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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.

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Betty Sherwood, Compiler

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SECTION I

PUBLICATIONS
OFFICE OF THE DIRECTOR

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
Jarir S. Dajani, ed. (Stanford Univ., Calif.), James V. Jucker, ed.,
and J. Lloyd Jones (Stanford Univ.) May 1978 300 p refs
Stanford-NASA-ASEE Summer Fellowship Program on
Eng. System Design held at Moffett Field, Calif., 1977
(Grant NGR-05-020-409)
(NASA-CP-2044; A-7347) Avail: NTIS HC A13/MF A01 CSCL
13F
A description of the airport area, its current transportation
capabilities, and recommendations for future access planning are
presented. For individual titles, see N79-10843 through N79-
10848.

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. Belsley Sep. 1978
101 p refs
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 technologies; each
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.

N79-11994* National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.
AMES COLLABORATIVE STUDY OF COSMIC-RAY NEUTRONS.
2. LOW- AND MID-LATITUDE FLIGHTS
L D Stephens, J B McCaslin, A R Smith, R H Thomas, J
E Hewitt, and L Hughes 1 Mar 1978 20 p refs Prepared
in cooperation with California Univ., the Lawrence Berkeley Lab
(Contract W-7405-eng-48)
(NASA-TM-79881; LBL-6738) Avail: NTIS HC A02/MF A01
CSCL 038
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.

N79-15888* National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.
HUMAN NEUROLOGICAL DEVELOPMENT: PAST, PRESENT
AND FUTURE
Ralph Pelligrino, ed. Nov 1978 60 p refs Symp. held at
Moffett Field, Calif., 18 May 1978; sponsored in part by Inst
for the Achievement of Human Potential, Philadelphia, Pa. Original
contains color illustrations
CSCL 06P
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 N79-
15888 through N79-15889.

N79-15907* National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.
VISUAL SIMULATION REQUIREMENTS AND HARDWARE
John C Dusterberry, In AGARD Piloted Aircraft Environ
see N79-15973 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 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.
AERONAUTICS AND FLIGHT SYSTEMS

FORMAL REPORTS

N78-10046# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
FLIGHT RESEARCH CAPABILITIES OF THE NASA/ARMY ROTOR SYSTEMS RESEARCH AIRCRAFT
Samuel White, Jr. and Gregory W. Condon Sep. 1978 30 p refs
(NASA-TM-78522; A-76022) Avail. NTIS HC A03/MF A01 CSCL 01C
A description is given of the capabilities and limitations of the Rotor Systems Research Aircraft (RSRA) that was demonstrated during the development contract, and assesses the expected research capabilities of the RSRA on delivery to the government.

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
(NASA-TM-78527; A-76251) Avail. NTIS HC A02/MF A01 CSCL 01D
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.

N78-11034# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
AN OVERVIEW OF THE QUIET SHORT HAUL RESEARCH AIRCRAFT PROGRAM
Michael D. Shovlin and John A. Cochrane Nov. 1978 41 p refs
(NASA-TM-78545; A-76726) Avail. NTIS HC A03/MF A01 CSCL 01C
An overview of the Quiet Short Haul Research Aircraft (QSSRA) 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 QSSRA to develop the technology are discussed. The concept of the QSSRA as a national flight research facility is explained.

N78-12013# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
APPLICATION OF SHOCK TUBE 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 01A
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 schlieren photography and airfoil pressure measurements show that steady 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.

N78-12019# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL INVESTIGATION OF WING FIN CONFIGURATIONS FOR ALLEVIATION OF VORTEX VAKES OF AIRCRAFT
Vernon J. Rossow Nov. 1978 38 p refs
(NASA-TM-78520; A-7593) Avail. NTIS HC A03/MF A01 CSCL 01A
A variety of fin configurations were tested on a model of the Boeing 747 in 40 by 80 foot wind tunnels. The test results confirmed 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 negligible by proper fin design.

N78-12019# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
COMPREHENSIVE HELICOPTER ANALYSIS: A STATE OF THE ART REVIEW
Wayne Johnson Nov. 1978 18 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
(NASA-TM-78539; AVRADCOM-78-56(AM)); A-7681) Avail. NTIS HC A02/MF A01 CSCL 01A
An assessment of the status of rotorcraft theory and analysis is presented. The technology level embodied in available design tools (computer programs) is examined, considering the problem areas of performance, loads and vibration, handling qualities and simulation, and aerelastic stability. The effectiveness of the present analyses is discussed. The characteristics of the technology in the analyses are reviewed, including the aerodynamics, induced velocity and wake geometry, dynamics technology, and machine limitations.

Author
N79-12621# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CANDIDATE-ROTOR CONFIGURATIONS FOR TRANSonic WIND TUNNEL Tests


The simulation results are discussed and the data are too wiry examined in a wind tunnel and the configuration tested. Remarks indicate good agreement with experimental data up to 40 deg angle of attack. Author

S.B.

N79-12642# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NONLINEAR DYNAMIC RESPONSE OF WIND TURBINE ROTORS Ph.D. Thesis - MIT

Inderjit Chopra Feb. 1977 233 p refs (Grant NSF AER-75-00828)

The nonlinear equations of motion for a rigid rotor restrained by three flexible springs representing the flapping, lagging and feathering motions are derivied using Lagrange's equations for arbitrary angular rotations. These are reduced to a consistent set of nonlinear equations using nonlinear terms up to third order.

Author


AIR POLLUTION FROM AIRCRAFT OPERATIONS AT SAN JOSE MUNICIPAL AIRPORT, CALIFORNIA


The amount of air pollution discharged by arriving and departing aircraft at the San Jose Municipal Airport was estimated. The contributions were made for each hour interval of a summer weekday in 1977. The contributions of both general aviation (personal and business aircraft) and certified air carriers (scheduled airliners) were considered. The locations at which the pollutants were discharged were estimated by approximating the flight paths of arriving and departing aircraft and calculating the distances at which the pollutants were considered to be released. The air pollutants considered were carbon monoxide, hydrocarbons, and oxides of nitrogen. S.B.S.

N79-12967# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A NONLINEAR TRAJECTORY COMMAND GENERATOR FOR A DIGITAL FLIGHT-CONTROL SYSTEM

Luigi S. Cuciani and Stein Weisenberger Nov. 1978 114 p refs (NASA-TP-1221: A-7074) Avail: NTIS HC A08/MF A01 CSCL 01C

Operational application of the command generator (CG) was examined in detail in a simulation of a flight control system with the aileron and rudder actuated by a computer program developed for the automated design of airfoils with a prescribed lift distribution. The nonlinear equations of motion for a rigid rotor restrained by three flexible springs representing the flapping, lagging and feathering motions are derivied using Lagrange's equations for arbitrary angular rotations. These are reduced to a consistent set of nonlinear equations using nonlinear terms up to third order.

Author

N79-14011# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AIRFOIL DESIGN BY NUMERICAL OPTIMIZATION USING A MINICOMPUTER

Raymond M. Hicks and C. A. Szelke (Computer Information Systems, Cupertino, Calif.) Dec. 1978 28 p ref

A computer code was developed for the automated design of low speed airfoils to a prescribed lift distribution. The program designs airfoils with a prescribed pressure distribution as well as those which minimize or maximize some aerodynamic force. The program is restricted to viscous, compressible flow. A typical design problem will execute in 4.5 hr on a HP 9830 minicomputer. A.R.H.

L79-14022# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

VOXEL EFFECTS FOR CANARD-WING CONFIGURATIONS AT HIGH ANGLES OF ATTACK IN SUBSONIC FLOW


A fully three-dimensional subsonic panel method that can handle arbitrary shed vortex wakes was used to compute the nonlinear forces and moments on simple canard-wing configurations. The lifting surfaces and wakes are represented by doublet panels. The Mangler-Smith theory is used to provide an initial estimate for the vortex sheet shed from the leading edge. The trailing-edge wake and the leading-edge wake downstream of the trailing edge are assumed to be straight and leave the trailing edge at an angle of alpha/2. Results indicate good agreement with experimental data up to 40 deg angle of attack. Author

N79-14024# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECTS OF UPPER SURFACE MODIFICATION ON THE AERODYNAMIC CHARACTERISTICS OF THE NACA 66 SUB 2-218 AIRFOIL SECTIONS


An upper surface modification designed to increase the maximum lift coefficient of a 63 sub 2 - 218 airfoil section was tested at Mach numbers of 0.2, 0.3, and 0.4 Reynolds numbers of 1.3 x 1 million, 2 x 10 sub 6 and 2.5 x 1 million. Comparisons of the aerodynamic coefficients before and after the modification were made. The upper surface modification increased the maximum lift coefficient of the airfoil significantly at all conditions. G.G.

N79-14082# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECTS OF VISUAL AND MOTION SIMULATION CUEING SYSTEMS ON PILOT PERFORMANCE DURING TAKEOFFS WITH ENGINE FAILURES


Operational application of the command generator (CG) was examined in detail in a simulation of a flight control system with the aileron and rudder actuated by a computer program developed for the automated design of airfoils with a prescribed lift distribution. The nonlinear equations of motion for a rigid rotor restrained by three flexible springs representing the flapping, lagging and feathering motions are derivied using Lagrange's equations for arbitrary angular rotations. These are reduced to a consistent set of nonlinear equations using nonlinear terms up to third order.

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 most 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.

Author

N79-143389# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. BI-DIRECTIONAL, BURIED-WIRE SKIN-FRICTION GAGE Hiroshi Hijachi (Dyn. Technol., Inc.) and David J. Peske Nov. 1978 27 p refs (NASA-TM-78531: A-7637) Avail: NTIS HC AO2/MF A01 CSCL 200 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 skin friction were then obtained on the cone surface.

Author

N79-15064# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. NEW NASA-AMES WIND-TUNNEL TECHNIQUES FOR STUDYING AIRPLANE SPIN AND TWO-DIMENSIONAL UNSTEADY 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 A01 CSCL 01C Two new wind tunnel test apparatuses were developed at NASA-Ames Research Center. The first is a rotary-balane 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.

Author

N79-15814# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. A SAFETY MARGIN AND FLIGHT REFERENCE SYSTEM AND DISPLAY FOR POWERED-LIFT AIRCRAFT Robert K. Haffley and Gordon H. Hardy In its The 14th Ann. Conf. on Manual Control Nov 1978 p 371-379 refs Prepared in cooperation with Systems Technol., Inc., Hawthorne, Calif. (For primary document see N79-15585 06-54) Avail: NTIS HC A99/MF A01 CSCL 05H 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.

Author

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.

G.Y.

N79-18789# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. COSF AND SCHEDULE MANAGEMENT ON THE QUIET SHORT-HAUL RESEARCH AIRCRAFT PROJECT Darrell E. Wilcox and Peter Pettersen Jan. 1979 20 p refs (NASA-TM-78547: A-7684) Avail: NTIS HC AO2/MF A01 CSCL 02A The Quiet Short-Haul Research Aircraft (QSRA) P-object, one of the largest aeronautical programs undertaken by NASA to date, achieved a significant cost underen. This is attributed to numerous factors, not the least of which were the contractual arrangement and the system of cost and schedule management employed by the contractor. This paper summarizes that system and the methods used for cost/performance measurement by the contractor and by the NASA project management. Recommendations are made for the use of some of these concepts in particular for future programs of a similar nature.

Author

N79-17798# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AERODYNAMIC PROPERTIES OF A FLAT PLATE WITH CAVITY FOR OPTICAL-PROPAGATION STUDIES Donald A. Buell Jan. 1979 100 p refs (NASA-TM-78487: A-7465) Avail: NTIS HC A05/MF A01 CSCL 01A Transonic wind-tunnel tests were performed on a flat plate with and without a cube-shaped cavity and antiresonance devices. Measurements were made of the optical propagation and aerodynamic properties of the boundary and shear layers. The model and its velocity profiles and pressures are described.

S.E.S.

N79-17804# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. WIND-TUNNEL INVESTIGATION OF THE THRUST AUGMENTOR PERFORMANCE OF A LARGE-SCALE SWEPT WING MODEL David G. Koeng and Michael D. Falarski (Army Aviation Res. and Develop. Command, St. Louis, Mo.) Feb 1979 58 p refs (NASA-TM-X-73239; AVRADCOM-TR-78-55(AMI)) Avail: NTIS HC A04/MF A01 CSCL 01A Tests were made in the Ames 40- by 80-foot wind tunnel to determine the forward speed effects on wing-mounted thrust augmentors. The large-scale model was powered by the compressor output of J-85 driven vipers compressors. The flap settings used were 15 deg and 30 deg with 0 deg, 15 deg, and 30 deg aileron settings. The maximum duct pressure, and wind tunnel dynamic pressure were 66 cmHg (26 in Hg) and 1190 N/sq.m (25 lb/sq ft), respectively. All tests were made at zero sideslip. Test results are presented without analysis.

J.M.S.

Algorithms were developed that attempt to identify which sensor in a tetrad configuration has experienced a step failure. An algorithm 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-tetrad 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.

N79-17872**/ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONFIGURATION MANAGEMENT AND AUTOMATIC CONTROL OF AN AUGMENTOR WING AIRCRAFT WITH VECTORED THRUST

138 p refs (NASA-TM-1222: A-7099) Avail NTIS HC A07/MF A01 CSCL 01C

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 an acceleration control. Acceleration commands are constructed from acceleration feedback acceleration to regulate path tracking errors. The central 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 for Ames experimental augmentor wing jet STOL research aircraft. Author

N79-18516**/ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

APPROXIMATION CONCEPTS FOR NUMERICAL AIRFOIL OPTIMIZATION

Garret N. Vandervorst. Mar. 1979 38 p refs (NASA-TP-1370; A-7882) Avail NTIS HC A03/MF A01 CSCL 01A

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.

N79-18516**/ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INERTIAL DYNAMICS OF A GENERAL PURPOSE ROTOR


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

N79-18899**/ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EVALUATION OF AIRCRAFT VORTEX UPSET MODEL BASED ON SIMULTANEOUS MEASUREMENTS OF WAKE VELOCITIES AND PROBE AIRCRAFT ACCELERATION


Simultaneous measurements were made of the upset responses experienced and the wake velocities 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.

A.R.H.

N79-18899**/ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HOLOGRAPHY AND LDV TECHNIQUES, THEIR STATUS AND USE IN AIRFOIL RESEARCH


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.

A.R.H.

N79-20009**/ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A NEW TWO-DIMENSIONAL OSCILLATING WING APARATUS FOR UNSTEADY AERODYNAMICS RESEARCH


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 motions at reduced frequencies to 0.3. oscillatory amplitudes to ±2 dogs, 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.

J.H.S.
N79-20004* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMIZATION OF MULTI-ELEMENT AIRFOILS FOR MAXIMUM LIFT
Avail: NTIS HC A20/MF A01 CSCL 01A
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 slot. The structure of the flow field is calculated 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 slot 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 maximum lift and flap positions.
J.M.S.

N79-20049* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF NUMERICAL OPTIMIZATION TO THE DESIGN OF ADVANCED SUPERCRITICAL AIRFOILS
Avail: NTIS HC A20/MF A01 CSCL 01A
An application of numerical optimization to the design of advanced airfoils for transonic aircraft showed that low-drag sections can be developed with the 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.

N79-20111* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
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 investigations. Specific guidelines for the guidance relationship, control characteristics, and display presentation concepts are given.
F.S.

N79-22002* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH ANGLE OF INCIDENCE IMPLICATIONS UPON AIR INTAKE DESIGN AND LOCATION FOR SUPERSONIC CRUISE AIRCRAFT AND HIGHLY MANEUVERABLE TRANSONIC AIRCRAFT
Leroy L. Presley In AGARD High Angle of Attack Aerodyn Jan 1979 10 p refs (For primary document see N79-21995 13-01)
Avail: NTIS HC A23/MF A01 CSCL 01C
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 reentrybody control scheme in 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.M.

N79-22026* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF AERODYNAMIC CHARACTERISTICS FOR SLENDER BODIES ALONE AND WITH LIFTING SURFACES TO HIGH ANGLES OF ATTACK
Leland H. Jorgensen In AGARD High Angle of Attack Aerodyn Jan 1979 40 p refs (For primary document see N79-21996 13-02)
Avail: NTIS HC A23/MF A01 CSCL 01A
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 semiphenomenal 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 2.0 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 symmetric, undesirable side forces are usually measured on the models at subsonic Mach numbers and zero angle of attack. Zero 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.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF A LARGE-SCALE VTOL LIFT-FAN TRANSPORT MODEL


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 fans, 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 PILOTED SIMULATOR STUDY ON AUGMENTATION SYSTEMS TO IMPROVE HELICOPTER FLYING QUALITIES


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 flapping 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 equations, 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.

AN INVESTIGATION OF A FULL-SCALE ROTOR WITH FOUR BLADE TIP PLANFORM SHAPES


A test of a full-scale helicopter rotor was conducted in the Ames Research Center 40 by 80 Foot Wind Tunnel to investigate performance loads and noise 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 of 0.72 to 0.97. The performance aspects are presented with power comparisons between tip shapes. On a power basis, the best overall tip shape was the swept-trapezoidal geometry.
N79-28014# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONTROL OF FOREBODY THREE-DIMENSIONAL FLOW SEPARATIONS

(A)NAS TM-78553; A-78411 Avail. NTIS HC A04/MF A01 CSCL 014

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 but on one side of the leeward meridian and beneath the vortex farthest from the wall, were effective in biasing the asymmetry. With this reorientation of the forebody vortices, 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 vortices positioned above the forebody vortices. M M M.

N79-28017# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

WIND-TUNNEL INVESTIGATION OF HIGHLY MANEUVERABLE SUPERSONIC V/STOL FIGHTER

(A)NAS TM-78599; A-78717 Avail. NTIS HC A03/MF A01 CSCL 024

Results from the initial wind-tunnel test of a large-scale, highly maneuverable supersonic V/STOL fighter model in the Ames 40- by 80-foot wind tunnel are summarized. The STOL configuration was tested combined upper surface blowing and spanwise blowing to improve the lift characteristics over a wide angle-of-attack range. A close-coupled canard was added to this configuration to create a highly maneuverable STOL aircraft. The 7.28 m (24 ft) span model was powered by two J-97 turbojet engines, each producing 9340 N (2200 lb) thrust at a pressure ratio of 2. With the nozzle flap and aileron set at 30 deg, the model produced lift coefficients greater than 4. The model was longitudinally unstable because of the forward canard position and because of the large body area of fuselage, stroke, and nacelles forward of the center of gravity. J A M.

N79-28035# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

QUIET PROPULSIVE LIFT FOR COMMUTER AIRLINES
Darrell E. Wilcox and John A. Cochrane Jun. 1979 29 p. refs

(A)NAS TM-78596; A-78611 Avail. NTIS HC A03/MF A01 CSCL 014

The performance of STOL or RTOL aircraft and NASA's research program to provide options for future design and certification of quiet propulsive-lift transports is described. M M M.

N79-27100# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LEADING EDGE SLAT OPTIMIZATION FOR MAXIMUM AIRFOIL LIFT

(A)NAS TM-78568; A-77531 Avail. NTIS HC A03/MF A01 CSCL 014

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-slatted 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

N79-27126# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AERODYNAMICS OF A TILT-NACELLE V/STOL PROPULSION SYSTEM

(A)NAS TM-78606; A-78491 Avail NTIS HC A02/MF A01 CSCL 214

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.

N79-27182# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A COMPARISON OF THE V/STOL HANDLING QUALITIES OF THE VAK-191B WITH THE REQUIREMENTS OF AGARD REPORT 877 AND MIL-F-53300
Seth B. Anderson Jul. 1979 38 p. refs

(A)NAS TP-1494; A-71171 Avail. NTIS HC A03/MF A01 CSCL 014

The handling qualities of the VAK-191B VTOL 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 effect 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 on reduced pilot workload during hover and low speed flight. S E S.

N79-27196# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EARTH WINDS, FLOW QUALITY, AND THE MINIMUM-PROTECTION INLET TREATMENT FOR THE NASA AMES 80, BY 130-FOOT WIND TUNNEL UNDER RETURN CIRCUIT
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 selected 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.


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 several values of the ratio of swirl velocity to axial velocity at the inlet of the divergent duct, assuming a locally parallel flow. The dipersion 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.


The aerodynamic characteristics of the augmentor wing concept with hypermixing primary nozzles were investigated. A large-scale semispan model in the Ames 40- by 80-Foot Wind Tunnel and Static Test Facility was used. The trailing edge augmentor flap system occupied 65% of the span and consisted of two fixed pivot flaps. The nozzle system consisted of hypermixing, lobe, many nuzzles, and BLC slot nozzles at the forward inlet, both as and ends of the throat, and at the aft flap. The entire wing leading edge was fitted with a 10% chord slat 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 diffuser 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 diffuser area ratio of 1.37.

K.L.


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 Faler and Lebovich's experimental data were used as the starting conditions at the entrance of the duct. The group velocity of wave propagation 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 field downstream of the entrance, the wave characteristics 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 axial symmetric as well as the nonsymmetric perturbations. M.M.M.


The thickness of the upper surface of 64 airfoils was increased from the leading edge to the position of maximum thickness. The modifications were generated using a numerical optimization routine coupled with an aerodynamic analysis code. The type of flowfield these rotors must operate in is discussed, and it is shown that simultaneous elimination of vibration and oscillatory blade loads is not an inherent solution to the roughness problem. The use of rotor blades or energy absorbing tips produced linear output relations are considered and a gain control for ROMULAN, a multicyclic controlling computer program, is introduced. Implications of the introduction of multicyclic systems into helicopters are discussed.

A.W.H.


