiative heat transfer rate and pressure on the front and the base regions are measured in the absence of ablation with sensors imbedded in the models in a stream consisting of 10% hydrogen in a bath of either neon or argon. The measured radiative heat-transfer rates and pressures are up to about 22 kW/cm2 and 12 atm, respectively, at the front stagnation point. The ratio of the base-to-stagnation point radiative heat-transfer rates is found to be about 0.15 for the sphere at Mach 1.8, about 0.20 for the sphere at Mach 4.8, and about 0.26 for the scale model at Mach 1.7. When the effects of model geometry and Mach number are accounted for, the present experimental results agree well with the theoretical prediction of Paris.

(Author)

The mechanism of radiative heating of the afterbody region of Jovian entry probe is analyzed. A theoretical model is derived to determine the average thermodynamic properties in the expanding region, recirculating region, recombination region, and neck region through application of one-dimensional conservation equations. Flow parameters are obtained from the shadowgraphs of a free-flight test. Radiative transfer is calculated using spectrally detailed computer codes accounting for nonequilibrium. The results show that the most severe heating occurs immediately behind the frustum, and that the recombination and neck regions are the major sources of radiation that heats the base stagnation point. The radiation flux to the base point is slightly stronger with ablation than without, its value being 0.11(1.34Sh/Br) squared kJ sq cm. Existing experimental data are shown to agree with the theoretical prediction. (Author)


Numerical simulations of viscous transonic flow over a circular-arc airfoil and in a diffuser are described. The simulations are made with a new computer program designed to serve as a tool in the development of improved turbulence models for complex flows. The program incorporates zero-, one-, and two-equation eddy viscosity models and includes a variety of subsonic and supersonic boundary conditions. The airfoil flow contains a shock-separated boundary-layer interaction that has resisted previous attempts at simulation. The diffuser flow also contains a shock-boundary-layer interaction, which has not been simulated previously. Calculations using standard turbulence models, developed originally for incompressible unseparated flows, are described. Results indicate that although there are interesting differences in predictions between the various models, none of them predict the flows accurately. Suggestions for improved turbulence models are discussed. (Author)


A detailed examination of the turbulent field in an unsteady transonic flow undergoing shock-induced separation is conducted. Ensemble averaged -nan and fluctuating velocities, obtained from conditionally sampled laser velocimeter data, are described and analyzed to assess the applicability of modeling concepts usually employed in steady-flow problems. Some comparisons with computations employing the Reynolds-averaged Navier-Stokes equations with a mixing-length turbulence model are then presented to illustrate the status of current predictive capabilities. The results appear to imply that turbulence models developed for steady flows apply and that the model need not reflect all the fine details of the turbulent structure but rather account in an approximate way for the production and destruction of the turbulence. G.R.


A numerical study of transient thermal response of a blunt-nosed axisymmetric body made of Teflon is presented using a two-layer thermal model. It is shown that phase change and transverse heat conduction have a considerable effect on the internal temperature field. Comparison of the numerical results with experimental data shows that the single-layer thermal model does not predict the thermal field, whereas the results of the two-layer thermal model agree reasonably well with the experiment. (Author)

Observations are presented of the spatial intensity gradients of 11-20 MeV per nucleon anomalous helium made with Pioneer 10 and Pioneer 11 over the radial range 1.1-1.3 AU for Pioneer 10 and to a heliographic latitude of 16 deg at 3.75 AU for Pioneer 11. Evidence is found for a significant gradient in heliographic latitude, with flux increasing away from the equatorial plane. The result shows that the common assumption of spherical symmetry for solar modulation is incorrect. By comparison with gradients measured for 29-67 MeV per nucleon helium and for 11-20 MeV and 26-67 MeV protons, it is found that both the radial and latitudinal gradients of the low-energy anomalous helium are the largest of those measured. The implications of these results for the origin of the anomalous component and for solar modulation are briefly discussed. (Author)


The Pioneer Venus mission evolved from studies conducted during the late 1960s and early 1970s. It was found that a need existed for low cost orbiters andlanders to explore the planet. The considered mission was to be accomplished with six separate vehicles arriving at Venus nearly simultaneously in mid December 1978. The probes are designed to survive entry and descent into the atmosphere. A description is presented of the approaches used to maintain sealing integrity for the large and small probes under the conditions imposed by the harsh Venusian environment. Attention is given to probe vehicle configuration, pressure vessel sealing requirements, material and configuration considerations, permanent seals, separable seals, development problems, and aspects of seal testing. (Author)


The orbiter and multiprobe components of the Pioneer Venus mission are briefly described. The orbiter was launched on May 20, 1978 and was placed into a highly eccentric near-polar orbit around Venus on December 4, 1978, while the multiprobe was launched on August 8, 1978 and reached Venus on December 9, 1978. Parameters of the orbiter orbit are presented, and modifications of the perihelion altitude are described. The time sequences of the probe entry vents are reported for the large probe, north probe, day probe, and night probe, which, along with the bus, are the components of the multiprobe. The multiprobe entry and impact locations as well as related data are reported. (M.L.)

Ultraviolet spectroscopy of the Venus cloud tops reveals absorption features attributed to sulfur dioxide in the atmosphere above the cloud tops. Measurements of scattered sunlight at 2603 angstroms show evidence for horizontal and vertical inhomogeneities in cloud structure. Images of the planet at SO2 absorption wavelengths show albedo features similar to those seen at 3650 angstroms from Mariner 10. Airglow emissions are consistent with an exospheric temperature of about 275 K. and a night airglow emission has been detected, indicating the precipitation of energy into the dark thermosphere. (Author)


An image of the infrared emission from the Earth-facing hemisphere of Venus was obtained at the time the Pioneer Venus probes penetrated the atmosphere. The thermal structure of the atmosphere at an altitude of about 275 K. and a night airglow emission has been detected, indicating the precipitation of energy into the dark thermosphere. (Author)


Each of the four Pioneer Venus probes carried instruments to measure the structure of the atmosphere, both below the cloud deck and above it to an altitude of at least 120 km. Preliminary results are presented on lower-atmosphere structure, thermal contrasts, and atmospheric stability. Alitudes derived from the data are given along with the temperature profile from 67 to 105 km, derived from the first analysis of the entry data of the north probe. All four probes lost temperature data at the 640 K. level, which is at an altitude of about 12 to 14 km. Values of temperature and pressure at touchdown are presented in a table. The pressure differences imply terrain elevations for the landing sites. Above 40 km, the measured profile moves from near adiabatic toward the theoretical profile for radiative equilibrium.


During the descent to the surface of Venus, the large probe infrared radiometer measured the net thermal radiative flux in several spectral bandpasses. Preliminary analysis has permitted us to estimate (1) the infrared extinction coefficient profile attributable to aerosols, with respect to their visible profile, in the upper atmosphere of Venus and (2) the water vapor mixing ratio below the clouds. An indication of the composition of a multicomponent cloud is seen in the data from the spectral bandpass from 6 to 7 micrometers.


Initial examination of data from the neutral mass spectrometer on the Pioneer Venus sounder probe indicates that the abundances of argon-36, argon-38, and neon-20 in the Venus atmosphere are much higher than those of the corresponding gases in Earth's atmosphere, although the abundance of radiogenic argon-40 is apparently similar for both planets. The lower atmosphere of Venus includes significant concentrations of various gaseous sulfur compounds. The inlet leak to the mass spectrometer was temporarily blocked by an apparently liquid component of the Venus clouds during passage through the dense cloud layer. Analysis of gases released during the evaporation of the droplets shows the presence of water vapor to some compound or compounds of sulfur.


Reflectivity spectra of the trailing and leading sides of lo, Europa, Callisto, and Ganymede are analyzed which were obtained at an altitude of 41,000 ft from the Kuiper Airborne Observatory with circular variable filter-wheel spectrometers in the spectral region from 0.7 to 5.5 microns. The data are compared with laboratory spectrum and with synthetic spectra constructed on the basis of simple multiscattering theory. The 2.9-micron feature in Callisto's spectra is attributed primarily to bound water; the fractional amounts of water-ice cover on the trailing and leading sides of Ganymede and on the leading side of Europa are estimated. The bare-ground areas on Ganymede are shown to have reflectivity properties comparable to those of Callisto's surface in the studied spectral region, and the surfaces of both satellites are found to contain significant quantities of bound water. It is suggested that minor but significant amounts of ferrous-bearing material (either ferrous salts or alkalifeldspars) can account for the 1.35-micron feature of lo.


Spectrophotometric observations of the Jovian satellite Io on February 20 and 21, 1978. (Universal Time) were made from 1.2 to 5.4 micrometers. Io's brightness at 4.7 to 5.4 micrometers was found to be frizzer to three times greater at an orbital phase angle of 68 deg than at orbital phase angles of 23 deg (5.5 hours before the brightening) and 240 deg (20 hours after the brightening). Since the 5-micrometer albedo of Io is near unity under ordinary conditions, the observer transient phenomenon must have been the result of an emission mechanism. Although several such mechanisms were examined, the actual choice is not clear.

Upper limits to the 50- and 100-micron emission from the Crab nebula are reported. These data are consistent with a spectrum that follows a power-law interpolation between the millimeter and near-infrared fluxes. The data are interpreted in terms of an upper limit to thermal emission by dust in the nebula. The upper limit to the amount of dust present is consistent with previously reported upper limits to optical extinction associated with the nebula. (Author)


The presented review is concerned with the problem of calculating compressible viscous flows. Basic numerical considerations and problems associated with calculating viscous flows are examined and current numerical approaches toward the solution of the Navier-Stokes equations are discussed. It is pointed out that the numerical solution of the full time-dependent equations for turbulent flow is not practical with present computers. Therefore, turbulence effects must be accounted for by modeling. Developments related to turbulence modeling are described. In connection with a discussion of numerical methods for solving viscous flow equations, attention is given to numerical domains of dependence for typical explicit and implicit methods, the diffusion problem, the convection-diffusion problem, and the split-hybrid method. G.R.


The resonant structure of Io leads to forced eccentricities that are considerably larger than the free values. Although still modest by all standards, these forced eccentricities coupled with the enormous tides induced by Jupiter lead to magnitudes of tidal dissipation that are large enough to completely dominate the thermal history of Io. In the present paper, the forced eccentricities are calculated and then substituted into an expression for the total tidal dissipation. The results point to the possibility that the dissipation of tidal energy in Io may have melted a major fraction of Io's mass. V.P.


A rate equation describing the desorption of particles from substrates has been formulated using a simple classical model in terms of the particulate escape probabilities and escape velocities. Numerical results for desorption rates as a function of temperature using simple two-body potentials are calculated for various metallic systems. These results were obtained for the low coverage limits and are found to be in good agreement with experimental findings. The present formulation also provides an improved picture of the physical nature of the commonly discussed parameters, such as the frequency factor, desorption energy, and desorption temperature in relation to observed desorption phenomena. (Author)


The thermochemical and flammability characteristics of laminating resins and composites currently in use and others being considered for use as aircraft interior panels are described. The properties studied included: (1) limiting oxygen index of the composite constituents; (2) fire containment capability of the composite; (3) smoke evolution from the composite; (4) thermogrammetric analysis; (5) composition of the volatile products of thermal degradation; and (6) relative toxicity of pyrolysis. The performance of high-temperature laminating resins such as modified phenolics, polyimides and bismaleimides is compared with the performance of epoxies. The relationship of increased fire safety with others, use of polymers with high anaerobic char yield is shown. Processing parameters of the state-of-the-art epoxy resin and the advanced resin composites are detailed. (Author)


We have obtained stratospheric aerosols from tropical to northern latitudes using special spacecraft on U-2 aircraft during 1976 and 1977. Aerosols characterized by large numbers of small particles are found in the tropical zone suggesting this is a region of particle growth; whereas aerosols containing mostly larger particles are distributed throughout the Northern Hemisphere indicating a well-mixed, mature population. We find the aerosol layer extends from higher altitudes near the equator to lower ones toward the pole. Although this gradient suggests mature aerosols may leave the stratosphere at high latitudes, the data are, as yet, inconclusive. Comparisons of our data with other recent aerosol measurements using different instruments are generally encouraging, suggesting that if similar populations were sampled, the results would be similar. When our calculated sulfate mass mixing ratios are compared with those measured directly by others, we find better agreement if we assume more dilute sulfate and water mixtures than previously proposed. (Author)


The technical feasibility of providing nearly continuous solar energy to a world-distributed set of conversion sites by means of a system of orbiting, large-area, low-areal-density reflecting structures is examined. Requisite mirror area to provide a chosen, year-averaged site intensity is shown. A modeled reflector structure, with suitable planarity and ability to meet operational torques and loads, is discussed. Typical spatial and temporal insolation profiles are presented. These determine the sizing of components and the output electric power from a baselined photovoltaic conversion system. Technical and economic challenges which, if met, would allow the system to provide a large fraction of future world energy needs at costs competitive to circa 1995 fossil and nuclear sources are discussed. (Author)


The structures and thermal evolutions of the large icy satellites of the outer solar system are considered. It is shown (for bodies
with resulting long-term stability of surface features to creep deformation conditions, reverses earlier conclusions and implies a rigid outer crust. Work, using improved values for material parameters and boundary conditions, reverses earlier conclusions and implies a rigid outer crust with resulting long-term stability of surface features to creep deformation. The combination of a rigid crust with active internal convection presents the additional possibility of surface features that are produced and maintained by dynamic internal processes. (Author)

Although 1-D (spherically symmetric) experiments of protostar collapse are highly idealized, they are the only ones which have been carried to a stage where a 'stellar' object is formed. Experiments have shown that the parameters (e.g., radius and luminosity) of the visible stellar core are sensitive to the assumed initial conditions, particularly the initial density. One of the main findings of 2-D numerical experiments is the formation of rings. Three-dimensional hydrodynamical calculations indicate that a collapsing cloud will break up into two or more orbiting subcondensations with the possible subsequent development of a stellar multiple system.

G.R.


Fan silencers with low-pressure drop have been designed and installed in the NASA Ames 7- by 10-Foot Wind Tunnel No. 1. The silencers are composed of an absorbent lining flush with the wind tunnel walls upstream of the fan and an absorbent splitter in the duct downstream of the fan. An acoustic insertion loss of 4 to 12 dB was measured between 100 and 1000 Hz. High-frequency performance of the silencers was reduced by test-section noise and by corner vanes which turned the sound waves so they followed the duct axis. Sound below 1.2 kHz diffracted around the 305-mm-long vanes and impinged on acoustically absorbent corner walls. Wind-tunnel flow losses are discussed.

(Author)


The paper demonstrates the feasibility of a bistatic synthetic aperture radar (BISAR) utilizing two satellites. The proposed BISAR assumes that the direction of the two narrow antenna beams are programmed to coincide over the desired area to be imaged. Functionally, the transmitter and receiver portions can be interchanged between the two satellites. The two satellites may be in one orbit plane or two different orbits such as geosynchronous and low-altitude orbits. The pulse repetition frequency and imaging geometry are constrained by contours of isodop and isodels. With two images of the same area viewed from different angles, it is possible in principle to derive three-dimensional stereo images. Applications of BISAR include topography, water resource management, and soil moisture determination. Advantages of BISAR over a monostatic SAR are mentioned, including lower transmitter power and greater ranges in incidence angle and coverage.

S.D.


Some general properties of multiplexing optical systems for astronomical applications are described. The advantages and disadvantages which characterize Fourier and digitally encoded instruments when faced with any of ten sources of noise are discussed.

B.J.


Because of the interlaced television scan, the two fields that form an interlaced video frame are generated 1/60 of a second apart. If the two fields are compressed independently, the correlation between adjacent lines is unused. The transmission rate can be reduced by using a field memory to form an interlaced frame. Four test images were processed as fields and as interlaced frames, using both theoretical and experimental compression designs. For comparable mean-square error and subjective appearance, field compression requires about one-half bit per sample more than frame compression. However, the overall transmission rate - the number of bits per image times the number of images per second - is more meaningful than the number of bits per sample. When transform compression at low transmission rates merges the adjacent lines, frame compression becomes similar to field repeating, and the memory can be reduced.

(Author)


The discussion is in three parts. First, laser spectroscopy is discussed with consideration given to single-photon and multiphoton processes. Second, attention is given to the use of lasers in studying molecular interactions and reaction dynamics. Finally, the paper discusses the relationship between chemistry and laser development.

B.J.


It is suggested that asymptotic results for the behavior of thin shells can be incorporated in a general computer code for the analysis of a complex shell structure. The advantage when compared to existing finite difference or finite element codes is a substantial reduction in computational labor with the capability of working to a specified level of accuracy. A reduction in user preparation time and dependence on user judgment is also gained, since many problems can be internally generated. The general theory is described in this paper, as well as the implementation in the computer code FAST 1 (Functional Algorithm for Shell Theory) for the analysis of the general axisymmetric shell structure with axisymmetric loading.

(Author)


A parametric study is performed for the existing monochromatic intensities scattered from finite plane-parallel inhomogeneous layers that are driven solely by a distribution of thermal sources. Intensities are obtained by invariably imbedding the standard and thermal scattering functions. The single-scattering albedo and the Henneylee-Greenstein phase-function parameter are varied independently, and both linear and exponential profiles are considered. Linear temperature profiles are used, including temperature inversions. The resulting intensities, as a function of the direction cosine of propagation, are discussed from a remote-sensing point of view. For an isothermal and homogeneous medium, the gross characteristics of the exiting intensity, represented by its overall slope, mean value (magnitude), and an interior maximum value, can be related to the total optical depth, single-scattering albedo, and phase function, respectively. For a homogeneous medium, linearly decreasing (in the line of sight) temperature profiles tend to obscure the phase-function information and decrease the apparent optical depth. On the other hand, linearly increasing temperature profiles tend to retain phase-function information and increase the apparent optical depth. Temperature inversion profiles give intensities very similar to those for purely linear profiles.

(Author)


Podolak and Danielson (1977) discussed the homogeneous model of Titan's atmosphere with the dust and gas uniformly mixed. They were able to reproduce the equivalent widths of the CH4 bands at 4680 and 5430 A but failed to agree with the observations in the near infrared. The present paper develops an inhomogeneous model which has the dust and gas essentially separated, this model agrees fairly well with the near-IR data of Younkin (1974) but does not agree with the data of Lutz et al. (1976) for the 4860 A band and it must be adjusted to match their data for the 5430-A band.

B.J.


Unidirectional fibrous composite material laminates are the construction material of a laminate. Four failure modes can occur in this material, and the identification of these modes is as important as the identification of onset of fracture. Acoustic emission (AE) pulses, generated by the change in the stress field resulting from cracking in a material, have a unique pattern of amplitude distribution that depends only on the mode of fracture and the type of material. By using a tapered double-cantilever beam as a crack starter for the unidirectional laminate, a crack with a constant stress intensity factor was induced, thus eliminating the factor of the stress level. Placing the laminate in different directions relative to the grips imposed a different failure mode. By plotting the log of the relative number of AE pulses above some level versus the log of the relative level, a single constant coefficient can be measured for each material and
mode of fracture. The AE energy is proportional to the energy released by the cracking, this proportionality depends on the medium where the AE waves have to travel, and not on the cracking mode. 

(Author)


The optical depths of the solar H Lyman-alpha and the He 584-A lines in interplanetary space are calculated. From these the solar line profiles at Saturn and Uranus are determined. It is found that the solar H Lyman-alpha line can be diminished strongly within a spectral region of about 0.04 A. The effects of solar line modulation on interplanetary and planetary glow observations are discussed. 

(Author)


Detailed experiments were conducted in a zero pressure gradient, supersonic turbulent boundary layer, including measurements of the three components of velocity fluctuations and the turbulent shear stress, for Reynolds numbers ranging from 11.7 million to 105 million at a freestream Mach number of 2.3. The mean flow measurements established the fully developed and equilibrium nature of the boundary layer. Measurements of the turbulence field show that the vertical and transverse fluctuations are essentially equal throughout the boundary layer at all Reynolds numbers, a feature that is different from observations in incompressible flows. The data show that the boundary layer exhibits similarity in the turbulence profiles for the entire Reynolds number range and agrees with previous compressible and incompressible data using Morkovin's scaling to account for compressibility effects. 

(Author)


It is pointed out that cryogenic engineering has been an integral part of space research almost from the beginning of the space age because of the significant performance advantages available from cryogenically fueled rocket engines. In recent years, space-related cryogenic engineering has expanded from booster engines to include spacecraft systems because of the vastly improved performance available from cooled detectors and systems. The requirements for detector cooling in space are examined, taking into account earth observations, atmospheric measurements, infrared astronomy, X-ray astronomy, gamma-ray astronomy, radio astronomy, relative measurements, magnetic field measurements, time measurements, and data processing. A description is presented of 1978-1981 U.S. spacecraft cryogenic detector systems. 

G.R.


The Infrared Astronomy Satellite (IRAS) is planned for launch in 1981, and is a joint project of the Netherlands, the United Kingdom and the United States. The instrument will consist of a superfluid helium-cooled 80 cm telescope with a large array of infrared detectors at the focal plane. The primary purpose of the mission is to perform an all-sky survey in the infrared region from 8 to 120 micrometers. The dewar contains 70 kg of superfluid helium which will maintain the telescope and detectors a 2K for one year. The dewar contains a supercritical helium cover tank which will be ejected after the experiment has been in orbit for two weeks. 

(Author)


A liquid-helium-cooled grating spectrometer has been developed for low-resolution far-infrared spectrometric measurements of astronomical sources conducted by the 30-cm NASA Lear Jet telescope. Simple MOSFET coupled transimpedance preamplifiers were adopted for the spectrometer design. The infrared spectrometer has resolving powers from 10 to 150 over the wavelength range from 45 to 115 microns. 

J.M.B.


A high-angular-resolution multiaperture far-IR photometric instrument for microlight observations of a variety of objects at effective wavelengths of 40 to 160 microns is described which is ideal for use on NASA's Kuiper Airborne Observatory. The operational principles of the instrument are discussed, along with the far-IR radiometer and the offset guiding module. System performance is evaluated on the basis of the noise-equivalent flux of the radiometer, guiding accuracy capability, the suitability to the scientific objectives of the filter bandpasses and focal-plane aperture sizes, the ease of operation, and operating efficiency. Some examples of recent observations with this instrument are provided. 

F.C.M.


Observational data related to climatic change on Venus, earth and Mars are reviewed. The channel features on Mars suggest an early to intermediate epoch of warmer and wetter climate while the layered polar deposits imply more recent periodic variations in climate. A more reducing atmosphere, which would have produced an enhanced greenhouse effect, may have been responsible for warmer periods in the early history of Mars and earth. Detailed calculations relating atmospheric pressure and composition to the temperature state of Mars are presented. The possibility of a runaway greenhouse effect on Venus resulting in the emplacement of volatiles entirely in the atmosphere is also examined. Periodic variations in orbital eccentricity and axial obliquity may have contributed to alternating glacial and interglacial periods on earth. Mechanisms accounting for the laminated terrain of Mars, and the influence of Martian tectonic disruptions on the planet's climate also receive attention. 

J.M.B.


Known properties of the current solar system and Bodenheimer's (1977) model of early Jupiter evolution are employed to develop a mechanism for satellite capture based on gas drag in primordial circumplanetary envelopes. In particular, the deceleration and fragmentation of the parent bodies passing through an extended primordial Jovian nebula may account for the clusters of prograde and retrograde satellites of Jupiter. Subsequently, the fragments probably underwent limited orbital evolution and were dispersed by collision with a stray body. The heavy element cores of the outer planets may also be due to primordial gas drag capture. Nebular gas capture of the Martian satellites Phobos and Demos. Neptune's
Nereid and Triton, and Saturn's Phoebe and Iapetus is also conceivable.


A79-32207 • Spatially resolved methane band photometry of Jupiter. J. M. B.


The steady state thickness and vertical structure of Saturn's rings are discussed with regard to whether a collapse to a monolayer due to particle collisions may be prevented by various mechanisms. The differences between thick rings and wavy monolayers are outlined and used to show that such coherent perturbations to the rings as satellite wakes and solar gravitational effects would produce a wavy monolayer while such dispersive mechanisms as meteors, ion drift and radial spreading, which would produce the random particle motions necessary to maintain a thick layer, are probably insignificant. Given a typical power law distribution of particle sizes, it is found that gravitational scattering of small particles by large ones would maintain a ring thickness of several times the radius of the largest particles. A steady state ring thickness of 20 to 50 meters derived from energy considerations would simply imply a maximum particle size of a few meters. A.L.W.


The use of infrared techniques to search for nonsolar planets is examined and compared with other possible methods. Long focus astrometry, spectroscopic radial velocity measurements and space-based astrometry all use visible light and need further refinement to be practical. Infrared offers an advantage of about 10 to the 5th over visible light as regards the ratio of power received from star and planet. Long baseline infrared interferometry from earth orbit could place an interferometric null on the star to enhance planetary signal to noise ratio. A spinning interferometer would modulate planetary emission to permit synchronous detection; such an interferometer is illustrated. The limit to sensitivity would be set by thermal radiation to the detector and the infrared component of zodiacal light. A.L.W.

The paper reexamines the problem of particle injection by Io and subsequent radial diffusion by flux tube interchange using a proper phase space density formulation. The mathematical formalism is developed, and the theoretical results are compared with the observations, taking into account the pitch angle and energy coverage of the detector on Pioneer 10. Two objectives are pursued: (1) to test the hypothesis of Siscoe and Chen (1977) that Io is the source for all of the plasma observed by Frank et al. (1978) inside 10 R_I; and (2) to describe a simple but flexible method intended to analyze the observations of any other plasma instrument flown through the inner Jovian magnetosphere, e.g., those on Voyager 1 and 2 and Galileo.

S.D.


A system of orbiting reflectors. SOLARES, has been studied as a possible means of reducing the diurnal variation and enhancing the average intensity of sunlight with a system of minimum mass and complexity. The key impact that such a system makes on the economic viability of solar farming and other solar applications is demonstrated. The system is compatible with incremental implementation and continual expansion to meet the world's power needs. Key technology, environmental, and economic issues and payoffs are identified. SOLARES appears to be economically superior to other advanced, and even competitive with conventional, energy systems and could be scaled to completely abate our fossil fuel usage for power generation. Development of the terrestrial solar conversion technique, optimized for this new artificial source of solar radiation, yet remains.

(Author)


Infrared observations are presented of two compact sources associated with molecular clouds. Photometry from 2 to 200 microns of the source associated with an OH maser in NGC 2071, OH 205.1-14.1, shows a steep increase in flux from 2 to 50 microns. Scans at several wavelengths fail to resolve the source. Photometry at 200 microns of the other object, GL 490, when combined with earlier 2-20 micron spectrophotometry, shows an infrared energy distribution that is much broader than that of the NGC 2071 source. Both sources are interpreted as young, possibly pre-main-sequence objects, W3(A) and W3(OH), in the W3/W4 system.