Several types of rotors which employ multicyclic control are reviewed and compared. Their differences are highlighted and their potential advantages and disadvantages are discussed. The flow field these rotors must operate in is discussed, and it is shown that simultaneous elimination of vibration and oscillatory blade loads is not an inherent solution to the roughness problem. The use of rotor blades or energy absorbing tips produced linear output relations are considered and a gain control for ROMULAN, a multicyclic controlling computer program, is introduced. Implications of the introduction of multicyclic systems into helicopters are discussed.

A.W.H.

A low cost inertial navigation system (INS) concept is described for flight missions characterized by moderate acceleration 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 novel 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 rates and an equivalent accelerometer type error is also cancelled. Rapid gyro-compensating, implemented with an open gimbal control loop, and a strapdown procedure provides calibration of gyro drift rate biases.

A.W.H.

**NASA CONTRACTOR REPORTS**


STUDY OF AERODYNAMIC TECHNOLOGY FOR V/STOL FIGHTER/ATTACK AIRCRAFT: HORIZONTAL ATTITUDE CONCEPT Final Report


A horizontal attitude V/STOL (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.
vertical lift and vectored-engine-over-wing blowing for supercircular dampening. Aerodynamic uncertainties were determined as those associated with the constraints which size the aircraft to a specific altitude of 1000 ft. A wind tunnel model and test programs are recommended for resolving these uncertainties.

G.G.

N79-10028# Northrop Corp., Hawthorne, Calif. STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT. VERTICAL ATTITUDE CONCEPT Final Report, 1 Nov. 1977 - 31 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 NAS2-9771) (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 flight is obtained by gimballing 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 interface, flight control integration, crew station concepts, advanced weapons, avionics, and materials are discussed.

G.Y.

N79-10027# Grumman Aerospace Corp., Bethpage, N.Y. STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT Final Report, 1 Nov. 1977 - 23 May 1978 W. Burhans, Jr., Vincent J. Crafts, Jr., N. Drinnenhoffer, Frank A. Dellamura, and Robert E. Krepski 23 May 1978 186 p refs Sponsored in part by the David Taylor Naval Ship Research and Development Center, Bethesda, Md. (Contract NAS2-9770) (NASA-CR-152129) Avail: NTIS HC A08/MF A01 CSCL 01A Vertical short takeoff: aircraft capability, supersonic delta 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.

N79-12064# 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 (Contract NAS2-9028) (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 Changes 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.

N79-12066# Systems Technology, Inc., Mountain View, Calif. A STUDY OF KEY FEATURES OF THE RAE ATMOSPHERIC TURBULENCE MODEL Wayne F. Jewell and Robert K. Helfrey Oct. 1978 84 p refs (Contract NAS2-9942) (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.
suitable for the design of ducted fans and open propellers. The unified method is based on the blade element approach and the vortex theory for determining the three-dimensional effects, so that two-dimensional data can be used for determining the resultant force on each blade element. Resolution of this force in the thrust and torque planes and integration allows the total performance of the rotor, fan or propeller to be predicted. Three different methods of analysis, one based on a momentum flow theory; another on the vortex theory of propellers; and a third based on the theory of ducted fans, agree and reduce cascade airfoil data to single line as a function of the loading and induced angle of attack at values of constant inflow angle. The theory applies for any solidity from .01 to over 1 and any blade section camber. The effects of the duct and blade number can be determined so that the procedure applies over the entire range from two blades open propellers, to ducted helicopter tail rotors, to axial flow compressors with or without guide vanes, and to wind tunnel drive fans.

Author
validity, fidelity, and deficiencies. Future prospects are discussed
and technology projections are made. Author

HUMAN OPERATOR IDENTIFICATION MODEL AND
RELATED COMPUTER PROGRAMS Final Report
(Contract NAS2-3754)
(NASA-CR-152237) Avail: NTIS HC A07/MF A01 CSCL 05H

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 (TVSR); (3) Optimal
Simulation Program (TVOP); and (4) Linear Identification Program
(SCDNT). The TV program converts the time domain state variable
system representative 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 provides time histories of
system states associated with an operator in the loop system.
The differences between the two programs are presented. The
SCDNT 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.

N79-17811*# Computer Sciences Corp. Mountain View, Calif.
THE EFFECT OF A VISUAL/MOTION DISPLAY MISMATCH
IN A SINGLE AXIS COMPENSATORY TRACKING TASK
cs3
Douglas K. Shiarchi and Richard S. Shirley In MIT Proc., 13th
Ann. Conf. on Manual Control 1977 p 361-376 refs (For
primary document see N79-17475 08-51)
(Contract NAS2-7806)
Avail: NTIS HC A20/MF A01 CSCL 05J

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 on the simulation. Is pilot performance reduced by the
contrast between displays? Would a more realistic simulation
occur if the visual servomechanisms were deglerated to match
the motion servomechanisms? Does the pilot need 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 can be of use 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-California Co., Burbank
DELTA METHOD, AN EMPIRICAL DRUG BUIDUP
Richard C. Feagin and William D. Morrison Dec. 1978 177 p
(Contract NAS2-8612)
(NASA-CR-151971; LR-27976-Vol-1) Avail: NTIS
HC A09/MF A01 CSCL 01A

An empirical drug 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 processes of
preliminary design. F.O.S.

N79-18572*# 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
(Contract NAS2-2238)
(NASA-CR-158244) 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 at length are presented. Also included are
program input formats, outputs and listings. G.Y.

N79-20085*# Stanford Univ., Calif. Joint Inst. for Aeronautics
and Astronautics.
FLAP-LAG-TORSION FLUTTER ANALYSIS OF A CONSTANT
LIFE ROTOR
Indarjit Chopra Jan. 1979 42 p
(Grant NAG-2317)
(NASA-CR-152244, SU-1JIA-TR-17) 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
pitch-lag and pitch-flap coupling) on the blade dynamics are
examined. With a suitable combination of lag damper and
pitch-flap coupling, it is possible to design a constant lift rotor
blades 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
Original contains color illustrations
(Contract NAS2-10072)
HC A05/MF A01 CSCL 14B

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 those 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 and Application

Continues today, however, the increasing complexity of phenomena both natural and man-made. In engineering and economics, considerations required greater mathematical sophistication. 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, the theory, based on complex variable theory were developed and applied primarily to single input, single output systems represented by a rational function, called the transfer function. The theory of automorphic theory developed rapidly from the end of the war to the early fifties and much of its motivation and development followed from linear, constant-coefficient, differential equations, and their solutions, the theory of transfer functions. 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.


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 10:1). The approach is to increase computational efficiency by structuring the program to take advantage of new computer vector software and by developing new algorithms when vector software cannot efficiently be 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. G.Y.


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

An Analysis of Long and Medium-Haul Air Passenger Demand, Volume 1 Final Report

A basic model was developed which is a two equation pair economic system in which air passenger demand and airline level-of-service are the endogenous variables. The model aims to identify the relationship between each of these two variables and its determining factors and to identify the interrelationship of demand and level-of-service with each other. The selected variable for the measure of air passenger traffic activity in a given pair market is the number of passengers in a given time that originate in one region and fly to the other region for purposes other than to make a connection to a third region. For medium and long haul markets, the model seems to perform better for larger markets. This is due to a specification problem regarding the route structure variable. In larger markets, a greater percentage of nonlocal passengers are accounted for by this variable. Comparing the estimated fare elasticities of long and medium haul markets, it appears that air transportation demand is more price elastic in longer haul markets. Long haul markets demand will saturate with a fewer number of departures than will demand in medium haul markets.

An Analysis of Short Haul Air Passenger Demand, Volume 2 Final Report

Several demand models for short haul air travel are proposed and calibrated in 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 underly several demand generating phenomena and therefore must be considered very carefully to 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.
THE IMPACT OF CHANGING TECHNOLOGY ON THE DEMAND FOR AIR TRANSPORTATION Final Report
James T. Kransicker and Nawal K. Tanaja Jun 1978 27 p refs
(Contract NAS2-9472) (NASA-CR-152191) Avail: NTIS HC A03/MF A01 CSCL 01C

Demand models for air transportation that are sensitive to the impact of changing technology were developed. The models are responsive to potential changes in technology, and to changing economic, social, and political factors as well. In anticipation of the wide differences in the factors influencing the demand for long haul and short haul air travel, the models were designed to clearly distinguish among the unique features of these markets.
J.M.S.

IDENTIFICATION OF HIGH PAYOFF RESEARCH FOR MORE EFFICIENT APPLICATOR HELICOPTERS IN AGRICULTURE AND FORESTRY
Kenneth T. Waters May 1979 84 p refs
(Contract NAS2-10040) (NASA-CR-152258: D210-11193-1) Avail: NTIS HC A06/MF A01 CSCL 01C

The results of a study of the uses of helicopters in agriculture and forestry in the United States are discussed. Comparisons with agricultural airplanes are made in terms of costs of aerial application to the growers. An analysis of cost drivers and potential improvements to helicopters that will lower costs is presented. Future trends are discussed, and recommendations for research are outlined. Operational safety hazards and accident records are examined, and problem areas are identified. Areas where research and development are needed to provide opportunities for lowering costs while increasing productivity are analyzed.

Identification of High Payoff Research for More Efficient Applicator Helicopters in Agriculture and Forestry.

PROCEDURE FOR NOISE PREDICTION AND OPTIMIZATION OF ADVANCED TECHNOLOGY PROPELLERS
J. M. S. Spowage and Samuel Bernstein Apr. 1979 54 p refs

The sound field due to a propeller operating at supersonic tip speed in a uniform flow was investigated. Using the fact that the wave front in a uniform stream is a conical surface, the fundamental solution to the convected wave equation was easily obtained. The four-ac coefficients of the pressure signature were obtained by a far field approximation, and are expressed as an integral over the blade platform. It is shown that conical of silence exit and aft the propeller plane. The semiapex angles are known. These angles are independent of the individual Mach number of the flight Mach number and the rotation Mach number. The result is confirmed by the computation of the ray path of the emitted Mach waves. The Doppler amplification factor strengthens the signal behind the propeller while it weakens that upstream.
J.M.S.

THREAT AND MASS FLOW CHARACTERISTICS OF FOUR 38 INCH DIAMETER TIP TURBINE FAR THRUST VECTORING SYSTEMS IN AND OUT OF GROUND EFFECT

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 J36/T58 turboprop engines used in the large scale powered model were tested on an isolated basis over a range of ground heights from H/D of 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/T58 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 nine percent; (2) a change in nose fan exit hub shape from flat plate to hemispherical produces no significant difference in louvered 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/T58 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.
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. S.E.S.

N78-28374# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
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. S.E.S.

N78-27128# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
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. GRA

N78-28142# Rockwell International Corp., Columbus, Ohio.
The following test results are appended: (1) wind tunnel data, (2) static thrust stand data, and (3) fan calibration data. R.E.S.

N78-28984# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
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. GRA

N78-28141# Rockwell International Corp., Columbus, Ohio.
The characteristics were determined of a lift cruise fan V/STOL multi-mission configuration in the near proximity to the edge of a small flat surface representation of a ship deck. Tests were conducted at both static and forward speed test conditions. The model (0.12 scale) tested was a four fan configuration with modifications to represent a three fan configuration. Analysis of data showed that the deck edge effects were in general less critical in terms of differences from free air than a full deck (in ground effect) configuration. The only exception to this was when the aft edge of the deck was located under the center of gravity. This condition, representative of an approach from the rear, showed a significant lift loss. Induced moments were generally small compared to the single axis control power requirements, but will likely add to the pilot work load. R.E.S.

A six-degree-of-freedom variable response 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 sampling of simulated STOL transport configurations flown to touchdown out of 6 deg. 75 kt MLS approaches, usually with a sidestep maneuver are discussed.

N78-30136*# Rail Co., Baltimore, Md.
MAINTENANCE COST STUDY OF ROTARY WING AIRCRAFT, PHASE 2 Interim Report
Aug. 1978 34 p (Contract NAS2-8143) (NASA-CR-152391) 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 the 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.

N78-30146*# Analytical Methods, Inc., Bellevue, Wash.
UNSTEADY FLOW MODEL FOR CIRCULATION-CONTROL AIRFOILS

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 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 airfoil airloads program or the Theodorsen hard flat 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.

N78-30193*# Massachusetts Inst of Tech., Cambridge, Lab for Information and Decision Systems
VTOL CONTROLS FOR SHIPBOARD LANDING M.S. Thesis

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 wave 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 control effort 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.

N78-31195*# Lockheed-Georgia Co., Marietta
CORRELATION OF DATA RELATED TO SHOCK-INDUCED TRAILING-EDGE SEPARATION AND EXTRAPOLATION TO FLIGHT REYNOLDS NUMBER

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.

N78-31222*# Systems Technology Inc., Mountain View, Calif
A COMPILATION AND ANALYSIS OF HELICOPTER HANDLING QUALITIES DATA, VOLUME 2: DATA ANALYSIS

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, lateral and directional equations in such a way that key handling qualities features are examined directly.

N78-32219*# Lockheed-Georgia Co., Marietta
ESTIMATION OF TUNNEL BLOCKAGE FROM WALL PRESSURE SIGNATURES: A REVIEW AND DATA CORRELATION

A method is described for estimating low speed wind tunnel blockage, including model volume, bubble separation and viscous wake effects. A tunnelcraft ship, source/sink, blockage 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.

M.M.M.

AN ANALYSIS OF PROP-FAN/AIRFRAME AERODYNAMIC INTEGRATION Final Report
(Contract NAS2-9104) (NASA-CR-152186, D6-47113) Unclassified report
NOTICE: Available to U.S. Government Agencies and Their Contractors

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

Practical problems experienced by industry and user groups in predicting the cost, reliability, and maintainability of avionics for general air-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 Mary Chase Jul. 1978 25 p

At NASA Ames Research Center, a color television monitor is located at the windshield 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

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 downspur 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.


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.

A.R.H.

Conference sponsored by the American Helicopter Society and NASA, Moffett Field, Calif., U.S. Army Air Mobility Research and Development Laboratory, 1978. 211 p, 210.00. (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 multistabular spar composite main rotor blade, and a bearingless main rotor structural design approach using advanced composites.

A.R.H.

In order to achieve more accurate predicted applied loads and inertial reactions during structural design, a non-linear flight dynamics model for evaluation of helicopter handling qualities and control system design has been developed. The light maneuvers conducted consist of the design specification requirements for symmetrical pullup and pushover, rolling pullouts, vertical takeoff, yaw maneuvers both in sideward flight and at forward speed, gusts, and the effects of tail rotor loss. The program provides data on acceleration, rates, attitudes, and applied loads at all critical points within the maneuver. The correlation of the flight dynamics model with UH-60A Black Hawk flight test data for longitudinal, lateral, and rudder inputs is generally good.

P.T.H.


The paper presents a method for calculating the torsional stiffness of a bearingless rotor system flexure. Simple analyses of the torque required to produce axial deformation in a uniformly twisted blade flexure that is axially loaded by the blade centrifugal force are performed. From these analyses, the constants in the expression for torque to twist a bearingless rotor are derived. The paper presents data on acceleration, rates, attitudes, and applied loads at all critical points within the maneuver. The correlation of the flight dynamics model with UH-60A Black Hawk flight test data for longitudinal, lateral, and rudder inputs is generally good.

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 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 CH-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)


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 capability for continuous safe operation for at least 30 minutes after damage from any single hit by a 12.7mm armor-piercing incendiary (API) projectile and minimization of damage effects from an impact by a 23mm high explosive incendiary (HEI) missile. The paper describes how this and other design goals were attained in the main rotor blade. Damage tolerant design concepts incorporated in the main rotor blade include deep structural chord of 50.5% of blade chord; mid spar design with redundancy and crack retardant, orient failure in spanwise direction, and vent pressure in spanwise direction; use of AM355CRT stainless steel; fiberglass used as crack retardant; redundant root fittings and root doubler; and redundant tip design. P.T.H.


The paper describes the testing in fatigue at design loads and the static testing under limit loads of the composite hub being developed for the CH-54B helicopter. The tests were designed so as not to destroy the single specimen in existence. The tests demonstrated fatigue strength sufficient to survive 1 million cycles of the fatigue design loads. A residual strength after fatigue testing sufficient to support the most critical flight loads was demonstrated. Adequate stiffness for dynamic compatibility with the rotor controls and drive train was also demonstrated. Information on the importance of secondary bending in the plates was obtained. P.T.H.


The paper discusses briefly some of the uses to which composite materials have been put in helicopter rotor blades and main rotor hubs. The BO-105 rotor blade is an all-composite structure consisting of a C spar, a foam-stabilized trailing edge, and a glass-cloth skin. Fabrication is entirely by hand. The main rotor blade for the AS-350 has a mechanically wound spar and skin, and may be one of the least expensive blades in the world. The Starflex rotor hub employs 5-glass-reinforced epoxy and elastomeric bearings to achieve a drastic simplification of the rotor head. The hub skirt consists of a built-up laminate of glass cloth. This hub is only 60% as heavy as a comparable fully articulated hub and costs only one-fourth as much to produce. P.T.H.


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. fabrication 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. (Author)


A multitubular spar (MTS) composite main rotor blade was developed for the AH-1G helicopter in the original production metal geometry. To minimize material cost, the wet filament winding (WFW) technique was used. The spar structure is spread over the forward half of the chord to provide ballistic survivability against the 23mm HEI-T threat. The blade passed all fatigue, static, repairability, and ballistic tolerance tests. Radar absorbing material molded into the leading edge made a significant reduction in radar cross section. Flight tests exploring 80% of the AH-1G flight envelope were conducted. A comparison of blade loads in similar flight conditions shows that the MTS and the metal blade loads are similar. Cost analysis showed that the MTS blade could be produced and sold for a lower price than the metal blade. P.T.H.


The bearingless main rotor (BMR) system has no pitch, flap, or lead/lag bearings. The twin fiberglass channel beams are the principal structural members which accommodate pitch inputs and normal flap and lag motions, as well as provide for the retention of the blades against centrifugal force. The material is tailored to meet the frequency criteria and still have low stress levels by placing the peak flap, chord, and torsional stress levels at different spanwise locations. The paper describes methods of analyzing the loads on the system and also the results of testing the system for its load responses. This formed the basis for life calculations for the components. Verification of fatigue analysis is in progress. P.T.H.
The electron temperature is equal or lower by approximately determination. This report describes the evaluation technique and plasma with low electron density are investigated with the purpose of torr, and $T_2$ between 5500 and 9500 K. The electron temperature presents results for an argon plasma with pressure between 3 and 10 microwaves transmitted through a bounded shock-heated argon plasma. C. P. Schneider (Munich, Hochschule der Bundeswehr, University of Washington Press, 1978, p. 482-489. 7 refs. A79-15258 * Microwave diagnostic for the determination of the electron temperature of a low density shock-heated argon plasma. C. P. Schneider (München, Hochschule der Bundeswehr, Munich, West Germany) and R. J. Exberger (NASA, Ames Research Center, Moffett Field, Calif.). In: Conference on Decision and Control, and Symposium on Adaptive Processing, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La., December 7-9, 1977, Proceedings. Volume 1. (A79-14657 04-63) Piscataway, N.J., Institute of Electrical and Electronics Engineers, Inc., 1977, p. 241-246. 8 refs. A brief review of model-based techniques for the design of aircraft flight directors is undertaken. An analytical director design technique which utilizes an optimal control model of the human pilot is then discussed in more detail. The analytical and experimental results of three specific director design studies are discussed, all involving control of a light utility helicopter. Finally, a general design methodology is discussed which can aid in the specification of pilot-centered display requirements. (Author)

A79-14873 * Lie theoretic aspects of the Riccati equation. R. Hermann (Harvard University, Cambridge, Mass.) and C. Martin (NASA, Ames Research Center, Moffett Field, Calif.). In: Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La., December 7-9, 1977, Proceedings. Volume 1. (A79-14657 04-63) Piscataway, N.J., Institute of Electrical and Electronics Engineers, Inc., 1977, p. 265-270. 9 refs. Various features of the application of Lie theory to matrix Riccati equations, of basic importance in control and system theories, are discussed. Particular consideration is given to centralizer foliation, the Cartan decomposition, the matrix Riccati equations on systems Grassmanian, local analysis near a zero point of a vector field, linearization in homogeneous space, the tangent bundle in terms of partitioned matrices, and stability properties of fixed points of Riccati vector fields. B.J.

A79-15021 * Ultrasonic welding /solid state bonding/ of aircraft structure - Fact or fancy? J. Devine, G. K. Dingler (Summa Corp., Hughes Helicopters Div., Culver City, Calif.), and R. G. Vollmer (U.S. Army, Aviation Research and Development Command, Fort Eustis, Va.). In: Conference on Helicopter Structures Technology, Moffett Field, Calif., November 15-18, 1977, Proceedings. (A79-10003 01-05) Moffett Field, Calif., U.S. Army Air Mobility Research and Development Laboratory, 1978. 24 p. 8 refs. The paper describes the ultrasonic welding of an inner skin to an outer skin of a YAH-04 helicopter access door. It was found that the ultrasonically welded access door had superior strength, reduced weight, and reduced cost as compared with other joining techniques. (Author)

A79-14871 * Design and evaluation of flight directors for V/STOL aircraft. R. A. Hess (NASA, Ames Research Center, Moffett Field, Calif.). In: Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La., December 7-9, 1977, Proceedings. Volume 1. (A79-14657 04-63) Piscataway, N.J., Institute of Electrical and Electronics Engineers, Inc., 1977, p. 241-246. 8 refs. A brief review of model-based techniques for the design of aircraft flight directors is undertaken. An analytical director design technique which utilizes an optimal control model of the human pilot is then discussed in more detail. The analytical and experimental results of three specific director design studies are discussed, all involving control of a light utility helicopter. Finally, a general design methodology is discussed which can aid in the specification of pilot-centered display requirements. (Author)

A79-14973 * Microwave diagnostic for the determination of laser energy conversion. G. Lee (NASA, Ames Research Center, Moffett Field, Calif.). In: Radiation energy conversion in space: Conference, 3rd, Moffett Field, Calif., January 26-28, 1978, Technical Papers. (A79-15601 04-44) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 549-566. 33 refs. This paper presents a survey of the status of laser energy converters. Since the inception of these devices in the early 1970's, significant advances have been made in understanding the basic conversion processes. Numerous theoretical and experimental studies have indicated that laser energy can be converted at wavelengths from the ultraviolet to the far-infrared. These converters can be classified into five general categories: photovoltaic, thermoelectric, photodetectors, optical diode, and photochemical. The conversion can be directly into electricity (such as the photovoltaic, thermoelectric, and optical diode) or it can go through an intermediate stage of conversion to mechanical energy, as in the heat engines. The photochemical converters result in storable energy such as hydrogen. Projected conversion efficiencies range from about 30% for the photochemical to nearly 75% for the heat engines. (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 feedback 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 an optimal design augmentation system (CAS), with the 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/-regressing 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 hover. 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 effect 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)


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)

The paper briefly reviews the role of helicopter systems in the provision of airport access services and evaluates 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 judge the potential of integrating the air transportation service of multiple airports in a given urban region.