Far-infrared maps of AFGL 333 at 50 and 100 microns with 40 arcsec resolution are presented. The observed luminosity of about 14,000 suns, together with previous radio continuum observations, indicates that the source is powered by a 80.5 zero-age main-sequence star. The relatively low molecular density of about 1000 per au inferred from the observed dust optical depth probably implies that AFGL 333 is not as young as the other H II/infrared objects, W3(A) and W3(OH), in the W3/W4 system.


The aim of the Post Landsat-D Advanced Concept Evaluation (PLACE) program was to identify the key technology requirements of earth observation systems for the 1985-2000 time frame. The program involved four efforts: (1) examination of future needs in the earth resources area, (2) creation of a space systems technology model capable of satisfying these needs, (3) identification of key technology requirements posed by this model, and (4) development of a methodology (PRISM) to assist in the priority structuring of the resulting technologies.

B.J.


The paper describes a study conducted to identify the technology development that would allow missions to Jupiter and Saturn to proceed beyond currently planned investigation of the upper atmosphere. The study considered a deep probe mission that would provide the capability to scientifically examine planetary atmospheres to the 1000 bar level and 1400 K level. The major conclusions of the study are that (1) a probe designed for Jupiter can be used with minor changes for Saturn, (2) new science instruments technology developments are required, and (3) the only new technology developments required in the engineering subsystem are high pressure thermal insulation materials and advanced data processing techniques.

B.J.


The retarding potential analyzer on the Pioneer Venus Orbiter Mission has been designed to measure most of the thermal plasma parameters within and near the Venusian exosphere. Parameters include total ion concentration, concentrations of the abundant ions, ion temperatures, ion drift velocity, electron temperature, and low-energy (0-50 eV) electron distribution function. To accomplish these measurements on a spinning vehicle with a small telemetry bit rate, several functions, including decision functions not previously used in RPA's, have been developed and incorporated into this instrument. The more significant functions include automatic...
numbers are illustrated for each planet. It is found that primordial heat can contribute substantially to the present surface heat flux of a planet.


A model of the energy balance of the dayside ionosphere of Venus is presented. The coupled energy equations for electrons and ions are solved numerically and the calculated temperatures are compared with temperatures measured by instruments on the Pioneer Venus Orbiter. Neutral and ion density profiles consistent with those measured by various Pioneer Venus experiments are used in the model. It was found that using standard EUV sou-les and thermal conductivities the calculations produce temperatures that are much lower than the measured ones. Consequently, further calculations were performed in which (1) the thermal conductivities were inhibited by means of an almost horizontal magnetic field and/or (2) heat inflow into both the electron and ion gas at the ion of the ionosphere was assumed due to solar wind interaction. It was found that the calculated and measured temperatures were in reasonably good agreement if the thermal conductivities were inhibited by a near horizontal field of about 10 gammas and if the electron and ion heat fluxes were taken to be 4 x 10^9 and 10^12 ergs/cm^2/sec, respectively.


A model of the diffusion of ionospheric plasma in the wake region of Venus is presented. It is shown that particle diffusion, which is assumed to be a consequence of the fluctuating magnetic field observed in the wake of Venus by Pioneer Venus and Veneras 9 and 10, can explain the plasma observations made in the wake by Veneras 9 and 10. The pressure due to these diffusing particles when balanced against the ionospheric pressure yield ionopause heights less than 1000 km for zenith angles less than about 135 deg. The model also predicts significant fluxes of low energy electrons and ions for zenith angles less than 135 deg., which are capable of producing the observed nightside ionosphere.


75

The Pioneer Venus large probe neutron mass spectrometer (LNMS) uses a single focusing magnetic sector field mass analyzer with mass range of 1-208 amu, resolution sufficient to separate the mercury isotopes, and sensitivity sufficient to detect minor constituents in the 1 ppm range relative to the CO2 in the Venus atmosphere. A combination of ion and chemical pumping is used to maintain a vacuum in the mass analyzer and to remove the atmosphere gases which enter the ion source chamber through a special leak. A microprocessor controls the operation of the instrument through a highly efficient peak stepping and data compression program, permitting acquisition of a complete mass spectrum roughly once each minute.

P. H.


Earlier results are extended to include data from Pioneer 10 to a radial range of 11.3 AU, and from Pioneer 11 inward from 5 AU to 3.75 AU after Jupiter encounter, and to a maximum heliographic latitude of 17 deg. The data include the period from March 1972 through October 1976, during which time the neutron monitor cosmic ray intensity was, except for a few significant excursions, near solar minimum level. It is shown that the radial gradients of all particle species considered are small and positive throughout the period of study. On a shorter time scale, the data indicate transient decreases in the value of the differential gradient associated with major decreases in the cosmic ray intensity in the inner solar system. The observations are consistent with a modulating region whose radius is large compared to 11 AU. The ‘anomalous’ helium component, present since 1972 at earth orbit, is observed continuously at all radial distances.

S. D.


A profile of electron intensities in the interplanetary medium from 1 to 12 AU obtained from Pioneer 10 measurements of the 3-MeV electron flux. A description of the electron flux at Jupiter shows the changes in the electron intensity at different distances from Jupiter. The amplitude of the electron flux increases with increasing distance from Jupiter. The data indicate a correlation between the sun and Jupiter. Amplitudes of the intensities increase with increasing distance from Jupiter. Amplitudes of the intensities increase with increasing distance from Jupiter.

C. K. D.

Voltage barriers in a ZnO varistor have been imaged by voltage-contrast scanning electron microscopy. They are due to grain boundaries and are capable of supporting voltage differences of up to about 4 V.

Author.


Radar observations accumulated over the past 14 yr are used to make a precise estimate of the spin vector of Venus. The results obtained from the spin vector of Venus may be adequately described in the standard 1950.0 coordinate system by a period of 243.01 + or - 0.03 days (retrorgrade) and a north pole direction corresponding to alpha = 272.8 + or - 0.5 deg and delta = 67.2 + or - 0.3 deg; the quoted errors represent estimates of 70% confidence intervals. The angular separations between the spin vectors representing the unit normals to the invariant plane of the solar system and the orbital plane of Venus are found to be 0.5 deg and 2.6 deg, respectively. It is concluded that Venus is not rotating with a resonance spin period relative to the orbit of earth and that the spin of Venus may be in a generalized Cassini state.

F. G. M.

A general and computationally fast formulation for radiative transfer with scattering. A. C. Colley and A. Sharma (Illinois University, Chicago, Ill.). American Institute of Aeronautics and Astronautics, Thermodynamics Conference, 14th, Orlando, Fla., June 4-6, 1979, Paper 79-1035. 9 p. 15 refs. NSF Grant No. 77-11173; Grant No. NCA2-0330-701.

A general formulation of monochromatic radiative transfer with scattering has been developed for plane-parallel geometry. The inhomogeneous and nonisothermal medium absorbs, emits, and anisotropically scatters radiation. Surfaces can emit and scatter radiation in any specified manner. The solution procedure uses the fact that phase incoherent scattering is linear in radiative sources. Certain basic scattering functions are then defined and calculated by an adding computer code using matrix algebra. These scattering functions are weighted by the temperature field and summed (superimposed) to obtain the solution for any specific problem. Numerical results for exiting intensities and one-sided heat fluxes from general media bound by one arbitrary surface are presented. These parametric studies demonstrate the effects of scattering particles and surfaces on radiative transfer from inhomogeneous and nonisothermal media. Application of the formulation to radiative equilibrium is also discussed. The conclusion is that all problems in plane-parallel radiative transfer with scattering can be solved by a common and computationally fast algorithm based on this formulation.

Author.


A laser-induced fluorescence technique for measuring the relative time-dependent density fluctuations in unsteady or turbulent flows is demonstrated. Using a 1.5 W continuous wave Kr(•) laser, measurements have been obtained in 0.1 mm diameter by 1 mm-long sampling volumes in a Mach 3 flow of N2 seeded with acetylene vapor. A signal amplitude resolution of 2% was achieved for a detection frequency bandwidth of 10 kHz. The measurement uncertainty was found to be dominated by noise behavior as photon statistical noise. The practical limits of signal-to-noise ratios have been characterized for a wide range of detection frequency bandwidths that encompasses those of interest in supersonic turbulence measurements.

Author.

On the basis of this investigation of the high-temperature behavior of polytetrafluoroethylene (PTFE), the transient one-dimensional ablation of PTFE has been developed by taking into account the optical transmittance of both the amorphous zone and the crystalline zone of PTFE layer. Results show that although the exposed surface receded at an apparently steady state, both the internal temperature and the thickness of the gel layer increased continuously due to the internal absorption of radiation. (Author)


This paper proposes an orbiting infrared interferometer with its fringe null centered on a nearby star at a distance of 10 parsecs. A large planet ('Jupiter') would have an angular separation from the star of about 0.5 arcsec. To have a fringe crest on the planet, a fringe period of 1.0 arcsec is needed and at 40 microns the required baseline is 8 m. Spinning the interferometer about the line of sight to the star results, even with pointing errors, in a relatively slowly varying but strongly suppressed stellar output and a more rapidly varying fringe-like planetary signal rich in higher harmonics. For pointing errors up to 0.5 arcsec the planet's fourth harmonic greatly exceeds that from the star thereby relaxing interferometer pointing tolerances. Indeed, it appears that the limiting factor is zodiacal infrared background radiation and not the intense localized stellar flux which can effectively be eliminated by the fringe null of the spinning infrared interferometer. (Author)


Line-by-line calculations of the radiative transport for a condition near peak heating for entry of the Galileo probe into the Jovian atmosphere are described. The discussion includes a thorough specification of the atomic and molecular input data used in the calculations that could be useful to others working in the field. The results from the calculation of spectrally averaged cross sections for diatomic absorbers such as CO and C2 in the boundary layer can lead to an underestimation (by as much as 29%) of the spectral flux at the stagnation point. On the other hand, for the turbulent region near the cone frustum on the probe, the flow tends to be optically thin, and the spectrally averaged results commonly used in coupled radiative transport flow-field calculations are in good agreement with the present line-by-line results. It is recommended that these results be taken into account in sizing the thermal thickness of the Galileo's heat shield. (Author)


This work includes the use of the RASLE code, ablation experiments in the Giant Planet Facility are numerically simulated. Of primary importance is the simulation of the low Mach number shock layer that envelops the test model. The RASLE shock-layer code, used in the Jupiter entry probe heat shield design, is adapted to the experimental conditions. RASLE predictions for radiative and convective heat fluxes are in good agreement with calorimeter measurements. In simulating carbonaceous ablation experiments, the RASLE code is coupled directly with the CMA material response code. For the graphite models, predicted and measured recessions agree very well. Predicted recession for the carbon phenolic models is 50% higher than that measured. This is the first time codes used for the Jupiter probe design have been compared with experiments. (Author)


A general class of even/odd transforms is presented that includes the Karhunen-Loeve transform, the discrete cosine transform, the Walsh-Hadamard transform, and other familiar transforms. The more complex even/odd transforms can be computed by combining a simpler even/odd transform with a sparse matrix multiplication. A theoretical performance measure is computed for some even/odd transforms, and two image compression experiments are reported. P.T.H.


The results of two studies aimed at developing efficient adaptive and nonadaptive techniques for compressing the bandwidth of multispectral images are summarized. These techniques are evaluated and compared using various optimality criteria including MSE, SNR, and recognition accuracy of the bandwidth compressed images. As an example of future requirements, the bandwidth requirements for the proposed Landsat D Thematic Mapper are considered. B.J.


The primary purpose of programmable satellite receivers is to provide flexibility in application through digital control of the important functions of the receiver. This permits the acquisition and demodulation of medium to low data rates in widely varying communications environments and over a wide range of modulation schemes. The first application of the programmable concept is in the high-reliability, low-power NASA Standard Command Detector Unit. A second programmable receiver has been designed and breadboarded for the Jupiter Orbiter Probe or Galileo mission. B.J.


The addition of an extra term to the conventional approximate transport equation for the turbulence energy dissipation rate is recommended. This term directly with the OMA material response code. For the graphite models, predicted and measured recessions agree very well. Predicted recession for the carbon phenolic models is 50% higher than that measured. This is the first time codes used for the Jupiter probe design have been compared with experiments. (Author)

This paper describes a recently developed boundary-layer prediction method for a variable property compressible flow, in which heat transfer takes place primarily by forced convection and for which the mainstream Mach number is small. The leading order terms, in asymptotic expansions for large Reynolds numbers, are obtained for the mean velocity and temperature distribution in both the inner and outer layer of the turbulent boundary-layer closure. Closure in the inner layer is achieved using an analytical model for the mean profiles which is based on the observed coherent structure of the time-dependent inner layer flow. For the outer layer, simple eddy viscosity and conductivity models are developed without recourse to the Reynolds analogy. In the prediction method a numerical solution of the outer layer equations is matched to the analytical inner layer profiles as the computation proceeds downstream. Calculations are presented for a range of adverse and favorable pressure gradient flows and the predicted results compare well with existing data. (Author)


The topology of lunar remanent fields is investiTed by analyzing simultaneous magnetometer and solar wind spectrometer data. The diffusion model proposed by Vanyan (1977) is applied to describe the field/potential interaction at the lunar surface is extended to investigate the interaction with fields characterized by two scale lengths, and the extended model is compared with data from three Apollo landing sites (Apollo 12, 15 and 16) with crustal fields of differing intensity and topology. Local remanent field properties from this analysis are compared with high spatial resolution magnetic maps obtained from the electron reflection experiment. It is concluded 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 early in the evolution of the crust. Smaller scale (5 to 10 km) magnetic sources close to the surface were left by bombardment and subsequent gardening of the upper layers of these magnetized regions. The small scale sized remanent fields of about 100 gauss are measured by surface experiments, whereas the larger scale sized fields of about 0.1 gauss are measured by the orbiting subsatellite experiments. (C.K.D.)


The paper considers the area in the vicinity of the crater Heronius. This area contains numerous sinuous rilles, craters with irregular planimeteric form, possible pyroclastic cones, and other features of probable volcanic origin and probably to be the vent region that supplied lavas both northward to Oceans Procellarum and southward to the Humorum basin. The approach used involves photogeologic interpretation of surface features and mapping of mare stratigraphy to derive a regional stratigraphic sequence. The sequence of mare volcanism provides insight into the complex emplacement of lunar lavas and the general volcanic history of the moon. (S.D.)


The graphs of diameter vs frequency plotted in the present study for primary impact craters produced in four time intervals exhibit an appreciable change in form with age. A deficiency of small craters relative to an extrapolation from the large-diameter parts of the craters curves is greatest and extends to the largest sizes in the oldest population (pre-Nectarian), whose curve approximates a log-normal form. Successively younger populations (Nectarian, Imbrian, Copernican plus Eratosthenian) have successively more small craters relative to larger ones and more nearly log-log distributions. Many of the craters thought to be small old primaries are here identified as secondary craters of basins, on the basis of previously developed criteria. (V.P.)


A model was developed for determining the composition and thicknesses of continuous deposits of large lunar impact craters and basins. Results of a photogeologic study and topographic analysis of continuous deposits of the lunar crater Delisle, which support the model, show that numerous secondary craters and crater chains with concentric dunes on their uprange rims occur well within the mapped deposits. At any given radius from Delisle, the secondary craters are of equal freshness and not vastly different in size, but with increasing radius they become better defined. The upper surface of the continuous deposits reaches the level of the pre-existing mare surface well within the mapped boundary of the deposits. (V.P.)


Meteoritic materials most probably impact planetary bodies along oblique trajectories inclined less than 45 deg above the surfaces. Laboratory studies of hypervelocity impacts against rock and particulate media are presented that indicate important effects of obliquity on crater size, shape, and ejecta distribution. The effects are particularly important to crater size-frequency analyses and geologic interpretations of crater formations. Impacts at shallow incidence, which are not uncommon, lead to ricochet of the impacting object accompanied with some entrained excavated materials at velocities only slightly reduced from the pre-impact value. (Author)


A study of the chemisorption of nitrogen atoms on a copper surface has been performed, based on an analysis of the electronic structure of the CuN cluster obtained from self-consistent field X-alpha scattered-wave calculations. Calculations show that the chemisorption of nitrogen on Cu(001) surfaces induces peaks below and above the Cu d-band region in the total density of states curve. The bonding orbitals formed between the N 2p and the Cu valence orbitals are generally found near the bottom of the Cu d-band region, while the antibonding orbitals formed between the N 2p and Cu

This paper presents a unified theory of the coherent multiple-photon excitation and laser-stimulated migration of atoms adsorbed on solid surfaces. We show that under steady-state excitation the migration of the adsorbed atom on the surface is diffusional, with diffusion constant dependent upon field intensity, surface temperature, relaxation constants, dipole moment strength, laser frequency, and the vibrational frequency of the adsorbed atom. In particular, it is shown that the rate of diffusion is proportional to the field intensity. Finally, we discuss the utility of laser-stimulated migration in the enhancement of surface chemical reactions, as well as in the analysis of surface relaxation processes.


The magnitude of the photon-induced current in Ag-Al2O3-Al metal-oxide-metal junctions has been studied as a function of photon energy and angle of incident radiation. Photoresponses were theoretically analyzed on the basis of a modified vacuum photoemission model (Jain, 1976; Slavri et al., to be published). Optical constants previously reported in the literature (Irani et al., 1971; Ehrenreich et al., 1963) were used to calculate the true spatial generation rate in Ag as Al as a function of the angle, polarization, of incident radiation, and film thickness. Results were found to be in very good agreement with experimentally determined values for a tunable dye laser with a KD* doubling crystal pumped by a Q-switched Nd:YAG laser with a LiTaO3 doubling crystal. The system provided retimes of 50 ns or less and peak powers of 10 W. Under short circuit conditions, the response to incident power was linear up to available power densities of 10 kW/cm2. Quantum efficiencies of about 0.1% at zero bias, near 3.8 eV under P polarization, were typically observed.

C.K.D.


The approximate probabilities of electron excitation (shake-up, shake-off) from various atomic states during nuclear in electron capture have been calculated in the sudden approximation, using Hartree-Fock wave functions. Total excitation probabilities are much lower than during inner-shell ionization by photons or electrons, and its states are more likely to be excited than np states. This latter result is borne out by K-alpha X-ray satellite spectra.


A hybrid receiver has been designed for the Galileo Project. The receiver, located on the Galileo Orbiter, will autonomously acquire and track signals from the first atmospheric probe of Jupiter as well as demodulate, bit-synchronize, and buffer the telemetry data. The receiver has a conventional RF and LF front end but performs multiple functions digitally under firmware control. It will be a self-acquiring receiver that operates under a large frequency uncertainty; it can accommodate different modulation types, bit rates, and other parameter changes via reprogramming. A broadband receiver and test set demonstrate a preliminary version of the sequential detection process and verify the hypothesis that a fading channel does not reduce the probability of detection.


The present paper deals with the influence of intense laser radiation on gas-phase molecular rate processes. Representations of the radiation field, the particle system, and the interaction involving these two entities are discussed from a general rather than abstract point of view. The theoretical methods applied are outlined, and the formalism employed is illustrated by application to a variety of specific processes. Quantum mechanical and semiclassical treatments of representative atom-atom and atom-diatom collision processes in the presence of a field are examined, and examples of box-and-continuum processes and heterogeneous catalysis are discussed within the framework of both quantum-mechanical and semiclassical theories.

V.P.


Seventeen thermal radiance maps of Venus were recorded in a 26-day interval near the 1977 conjunction. An average symmetrical two-dimensional function was removed from the data. Features remain near the east and west limbs which correspond in part to previously reported solar-related effects but there are important differences, and reasons are given for questioning the interpretation of some of the earlier data. It is concluded that these features cannot be solely under solar control. Features are also found at both poles, just inside the region covered by the ultraviolet polar hood. These are not inconsistent with disturbances rotating rapidly around the planet. There is weak evidence for a 3-day rotation in some features.


The flux from the central region of the Crab Nebula in three broad spectral passbands with flux-weighted mean wavelengths of 300 microns, 400 microns, and 1 mm has been measured. The inferred total flux densities for the entire nebula are consistent with an extrapolation of the power law spectrum found at longer wavelengths. Derivation of various flux densities are presented, and it is concluded that the luminosity of dust emission from the Crab Nebula varies between 1300 and 5000 km as the temperature varies from 40 to 120 K, respectively.

C.F.W.

The Pioneer Venus Orbiter and the Multiprobe spacecraft propulsion subsystems and their performance are presented. Monopropellant hydrazine subsystems on each spacecraft provided the capability to spin up the spacecraft after separation and perform all spin rate, velocity, and attitude changes required by the control subsystem to satisfy mission objectives. The propulsion subsystem provides thrust on demand by supplying anhydrous hydrazine from the propellant tanks through manifolds, filters and valves to the thrust chamber assembles where the hydrazine is catalytically decomposed and ejected as a fine mist in a conical nozzle. The sub-systems consist of seven 1 Ibf thrusters for the Orbiter and six 1 Ibf thrusters for the multiprobe which are isolated by two latch valves from the two propellant tanks so that two redundant thruster clusters are provided to ensure mission completion in the event of a single point failure. The propellant feed system is of all-welded construction to minimize weight and leakage and titanium is used as the primary material of construction. The multiprobe burned up on entering the Venus atmosphere with enough propellant left for the mission and the Orbiter was inserted into Venus orbit with enough propellant remaining for more than 2 earth years of orbital operations. A.T.


The most significant data on fields and plasmas in the outer solar system, based on observations by Pioneer 10 and 11, are reviewed. Attention is given to (1) corotating shocks and the evolution of high speed solar wind streams, (2) the effect of the changing structure of the interplanetary medium on energetic particles, (3) the propagation of flare-generated shocks through the outer solar system, (4) radial gradients in the solar wind and interplanetary field, and (5) the dependence of the interplanetary sector structure on heliographic latitude. B.J.


Magnetic field measurements made by the vector helium magnetometers on board Pioneer 10 and 11 reveal the existence of a current sheet (thickness of about 2 Jupiter radii) carrying an eastward current. Self-consistent studies of the current sheets show that the magnitude of the current is of the order of 0.01 A/m and that the current is carried by a hot (T greater than 1 keV) plasma, the density of which varies between 1 cu cm at 30 Jupiter radii to 100 cu cm at 80 Jupiter radi. The current sheet is warped azimuthally and parallel to the magnetic dipole equator. The existence of an azimuthal field component indicates a soloidal plasma flow transporting some 10 to the 23th ions per second from Jupiter into the outer magnetosphere. It is shown that, if the inner magnetosphere is in a steady state, this plasma must be transported outward within the current sheet by a diffusion process which is faster than the one responsible for particle transport in the inner magnetosphere but slower than Bohm diffusion. (Author)


This report deals with early results from the Pioneer Venus Orbiter and multiprobe missions, which encountered Venus on December 4 and December 9, 1978, respectively. Initial results for the multiprobe mission and for the first 30 days of the Orbiter mission have already been reported. Additional mission features and updated mission parameters based on refined tracking data and trajectory computations are presented here. Scientific results for both missions are discussed which cover the first 130 days (or orbits) of the nominal 243-day Orbiter mission. (Author)


The altitude profiles of temperature and pressure were measured during the descent of four Pioneer Venus probes, showing small contrasts below the clouds, but significant differences within the clouds at altitudes from 45 to 61 km. Measurements of pressure differences were found to be consistent with the cyclostrophic balance of zonal winds ranging from 110 to 150 m/sec at 80 km and from 43 to 77 m/sec at 40 km. The clouds were 10 to 20 K warmer than the extended profiles of the lower atmosphere and the middle cloud is convectively unstable. Both phenomena are due to thermal radiation from below. Meridional wind velocities were studied, concluding that significant planetary scale non-axisymmetric motions were present at latitudes below 30 degrees. This result is consistent with the day-night pressure difference. Indications of flow oscillations in the lower atmosphere were noted and the inference of wave motions in the lower atmosphere was supported by analysis of oscillations in the Doppler residuals. C.F.W.


The composition of the Venusian atmosphere was studied using a mass spectrometer on the Pioneer Venus sounder probe. The single-focusing magnetic-sector spectrometer scanned the mass range from hydrogen through mercury with a dynamic range of six decades. Data taken by the mass spectrometer were compared with those of a gas chromatograph, resulting in slight discrepancies due to the use of a spurious ion pump acting as a sink for entry of rare gases through the inlet leak. A surprisingly large concentration of primordial Ar-36 and Ar-38 was discovered in a ratio of 5 to 1. It was concluded that the large excess of primordial argon was a valid result and that the mixing of HCl in the lower Venusian atmosphere was less than a few parts per million. Arguments against the source for excess primordial gases on Venus were presented. Concentrations of other elements such as Ne, Kr, He, S, and O were discussed. Although the mass peaks in the spectrum were real, it was not clear whether all of the chemical reactions (i.e., COS production) actually occurred in the atmosphere. Until further analysis can be made, it will be uncertain how the inlet system, which is at atmospheric temperature, affected the results. C.F.W.


Comparisons are made between the volatile inventories of the terrestrial planets, including Pioneer Venus data, and the predictions of three classes of theories for the origin of planetary atmospheres. Serious difficulties arise for the primary atmosphere and external source hypotheses. The gain accretion hypothesis can account for the trends in the volatile inventory from Venus to earth to Mars, if volatiles were incorporated into planet-forming grains at nearly the same temperature for all of these planets, but at systematically lower pressures in the regions of planet formation farther from the center of the solar nebula. (Author)

The night airglow spectrum of Venus in the ultraviolet is dominated by the V-prime = 0 progressions of the gamma and delta bands of nitric oxide. The bands are produced by two-body radiative recombination of nitrogen and oxygen atoms. Since the source of these atoms is in the dayside thermosphere, the night airglow is a tracer of the day-to-night thermospheric circulation. The airglow is brightest at equatorial latitudes and at longitudes on the morning side of the antisolar meridian.


Several photometric measurements of Venus made from the Pioneer Venus orbiter and probes indicate that solar near-ultraviolet radiation is being absorbed throughout much of the main cloud region, but little above the clouds or within the first one or two optical depths. Radiative transfer calculations were carried out to simulate both Pioneer Venus and ground-based data for a number of proposed cloud compositions. This comparison rules out models involving nitrogen dioxide, meteoritic material, and volatile metals as the source of the ultraviolet absorption. Models involving either small (approximately 1 micrometer) or large (approximately 10 micrometers) sulfur particles have some serious difficulties, while those involving sulfur dioxide gas appear to be promising.


Winds in the lower atmosphere of Venus, inferred from three-dimensional radio interferometric tracking of the decays of the Pioneer day and north probes, are predominantly easterly with speeds of about 1 m/sec near the surface, 50 at the bottom of the clouds, and more than 200 within the densest, middle cloud layer. Between about 25 and 55 km altitude the average flow was slanted equatorward, with superimposed wavelike motions and alternating layers of high and low shear.


Results of radio occultation measurements of electron density profiles of the nightside ionosphere of Venus are shown. Solar zenith angles from 90 to 164 deg, obtained from the Pioneer Venus Orbiter, are reported. Data were derived from closed-loop $S$ and $\hat{S}$ band signals received by the Deep Space Network upon ionospheric entry and exit of the spacecraft. Nightside electron density profiles are found to be rather uniform in the solar zenith angle range from 95 to 107 deg, with peak electron densities ranging from 2,000 to 40,000/cm$^2$, while between 110 and 164 deg, profiles exhibit a high degree of variability and peak electron densities vary from 7,600 to 31,800/cm$^2$. A possible mechanism for the maintenance of the nightside Venus ionosphere during the long Venus night, which is consistent with the observed spatial and temporal variability of deep ionospheric electron density profiles, is proposed to be impact ionization by precipitating particles, although transport processes from the dayside may also be important.


The thermal structure of and energy influx to the dayside and nightside Venus ionosphere are discussed, based on data obtained by the Pioneer Venus spacecraft. Where the dayside ionosphere appears relatively constant in total ion concentration, ion and electron temperatures and ion composition below the ionopause, retarding potential analyzer measurements confirm the presence of strong spatial and temporal variations in nightside ion concentration. Ion temperatures on the nightside above 225 km are found to be larger by a factor of two or more than on the dayside, and comparable to electron temperatures on the day and night sides. Models of dayside and nightside ion temperatures consistent with observations require the heat input of 0.003 erg/cm$^2$ sec and 0.005 erg/cm$^2$ sec, respectively, to the ion-gas to raise the ion temperature above that of the neutral gas, presumably by means of Joule heating.


Data from the Pioneer Venus ion mass spectrometers are compared with model calculations of the ion density distributions appropriate for daytime conditions. The model assumes diffuse equilibrium upper boundary conditions for the major ions (O$^2+$, O$^+$, CO$^2+$, H$^+$, and H$^+$). The agreement between the calculated and measured gross behavior of these ions is reasonably good except for H$^+$, which may be influenced strongly by convective transport processes. The distributions of five minor ions (C$^+$, N$^+$, NO$^+$, CO$^+$), and N2$^+$ are also calculated for the chemically controlled region (less than approximately 200 km). The agreement is, in general, poor, an indication that the present understanding of the Venus minor ion chemistry is still incomplete.


It is shown that whistler mode waves from the ionosphere of Venus are absorbed by Landau damping at the dayside ionosphere boundary. This process heats the ionospheric electrons and it may provide an important energy input into the dayside ionosphere. Cyclotron damping of the waves does not occur in the same region. However, Landau damping of ionosheath waves is apparently not an important energy source in the nightside ionosphere. Impulsive events in the nightside ionosphere seem to fall into two classes: (1) lightning signals (near periastron) and (2) noise, which may be caused by gradient or current instabilities.

A79-40835 * Initial Pioneer Venus magnetic field results - Nightside observations. C. T. Russell, R. C. Elphic, and J. A. Slavin

Additional plasma measurements in the vicinity of Venus are presented. It is shown that (1) there are three distinct plasma electron populations - solar wind electrons, ionospheric electrons, and nightside ionospheric electrons; (2) the plasma ion flow pattern in the ionosphere is consistent with deflected flow around a blunt obstacle; (3) the plasma ion flow velocities near the downstream wake may, at times, be consistent with the deflection of plasma into the tail, closing the solar wind cavity downstream from Venus at a relatively close distance (within 5 Venus radii from the planet); (4) there is a separation between the inner ionopause of the downstream ionosphere and the upper boundary of the nightside ionosphere; and (5) during the first 4.5 months of orbit, the measured solar wind plasma speed continued to vary, showing a number of high-speed, but generally nonrecurrent, streams.


Pioneer 10 Ames plasma analyzer data collected in the 6.1 to 12.6 AU range of heliocentric distances (November 1974 to April 1977) have been examined for interplanetary shock waves. Eighteen shock signatures have been identified, with four of these being of the reverse type and the remainder the forward type. Sonic Mach numbers in the range from 3 to 10 are estimated for these events.


A large body of spectral data for protons with energies greater than 200 keV has been analyzed. It is concluded that the main body of plasma in the Jovian current sheet observed by Pioneer 10 on its outbound pass probably has an energy well below the lowest threshold of the Pioneer 10 detectors. This premise is examined using a semimechanical model of the magnetic field in the magnetodisk and simple magnetohydrodynamic theory. Results indicate that the dominant contribution to the plasma pressure in the region from 25 to 65 Jupiter radii is from as yet unobserved protons (ions) with energies of the order of 0.1 to 10 keV.

C.K.D.


Far-infrared observations (40-160 microns) of eight optical emission-line stars are presented. Six of these stars, LkH alpha 198, T Tau, lKH alpha 101, V380 Ori, R Mon, and MWC 1080, show substantially more far-infrared emission than would be expected on the basis of a blackbody extrapolation of their 10-20-micron fluxes. Additionally, in the reverse case, the far-infrared emission is shown to be spatially extended (greater than 40 arcsec). A simple model of the thermal emission from cool circumstellar dust (30-70 K) shows that these stars are surrounded by material left over from the star formation process; this result confirms the extreme youth of these stars. MWC 349 was detected at a level consistent with the expected free-free flux from its surrounding H II region, and RY Tau was not detected in the far-infrared; there is little circumstellar dust with temperatures of 20-100 K in these objects.


This letter presents a spectrum of IRC + 10216 in the 3000-4400-kyrger region at 9-kyrger resolution. A molecular feature at 3400-3600 kyrger has been detected which is attributed to an unspecified N H bonded molecule; the feature appears to be variable in phase with the infrared light curve. Evidence is given for temperature variations of the emitting dust shell in phase with the infrared light curve. The results suggest that the variability of the molecular feature is due to reversible dissociation of the responsible molecule, which could occur at the higher temperatures accompanying the maxima of the light curve.


New observations using the Arecibo telescope have failed to detect intergalactic intracluster H I in the Coma Cluster. This represents a factor of two improvements over our previously reported limit (Wright et al., 1974) and makes it less likely that the cluster can be dynamically bound by H I. The highly flattened, rapidly rotating, extremely dense, cold H I clouds permitted by the observations will not evaporate over the cluster lifetime, but violate global stability criteria and hence cannot provide the missing mass in the cluster.


In the present study, problems of laminar and turbulent two-dimensional flow of a viscous compressible fluids near the trailing edge of a thin flat plate are considered. The complete set of Navier-Stokes equations is solved by the finite-difference method of MacCormack (MacCormack and Baldwin, 1975). It is an explicit, predictor-corrector, time-splitting method of second order accuracy. The computational mesh employed has sufficient resolution for all of the characteristic lengths suggested by theory. In the laminar case, the present results are compared with the triple deck solution of Daniels (1974). This comparison indicates that the asymptotic triple deck theory for supersonic trailing edge flow is accurate within five percent for Reynolds numbers greater than 1000. In the turbulent case, the Prandtl-Von Driest-Glauser algebraic eddy viscosity model is used. The numerical results show that the region of upstream influence is approximately of the order of the boundary layer thickness. The solutions for skin friction, pressure and wake centerline velocity are presented.

(Author)

The characteristics of a CW water vapor laser operating at 118 and 28 microns are reported. By monitoring the discharge current, helium gas pressure, and water vapor pressure, a criterion for optimum power output has been obtained. Peak powers of 6 and 114 MW are obtained, respectively, for the 118- and 28-micron lines for a 4.5-m discharge tube. (Author)


Simultaneous solar-wind proton data obtained at several heliocentric distances during radial alignments are compared. The radial variations associated with two high-speed streams in the solar wind are studied as examples of the radial evolution of the solar-wind speed distribution and of high-speed streams in the solar wind as observed in the ecliptic plane in 1973. Pioneer 11 data on high-speed stream in the solar wind observed at about 1.5 and 3.7 AU are compared with the corresponding high-speed-stream data obtained at earth. These analyses indicate that as these high-speed streams propagated to these extended heliocentric distances, there was an erosion of the highest speeds and a general narrowing of the speed distribution. These observations are consistent with the exchange of momentum in the solar wind between high-speed streams and low-speed streams as they propagate outward from the sun. (Author)


The results of preliminary analysis of the in situ observations of solar wind plasma and interplanetary magnetic field data are presented. It is indicated that two planetary shocks associated with the August 1972 solar events propagated at approximately constant speed between 0.8 AU and 2.2 AU. This result is contrary to some theoretical expectations and earlier reports for these events of a strong deceleration of these shocks with increasing heliocentric distance. One example given is the difference between observed shock speeds of 700 km/sec and the estimated speeds of 2200 km/sec for Pioneer 9 and 1000 km/sec for Pioneer 10. These higher average speeds associated with the propagation of the shocks from the sun to the spacecraft, therefore, imply an extremely strong deceleration closer to the sun (within 0.8 AU). M.E.P.


On the basis of conservative assumptions, a phenomenological approach is used to address the source strength of Jupiter for interplanetary electrons. It is estimated that Jupiter emits approximately 10 to the 24th - 10 to the 26th electrons per sec with energies in excess of 6 MeV, which sources may be compared with the population of approximately 3 x 10 to the 28th electrons of the same energy in the Jovian outer magnetosphere. It is concluded that Jupiter accelerates particles at a rate exceeding that of ordinary trapped particle dynamic processes. M.E.P.


The velocity distributions along solar radii for hydrogen and helium in interplanetary space are calculated by using the Danby-Cann model modified with a loss function. From these distributions the radial temperature and radial flow velocity of the interplanetary gases are determined. The effects of solar gravitation and ionization loss, due to charge exchange and photoionization, on the gas temperature and velocity are described. (Author)


An attempt is made to establish a connection between linear multistep methods for applications to ordinary differential equations and their extension (by approximate factorization) to alternating direction implicit methods for partial differential equations. An earlier implicit factored scheme for the compressible Navier-Stokes equations is generalized by innovations that (1) increase the class of temporal difference schemes to include all linear multistep methods, (2) optimize the class of unconditionally stable factored schemes by a new choice of unknown variable, and (3) improve the computational efficiency by the introduction of quasi-one-leg methods. B.J.


A fast, fully implicit approximate factorization (AF) algorithm designed to solve the conservative transonic full-potential equation in either two or three dimensions is described. The algorithm uses an upward bias of the density coefficient for stability in supersonic regions. This provides an effective upward bias of the streamwise terms for any orientation of the velocity vector (i.e., 'rotated differencing'), and thereby greatly enhances the reliability of the present algorithm. A numerical transformation is used to establish an arbitrary body-fitted finite-difference mesh. Computed results for both airfoils and simplified wings demonstrate substantial improvement in convergence speed for the new algorithm relative to standard successive-line overrelaxation algorithms. (Author)

A new technique is described for solving subsonic flow dynamic problems containing multiple regions of continuous flow, each bounded by a permeable or impermeable surface. Region boundaries are, in general, arbitrarily shaped and time dependent. Discretization of such a region for solution by conventional finite difference procedures is accomplished using an elliptic solver which alleviates the dependence on a particular base coordinate system. Multiple regions are coupled together through the boundary conditions. The technique has been applied to a variety of problems including the shock diffraction and pointed wedge with detached bow shock. (Author)

A79-45458 * Convection and lunar thermal history. P. Cassen, R. T. Reynolds, F. Graziani, A. Summers, J. McNelis, and L. Blalock (NASA, Ames Research Center, Theoretical and Planetary Studies Branch, Moffett Field, Calif.). Lunar and Planetary Institute and NASA, Workshop on Solid Convection in the Terrestrial Planets, Moffett Field, Calif., Dec. 12, 13, 1977.) Physics of the Earth and Planetary Interiors, vol. 19, June 1979, p. 183-196. 50 refs. The effects of solid interior convection on the thermal history of the moon are examined. Convective models of lunar evolution are calculated to demonstrate the influence of various viscosities, radioactive heat source distributions and initial temperature profiles and tested by means of a thermal history simulation code. Results indicate that solid convection does not necessarily produce a quasisteady thermal balance between heat sources and surface losses. The state of the lithosphere is found to be sensitive to the efficiency of heat source redistribution, while that of the convecting interior depends primarily on rheology. Interior viscosities of 10 to 22 and 222 cm/sec are obtained, along with a central temperature above 1100 C. It is suggested that mare flooding could have been the result of magma production by pressure release melting in the upwelling region of convection cells. A.L.W.


Infrared observations of the NGC 7538 region at wavelengths from 1.6 to 11 mm are presented and analyzed with the aim of understanding both the large-scale structure of this region of current star formation and the properties of the individual compact objects within it. At far-infrared wavelengths (25-130 microns), emission is seen from the visible H II region, from the vicinity of the previously known maser sources and dust-embedded compact H II regions, and from a new region called NGC 7538E. Coincident with NGC 7538E are a point-like 1.25 micron infrared source, NGC 7538-IRS9, which probably provides the power for the far-infrared emission, and an extended source of 2.2 micron emission which appears to be an infrared reflection nebula. The compact H II regions, the maser sources and IRS9 are located within a dense molecular cloud at the edge of the optical H II region. This cloud, which has a mass of approximately 9000 solar masses, is detected in emission at 1 mm. The NGC 7538 region appears to contain examples of different stages in the formation of massive stars; it is suggested that the center of star formation is moving systematically toward the southeast in this region. (Author)


By observation of the large Forbush decrease in cosmic-ray intensity of April-May 1978 at heliocentric radial distances of 1.01, 6.97, and 15.91 AU, it is found that the causative magnetized plasma cloud moved outward from the sun at an apparent radial speed of about 980 km/s, independent of radial distance over this range. Recovery from the impulsive decrease in intensity was extended slower at the larger distances. On the basis of this fact and other considerations, several tentative suggestions are made as to the large-scale nature of Forbush decreases and their relationship to the 11-year solar modulation of galactic cosmic-ray intensity. (Author)


Examination of Pioneer 7 NASA Ames Research Center plasma analyzer data obtained in February 1977 at about 3100 earth radii, downstream from earth in the vicinity of the expected extended geomagnetic tail indicate that tail-related phenomena may have been observed. These observations are characterized by intermittent intervals of extremely low levels of plasma ion flux. Corresponding Prognoz 5 Space Research Institute plasma ion data obtained in the vicinity of earth indicate typical solar wind flux levels and a relatively steady character of the solar wind during this time. These recent Pioneer 7 observations in the vicinity of the expected geomagnetic tail at about 3100 earth radii are consistent with earlier Pioneer 7 observations in September 1966 at about 1000 earth radii and represent the most extended positive observational information of the extended nature of the geomagnetic tail. These measurements suggest that at times Jupiter's magnetosphere may have tail-associated phenomena extending to distances of about 10 AU downstream from the planet. These measurements also raise the possibility that at times comets may have tail-associated phenomena extending downstream from the visible tail. (Author)


The Pioneer Venus Orbiter ultraviolet spectrometer sees variable disk brightness features similar to the well-known 'UV markings' seen at longer wavelengths. The bright features are consistent with a homogeneous cloud of H2SO4 aerosols. The darker features show the presence of a broad-band absorber, which is at some depth in the cloud layer. Additional contrast arises from SO2 absorption. The observed strength of the SO2 absorption as a function of wavelength rules out a uniform mixing ratio for the SO2. The data are well fitted by an inhomogeneous light scattering model in which the SO2 scale height is one-fifth of the CO2 scale height, and the mixing ratio of SO2 at 40 mb is 10 to the 7th. A model of the oxidation of sulfur dioxide in the upper cloud reproduces the observed vertical distribution of SO2 and indicates that SO2 alone is sufficient to produce the observed amount of H2SO4 in this region. (Author)

Errors in lunar magnetic field data acquired by the Apollo 12, 15 and 16 surface magnetometers and the two magnetometers on board the lunar-orbiting Explorer 35 satellite are examined and the implications of these errors for investigations of lunar magnetic induction are discussed. It is found that during the first four lunations of Apollo 12 magnetometer operation, the gain and offset differences with respect to both Explorer magnetometers are 1 to 2% and 0.5 gamma, respectively, with close agreement between the two Explorer magnetometers, but increase up to 80% and 1 gamma by the eighth lunation, accompanied by the degradation of the agreement between the orbital instruments, which indicates the malfunction of the Explorer instruments by the fifth lunation. An additional anomaly, associated with the exit of the spacecraft from the lunar shadow, is also found, along with the nonlinear field response of the Apollo 15 magnetometer near zero field and small magnitude noise in the surface magnetometers. The effects of gain errors on electrical conductivity determinations are estimated and previously published lunar magnetic permeability results are adjusted to account for magnetometer gain uncertainties, yielding a permeability of 1.012 ± 0.011.


The paper surveys topics related to the origin, expansion, and acceleration of the solar wind and the plasma physics of the interplanetary medium. The study of the relationship between coronal holes and solar-wind stream and the associated revision of ideas about solar wind acceleration and heating are reviewed. In addition, topics like hydromagnetic waves and turbulence, and interplanetary electrons, as items of particular importance during the past quadrennium, are discussed. While the research discussed was concerned with data taken near solar minimum, further solar-wind studies will concentrate on observations from the rising and maximum phases of the solar cycle.

A79-46424 * The dynamics of the Jovian magnetosphere. C. K. Goertz and M. F. Thomsen (Iowa, University, Iowa City, Iowa). Reviews of Geophysics and Space Physics, vol. 17, June 1979, p. 731-743. 200 refs. NSF Grant No. AMT-76-82739; Contract No. NAS2-6553.

The current status of the understanding of the dynamics of Jupiter's magnetosphere is reviewed. A brief summary is presented of the concepts and processes which were identified as being of probable importance by pre-Pioneer 10 and 11 work (both theoretical and observational). The insights provided by the in situ Pioneer flights are then discussed. The Jovian magnetosphere consists of several relatively distinct regions: the inner magnetosphere, the intermediate magnetosphere, the outer magnetosphere, a transition region just inside the magnetopause, and the magnetotail. The base particle and magnetic field characteristics of these regions are summarized, and the dynamical processes which are currently thought to be significant in each of them are reviewed. Finally, some outstanding questions and problems are identified for future treatment based on Pioneer data or on data from the upcoming Voyager and Galileo missions.


The relationship between airborne and ground-based measurements of soil and crop canopy temperatures is investigated for a partial crop canopy. Daily ground-based measurements using a wide-field radiometer orientation towards the nadir at a height of 1.5 m and airborne thermal imagery at two-week intervals were obtained throughout the entire growing season of a stand of wheat.
for a supersonic linear flow over an inclined body of revolution. Test cases for Mach 2.8 flow over a cylinder with 15 deg flare angle at angles of attack of 0, 1, and 4 deg are calculated. Good agreement is obtained between the present computed results and experimental measurements of surface pressure. A pair of vortices on the leeward and a peak in the normal force distribution near the flared juncture are predicted; the role of circumferential communication is discussed. (Author)


The paper presents and analyzes absolute energy density data on electrons from the University of Iowa instrument on Pioneer 10 for one example of a plasma sheet traversal in Jupiter's dawn magnetodisk on 6-7 December 1973. The absolute integral omnidirectional intensity spectrum of electrons is based on a full and accurate reduction of the counting rate data. The main finding is that electrons of energy greater than 0.060 MeV provide only about 3% of the charged particle pressure required to explain the observed depression in the magnetic field at the center of the plasma sheet, in spite of the fact that the intensity of such electrons is well correlated with the depression of the magnetic pressure throughout the sheet. S.D.


The paper examines the dynamic calibrations of the hot film and modified hot-wire probes with a view to assess their suitability for use in experiments for the measurement of turbulent fluctuations in compressible boundary-layer flows. Results are presented of tests on some sensors in both subsonic and supersonic boundary-layer flows. A simple technique is presented for determining dynamic calibration correction factors for the sensitivities involved. S.D.


A computer program called NEORAP is described that calculates the radiative properties of nonequilibrium ionized hydrogen. From the given electron temperature, electron density, and atom density values (which do not necessarily satisfy the equilibrium relationship) and intensities of incident radiation, the non-Boltzmann populations of electronic states are computed by solving the equation of quasi-steady-state population distribution. Emission and absorption coefficients are determined as functions of wavelength by invoking the principle of detailed balance between the upper and lower states of each radiative transition. Radiative transfer through the medium is computed assuming a one-dimensional uniform slab. The rate of ionic reaction is also computed. When used on a sample case, the program shows that there is a large difference between the calculated intensities of radiation emitted by a bulk of equilibrium and nonequilibrium hydrogen. The accuracy of the program is estimated to be better than 10%. (Author)


This paper contains an overview of a theoretical framework for the design of reliable multivariable control systems, with special emphasis on actuator failures and necessary actuator redundancy levels. Using a linear model of the system, with Markovian failure probabilities and quadratic performance criteria, it is shown that the control problem is posed and solved. The solution requires the iterative convergence of Riccati-like matrix difference equations; if these converge one has a reliable design; if they diverge, the design is unreliable, and the system design cannot be stabilized. In addition, it is shown that the existence of a stabilizing constant feedback gain and the reliability of its implementation is equivalent to the convergence properties of a set of coupled Riccati-like matrix difference equations. In summary, these results can be used for offline studies relating the open-loop dynamics, desired performance, actuator mean-time-to failure, and functional or individual actuator redundancy, with and without feedback gain reconfiguration strategies. (Author)


This paper considers a novel approach to coding or classifying sequences of real numbers through the use of (generally nonlinear) finite-dimensional discrete-time systems. The problem involves a finite-dimensional discrete-time system (which we call a real acceptor) in cascade with a threshold type device (which we call a discriminator). The proposed classification scheme and the exact nature of the classification problem are described, along with two examples illustrating its applicability. Suggested approaches for further research are given. (Author)


An investigation of the Martian polar cap winds and their response to a variety of factors is carried out by numerical experiments based on a zonally symmetric primitive equation model. The seasonal thermal forcing, mass exchange between polar caps and atmosphere, large-scale topography, and polar cap size are discussed, noting that topography has a small effect, but the circulation intensity increases with cap size. The model results show that surface winds near the edge of a retreating polar cap are enhanced, and that the surficial wind indicators near the south pole are formed during spring and those near the north pole during winter. It is suggested that the high-altitude dune fields in the northern hemisphere are formed when the terrain is covered by frost, and that the saltating particles are 'snowflakes' which formed by the mechanism proposed by Pollack (1976). The model results for the winter simulation compare favorably with general circulation model (GCM) calculations. A.T.


It is found that high yields of pentaerythritol diformal can be prepared in less than 10 minutes by heating a stirred mixture of pentaerythritol with a slight excess of paraformaldehyde up to about 120 C in the presence of catalytic amounts of acid, but without any solvents or with only a small amount of water. The reaction was carried out in two stages: first by preparing the monoformal with a molar equivalent of paraformaldehyde in about five minutes, and then, after cooling to about 70 C, adding the remainder of paraformaldehyde in 1% excess, and heating to about 120 C for a total heating time of 10 minutes.

V.T.


The use of a newly combined ultrahigh vacuum technique for studying continuous and particulate evaporated thin films using thermal desorption spectroscopy (TDS), transmission electron microscopy (TEM), and transmission electron diffraction (TED) is discussed. It is shown that (1) CO thermal desorption energies of epitaxially deposited (111) Ni and (111) Pd surfaces agree perfectly with previously published data on bulk (111) single crystal, (2) contamination and surface structural differences can be detected using TDS as a surface probe and TEM as a complementary technique, and (3) CO desorption signals from deposited metal coverages of one-thousandth of a monolayer should be detectable. These results indicate that the chemisorption properties of supported 'microsurfaces' of metals can now be investigated with very high sensitivity. The combined use of TDS and TEM-TED experimental methods is a very powerful tool for fundamental studies in basic thin film physics and in catalysis. (Author)


The infrared spectral intensities for HOCl and H02 have been calculated using a new ab initio technique. Theoretical results for the geometries, vibrational frequencies, and the dipole moments of these species are also reported. All of the calculations were performed at the SCF level using Hartree-Fock quality basis sets. The results for the molecular geometries and the vibrational frequencies are in good agreement with available experimental data. It is believed that the computed intensities are accurate to at least 50%. The results should be helpful in attempts to determine the stratospheric abundance of HOCl and H02 by in situ infrared spectroscopic measurements. (Author)


A second-order method for solving two-point boundary value problems on a uniform mesh is presented where the local truncation error is obtained for use with the deferred correction process. In this simple finite difference method the tridiagonal nature of the classical method is preserved but the magnitude of each term in the truncation error is reduced by a factor of two. The method is applied to a number of linear and nonlinear problems and it is shown to produce more accurate results than either the classical method or the technique proposed by Keller (1969).

C.F.W.


On December 9, 1978 the neutral gas mass spectrometer aboard the NASA Pioneer Venus multiprobe bus has measured density, composition, and temperature of the Venus dayside thermosphere. There was no positive identification of argon down to the lowest measured altitude of 130 km. For the altitude level of 135 km the following upper limits for the number densities of argon isotopes were derived: n(Ar-36) less than 1.3 times 10 to the 6th power per cu cm and n(Ar-40) less than 2.8 times 10 to the 6th power per cu cm. From our upper atmosphere observations we infer for the troposphere of Venus the following upper limits for the mixing ratios: n(Ar-36)/total number density less than 9 times 10 to the minus 6th power and n(Ar-40)/total number density less than 20 times 10 to the minus 6th power. (Author)
The direct electrical resistance and the electrical contact resistance of graphite fibers released from both burned and unburned fiberite T300/1034 composite were measured. The voltage at which arcing occurs due to fibers settling on electrical conductors was also determined. On the basis of results obtained, an assessment was made of the hazards posed by graphite fibers to electrical equipment.

(Author)


The instruments and techniques of biomagnetic measurement have progressed greatly in the past 15 years and are now of a quality appropriate to clinical applications. The paper reports on recent developments in the design and application of SQUID (Superconducting Quantum Interference Device) magnetometers to biomagnetic measurement. The discussion covers biomagnetic field levels, magnetocardiography, magnetic susceptibility plethysmography, ambient noise and sensor types, principles of operation of a SQUID magnetometer, and laboratory techniques. Of the many promising applications of noninvasive biomagnetic measurement, magnetocardiography is the most advanced and the most likely to find clinical application in the near future.

S.D.