The paper presents the recent technological developments in the United States in the field of rotorcraft and powered-lift research, with primary emphasis on the compound helicopter and the augmentor thrust approach 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.


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.


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.


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 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.


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.

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)


A new optimization algorithm is presented. The method is based on sequential application of a second-order Taylor’s series approximation to the airfoil characteristics. Compared to previous methods, design efficiency improvements of more than a factor of 2 are demonstrated. If multiple optimizations are performed, the efficiency improvements are more dramatic due to the ability of the technique to utilize existing data. The method is demonstrated by application to subsonic and transonic airfoil design but is a general optimization technique and is not limited to a particular application or aerodynamic analysis. (Author)


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)


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 aft 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.


The reported investigation is concerned with an extension of a theory presented by Hawkin and Lowson (1974). The extension considers also forward flight. Attention is given to the retarded potential solution of the convected wave equation, the Fourier components of acoustic pressure, the zones of relative silence and Doppler amplification, and the asymptotic evaluation of a noise field for a large wave number. The discussed analysis provides the Fourier coefficients of the acoustic signature of a supersonic rotor in a uniform flow. The results are represented by an integral over the blade planform which must be evaluated numerically. The fast Fourier transform can be employed for the Fourier inversion. G.R.


Three-dimensional corrections to the nonlinear mixed flow
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.

F.G.M.

A79-23516 * #  Numerical simulation of steady supersonic
viscous flow. L. B. Schiff and J. L. Steiger (NASA, Ames Research
Center, Moffett Field, Calif.); American Institute of Aeronautics and
Astronautics, Aerospace Sciences Meeting, 17th, New Orleans, La.,
Jan. 15-17, 1979, Paper 79-0130. 20 p. 31 refs.

A noniterative, implicit, space-marching, finite-difference algo-
rithm 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.

A79-23526 * #  Computational optimization and wind tunnel
test of transonic wing designs. H. P. Haney, R. R. Johnson (Vought
Corp., Dallas, Texas), and R. M. Hicks (NASA, Ames Research Center,
Aerodynamics Research Branch, Moffett Field, Calif.); American
Institute of Aeronautics and Astronautics, Aerospace Sciences
12 p. 7 refs.

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 equa-
tion for subsonic 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.

A79-23575 * #  An experimental investigation of the flow field
of a rectangular wall jet. C. Horne and K. Karamcheti (Stanford
University, Stanford, Calif.); American Institute of Aeronautics and
Astronautics, Aerospace Sciences Meeting, 17th, New Orleans, La.,

The structure of a laminar, rectangular wall jet developing from
an initially parabolic velocity profile was investigated with measure-
ments 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 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
convection 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.

A79-24179 * #  Calculating hovering helicopter flight dynamics
with a circulation-controlled rotor. W. Johnson (NASA, Ames Re-
search Center; U.S. Army, Aeromechanics Laboratory, Moffett Field,
Calif.) and J. Chopra (NASA, Ames Research Center, Moffett Field,

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 flaps
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 blowing coefficient, which depends on the flaps
frequency and rotor lift, negative speed stability is produced and the
dynamic characteristics of the helicopter with a circulation-
controlled rotor are discussed. Probabilistic results of the blowing is a
reduction in the rotor speed stability derivative. Above a
critical level blowing coefficient, which depends on the flaps
frequency and rotor lift, negative speed stability is produced and the
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controlled rotor are discussed. Probabilistic results of the blowing is a
reduction in the rotor speed stability derivative. Above a

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 254-t-diameter three-bladed rotors compared with existing theoretical predictions which include wind-tunnel wall reflection. (Author)

A numerical optimization program using constraint approximations for preliminary sizing of wing structural design parameters to satisfy simultaneous strength and aeroelastic requirements is described. The effects of wing flexibility on loads and flutter are included. The iterative procedure approximates wing internal load distributions and flutter response in generating design constraints. Though a linear Taylor series approximation to the variation of flutter speed is made, constraints in general are formulated as nonlinear and solved in a minimum weight problem using a feasible directions search. The technique is demonstrated for the determination of the optimal ply orientations and for simultaneous sizing for strength and flutter with simple constraint approximations. (Author)
Twice during the spring of 1978, the two steel-plates '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-ber-ling mode and experienced stresses 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)


Relation 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 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 buffeting are described. It is shown that the dynamic pressure data on the tail surface at the specified flight conditions serve to determine the local 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 of flapping-feathering wind turbine blade under a gravity field and with shear flow. Lagrangian 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 of flapping-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 cone 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 bi-affine 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 K/s-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 K/s-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-16 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. 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 convectoring mono- 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 triagonal 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/propulsion system 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 limitations 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 SNO03 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. (Author)


This paper describes the design and performance of the Quiet Short-Heul Research Aircraft (QSRA) 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 seriously affected propulsion system performance, particularly engine acceleration characteristics, requiring an integration of BLC system and powerplant controls. Funding limitations for the QSRA Project prevented extensive full-scale testing and systems mockups, resulting in a high reliance on demonstral-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. (Author)


A frequency-domain stability criterion is presented, generalizing the well-known circle stability criterion to multiloop feedback systems having bounded nonlinearity, parameter variations, and/or frequency-dependent ignorance of component dynamics. Unlike previous generalizations, the theorem is not restricted to weakly-coupled, diagonally dominant or nearly normal systems. Potential applications include the analysis of feedback system stability and multiloop feedback system stability margins. (Author)


Scalar density fluctuations were measured nondiurnsively 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. 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. (Author)


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, 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 saving, even for the most difficult mix. Also, there is a fuel savings and reduced controller workload for the profile descent procedures. (Author)


Relativistic calculations of radiative transition rates to L-sub-shell vacancy states in selected atoms with Z in the 70-90 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. Relativity is found to affect the L-sub shell Auger widths by 10-25% and individual transition rates to certain 1-j configurations by as much as 40% at Z = 80. The widths of L sub i vacancy states and the L sub 2 Coster-Kronig yields 133 from these relativistic calculations are much better with experiment than earlier nonrelativistic theoretical values. (Author)


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 early capability of the program, the flow about a hypothetical lifting rotor blade having twist, airfoil thickness taper, and a 20 deg sweptback tip was analyzed at four different positions 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. (Author)

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.


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 data-linked 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.


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.


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.


The results of single-pilot instrument flight rules (SPIFR) experiments conducted on the NASA-Ames V/STOLAND simulator are presented. A number of 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 aid, 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.


Results of experimental studies on viscous cross-flow over circular cylinders for Reynolds numbers from 0.15 x 10 to 6 to 10.9 x 10 to the 6th at Mach numbers of less than 0.3 are presented and compared with previous experimental results. 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.


A linearized model is developed that includes the effects of viscous cross-flow and boundary-layer separation, which are evaluated for a supersonic-tip delta wing. A particular emphasis is placed on the variation of drag coefficients and pitching moment coefficients with angle of attack. Results are presented for free pitching motion of a delta wing of aspect ratio 3.4 with a root chord of 18 inches, and the effects of the root end plate and of tunnel blockage on drag measurements are also discussed.

V.T.

The results of an experimental investigation of shock-induced stall and leading-edge stall on a 64A010 airfoil section are presented. Advanced nonintrusive techniques - laser velocimetry, holographic interferometry, and buried-wire anemometry - were used in characterizing 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.


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.


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. Metal Auger splitting is found to contribute Auger electrons from certain transitions among several l-shells. 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 N4-L Auger transitions instead.


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. Internal and external nacelle pressures were measured. It was found that the cooling flow accounts for about 13% of the estimated airplane drag and about 42% of the cooling flow drag is associated with the internal flow. It was concluded that improvements could be made by relocating both the inlet and the outlet of the cooling air.


One possible technique for obtaining longitudinal control on a tilt-nacelle V/STOL aircraft is the use of a variable attitude vane assembly mounted in the propulsion system exhaust. Deflecting the vane produces large forces and moments without depending on forward speed of the aircraft. Tests are carried out in the Ames 40 by 80 ft wind tunnel on a large-scale tilt-nacelle V/STOL propulsion system with and without a variable attitude control vane assembly. Aerodynamic characteristics are analyzed in terms of nacelle aerodynamics, vane aerodynamics, and vane-induced effects on the nacelle aerodynamics. It is shown that the aerodynamic forces due to the nacelle without the vane can be a significant part of the total forces produced by the propulsion system. The control vane effectively produces large changes in pitching moment which are accompanied by significant changes in total lift and drag. The vane has a substantial effect on the propulsion system aerodynamics. Other pertinent results are also given.

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 dynamical system and the other region containing the 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 input-output relation of the 'feedback' element. Nonlinear system stability criteria of both the input-output type and the state-space (Liapunov) 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' (1966) coincidence 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 approximated 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 l/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 multidimensional 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 in the proof 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 ogive 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 variations in 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 ogive 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 rotor 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 tested in an omnirange 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 maneuverability 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 wind 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 goal is a 300-knot 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 VSTOL 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.

(Author)


Ardema (1974) has formally linearized the two-point boundary 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 math model and type of test data used with each of the identification methods. The use of fairly complete math 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.

(Author)


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 up 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

Robert H. Stoub, inventor (to NASA) Issued 30 Jan 1979

N79-25571** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AIRCRAFT ENGINE NOZZLE Patent Application

Norman E. Sorensen and John A. Latham, inventors (to NASA) Filed 23 Mar 1979. 14 p

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

Shmuel J. Merheb, 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. It 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.
A STRONAUTICS

FORMAL REPORTS

N78-10045# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif
DIRECT NUMERICAL SOLUTION OF THE TRANSONIC PERTURBATION INTEGRAL EQUATION FOR LIFTING AND NONLIFTING AIRFOILS
The linear transonic perturbation integral equation previously derived for nonlifting airfoils is formulated for lifting cases. The method of 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. Results of both lifting and nonlifting examples indicate that the method is satisfactory.

Author

N78-10189# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif
A TEMPERATURE DEPENDENT FATIGUE FAILURE CRITERION FOR GRAPHITE/EPOXY LAMINATES
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 both static strength and fatigue strength is observed with increasing temperature. This reduction appeared more severe in fatigue loading than in static tension 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.

Author

N78-10480# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif
NUMERICAL AERODYNAMIC SIMULATION FACILITY
Critical to the advancement of computational aerodynamics capability is the ability to simulate flows about three-dimensional configurations that contain both compressible and viscous effects including turbulence and flow separation at high Reynolds numbers. Analyses were conducted of two solution techniques for solving the Reynolds averaged Navier-Stokes equations describing the mean motion of a turbulent flow with certain terms involving the transport of turbulent momentum and energy modeled by auxiliary equations. The first solution technique is an implicit approximate factorization finite-difference scheme applied to three-dimensional flows that avoids the restrictive stability conditions when small grid spacing is used. The approximate factorization reduces the solution process to a sequence of three one-dimensional problems with easily inverted matrices. The second technique is a hybrid explicit/implicit finite-difference scheme which is also factored and applied to three-dimensional flows. Both methods are applicable to problems with highly distorted grids and a variety of boundary conditions and turbulence models.

G G

N78-10809# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif
AN EXTENSION OF A STABILITY TO ALTERNATING DIRECTION IMPLICIT METHODS
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 of 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.

S B S

N79-10810# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif
DESIGN OF TRANSONIC AIRFOIL SECTIONS USING A SIMILARITY THEORY
A study of the available methods for transonic airfoil and wing design indicates that the most powerful technique is the numerical optimization procedure. 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 of the similarity theory 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
N78-12029*† National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
CONFERENCE ON FIRE RESISTANT MATERIALS (FIREMEN): A COMPILATION OF PRESENTATIONS AND PAPERS
The proceedings of the NASA Fire Resistant Materials Engineering (FIREMEN) Program held at Ames Research Center on April, 13, 14, 1978 are reported. The purpose of the conference was to discuss the results of NASA in the field of aircraft fire safety and fire resistant materials. The program components include the following: (1) large-scale testing; (2) fire toxicology; (3) polymeric materials; and (4) bibliography related and, or generated from the program. For individual titles, see N78-12030 through N78-12047

N78-12040† National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
OVERVIEW OF FIREMEN PROGRAM AT Ames RESEARCH CENTER
Demetrius A. Kourides In its Conf. on Fire Resistant Mater. Oct. 1978 p 247-282 (For primary document see N78-12029 CSCL 13L
The Ames Firemen Program is described. The key elements of the program include: (1) the development and evaluation of aircraft fire resistant composite panels; (2) the thermochemical and flammability characterization of thermostet and thermoplastic resins; and (3) the evolution of fire resistant aircraft seat components. The first two elements are presented S.E.S.

N78-12223† National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
STRAIN RATE-TEMPERATURE BEHAVIOR OF HIGH DENSITY POLYETHYLENE IN COMPRESSION
The compressive strain rate/temperature behavior of highly linear high density polyethylene was analyzed in terms of the predictive relations developed for metals and other crystalline materials. For strains of 5 percent and above, the relationship between applied strain rate, dotted epsilon, and resulting flow stress, sigma, was found to be dotted epsilon exp times (Q sub f/ R1) k (sigma/sigma sub c) to the nth power; the left-hand side is the activation-energy-compensated strain rate, where Q sub f is activation energy for flow, R is gas constant, and T is temperature. k is a constant. n is temperature-independent stress exponent, and sigma/sigma sub c is structure-compensated stress. A master curve resulted from a logarithmic plot of activation-energy-compensated strain rate versus structure-compensated stress Author

N78-12383† National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
ON THE MEASUREMENT OF TURBULENT FLUCTUATIONS IN HIGH-SPEED FLOWS USING HOT WIRES AND HOT FILMS
A hot wire has a limited life in high speed wind tunnel flows because it is typically subjected to large dynamic loads. As a consequence, hot films and modified hot wires are frequently used for turbulence measurements in such 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

N78-13473† San Jose State Coll. Foundation, Calif. Dept. of Geology.
The feasibility of using penetrators in earth applications is examined. Penetrator applications in exploration for mineral resources only is summarized. Instead, the feasibility for using penetrators is described. Portions of this report are incorporated into a more extensive report examining other penetrator applications in exploration for fossil fuels, geothermal resources, and in environmental and engineering problems, which is to be published as a NASA technical publication. G.Y.

N79-14790† National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
A SIMULATOR STUDY OF THE INTERACTION OF PILOT WORKLOAD WITH ERRORS, VIGILANCE, AND DECISIONS
A full mission simulation of a civil air transport scenario that had two levels of workload was used to observe the actions of the crews and the basic aircraft parameters and to record heart rates. The results showed that the number of errors was very variable among crews but the mean increased in the higher workload case. The increase in errors was not related to rise in heart rate but was associated with vigilance times as well as the days since the last flight. The recorded data also made it possible to investigate decision time and decision order. These also varied among crews and seemed related to the ability of captains to manage the resources available to them on the flight deck. G.G.

N79-15086† National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
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

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NA87-15973# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

FLASH-FIRE PROPENSITY AND HEAT-RELEASE RATE STUDIES OF IMPROVED FIRE RESISTANT MATERIALS
Larry L. Fawell Dec. 1978 48 p

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

NA87-15989# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

VISUALLY INDUCED MOTION IN FLIGHT SIMULATION
Lawrence R. Young In AGARD Piloted Aircraft Environ.
Simulation Tech. Oct. 1978 8 p refs (For primary document see NA87-15973 07-09)
(Grant NsG-2236. Contract F36651-76-C-0039)
Avail: NTIS HC A14/MF A01 CSCL 01E

Visually induced yaw (circulation) resulting from a moving, wide field presentation, and its interaction with vestibular v.v cues generated by base motion is discussed. A model is presented for the interaction between visual and motion cues in which the emission energy influences the ratio of the velocity at the 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 (linearvection) and interaction with m.m 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

NA87-16483# 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
Tatsuo Shimazaki and Inland C. Helmsia (Informatics, Inc., Palo Alto, Calif.) Jan 1979 34 p refs
(NASA-TP-1398. A-7557) Avail: NTIS HC A04/MF A01 CSCL 04B

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 the heating calculations in the third dimensional global circulation models below 80 km. Applying the formula to the distributions of the absorber gases and uncertainties in the O3 distribution above approximately 50 km and the H2O distribution below approximately 20 km may seriously affect the global distributions of the heating rate in these regions.

G.G

NA87-16709# National Aeronautics and Space Administration. Ames Research Center, Moffett Field. Calif.

A CRITICAL REVIEW OF THE LIFE SCIENCES PROJECT MANAGEMENT AT AMES RESEARCH CENTER FOR THE SPACELAB MISSION DEVELOPMENT TEST 3
Robert Helmus (Texas Univ. Austin), John Wilhelm (Texas Univ. Austin), Treve A. Tanner (California State Univ. Hayward), Joan E. Sieber (Texas Univ. Austin), and Susan Burgenbauch Jan 1979 60 p refs
(Grant NsG-2065. NCA-2-DR290-705)
(NASA-TP-1364. A-7536) Avail: NTIS HC A04/MF A01 CSCL 05A

A management study was initiated by ARC (Ames Research Center) to specify Spacelab Mission Development Test 3 activities and problems. This report documents the problems encountered and provides conclusions and recommendations to project management for current and future ARC life sciences projects. An executive summary of the conclusions and recommendations is provided. The report also addresses broader issues relevant to the conduct of future scientific missions under the constraints imposed by the space environment.

G.Y.

NA87-16790# National Aeronautics and Space Administration. Ames Research Center, Moffett Field. Calif.

ORIGIN AND EVOLUTION OF THE SATURN SYSTEM: OBSERVATIONAL CONSEQUENCES
James B. Pollack in JPL The Saturn System Dec. 1978 p 9-30 refs (For primary document see NA87-16758 07-91)
Avail: NTIS HC A18/MF A01 CSCL 03B

A number of important cosmogenic questions concerning the Saturn system can be addressed with a Saturn orbiter-dual-probe spacecraft mission. These questions include: the origin of the Saturn system; the source of Saturn's excess luminosity; the mechanism by which the irregular satellites were captured; the influence of Saturn's early luminosity on the composition of its regular satellites; and the origin of the rings. The first two topics can be studied by measurements made from an entry probe into Saturn's atmosphere, while the remaining issues can be investigated by measurements conducted from an orbiter. Background information is provided on these five questions describing the critical experiments needed to help resolve them.

G.G.

NA87-16768# 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 p 149-160 refs (For primary document see NA87-16758 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 aerosols 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 ni 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

NA87-16780# 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 NA87-16758 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-peculiar technology for probe exploration of the Saturnian system.

G.G.

NA87-16800# 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 NASA TP 1369 A 76421 Avail NTIS HC A02/MF A01
temperature thermal diodes N79 19267 *
conductance which results in a greater overall evaporator
temperature range 170 K to 220 K Results show that the
systems are described Two diode types liquid trap and
and thermal models were constructed to predict their behavior
in the reverse mode The diode which are of similar sue and
show the susceptibility of the diodes to recovery to forward mode
also included are data which
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.
S E S

EFFECT OF MOISTURE ON THE FATIGUE BEHA-VIOR OF
GRAPHITE/EPOXY COMPOSITE LAMINATES
S V Ramani (Virginia Polytechnic Inst and State Univ.,
Blacksburg) and H G Nelson Jan 1979 49 p refs
(NASA-TM-78548; A 7669) Avail NTIS HC A03/MF A01
CSSL 11D
The form of the moisture distribution in the specimen gradient and flat
tests are considered to evaluate 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

TIME-DEPENDENT LOCAL DENSITY MEASUREMENTS IN
UNSTEADY FLOWS
21 p refs
(NASA-TM-78555; A 7720) Avail NTIS HC A02/MF A01
CSSL 148
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 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 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.


discussed and possible applications for the 1980 and 1985 to
three dimensional time averaged Navier-Stokes equation is
optimization are presented A

ewer models and new computer codes are 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 flow-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.

N79-16916# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.

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

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

N79-18948# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif.