The spectral absorption cross section of the Swings band of C3 was determined from measurements behind incident shock waves that heated a gas mixture of argon and acetylene. These measurements spanned the spectral region between 300 and 540 nm, and were obtained at temperatures between 3200 and 4000 K. An electronic oscillator strength of 0.033 was deduced from the measurements.

(Author)


Partial cross sections of definite parity, calculated for electronic-rotational energy transfer in the F-H2 collision system, interweave with increasing total angular momentum J. An explanation, in terms of diabatic curve crossings induced by the centrifugal potential in the body-fixed coordinate system, predicts the interweaving to occur only in systems having half-integer J.

(Author)

A79 51237 * The utilization of abelian point group symmetry in the graphical unitary group approach to the calculation of correlated electronic wavefunctions. I. Shavitt (Battelle Columbus Laboratories, Ohio State University, Columbus, Ohio). Chemical Physics Letters, vol. 63, June 1, 1979, p. 421-427. 20 refs. Grant No. NSF 2231.

A procedure is described for the utilization of abelian point group symmetry in the graphical unitary group approach (GUUGA) to calculations of correlated electronic wavefunctions. The procedure is based on a recursively computed set of symmetry dependent counting indices, and results in the separate numbering, without gaps, of the Gelfand states (configuration functions) belonging to each symmetry species.

(Author)


It is possible that tidal dissipation in an icy crust on Europa preserved a liquid water layer beneath it, provided that the three-body orbital resonance for Io, Europa, and Ganymede is ancient. The liquid water layer could be a continuing source of the observed surface frost. If Europa's water mantle were ever completely frozen, heating by tidal dissipation would not exceed that produced by radioactive elements, and the mantle would remain frozen.

(Author)


The paper reexamines the evidence on the intensity of Venusian tectonic/volcanic activity and suggests alternate hypotheses. Three major questions are discussed: (1) whether the presence of large, presumably primordial craters on Venus requires an intensity of tectonic/volcanic activity significantly less than on earth, (2) what thicknesses of lithosphere are implied for reasonable models of temperature and volatile content of the upper mantle of Venus, and (3) can the recently obtained Ar-40 content of the Venus lower atmosphere help define the relative tectonic/volcanic activities of Venus and earth. It was shown that the abundance of Ar-40 in the Venus atmosphere lies between the earth value and one-tenth of the earth value, and since erosional liberation of Ar-40 on Venus will be inefficient, this range for Ar-40 abundance indicates an active tectonic history. It is concluded that the presence of craters and possible mantle dryness does not restrict Venus's tectonics to a Mars-like model, and an earth-like model is equally probable.

A.T.


"Multiply-twinned" gold particles with hexagonal bright field TEM profile were determined to be icosahedral composed of 20 identical and twin-related tetrahedral building units that do not have an fcc structure. The crystal structure of these slightly deformed tetrahedra is rhombohedral. Experimental evidence supporting this particle model was obtained by selected-zone dark field and weak beam dark field electron microscopy. In conjunction with the results of part I, it has been concluded that multiply-twinned gold particles of pentagonal or hexagonal profile that are found during the early stages of the vapor deposition growth process on alkali halide surfaces do not have an fcc crystal structure, which is in obvious contrast to the structure of bulk gold.

(Author)


Based on the exact crystal structure of decahedral and icosahedral particles, high energy electron diffraction patterns and image profiles have been derived for various high symmetry orientations of the particles with respect to the incident beam. These results form a basis for the identification of small metal particle structures with advanced methods of transmission electron microscopy.

(Author)

The crystal structure of the tetrahedral twins in multiply-twinned icosahedral particles with dodecahedral point group symmetries has been examined and correlated with the face-centered cubic structure. Details on the crystal structure as well as the geometrical relationships among twins in each particle are presented. These crystallographic facts serve as a basis for the interpretation of small particle images obtained with advanced methods of transmission electron microscopy.


Magnetic fluctuations measured by the Lunokhod 2 magnetometer in the Bay Le Monnier are distinctly anisotropic when compared to simultaneous Apollo 16 magnetometer data measured 1100 km away in the Descartes highlands. This anisotropy can be explained by an anomalous electrical conductivity of the upper mantle beneath Mare Serenitatis. A model is presented of anomalously lower electrical conductivity beneath Serenitatis and the simultaneous magnetic data from the Lunokhod 2 site at the mare edge and the Apollo 16 site are compared to the numerically calculated model solutions. This comparison indicates that the anisotropic fluctuations can be modeled by a nonconducting layer in the lunar lithosphere which is 150 km thick beneath the highlands and 300 km thick beneath Mare Serenitatis. A decreased electrical conductivity in the upper mantle beneath the mare may be due to a lower temperature resulting from heat carried out the magma source region to the surface during mare flooding. (Author)


Experimental evidence shows the importance of external boundary conditions on the overall performance of a rotating heat pipe condenser. Data are presented for the boundary conditions of constant heat flux and constant wall temperature for rotating heat pipes containing either pure vapor or a mixture of vapor and noncondensable gas as working fluid. (Author)


An explanation for the vertical structure and thickness of Saturn's rings compatible with observational data is presented. The model of the rings as being many particles thick is shown to be possible, with random particle motions preventing the complete flattening of the system and a gaussian distribution of particle density with vertical displacement. The model prediction of a maximum ring thickness of tens of meters, however, is in conflict with observations of ring thickness of at least 0.8 km at ring-plane passage. It is shown that perturbations to ring particle orbits caused by the sun and Saturn's large satellites may produce long and short-period coherent vertical ring displacements and a nonlinear displacement of the ring plane from the equatorial plane with radial distance, leading to an apparent edge-on thickness of a few hundred meters. A.L.W.


Direct measurements of the optical depth above the two Viking landers are presented for a period covering the summer, fall, and winter seasons in the Northern Hemisphere, a time period during which two global dust storms occurred. The data are used to define the properties of suspended dust particles in the Martian atmosphere and to assess their role in a number of meteorological and geological processes. Major conclusions are: (1) both the radiative effects of dust particles and the threedynamical effects of large-scale atmospheric motions have a significant impact on the vertical temperature structure; (2) Pertinent feedback effects play an important part in the generation of some local dust storms, in the expansion of local dust storms to global proportions, and in the subsequent decay of global dust storms; (3) An important mechanism for the removal of dust particles from the atmosphere is the CO2 condensation-sedimentation process; and (4) that the polar laminae are constructed from atmospheric dust and water ice is hypothesized. S.D.


An explicit result is presented for the two-dimensional Green function for an orthorhombic body containing a crack along an orthorhombic plane and with its tip in an orthorhopic direction. A formal solution and a numerical program for its calculation are presented for a crack on a plane rotated about an orthorhopic direction. The use of such Green functions to couple a finite element mesh to a surrounding elastic continuum, thereby shortening finite element calculations for composite bodies with macroscopic orthotropic symmetry, is discussed. (Author)


The results of a series of laboratory experiments initiated to simulate Martian eolian erosion are presented. Experiments were conducted under Martian atmospheric pressure and compared to natural eolian sand produced on earth. It is reported that the less dense atmosphere on Mars resulted in more energetic eolian erosion manifested by an slightly higher rate of grain rounding and surface textures that included semicircular depressions termed 'popouts'. It is suggested that physical and chemical weathering may proceed more rapidly on Mars than on earth, given a sufficient supply of water vapor. In addition, clay mineral formations should be facilitated by the presence of large amounts of disrupted material. Finally, it is noted that the disrupted material could increase the ability of the soil to act as a reservoir for water thereby provisionally explaining the large amount of bound water on the surface soil material over much of Mars. M.E.P.

A79-52815 * Cosmic ray ionization of the Jovian atmosphere. L. A. Capone (San Jose State University, San Jose, Calif.). J. Dubach (Instituut voor Kernfysich Onderzoek, Amsterdam,
An approximate form of the Boltzmann equation has been used to obtain local ionization rates due to the absorption of galactic cosmic-ray induced cascade in the Jovian atmosphere. It is suggested that the absorption of galactic cosmic-ray energy at relatively high pressures in the Jovian atmosphere may be especially important in ionizing the atmosphere at levels where the total number density exceeds 10 to the 19th per cu cm (well below the ionospheric layers produced by solar EUV). A model containing both positive and negative ion reactions has been employed to compute electron and ion number densities. Peak electron number densities of the order of 1000 per cu cm may be expected even at relatively low magnetic latitudes. The dominant positive ions are NH4(+) and OHn(+) cluster ions, with n at least 2. It is suggested that the absorption of galactic cosmic-ray energy at such relatively high pressures in the Jovian atmosphere (M about 1 to 10 to the 18th to 10 to the 20th per cu cm) and the subsequent chemical reactions may be instrumental in the local formation of complex hydrocarbons.

(Author)


The Galileo satellite program includes the Galileo A entry probe to the Jovian equatorial atmosphere in mid-1985. Optical and RF sensors for a lightning detection system are included as a part of the entry probe experimental payload. In this paper, calculations of the RF wave propagation and reflection characteristics of the equatorial Jovian atmosphere and ionosphere for frequencies less than 100 kHz are presented. It is shown that wave propagation is limited to line-of-sight and one-hop from the ionosphere. Results are also presented of a statistical treatment of the RF wave power densities for the case of a finite number of events and for the case of a uniformly distributed source. The results can be applied to specific RF experiment configurations concerned with establishing the statistical characteristics of Jovian lightning.

(Author)


Two spacecraft with scientific instruments, a Multiprobe and an Orbiter, were sent to Venus by the USA in 1978 and successfully performed a series of measurements of the Venusian environment, in situ from the probes and remotely from the Orbiter. The paper discusses the scientific objectives of the missions, describes the spacecraft and trajectories, presents the performance of the spacecraft and instruments, and summarizes the scientific findings. The results indicate an excess of primordial argon at Venus; four distinct cloud layers were observed; four widely separated sites were observed in both daylight and night time show almost no differences in atmospheric temperature and pressure below about 50 km altitude, winds up to 200 m/sec were observed at high altitudes; large plateaus were identified on the surface.

(Author)


The paper presents a state-of-the-art review of interplanetary fluctuations, their origins, and their effects on the solar wind. Typical values of parameters to waves and turbulence waves are examined, along with a classification of large-amplitude waves. Cases where description by the MHD theory is qualitatively correct and where it can be misleading are noted. An attempt is made to state rigorously the essential points of hydromagnetic-wave theory and to identify areas in which theoretical research needs to be extended. The review covers the observed hydromagnetic fluctuations, their interpretation in terms of current theory, and the degree of closure between observation and theory. The spatial distribution and origins of waves in the solar wind are discussed.

V.P.


The history of investigation of the solar wind interaction with Mars, Venus, and Mercury is reviewed, and our knowledge on this interaction for each of the three planets is compared. The primary objective is to gain insight into the basic physical mechanisms operative in the earth's magnetosphere from a study of the somewhat different magnetospheres of the planets under consideration. Mercury and Venus have significant dipole moments which play an important part in solar wind interaction. The Martian magnetic moment appears to be too weak to influence solar wind interaction. As expected, the bow shock of Mercury and the earth are quite similar since the magnetic moment of each is sufficient to stand off the solar wind. The shocks of Venus and Mars are also similar, but the Venusian shock lies much closer to the planet than the Martian shock. Both Mercury and Venus show evidence of substorm-like field and particle behavior, but with clear differences in the time scale.

V.P.


The paper covers the principles, observational procedures, and results relating to occultations of stars by solar system bodies other than the moon. Physical processes involved in occultations are presented including (1) extinction by ring material, (2) differential refraction by a planetary atmosphere, (3) extinction by a planetary atmosphere, and (4) Fresnel diffraction by sharp edges. It is noted that from a sufficient number of immersion and emersion timings of a stellar occultation, the radius and ellipticity of the occuring body can be accurately determined. From an occultation by a planet...
having an atmosphere, temperature, pressure, and number density profiles can be obtained along with information about the composition of the atmosphere and the extinction. V.T.


Intensities and N2 collision-broadening coefficients are measured for 82 water vapor absorption lines between 715 and 732 nm potentially applicable to laser remote sensing of atmospheric water vapor. Absolute line strengths and widths were determined from spectra corrected for instrument resolution, air-path absorption and Lorentz and Doppler broadening for pure water vapor and water vapor-nitrogen mixtures in a multipass absorption cell with a base path length of 25 m (White cell). Line strengths are observed to range from 4 x 10^29 to 4 x 10^30 kaysers/molecule per sq cm, and collision broadening coefficients are found to be approximately equal to 0.1 kaysers/atm. A.L.W.

A79-54486 * The mean Jovian temperature structure derived from spectral observations from 105 to 630 cm kaysers. D. Goorvitch, E. F. Erickson, J. P. Simpson, and A. T. Tokunaga (NASA, Ames Research Center, Moffett Field, Calif.). Icarus, vol. 40, Oct. 1979, p. 75-86. 40 refs. Far-infrared observations of the thermal emission of Jupiter are used to determine the temperature at 1 bar. High-altitude observations of the whole disk brightness temperature of Jupiter in the range of 100 to 347 kaysers were inverted to obtain a P.T profile between 1.5 and 0.06 atm, assuming the opacity sources of the H2 collisionally induced continuum and the rotation inversion bands of ammonia. The P.T profile derived from the spectrum reproduces the main features of the observed spectrum, with a slightly improved fit if the effects of ammonia haze opacity or NH3 supersaturation in the saturated region are taken into account. The Jovian temperature is found to be 160° or -7 K at 1 bar, and 105° or -3 K at the inversion level at 0.15 bar. The 1-bar temperature is shown to be consistent with jovian interior models which match the observed gravitational moment. A.L.W.

PATENTS

N79-11215* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AMBIENT CURE POLYIMIDE FOAMS Patent Application Paul M. Sadows, Salvatore R Ricciocci, and Charles L Hamershem, inventors (NASA) (Rockwell Intern., Thousand Oaks, Calif.) Filed 31 Oct 1978 15 p (NASA-Case-ARC-11170-1; US-Patent-App-SN 956161) Avail. NTIS HC-A02/MAF A01 C151 CTD. Flame and temperature resistant polyimide foams are prepared by the reaction of an aromatic dianhydride (pyromellitic dianhydride) with an aromatic polyisocyanate (polyurethane isocyanate), in the presence of an inorganic acid and furfural alcohol. Usable acids include dilute sulfuric acid, dilute nitric acid, hydrochloric acid, polyphosphoric acid, and phosphoric acid, with the latter being preferred. The dianhydride and the isocyanate in about equimolar proportions constitute about 50% of the reaction mixture, the rest being made up with the acid and the alcohol in a ratio of about 1:1:1. An exothermic reaction between the acid and the alcohol provides the heat necessary for the other components to polymerize without recourse to external heat sources. The mixture can be sprayed on any surface to form polymeric foam in locations where the application of heat is not practical or possible, for instance, between walls or on mine tunnel surfaces. NASA


N79-18077* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. CRYOGENIC CONTAINER COMPOUND SUSPENSION STRAP Patent Application John W. Vorreiter, inventor (NASA) Filed 22 Aug. 1978 13 p. (NASA-Case-ARC-11157-1; US-Patent-App-SN 935827) Avail. NTIS HC A02/MAF A01 C151 CTD. A support strap for use in a cryogenic storage vessel for supporting the inner shell from the outer shell with a minimum heat leak is presented. The compound suspension strap is made from a unidirectional fiberglass epoxy composite material with an ultimate tensile strength and fatigue strength which are approximately doubled when the material is cooled to a cryogenic temperature. NASA


New crosslinked elastomeric polyimides were prepared by a 4 step procedure which consists of: (1) forming a poly (imidoyldiamine) by the reaction under reflux conditions of anhydrous ammonia with certain perfluorinated alkyl or allyltinidines; (2) forming a linear polyimine by cyclizing the imidoylamine linkages by reaction with certain perfluorinated alkyl or alkyl ether anhydrides or halides. (3) extending the linear polyimine chain by further refluxing in anhydrous ammonia, and (4) heating to cyclize the new imidoylamine linkages and thereby crosslink the polymer.

Crosslinked 1,2,4-oxadiazole elastomers were prepared by thermally condensing: (1) monomers having the formula \( \text{H}_2\text{N(H)}\text{O} \text{C}=\text{O} \text{R} \), where \( R \) is a triazine ring-forming group such as nitro or amine or a mixture of such groups with amidoamine, or (2) a mixture of said monomer with \( \text{RC}(\text{NO})\text{H} \text{N} \text{H} \text{N} \text{H} \text{N} \text{H} \text{C} \text{R} \), with \( R \) in these formulas standing for a bivalent organic radical having one or more of the following carbonic, amino, amido, imino, or oxo groups. The overall monomer charge could have \( m + n \) ranging from 1 to 18, and about 0.5 to 30% boron oxide based on the weight of the final polymer.

Flexible intumescent protection sheeting of unusually uniform thickness were prepared from epoxy-polysulfide compositions, containing microfibers and the ammonium salt of the 1,4-diamino-2,3-sulfonic acid, as disclosed in U.S. Pat. No. 3,653,464, except that an ammonium salt particle size in the order of 5 to 8 microns and a fiber size of about 1/128th inch in length and 3 to 5 microns in diameter were found critical to obtain the required density of 1.46 to 1.50 g/cc. The insulating sheeting was prepared by a continuous process involving vacuum mixing, calendaring, and curing under very strict conditions which depend to some extent upon the thickness of the sheet produced.

Flexible impregnant containing perfluoroalkyl polytriazines containing pendent iodo difluoromethyl groups were prepared by the reaction of perfluoralkyl dinitrites with ammonia to form polyimidoylamine, followed by the cyclization of the imidoylamine groups with, e.g. various mixtures of a perfluorooctyl fluoride with an omega-iodo perfluorooctyl fluoride. The polyimides obtained are cured by heat which causes crosslinking at the iodo difluoromethyl groups by elimination of iodine and formation of carbon to carbon bonds.

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The synthesis of a sealer for aircraft structures is described. Perfluoralkyl polyimides containing pendent iodo difluoromethyl groups were prepared by the reaction of perfluoroalkyl dinitrites with ammonia to form polyimidoylamine, followed by the cyclization of the imidoylamine groups with, e.g. various mixtures of a perfluorooctyl fluoride with an omega-iodo perfluorooctyl fluoride. The polyimides obtained are cured by heat which causes crosslinking at the iodo difluoromethyl groups by elimination of iodine and formation of carbon to carbon bonds.

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Formals of CH2OHCHOHinCH2 polyols (n = 2 to 4) are prepared in less than 15 minutes by heating to about 125°C a mixture of e.g. sorbitol and paraformaldehyde in slight excess (5 to 10%) in the presence of e.g. sulfuric acid in catalytic quantities. Elution with methanol and filtration yield the pure solid cyclic triformal. The process can be carried in stages, using most stoichiometric quantities of paraformaldehyde, but without any change in overall heating time. NASA
LIFE SCIENCES

FORMAL REPORTS


The Soviet experiments flown on the Cosmos 782 mission are summarized. Seven countries participated with experiments in 15 categories. The experiments in general concentrated on comparing the effects of weightlessness versus artificial gravity on genetics, growth, development and aging. The 11 U.S. experiments used rats, fruit flies, carp, tissue slices, embryos, fish eggs and radiation dosimeters. Lists of participating countries, experiments, and mission operations are presented. The U.S. experiment hardware, preflight activities, and postflight activities relevant to the 11 U.S. experiments on board the Soviet spacecraft are described. For individual titles see N79 11652 through N79 11670.


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Lymph nodes of the vacuum control group showed only normal variations of structure. Both nodular and diffuse arrangement of the parenchyma were found which is further reflected in the fibrous framework as seen in microfiches. Active germinal centers with pyonuclear positive cells are found in some of the nodes of three rats of this group. Mitoses are occasionally observed. Neutrophilic cells and debris within the centers are normal in amount. The sinuses contain the cells usually seen in lymphocytes, histiocytes, plasma cells, and some erythrocytes.

N79 11654's National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif. ALTERATIONS IN ERYTHROCYTE SURVIVAL PARAMETERS IN RATS AFTER 19.5 DAYS ABOARD COSMOS 782 Final Report Henry A. Leon, Stephen A. Landaw (Veterans Administration Hosp., Syracuse, N. Y.) and Jennifer Cummings In its US Ext, Flown on the Soviet Satellite COSMOS 782 Sep 1978. p 200-206 (For primary document see N79 11651 02 51). Avail. NTIS HC A18/MF A01 CSCL 06C. Evidence of gastric ulceration or severe erosion of the gastric mucosa was sought in rats following 19.5 days of spaceflight on the Cosmos 782 Biological Satellite. The stomachs from the flight animals were compared macroscopically, and histologically with stomachs removed from animals of the synchronous and vacuum control groups. None of the animals in the flight or the control groups ulcerated, and there were no obvious histologic differences in gastric erosion among the groups. The reasons for this failure to ulcerate are discussed.
on the Soviet Satellite COSMOS 782 Sep 1978 p 237 232 refs (For primary document see N79 11651 02 51) Avail NTIS HC A18 MF A01 CSCL 06C

Rats were subjected to 19.5 of weightless space flight aboard the Soviet Biostatellite Cosmos 782. The survival parameters of a cohort of erythrocytes labeled 15 days pre flight based on the output of Co 14 were evaluated upon return from orbit. These were compared to typanum control rats injected at the same time. Statistical evaluation indicates that all survival parameters were altered by the space flight. The mean potential life span which was 62.4 days in the control rats was decreased to 59.0 days in the flight rats, and random hemolysis was increased three fold in the flight rats. The measured size of the cohort was decreased lending further support to the idea that hemolysis was accelerated during some portion of the flight. A number of factors were discussed which might be contributory to these changes. These factors include forces associated with launch and reentry, atmospheric and environmental parameters dietary factors radiation and weightlessness. Author

N79 11664# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.


Pituitary function was investigated in rats subjected to 19.5 days orbital space flight Male SPF Wistar rats were divided into vomam control (VCI synchronous control SCI) and flight (FI) groups. SC rats were subjected to the same caging RH002 RH002 and temperature as F rats. Rats from each treatment group were sacrificed either immediately after recovering from flight or after 25 days after recovery. Space flight caused a marginal increase in growth. Pituitary concentrations of hormones were similar for all groups as were the hematocrits. At R 25 F rats had increased plasma prolactin concentrations decreased pituitary GH and increased vasopressin. Pituitary and plasma concentrations of other hormones remained unchanged from control values. Hematocrits of flight rats were higher than those for rats at R 0. Anterior pituitary and testicular weights were unaffected by space flight whereas adrenal weights (2 rats from each group) were 30% heavier than controls at R 0 and 15% heavier at R 25. Flight rats also had enlarged posterior lobes. Author

N79 11665# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.

QUANTITATIVE ANALYSIS OF SELECTED BONE Parameters Final Report Linda Meric Hinton and David J Baylink (Veterans Admin Hospital Seattle) In its US Exp Flown on the Soviet Satellite COSMOS 782 Sep 1978 p 321 351 refs (For primary document see N79 11651 02 51) Avail NTIS HC A18 MF A01 CSCL 06C

The effect of space flight on bone formation and mineralization bone resorption bone length bone density and bone size distribution and bone mechanical properties in rats was investigated and compared to vamam and synchronous control groups. The most striking effects were found on bone formation. All parameters were investigated in the flight animals immediately after flight were significantly decreased from both the vamam and synchronous control groups. An arrest line zone was found at the endosteum and the periosseum of the flight animals suggesting that a complete cessation of bone growth occurred during space flight. By 25 days postflight the flight animals showed a significant increase in bone formation when compared to the vamam controls suggesting that a rebound in bone formation occurred following flight. Author

N79 11666# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.

COSMIC RAY EFFECTS ON THE EYES OF RATS FLOWN ON COSMOS 782 Final Report Delbert E Philpott Robert Corbett Charles TURNBILL Gladys Hanson David Leafer Sam Black Walter Sapp Gloria Klein and Loya F Sall In its US Exp Flown on the Soviet Satellite COSMOS 782 Sep 1978 p 352 381 refs (For primary document see N79 11651 02 51) Avail NTIS HC A18 MF A01 CSCL 06R

The eyes from six rats were fixed at the recovery site in red laser 80% 75 days in a 62 deg orbit. Twelve more flight eyes were fixed 25 days later. These two preparations and eyes exposed to 1000 rad of neon and argon were compared to obtain data on possible radiation effects on the retina. The outer nuclear layer was examined for radiation changes because these nuclei control the synthesis of the outer segments. Nerve nuclei were found in the outer nuclear layer and channels were localized in the outer segment area Macrophages were seen between the pigment layer and outer segments. Comparison of the zero day and 25 day postflight eyes suggested some possible recovery. Flight flashes seen by space travelers and damage from cosmic rays appeared to arise from two different sites of interaction. The flashes are created by cosmic ray traversal of the outer segments while pathology when it occurs is quite possible from interaction with some part of the nucleus. Author

N79 11670# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.


The biological effects of weightlessness were investigated on Drosophila melanogaster of the Donaellew strain which developed and spent the first days of adult life in space following a 19.5 day exposure to zero g. The flies were studied by morphological, chemical and behavioral techniques. The development of Drosophila was insensitive to weightlessness and the aging process was not influenced except for a slight reduction in the amount of lipofuscin present in the midgut and Malpighian tubules. Author

N79 11671# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.


Results of spaceborne experiments onboard the Cosmos 936 satellite are reported. Alternations in normal bone chemistry, muscle structure and general physiology resulting from spaceflight are covered along with measurements of cosmic radiation and its potential hazard to man during prolonged spaceflights. Postflight activities involving the seven U.S. experiments are emphasized for individual titles see N79 11672 through N79 11679

N79 11672# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.

THE COSMOS 936 MISSION Final Report Kenneth A Souza In its US Exp Flown on the Soviet Satellite COSMOS 936 Sep 1978 p 131 refs (For primary document see N79 11672 02 51) Avail NTIS HC A13 MF A01 CSCL 06C

Cosmos 936 an unmanned spacecraft carrying biology and physics experiments from 9 countries including both the Soviet
Union and the U.S. is described. An overview of the mission focusing on preflight on-orbit and postflight activities pertinent to the seven U.S. experiments aboard Cosmos 936 is presented.

J M S

N79 11673'* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

EFFECTS OF WEIGHTLESSNESS ON THE GENETICS AND AGING PROCESS OF DROSOPHILA MELANOGASTER

Jame Miquel and Delbert E Phupott

TO PROLONGED SPACE FLIGHT Final Report

In its US Exp Flown on the Soviet Satellite COSMOS 936 Sep 1978 p 32 59 refs (For primary document see N79 11671 02 51)

The biological effects of space flight were investigated on fruit flies (male Drosophila melanogaster) in an experiment planned jointly with the USSR. The effects of near weightlessness on the developmental and aging processes were studied. Larval cultures and mature flies (imagos) were exposed to the space environment onboard the Cosmos 936 biosatellite. It is shown that the effect of hypogravity on the experiment planned jointly with the USSR. The effects of weightlessness and centrifugation are not appreciably associated with growth and morphogenesis. The results of a detailed investigation by scanning electron microscopy of the development processes of Drosophila fruit flies (male Drosophila melanogaster) presented.

J M S

N79 11674'* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

EFFECT OF WEIGHTLESSNESS AND CENTRIFUGATION (LXG) ON ERYTHROCYTE SURVIVAL IN RATS-SUBJECTED TO PROLONGED SPACE FLIGHT Final Report

Henry A. Leon, Stephen A. Landaw, Veterans Administration Hospital Syracuse, N.Y. and Luba V. Serova (Inst for Biomedical Problems, Moscow) In its US Exp Flown on the Soviet Satellite COSMOS 936 Sep 1978 p 60 76 refs (For primary document see N79 11671 02 51)

Avail NTIS HC A13 MF A01 CSCL 065

Rats were flown aboard the biosatellite Cosmos 936 for 185 days. Five rats were subjected to near weightless space flight and five rats were subjected to a one g force via an onboard centrifuge. These rats and 3 control groups were injected with 2 C14 glycerin 19 days preflight. The flight rats were recovered from orbit after 185 days of space flight. Erythrocyte hemolysis and life span were evaluated in the five groups of rats by quantitation of radioactive carbon monoxide exhaled in the breath which arises from the breakdown of the previously labeled hemoglobin. The results are supportive of previous findings wherein hemolysis was found to increase as a result of weightless space flight. A comparison with the centrifuged animals indicates that artificial gravity attenuates the effect of weightlessness on hemolysis and appears to normalize the hemolytic rate in the early postflight period.

J M S

N79 11675'* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

SPACE RADIATION DOSIMETRY ONBOARD COSMOS 936 US PORTION OF EXPERIMENT K 206 Final Report


Avail NTIS HC A13 MF A01 CSCL 065

The space radiation environment was investigated in a joint U.S./USSR experiment onboard the Cosmos 936 biosatellite. Results derived from measurements made in a variety of passive radiation detectors including plastic nuclear track detectors, fission foil detectors, thermoluminescence dosimeters, and nuclear emulsions are reported. The mean observed HZE particle flux as measured in cellulosic nitrate plastic detectors was 175 sq cm day (~ 20%). The fluences of thermal neutrons and high energy neutrons were respectively 364 000 sq cm 950 000 sq cm and 2 100 000 sq cm the total dose as measured in TLD chips located at two sites in the U.S. 25% part of the K 206 container was 424 mrad (~ 9%) and 523 mrad (~ 11%). The mean tissue equivalent proton energy density as measured in nuclear emulsions located in the U.S. 25% part of the K 206 container was 272 000 u cm tissue. The physical parameters of the radiation environment reported here specific important dosimetric information required to assay the potential radiation hazards to life systems in space.

J M S

The activities of about 30 enzymes concerned with carbohydrate and lipid metabolism and the levels of glycolgen and of the individual fatty acids in hepatic lipids in rat livers exposed to space flight conditions were examined. Statistically significant decreases in the activity levels of glycolgen phosphorylase, alpha glycerol phosphate acyl transferase, diglyceride acyl transferase, aconitase, and 6-phosphoglucocinate dehydrogenase were noted in the weightless group. All enzyme activities returned to normal 25 days postflight. When the liver glycogen and the total fatty acids of the flight animals were determined, significant differences that could be attributed to reduced group at recovery contained more than twice the amount of glycogen and half the centrifuged controls and a remarkable shift in the ratio of palmitate to palmitoleate was noted.

J M S

N79 11676'* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

QUANTITATIVE ANALYSIS OF SELECTED BONE PARAME

TERS Final Report

Emily Morey Holton, Russell T Turner (Veterans Administration Hospital, Tacoma, Wash.) and David J Baylink (Veterans Administration Hospital, Tacoma, Wash.) In its US Exp Flown on the Soviet Satellite COSMOS 936 Sep 1978 p 135 183 refs (For primary document see N79 11671 02 51)

Avail NTIS HC A13 MF A01 CSCL 065

The effect of space flight on bone formation, bone resorption, bone length, bone density and pore size distribution, bone mechanical properties and bone cell number in both flight and 1 G flight centrifuged rats was investigated and compared to ground control groups. The data obtained suggest that no gross change in endosteal bone resorption occurs during flight or postflight that mean periosteal bone formation rate decreases about 45% and is not corrected by centrifugation that the decrease in formation rate may be due in part to a cessation of bone formation which occurs sometime after the eleventh day of flight and continues until the second postflight day that although centrifugation did not correct the defect in periosteal bone formation rate during flight it appears to hasten the recovery following flight that femur stiffness decreases about 30% and that centrifugation did do the defect in bone mechanical properties. All perturbations produced by space flight returned to or exceeded normal values by 25 days after flight.

Author

N79 11677'* San Francisco Univ Calif Physics Research Group

SPACE RADIATION DOSIMETRY ONBOARD COSMOS 936 US PORTION OF EXPERIMENT K 206 Final Report


Avail NTIS HC A13 MF A01 CSCL 065

The space radiation environment was investigated in a joint U.S./USSR experiment onboard the Cosmos 936 biosatellite. Results derived from measurements made in a variety of passive radiation detectors including plastic nuclear track detectors, fission foil detectors, thermoluminescence dosimeters, and nuclear emulsions are reported. The mean observed HZE particle flux as measured in cellulosic nitrate plastic detectors was 175 sq cm day (~ 20%). The fluences of thermal neutrons and high energy neutrons were respectively 364 000 sq cm 950 000 sq cm and 2100 000 sq cm the total dose as measured in TLD chips located at two sites in the U.S. 25% part of the K 206 container was 424 mrad (~ 9%) and 523 mrad (~ 11%). The mean tissue equivalent proton energy density as measured in nuclear emulsions located in the U.S. 25% part of the K 206 container was 272 000 u cm tissue. The physical parameters of the radiation environment reported here specific important dosimetric information required to assay the potential radiation hazards to life systems in space.

J M S
COSMIC RAY EFFECTS ON THE EYES OF STATIONARY N79 11678 National Aeronautics and Space Administration

EXPERIMENT K.207 Final Report


Avail. NTIS HC A13/MF A01 CSCL 09R

Ten rats centrifuged during flight to simulate gravity and 5 in flight stationary experiencing hyogravity, orbited the earth in a 628 deg orbit for 185 days in the Russian satellite Cosmos 936. The animals were sacrificed 25 days post-recovery and the eyes were enucleated and fixed immediately. No differences were noted comparing flight stationary to flight centrifuged. Affected cells in the outer nuclear layer were again found similar to those seen in K.O.07. Preliminary results using the digitizer to quantitate the tissue response indicated an increase in cell size after radiation and decrease in the number of cells in the outer nuclear layer.

Author

PHYSIOLOGICAL RESPONSES OF WOMEN TO SIMULATED WEIGHTLESSNESS: A REVIEW OF THE FIRST FEMALE BED-REST STUDY

Harold Sanders and David L. Winter. 1978. 92 p. refs

Subjects were exposed to centrifugation, to lower body negative pressure (LBNP), and to exercise stress both before and after bed rest. Areas studied were centrifugation tolerance, fluid electrolyte changes and hematology, tolerance to LBNP, physical working capacity, biochemicines, blood fibronectin activity, female metabolic and hormonal responses, circadian alterations and gynecology. Results were compared with the responses observed in similarly bed-rested male subjects. The bed-rested females showed deconditioning responses similar to those of the males although with some differences. Results indicate that women are capable of coping with exposure to weightlessness and moreover that they may be more sensitive subjects for evaluating countermeasures to weightlessness and developing criteria for assessing applicants for shuttle voyages.

G.G.

MODELING THE HUMAN AS A CONTROLLER IN A MULTITASK ENVIRONMENT


The study deals with 165 inadvertent operations on or into inappropriate portions of the aircraft areas at controlled airports. Pilot-initiated and controller-initiated incursions are described and discussed. It was found that a majority of the pilot-initiated occurrences involved operation without a clearance, controller-initiated occurrences usually involved failure to maintain assured separation. The factors associated with these occurrences are analyzed. It appears that a major problem in these occurrences is inadequate coordination among the various system participants. Reasons for this, and some possible solutions to various aspects of the problem, are discussed. A sample of reports from pilots and controllers is presented. These relate to undesired occurrences in air transport, general aviation, and air traffic control operations, to ATC coordination problems, and to a recurrent problem in ASRS reports, parachuting operations. A sample of alert bulletins and responses to them is presented.

Author

79-15689** National Aeronautics and Space Administration

AMES RESEARCH CENTER

THE 14TH ANNUAL CONFERENCE ON MANUAL CONTROL

Nov 1978 692 p refs Conf held at Univ of Southern Calif.

Los Angeles 25 27 Apr 1978


Grant NsG 2119

Avail. NTIS HC A99/MF A01 CSCL 05H

Modeling the human as a controller of slowly responding systems with preview is considered. Along with control tasks, discrete noncontrol tasks occur at irregular intervals in multitask situations such as these. It has been observed that humans tend to apply piecewise constant controls. It is believed that the magnitude of controls and the durations for which they remain constant are dependent directly on the system bandwidth, preview distance, complexity of the trajectory to be followed, and nature of the noncontrol tasks. A simple heuristic model of human control behavior in this situation is presented. The results of a simulation study, whose purpose was determination of the sensitivity of the model to its parameters, are discussed.

Author

PROSPECTS OF A MATHEMATICAL THEORY OF HUMAN BEHAVIOR IN COMPLEX MAN MACHINE SYSTEMS TASKS

A structural description leads to a block diagram and a time-sharing computer analogy. The range of applicability of existing mathematical models is considered with respect to the hierarchy of human activities in actual complex tasks. Other mathematical tools so far not often applied to man-machine systems are also discussed. The mathematical descriptions at least briefly considered here include utility, estimation, control, queuing, and fuzzy set theory as well as artificial intelligence techniques. Some thoughts are given as to how these methods might be integrated and how further work might be pursued.

Author: A. H.

A MODEL FOR DYNAMIC ALLOCATION OF HUMAN ATTENTION AMONG MULTIPLE TASKS

N79-15627# Massachusetts Inst of Tech Cambridge
Man-Machine Systems Lab
A MODEL FOR DYNAMIC ALLOCATION OF HUMAN ATTENTION AMONG MULTIPLE TASKS

N79-15628# San Jose State Univ. Calif
PERPETUAL FACTORS INVOLVED IN PERFORMANCE OF AIR TRAFFIC CONTROLLERS USING A MICROWAVE LANDING SYSTEM

N79-15629# Utah Univ., Salt Lake City
TIME ESTIMATION AS A SECONDARY TASK TO MEASURE WORKLOAD: SUMMARY OF RESEARCH
losses; and (3) to acquire a body of data needed to formulate an appropriate countermeasures program for the prevention of skeletal deconditioning. Space flight experiment simulation facilities are under development and will be tested for their capability in supporting certain of the requirements for these investigations.

G.Y.

N79-21082* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

RECOMMENDATIONS OF THE PANELS: PANEL ON OZONE DESTRUCTION TECHNIQUES

Ted Wydeven In NASA. Lewis Res. Center. Ozone Contamination in Aircraft Cabins. Mar 1979 9 10 (For primary document see N79-21001 12-03)

Avail NTIS HC A05/MF AO1 CSCL 065

Catalyst materials to reduce weight, size, and cost of the ozone removal device were developed. Catalyst bed lifetime, competitive reactivity contaminants in the inlet air on the catalyst bed efficiency for ozone removal, and the kinetics and mechanism by which ozone is destroyed on selected catalysts were studied.

S.E.S.

N79-18694* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

VISION

Richard F. Haines In its Human Neurol. Develop. Nov 1978 p 35 45 Original contains color illustrations (For primary document see N79-15887 06-98)

Avail NTIS HC A04/MF AO1 CSC 06P

Visual input methods are considered for the therapeutic treatment of autistic and brain-damaged patients, and to provide a controlled stress environment for visual perception problems.

G.G.


ORGANIC CHEMISTRY ON TITAN

Sherwood Chang, Thomas Scattergood, Sheldon Aronowitz, and Jose Flores In JPL. The Saturn System. Dec 1978 p 161-184 refs (For primary document see N79-16758 07-91)

Avail NTIS HC A18/MF AO1 CSCL 038

Observations of nonequilibrium phenomena on the Saturn satellite Titan indicate the occurrence of organic chemical evolution. Greenhouse and thermal inversion models of Titan's atmosphere provide environmental constraints within which various pathways for organic chemical synthesis are assessed. Experimental results and theoretical modeling studies suggest that the organic chemistry of the satellite may be dominated by two atmospheric processes: energetic particle bombardment and photochemistry. Reactions initiated in various levels of the atmosphere by cosmic ray, Saturn wind, and solar wind particle bombardment of a CH4 - N2 atmospheric mixture can account for the C2-hydrocarbons, the UV-visible absorbing stratospheric haze, and the reddish color of the satellite. Photochemical reactions of CH4 can also account for the presence of C2-hydrocarbons. In the lower Titan atmosphere, photochemical processes will be important if surface temperatures are sufficiently high for gaseous NH3 to exist. Hot H-atom reactions initiated by photo-dissociation of NH3 can couple the chemical reactions of NH3 and CH4 and produce organic matter.

G.G.

N79-19021* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECTS OF HYPODYNAMIC SIMULATIONS ON THE SKELETAL SYSTEM OF MONKEYS

D R Young and J W Tremor

Fight Center Ninth Corot on Space Simulation 1977 p 123 140 refs (For primary document see N79-21001 12-03)

Avail NTIS HC A05/MF AO1 CSCL 065

The goals of the program are (1) to uncover the mechanisms by which weightlessness affects the skeletal system, (2) to determine the consequences and reversibility of bone mineral

losses; and (3) to acquire a body of data needed to formulate an appropriate countermeasures program for the prevention of skeletal deconditioning. Space flight experiment simulation facilities are under development and will be tested for their capability in supporting certain of the requirements for these investigations.

G.Y.

N79-21082* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

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Avail NTIS HC A05/MF AO1 CSCL 065

Catalyst materials to reduce weight, size, and cost of the ozone removal device were developed. Catalyst bed lifetime, competitive reactivity contaminants in the inlet air on the catalyst bed efficiency for ozone removal, and the kinetics and mechanism by which ozone is destroyed on selected catalysts were studied.

S.E.S.

N79-21382* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE 12TH AEROSPACE MECHANISMS SYMPOSIUM


Mechanisms developed for various aerospace applications are discussed. Specific topics covered include: boom release mechanisms, separation on space shuttle orbiter/Boeing 747 aircraft, payload handling, spaceborne platform support, and deployment of spaceborne antennas and telescopes. For individual titles, see N79-21353 through N79-21373.

N79-21741* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COMPUTER PROGRAM FOR CALCULATION OF OXYGEN UPTAKE


A description and operational procedures are presented for a computer program, written in Super Basic, that calculates oxygen uptake, carbon dioxide production, and related ventilation parameters. Program features include (1) the option of entering slope and intercept values of calibration curves for the O2 and CO2 and analyzers, (2) calculation of expired water vapor pressure, and (3) the option of entering inspired O2 and CO2 concentrations. The program is easily adaptable for programmable laboratory calculators.

Author

N79-25914* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PLANNING AND MANAGING FUTURE SPACE FACILITY PROJECTS

Joan E. Sieber (California State Coll. Hayward), John A. Wilhelm (Texas Univ. Austin), Treve A. Tanner, Richard L. Helmreich (Texas Univ. Austin), and Susan F. Burgenbauch (Texas Univ. Austin) May 1979 29 p refs (NASA-TM-78586. A-7811) Avail NTIS HC A03/MF AO1 CSCL 05A

To learn how ground-based personnel of a space project plan and organize their work and how such planning and organizing relate to work outcomes, longitudinal study of the management and execution of the Space Lab Mission Development Task 3 (SKD 3) was performed at NASA Ames Research Center. A
view of the problems likely to arise in organizations and some methods of coping with these problems are presented as well as the conclusions and recommendations that pertain strictly to SMD 3 management. Emphasis is placed on the broader context of future safety facility projects and additional problems that may be anticipated. A model of management that may be used to facilitate problem solving and communication - management by objectives (MBO) is presented. Some problems of communication and emotion management that MBO does not address directly are considered. Models for promoting mature, constructive and satisfying emotional relationships among group members are discussed. A.R.H.


The technical papers from the five tasks groups that took part in the 1977 Ames Summer Study on Space Settlements and Industrialization Using Nonterrestrial Materials are presented. The papers are presented under the following general topics: (1) research needs for regenerative life-support systems, (2) habitat design, (3) dynamics and design of electromagnetic mass drivers, (4) asteroids as resources for space manufacturing, and (5) processing of nonterrestrial materials. For individual titles, see N79-32226 through N79-32241.


Avail. NTIS MF A01: SDD HC CSCL 22B

The second phase of analyses that were conducted by the Life Support Systems Group of the 1977 NASA Ames Summer Study is described. This phase of analyses includes a preliminary review of relevant areas of technology that can contribute to the development of closed life-support systems for space habitats, the identification of research options in these areas of technology, and the development of guidelines for an effective research program. The areas of technology that were studied included: (1) nutrition, diet, and food processing; (2) higher plant agriculture; (3) animal agriculture; (4) waste conversion and resource recovery; and (5) system stability and safety. Results of these analyses, including recommended research options and criteria for establishing research priorities among these many options, are discussed. G.Y.


A number of candidate computer-generated cockpit displays of traffic information (CDTI) displays and display options were simulated statically and were shown to 23 airline pilots who were asked to respond to more than 250 questions about them. The pilots indicated that the amount and complexity of navigational information displayed should increase with altitude and map scale. Terrain information should appear automatically if a pilot's own aircraft descends below the minimum safe altitude and should include only those obstruction within 2,000 ft or less. Few pilots that weather information should be displayed on a CDTI. But if it was, it should be at pilot request only. A chevron-shaped symbol, located so that the majority of the map area was ahead was preferred. The position altitude ground speed ground track. A.R.H.


Two alternate head-up display devices (HUD) were compared for properties relevant to the accurate performance of concurrent tasks in real flight conditions and in various flight modes. The comparisons were made to find the disorientation resistance of the HUDs along with the tracking accuracy, interference resistance, fixation resistance, and error resistance. The use of displacement and flight path information for vertical control is discussed in terms of flight stability. Several combinations of symbols and driving signals are described, including a compensated control law, which were used in simulated flight to deal with wind shear. A.W.H.
that of the optimal model show a great similarity, but indicate
liminal trials comprising the human subject's performance to
the information to the dynamic programming routine. Preliminary
trials which might occur in the immediate future and provides
a calculation. A Boyesian estimator was included which estimates
the trajectory during the next time period and then rates the
performance. The Varietal Functions Research (VFR) Experiment
was established to investigate the neurosensory and related physiolog-
ical processes believed to be associated with the space flight
nausea syndrome and to develop logical means for its prediction
and treatment. The VFR Project consists of ground and spaceflight experimentation using frogs as specimens. The phase B Preliminary Design Study provided for the preliminary
design of the experiment hardware, preparation of performance
and hardware specification and a Phase C/D development plan,
establishment of STS (Space Transportation System) interfaces
and mission operations, and the study of a variety of hardware,
experiment and mission options. The study consist of three major
tasks: (1) mission mode trade-off; (2) conceptual design; and (3)
preliminary design. G.Y.

N79-174987# Massachusetts Inst. of Tech. Cambridge
of Manual Control, 1977, p 237-244 (For primary document see
N79-17475 08-51)
Avail NTIS HC A20/MA01 CSCS 08B
An optimal decision control model was developed, which is
based primarily on a dynamic programming algorithm which looks at
all the available task possibilities, charts an optimal trajectory, and
commits itself to do the first step (i.e., follow the optimal
trajectory during the next time period), and then iterates the
calculation. A Bayesian estimator was included which estimates
the tasks which might occur in the immediate future and provides
this information to the dynamic programming routine. Preliminary
trials comparing the human subject's performance to that of the optimal model show a great similarity, but indicate
that the human skips certain movements which require quick
change in strategy. J.M.S.

N79-17488# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.
THE HUMAN AS A DETECTOR OF CHANGES IN VARIANCE
AND BANDWIDTH c63
Renwick E. Curry and T. Govindaraj (Ill. Univ., Urbana). In MIT
(For primary document see N79-17475 08-51)
Avail NTIS HC A20/MA01 CSCS 05J
The detection of changes in random process variance and
bandwidth was studied. Psychophysical thresholds for these two
parameters were determined using an adaptive staircase technique
for second order random processes at two nominal periods (1
and 3 seconds) and damping ratios (0.2 and 0.707). Thresholds
for bandwidth changes were approximately 9% of nominal except
for the (3sec,0.2) process which yielded thresholds of 12%. Variance
thresholds averaged 17% of nominal except for the
(3sec,0.2) process in which they were 32%. Detection times for
suprathreshold changes in the parameters may be roughly
described by the changes in RMS velocity of the process. A
more complex model is presented which consists of a Kalman
filter designed for the nominal process using velocity as the
input, and a modified Wald sequential test for changes in the
variance of the residual. The model predictions agree moderately
well with the experimental data. Models using heuristics, e.g.,
level crossing counters, were also examined and are too-nd to
be descriptive but do not afford the unification of the Kalman
filter/sequential test model used for changes in mean. J.M.S.
runway occupancy time only. An experiment contrasted air traffic control in a MLS environment under a centralized form of management and under distributed management which was supported by a traffic situation display in each of the 3 piloted simulators. Objective flight data, verbal communication and subjective responses were recorded on 18 trial runs lasting about 20 minutes each. The results were in general agreement with previous distributed management research. In particular, distributed management permitted a smaller spread of intercrossing times and both pilots and controllers perceived distributed management as the more 'ideal' system in this task. It is concluded from this and previous research that distributed management offers a viable alternative to centralized management with definite potential for dealing with dense traffic in a safe, orderly and expeditious manner.

L S.


DESIGN OUTLINE FOR A NEW MULTIMAN ATC SIMULATION FACILITY AT NASA-AMES RESEARCH CENTER


Avail: NTIS HC A20/MF A01 CSCL 14B

A new and unique facility for studying human factors aspects in aeronautics is being planned for use in the Man-Vehicle Systems Research Division at the NASA-Ames Research Center. This facility will replace the existing three cockpit/single ground controller station and be expandable to include approximately seven cockpits and two ground controller stations. Unlike the previous system, each cockpit will be mini-computer centered and linked to a main CPU to effect a distributed computation facility. Each simulator will compute its own flight dynamic and flight path predictor. Mechanical flight instruments in each cockpit will be locally supported and CRT cockpit displays of (e.g.) traffic and or RNAV information will be centrally computed and distributed as a means of extending the existing computational and graphical resources.

An outline of the total design is presented which addresses the technical design options and research possibilities of this unique man-machine facility and which may also serve as a model for other real time distributed simulation facilities.

L S.


TWO MEASURES OF PERFORMANCE IN A PEG-IN-HOLE MANIPULATION TASK WITH FORCE FEEDBACK


Avail: NTIS HC A20/MF A01 CSCL 06J

The results are described from two manipulators on a peg-in-hole task, which is part of a continued effort to develop models for human performance with remote manipulators. Task difficulty is varied by changing the diameter of the peg to be inserted in a 50 mm diameter hole. An automatic measuring system records the distance between the tool being held by the manipulator and the receptacle into which it is to be inserted. The data from repeated insertions are processed by computer to determine task times, accumulated distances, and trajectories. Experiments with both the MA-11 cable-connected master-slave manipulator common to hot cell work and the MA-23 servo-controlled manipulator (with and without force feedback) are described. Comparison of these results with previous results of the Ames Manipulator shows that force feedback provides a consistent advantage.

L S.

N79-17519# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.

SPEECH AS A PILOT INPUT MEDIUM


13th Ann. Conf. on Manual Control 1977 p 480-482 refs (For primary document see N79-17475 08-51) (Grant NGR-45-003-108)

Avail: NTIS HC A20/MF A01 CSCL 06H

The speech recognition system under development is a trainable pattern classifier based on a maximum-likelihood technique. An adjustable uncertainty threshold allows the rejection of borderline cases for which the probability of misclassification is high. The syntax of the command language spoken may be used as an aid to recognition, and the system adapts to changes in pronunciation if feedback from the user is available. Words must be separated by 25 second gaps. The system runs in real time on a mini-computer (PDP 8) and was tested on 120,000 speech samples from 100- and 100-word vocabularies. The results of these tests were 99.9% correct recognition for a vocabulary consisting of the ten digits, and 99.9% recognition for a 100-word vocabulary of flight commands, with a 5% rejection rate in each case. With no rejection, the recognition accuracies for the same vocabularies were 99.5% and 98.6% respectively.

L S.


A new method for collecting in-vivo bone strain data in monkeys has been developed and tested. The method includes a system which consists of a new design of implantable strain transducer and its companion telemetry package. The transducer fits into a hole drilled in a monkey tibia and is threaded for subsequent bone ingrowth. The transducers and telemetry package are biocompatible for over 503 days. The telemetry package uses Pulse Interval Ratio Modulation (PIRM) to transmit strain information to receiving equipment located outside the animal housing cage. (Author)


The paper describes the design, development, integration, and testing of two prototype holding facilities: (1) a unit housing 36 laboratory rats in individual cages, and (2) a unit housing one unrestrained 14-kg rhesus monkey. Both units are environmentally controlled enclosures, complete with food, water, and waste collection equipment. Timer-controlled fluorescent lights in both units permit automatic day-night cycling. Both units are designed to be compatible with Spacelab interfaces and to be operable by NASA payload specialists. B.J.


Organic chemistry in space, organic materials in space exploration, and biochemistry of man in space are briefly surveyed. A model of Jupiter's atmosphere is considered, and the search for organic molecules in the solar system and in interstellar space is discussed. Materials and analytical techniques relevant to space exploration are indicated, and the blood and urine analyses performed on Skylab are described. M.L.


Circadian rhythm characteristics in healthy male and female humans were studied at 4-hour intervals for urine volume, cortisol, 5-hydroxyindoleacetic acid (5-HIAA), Na, K, Na/K ratios in the urine, as well as plasma cortisol. While plasma and urinary cortisol rhythms were very similar in both sexes, the described rhythms in urine volume, electrolyte, and 5-HIAA excretion differ for the two sexes. The results suggest that sex differences exist in the circadian patterns of important hormone and metabolic functions and that the internal synchrony of circadian rhythms differs for the two sexes. The results seem to indicate that the rhythmic secretion of cortisol does not account for the pattern of Na and K excretion. M.L.