SOME RECENT PROGRESS IN TRANSONIC FLOW
COMPUTATION
Computational Fluid Dyn. Vol. 1 1976 122 p refs (For primary
document see N79-18943 10-02)
Avail. NTIS HC A18/MF A01 CSSL10A
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 constriction associated with small
disturbance theory. Governing equations are the practical
coordinate system using 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

TRANSIENT SHUTDOWN ANALYSIS OF LOW-
TEMPERATURE THERMAL DIODES
Richard J Williams Mar 1979 21 p refs
(NASA-TM-1368; A 7842) Avail NTIS HC A02/MF A01
CSSL 20D
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 shut
down from the forward mode (8 mm as opposed to 10 mm).
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

STABILITY AND PROSPECTS OF COMPUTATIONAL FLUID
DYNAMICS
Dean R Chapman In Von Karman Inst for Fluid Dyn.
Computational Fluid Dyn. Vol. 2 1976 36 p (For primary
document see N79-18948 10-02)
Avail. NTIS HC A18/MF A01 CSSL10A
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. This 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

OUTER PLANETS PROBE TESTING
J A Emmitt and P J Smith (McDonnell Douglas Aerospace Co.
St. Louis, Mo.) J M Grote (McDonnell Douglas Aerospace 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 N79-19013 10-12)

41
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 (SS) flights in the stratosphere; and, large number 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 SSTs are unlikely to upset the stratospheric aerosol layer enough to significantly impact climate.

J. M. S.

N79-20808$^f$ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DETERMINATION OF THE TELLURIC WATER VAPOR ABOSORPTION CORRECTION FOR ASTRONOMICAL DATA OBTAINED FROM THE KUIPER AIRBORNE OBSERVATORY

E. F. Erickson, J. P. Simpson, P. M. Kuhn (NOAA, Boulder, Colo.), and L. P. Stearns (NOAA, Boulder, Colo.) Apr. 1979 13 p refs (NASA-TM-78582; A-7805) Avail. NTIS HC A02/MF A01 CSCL 03A

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.

N79-20807$^s$ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

APPLICATION OF A COUPLED AEROSOL - RADIATION TRANSFER MODEL TO CLIMATIC 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 (SS) flights in the stratosphere; and, large number 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 SSTs are unlikely to upset the stratospheric aerosol layer enough to significantly impact climate.

J. M. S.

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investigated. Turbulence quantities, as well as mean velocities, were measured between 3 and 23 diameters 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 oscillations 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

N79-21705+ Hughes Aircraft Co., Culver City, Calif.
DEPLOYMENT MECHANISMS ON PIONEER VENUS PROBES
Avail. NTIS HC A11/MF A01 CSCL 20K
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 segments for good deployment torque, and 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.

MAGNETOMETER DEPLOYMENT MECHANISM FOR PIONEER VENUS
Avail. NTIS HC A11/MF A01 CSCL 20K
A deployable boom mechanism was developed to deploy magnetometers from the Pioneer Venus orbiter spinning 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 orbital insertion force while extended. The detailed design is described, along with the test methods developed for qualification in a one-g field.

Author

THE NASA-AMES RESEARCH CENTER STRATOSPHERIC AEROSOL MODEL. 2. SENSITIVITY STUDIES AND COMPUTATIONAL ANALOGS
A 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 predetermining or biasing the model predictions. The simulation, which extends from the surface to an altitude of 58 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 0.01 and 0.02 microns.

Author

THE NASA-AMES RESEARCH CENTER STRATOSPHERIC AEROSOL MODEL. 1. PHYSICAL PROCESSES AND COMPUTATIONAL ANALOGS
A 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 predetermining or biasing the model predictions. The simulation, which extends from the surface to an altitude of 58 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 0.01 and 0.02 microns.

Author

N79-21982† 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 determined from a synthetic spectrum analysis. New results are reported for the Bilik-Renay radiation. Swih Deslandres-d'AZamba, Fox-Herzberg, Mulliken, and Freyemark systems.

Author

VISCOSITY AND THERMAL CONDUCTIVITY OF MODEL JUPITER ATMOSPHERES
C. Frederick Hansen Apr. 1979 28 pages ref... (NASA-TM-78558: A-7775) Avail. NTIS HC A03/MF A01 CSCL 04A
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

FIELD MEASUREMENTS OF PENETRATOR SEISMIC COUPLING IN SEDIMENTARY AND VOLCANIC ROCKS
Yoos Naitamura (Texas Univ. Galveston). Mary V. Latham (Texas Univ. Galveston). Cliff Frohlich (Texas Univ. Galveston). Maxwell B. Blanchard (Johnson Space Center, Houston, Tex.), and James...
Field experiments were conducted to determine how well a seismometer installed using a penetrator would be coupled to the ground. A dry-lake bed and a lava bed were chosen as test sites to represent geological environments of two widely different material properties. At each site, two half-scale penetrators were fired into the ground, a three-component geophone assembly was positioned near the aft end of each penetrator, and dummy penetrators were at various distances to generate seismic signals. These signals were detected by the penetrator-mounted geophone assembly and by a reference geophone assembly buried or anchored to surface rock and 1 m from the penetrator. The recorded signals were digitized, and cross-spectral analyses were performed to compare the 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 seismometers installed by conventional methods for the frequency range of interest in earthquake seismology. A.R.H.

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. Wurtele (Battelle Columbus Lab.), J. G. Stephan (Battelle Columbus Labs.), T. F. Ebbert (Battelle Columbus Labs.), H. E. Smail (Battelle Columbus Labs.), J. McKeon (Bendix Aerospace Systems Div.), and N. Schmidt, Principal Investigators (Bendix Aerospace Systems Div.). 5 Feb. 1977 430 p. refs. Original contains color imagery. 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 068

The author has identified the following significant results. A uniform current 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 trends, and resource inventory. Deslandres d'Azambuja, Fox Herzberg, Mulliken, and Fryerwick systems. Author.
N79-23909‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN IMPLICIT ALGORITHM FOR THE CONSERVATIVE, TRANSONIC FULL-POTENTIAL EQUATION WITH EFFECTIVE ROTATED DIFFERENCING
Terry L. Holst and John Albert (Santa Clara Univ., Calif.) Apr. 1979 37 p refs (Contract NAS8-0885-003) (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.

N79-25068‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED RADIATION FROM THE SPACE SHUTTLE CONTAMINANT ENVIRONMENT
c11 J. P. Simpson and F. C. Witteborn In AFML Proc. of the USAF/NASA Intern. Spacecraft Contamination Conf. 1979 p 176-207 refs (For primary document see N79-25048 16-12) (Contract NAS2-69363) Avail. NTIS HC A99/MF A01 CSCL 228

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 spilled by micrometeoroids.

J.M.S.

N79-25342‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VORTEX SIMULATION OF THREE-DIMENSIONAL SPOT-LIKE DISTURBANCES IN A LAMINAR BOUNDARY LAYER

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

Intr. Berkeley), and R. Weiss (MIT) Jun. 1979 120 p refs (NASA-TM-78598; A-7874) Avail. NTIS HC A08/MF A01 CSCL 03A

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 described, 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

N79-26716‡ 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 213 km of ozone, temperature, pressure, water vapor, aerosols, fluorocarbons, methane, nitrous oxide, nitric oxide, and nitric acid. Balloon sondes flew four times per day providing 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.

Author

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 Exp. 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 ozonesonde 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 employs 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
SAS 2 system on July 26, 27, 30 and 31, 1977. Generally, 30-min measurements were made at each of six altitudes ranging from 48,000 ft to 70,000 ft, and separated by 8,000 ft intervals.

CONVERGENCE ZONE EXPERIMENT on board a Learjet aircraft were also carried out cryogenically collecting samples at 13.7 to 21.3 km. 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.

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 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.

The 1977 Intertropical Convergence Zone Experiment Jun 1979 p 51-60 ref (For primary document see N79-26715 17-47) Avail NTIS HC A21/MF A01 CSCL 04B

To investigate whether injection sources of the stratospheric aerosol layer could be detected in the tropical 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 reenters the troposphere. The methods used in the investigations and the results obtained from the analyses are described.

Airborne Pressure and Temperature Measurements During the 1977 Intertropical Convergence Zone Experiment

Robert M. Almerrin

In its The 1977 Intertropical Convergence Zone Exp. Jun. 1979 p 153-164 ref (For primary document see N79-26715 17-47) Avail NTIS HC A21/MF A01 CSCL 04B

During the 1977 ITCZ (Intertropical Convergence Zone) experiment in Panama two aircraft and numerous balloon-borne radiosonde instruments were equipped to measure pressure and temperature. The experiment was a coordinated effort to evaluate the meteorological conditions that prevailed from July 17 through 31, 1977. A critical analysis of the data collected on one of the aircraft (the Learjet) operating at altitudes to 13,000 m for about 2 hr each day during most days of the experiment is presented. The discussion includes a comparison of the vertical profiles of potential temperature obtained from the Learjet with those obtained from balloons launched at Ft. Sherman Time histories of pressure, temperature, and potential temperature as observed from the Learjet are also presented.
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


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 98 deg. Author

N79-31166*‡ National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONFERENCE ON FIRE RESISTANT MATERIALS: A COMPILATION OF PRESENTATIONS AND PAPERS


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 MATRIXES 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-78910; 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 resins 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


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 0.1; are 2 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. 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: ILLIAC 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 A02/MF A01 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. Willia.*ns (NASA Johnson Space Center), David S. McKay (NASA Johnson Space Center), and David W. Aldridge (RO Amex Corp.) in Space Resources and Space Settlements 1979 p 275-288 (refs (For primary document see N79-32225 23-12) Avail NTIS MF A01 SOD HC CSCL 038

The beneficiation of lunar plagioclase 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 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 (fiberglass 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 1.5 and 3.5 W/cm². Choices of contact and silicon adhesives for bonding 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

N79-23433* 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 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 in 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* United Systems, Inc. Irvine, Calif.


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 hexachlorocyclotriphosphazene polymerization, (3) the nature of the nonreactive substituents, and (4) the mode of introduction of the hydroxyl entity. The specific approaches taken are based on the selection made, and the results are discussed.

Author

A.R.H.
AIRCRAFT PASSENGER SEAT MATERIALS. PHASE 2 FMtd
STUDY TO DEVELOP IMPROVED FIRE RESISTANT

that the fire was contained within the lavatory during the

BODY AIRCRAFT LAVATORY MODULE Finial Report

MENTS WITH IMPROVED FIRE RESISTANCE CHARACTER

criesectenstics Additionally, a source fire consisting ul one and

combinations representative of cushion configurations. Tests were

based upon materials data and general seat dasgn cmens G

developed Finally L preliminary Nat specification was written

u. •-haff pounds of rowspaper in

ASSESSMENT STUDY OF INFRARED DETECTOR ARRAYS

N79-10378*# Nalesen Engineering and Research, Inc., Mountain
View, Calif.

METHODS OF SEPARATION OF VARIABLES IN TURBU-
LENCES THEORY Final Report
Shunichi Tsuge Oct. 1978 66 p refs
(Contract NAS2-9535) (NASA-CR-3064; NEAR-TR-137)
HC A04/MA A01 CSCL 20D
Two schemes of closing turbulent moment equations are

proposed both of which make double correlation equations

separated into single-point equations. The first is based on

neglected triple correlation, leading to an equation differing from

small perturbed gadynamic equations where the separation

constant appears as the frequency. Grid-produced turbulence is

described in this light as time-independent, cylindrically-isotropic

turbulence. Application to wall turbulence guided by a new

asymptotic method for the Orr-Sommerfeld equation reveals a

neutrally stable mode of essentially three dimensional nature.

The second closure scheme is based on an assumption of identity

of the separated variables through which triple and quadruple

correlations are formed. The resulting equation addc., to its

equivalent of the first scheme, an integral of nonlinear convective

in the frequency describing a role due to triple correlation of

direct energy-cascading. Author


ASSSESSMENT STUDY OF INFRARED DETECTOR ARRAYS
FOR LOW-BACKGROUND ASTRONOMICAL RESEARCH
Final Technical Report
K J. Ando Aug. 1978 98 p refs
(Contract NAS2-9868) (NASA-CR-152169) Avail NTIS HC A05/MA A01 CSCL
03A
The current state-of-the-art of infrared detector arrays

employing charged coupled devices (CCD) or charge injection
devices (CID) readout are assessed. The applicability, limitations
and potentials of such arrays under the low-background
astronomical observing conditions of interest for SRIFT (Shuttle
Infrared Telescope Facility) are determined. The following are

reviewed: (1) monolithic extrinsic arrays; (2) monolithic intrinsic
arrays; (3) charge injection devices; and (4) hybrid arrays. G.Y.


STUDY TO DEVELOP IMPROVED FIRE RESISTANT
AIRCRAFT PASSENGER SEAT MATERIALS, PHASE 2 Final
Fred E. Duskin, William H. Shook, Edward L. Trabold, and Howard
H. Spieth [1978] 379 p refs
(Contract NAS2-93371) (NASA-CR-152184) Avail NTIS HC A017/MF A01 CSCL
01C Fire tests are reported of improved materials in multilayered
combinations representative of cushion configurations. Tests were
conducted to determine their thermal, smoke, and fire resistance
characteristics. Additionally, a source fire consisting of one and
0.25-inch half pounds of newspaper in a tented configuration was
deployed. Finally, a preliminary seat specification was written
based upon materials data and general seat design criteria. G.G.

DEVELOPMENT OF AIRCRAFT LAVATORY COMPART-
MENTS WITH IMPROVED FIRE RESISTANCE CHARACTER-
ISTICS, PHASE 1: FIRE containment Test of A Wide
BODY AIRCRAFT LAVATORY MODULE Final Report
R A. Anderson, D B. Arnold, G A Johnson, and T A. Tustin
Jul. 1978 84 p Refer to publication
(Contract NAS2-8700) (NASA-CR-152074; DE-44885)
HC A05/MF A01 CSCL 11G
A test was conducted to evaluate the fire containment
characteristics of a Boeing 747 lavatory module. Results showed
that the fire was contained within the lavatory during the
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

N79-12772*# Illinois Univ. at Urbana-Champaign, Urbana.
Coordinated Science Lab.

ADAPTIVE ALLOCATION OF DECISION MAKING RESON-
SIBILITY BETWEEN HUMAN AND COMPUTER IN MULTI-
TASK SITUATIONS Ph.D. Thesis
Yee-yeen Chu Sep. 1978 150 p refs
(Grant NsG-2219) (NASA-CR-157937; T-66) Avail NTIS HC A07/MF A01 CSCL
09B
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.

N79-14997*# Arizona Univ., Tucson. Engineering Experiment
Station.

A NEW METHOD FOR DESIGNING SHOCK-FREE TRANS-
SONIC CONFIGURATIONS
1978 35 p refs Presented at the AIAA 11th Fluid and
(Grant NsG-2112; Contract N00014-78-C-0182; Grant
AF-AFOSR-2954-78) (NASA-CR-158063; Paper-78-114; TEd-78-04) Avail NTIS
HC A03/MF A01 CSCL 01A
A method for the design of shock free supercritical airfoils,
wings, and three dimensional configurations is described. Results
illustrating the procedure in two and three dimensions are given.
They include modifications to part of the upper surface of an
NACA 64A410 airfoil that will maintain shock free flow over a
range of Mach numbers for a fixed lift coefficient, and "ne
modifications required on part of the upper surface of a wing with an NACA 64A410 root section to achieve a shock free flow. While the results are given for inviscid flow, the procedures can be employed iteratively with boundary layer calculation in order to achieve shock free viscous designs. With a shock free pressure field the boundary layer calculation will be reliable and not complicated by the difficulties of shock wave boundary layer interaction. Author

FIELD MEASUREMENT OF PENETRATOR SEISMIC
COUPLING IN SEDIMENTS AND VOLCANIC ROCKS
Yasuo Nakamura, Gary V. Latham, and Cliff Frolich Jan.
1979 82 p refs (Grant NsG-2310) (NASA-CR-158081; Contrib-316) Avail NTIS
HC A04/MF A01 CSCL 08G
Field experiments were conducted to determine experimentally
now well a seismometer installed using a penetrator would be
coupled to the ground. A dry lake bed and a lava bed were
chosen as test sites to represent geological environments of
two widely different material properties. At each site, two
half-scale penetrators were fired into the ground, a three-
component geophone assembly was mounted to the aft end of
each penetrator, and dummy penetrators were fired at various
distances to generate seismic signals. The recorded signals were
digitized, and cross spectral analyees were performed to compare
the observed signals in terms of power spectral density ratio,
cohereance 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, although some minor differences were observed at
frequencies near the upper limit of the frequency band. Author
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 this analysis. Estimates of $K_{ij}$ are based on the tentative assumption that the diffusivity is proportional to the slope of the isentropic surfaces.

**N79-23068**
Martin Marietta Corp., Denver, Colo.
**STUDY OF ENTRY AND LANDING PROBES FOR EXPLORATION OF TITAN**
Final Report
31 Mar. 1979 213 p
(Contract NASA-9898)
(NASA-CR-152275; MCR-79-512) Avail. NTIS HC A10/MF A01 CSCL 038
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.

**N79-24298**
Grumman Aerospace Corp., Bethpage, N.Y.
**DESIGN, FABRICATION AND TEST OF A HYDROGEN HEAT PIPE**
Final Report
J. Allen Feb. 1979 76 p refs
(Contract NASA-9291) Avail. NTIS HC A05/MF A01 CSCL 200
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 5063-T6 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 the static wicking height increased markedly to 4.5 cm. The heat pipe became operational between 20 and 30 K after a time lag of 0.1 s 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. (2) Static wicking height of 1.42 cm, and (3) overall heat pipe conductance of 1.7 watts/deg C.

**N79-28008**
Control Data Corp., St. Paul, Minn.
**FEASIBILITY STUDY FOR A NUMERICAL AERODYNAMIC SIMULATION FACILITY: SUMMARY**
Final Report
4 Vol
(Contract NASA-9898)
(NASA-CR-152288) Avail. NTIS HC A02/MF A01 CSCL 148
A Numerical Aerodynamic Simulation Facility (NASF) 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 economies in aerodynamic and aircraft body design. A model for a NASF/FMP (Flow Model Processor) ensemble using a possible approach to meeting NASF goals is presented. The computer hardware and software are presented, along with the engine design and performance analysis and evaluation.

**N79-28009**
Control Data Corp., St. Paul, Minn.
**FEASIBILITY STUDY FOR A NUMERICAL AERODYNAMIC SIMULATION FACILITY: VOLUME 2: HARDWARE SPECIFICATIONS/DESCRIPTIONS**
Final Report
(Contract NASA-9898)
(NASA-CR-152288) Avail. NTIS HC A20/MF A01 CSCL 148
An FMP (Flow Model Processor) was designed for use in the Numerical Aerodynamic Simulation Facility (NASF). The NASF 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.

**N79-28071**
Burroughs Corp., Poohl, Pa.
**NUMERICAL AERODYNAMIC SIMULATION FACILITY FEASIBILITY STUDY, EXECUTIVE SUMMARY**
May 1979 24 p refs
(Contract NASA-9897)
(NASA-CR-152284) Avail. NTIS HC A02/MF A01 CSCL 148
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 thoroughness 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.

(NASA-CR-152285) Avail NTIS HC A99/MA F01 CSCL 148

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 thoroughness 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, software, user language and fault tolerance. R.E.S.

N79-27044*# Cornell Univ., Ithaca, N.Y. Dept. of Astronomy
Martin Harwit Jul 1979 7 p refs (Grant NaG-2282)
(NASA-CR-158751) Avail NTIS HC A02/MA F01 CSCL 133

Because observations of the Kleinmann-Low region of the Orion Nebula reveal significant polarization in the wavelength range from 13 to 15 micron, 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 Kupfer Airborne Observatory's 90 cm telescope. About two hours of data were obtained on the Orion Nebula on each of two flights. More careful calibration on Jupiter (assumed to be unpolarized) was 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.

N79-27946*# Rochester Univ., N.Y. Dept of Chemistry
SEMICLASSICAL THEORY OF ELECTRONICALLY NONADIABATIC TRANSITIONS IN MOLECULAR COLLISION PROCESSES
(Grant NaG-2198, Contract F48620-78-C-0006, Grant NSF CHE-77-27826)
(NASA-CR-158776) Avail NTIS HC A05/MA F01 CSCL 02C

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 time domain. The relevant concepts of molecular scattering theory and related dynamical models are described and the formalism is developed and illustrated with simple examples - 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.
CRYOGENIC THERMAL DIODE HEAT PIPES Final Report J Alario Feb 1979 59 p refs (Contract NAS2-10010)
(NASA-CR-152268) Avail NTIS HC A04/MA F01 CSCL 20D

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 diodes. 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
Donno Hankins, Principal Investigator 31 Dec. 1978 112 p refs (Original contains imagery) Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198

There are no authors identified significant results in this report.

N79-28710*# United Technologies Research Center, East Hartford, Conn
SOLAR SUSTAINED PLASMA/ABSORBER CONCEPTUAL DESIGN Final Report, 1 Aug 1978-28 Feb. 1979
Richard J. Rodgers, Nicholas L. Krascella, and John S. Kendall Feb 1979 61 p refs (Contract NAS2-10010)
(NASA-CR-152304, R78-914392) Avail NTIS HC A04/MA F01 CSCL 10A

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

52
**N79-28143**

*Flow Research, Inc., Kent, Wash.*

**THE DIRECT NUMERICAL SIMULATIONS OF THE TURBULENT WAKES OF AXIASSYMMETRIC BODIES**

Interim Report


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, axiassymetric 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


A highly reflective hypervaporized (\( \sim 25 \) ppm ion impurities) slip cast fused silica heat shield 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, stress analysis, and sub-scale fabrication. Successful fabrication of a one-half scale Saturn probe (shape and size) 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 (1.5-2.1) using a factor of safety of 1.25. An alternate hypervaporized material formulation to increase the strength and toughness for a greater safety margin was evaluated. The alternate material incorporates short hypervaporized 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 reflectance.

A. W. H.

**N79-31364**

*Boeing Commercial Airplane Co., Seattle, Wash.*

**DEVELOPMENT OF AIRCRAFT LAVATORY COMPARTMENTS WITH IMPROVED FIRE RESISTANCE CHARACTERISTICS. PHASE 2: SANDWICH PANEL RESIN SYSTEM DEVELOPMENT.**

Final Report


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 (F&ST) characteristics superior to the existing epoxy resin. Candidate resins studied were phenolic, polyimide, and bismaleimide. Based on the results of a series of F&ST tests 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.