The optic nerves of C57BL/6J mice ranging from 3 to 30 months were examined by electron microscopy. At ages investigated, optic nerve axons contained enlarged mitochondria with abnormal cristae. With increasing age, a large number of necrotic axons were observed and were in the process of being phagocytized. The abnormal mitochondria may represent preliminary changes that eventually lead to necrosis of the axon. (Author)


The possibility that intelligent life may be widespread in the universe is now being investigated. A formula for estimating the number of coexisting communicative civilizations has been developed by Drake. A good way of conducting a search for extraterrestrial intelligence (SETI) is to examine the microwave window of the electromagnetic spectrum for narrow-band signals which such civilizations may be transmitting. Two specific search strategies are described. Both employ existing antennas equipped with sophisticated multi-channel spectrum analyzers and pattern recognition devices. The Ames Research Center proposal is a high sensitivity, high-resolution search of nearby promising stars and selected sky areas in the "water hole" (1400-1427 MHz). The Jet Propulsion Laboratory proposal is for a survey of most of the sky over a significant portion of the free-space microwave window at lower sensitivities and resolutions. The approaches are complementary and both are being pursued. The consumption of these programs could achieve one of the most profound discoveries in the history of human civilization, or at least will show the way to future efforts. (Author)

A79 12511 * Planetary protection guidelines for Outer Planet missions. P. Stabekis (Exoteck Research and Analysis, Inc. Gaithersburg, Md.) and D. L. DeVincenzi (NASA, Ames Research Center, Moffett Field, Calif.). In: Life sciences and space research XVI. Proceedings of the Open Meetings of the Working Group on Space Biology, Tel Aviv, Israel, June 7-8, 1977. (A79 12508 02 51) Oxford, Pergamon Press, Ltd., 1978, p. 39-44. 8 refs. Facilities, techniques, and operational procedures used to implement Planetary Protection (PP) requirements for the Viking Project are reviewed in order to better define the COSPAR resolution which proposes that Outer Planet spacecraft be assembled using Vikiing-like clean room technology. It is concluded that, for such missions, PP requirements can be met by adopting Viking cleanroom standards personnel and operation procedures, and by establishing PP as an official entity in project management. (Author)


An oxygen generation system design based on the static feed water electrolysis concept is described. The system is designed to generate 4.20 kg/d of oxygen to satisfy the metabolic needs of a three-person crew, to compensate for spacecraft leakage, and to provide the oxygen required by the electrochemical depolarized CO2 concentrator. The system has a fixed hardware weight of 75 kg, occupies a volume of 0.11 m³, and requires only 1.1 kw of electrical power. The static feed electrolysis concept is discussed, and experimental data on the high-performance electrode are presented. M. L.


Two transporter devices have been developed by the NASA Ames Research Center, primarily for the purpose of storing small vertebrates and primates in the mid-deck avionics bay of the Shuttle during launch and entry. Further, the possible exposure of the animals to high temperatures in Spacelab during entry and post landing will be eliminated. The transporters will provide experimenters more timely access to their animals during experiment critical pre-launch, and post landing periods. Rechargeable batteries in the transporters will provide life support system functions for the animals during periods of transfer and during mission phases in which power is temporarily unavailable. The transporters have been successfully designed, fabricated, and tested. Integrated testing of the transporters was performed in the Space Mission Development III (SMD III) Simulation at the NASA Johnson Space Center. (Author)


NASA is planning to perform a series of Vestibular Function Research (VFR) investigations on the early STS missions to investigate those neurosensory and related physiological processes believed to be associated with the space flight nausea syndrome. The first flight is scheduled for the 1981 Spacelab III Mission in which four frog specimens, mounted on a frog sitting centrifuge device will be subjected to periodic acceleration stimuli and periods of artificial gravity. The vestibular nerve firing responses of each frog specimen will be monitored through implanted neutral bouyancy micro electrodes and transmitted to the ground for quick analysis during the flight. The experiment will be directed at investigating: (1) adaptation to weightlessness; (2) acceleration stimulus; and (3) readapting to earth's gravity. (Author)


Equipment required for Space Transportation System biological experiments is considered, and environmental factors and operational constraints affecting the performance of experiments are examined. Specimen housing is discussed, problems associated with telemetry procedures are characterized, and attention is directed to the problems of handling hazardous fixatives, radionuclides, and chemicals. M. L.

A79 12587 * Instrumentation for controlling and monitoring environmental control and life support systems. P. Y. Yang J.

Advanced instrumentation concepts for improving performance of manned spacecraft: Environmental Control and Life Support Systems (EC/ESS) have been developed at Life Systems, Inc. The difference in specific EC/ESS instrumentation requirements and hardware during the transition from exploratory development to flight production stages are discussed. Details of prior control and monitor instrumentation designs are reviewed and an advanced design presented. The latter features a minicomputer-based approach having the flexibility to meet process hardware test programs and the capability to be refined to include the control dynamics and fault diagnostics needed in future flight systems where long duration, reliable operation requires in-flight hardware maintenance. The emphasis is on lower EC/ESS hardware life cycle costs by simplicity in instrumentation and using it to save crew time during flight operation. (Author)


Red cell survival, ferrokinetics, and hematologic parameters were investigated in beagle dogs exposed to chronic hypergravity (2.6 Gx). Ineffective erythropoiesis, red cell mass, plasma volume, and CO-51-elution were significantly increased; maximum Fe-59 incorporation was decreased, and there was no change in the mean erythrocyte life span following autologous injection of Cr-51 labeled red cells and Fe-59 labeled transferrin. Red cell count, F(c聆), total body hemoglobin (Hb), susceptibility to osmotic lysis, and differential reticuloocyte count were increased. White blood cells constituted 1% of the blood count, venous blood pH, mean cell volume, mean cell Hb, mean cell Hb concentration, and serum iron were decreased. No changes were observed for body mass, ng Fe per g Hb, iron binding capacity, percent saturation of iron carrying capacity, or the electrophoretic mobility of purified Hb. This study indicated that chronic exposure to hypergravity induced changes in red cell size, volume, total mass, and membrane permeability. (Author)


A specific methodology is proposed for an improved system of coding and analyzing crew member interaction. The complexity and lack of precision of many crew and task variables suggest the usefulness of such linguistic techniques for modeling and computer simulation of the crew performance process. Other research methodologies and concepts that promise for increasing the effectiveness of research on crew performance are identified. B.J.


Errors limiting the application of recursive digital filters which have poles near z = +1 are considered, and a filter structure for pole locations close to z = +1 is proposed. The filter structure, based on digital incremental computers, has low sensitivity and good error characteristics for pole locations near z = +1. Expressions for the roundoff error are derived, and errors associated with the proposed structure and a conventional structure are compared. A design procedure is suggested for implementing the new filter structure when the transfer function is given. Simulation results are presented. M.L.


The paper describes Spacelab Mission Development Test III (SMD III) whose principal scientific objective was to demonstrate the feasibility of conducting biological research in the Life Sciences Spacelab. The test also provided an opportunity to try out several items of Common Operational Research Equipment (CORE) hardware being developed for operational use in Shuttle/Spacelab, such as rodent and primate handling, transportation units, and a 'zero-g' surgical bench. Operational concepts planned for Spacelab were subjected to evaluation, including animal handling procedures, animal logistics, crew selection and training, and a 'remote' ground station concept. It is noted that all the objectives originally proposed for SMD III were accomplished. B.J.


In two surface samples of marine sediment, the percentages of D-alanine and D-aspartic acid are significantly higher than the other D-amino acids and are similar to the range found in soils. The percentage of D-glutamic acid is also higher than the other amino acids but less than D-alanine and D-aspartic acid. These D-amino acids may come mainly from bacteria. (Author)


A method is proposed for onboard measurement and display of specific windshear and energy management data derived from an air data computer. An open-loop simulation study is described which was carried out to verify the feasibility of this display concept, and whose results were viewed as a basis to develop the respective cockpit instrumentation. The task was to fly a three-degree landing approach under various shear conditions with and without specific information on the shear. Improved performance due to augmented cockpit information was observed. Critical shears with increasing tailwinds could be handled more consistently and with less deviation from the glide path. V.P.

Dilute (0.1 M) solutions of HCN condense to oligomers at pH 9.2, and hydrolysis of these oligomers yields 4,5
dihydroxypyrimidine, orotic acid, 5-hydroxypyrimidine, orotic acid, 5-hydroxypyrimidine, and 4-
aminomimidazole-5-carboxamide, and amino acids. It is suggested that the three main classes of nitrogen-containing biomolecules - purines, pyrimidines, and amino acids - may have originated from HCN on the primitive earth. It is also suggested that the presence of orotic acid and 4-aminomimidazole-5-carboxamide might indicate that contemporary biosynthetic pathways for nucleotides evolved from the compounds released on hydrolysis of HCN oligomers.

M.L.


In anticipation of possible large-scale, long-duration space missions which may be conducted in the future, NASA has begun to investigate the research and technology development requirements to create life support systems for large space habitats. An analysis suggests feasibility of a regenerative of food in missions which exceed four years duration. Regeneration of food in space may be justified for missions of shorter duration when large crews must be supported at remote sites such as lunar bases and space manufacturing facilities. It is thought that biological components consisting principally of traditional crop and livestock species will prove to be the most acceptable means of closing the food cycle. A description is presented of the preliminary results of a study of potential biological components for large space habitats. Attention is given to controlled ecosystems, Russian life support system research, controlled environment agriculture, and the social aspects of the life-support system.

G.R.


The three experimental approaches incorporated into the Viking biology instrument have yielded results that are most readily explained as nonbiological phenomena. The predominant view among investigators trying to simulate the Mars results is that the surface material of Mars contains strongly oxidizing compounds which would account for many of the more intense reactions seen on Mars. Other mechanisms are also currently being proposed and studied.

(Author)


An attempt is made to explain the cardiovascular regulatory responses to lower body negative pressure (LBPN) stress, both in the absence of and following blood or plasma volume loss, the latter being factors regularly observed with short or long term recumbency or weightlessness and associated with resulting cardiovascular deconditioning. Analytical expressions are derived for the responses of mean venous pressure and blood volume pooled in the lower body due to LBPN. An analysis is presented for determining the HR change due to LBPN stress following blood volume loss. It is concluded that the reduced orthostatic tolerance following long-term space flight or recumbency can be mainly attributed to blood volume loss, and that the associated cardiovascular responses characterizing this orthostatic intolerance is elicited by the associated central venous pressure response.

S.D.


The first gas chromatographic analysis of the lower atmosphere of Venus is reported. Three atmospheric samples were analyzed. The third of these samples showed carbon dioxide (96.4 percent), molecular nitrogen (3.41 percent), water vapor (0.135 percent), molecular oxygen (69.3 ppm), argon (18.6 ppm), neon (4.31 ppm), and sulfur dioxide (186 ppm). The amounts of water vapor and sulfur dioxide detected are roughly comparable with the requirements of greenhouse models of the high surface temperature of Venus. The large positive gradient of sulfur dioxide, molecular oxygen, and water vapor from the cloud tops to their bottoms, as implied by Earth-based observations and these results, gives added support for the presence of large quantities of aqueous sulfuric acid in the clouds. A comparison of the inventory of inert gases found in the atmospheres of Venus, Earth, and Mars suggests that these components are due to outgassing from the planetary interiors.

(BO)


Research on the biological effects of RF radiation in the United States has undergone a series of swings during the last three decades. The resurgence of research during the past decade is examined in the light of two projects: the proposed Space Power Station and SETI.

B.J.


A theoretical search for the most stable conformations (i.e., stacked or hydrogen bonded) of the base pairs A·U and G·C in water, CD4, and CH3OH solutions is presented. The calculations of free energies indicate a significant role of the solvent in determining the conformations of the base-pair complexes. The application of the continuum method yields preferred conformations in good agreement with experiment. Results of the calculations with this method emphasize the importance of both the electrostatic interactions between the two bases in a complex, and the dipolar interaction of the complex with the entire medium. In calculations with the solvation shell method, the last term, i.e., dipolar interaction of the complex with the entire medium, was added. With this modification the prediction of the solvation shell model agrees both with the continuum model and with experiment, i.e., in water the stacked conformation of the bases is preferred.

(Author)

A79-26371  Optimum geometries and relative energies for guanine, the imino-enol tautomer: of guanine, the enol tautomer of guanine, adenine, and the imino tautomer of adenine as found by the MINDO/2 SCF MO method. T. J. Zwienski (College of Mount Saint


A problem encountered in the analysis of amino acids in chemical evolution experiments and in extracts of meteorites is the large number present. A method for selectively destroying the alpha-amino acids, with only the beta- and gamma-amino acids remaining in the solution, is described. The amino acids used were racemized, with one milliliter of solution containing 0.0000025 mol of each acid irradiated in a 1-cm quartz cell having 254-nm monochromatic light in the presence of CuCl2. Excess H2S was added to precipitate the Cu (2+) as CuS. A gas chromatographic analysis was used to observe that irradiation with 254-nm light in the presence of CuS reduced all amino acids except the beta and the gamma types. It is concluded that with such a procedure, complex mixtures of amino acids can be simplified to make identification by GC mass spectrometry easier.


A total of 24 subjects (17 M, 7 F) was tested in an experimental study of annoyance rating of multiple noisy events (30 sets of noise bursts). The scaling technique known as functional measurement was used to determine whether annoyance integrates additively over events and if so, to measure the power law exponent which relates the levels of the events to the additive scale values. To this end, groups of three noises were presented at three levels in a factorial arrangement to check the additive hypothesis and to estimate the scaling function. Also, a series of noise bursts of constant level but varying in set size were considered. The functional measurement of annoyance ratings of sets of three simulated flyovers showed that the integration of annoyance can be represented as an additive process in terms of scale values that are power functions of the sound power with a power-law exponent near 0.7.


The paper examines RNA-ribosomal changes observed in protozoa and fixed postmitotic cells, as well as the characteristics of intermitotic cells. Attention is given to a discussion of the implications of the reported ribosomal changes as to the senescent deterioration of protein synthesis and physiological functions. A survey of the literature suggests that, while the data on ribosomal change in dividing cells both in vivo and in vitro are inconclusive, there is strong histological and biochemical evidence in favor of some degree of quantitative ribosomal loss in fixed postmitotic cells. Since these decreases in ribosomes are demonstrated in differential cells from nematodes, insects and mammals, they may represent a universal manifestation of cytoplasmic senescence in certain types of fixed postmitotic animal cells. The observed variability in ribosomal loss for cells belonging to the same type suggests that this involution phenomenon is rather related to the wear and tear suffered by a particular cell.

**A79-27953** # RFCr/Cr-51 halflife and albumin turnover in growing Beagle dogs during chronic radial acceleration. D. A. Beekman, J. W. Evans (California, University, Davis, Calif.), and J. Oyama (NASA, Ames Research Center, Biomedical Research Div., Moffett Field; California, University, Davis, Calif.). *Aviation, Space, and Environmental Medicine,* vol. 50, Mar. 1979, p. 212-217. 30 refs. Abridged. Grants No. NCA2 OR 180 508.

The effects of chronic centrifugation on growing Beagle dogs exposed to -2 or -2.6 Gx on albumin and RFCB turnover rates, albumin concentration and space, and total blood volume were determined and compared with caged and run control of animals. Albumin-(1-125) and autologous RFCB-(0-51) preparations were injected into all dogs at day 82 of the centrifugation periods, and the disappearance curves were determined by successive bleedings of the animals over the next 35 d, during which the centrifugation was continued. There were no differences in albumin turnover rates or space. Two populations of RBCs were found in both centrifuged groups, one with a normal half-life of 27 + or - 1 S.E.M. d, and one with a significantly shorter half-life of 15 + or - 2 S.E.M. d. An absolute polycythemia was also observed in both centrifuged groups. The results suggest that chronic centrifugation affects some as yet unknown mechanism to affect RBC population kinetics.


An energy balance model has been developed to investigate how the Martian atmospheric environment could influence a community of photosynthetic microorganisms with properties similar to those of a cyanophyte (blue-green algal mat) and a lichen. Surface moisture and soil nutrients are assumed to be available. The model was developed to approach equatorial equinox conditions and includes parameters for solar and thermal radiation, convective and conductive energy transport, and evaporative cooling. Calculations include the diurnal variation of organism temperature and transpiration and photosynthetic rates. The influences of different wind speeds and organism size and resistivity are also studied. The temperature of organisms in mats less than a few millimeters thick will not differ from the ground temperature by more than 10 K. Water loss is actually retarded at higher wind speeds, since the organism temperature is lowered, thus reducing the saturation vapor pressure. Typical photosynthetic rates lead to the production of 1 millionth to 100 billionths mla 02 per sq cm/day.


An experimental study was carried out to compare fluid and electrolyte shifts after heavy exercise performed by four voluntary male subjects (26-45 yr) in sitting and supine positions. Plasma volume and electrolyte shifts were measured during the 6-hm control period and for 60 min after a continuous peak oxygen uptake test. The results indicate that the most likely driving force for the restitution of plasma volume after peak exercise is provided by a change in hydrostatic and/or systemic blood pressures when exercise ceases.

S.D.


The clay kaolinite was tested for its ability to promote nucleotide oligomerization in model prebiotic systems. Heterogeneous mixtures of clay, water and nucleotide were repeatedly evaporated to dryness at 60 °C and redissolved in water in cyclic fashion in the presence or absence of cyanamide and/or ammonium chloride. With or without cycling, kaolinite alone did not promote the oligomerization of nucleotides at detectable levels. Cycling of clay in combination with cyanamide, however, promoted high levels of condensation to a mixture of oligonucleotides and dinucleotide pyrophosphate without requiring ammonium chloride. Although cycling with clay favored synthesis of dinucleotide pyrophosphate, cycling without clay enhanced formation of oligonucleotides. These results support the hypothesis that the presence of clays in fluctuating environments would have influenced the course of prebiotic condensation reactions.

(Author)


Previous studies on the yeast Saccharomyces cerevisiae have shown that two different forms of the enzyme acetyl coenzyme A synthetase (ACS) are present, depending on the conditions under which the cells are grown. The paper evaluates the usefulness of a method designed to assay both synthases simultaneously in yeast homogenates. The data presented confirm the possibility of simultaneous detection and estimation of the amount of both ACSs of S. cerevisiae in crude homogenates of this strain, making possible the study of physiological factors involved in the formation of these isoenzymes. One important factor for specifying which of the two enzymes is found in these yeast cells is the presence or absence of oxygen in their environment. Aeration not only affects the ratio of the two ACSs but also appears to affect the cellular distribution of these enzymes. Most of the data presented suggest the possibility that the nonaerobic ACS may serve as a precursor to the aerobic form.

S.D.


The effects of hypertonic sodium and calcium ingestion on body temperature during exercise in cool and hot environments are investigated. Rectal and mean skin temperatures, sweat rates and arm and leg total blood flows were measured in men during periods of rest, submaximal exercise and recovery at temperatures of 26.5 °C and 39.4 °C after ingestion of NaCl and CaCl2 solutions. In both environments, higher rectal temperatures are observed after hypertonic sodium ingestion, which is also associated with attenuated blood flow in the extremities, lower sweat rates and slightly higher skin temperature in the heat, indicating significant thermoregulatory responses. Hypertonic calcium and isotonic sodium cause no temperature change, although calcium caused a reduction of blood flow in the extremities.

A. L. W.


Carbonyl sulfide (COS) has been detected in the stratosphere, and mixing ratio measurements are reported for altitudes of 15.2 to 31.2 km. A large volume cryogenic sampling system mounted on board a U-2 aircraft has been used for lower stratosphere measurements and a balloon platform for measurement at 31.2 km. These observations and measurements strongly support the concept that stratospheric COS is an important precursor in the formation of sulfuric acid aerosols.

(Author)


Active serine accumulation in cell envelope vesicles from Halobacterium halobium proceeds by co-transport with Na+ and can be induced by either transmembrane electrical potential or transmembrane Na+ concentration difference. It was shown earlier that in the former case the initial transport rate is a fourth-power function of the magnitude of the electrochemical potential difference of sodium ions, and in the latter, a second-power function. A possible interpretation of this finding is cooperativity of sodium transporting sites in the transport carrier. When both kinds of driving force are imposed simultaneously on the vesicles, fourth-power dependence on the total potential difference of sodium ions is obtained, suggesting that the transport carrier is regulated by the electrical potential. Heat treatment of the vesicles at 48 °C partially inactivates transport and abolishes this effect of the electrical potential.

(Author)


The basic theory of the spreading of liquids on solid surfaces is discussed with reference to the formation of intermediate phases and it is applied to the spreading of liquid metals on solid metallic surfaces. Particular consideration is given to data on the kinetics of spreading for the systems Sn-Co, Al-Co, and Al-Ni. Detailed attention is then paid to the spreading of liquid iron (and of metals
of the iron family) on aluminum and its alloy and to the spreading of liquid aluminum on iron (and metals of the iron family). B.J.


The binding of nucleotides to homionic clays is studied as a possible mechanism for the concentration and catalysis of biological or prebiotic materials on the prebiotic earth. Samples of radioactively labeled adenosine and thymidine nucleotides were mixed in solutions with bentonite, kaolinite or Dowex 50 particles in which all exchangeable sites were occupied by Na, Mg, Ca, Mn, Fe, Cu or Zn ions. The binding of nucleotides to homionic clays is observed, with adenosine nucleotides favored over thymidine, bentonite as the best absorber, and greater binding to clays homionic in transition metal ions. Results indicate that the oligomerization of nucleotides may be possible by this mechanism, however difficulties in nucleotide variability and base pairing may arise due to the observed preference for purines at the adsorption sites.


Earlier manned spaceflight studies have revealed that the near-weightless environment of orbital flight produce certain biological effects in humans, including abnormalities in mineral metabolism. The data collected were compatible with bone mineral loss. Cosmos 782 and 936 experiments have shown a decrease in rat bone formation rate. In this paper, a rat model of weightlessness is described, which is unique in that the animal is free to move about a 360-deg arc. The model meets the requirements for an acceptable system. Data from the model and spaceflight are presented. Many of the responses noted in suspended animals indicate that the model closely mimics results from rats and man exposed to near-weightlessness during orbital spaceflight.


The joint US-USSR biological satellite missions carried out in 1975 and 1977 using Cosmos 782 and Cosmos 936 spacecraft, respectively, is reviewed. The experimental equipment and the biological specimens aboard the aircraft are considered, and it is noted that Cosmos 782, unlike Cosmos 936, carried no centrifuges for rats, although it did contain a centrifuge where a variety of biological specimens, including soil and tree tissue, were subjected to artificial gravity during space flight. The ground control groups, designed for biological experiments under simulated space conditions, are taken into account. The U.S. experiments aboard the aircraft are described, with attention given to the experiments with rats, fish embryos, plants, and insects. Results of the experiments are noted, including the finding that space flight factors, especially weightlessness, have a measurable effect on the erythrocytic and musculoskeletal systems of rats.


Experiments were conducted on ten young male subjects to determine sweating onset, distribution, and patterns, as well as the relationships of these responses to body temperature during heat acclimation and moderate conditioning. A comparison was made between moderate temperature (24 C) conditions. The subjects are randomly assigned to two groups of five subjects each. The experimental period consisted of eight successive days of either graded exercise to exhaustion on a bicycle ergometer in heat (acclimation group) or in a temperate environment (control group). Major conclusions are that (1) acclimation and conditioning result in relatively more sweat rate on the limbs than on the torso, but that these changes are less related to body temperature than torso sweat rate; and (2) sweating sensitivity increases during acclimation and conditioning, but its contribution to heat acclimation is minor.


The thermostrucural response of three candidate carbon-carbon composites for the Jovian entry probe heatshield was investigated. The analysis for the three materials, Sandia Felt, Carbitex 700, and SA1 4-D wave carbon-carbon was conducted using a dual finite element approach which involved heat conduction as well as the structural response. A receding boundary due to ablation and inertial loads encountered by the probe were included. Severe cracking, circumferential and radial, and interlaminar shear failure was observed during the radiative heating pulse for the Sandia Felt and Carbitex 700 materials, respectively. The 4-D wave material showed no failures over the entire entry.


The cat is proposed as a model for the study of motion and space sickness. Development of a scale for rating the motion sickness severity in the cat is described. The scale is used to evaluate an antimotion sickness drug, d-amphetamine plus scopolamine, and to determine whether it is possible to predict sickness susceptibility during parabolic flight, including zero-G maneuvers, from scores obtained during ground based trials.


Condensation reactions in cyamidine: 4-amino-5-imidazole-carboxamide and cyamidine, imidazole systems under dehydrating conditions at moderate temperatures (60 to 100 deg C) were investigated. The cyamidine, imidazole system was used for synthesis of palmitoylglycerol from ammonium palmitate and glycerol. With the addition of deoxycytidine to the former system, P1, P2, deoxycytidine 5 prime-phosphate was obtained; the same cyamidine, 4-amino-5-imidazole-carboxamide system was used to synthesize deoxycytidine oligonucleotides using deoxycytidine 5

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prime-phosphate and deoxythymidine 5'-prime-triphosphate, and peptides using glycine, phenylalanine or isoleucine with adenosine 5'-prime-triphosphate. The pH requirements for these reactions make their prebiotic significance questionable; however, it is conceivable that they could occur in stable pockets of low interlayer acidity in a clay such as montmorillonite.

C.K.D.


Compounds obtained by hydrolysis of HCN oligomers formed by allowing pH 9.2, 0.1 M cyanide to stand at room temperature for 4 to 12 months were analyzed. Hydrolysis of HCN oligomers yielded 4,5-dihydroxypyrimidine and 5-hydroxypyrazine; urotic acid was detected after hydrolysis at pH 8.5. A unified pathway from diaminofumarimorinole to the pyrimidines observed is suggested. As purines, pyrimidines and amino acids are released by hydrolysis of HCN oligomers in either acidic or mildly basic aqueous solutions, they could have been formed on the primitive earth in spite of fluctuations in pH. 4,5-dihydroxypyrimidines appear to be likely candidates for incorporation into primitive nucleic acids, as they should undergo Watson-Crick hydrogen bonding with adenine.

C.K.D.


The present paper deals with the characteristics and potentialities of a recently developed computer-based molecular modeling system. Some characteristics of current coding systems are examined and are extrapolated to the apparent requirements of primitive prebiological coding systems.

V.P.


The investigation of specific interactions among biological molecules must take into consideration the stereochemistry of the structures. Thus, models of the molecules are essential for describing the spatial organization of potentially interacting groups, and estimations of conformation are required for a description of spatial organization. Both the function of visualizing molecules, and that of estimating conformation through calculations of energy, are part of the molecular modeling system described in the present paper. The potential uses of the system in investigating some aspects of the origin of life rest on the assumption that translation of conformation from genetic elements to catalytic entities would have been required for the development of the first replicating systems subject to the process of biological evolution.

V.P.


Carbon, nitrogen and sulfur contents, as well as carbon isotopic compositions, were determined for seven lunar rocks from the Apollo 15, 16 and 17 missions. Sequential combustion at three temperatures was used to resolve terrestrial contamination from indigenous lunar volatiles. Nitrogen abundances averaged 0.4 micrograms/gram in the samples. The results of the sequential combustion analysis suggested that all the samples contained variable amounts of terrestrial carbon contamination prior to examination. Indigenous lunar carbon abundances ranging from 2.5 to 6 micrograms/gram were found. Thus the moon appears to be substantially depleted in nitrogen and carbon relative to the earth and C and H meteorites.

J.M.B.


A single-step most-probable-number method for determining the number of fecal coliform bacteria present in sewage treatment plant effluents is discussed. A single growth medium based on that of Reasoner et al. (1976) and consisting of 5.0 gr proteose peptone, 3.0 gr yeast extract, 10.0 gr lactose, 7.5 gr NaCl, 0.2 gr sodium lauryl sulfate, and 0.1 gr sodium desoxycholate per liter is used. The pH is adjusted to 6.5, and samples are incubated at 44.5 deg C. Bacterial growth is detected either by measuring the increase with time in the electrical impedance ratio between the inoculated sample vial and an uninoculated reference vial or by visual examination for turbidity. Results obtained by the single-step method for chlorinated and unchlorinated effluent samples are in excellent agreement with those obtained by the standard method. It is suggested that in automated treatment plants impedance bio data could be automatically matched by computer programs with the appropriate dilution factors and most probable number tables already in the computer memory, with the corresponding result displayed as fecal coliforms per 100 ml of effluent.

C.K.D.

The polymerization of ethylene in an atmospheric pressure-pulsed discharge has been studied. Partial pressures of ethylene up to 4 kN/m were used with helium as a diluent. Deposition rates (on glass slides) were the same throughout the discharge volume over a wide range of operating conditions. These rates were in the 1-2 A/sec range. The films were clear, soft, and showed good adhesion to the glass substrates. Oligomers large enough to visibly scatter 637.8 nm light were observed in the gas phase under all conditions in which film deposition occurred. The experimental results suggest that Brownian diffusion of these oligomers was the rate-limiting step in the film deposition process.

(Author)


The role of the serotoninergic system in the regulation of amphetamine-induced behavior, a behavior primarily controlled by dopaminergic neuromodulation, was investigated in rats fed on a low tryptophan diet since weaning. It was found that reductions in brain serotonin (5-HIT) produced by diet result in decreased stereotypy after amphetamine administration. This indicates that although stereotyped behavior is primarily mediated by dopaminergic mechanisms, it can also be modulated by other neurotransmitter including 5-HT. It was also shown that changes in brain serotonin levels can affect psychomotor stimulant-induced hypothermia.

C.K.D.


The permeability of Halobacterium halobium vesicle membranes to potassium ions was investigated, and possible mechanisms for the regulation of the gradient of protons by the transmembrane movement of these ions were studied. The lack of a potassium ion diffusion potential in the absence of valinomycin, light-induced electrical potentials in excess of the chemical potential difference for potassium ions, and direct measurements of potassium ion influx during illumination show that the membranes are relatively impermeable to these ions. As a result of sodium ion extrusion during illumination, chlorine ions and water must be lost and the vesicles collapse. The light-induced collapse of vesicles is diminished only if the influx of potassium ions is increased.

C.K.D.


Laboratory simulation and tests of the inlet sampling system and columns of the Pioneer Venus gas chromatograph show that the sensitivity to argon is not diminished after the column regeneration step, that argon isotopes are not separated, that oxygen and sulfur dioxide are not produced in the inlet sampling system from sulfur trioxide, and that sulfur trioxide is not formed from sulfur dioxide and oxygen. Comparison of the volatile inventory of Venus and earth imply similar efficiencies of early outgassing but a lower efficiency for later outgassing in the case of Venus. The high oxidation state of the Venus atmosphere in the region of cloud formation may prohibit the generation of elemental sulfur particles.

(Author)

A79-41185 * Thermoregulation in unrestrained rats during and after exposure to 1.5-4 G. J. Giacchino, B. A. Horwitz, and J. M. Horwitz (California, University, Davis, Calif.). Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology, vol. 46, June 1979, p. 1049-1053. 11 refs. Grant No. NS-G-2234.

Unrestrained rats were exposed to cold for 1 h and immediately after exposure to hypergravity fields (1.5-4 G) to determine if they recover their ability to thermoregulate on reentry to 1-G conditions. In contrast to the decreased body temperatures observed when cold exposure occurred concurrently with acceleration, hypothalamic, carotid, and brown fat temperatures did not fall when rats were exposed to cold immediately after return to 1 G. These results support the hypothesis that the thermoregulatory alterations seen under hypergravity conditions are manifestations of an effect of ongoing exposure to hypergravity and can be reversed on termination of acceleration. The reversibility of the thermoregulatory impairment is apparently unaffected by the magnitude of the acceleration field over a range of 1.5-4 G.

(Author)


The Arabidopsis thaliana plant species is tested to determine how a higher plant will develop from seed to maturity when deprived of all gravitational information that it might use to control its growth. Experimental results show that Arabidopsis seedlings can develop to maturity by means of a light dependent but CO2 independent metabolism that feeds on organic compounds derived from the culture medium. This process is identified as photoassimilation. The ability of a higher plant to nourish itself by photoassimilation and thereby to survive in a hermetically sealed chamber of small dimensions is more than a biochemical curiosity. It allows the botanical investigator to design a culture system convenient for space-flight applications, which ensures isolation of each test plant from the gaseous environment of the spacecraft.

S.D.


A 10-kg male pig-tailed monkey (Macaca nemestrina) was selected as an optimal species for spaceflight studies on weightlessness. Three days before the simulated launch, the animal was placed in a fiberglas pod system to provide continuous measurement of respiratory gas exchange. Attention is given to examining the effects of weightlessness on several basic parameters of metabolic and cardiovascular function in an adult nonhuman primate. The 10.7-day total simulated experiment period consisted of preflight 2.6 days, infight 6.3 days, and postflight 1.8 days. Statistically significant diurnal variation was noted in oxygen consumption and CO2 production rates, body temperature and HR, but not in respiratory quotient or blood pressure. The high quality of the continuous data obtained demonstrates the feasibility of performing multivariate physiological experimentation on nonhuman primates in the SpaceLab environment.

S.D.

A simple physiological model of mortality kinetics is used to assess the intuitive concept that the aging rates of populations are proportional to their mortality rates. It is assumed that the vitality of an individual can be expressed as a simple summation of the weighted functional capacities of its organs and systems that are indispensable for survival. It is shown that the mortality kinetics of a population can be derived by a linear transformation of the frequency distribution of vitality, assuming a uniform constant rate of decline of the physiological functions. A simple comparison of two populations is not possible when they have different vitality frequency distributions. Analysis of the data using the model suggests that the differences in decline of survivorship with age between the military pilot population, a medically insured population, and the control population can be accounted for by the effect of physical selection on the vitality frequency distribution of the screened populations. S.D.

A79-43208 * Limb blood flow: Rest and heavy exercise in sitting and supine positions in man. J. E. Greenleaf, L. D. Montgomery (NASA, Ames Research Center, Laboratory of Human Environmental Physiology, Moffett Field, Calif.), P. J. Brock (NASA, Ames Research Center, Laboratory of Human Environmental Physiology, Moffett Field; California State University, Hayward, Calif.), and W. Van Beaumont (NASA, Ames Research Center, Laboratory of Human Environmental Physiology, Moffett Field, Calif., St. Louis, University, St. Louis, Mo.). *Aviation, Space, and Environmental Medicine*, vol. 50, July 1979, p. 702-707. 31 refs.

The objectives of the study were twofold: (1) to determine the effect of body position (hydrostatic pressure) on total blood flow in active and passive limbs at rest and after severe exercise; and (2) to further evaluate the impedance technique for measurement of blood flow. To this end, the effect of body position on the redistribution of total blood flow in active (leg) and passive (forearm) limbs during exercise was determined by measuring total limb impedance (blood flow) in five male and one female subjects in sitting and supine positions with a modified Beckman BR-100 teograph. The results show that at rest and after exercise, the supine position induces significantly greater flows in the leg but not in the forearm. With severe exercise, blood flows are increased in both passive and active limbs, so that there is probably no net transfer of blood volume from passive to active muscles. The advantages of the impedance technique over other methods are stressed. S.D.


Plasma corticosterone and plasma and pituitary ACTH concentrations were determined during feeding and after application of an acute stress at various times after food and water presentation to male rats maintained on a restricted feeding and watering schedule. Both plasma corticosterone and ACTH concentrations fell after the presentation of food and water, and this fall was accompanied by increased levels of ACTH in the pituitary gland. In addition, a rise in plasma levels of ACTH was inhibited in response to an acute stress applied at 0.5 min after presentation of food and water, but ACTH synthesis was not. This inhibition of ACTH and corticosterone secretion responses to stress was transient and dissipated as a relatively linear function of the interval between food presentation and application of the stress. The results suggest that this feeding-induced, corticosteroid-independent inhibition of pituitary-adrenal activity involves active inhibitory mechanisms operating initially on ACTH secretory processes of the pituitary and later on the synthesis of ACTH or on the secretion of hypothalamic corticotropin-releasing factor. (Author)


A detailed design synthesis analysis of the BK Syme prosthesis is provided, to determine the socket's cutout orientation size and shape, cutout fillet shape, socket wall thickness distribution and the reinforced fiber distribution in the socket wall, or a minimally stressed structurally safe lightweight prosthesis. For analysis purposes, the most adverse socket loading is obtained at the push-off stage of gait; this loading is idealized as an axial in-plane loading on the bottom edge of the circular cylindrical socket shell whose top edge is considered fixed. Finite element stress analysis of the socket shell (with uniform and graded wall thickness) are performed for various orientations of the cutout and for various types of corner fillets. A lateral cutout with a streamline fillet is recommended. The wall material (i.e., thickness) distribution is determined so as to minimize the stresses, while ensuring that the wall material's stress limits are not exceeded. For such a maximally stressed lightweight socket shell, the panels in the neighborhood of the cutout are checked to ensure that they do not buckle under their acquired stresses. A fiber-reinforced laminated composite socket shell is also analyzed in order to recommend optimum variables in orientations and densities of reinforcing fibers. (Author)


The paper emphasizes fluid and electrolyte parameters that affect the hyperthermia of physical exercise (metabolic heat production). The major hypothesis discussed is that fluid and electrolyte changes influence thermal regulation within the fine control boundaries. A second working hypothesis is that the elevation of core temperature during exercise is a regulated phenomenon that is beneficial to the organism in terms of efficiency and potential for survival and is not merely a failure of the thermoregulatory control system. The central thermoregulatory mechanism seems more responsive to the hypothalamic effect of calcium than to the hyperthermic effect of sodium. The mechanisms controlling plasma fluid-electrolyte shifts, particularly during exercise and recovery from exercise, may play an important part in exercise thermoregulation. S.D.


Viewing a large, patterned field rotating about the line of sight produces two measurable effects: cyclotorsion of the eyes (torsion) and a perceived displacement of vertical and horizontal (tilt). Experiments examining binocular interaction for these effects show: (1) both effects demonstrate summation in normal individuals and thus both involve a binocular process; (2) the proc for tilt is different than for torsion, since summation for torsion is spared in stereoblind individuals while that for tilt is eliminated. (Author)


A series of experiments was conducted to assess the role of photoperiodic postural and social cues in the regulation of the plasma cortisol rhythm in normal human subjects. Young healthy adult male volunteers, aged 20-25, were used as the test subjects and were selected following extensive physical and psychological examinations. The time at which peak plasma cortisol concentration occurred was calculated from harmonic curves fitted to each set of 24-hr data from each subject. The findings suggest that the plasma cortisol rhythm is not affected appreciably by the absence of postural change, whereas light and social interaction affect this rhythm profoundly. S.D.


Evidence supporting the existence of bioassayable growth hormone-like activity in blood plasma distinct from the growth hormone measurable by radioimmunoassay and from somatomedin is presented. Tibial assays of the growth-hormone-like activity of injected, concentrated normal human and rat plasma in hypophysectomized rats reveal 200- and 50-fold activity excesses, respectively, with respect to the amount of growth hormone detected by radioimmunoassay. The origin of this bioassayable plasma hormone has been localized to the region of the pituitary, the origin of growth hormone, a distribution not followed by somatomedin C. Purification of the bioassayable agent indicates that it has a molecular weight of between 60,000 and 80,000, in contrast to that of growth hormone (20,000), and that the bioassayable activity is distinct from that of somatomedin C. Growth hormone-like activity detected in Cohn fraction IV as well as plasma activity, are found to be collectable on Dowex 50 resin, in contrast to somatomedin C and nonsuppressible insulin-like activity. The formation of bioassayable growth hormone-activity insns from radioimmunoassayable growth hormone and directly in the pituitary is suggested. A.L.W.


The transport of Na(+) via an H(+)Na(+) antiporter and of aspartate and serine via Na(+)amino acid symport systems was studied in Halobacterium halobium cell envelope vesicles. Gradients for H(+) were produced by illuminating the bacteriohopdopsin-containing vesicles at different light intensities, and the rate and extent of Na(+) tranport were followed as functions of the electrochemical potential difference for protons. The coupling of Na(+) and H(+) gradients suggested a translocation stoichiometry of 2H(+)Na(+) for the antiporter. The rate of Na(+) transport increases steeply above a critical transmembrane electrochemical proton gradient, and since the electrical and the chemical potentials of H(+) at this threshold point vary with the experimental conditions, while the sum of these potentials is constant, it was concluded that the gating of the Na(+) transport is caused by the total electrochemical gradient. A.T.


Aerosol deposition in the upper respiratory system (trachea to segmental bronchi) is considered and the importance of turbulent diffusion as a deposition mechanism is evaluated. It is demonstrated that for large particles (diameter greater than about 5 microns), turbulent diffusion is the dominant deposition mechanism in the trachea. Conditions under which turbulent diffusion may be important in successive generations of the pulmonary system are determined. The probability of particle deposition is compared with probabilities of deposition, as determined by the equations generally used in regional deposition models. The analysis is theoretical; no new experimental data is presented. (Author)


The cell membrane of Halobacterium halobium exhibits differential regions which contain crystalline arrays of a single kind of protein, termed bacteriorhodopsin. This bacterial retinal-protein complex resembles the visual pigment and, after the absorption of protons, translocates H(+) across the cell membrane, leading to an electrochemical gradient for protons between the inside and the outside of the cell. Thus, light is an alternate source of energy in
those bacteria, in addition to terminal oxidation. The paper deals with work on light-driven transport in H. halobium with cell envelope vesicles. The discussion covers light-driven movements of H(+), Na(+), and K(+); light-driven amino acid transport; and apparent allosteric control of amino acid transport. The scheme of energy coupling in H. halobium vesicles appears simple, its quantitative details are quite complex and reveal regulatory phenomena. More knowledge is required of the way the coupling components are regulated by the ion gradients present.

S.D.

A79-49985


A study to determine the effect of heat acclimation and physical training in temperate conditions on changes in exercise tolerance following water-immersion deconditioning is presented. Five young men were tested on a bicycle ergometer before and after heat acclimation and after water immersion. The subjects and the experimental procedure, heat acclimation and exercise training, water immersion, and exercise tolerance are discussed. Heat acclimation resulted in the usual decreases in exercise heart rate and rectal temperature and an increase in sweat rate. Water immersion resulted in substantial diuresis despite water consumed. The results show that heat acclimation provides an effective method of preventing the adverse effects of water-immersion deconditioning on exercise tolerance.

A.T.

A79-50205


A79-50227


Research on retinal circulation during space flight required the development of a simple technique to provide self-monitoring of blood vessel changes in the fundus without the use of mydriatics. A Kowa RC-2 fundus camera was modified for self-photography by the use of a bite plate for positioning and cross hairs for focusing the subject's retina relative to the film plane. Dilatation of the pupils without the use of mydriatics was accomplished by dark-adaptation of the subject. Pictures were obtained without pupil construction by the use of a high speed strobe light. This method also has applications for clinical medicine.

(Author)

A79-50232


A79-53000


The properties and functions of the light-energy-transducing purple membrane of Halobacterium halobium are reviewed. Consideration is given to the protein structure and composition of the membrane and the photochemistry of the protein-retinal complex known as bacteriorhodopsin. The role of bacteriorhodopsin in establishing and maintaining an electrochemical (H+/) gradient is examined, and interactions of this gradient with Na+ and K+ gradients, the light-induced transport of amino acids and the light-induced phosphorylation of ADP are considered. Bacteriorhodopsin and the respiratory chain are discussed as alternative routes of energy for the maintenance of the H+ gradient. Advantages of the Halobacterium purple membrane system for studies of membrane energetics and the confirmation of the chemiosmotic hypothesis are also noted.

A.L.W.

A79-53291


Results of the medic's experiment on payload specialist workloads conducted as part of the ASSESS II airborne simulation of Spacelab conditions is reported. Subjects were fitted with temperature probes and EOG, EKG and EEG electrodes, and hormone and electrolyte excretion was measured in order to evaluate the changes in circadian rhythms, sleep patterns and stress responses brought about by mission schedules over the ten days of the experiment. Internal dissociations of circadian rhythms, sleep disturbances and increased stress levels were observed, especially during the first three days of the experiment, indicating a considerable workload to be imposed upon the payload specialists. An intensive premision simulation is suggested as a means of estimating overall workloads and allowing payload specialist adaptation to mission conditions. The biostimulation which was developed and applied to the airborne laboratory is concluded to be a practical and reliable tool in the assessment of payload specialist workloads.

A.L.W.

PATENTS


Calcium superoxide is prepared in high yields by spreading a quantity of calcium peroxide diperioxidehydrate on the surface of a container, positioning said container in a vacuum chamber on a support structure through which a coolant fluid can be circulated, partially evacuating said vacuum chamber, allowing the temperature of the diperioxidehydrate to reach the range of about 0 to about 40 C. maintaining the temperature selected for a period of time sufficient to complete the disproportionation of the diperioxidehydrate to calcium superoxide, calcium hydroxide, oxygen, and water; constantly and systematically removing the water as it is formed by sweeping the reacting material with a current of dry inert gas and/or by condensation of said water.
on a cold surface, backfilling the chamber with a dry inert gas, and finally, recovering the calcium superoxide produced.

Official Gazette of the U.S. Patent Office

N79-10724*
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

CONTINUOUS MONITORING DEVICE FOR THE LEFT VENTRICULAR OUTLINE

Patent


A real-time contour detector and data acquisition system is described for an angiographic apparatus having a video scanner for converting an x-ray image of a structure characterized by a change in brightness level compared with its surrounding into video format and displaying the x-ray image in recording video fields. The real-time contour detector and data acquisition system includes track and hold circuits, a reference level analog computer circuit, a digital comparator, a field memory, and a computer interface.

Official Gazette of the U.S. Patent Office

N79-11864*
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

SUBCUTANEOUS CHANNELING PROBE Patent Application

Gordon F. Lund (NAC-NRC), Richard C. Simmonds, and Bill A. Williams, assignors (to NASA) Filed 31 Oct 1978 12 p

NASA Case-ARC-11091-1; US-Patent-App-SN-956162)

The subcutaneous channeling probe 15 provided an instrument for use in the placement of biosensors with long leads in animals. The probe channelled subcutaneously through connective tissue from the site of lead entry 4 to the site of biosensor placement. After securing a sensor to the end of the probe, the probe was pulled out of an exit incision 5, guiding the biosensor and lead into place. The probe was constructed of flexible rod material such as standard 9.5 mm (0.375 inch) nylon rod and was provided with blunted pointed tips. Spearhead tip 8 and tapered end tip 9. This design permitted the efficient channeling of the instrument through connective tissue when force was exerted through the rod. However, because of the blunted edges 19 and tips, the actual cutting of the connective tissue was kept to a minimum. Further, the probe was constructed in sections 16, 17, and 18.

Official Gazette of the U.S. Patent Office

N79-14180*
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

MICROELECTROPHORETIC APPARATUS AND PROCESS Patent


New gel tray and lid assemblies designed for use in conjunction with slotted electrophoretic membranes were developed to take advantage of recently improved microelectrophoretic accessories which include a multisample applicator capable of applying up to 10 samples consecutively or simultaneously, and a temperature control plate for dissipating the heat produced by electrophoresis in a gel. The trays and membranes can be stored, refrigerated, and shipped on dry ice. The gels are available in many sizes and can be marketed ready for use as electrophoretic media or impregnated with various specific substrates and dyes.

Official Gazette of the U.S. Patent and Trademark Office

N79-14214*
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

PREPARATION OF DIELECTRIC COATING OF VARIABLE DIELECTRIC CONSTANT BY PLASMA POLYMERIZATION Patent


A plasma polymerization process for the deposition of a dielectric polymer coating on a substrate comprising disposing of the substrate in a closed reactor between two temperature controlled electrodes connected to a power supply is presented. A vacuum is maintained within the closed reactor, causing a monomer gas or gas mixture of a monomer and diluent to flow into the reactor, generating a plasma between the electrodes. The vacuum varies and controls the dielectric constant of the polymer coating being deposited by regulating the gas total and partial pressure, the electric field strength and frequency, and the current density.

Official Gazette of the U.S. Patent and Trademark Office

N79-14788*
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

INDOMETHACIN-ANTI-HISTAMINE COMBINATION FOR GASTRIC ULCERATION CONTROL Patent Application

Patricia A. Brown (San Jose State Univ., Calif.) and Joan Vernikos-Danielis, assignors (to NASA) Filed 29 Dec 1978 19 p

NASA Case-ARC-11118-2; US-Patent-App-SN-974,476

NTIS HC A02/MF A01

A radio frequency glow discharge reactor is described for removing trace oxidizable contaminants from an oxygen bearing atmosphere. The reaction chamber is defined by an inner metal electrode facing a dielectric 10 and an outer conductive electrode. In one embodiment, a conductive liquid forms the conductor of an outer electrode and cools the dielectric. A resonator coupled to a variable frequency receiver generates the high voltages for creating a glow discharge in the chamber at a predetermined pressure whereby the trace contaminants are oxidized into a few simple non-toxic products that may be easily recovered. The corresponding process for removal of trace contaminants from an oxygen-bearing atmosphere with high efficiency independent of the concentration level is also disclosed. Official Gazette of the U.S. Patent and Trademark Office

N79-15245*
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

ELECTRIC DISCHARGE FOR TREATMENT OF TRACE CONTAMINANTS Patent


A plasma polymerization process for the deposition of a dielectric polymer coating on a substrate comprising disposing of the substrate in a closed reactor between two temperature controlled electrodes connected to a power supply is presented. A vacuum is maintained within the closed reactor, causing a monomer gas or gas mixture of a monomer and diluent to flow into the reactor, generating a plasma between the electrodes. The vacuum varies and controls the dielectric constant of the polymer coating being deposited by regulating the gas total and partial pressure, the electric field strength and frequency, and the current density.

Official Gazette of the U.S. Patent and Trademark Office

N79-18082*
National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif

OXYGEN POST-TREATMENT OF PLASTIC SURFACE

Ames Research Center, Moffett Field, Calif

A radio frequency glow discharge reactor is described for removing trace oxidizable contaminants from an oxygen bearing atmosphere. The reaction chamber is defined by an inner metal electrode facing a dielectric 10 and an outer conductive electrode. In one embodiment, a conductive liquid forms the conductor of an outer electrode and cools the dielectric. A resonator coupled to a variable frequency receiver generates the high voltages for creating a glow discharge in the chamber at a predetermined pressure whereby the trace contaminants are oxidized into a few simple non-toxic products that may be easily recovered. The corresponding process for removal of trace contaminants from an oxygen-bearing atmosphere with high efficiency independent of the concentration level is also disclosed. Official Gazette of the U.S. Patent and Trademark Office
FORMAL REPORTS

**N79-19022** National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.

**AIRCRAFT FLIGHT SIMULATION OF SPACELAB EXPERIMENT USING AN IMPLANTED TELEMETRY SYSTEM TO OBTAIN CARDIOVASCULAR DATA FROM THE MONKEY**


Avail. NTIS HC A20/MF A01 CSCL 06B

The utility of a multichannel implantable telemetry system for obtaining cardiovascular data was tested in a monkey with a CV-990 aircraft flight simulation of a space flight experiment. Valuable data were obtained to aid planning and execution of flight experiments using chronically instrumented animals. Author

**N79-20185** National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.

**CALORIMETER PROBES FOR MEASURING HIGH THERMAL FLUX**

Larry D. Russell. Apr, 1979 13 p
(NASA-TM-78573; A-7772) Avail. NTIS HC A02/MF A01 CSCL 14B

Expendable, slug-type calorimeter probes were developed for measuring high heat-flux levels of 10-30 kW/cm² in electric-arc jet test facilities. The probes were constructed with thin tungsten caps mounted on Teflon bodies. The temperature of the back surface of the tungsten cap is measured, and its time rate of change gives the steady-state absorbed heat flux as the calorimeter probe heats to destruction when inserted into the arc jet. Design, construction, test, and performance data are presented. S.E.S.

**N79-21384** National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.

**ADVANCED VEHICLE SEPARATION APPARATUS**


Avail. NTIS HC A11/MF A01 CSCL 20K

A method of obtaining testing data from two independent models or bodies in a conventional wind tunnel is described. The system makes efficient use of wind tunnel test time with computer control performing complex coordinate transformations necessary for model positioning. The apparatus is designed to be used in any of the three Unitary Wind Tunnels at NASA-Ames Research Center. Mechanical design details and a brief description of the control system for the separation apparatus are presented. J.M.S.

**N79-21373** National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.

**NASA ARC 91.5-cm AIRBORNE INFRARED TELESCOPE**


Avail. NTIS HC A11/MF A01 CSCL 20K

A 91.5 cm aperture telescope installed aboard NASA-Lockheed C-141A aircraft for the performance of infrared astronomy is described. A unique feature of the telescope is that its entire structure is supported by a 41 cm spherical air bearing which effectively uncouples it from aircraft angular motion, and with inertial stabilization and star tracking, limits tracking errors to less than 1 arc second in most applications. A general description of the system, a summary of its performance, and a detailed description of an offset tracking mechanism is presented. J.M.S.