A. R. H.

**N79-33121**

*Stanford Univ., Calif.*

Guidance and Control Lab.

**CONTROL SYSTEM DESIGNS FOR THE SHUTTLE INFRARED TELESCOPE FACILITY**


The stringent pointing and stability requirements of the Shuttle Infrared and Telescope Facility (SIRTF) are stressed as well as the demands that infrared astronomy and the SIRTF in particular place on the design of the pointing system.

M. M. M.

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### JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

**A79-10162**


A system of orbiting space reflectors is described, analyzed, and shown to economically provide nearly continuous insolation 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 sq km area are shown to be optimum and can be made at under 10 mg sq m 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 insolation as a function of orbital parameters, time, and site location. Various applications (agricultural, solar-electric production, weather enhancement, etc.) are described.

**A79-10589**


A one-tenth scale model of the Shuttle Infrared Telescope Facility (SIRTF) 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(+), O2(+), 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 in O2 N2, and H2O at the primary optics of the SIRTF can be obtained using 20 K helium with a pressure of .00001 torr and a flow rate of less than 0.1 g/s.

**A79-10624**


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.

(Author)
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The Pioneer Venus spacecraft 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 its characteristics directly to earth while descending to the surface. The development of this spacecraft required the solution of many difficult and unique technical problems.


The survey needs of the U.S. Department of Agriculture are immense, ranging from individual crop coverage at specific intervals to general land use classification. The aggregate of all desirable resolutions and sensor types applicable to airborne platforms yields an annual survey coverage rate equivalent to about 6 times the U.S. land area. An intermediate annual survey level equal to the U.S. area can meet all currently perceived crop survey needs and provide sample imagery over many other resource areas. This decreased survey level can be accomplished with one or two high altitude aircraft or medium altitude aircraft. Survey costs range from about 25 cents to several dollars per square nautical mile depending primarily on resolution requirements and the aircraft used. (Author)


Simultaneous sets of interplanetary and planetary data obtained by Pioneer 10 and Pioneer 11 are compared with a view toward identifying major changes in the solar wind and their possible influence on the Jovian magnetosphere. The results are discussed relative to variations in magnetopause location, pressure balance at the magnetopause, acceleration of energetic trapped radiation, plasma density from the response time of the Jovian magnetosphere, and the time constants of magnetospheric circuit models. A major finding is that three out of four cases in which the Pioneers reentered the magnetosphere are the result of time variations associated with changing interplanetary conditions. The compressibility of the Jovian magnetosphere is enhanced because the field inside the magnetopause is not the planetary field but is primarily caused by currents inside the magnetosphere, presumably the equatorial current sheet.


Analysis of vector helium magnetometer measurements during the Pioneer 10 outbound pass through the Jovian magnetosphere reveals that the average location of the near-equatorial current sheet is a surface whose shape is determined by the velocity at which the magnetopause is accelerated by a rotating tilted dipole present to large radial distances. A model is presented which is a surface encircling the planet and rotating rigidly with it. Based on a linear fit to the times of the current sheet crossings, a formula is derived for the surface representing the average position of the near-equatorial current sheet in the Jovian magnetosphere.

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 characteristics directly to earth while descending to the surface. The development of this spacecraft required the solution of many difficult and unique technical problems.


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 + 202 largely resolves these problems. A two-dimensional model of stratospheric trace constituents 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.


The LIR (large probe infrared radiometer) instrument has been developed for the NASA Ames Research Center for use in the 1978 Venus Atmospheric Probe Mission. The mission objectives are to determine the nature and composition of the clouds, the composition and structure of the atmosphere, and the atmospheric circulation pattern of the planet Venus. The LIR is a six-channel (3-50 micron) internally calibrated radiometer which measures the radiances of the planet for a single pass of a horizontal beam. A single rotating section with a 45 deg bend and containing a collimator alternately views up and down through director/extentee pipes located adjacent to the diamond window. Light is transferred from the rotating section to a fixed section containing a diamond diffuser to the photometric field of view overlap. A single rotating section with a 45 deg bend and containing a collimator alternately views up and down through director/extentee pipes located adjacent to the diamond window. Light is transferred from the rotating section to a fixed section containing a diamond diffuser to the photometric field of view overlap.

Contract No NAS2 8300.


Three relatively recently discovered anomalies are considered. The goal of isotopic research is to understand what phenomena are responsible for the observed isotopic anomalies, and thereby to determine the initial solar system isotopic composition. Until recently there has been no measured isotopic ratios which could not
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 Papanastasshou (1974). 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 these anomalies with regard to models of solar system formation and evolution.

G.R.


A study of the UV photodissociation of hypochlorous acid is conducted on the basis of ab initio SCF-CF calculations. These calculations show that HOCI has only a single peak in the UV photoabsorption spectrum at 220 nm. This result implies that HOCI would have a long lifetime for photodissociation if it were to be formed in the stratosphere. The photodissociation products of HOCI have been identified as CHOH, based on an examination of the topographies of the excited electronic state potential energy surfaces. The results of this study indicate that HOCI could be a significant reservoir for stratospheric chlorine. G.R.


A model of the lower atmosphere of Mars has been constructed that combines aerosol absorption and scattering with a line-by-line analysis of CO2 and H2O in a multilayer radiative transfer program. Aerosol absorption previously inferred from the NASA Lear Jet Observatory data was used to measure the optical complex indices of refraction of appropriate Martian analogs from 0.4 to 2.5 microns. The aerosol vertical particle density scale was deduced using the Viking camera observations of the soil and sky intensities between 0.4 and 1.0 microns in comparison with those modeled using a multilayer Mie scattering program. A comparison of observed Mars atmospheric absorptions was made with those obtained using Lorentz, Vogt, and Doppler line profiles in a multilayer model of the CO2 and H2O. The Vogt line profile of CO2 absorption at approximately 4976 kaysers was then combined in a multilayer aerosol model of the Martian atmosphere. An evaluation of the effect on the line shape was made using several aerosol loadings. (Author)


An experimental study using accelerometers as well as pressure and temperature sensors was carried out for accurate determination of the thermal structure of the atmosphere of Mars from the two Viking landers. A comparison was made with the neutral thermal structure above 130 km and with the ion temperatures. Both entries exhibited strong temperature fluctuations about the mean, which was attributed to thermal tides. The mean temperature of the atmosphere above the boundary layer was shown to be governed by radiative equilibrium, while the radiative boundary layer was observed to be 4 km deep. Ion temperatures indicated a structure correlated with that of the neutral atmosphere at altitudes up to 160 km. Thickness of the convective boundary layer was 6.5 km in late summer afternoon. (Author)


The method of separation of variables is shown to make turbulent correlation equations of Karman-Howarth type tractable for shear turbulence as well under the condition of neglected triple correlation. The separated dependent variable obeys an Orr-Sommerfeld equation. A new analytical method is developed using a scaling law different from the classical one due to Heisenberg and Lin and more appropriate for wall 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-am 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. (Author)


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 to 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. (Author)


The problem of resonance scattering of X-ray emission lines in the solar corona is investigated. For the resonance lines of some helium-like 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 solar 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 helium-like oxygen (O VII) 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)


The Lin-Shu dispersion relation, with corrections to match experimental conditions and in combination with a quantization rule, permits growth rates to be calculated for axisymmetric disturbances in an axisymmetric disk of stars. Growth rates calculated this way are in reasonable quantitative agreement with recently published results from a series of numerical experiments. The agreement confirms the physical basis of the theory and demonstrates that the theory remains valid even when strained somewhat in the application to galactic models. (Author)


On-board data processing has been developed for the Infrared Astronomical Satellite (IRAS) telescope system to effectively utilize the RF bandwidth and minimize the ground-data processing costs. Use of filtering techniques, data deglitching circuits, and data encoding algorithms are combined with a microprocessor-controlled telescope system to achieve a system dynamic range of 100,000 with a noise equivalent flux density of no less than 10 to the minus 19th W/sq cm. Extraneous data, e.g., noise due to radiation hits, will be removed prior to transmission, thereby optimizing ground-data processing for the highest sensitivity and reliability. Simulation results are presented which demonstrate the advantages gained through the use of onboard data processing and illustrate the possible merging of these techniques with an array for the future evolution of 'smart' sensors. (Author)


On-board preprocessing of astronomical data from integrated infrared detector arrays and discrete detectors will allow increases in sensitivity and reductions in costs for observations from cryogenic space telescopes. A variety of preprocessing functions for this application, which could be implemented either through analog on-chip devices or through external microprocessors, is identified. Software simulations and laboratory evaluations are underway to determine the effectiveness of these preprocessing schemes. (Author)


The paper evaluates and compares the performance of earth storable and space-storable liquid bipropellant propulsion systems in high-energy planetary mission applications, including specifically Saturn and Mercury orbiters, as well as asteroid and comet rendezvous missions. The discussion covers a brief review of the status of space-storable propulsion technology, along with an illus trative propulsion module design for a three-axis stabilized outer planet and cometary mission spacecraft of the Mariner class. The results take revised Shuttle/Upper Stage performance projections into account. It is shown that in some of the missions the performance improvement achievable in the ballistic transfer mode with space-storable spacecraft propulsion can provide a possible alternative to the use of solar-electric propulsion. S.D.

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 cycladdition of double bonds in certain polymers with a 1,8-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. Loss of ammonia from the J = 5 and J = 6 ammonia bands at moderate resolution might permit detection of the ammonia distribution. The lack of prominent emission cores in the NH3 rotation-inversion lines only implies that the mixing ratio is low. The paper describes the model which can produce observed emission cores. The photochemical dissociation is extremely efficient at low pressures which is necessary to account for the observed emission cores. The calculations were carried out with a one-dimensional computer model. The ammonia is uniformly mixed if the inversion temperature is low but, at a higher inversion temperature, emission cores will be observable unless the photodissociation is extremely efficient down to at least the inversion layer.


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 Al2O3 and by tropospheric mixing of particles and pollutant SO2 and COS. In order to assess the effects of these perturbations 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 were also performed on the climatic impact of perturbed aerosols due to volcanic eruptions and Space Shuttle flights.


High shock-tube velocities simulating Jovian entry have been achieved with an 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 discussed. Several programs using the shock tube for developmental research in energy and industrial applications are outlined.


Gas containing SiO, SiO2, SiH, and Si2 were produced in the reflected-shock region of a shock tube by heating SiC4 + N2O + Ar + SiH4 mixtures with shock waves. Spectral absorption characteristics were measured in the 160-550 nm wavelength range and in the 2800-3600 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, SiH, 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.


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Possible effects of HOCl aeronomy in the terrestrial stratosphere are reexamined. Chemical kinetic data for HOCl are analyzed which are required in aeronomical studies, and the possible role of HOCl as a reservoir of atmospheric chlorine is evaluated. Chemical production and loss of HOCl in the stratosphere is considered, along with photolysis of HOCl and prospects for HOCl as an inert chlorine reservoir. It is shown that a recent theoretical calculation of the HOCl 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 HOCl aeronomy are proposed. F.G.M.


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 time 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. This 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.


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 spaceflight conditions and at background levels as low as 8 million photons/sec cm-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 spot scanning optics. A noncontaminating high-vacuum pumping system will be used to evacuate the chamber prior to cool-down 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 are 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 8-12-micron IR sky survey; it will provide results of high reliability and sensitivity, produces 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.


Experimental results on the Reynolds number influence on the lee-side flowfield 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 to the left and right of the Stanbrook-Squire boundary. Under leading-edge separation conditions, the vortex position and intensity, and 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 reflector, computer-aided design, cost effects, and environmental and social effects. P.T.H.


This paper takes a look at the 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, photocell chemical, photoemissive convertors, heat engines, dielectric energy conversion, electrostatic generators, solar plasma 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 CO and CO2 electric-discharge lasers (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-jumped 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 Electronic Laser Energy Converter (TELEC) is a high-power density plasma device designed to convert a 10.6-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 cycles, 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 technological 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 photoexcitation of electrons with subsequent tunneling induced by ultraviolet radiation are given. It is estimated that quantum efficiencies of the order of 5% and higher 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

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electronic energy transfer in molecular (in particular atom-atom) collisions; collision-induced ionization and emission; and unmolecular dissociation.

V.P.


The shear moduli G13 and G23 for two different composites (AS3501 and T300/S209) 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 transversally 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 studied were 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-plane 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 multi-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 sub-annual 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-destruction 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 SiO2, 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 0.88 ± 0.10 atomic unit.

(Author)


Theoretical results pertaining to internally excited translational-rotational energy relaxation in a spatially uniform diatomic gas far removed from roldi 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-equipartition (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) translational-rotational transitions 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-cyl 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.


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 oaks and the resulting flow field are addressed. (Author)


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. (M.L.)


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. (V.P.)


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 aileron 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. (Author)

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.

Methods of correcting finite-difference solutions for the effect of truncation error or the use of an approximate basis equation are described and examples given.


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 nondetective 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.


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 thermogravimetric 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 polyphenylene sulfide, polyarylate sulfone, 9,9-bis(4-hydroxyphenyl)fluorene, polycarbonates, polydimethylsiloxane and polyether sulfone. 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.

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. An effort has been initiated to develop and use existing observational data to study terrestrial aerosols with satellite-borne sensors. In addition, Martian aerosols appear to have played a role in climate changes that may have terrestrial counterparts. Of particular concern are dust storms observed from the Mariner 9 orbiter spacecraft, which studied Mars during 1971 and 1972, and the Viking orbiter and lander spacecraft, which conducted measurements commencing in the middle of 1976 and continuing through the present. Two global dust storms were observed from their commencement to their demise.


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 the 27-day variations, the column density fluctuates by about 7%, the lack of a full response being due to the time required for vertical motions to redistribute ozone from the altitudes of maximum production to those of maximum steady-state value. The 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.

Twenty-three stars that are suitable for use as secondary spectrophotometric standards are compared with Alph A Lyrae in the wavelength range between 5840-1 and 1.1 microns. The consistency of the present data with previously existing measurements is discussed, along with the reliability of the present data. It is found that there is good agreement with previous data in some cases, but moderate or substantial discrepancies are exhibited in others. It is suggested that extinction variation is the most probable cause of the discrepancies, and observational procedures that may improve the situation with regard to the discrepancies are proposed.


The thermochemical 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 thermogravimetric analysis in a nonisothermal environment; (3) flammability properties such as oxygen index, flame spread, and smoke evolution; and (4) selected physical properties. The thermoplastic polymers evaluated include polyphenylene sulfide, polyary I sulfone, 9,9-bis[9(4-hydroxyphenyl)fluorenyl]fluorene, polyarylfuran, polyaromatic polysiloxane, and polyether sulfone. The thermoset polymers evaluated include epoxy, bismaleimide, a modified phenolic, and polyarylamino 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.

11 refs. Grant No. NCA2-3R108-801.

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 systems 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 spheroidal forms 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 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, aft-cambered shape of the supercritical 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 also made of the changing market environment for developing future large computers, and of the projections of microelectronics 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 parallel Navier-Stokes (PNS) marching finite-difference method is utilized 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 economies can be obtained by applying methods like the present, in lieu of full Navier-Stokes methods, in zonal 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. Naphthene was shock-heated to produce a mixture, at about 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 evacuable spectograph. The observed spectra were dominated by those of C2 and C3 and an unknown band at wavelengths below 300 nm. The cross sections of the C3 Swings band in the 300 to 450 nm range agreed with previous measurements within a factor of 1.5. No absorption was observed in the wavelength range from 550 to 700 nm. The unknown broadband absorption with a peak cross section of 4 times 10 to 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 was due to the stagnation point wall by about 12.5% in a typical flight condition.

(Author)


A scale model of the Jovian entry vehicle of 6.4 cm diameter is tested in an electric arc-driven shock tube while a sphere model of 5 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 to about 22 kW/sq cm 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 1/4 for the sphere at Mach 1.8, about 1/20 for the sphere at Mach 4.8, and about 1/6 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 Park.

(Author)
The mechanism of radiative heating of the afterbody region of Jovian entry probe is analyzed. A theoretical model is derived to determine the angle of thermodynamic properties in the expanding region, recirculating region, recombining region, and neck region through application of one-dimensional conservation equations. Flow parameters are obtained from the shadowgraphs of a five-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 recirculation 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 $0.114(3)/Ps$ 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 two different models, and two-equation and one-equation 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 mean 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 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. (Author)


Implicit approximate factorization techniques (AF) are investigated for the solution of matrix equations resulting from finite-difference approximations to the full potential equation in conservation form. For transonic flows, an artificial viscosity, required to maintain stability in supersonic regions, is introduced by an upward bias of the density. Two implicit AF procedures are presented, and their convergence performance is compared with that of the standard transonic solution procedure: successive line overrelaxation (SLOR). Subcritical and supercritical test cases are considered. Results indicate a substantial improvement in convergence rate for AF schemes relative to SLOR. (Author)


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 transvers-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 real value of the thermal field, whereas the results of the two-layer thermal model agree reasonably well with the experiment. (Author)


A description is presented of a strategy for analyzing the combustion process and the degradation products which are formed. One of three primary objectives in the study of polymer degradation is related to the characterization of the material to be studied and the investigation of the thermal behavior of the material. Another objective is concerned with the definition of the nature of the decomposition process by identification and quantitation of the degradation products. The third objective involves the determination of the mechanism and kinetics of the decomposition process. The methods of sample degradation include pyrolysis, oxidative degradation, flaming combustion, and the use of large-scale combustion chambers. Methods of chemical separation and identification are considered, taking into account low-boiling volatiles, high-boiling volatiles, and ancillary techniques. (Author)


The dynamical properties of a prolate bar have been studied by means of a three-dimensional computer model. The bar pattern rotates in the sense of the total angular momentum. The mean particle motion is a rapid streaming in the direction of pattern rotation as seen from a frame that rotates with the bar. Rotation rates that would be inferred from observation are significantly (2.3 times) faster than the pattern rotation speed. Velocity dispersions are anisotropic with the largest component along the bar. Particle oscil- lates in the bar potential significantly faster than pattern rotation. About 25% of the star orbits are near 2:1 resonance with the slow motion along the bar. Particle motion is highly ordered in the bar. Observable properties are described, where comparisons can be made, observable properties are in agreement with observations of brightness contours, velocity fields, and velocity dispersions. The bar has nearly exponential density profiles. (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 11.13 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 at the rate of about 2% to 3% per degree of latitude. This 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 per nucleon and 29.67 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 and landers 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. G.R.


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 perigee altitude are described. The time sequences of the probe entries 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.


The ionosphere, ionosheath, ionopause, and bow shock wave of Venus are characterized. Venus is found to have a well-defined strong standing bow shock wave. In the ionosheath, downstream from the shock, compressed and heated postshock plasma apparently interacts directly with the ionosphere. Plasma ion velocity deflections suggest that the ionopause has a blunt shape. The positions of the bow shock and ionopause are variable and appear to respond to changes in the external solar wind pressure. M.L.


Pioneer Venus in situ measurements of thermal plasma quantities were obtained by a retarding potential analyzer. Evidence for significant solar wind heating of the ionosphere and indications that the ionosphere is close to diffusive equilibrium are reported. Information on ionopause height, the ionospheric particle pressures at the ionopause, and the measured ratio of ionospheric scale height to ionopause ratio is presented. M.L.


The neutral mass spectrometer on board the Pioneer Venus multiprobe bus measured composition and structural parameters of the dayside Venus upper atmosphere on 9 December 1978. Carbon dioxide and helium number densities were 6 x 10 to the 9th and 5 x 10 to the 6th per cubic centimeter, respectively, at an altitude of about 137 kilometers. The mixing ratios of both argon-36 and argon-40 were approximately 80 parts per million at an altitude of 135 kilometers. The exospheric temperature from 160 to 170 kilometers was 285 plus or minus 10 K. The helium homopause was found at an altitude of about 137 kilometers. (Author)


Measurements of the changes in orbital period of the Pioneer Venus orbiter are used to estimate the density of the upper atmosphere of Venus at altitudes in the range from 150 to 700 km. At 150 km, the dayside mean density is 1.4 times 10 to the 13th g/cc and the nightside mean density is 4 times 10 to the 14th g/cc. The oscillatory patterns of density variation are described. The data for densities between 150 and 200 km on the dayside are sketchy but the data imply a scale height between 15 and 20 km. 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 probe penetrated the atmosphere. The thermal structure of the atmosphere at the 85-millibar level included regions of rapidly varying polar features, a solar-related sunset warm area, and a nonsolar-fixed nighttime warm area. The probe succeeded in entering each of these three thermal regions. (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. Altitudes 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 from 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 elevation features at the landing sites. Above 40 km, the measured profile moves from near adiabatic toward the theoretical profile for radiative equilibrium. G.R.