**N79-21391** National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.

**TWO-DIMENSIONAL OSCILLATING AIRFOIL TEST APPARATUS**


Avail. NTIS HC A11/MF A01 CSCL 20K

A two dimensional oscillating airfoil test apparatus is presented as a method of measuring unsteady aerodynamic forces on an airfoil or rotor blade section. The oscillating airfoil test rig, which is being built for use in the 11 x 11 foot transonic wind tunnel (speed range M = 0.4-1.4), will allow determination of unsteady loadings and detailed pressure distributions on representative airfoil sections undergoing simulated pitching and flapping motions. The design details of the motion generating system and supporting structure are presented. This apparatus is new in the construction phase. J.A.M.

**N79-21822** National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.

**NASF TRANSPOSITION NETWORK: A COMPUTING NETWORK FOR UNSCRAMBLING p-ORDERED VECTORS**

Raymond S. Lim. Apr, 1979 37 p refs
(NASA-TP-1426; A-7645) Avail. NTIS HC A03/MF A01 CSCL 09B

The viewpoints of design, programming, and application of the transportation network (TN) is presented. The TN is a programmable combinational logic network that connects 521 memory modules to 512 processors. The unscrambling of p-ordered vectors to 1-ordered vectors in one cycle is described. The TN design is based upon the concept of cyclic groups from abstract algebra and primitive roots and indices from number theory. The programming of the TN is very simple, requiring only 20 bits. 10 bits for offset control and 10 bits for barrel switch shift control. This simple control is executed by the control unit (CU), not the processors. Any memory access by a processor must be coordinated with the CU and wait for all other processors to come to a synchronization point. These wait and synchronization events can be a degradation in performance to a computation. The TN application is for multidimensional data manipulation, matrix processing, and data sorting, and can also perform a perfect shuffle. Unlike other more complicated and powerful permutation networks, the TN cannot, if possible at all, unscramble non-p-ordered vectors in one cycle. S.E.S.
N79-229447# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DESIGN OF A PIEZOELECTRIC SHAKER FOR CENTRIFUGE TESTING

Jeffrey G. Cancilini and Jerald M. Henderson (California Univ., Davis) In NASA Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p 59-70 refs (For primary document see N79-22539 13-39)

Avail NTIS HC A13/MF A01 CSCL 131

The design of a prototype piezoelectric shaker and its development to date is described. Although certain design problems remain to be solved, the piezoelectric system shows promise for adaptation to a larger payload system such as the proposed geotechnical centrifuge at the Ames Research Center.

J.A.M.

N79-22847# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HELICAL GRIP FOR THE CABLE CARS OF SAN FRANCISCO

Richard J. Peyran In NASA Johnson Space Center The 13th Aerospace Mech. Symp. 1979 p B3-93 refs (For primary document see N79-22539 13-39)

Avail NTIS HC A13/MF A01 CSCL 131

A helical cable car grip to minimize high maintenance costs of San Francisco's cable car operation is presented. The grip establishes a rolling contact between the cable and grip to reduce sliding friction and associated cable wear. The design, development, and testing of the helical cable car grip are described.

J.A.M.

N79-287672# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A LONG-RANGE AND LONG-LIFE TELEMETRY DATA ACQUISITION SYSTEM FOR HEART RATE AND MULTIPLE BODY TEMPERATURES FROM FREE RANGING ANIMALS


The system includes an implantable transmitter, external receiver-transmitter collar, and a microprocessor-controlled demodulator. The size of the implant is suitable for animals with body weights of a few kilograms or more; further size reduction of the implant is possible. The ECG is sensed by electrodes, designed for internal telemetry and to reduce movement artifacts. The R-wave characteristics are then specifically selected to trigger a short radio frequency pulse. Temperatures are sensed at desired locations by thermistors and then, based on a heartbeat counter, transmitted intermittently with pulse interval modulation. This modulation scheme includes first and last calibration intervals for a reference by ratios with the temperature intervals to achieve good accuracy even over long periods. Pulse duration and pulse sequencing are used to discriminate between heart rate and temperature pulses as well as RF interference.

Author

N79-24667# Washington Univ. Seattle Dept. of Atmospheric Sciences

MIDDLE ATMOSPHERE PROJECT A SEMI-SPECTRAL NUMERICAL MODEL FOR THE LARGE-SCALE STRATOSPHERIC CIRCULATION

James R. Holton and William Wehrbein May 1979 78 p refs (Grant NSF-G-2228). (NASA CR 156663. Rept 1) Avail NTIS HC A05/MF A01 CSCL 04A

The complete model is a semispectral model in which the longitudinal dependence is represented by expansion in zonal harmonics while the latitude and height dependencies are represented by a finite difference grid. The model is based on the primitive equations in the log pressure coordinate system. The lower boundary of the model domain is set at the 100 mb level (i.e., near the tropopause) and the effects of tropospheric forcing are included in the lower boundary condition. The upper boundary is at approximately 96 km and the latitudinal extent is either global or hemispheric. The basic differential equations and boundary conditions are outlined. The finite difference equations are described. The initial conditions are discussed and a sample calculation is presented. The FORTRAN code is given in the appendix.

N79-24957# Informatics, Inc. Palo Alto, Calif.

COMPUTATIONS OF UNSTEADY TRANSSONIC FLOW GOVERNED BY THE CONSERVATIVE FULL POTENTIAL EQUATION USING AN ALTERNATING DIRECTION IMPLICIT ALGORITHM

Peter M. Goorjian Jun 1979 48 p refs (Contract NAS2-1027). (NASA CR-152274). Avail NTIS HC A03/MF A01 CSCL 01A

A development was the time linearization of the density function. This linearization reduces the solution process from solving just a single equation. Two sample cases were computed. First, a one dimensional traveling shock wave was computed and compared with the analytic solution. Second, a two dimensional case was calculated for a flow field which resulted
from a thickening and subsequently, thinning airflow. The resulting flow field, which included a traveling shock wave, was compared to the flow field obtained from the low frequency, small disturbance, transonic equation. J A M


The manual is intended to show the revisions and additions to the current STAR FORTRAN. The changes are made to incorporate an FMP (Flow Model Processor) for use in the Numerical Aerodynamic Simulation Facility (NASF) for the purpose of simulating fluid flow over three-dimensional bodies in wind tunnel environments and in free space. The FORTRAN programming language for the STAR-100 computer contains both CDC and unique STAR extensions to the standard FORTRAN. Several of the STAR FORTRAN extensions to standard FORTRAN allow the FORTRAN user to exploit the vector processing capabilities of the STAR computer. In STAR FORTRAN vectors can be expressed with an explicit notation. Functions are provided that return vector results, and special call statements enable access to any machine instruction.


A time-height section of the quasi-biennial oscillation is presented for the period 1950-1978. The data are from the Canal Zone station through June 1970 and from Kwajalein from July 1970 through April 1978 (both stations are near 9 deg N). The most striking feature in the new data is the unusually strong westerly phase which occurred in the winter of 1977-1978. The magnitude of the westerly amplitude in December 1978 was over 60 m/sec at and above 10 mb. The easterly phase below the westerly phase of the 1977-1978 winter was also unusually large. The other features in the new data are consistent with past observations.

B J


The Pioneer Venus electric field detector was used to observe significant effects of the interaction of the solar wind with the ionosphere of Venus all along the orbiter trajectory. Information on sharp and diffuse shock structures and plasma oscillations emitted by suprathermal electrons beyond the bow shock is considered, and wave particle interaction phenomena important near the boundary of the dayside ionosphere are noted.

M L

A79-24170 * Preliminary results of the Pioneer Venus nephelometer experiment. B. Ragent (NASA Ames Research Center, Moffett Field, Calif.) and J. Blamont (CRNS, Service d'Aéronomie, Verrières-le-Buisson, Essonne, France). Science, vol. 203, Feb. 23, 1979, p. 790-792. 7 refs. Preliminary results of the nephelometer experiments conducted aboard the large sounder, day, night, and night probes of the Pioneer Venus mission are presented. The vertical structures of the Venus clouds observed simultaneously at each of the four locations from altitudes of from 63 kilometers to the surface are compared, and similarities and differences are noted. Tentative results from attempting to use the data from the nephelometer and cloud particle size spectrometer on the sounder probe to identify the indices of refraction of cloud particles in various regions of the Venus clouds are reported. Finally the nephelometer readings for the day probe during impact on the surface of Venus are presented.

A79-28074 * Data processing in infrared astronomy. R. F. Pelzmann, Jr. (NASA Ames Research Center, Institute for Advanced Computation, Moffett Field, Calif.). In: Modern utilization of infrared technology. IV. Proceedings of the Seminar, San Diego, Calif., August 30, 31, 1978. (A79-28069 10-35) Bellingham, Wash.: Society of Photo-Optical Instrumentation Engineers, 1978. p. 36-42. 7 refs. Infrared astronomy is often carried out with rocket probes or orbiting satellite telescopes in order to escape the effects of atmospheric absorption. The data returned from such missions is a highly abstracted digital representation of measurements made by analog detectors. The ability to extract infrared-emission information from these data streams depends on a thorough understanding of all the information flow from the telescope aperture to the computer center. This paper reviews the primary elements of this end-to-end

Soft X-ray observations of the solar corona over the period 1970-1978 show that the number of small short-lived bipolar magnetic features (X-ray bright points) varies inversely with the sunspot index. During the entire period from 1973 to 1978 most of the magnetic flux emerging at the solar surface appeared in the form of bright points. In 1970, near the peak of solar cycle 20, the contributions from bright points and from active regions appear to be approximately equal. These observations strongly support an earlier suggestion that the solar cycle may be characterized as an oscillator in wave-number space with relatively little variation in the average total rate of flux emergence. (Author)


This paper describes the encoding and decoding of a (31,15) Reed-Solomon Code for multiple-burst error correction for large memory systems. The decoding procedure consists of four steps: (1) syndrome calculation, (2) error-location polynomial calculation, (3) error-location numbers calculation, and (4) error values calculation. The principal features of the design are the use of a hardware shift register for both high-speed encoding and syndrome calculation, and the use of a commercially available (31,15) decoder for decoding. (Author)


Backscattering data for the nephelometer experiments conducted aboard the Pioneer Venus mission probes, including data up to the highest altitudes measured by the probes, are presented. A few small signals were detected below the main cloud deck. Ambient radiation was measured at near-ultraviolet and visible wavelengths; the variation of extinction of near-ultraviolet with altitude is inferred. Ambient radiances decreased more rapidly at 300 than at 745 nanometers in the lower atmosphere. (Author)


A completely implantable epidural pressure telemetry system designed for accurate measurement of intracranial pressure (ICP) is described. The implant device is batteryless, providing unlimited operating life. The described system uses a capacitive pressure transducer with excellent long-term stability. Once detected with the transducer and conveyed to a frequency with the oscillator electronics, the pressure signal is digitized. It is then telemetered without the possibility of further degradation. After detection with the small external module, the data can be retransmitted by a radio link for complete patient mobility or the energizer signal pickup module can be wired to a bedside readout unit. Continuous data are available from the system so that the dynamic ICP changes reflecting arterial blood pressure can be observed and used for diagnosis. S.D.


An implant telemetry system for the simultaneous monitoring of temperature, activity, and EKG from small animals, such as rats, has recently been designed with the novel feature that instead of a battery the system is energized by an inductive field. A 250 kHz resonant coil surrounds the cage (30 x 30 x 20 cm) and provides the approximately 100 microwatts of power required to operate the implant transmitter while allowing the animal unrestrained movement in the cage. The implant can also be battery operated if desired. RF transmission is in the 810 MHz band, which allows the use of a simple, essentially single IC chip, receiver. (Author)


A time-dependent primitive equation model for an equatorial channel is used to assess the interaction of equatorial Kelvin and mixed Rossby-gravity waves with the mean flow. The proposed model involves a semiplicit time-differencing scheme and a finite-difference grid in the meridional plane. It is shown that forced equatorial waves interact with mean flow to produce equatorial jets characterized by downward-moving westerly Kelvin wave forcing) and easterly mixed Rossby-gravity wave forcing) shear zones, respectively. For parameters characteristic of the observed waves in the equatorial stratosphere, the wave-mean flow interaction process always reduces the amplitude of any initial cross-equatorial mean wind shear. The mean flow profile tends to become symmetric about the equator as the interaction process continues. S.D.


An examination of daily meteorological rocket data taken during January and February 1977 at Kwajalein, Marshall Islands (9 deg N, 168 deg E) suggests the presence of a large oscillation in the meridional wind with a period near 2 days. Some rocket data taken concurrently at other stations is also presented. The Canal Zone station (9 deg N, 80 deg W) suggests a possible 2-day oscillation, while middle and high-latitude stations show variability with periods ranging from 2.5 days. (Author)


The application of Doppler shifted laser light to the measurement of the two velocity components normal to the optical axis of the system is relatively simple as compared to the measurement of the on-axis velocity component. The present paper deals with the reference-beam (local oscillator) technique and the dual-beam (fringe mode) technique, which have been developed for measuring the on-axis component. Some results obtained for the on-axis component are examined. V.P.
Nitric oxide may be produced in the atmosphere of Venus by lightning storms in the clouds. The paper suggests that the odd nitrogen thus formed may play an important part in the chemistry of the clouds. Specifically, production rates for NO2 in the limiting case of high NO concentrations are estimated. If the NO density is high, it is suggested that NO2 may catalyse the production of sulfuric acid aerosol from sulfur dioxide and water vapor, and may also form nitrogen-sulfur compounds such as nitrosyl sulfuric acid, NOHSO4.

The large particles seen by the Pioneer Venus sounder probe may contain considerable quantities of NOHSO4. If this is the case, odd nitrogen must be present in the atmosphere in at least a parts-per-million mixing ratio.

**PATENTS**

N79 18580® National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.

**MINIATURE IMPLANTABLE ULTRASONIC ECHOSONOMETER Patent**

N79 26771® National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.

**BIOMEDICAL ULTRASONOSCOPE Patent**
Robert D. Lee, inventor (to NASA). Issued 29 May 1979 12 p Filed 30 Sep 1976 Supersedes N77 15619 (15 p 06 p 0786)

N79 31499® Oxides of nitrogen and the clouds of Venus

N79 31498® National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.

**ELECTRICAL SHORT LOCATOR Patent Application**

An electrical short finding instrument suited for locating shorts as they occur while an electrical system is being wired, sounds an alarm as soon as a short is produced and further identifies the conductors that are shorted together. A ring counter derives input pulses from a squarewave oscillator. The outputs of the counter are fed through transistors to an array of light-emitting diodes. Each diode is connected to an electrical conductor, such as a bus bar, that is to be tested. Leads and connector permit such connections to be made to the bus bar assembly. In the absence of a short between two electrical conductors the diodes are sequentially illuminated. When a short occurs, a comparator/multivibrator circuit triggers an alarm and stops the oscillator and the sequential energization of the diodes. The two diodes that remain illuminated identify the bus bars that are shorted.

**NASA**
FEDERAL AVIATION ADMINISTRATION

JOURNAL ARTICLES, BOOKS AND
CHAPTERS OF BOOKS


A simulation program was devised to study the effects of fuel isolated rotor. However, if both rotors do not have the same blade geometry, rotating stall affects the whole compressor only if the first stage initiates it, and in the case of wall separation, this phenomenon is restricted to the stage in which it is initiated.

(Author)


A multiple grid method for transonic flow calculations is developed. The proposed scheme incorporates a generalized alternating direction method as the smoothing algorithm. Numerical experiments indicate that this multigrid alternating-direction method converges rapidly and reliably for a range of cases typical of the cruising regime up to the onset of drag rise. It also appears that the method can be readily generalized to treat three-dimensional flows.

B.J.
U.S. ARMY RESEARCH AND TECHNOLOGY LABORATORIES

FORMAL REPORTS

N79 10029
Army Research and Technology Labs Moffett Field, Calif
VELOCITY MEASUREMENT ABOUT A NACA 0012 AIRFOIL WITH A LASER VELOCIMETER
Danny R. Hoad, Warren H. Young, Jr., and James F. Meyers
Jun 1978 15 p refs
(AD-A056447) Avail NTIS HC A02/MF A01 CSCL 20/4

A laser velocimeter measured the velocity field about a wing with a NACA 0012 airfoil section. These measurements were compared at two low angles of attack (0 deg, 4.15 deg) with a two-dimensional viscous flow prediction program. At 0 deg the comparison provided confidence in the effectiveness and accuracy of the laser velocimeter. At 4.15 deg, the data indicated that a small laminar separation bubble with oscillating shear layer probably existed. The unique capability of the laser velocimeter in measuring absolute flow magnitude and direction without prior knowledge of general flow direction was demonstrated in the complex separated reverse flows over the wing at an angle of attack of 19.4 deg.

N79 22039
Boeing Vertol Co., Philadelphia, Pa
ROTARY WING AERODYNAMICS VOLUME 1: BASIC THEORIES OF ROTOR AERODYNAMICS WITH APPLICATION TO HELICOPTERS
W. Z. Stepniewski Washington NASA Jan 1979 302 p refs
(Contract NAS2-7007)
(NASA CR-3082) Avail NTIS HC A14/MF A01 CSCL 01A

The concept of rotary-wing aircraft in general is defined. The energy effectiveness of helicopters is compared with that of other static thrust generators in hover, as well as with various air and ground vehicles in forward translation. The most important aspects of rotor blade dynamics and rotor control are reviewed. The simple physical model of the rotor offered by the momentum theory is introduced and its usefulness and limitations are assessed. The combined blade-element and momentum theory approach, which provides greater accuracy in performance predictions, is described as well as the vortex theory which models a rotor blade by means of a vortex filament or vorticity surface. The application of the velocity and acceleration potential theory to the determination of flow fields around three dimensional, non-rotating bodies as well as to rotor aerodynamic problems is described. Airfoil sections suitable for rotors are also considered.

The feasibility of using the critical tracking task to evaluate kinesthetic-tactual displays was examined. The test subjects were asked to control a first-order unstable system with a continuously decreasing time constant by using either visual or tactual unidimensional displays. The results indicate that the critical tracking task is both a feasible and a reliable methodology for assessing tactual tracking. Further, that the critical tracking methodology is as sensitive and valid a measure of tactual tracking as visual tracking is demonstrated by the approximately equal effects of quickening for the tactual and visual displays.

S.D.
AEROMECHANICS LABORATORY

FORMAL REPORTS

N79-10864*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
AEROAOCUSTIC RESEARCH: AN ARMY PERSPECTIVE
H. Andrew Morse and Fredric H. Schmertz. In NASA Langley
Res Center Helicopter Acoustics Pt 2 Aug 1978 p 797-817
refs Prepared in cooperation with Army Res and Technol Labs,
Fort Eustis, Va (For primary document see N79 10843 01-71)
Avail NTIS HC A19/MF A01 CSCL 20A
A short perspective of the Army aeroaocustic research
program is presented that emphasizes rotary wing, aerodynamically
generated noise. Exciting breakthroughs in experimental tech
niques and facilities are reviewed which are helping build a
detailed understanding of helicopter external noise. Army and
joint Army/NASA supported research programs in acoustics which
promise to reduce the noise of future helicopters without severe
performance penalties are included. J M S

N79-15977*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
MISSION ENVIRONMENT SIMULATION FOR ARMY
ROTORCRAFT DEVELOPMENT: REQUIREMENTS AND
CAPABILITIES
David L Key, Billy L Odneal and John B. Sinacori. In AGARD
Piloted Aircraft Environ Simulation Tech, Oct 1978 17 p
refs Prepared in cooperation with Army Aviation Res and Develop
Command, Moffett Field, Calif. (For primary document see
N79-15973 07-09)
Avail NTIS HC A14/MF A01 CSCL 01E
The rich and varied detail visible in terrain flight must be
presented by a wide field of view system with much detail and
high resolution. The rotary-wing R&D simulator must have great
versatility for easy change of cab configurations and the capability
to accommodate a two or three man crew. Basic specifications
for an adequate visual display were developed and are compared with
current and forecasted techniques for image generation and
presentation. Results of a study performed to determine the feasibility
of meeting these requirements using the current
technology of TV camera-model image generation and projected
display are discussed and an assessment of the possibility that
computer generated imagery can achieve the desired level of
detail is presented. G Y

N79-20103*# Washington Univ., St Louis, Mo. School of
Engineering and Applied Science
THE ROLE OF ROTOR IMPEDANCE IN THE VIBRATION
ANALYSIS OF ROTORCRAFT, PART 4: Final Report
Kurt H. Hohenemser, Jun 1978 38 p refs Prepared for
Army Aviation Res and Develop. Command, Moffett Field, Calif
(Contract NAS2-7613) (NASA CR 152261) Avail NTIS HC A03/MF A01 CSCL
01C
A method for a strongly idealized case of vertical excitation
and for rolling and pitching moment excitation of a four bladed
hingeless rotor on an up-focusing flexible mount is developed.
The aerelastic rotor impedances are computed directly with a
finite blade element method that includes aerodynamics. The
rotor impedance matrix for three or more blades is determined
from the root moment impedance for a single blade by a simple
multiblade transformation rule. Force and moment amplitudes
transferred from the rotor to support are found to be critically
dependent on the support dynamics. S E S

N79-26883*# Stanford Univ., Calif. Dept of Aeronautics
and Astronautics
AERODYNAMIC SOUND GENERATION DUE TO VORTEX-
AEROFIOL INTERACTION. PART 2: ANALYSIS OF THE
ACOUSTIC FIELD
R. Parasa rthi and K. Karamcheti. Sep 1972 75 p refs
Sponsored in part by Army Mobility Res and Develop. Com-
mand. (Contract NAS2 61581) (NASA CR 152231) Avail NTIS HC A04/MF A01
CSCL 20A
The Lighthill method was the basic procedure used to analyze
the sound field associated with a vortex of modified strength
interacting with an airfoil. A free vortex interacting with an airfoil
in uniform motion was modeled in order to determine the sound
field due to all the acoustic sources, not only on the airfoil
surfaces (dipoles), but also the ones distributed on the per-
turbed flow field (quadrupoles) due to the vortex-airfoil interaction.
Because inviscid flow is assumed in the study of the interaction,
the quadrupoles considered in the perturbed flow field are entirely
due to an unsteady flow field. The effects of airfoil thickness on
the second radiation are examined by using a symmetric Joukowskii
airfoil for the vortex-airfoil interaction. Sound radiation in 
plane, far field simplification, and computation of the sound field are
discussed. A R H

WIND TUNNEL TESTS OF FOUR FLEXIBLE WING ULTRA-
LIGHT GLIDERS
Robert A. Ormiston. In NASA Langley Res Center Sci and
Technol of Low Speed and Motorless Flight, Jun 1979
p 557-589 (For primary document see N79 27070 18-01)
Avail NTIS HC A99/MF A01 CSCL 01A
The aerodynamic lift, drag, and pitching moment characters-
tics of four full scale, flexible wing ultralight gliders were measured
in the settling chamber of a low speed wind tunnel. The gliders
were tested over a wide range of angle of attack and at two
different velocities. Particular attention was devoted to the lift
and pitching moment behavior at low and negative angles of
attack because of the potential loss of longitudinal stability of
flexible wing gliders in this regime. The test results were used to
estimate the performance and longitudinal control characteris-
tics of the gliders. J A M
JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


In an improved method which retains the advantage of separate treatment of rotor and airframe, the rotor impedance is used to correct the input to the airframe. This improved method is illustrated for a strongly idealized case of vertical excitation and then for rolling and pitching moment excitation of a four bladed hingeless rotor on an up-focusing flexible mount. Contrary to the usual approach, these results represent aerelastic blade motions by a series of normal blade modes in vacuum, the aerelastic rotor impedances are computed directly with a finite blade element method that includes aerodynamics. The rotor impedance matrix for the support is found to be critically dependent on the support dynamics.


A two-dimensional experiment was conducted in a water tunnel using hydrogen bubble flow visualizations for the purpose of exposing, independently, the behavior of the viscous and inviscid domains during unsteady airfoil stall. By imposing a large amplitude pitch oscillation about the static stall angle of a modified NACA 0012 airfoil, an unsteady environment was created that not only altered considerably the progression of flow reversal along the airfoil surface from what was observed in steady flow, but also caused a unique succession of vortical developments to appear that is unparalleled in steady flow. More importantly, the first stage of dynamic stall was found to be the rapid spread of a thin region of reversed flow over the entire upper surface of the airfoil, which momentarily created a free-shear layer without any appreciable disturbance of the viscous-inviscid boundary. This free-shear layer broke down rapidly into a multitude of discrete vortices that eventually coalesced to produce a dominant shear-layer vortex, followed by a dynamic-stall vortex.


The direct analytical method of Ritz is applied to solve for the modal frequencies, mode-shapes, and response of a nonuniform rotating beam with discontinuities in bending stiffness and mass distribution. Unlike conventional modal methods, however, separate series of admissible functions are assumed within segments of the beam that are free from discontinuities in stiffness and mass properties. Results are obtained that converge to the exact solution so that bending moment and shear force distributions can be expressed simply and accurately in terms of derivatives of the displacement. Results from this method are compared with those from conventional Rayleigh-Ritz methods and found to be superior in terms of accuracy and simplicity.


The AD-1 manned flight test program being conducted jointly by the Ames and Dryden Flight Research Centers of NASA is intended to evaluate the stability, control, and handling characteristics of oblique-wing aircraft. The results of the aerelastic stability analysis carried out at Ames in support of the AD-1 program are presented for the oblique wing both with and without ailerons. When the wing is swept, the significant mode of instability is low-frequency, oblique-wing flutter. With the oblique unswept, however, the critical mode is bending/torsion/aileron flutter. The latest version of the NASTRAN computer code, as well as the Ames PASS-F-LUT program, was used in these studies.


The Ritz direct method is applied to a class of Sturm-Liouville structural vibration problems with discontinuous coefficients. Terms of a power series are used as admissible functions within segments of the domain that are chosen to have all discontinuities at their
extremities. Only geometric boundary conditions are satisfied by the admissible functions, chosen to be terms of a power series, and geometric continuity is enforced at the segment boundaries.


Development of the Second Generation Comprehensive Helicopter Analysis System (2GCHAS) is being initiated by the U.S. Army Research and Technology Laboratories. This system provides the capability to model the total helicopter to predict performance, loads, vibration, aeroelastic stability, stability and control, and acoustics characteristics. This interdisciplinary analysis system is a basic tool required to support the rotorcraft design process. Aspects of this system which affect its application as a design tool are addressed. A primary consideration in the development of the system is the manner in which component parts of the helicopter are combined analytically to represent the total vehicle system. The results of a workshop conducted to discuss formulation of equations and related issues are summarized. Requirements to make the system easy to use are explored, including the manner in which it is applicable through all phases of aircraft design and development from conceptual analysis through flight test and detailed modification support.

(Author)
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