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 cloud top. An indication of the composition of a multicomponent cloud is seen in the data from the spectral bandpass from 6 to 7 micrometers. (Author)


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. (Author)


Altimetry and radar scattering data for Venus, obtained from 10 of the first 13 orbits of the Pioneer Venus orbiter, have disclosed what appears to be a rift valley having vertical relief of up to 7 kilometers, as well as a neighboring, gently rolling plain. Planetary oblateness appears unlikely to exceed 1/2500 and may be substantially smaller. (Author)


Reflectivity spectra of the trailing and leading sides of Io, 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 alkali feldspar) can account for the 1.35-micron feature of Io. (Author)


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 three to five 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. (Author)

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 of 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) thermogravimetric analysis; (5) composition of the volatile products of thermal degradation; and (6) relative toxicity of pyrolys. 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 the use of polymers with high anaerobic char yields 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 sensors 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 those derived from other aerosol measurements by 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-1975 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
comparable in size and mass to the Galilean satellites, having sizeable mass fraction of H2O, and with meteoritic abundances of radioactive materials contained within their silicate fractions) that the crust of solid ice over a liquid mantle predicted by conductive heat-transfer calculations is unstable to large-scale solid-state convection. For appropriate material parameters, convective heat-transfer rates are sufficient to freeze a large liquid mantle on a time scale that is short compared to the lifetime of the body. It is also concluded that the ice layer is convecting at the present time. A reevaluation of previous 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)


The present paper deals with a second-generation reusable surface insulation (RSI) material, termed LI-2200, which has been chosen for use on limited areas of the Orbiter heat shield. It is a rigid sintered fibrous silica containing about 3% by weight 1200 grit silicon carbide powder, capable of surviving multiple reentries at temperatures on the order of 1400 C. The lower thermal conductivity achieved by opacification with silicon carbide is demonstrated by radiant transmission measurements and thermal response tests. V.P.


A review is presented of some features of hybrid integrated circuits that make their use advantageous in miniature biotelemetry applications. The various techniques for fabricating resistors, capacitors and interconnections by both thin film and thick film technology are discussed. The use of chip capacitors, resistors, and especially standard IC chips on substrates with fired-on interconnection patterns is emphasized. The review is designed primarily to acquaint biotelemetry users and designers with an overview of this fabrication technique so that they can better communicate their needs with an understanding of its limitations and advantages to facilities specializing in hybrid construction. (Author)


This paper compares theoretical and experimental picture compression designs, for images processed in 8 x 8 blocks using the Walsh-Hadamard transform (WHT). The optimum picture compression design is well known, if the mean-square error (mse) is used as the measure of distortion, and if it is assumed that the video process is a stationary first-order Markov process with a Gaussian distribution. This theoretical design gives useful results when the transform processing is done on full pictures, but gives inferior results (relative to empirical design) when transform processing is done on small 8 x 8 blocks. The use of non-Gaussian distributions for the transform components fails to improve this poor performance, which is due to the nonstationary nature of the video process. An experimentally based design procedure, which considers nonstationarity, yields significantly improved mse and subjective performance. (Author)


A sample of polystyrene was evaluated for toxicity of pyrolysis gases, using the toxicity screening test method developed at the University of San Francisco. Under several test conditions, this material gave shorter times to death than many other synthetic polymers. Carbon monoxide appeared to be the principal toxicant in the pyrolysis gases. (Author)


The use of restrained and confined rats in some procedures used in combustion toxicology introduces the problems of obtaining rats of the appropriate size for the apparatus, and of identifying any artifacts resulting from the use of restraint alone. Feeding studies indicate that controlled feeding of fast-growing strains such as the Sprague-Dawley can hold rat size essentially constant for significant periods of time. The undesirable aspects are the need to cage the animals individually, with resultant psychological as well as metabolic effects. Restraint studies of slow-growing strains such as the Fischer 344 indicate that denying access to food and water for periods of several hours at a time interrupts normal gain only temporarily. (Author)


Topics discussed at the third NASA conference on radiant energy conversion are reviewed. The unconcentrated photovoltaic-generation version of a solar power satellite is described, noting that it will consist of a 21.3 x 5.3 sq km silicon-solar-cell array expected to provide 17 Gw of electrical power, with 1 km in diameter transmitters oriented to beam 2.45 GHz microwave power to two receiving/rectifying 'receptors' on earth. The Solares space energy system concept, designed for providing a large fraction of the world's energy needs at costs comparable to those of future coal/nuclear alternative, is considered, as are subsystems for improving the economics of the solar power satellite. A concept proposing the use of relativistic electron-storage rings for electron-beam energy transmission and storage, and a report on the production of a high temperature plasma with concentrated solar radiation are taken into account. Laser-conversion systems, including the direct-solar-pumped space laser, and the tele-powered spacecraft, are discussed. A.A.


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 major 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 absorptive lining flush with the wind tunnel walls upstream of the fan and an absorptive splitter in the duct downstream of the fan. An acoustical 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 dead zones 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-earth orbits. The pulse repetition frequency and imaging geometry are constrained by contours of isodops 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.


Finite difference methods for the numerical solution of mixed initial-boundary value problems for hyperbolic equations are studied. The reported investigation has the objective to develop a technique for the total error analysis of a finite difference scheme, taking into account initial approximations, boundary conditions, and interior approximation. Attention is given to the Cauchy problem and the initial approximation, the homogeneous problem in an infinite strip with inhomogeneous boundary data, the reflection of errors in the boundary, and two different boundary approximations for the leapfrog scheme with a fourth order accurate difference operator in space.

G.R.


Results of an atomic calculation supporting two-dimensional diffusion of a Pt atom on a Pt(110) surface are presented. The calculations for diffusion energy matrices indicate that interchannel diffusion by the replacement of a channel-wall atom by the adatom is energetically favorable. A.A.


Jovian electron intensity in the energy range 2-7 MeV was measured along the trajectory of Pioneer 11 up to 16 deg heliographic latitude. These electrons have crossed the average direction of the interplanetary magnetic field, propagating normal to the solar equatorial plane, and their intensity continues to be modulated by corotating interaction regions over this latitude range. From these data, the electron diffusion coefficient perpendicular to the equatorial plane (K2 = 2 x 10 to the 20th sq cm/s) was derived to within a factor of 2 using a three-dimensional diffusion-convection model and the values of the parallel and perpendicular diffusion coefficients in the solar equatorial plane (Kx = 5 x 10 to the 22nd sq cm/s, K2 = 10 to the 21st sq cm/s, respectively), which had previously successfully described Jovian electron propagation near the equatorial plane from 1 to about 10 AU. These results indicate that the Jovian electron intensity may be very low at high solar latitudes. (Author)


Results are presented for theoretical calculations of lidar backscatter at wavelengths of 0.6943 and 1.06 microns from the stratospheric aerosol. The computations are based on the size distribution, particle number density, and particle composition predicted by a one-dimensional model of the stratospheric aerosol layer that assumes that the primary source of sulfur to the stratosphere is biogenic OCS released at ground level. The aerosol particles are taken to be spherical liquid H2SO4-H2O solution droplets with solid cores, which undergo condensation, evaporation, coagulation, sedimentation, and vertical eddy mixing. The theoretical backscatter profiles are compared with experimental results obtained from actual lidar observations of the stratospheric aerosol layer before and after the eruption of Volcan de Fuego in October 1974. The model predictions are shown to be in good agreement with the average of a number of observations. F.G.M.
A79-29005  

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

B.J.

A79-28017  

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)

A79-28129  

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.

A79-28267  

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 routine calculations can be internally generated. The general theory is described in this paper, as well as the implementation in the computer code FASTI (Functional Algorithm for Shell Theory) for the analysis of the general axisymmetric shell structure with axisymmetric loading. (Author)

A79-29176  

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 4860 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. (Author)

A79-30248  

Undirectional fibrous composite material laminae 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 specimen and 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

S
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 less than 0.2 A from the line center. On the other hand, there is no significant absorption of the He 584-A line except in the downwind region, where absorption occurs within a spectral region of about 0.04 A. The effects of solar line modification on planetary and interplanetary 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 difficult 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 20 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 multiperture far-IR photometric instrument for multicolor 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 distortions on the planet's climate also receive attention.

J.M.B.


Known properties of the current solar system and Badenheimer's (1977) model of early Jovian 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 two-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 drag capture of the Martian satellites Phobos and Deimos, Neptune's
conceivable. J.M.B

Nereid and Triton, and Saturn’s Phoebe and Iapetus is also

of Quantitative Spectroscopy and Radiative

sections and A 2 Delta X 2 Pi band transition moments of Si H. C.

(1979, p. 373 385. 17 refs.

the 6190-, 72%, and 8900-A bands. If - Analysis of the south

JPL 954057; No. NAS2.6265.

Spot and north trop ical zone have highest methane reflectivities,

analyzed for the south equatorial belts (SEBs) and south tropical

and two-docd models of the vertical distribution of aerosols in the

continuum. A.L.W.

thickness is less and the lower cloud is deeper than in the STrZ. A

suitable for the SEBs. The SEB upper cloud is deeper, cloud

have between 0.55 and 0.43 bar total pressure and optical depth

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planet Long baseline infrared interferometry from earth orbit could

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(Author)

Kourtrdes (NASA, Ames Research Center, Moffett Field, Calif.). J. A. Burns, and

a maximum particle size of a few meters. A.L.W.

Lion, of particle saes, it is found that gravitational scattering of small

produce the random particle motions necessary to maintain a thick

radiation pressure. Kepler shear and radial spreading, which would

monolayer while such di"rsive mechanisms as meteoroid impact.

The differences between thick rings and wavy , monolayers are

similar condition met in early winter does not necessarily produce a

high ozone density because of the predicted higher HO2 density.

Seasonal variations in ozone abundance are discussed in terms of the

abundances of H2O and H2 and the seasonal variations in their

reaction products H2O2 and HO2. The roles of transport and the

aerosol loss to the surface, and the differences between northern

and southern hemisphere ozone distributions are also discussed.

(Author)

32650 • Thermochcmical and flammabilityproperties of

some thermoplastic and thermoset polymers. A. A.

Kourtides (NASA, Ames Research Center, Moffett Field, Calif.).

Thermochemical and flammability properties of thermoplast- 

cic and thermoset polymers are discussed. The results of a thermo-

grammetric analysis of the polymers conducted on a DuPont 950

thermogravimetric analyzer using both nitrogen and air atmospheres

are presented. Experimental data on smoke evolution are given, and

the methodology for assessing the relative toxicity of the pyrolysis

effluents is described. The values obtained from the flammability

tests are compared with the stoichiometric char yield, and it is shown

that the ignition tendency of the polymers is a linear function of

the resin char yield.

A.A.

spot polarizations of Jupiter in the 6190, 7250 and 8900 A

zone (STrZ). It is found that the polar hoods, equatorial zone, Red

Spot and north tropical zone have highest methane reflectivities,

with the temperate zones and polar regions having low reflectivity

and the STrZ and SEBs having intermediate values. The data on the

SEB and STrZ are analyzed in terms of diffuse reflecting-scattering

and two-cloud models of the vertical distribution of aerosols in the

Jovian atmosphere. To fit observations, the STrZ cloud top must

have between 0.55 and 0.43 bar total pressure and optical depth

between 1.5 and 2.5. The reflecting-scattering models are not

suitable for the SEBs. The SEB upper cloud is deeper, cloud

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 and solar gravitational effects would produce a

wavy monolayer while such dispersive mechanisms as meteoroid impact,

radiation pressure, Kepler shear and radial spreading, which would

produce the random particle motions necessary to maintain a thick

layer, are probably insignificant. Given a typical power law distribu-

tion of particle size, it is found that gravitational scattering of small

particles by large ones would maintain a ring thickness of several

time the radius of the largest particles. A steady state ring thickness

of 20 to 50 meters, derived from energy considerations, would imply

a maximum particle size of a few meters. A.L.W.

A79-32208 • The vertical structure and thickness of

Saturn’s rings. J. N. Cuzzi (NASA, Ames Research Center, Moffett

Field, Calif.). R. H. Durisen (NASA, Ames Research Center, Moffett

Field, Calif.; Indiana University, Bloomington, Ind.) J. A. Burns, and

P. Hamill (Ames Research Center, Moffett Field, Calif.; Cornell


Grants No. NCA2-OR175-701; No. NSG-2227.

The vertical structure of Saturn’s rings is 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 and solar gravitational effects would produce a wavy monolayer while such dispersive mechanisms as meteoroid impact, radiation pressure, Kepler shear 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 size, 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 imply a maximum particle size of a few meters. A.L.W.

The paper reexamines the problem of particle injection by lo and subsequent radial diffusion by flux tube interchannel 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 lo is the source for all of the plasma observed by Frank et al. (1978) inside 10 RJ; 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.


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 is much broader than that of the NGC 2071 source associated with molecular clouds. Photometry from 2 to 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 associated with an OH maser in NGC 2071, OH associated with molecular clouds. Photometry from 2 to 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 associated with an OH maser in NGC 2071, OH associated with molecular clouds.


Recent measurements by the Pioneer 10 and Helios 1 spacecraft show that the leading edge of a corotating structure spreads as it moves from 0.3 AU to the orbit of the earth and steepens again farther out. By including Landau damping effects in the dynamical behavior of the streams, the above qualitative features can be accounted for. (Author)


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 B0.5 zero-age main-sequence star. The relatively low molecular density of about 1000 per cu cm 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. (Author)


The aim of the Post Landsat-D Advanced Concept Evaluation (PLACE) program was to identify the key technology requirements of earth-orbiting systems for the 1985-2000 period. 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.


The paper describes a study conducted to identify the technology development needs that would allow the development of space system concepts of Jupiter and Saturn to proceed beyond currently planned investigation of the upper atmosphere. The study considered a deep probe mission that would allow the capabilities 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 instrument 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.


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 ionosphere. Parameters include 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
Electrometer ranging with background current compensation; digital, quadratic retarding potential step generation for the ion and low-energy electron scans; a current sampling interval of 2 ms throughout all scans; digital logic inflection point detection and data selection; and automatic scan direction detection. Extensive numerical simulation and plasma chamber tests have been conducted to verify adequacy of the design for the Pioneer Mission. (Author)


Far-infrared (40-150 microns) observations of W51 (G49.5-O.4), K3-50, DR 21, NGC 7538, and W3(OH) are presented and discussed. At these wavelengths each source is dominated by a small bright component closely associated with a compact H II region. Their spectra can be explained as emission by dust at temperatures of 30-50 K. Some of the objects appear to be optically thick out to wavelengths of about 60 microns. Of the 10 source components in the five regions, at least four may be powered by pre-main-sequence stars. The far-infrared data are consistent with depletion of volatile components of the dust within compact H II regions, but do not clearly require destruction or expulsion of refractory grains. The bulk of the dust which emits primarily in the far-infrared must lie in a dense shell immediately outside the ionized zone. The sources are possible precursors to open clusters with stellar masses in the range of 1,000 to 10,000 solar masses. (Author)


A new time-dependent one-dimensional model of the stratospheric sulfate aerosol layer is developed. The model treats atmospheric photochemistry and aerosol physics in detail and includes the interaction between gases and particles explicitly. It is shown that the numerical algorithms used in the model are quite precise. Sensitivity studies and comparison with observations are made. The simulated aerosol physics generates a particle layer with most of the observed properties. The sensitivity of the calculated properties to changes in a large number of aeronomic aerosol parameters is discussed in some detail. The sensitivity analysis reveals areas where the aerosol model is most uncertain. New observations are suggested that might help resolve important questions about the origin of the stratospheric aerosol layer. S.D.


A model of the diffusion of ionospheric plasma into 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 particle 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. (Author)


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The Pioneer Venus large probe neutral 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.T.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 3-6 MeV electron flux shows recurring intensity peaks. The amplitude of which decreases with increasing distance from Jupiter both in the direction of the sun and away from it. Concurrent IMP-8 measurements of the 2-12 MeV electron flux revealed a series of 27-day recurrent intensity increases modulated with a period of about 13 months, beginning about four months before the probable magnetic field connection between earth and Jupiter. Amplitudes of the intensity increase reached a maximum near the time of best connection. These results are consistent with a three-dimensional interplanetary diffusion model with Jupiter as a continuously emitting point source.

C.K.D.

A79-37688 * Direct observation of voltage barriers in ZnO varistors. O. L. Krivanek, P. Williams, and Y. C. Lin (California, University, Berkeley, Calif.); Applied Physics Letters, vol. 34, June 1, 1979, p. 805, 806. 13 refs. Research supported by the U.S. Department of Energy; NSF Grant No. DMR 77-24022; Grant No. NCA20R050 705.

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 show that 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 (retrograde) 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 vector and those vectors representing the unit normals to the invariable 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.

A79-38026 * A general and computationally fast formulation for radiative transfer with scattering. A. C. Cogley and A. Sharma (Illinois, University, Chicago, Ill.). American Institute of Aeronautics and Astronautics, Thermophysics Conference, 14th, Orlando, Fla., June 6-9, 1979, Paper 79-1035, p. 9. 15 refs. NSF Grant No. 77-11713; Grant No. NCA20R0330-701.

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 adding 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 15 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 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 statistical noise. The practical limits of signal-to-noise ratios have been characterized for a wide range of detection frequency bandwidths that encompass 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 the 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 increase continuously due to the internal absorption of radiation. (Author)

A79-38289 * An orbiting infrared interferometer to search for nonsolar planets. R. H. MacPhie (Waterloo, University, Waterloo, Ontario, Canada) and R. N. Bracewell (Stanford University, Stanford, Calif.), Astronautics and Aeronautics, vol. 17, No. 6, June 1979, pp. 271-278. 10 refs. Grant No. NCA2-OR745-716.

This paper proposes an orbiting infrared interferometer with its fringe null centered on a nearby star at a distance of about 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 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 indicate the use 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 25%) 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 thickness of the Galileo's heat shield. (Author)


Utilizing a series of existing computer codes, 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 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)


A general class of even/odd transforms is presented that includes the Karhunen-Loeve transform, the discrete cosine transform, the Walsh-Hadamard transform, and the other familiar transforms. The 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.


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.


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 rate signals 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.


The addition of an extra term to the conventional approximate transport equation for the turbulence energy dissipation rate is recommended. The term may be viewed as emphasizing the role of irrotational deformations in promoting energy transfer across the spectrum or, equivalently, as augmenting the influence of normal strains. Calculations including the new term are reported for the plane and round jet and for several turbulent boundary layers. In the cases considered the addition of the new term significantly improves agreement with experimental data.

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 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 investigated by analyzing simultaneous magnetometer and solar wind spectrometer data. The diffusion model proposed by Vanyan (1977?) is used to describe 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 size remanent fields of about 100 gauss are measured by surface experiments, whereas the larger scale size 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 Herusigus. This area contains numerous sinuous rilles, craters with irregular planimetric form, possible pyroclastic cones, and other features of probable volcanic origin. Small volcanoes and small pyroclastic areas are present within the rim of the crater and within a 10 km radius of the summit of the cone. Preliminary research summarized in a regional stratigraphic section. The sequence of mare volcanism provides insight into the complex emplacement of lunar lava flows in 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 smaller craters relative to an extrapolation from the large-diameter parts of the 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 preexisting 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 their 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...
orbital as are found to lie above the Cu d-band region. These hybridized orbitals involving the N 2p orbital gave a satisfactory interpretation of the adsorbate-induced structure reported in N(Cu001) ultraviolet photoemission studies. (Author)


This paper presents a unified theory of the coherent multiple-phonon 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 diffusionless, 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 relaxational processes. (Author)


The magnitude of the photon-induced current in Ag-AI2O3-Al metal-oxide-metal junctions has been studied as a function of photon energy and angle of incidence. Photocurrents were theoretically analyzed on the basis of a modified vacuum photoemission model (Jain, L., 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 and 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 KDp doubling crystal pumped by a Q-switched Nd:YAG laser with a LiIO3 doubling crystal. The system provided rimes of 50 ns or less and peak powers of 10 W. Under short circuit conditions, the photoresponse to incident power was linear up to available power densities of 10 kw/cm. Quantum efficiencies of about 0.1% at zero-bias, near 3.8 eV under P polarization, were typically observed. C.K.D.


Approximate probabilities of electron excitation (shakeup-shakeoff) from various atomic states during nuclear ms 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. (Author)


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 breadboard 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. B.J.


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-diatomic collision processes in the presence of a field are examined, and examples of both 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 consistent with disturbances rotating rapidly around the planet. There is weak evidence for a 5-day rotation in some features. (Author)


The flux from the central region of the Crab Nebula in three broad spectral bands with flux-weighted mean wavelengths of 300 microns, 200 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. Derivatives of various flux densities, spectral slopes, and flux densities, are presented, and it is concluded that the luminosity of dust emission from the Crab Nebula varies between 1300 and 5000 kuns 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 assemblies where the hydrazine is catalytically decomposed and ejected into a conical nozzle. The subsystems consist of seven 1 lbf thrusters for the Orbiter and six 1 lbf 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 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.


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.


Magnetic field measurements made by the vector helium magnetometers on board Pioneers 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 sheet show that the magnitude of the current is of the order of 0.01 Am 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 radii. The current sheet is warped azimuthally and parallel to the magnetic dipole equator. The existence of an azimuthal field component indicates a convecting plasma flow transporting some 10 to the 791h ions per second from Jupiter into the outer magnetosphere. It is shown that, if the outer 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.


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.


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 was 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.


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 spotty ion pump acting as a sink for 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 sun as 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 (e.g., 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.


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 accrual 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)
Science, these atoms is in the dayside thermosphere, the night airglow is a bands of nitric oxide. The hands are produced by two-body radiative side of the ant-solar meridwri. (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 trace of the day-to-night thermospheric circulation. The airglow 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 ethylene, small (approximately 1 micrometer) or large (approximately 10 micrometers) sulfur particles have serious difficulties, while ones involving sulfur dioxide gas appear to be promising.


Winds in the lower atmosphere of Venus, inferred from three-dimensional radio interferometric tracking of the descendents of the Pioneer Venus 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.


It is shown that whistler mode waves from the ionosheath 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 to 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. Immersive events in the nightside ionosphere seem to fall into two classes. (1) Lightening signatures near periapsis, and (2) noise, which may be caused by gradient or current instabilities.

Initial Pioneer Venus magnetic field results - Nightside observations. C. T. Russell, C. R. Elphic, and J. A. Slavin
Initial observations by the Pioneer Venus magnetometer on the nightside of Venus frequently reveal moderately strong fields from 20 to 30 nanoteslas. However, there is little evidence that these fields arise from an internal dynamo, since they are mainly horizontal and vary from orbit to orbit. Determining a precise upper limit to the intrinsic moment awaits further processing. This limit is expected to be much less than 10 to the twenty-second gauss-cubic second.

(Author)

**A79-40836**  
**Electron observations and ion flows from the Pioneer Venus Orbiter plasma analyzer experiments.** D. S. Intriligator  

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 ionosphere 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) to the planet; (4) there is a separation between the inner boundary of the downstream ionosphere and the upper boundary of the nightside ionosphere; and (5) during the first 4.5 months in orbit, the measured solar wind plasma speed continued to vary, showing a number of high-speed, but generally nonrecurrent, streams.

(Author)

**A79-41292**  

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.

(Author)

**A79-41293**  

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 magnetotail 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.

**A79-41325**  

Far-infrared observations (40-160 microns) of eight optical emission-line stars are presented. Six of these stars, LKM alpha 198, T Tau, lK-H 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, 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.

(Author)

**A79-41354**  

This letter presents a spectrum of IRC +10216 in the 3000-4400-kyraser region at 9-kyraser resolution. A molecular feature at 3400-3600 kyrasers 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.

(Author)

**A79-41520**  

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.

(Author)

**A79-41771**  

In the present study, problems of laminar and turbulent two-dimensional flow of a viscous compressible fluid 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 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-Van Driest-Glaser 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 center-line velocity are presented.

(Author)

The power flux into the magnetosphere from the solar wind is analyzed using the model of polar cap electric fields described by D'Angelo (1977). It is shown that the substorm parameter proposed by Akasofu (1978) to predict the probability of a substorm can be interpreted as the portion of the solar wind electromagnetic power flux which penetrates the magnetosphere at a given moment. C.K.D.


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 streams 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 distributions. These observations are consistent with the exchange of energy between the solar wind and the interstellar medium. (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-Camball formula 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 temporally difference schemes to include all linear multistep methods, (2) optimize the class of unconditionally stable factored schemes by a new choice of unknown variables, 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 upwind bias of the density coefficient to stabilize in supersonic regions. This provides an effective upwind difference of the streamwise terms for any orientation of the velocity vector (i.e., rotated differentiation), 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 indicate 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 fluid dynamic problems containing multiple regions of continuous flow, each bounded by a permeable or impenetrable 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)

A79-45456 * Convection and lunar thermal history. P. Casen, R. T. Reynolds, F. Graziani, A. Summers, J. McNielis, and L. Blaiock (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 quasi steady 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 the 21st to 10 to the 22nd 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 to 1.2 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 from 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-IR59, which probably provides the power for the far-infrared emission, and an extended source of 2.2 micron emission which appears to be a infrared reflection nebula. The compact H II regions, the maser sources and IR59 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 to 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 960 km/sec, independent of radial distance over this range. Recovery from the impulsive decrease in intensity was prolonged and 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 100 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)


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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 investigation 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 Explorer magnetometers are 1 to 2% and 0.5 gamma, respectively, with close agreement between the two Explorer magnetometers, but increase up to 60% 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. A.L.W.


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 streams, and the associated revision of ideas about solar wind acceleration and heating are reviewed. In addition, topics of 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.


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 images 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 magnetosheath. 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-view radiometer oriented towards the north 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. When corrected for atmospheric effects, the airborne measurements were found to be virtually identical to ground-based measurements, with a regression line slope of 0.985, a standard deviation of 1.8 C and a correlation coefficient of 0.97.


It is shown that topology rules can define a small number of singular points on an aerodynamic surface and in the flow which can be combined in various ways to create the structures and characterize the physical mechanisms of three-dimensional separated flows. This topological development is based on the hypothesis that vector fields of skin-friction lines and external streamlines remain continuous. Among examples treated are the lee-side separated flows about slender bodies at angle of attack with symmetric or asymmetric wake structures; about a protuberance normal to a wall; and over a rearward-facing axisymmetric step.


Experimental values of wall pressure and skin friction have been obtained for Mach numbers from 1.32 to 1.48 and for Reynolds numbers from 8.5 x 10 to the 6th to 225 x 10 to the 6th. Increasing the Mach number reduces the wall shear and promotes instability near separation. Reynolds number variations have little effect except at the lowest value where the flow abruptly approaches separation. Comparisons are made with solutions to the time-dependent, Reynolds-averaged, Navier-Stokes equations incorporating a two-equation, Wilcox-Rubesin turbulence model. The computations are in agreement with the experimental results. Additional numerical results indicated that the wind-tunnel walls constrained the flow and suppressed the formation of a separation bubble at the shock wave.


An investigation of trailing-edge flows at high Reynolds numbers and subsonic Mach numbers is presented. Symmetric and asymmetric trailing-edge flows are studied, each flow having pressure gradient regions upstream of the trailing edge similar to an airfoil. Measurements include model surface pressures, mean velocity, turbulent shear stress, and turbulent kinetic energy profiles in the trailing-edge and near-wake regions. Comparisons of the symmetric data with numerical solutions of boundary-layer as well as Navier-Stokes equations employing two different turbulence models show increasing effects on viscous interactions as the Mach number increases. Both turbulence models yielded solutions of the mean flow of comparable quality. The experimental results of the asymmetric case are discussed.


A mixed explicit-implicit scheme is used to solve the time-dependent thin-layer approximation of the Navier-Stokes equations.
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 0.1 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 in 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 cost systems, the optimal solution for the actuator redundancy problem is posed and solved. The solution requires the iteration of a set of highly coupled 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, required performance, actuator mean time to failure, and functional or identical 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 model 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)

A79-48086 * A numerical model 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-latitude dune fields in the northern hemisphere are formed when the terrain is covered by frost, and that the业主tering 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.


An exact solution of the kinetic and electromagnetic equations for a large-amplitude plane magnetoacoustic wave propagating transverse to the magnetic field in a hot collisionless plasma is presented. The solution gives simple relations among the magnetic field strength, density, stress tensor, and plasma velocity, all of which are measurable in the interplanetary plasma. These relations are independent of the electron and ion velocity distributions, subject to certain restrictions on 'high-velocity tails.' The magnetic field of the wave is linearly polarized. The wave steepens to form a shock much as the analogous waves of MHD theory do. (Author)


Results of low-pressure wind tunnel testing and theoretical considerations are used to estimate the eolian transport of surface material on Mars. Salivation on Mars, equations of particle motion, computational results, and analytical determination of surface material movement are considered. A semiempirical formula is developed for estimating the total amount of surface material moving in eolian saltation, surface traction, and suspension. Numerical solutions of the equations of motion for particle trajectories on the surface of Mars are presented. The ratio of final particle speed to the particle threshold friction speed is found to be several times that of saltation on earth. S.D.


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 that it produces more accurate results than either the classical method or the technique proposed by Keller (1963). 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 measuring 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(36Ar) less than 1.3 times 10 to the 6th power per cu cm and n(40Ar) 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(36Ar)/total number density less than 9 times 10 to the minus 8th power and n(40Ar)/total number density less than 20 times 10 to the minus 8th power. (Author)


The infrared spectral intensities for HOCl and HOCl 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 HOCl by in situ infrared spectroscopic measurements. (Author)


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 found 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 technique for fundamental studies in basic thin film physics and in catalysis. (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 biometric measurement have progressed greatly in the past 15 years and are now of a quality adequate to clinical applications. The paper reports on recent developments in the design and application of SQUID (Superconducting Quantum Interference Device) magnetometers to biometric measurement. The discussion covers biometric 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 biometric 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 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)


A procedure is described for the utilization of abelian point group symmetry in the graphical unitary group approach (GUGA) 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 disruption in an ice 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' 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 icosahedra 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 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 using 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 anomalously 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 regions to the surface during mare flooding.


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.


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.


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 thermodynamical 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.


An explicit result is presented for the two-dimensional Green function for an orthotropic body containing a crack along an orthotropic plane and with its tip in an orthotropic direction. A formal solution and a numerical program for its calculation are presented for a crack on a plane rotated about an orthotropic 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.


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.

A79-52815 * Cosmic ray ionization of the Jovian atmosphere. L. A. Capone (San Jose State University, San Jose, Calif.), J. Dubach (Instituut voor Kernfysicus Onderzoek, Amsterdam, Netherlands).

The Galileo satellite program includes a demonstration of an 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 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.


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, a distinct cloud layer was observed, four widely separated sites were observed in both daytime and night time and the magnetic ionosphere and perturbation were observed above 50 km altitude, a temperature of 400 m/s was observed at high altitudes, large plateaus and features were observed on the surface.


The paper reports the two observing programs conducted to compare two techniques which have been proposed as methods for performing the requisite Fourier transformations in very large multichannel spectrum analyzers (MCWA): the direct digital FFT and optical transform processor. The details of the observations at NRAO utilizing a direct digital FFT are given. A description of the NAIC, Arecibo observations utilizing an optical processor at the Environmental Research Institute of Michigan (ERIM) and a microdensitometer at Electromagnetic System Laboratories (ESL) is presented. For both observing programs, statistical analysis of the power spectra produced by the non-real-time MCWS (or post-processing) was accomplished.

V.T.


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 in the solar wind 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 occulting 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 62 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 2 to 6 x 10 10 per cm, and collision broadening coefficients are found to be approximately equal to 0.1 kaysers/atom.

A.L.W.


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 0.05 K atm at the 2% opacity sources the H2 collisionally induced continuum and the rotation inverion 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 ± 9 K at 1 bar, and 105 ± 3 K at the inversion level at 0.15 bar. The 1-bar temperature is shown to be consistent with Jupiter interior models which match the observed gravitational moment. A.L.W.

PATENTS


Flame and temperature resistant polyimide foams are prepared by the reaction of an aromatic dianhydride (pyromellitic dianhydride) with an aromatic polysyocyanate (polymethylene polyphenylisocyanate), in the presence of an inorganic acid and furfuryl 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. 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.


A process is described for the preparation of composite laminate structures of glass cloth preimpregnated with polybismaleimide resin and adhered to a polybismaleimide glass or aromatic polyamide paper honeycomb cell structure that is filled or partially filled with a syntactic foam consisting of a mixture of bismaleimide resin and carbon microballoons. The carbon microballoons are prepared by pyrolyzing phenolic microballoons and subsequently bonded using a 2% bismaleimide solution. The laminate structures are cured for two hours at 477 deg K and are adhered to the honeycomb bismaleimide adhesive using a pressure of 700 KPa/sq m pressure at 450 deg K. The laminate composite is then post-cured for two hours at 527 deg K to produce a laminate having a density in the range from about 95 kilograms per cubic meter to 130 kilograms per cubic meter. Official Gazette of the U.S. Patent and Trademark Office.


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.


Diamidoxime monomers are intermolecularly and thermally condensed to form a heat and chemical resistant polymer containing 1,2-oxadiazole linkages, with identical bivalent organic radicals or any combination of bivalent organic radicals selected from the group consisting of -(CN=), where R ranges from 2 to 8 when X is fluorine and 2 to 18 when X is hydrogen, chlorine, nitro or aryl alylene, and an oligomeric or polymeric radical prepared by reacting a dicarboxylic acid halide with a fluorinated epoxide.

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


91
New crosslinked elastomeric polyimidazolines were prepared by a 4 step procedure which consists of: (1) forming a poly(amic acid) by the reaction under reflux conditions of anhydrous ammonia with certain perfluorinated alkyldiimido-

3un or alkyllithium anhydrides or halides. (3) extending the polyimidazoline chain by further refluxing in anhydrous ammonia, and (4) heating to cyclize the new imidoylamine linkages and thereby crosslink the polymer.

N78-22302† National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE 1,2,4-OXADIAZOLE ELASTOMERS Patent Application. Robert W. Rosser, Ibrahim M. Shalhoub (San Jose State Univ. Foundation, Calif) and Hanoi Kwong, inventors (to NASA) (San Jose State Univ. Foundation, Calif.) Filed 9 Apr 1979 17 p
(NASA Case-ARC-112531 US-Patent-Appi-SN-028303) Available NTIS HC A02/MA01 CSCL 07C
Crosslinked 1,2,4-oxadiazole elastomers were prepared by thermally condensing: (1) monomers having the formula H2N(HO)C=Q, where Q is a triazine ring-forming group such as nitro or amine or a mixture of such groups with amidoimide, or (2) a monomer and monomer with RCINO(NOH)H2, with R in these formulas standing for a bivalent organic radical having the formula: -(CX2) sub n- or -CFY(CF2CFY) sub m sub n CFY, where X is fluorine or hydrogen, Y is fluorine or trifluoromethyl, p ranges from 1 to 18, and m + n ranges from 2 to 7. In the monomer charge, the overall proportions of amidoxime groups to triazine-ring forming groups varies depending on the extent of crosslinking desired in the final polymer.

N78-23432† National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A high acceleration umbilical cable deployment system was devised for enabling electrical communication between a ballistic projectile forebody and an afterbody. A cable coiled on a spool is housed within a ballistic casing having a drag funnel at the rear end. The cable is sandwiched between a foam plug and the drag funnel before it leaves the forebody and is secured in a strain relief at the apex of a funnel in the afterbody. On deployment, when the bodies are separated, energies that would tend to rupture the cable are expended by the funnels. Drag and strain relief.

N78-24062† National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A refractory composite insulating material was prepared from silica fibers and aluminosilicate fibers in a weight ratio ranging from 1:19 to 19:1, and about 0.5 to 30% boron oxide, based on the total fiber weight. The aluminosilicate fiber and boron oxide requirements may be satisfied by using aluminoborosilicate fibers and, in such instances, additional free boron oxide may be incorporated in the mix up to the 30% limit. Small quantities of refractory opacifiers, such as silicon carbide, may be added also. The composites just described are characterized by the absence of a nonfibrous matrix.

N78-24153† National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
(NASA Case-ARC-112411 US-Patent-Appi-SN-037066) Available NTIS HC A02/MA01 CSCL 07C
The synthesis of a sealer for arc high-temperature is described. Perfluoroalkyl polyimidazolines containing pendant difluoromethyl groups are prepared by the reaction of perfluoroalkyl difluoromethyl groups with ammonia to form poly(imidoylamidines), followed by the cyclization of the imidoylamidine groups with, e.g., various mixtures of a perfluoroacrylic fluoride with an omega-iodo perfluoro acyl fluoride. The polyimidazolines obtained are cured by heat which causes crosslinking at the iodo difluoro methyl groups by elimination of iodine and formation of carbon to carbon bonds.

N78-26100† National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Flexible intumescent protection sheeting of unusually uniform thickness were prepared from epoxy-polysulfide compositions, containing microfibers and the ammonium salt of 1,4-dinitroaniline-2-sulfonic acid, as disclosed in U.S. Pat. No. 3,863,464, 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 1.4 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.

N79-30375† National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN IMPROVED SYNTHESIS OF 2,4,8,10-TETROXASPIRO(5.8)UNDECANE Patent Application. Algudas C. Poshkus, inventor (to NASA) (NAS-NRC) Filed 3 Jul 1979 12 p Sponsered by NASA
(NASA Case-ARC-112431 US-Patent-Appi-SN-054502) Available NTIS HC A02/MA01 CSCL 07D
Pentaerythritol is converted to its diformal, 2,4,8,10-tetraspiro(5.8)undecane, by heating it to a temperature within the range of about 110 to 150 C for a period of up to 10 minutes, in the presence of a slight excess of paraformaldehyde and of a catalytic quantity of an acid catalyst such as sulfuric acid. The reaction is carried out in two steps, by forming first the monoformal, then the diformal. The total reaction time is about 10 minutes and yield of diformal are greater than 90%.

N79-30376† National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
(NASA Case-ARC-112441 US-Patent-Appi-SN-054501) Available NTIS HC A02/MA01 CSCL 07C

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

N79 11651* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

US EXPERIMENTS FLOWN ON THE SOVIET SATELLITE COSMOS 782 Final Reports
S Ya Shalayan et al, 1978 p 171 refs 
Avail NTIS HC A18 MF A01 CSCL 065

N79 11652* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

US EXPERIMENTS FLOWN ON COSMOS 782 Final Reports
Wayne H Howar and Kenneth A Souza In its US Expt Flown on the Soviet Satellite COSMOS 782 Sep 1978 p 137 For primary document see N79 11651 02 S 1
Avail NTIS HC A18 MF A01 CSCL 06B

The Cosmos 782 mission is 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, carrot 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 are briefly described.

N79 11661* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

EFFECT OF SPACE FLIGHT ON CELL MEDIATED IMMUNITY Final Report
Adriel D Mendel and Edward Balish (Wisconsin Univ Madison) In its US Expt Flown on the Soviet Satellite COSMOS 782 Sep 1978 p 207 216 (For primary document see N79 11651 02 51)
Avail NTIS HC A18 MF A01 CSCL 06C

The cell-mediated immune response to Listeria monocytogenes was studied in rats subjected to 19.5 days of flight in a Soviet spacecraft. Groups of rats were immunized with 1,000,000 formalin killed Listeria suspended in Freunds Adjuvant Complete adjuvant five days prior to flight. Immunized rats subjected to the same environmental parameters as the flight rats excepting flight and immunization and non-immunized rats held in a normal animal colony served as controls. Following recovery, lymphocyte cultures were prepared from spleens of all rats and cultured in vitro in the presence of Listeria antigens, phytohemagglutinin, Concanavalin A and purified protein derivative (PPD) and measured for their uptake of H3 thymidine. The lymphocytes of all rats gave a blastogenic response to phytohemagglutinin and Concanavalin A. Although individual rats varied considerably, all flight and immunized control rats gave a blastogenic response to the Listeria antigens and PPD. With several mitogens the lymphocytes of flight rats showed a significantly increased response over the controls. The data do not support a hypothesis of a determined effect of space flight on cell-mediated immunity and suggest an opposite effect.

N79 11662* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

EXPERIMENT K 002 RESULTS OF HISTOLOGICAL EXAMINATION OF INGUINAL LYMPH NODES. SUPPLEMENTARY REPORT Final Report
Lisbeth M Kjaer In its US Expt Flown on the Soviet Satellite COSMOS 782 Sep 1978 p 227 231 (For primary document see N79 11651 02 51)
Avail NTIS HC A18 MF A01 CSCL 06C

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

N79 11663* National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

ALTERATIONS IN ERYTHROCYTE SURVIVAL PARAMETERS IN RATS AFTER 195 DAYS ABOARD COSMOS 782 Final Report
Henry A Leon Stephen A Landau (Veterans Admin Hosp Syracuse NY) and Jennifer Cummings In its US Expt Flown
on the Soviet Satellite COSMOS 782 Sep 1978 p 237 252 refs (For primary document see N79 11651 02 51) Avail NTIS HC A18 MF A01 CSCL 06C

Rats were subjected to 19.5 days of weightlessness space flight aboard the Soviet Biostatellite Cosmos 782. The survival parameters of a cohort of erythrocytes labeled 15.5 days pre-flight based on the output of Co 14 were evaluated upon return from orbit. These results were compared to vacuum 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 heamatocrit 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 re-entry, atmospheric and environmental parameters, dietary factors, radiation and weightlessness. 

N79 11664' National Aeronautics and Space Administration Amer. Research Center Moffett Field Calif.

EFFECTS OF SPACE FLIGHT ON THE PRODUCTION OF PLASMA AND GLANDULAR CONCENTRATIONS OF PITTUITARY HORMONES

Final Report

Pituitary function was investigated in rats subjected to 19.5 days orbital space flight. Male SPF Wistar rats were divided into vacuum control (VCI), synchronous control (SCI) and flight (FI) groups. SCI and FI rats were subjected to the same caging RH002 RH003 and temperature as FI rats. Rats from each treatment group were sacrificed either immediately after recovery from flight (R 0) or 25 days after recovery. Space flight caused a marked inhibition of growth. Pituitary concentrating of hormones were similar for all groups as were the hematocrits. At R 25, FI rats had decreased plasma prolactin concentrations decreased pituitary G H and increased pituitary vasopressin. pituitary and plasma concentrations of other hormones remained unchanged from control values. Hematocrits of flight rats were higher than VCI and SCI values at R 25 and higher than for SCI 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. 

N79 11668' National Aeronautics and Space Administration Amer. Research Center Moffett Field Calif.

QUANTITATIVE ANALYSIS OF SELECTED BONE PARAME TERS Final Report
Linda Merlyth Bottom 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 were investigated in rats subjected to vacuum 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 vacuum and synchronous control groups. An arrest line was found in both the endosteum and the periosteum of the flight animals suggesting that a complete cessation of bone growth occurred during space flight. Before 25 days postflight the flight animals showed a significant increase in bone formation when compared to the vacuum controls suggesting that a rebound in bone formation occurred following flight. 

N79 11669' National Aeronautics and Space Administration Amer. Research Center Moffett Field Calif.

COSMIC RAY EFFECTS ON THE EYES OF RATS FLOWN ON COSMOS 782 Final Report

The eyes from six rats were fixed at the recovery site in Russia after circling the earth for 19.5 days in a 62.8 deg. orbit. Twelve more flight eyes were fixed 25 days later. These two preparations and eyes exposed to 1000 rads 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. Necrotic nuclei were found in the outer nuclear layer and channels were located 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 possibly from interaction with some part of the nucleus. 

N79 11670' National Aeronautics and Space Administration Amer. Research Center Moffett Field Calif.

EFFECTS OF WEIGHTLESSNESS ON THE EMBRYONIC DEVELOPMENT AND AGING OF DROSOPHILA

Final Report

The biological effects of weightlessness were investigated on Drosophila melanogaster of the Domodedov 32 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. 

N79 11671' National Aeronautics and Space Administration Amer. Research Center Moffett Field Calif.

US EXPERIMENTS FLOWN ON THE SOVIET SATELLITE COSMOS 936 Final Reports

Results of spacebone experiments onboard the Cosmos 936 satellite are reported. Alterations 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 Amer. 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 11671 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
The biological effects of space flight were investigated on fruit flies (Drosophila melanogaster) in an experiment planned jointly with the USSR. The effects of hypogravity on the development processes of Drosophila are not appreciably associated with growth and morphogenesis. However, in weightlessness during the young and middle age phases of their adult life span show reduced viability and a detrimental effect on longevity.

The effect of space flight on bone formation, bone resorption, bone length, bone density, and bone 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 postflight 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 postflight bone formation rate during flight, it appears to hasten the recovery following flight that femoral stiffness decreases about 30% and that centrifugation did not correct the defect in bone mechanical properties. All perturbations produced by space flight returned to or exceeded normal values by 25 days after flight.

The activities of about 30 enzymes concerned with carbohydrate and lipid metabolism and the levels of glycogen 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 glycogen phosphorylase, alpha-dglycerol phosphate acyl transferase, diglyceride acyl transferase, acanthase, and 6-phosphoglucomutase 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 than the centrifuged controls and a remarkable shift in the ratio of palmitate to palmitoleate was noted.

The space radiation environment was investigated in a joint US-USSR experiment onboard the Cosmos 396 bisatellite. Results derived from measurements made in a variety of passive radiation detectors, including plastic nuclear track detectors, foils detectors, photoluminescence dosimeters, and nuclear emulsions are reported. The measured heavy ion particle flux was measured in cellulose nitrate plastic detectors, was 1.75 sq cm day. -20%. The fluences of thermal neutrons resonance neutron, and high energy neutrons were respectively 364,000 sq cm, 120,000,000 sq cm, and 2,100,000 sq cm. The total dose as measured in TLD chips located at two sites in the U.S. and 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 cmt cm tissue. The physical parameters of the radiation environment reported help identify, among the few reports of the type, the effects of radiation hazards to life systems in space.
N79-11678# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.
COSMIC RAY EFFECTS ON THE EYES OF STATIONARY
AND CENTRIFUGED RATS FLOWN ON COSMOS 936.
EXPERIMENT K-207 Final Report
Avail. NTIS HC A13/MF A01 CSCL 059
Ten rats; 5 centrifuged during flight to simulate gravity and
5 in flight stationary experiencing hypogravity, orbited the earth
in a 62.8 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 where
synthesis of the outer segment takes place showed swelling
and disruption of the membranes. Channels were again found similar to those seen in K-007. 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

N79-13686# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.
PHYSIOLOGICAL RESPONSES OF WOMEN TO SIMULATED
WEIGHTLESSNESS: A REVIEW OF THE FIRST FEMALE
BED-REST STUDY
Harold Sandler and David L Winter 1978 92 p refs (NASA-SP-430) Avail. NTIS HC A05/MF A01 CSCL 065
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 hematolgy tolerance, to LBNP
physical working capacity, biochemistry, fluid fibroblastic
activity, female metabolic and hormonal responses, cardiovascular
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.

N79-14060# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly
Aug 1978 61 p refs Prepared in cooperation with Battelle
Columbus Labs. Mountain View Calif. (NASA TM-78528 A7826 OR-7) Avail. NTIS HC 004/MF A01 CSCL 01C
A sample of reports relating to operations during winter
weather is presented. Several reports involving problems of
judgment and decision-making have been selected from the
numerous reports representative of this area. Problems related
to aeronautical charts are discussed in a number of reports. An
analytic study of reports involving potential conflicts in
the immediate vicinity of uncontrolled airports was performed. The
results are discussed in this report. It was found that in
three fourths of 127 such conflicts neither pilot or only one of
the pilots was communicating position and intentions on the
appropriate frequency. The importance of providing aural
transfer of information as a backup to the visual see and avoid mode
of information transfer as discussed it was also found that a
large fraction of pilots involved in potential conflicts on final
approach had executed straight-in approaches, rather than the
recommended traffic pattern entries, prior to the conflicts. A
selection of alert bulletins and responses to them by various
segments of the aviation community is presented.
G.G.

N79-15014# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly
Oct 1978 60 p refs Prepared in cooperation with Battelle
Columbus Labs. Mountain View Calif. (NASA TM-78540 A7662 OR-8) Avail. NTIS HC A04/MF A01 CSCL 01C
The study deals with 165 inadvertent operations on or into
inappropiate 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

N79-15088# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif.
THE 14TH ANNUAL CONFERENCE ON MANUAL CON- TROL
Nov 1978 692 p refs Conf held at Univ of Southern Calif.
Human operator dynamics during actual manual control or
while monitoring the automatic control systems involved in
air-to-air tracking, automobile driving, the operator of underwater
vehicles and remote handling are examined. Optimal control
models and the use of mathematical theory in representing man
behavior in complex man machine system tasks are discussed
with emphasis on eye/head tracking and scanning; perception
and attention allocation; decision making; and motion simulation
and effects. For individual titles see N79 15589 through
N79 15634

N79-15686# Illinois Univ. Urbana Dept of Mechanical and Industrial Engineering
MODELING THE HUMAN AS A CONTROLLER IN A
MULTITASK ENVIRONMENT
T Govindaraj and William B Rouse In NASA Ames Res.
Center The 14th Ann Conf on Manual Control Nov 1978 p 75 83 refs (For primary document see N79 15588 06 54)
(Grant NoG 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

N79-15689# Illinois Univ. Urbana Dept of Mechanical and Industrial Engineering
PROSPECTS OF A MATHEMATICAL THEORY OF HUMAN
BEHAVIOR IN COMPLEX MAN MACHINE SYSTEMS
Treas
Gunnar Johannsen and William B Rouse In NASA Ames Res.
Center The 14th Ann Conf on Manual Control Nov
A hierarchical humans activities is derived by analyzing automobile driving in general terms. 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 have not often applied to human machine systems are also discussed. The mathematical descriptions at least briefly considered here include utility, estimation of human 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.

ANALYSIS OF A VTOL HOVER TASK WITH PREDICTOR DISPLAYS USING AN OPTIMAL CONTROL MODEL OF THE HUMAN OPERATOR

Gunnar Johansson and T. Govindaraj

NASA Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p. 137-159 refs (For primary document see N79-15588 06-54) (Grant NAG-2119)

Avail. NTIS HC A99/MF A01 CSCL 05H

The influence of different types of predictor displays in a longitudinal VTOL hover task is analyzed in a theoretical study. It was assumed that pitch angle and position are presented to the pilot in separate displays namely the artificial horizon and position display. The predictive information is calculated by means of a Taylor series. From earlier experimental studies it is well known that predictor displays improve human and system performance and result in reducing human workload. In this study, an optimal control model is used to prove the effect theoretically. Several cases with differing amounts of predictive and rate information are compared.

A MODEL FOR DYNAMIC ALLOCATION OF HUMAN ATTENTION AMONG MULTIPLE TASKS

Thomas B. Sheridan and M. Kamal Tulga

NASA Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p. 569-592 refs (For primary document see N79-15588 06-54) (Grant NAG-2118)

Avail. NTIS HC A99/MF A01 CSCL 05H

The problem of multi-task attention allocation with special reference to aircraft piloting is discussed with the experimental paradigm used to characterize this situation and the experimental results obtained in the first phase of the research. A qualitative description of an approach to mathematical modeling, and some results obtained with it are also presented to indicate what aspects of the model are most promising. Two appendices are given which (1) discuss the model in relation to graph theory and optimization and (2) specify the optimization algorithm of the model.

PILOT DECISION MAKING IN A COMPUTER-AIDED FLIGHT MANAGEMENT SITUATION

Yee-Yen Chu and William B. Rouse

NASA Ames Res. Center The 14th Ann. Conf. on Manual Control Nov. 1978 p. 677-690 refs (For primary document see N79-15588 06-54) (Grant NAG-2119)

Avail. NTIS HC A99/MF A01 CSCL 05H

An experimental representation of a computer-aided multi-task flight management situation has been developed. A computer aiding program was implemented to serve as a back-up decision maker. An experiment was conducted with a balanced design of several subject runs for different workload levels. This was achieved using three levels of subsystem event arrival rates, three levels of control task involvement and three levels of availability of computer aiding. Experimental results compared quite favorably with those from a computer simulation which employed a queueing model. It was shown that the aiding had enhanced system performance as well as subjective ratings, and that the adaptive aiding policy further reduced subsystem delay.

TIME ESTIMATION AS A SECONDARY TASK TO MEASURE WORKLOAD: SUMMARY OF RESEARCH

Sandra G. Hart, Duncan McPherson (Calif. Univ. Berkeley) and Leslie L. Loomba (San Jose State Univ.)

d subjects and to provide a controlled stress environment for visual perception problems. 

Ames Research Center Moffett Field Calif Extraterrestrial Biology Div

ORGANIC CHEMISTRY ON TITAN

Sherwood Chang. Thomas Scattering, 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 A01 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

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. Helmech (Texas Univ. Austin), and Susan F. Burgenbauch (Texas Ll Austin) and Susan F. Burgenbauch (Texas Ll Austin) and Susan F. Burgenbauch (Texas Ll Austin)

A research and development program was undertaken to evaluate the skeletal losses of subhuman primates in hypodynamic environments. The goals of the program are (1) to uncover the mechanisms by which weightlessness affects the skeletal system, and (2) to determine the consequences and reversibility of bone mineral losses; and (3) to acquire a body of data needed to formulate an appropriate countermeasure 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.

Ames Research Center Moffett Field Calif Extraterrestrial Biology Div

EFFECTS OF HYPODYNAMIC SIMULATIONS ON THE SKELETAL DECONDITTONING SPACE FLIGHT EXPERIMENT SIMULATION FACILITIES

D R Young and J W. Tremor In NASA Goddard Space Flight Center Ninth Conf on Space Simulation 1977 p 123-140 refs (For primary document see N79-19013 10-12) Avail NTIS HC A30/MF A01 CSCL 081

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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 p 9-10 (For primary document see N79-21011 12-03) Avail NTIS HC A05/MF A01 CSCL 085

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.

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

Ames Research Center Moffett Field Calif

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Ames Research Center Moffett Field Calif
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 space 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.

N79-27139# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ADVANCED COCKPIT INSTRUMENTATION SYSTEM: THE COORDINATED COCKPIT DISPLAY
D. L. Baty and M. L. Watkins (San Jose State Univ.) Jul. 1979 22 p refs
(NASA-TM-78559, A-7733) Avail NTIS HC A02/MF A01 CSCL O10
Cathode Ray Tube (CRT) and computer technologies are described in one approach to the replacement of flight instruments using three separate color CRT's. Each CRT display information pertinent to one of the three orthogonal projections of the aircraft flight situation. Three airline pilot's assessment of the display set is presented. Comments, rankings, and ratings show that the pilots accepted the concept of pictorial flight displays S.E.S.

N79-3116# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL CONTROL REQUIREMENTS FOR LIFE SCIENCES
Avail NTIS HC A99/MF A01 CSCL 22B
The Life Sciences dedicated Spacelab will enable scientists to test hypotheses in various disciplines. Building upon experience gained in mission simulations, orbital flight test experiments, and the first three Spacelab missions, NASA will be able to progressively develop the engineering and management capabilities necessary for the first Life Sciences Spacelab. Development of experiments for these missions will require implementation of life-support systems not previously flown in space. Plant growth chambers, animal holding facilities, aquatic specimen life-support systems, and centrifuge-mounted specimen holding units are examples of systems currently being designed and fabricated for flight. Author (ESA)

N79-3218# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COCKPIT DISPLAYS OF TRAFFIC INFORMATION: AIRLINE PILOTS OPINIONS ABOUT CONTENT, SYMBOLS, AND FORMAT
Sandra G. Hart (Tufts Univ, Medford, Mass.) and Thomas E. Wempe Aug 1979 54 p refs
(NASA-TM-78601, A-7884) Avail NTIS HC A04/MF A01 CSCL 170
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 navigation 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, weight class, and flightpath history of other aircraft should be presented graphically by coding the shape of the symbol for other aircraft or presented digitally in data tags displayed at pilot request. All pilots thought that color coding was necessary to recognize different categories of information quickly and accurately. The majority of pilots felt that a CDTI would provide useful information even though its presence might increase their workload somewhat particularly during its introductory stages.

N79-32225# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE RESOURCES AND SPACE SETTLEMENTS
(NASA-SR-428) Avail NTIS MF A01, SOD HC CSCL 22B
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.

N79-32227# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RESEARCH PLANNING CRITERIA FOR REGENERATIVE LIFE SUPPORT SYSTEMS APPLICABLE TO SPACE HABITATS
Avail NTIS MF A01; SOD 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, artificial 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.

N79-33201# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A REVIEW OF SOME HEAD-UP DISPLAY FORMATS
J. M. Nash (NAS-NRC) Oct 1979 51 p refs
(NASA-TP-1489, A-7708, HUD-4) Avail NTIS HC A04/MF A01 CSCL 01D
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.
NASA CONTRACTOR REPORTS

N78-11683# Lockheed Missiles and Space Co., Sunnyvale, Calif.
VESTIBULAR FUNCTION RESEARCH (VFR) EXPERIMENT.
PHASE II: DESIGN DEFINITION STUDY Final Report
(Contract NAS2-79715p)
(NASA CR-152227) Avail NTIS HC A03/MF A01 CSCL 06K

The Vestibular Functions Research (VFR) Experiment was established to investigate the dynamics of the human vestibular system. The experiment design was described in detail, including the equipment used and the procedures for data collection. The study involved the analysis of data from preliminary trials to assess the performance of human subjects on tasks that might occur in the future.

N78-18550# GARO Inc., Niles, Ill.
FOUR-MAN RATED DUAL CATALYST SYSTEM FOR THE RECOVERY OF WATER FROM URINE Final Report
(Contract NAS2-79715)
(NASA CR-152227) Avail NTIS HC A03/MF A01 CSCL 06K

The dual catalyst system was integrated with a 4-man rated urine wick evaporator. During operation, urine vapor produced by the wick-evaporator was passed through the catalyst system to remove ammonia and volatile hydrocarbons. Water was recovered by condensation in a water-cooled condenser. The system operated continuously with no manual adjustments, except periodic supply of urine and removal of the recovered water. The average urine recovery rates achieved during each of the three endurance tests were 0.137, 0.217, and 0.235 kg/hr. The quality of the recovered water met drinking water standards, with the exception of a generally low pH.

N78-17490# Massachusetts Inst. of Tech., Cambridge
MODELING HUMAN DECISION MAKING BEHAVIOR IN SUPERVISORY CONTROL
(Grant NGR 22009-733)
Avail NTIS HC A20/MF A01 CSCL 06J

An optimal decision control model was developed, which is based primarily on a dynamic programming algorithm that looks at all the available task possibilities, selects the optimal strategy, 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 against the model show a great similarity, but indicate that the human skips certain movements which require quick change in strategy.

N78-17498# National Aeronautics and Space Administration.
AMES RESEARCH CENTER, MOUNTAIN VIEW, CALIF.
THE HUMAN AS A DETECTOR OF CHANGES IN VARIANCE AND BANDWIDTH
(Grant NGR 22009-733)
Avail NTIS HC A20/MF A01 CSCL 06J

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 (1 sec, 0.2) process which yielded thresholds of 12%. Variance thresholds averaged 17% of nominal except for the (3 sec, 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 found to be descriptive but do not afford the unification of the Kalman filter/sequential test model for changes in mean.

N78-17497# Massachusetts Inst. of Tech., Cambridge
A QUEUEING MODEL OF PILOT DECISION MAKING IN A MULTI-TASK FLIGHT MANAGEMENT SITUATION
(Grant NGR 2119)
Avail NTIS HC A20/MF A01 CSCL 06B

Allocation of decision making responsibility between pilot and computer is considered and a flight management task designed for the study of pilot-computer interaction is discussed. A queueing theory model of pilot decision making in this multi-task environment and control monitoring situation is presented. An experimental investigation of pilot decision making and the resulting model parameters are discussed.

Author

N78-17498# National Aeronautics and Space Administration.
AMES RESEARCH CENTER, MOUNTAIN VIEW, CALIF.
INTERRUPTED MONITORING OF A STOCHASTIC PROCESSE6
E. Palmer in MIT Proc. 13th Ann. Conf. on Manual Control 1977 p 237-244 refs (For primary document see N79-17475 08-51)
(Grant NGR 2119)
Avail NTIS HC A20/MF A01 CSCL 12A

Normative strategies are developed for tasks where the pilot must interrupt his monitoring of a stochastic process in order to attend to other duties. Results are given as to how characteristics of the stochastic process and the other tasks affect the optimal strategies. The optimum strategy is also compared to the strategies used by subjects in a pilot experiment.

J. M. S.
L.
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 simulated 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


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 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


Available: NTIS HC A20/ MF A01 CSCL 05J

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 460-462 refs (For primary document see N79-17475 08-51) (Grant NGR-45-003-108)

Available: NTIS HC A20/ MF A01 CSCL 05H

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 and following training was tested on 120,000 speech samples from 10- 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.


SIMULATION EVALUATION OF COMBINED 4D RNAV AND AIRBORNE TRAFFIC SITUATION DISPLAYS AND PROCEDURES APPLIED TO TERMINAL AERIAL MANEUVERS


Available: NTIS HC A03/ MF A01 CSCL 17G

Simulation scenarios were developed in which subject pilots must simultaneously follow a 3D terminal airspace structure and arrive at fixed waypoints within the structure precisely at pre-scheduled times in the presence of a full range of wind conditions aloft, and monitor nearby traffic on an airborne traffic situation display, especially during operations. Open-loop simulator tests of the single-stage 4D RNAV algorithm indicate that a descending pilot can comply quite closely with an assigned time of arrival at a 3D waypoint, simply by tracking a pre-calculated speed profile. Initial experiments show that the aircraft arrives at the 3D waypoint within a few seconds of the anticipated time. The presence of headwinds or tailwinds does not affect the arrival time error as long as the wind is accurately modeled in the descent algorithm. Results all but guarantee a 5 second standard deviation in arrival time error can be realized in closed-loop descents at very moderate pilot workload levels.

A.R.H.

N79-25704* Florida Agricultural and Mechanical University, Tallahassee. School of Pharmacy.

MICROBIAL TRANSFORMATION OF NUCLEOSIDES Final Report

S. S. Lamba 1979 17 p (Grant NoG-2103) (NASA CR-158696) Available: NTIS HC A02/ MF A01 CSCL 06C

A study involving the use of coultur counter in studying the effects of neomycin on E. coli. S. aureus and A. aerogenes was completed. The purpose of this was to establish proper technique for enumeration of cells per ml. It was found that inhibitory effects on growth of E. coli and A. aerogenes, both gram negative organisms, were directly related to the concentration of neomycin used. However, in case S. aureus, a gram positive organism, a decreased inhibition was noted at higher concentrations. A paper entitled. Use of Coultur Counter in Studying Effect of Drugs on Cells in Culture 1 - Effects of Neomycin on E. coli, S. aureus and A. aerogenes, is attached in the appendix. Laboratory procedures were also established to study the effects of nucleoside antibiotic cordycepin on He La cell grown in suspension cultures.

G.Y.
MAXIMIZING STORAGE STABILITY OF FOODS TO BE USED FOR RSUPPLY IN A CONTROLLED ECOLOGICAL LIFE SUPPLY SYSTEM: EVALUATION OF RESEARCH 

Two multicell, liquid-cooled, advanced electrochemical depolarized carbon dioxide concentrator modules were fabricated. The cells utilized advanced, lightweight, plated anode current collectors, internal liquid cooling and lightweight cell frames. Both were designed to meet the carbon dioxide removal requirements of one-person, i.e. 1.0 kg/d (2.2 lb/d). M.M.M.

ELECTROCHEMICALLY REGENERABLE CARBON DIOXIDE ABSORBER 

Preliminary designs were generated for two electrochemically regenerable carbon dioxide absorber concepts. Initially, an electrochemically regenerable absorption bed concept was designed. This concept incorporated the required electrochemical regeneration components in the absorber design, permitting the absorbent to be regenerated within the absorption bed. This hardware was identified as the electrochemical absorber hardware. The second hardware concept separated the functional components of the regeneration and absorption process. This design approach minimized the extravehicular activity component volume by eliminating regeneration hardware components within the absorber. The electrochemical absorber hardware was extensively characterized for major operating parameters such as inlet carbon dioxide partial pressure, process air flow rate, operational pressure, inlet relative humidity, regeneration current density and absorption/regeneration cycle endurance testing. R.E.S.


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


A79-12475 *


A79-12509 *


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" (1400-1277 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 consummation 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 *


Facilities, techniques, and operational procedures used to implement Planetary Protection (PP) requirements for the Viking Project are reviewed in order to better define the CODSPAR resolution which proposes that Outer Planet spacecraft be assembled using Viking-like clean room technology. It is concluded that, for such missions, PP requirements can be met by adopting Viking clean room standards personnel and operation procedures, and by establishing PP as an official entity in project management.

(Author)

A79-12552 *


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 cm3, 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.

A79-12559 *


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 recovery. These animals will be used in Life Science Spacelab experiments. Stowage in the mid-deck area will reduce animal exposure to the high noise levels existing in Spacelab during launch; 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 experimenters have been successfully designed, fabricated, and tested. Integrated testing of the transporters was performed in the Space Mission Development III (SM III) Simulation at the NASA Johnson Space Center.

(Author)

A79-12574 *


NASA is planning to perform a series of vestibular function research (VFR) investigations on the early STS missions to investigate those neuromotoric 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 experimentation will be directed at investigating: (1) adaptation to weightlessness, (2) adaptation to artificial gravity, (3) response to artificial gravity (in a weightlessness environment) and (4) readaptation to earth's gravity upon return.

(Author)

A79-12584 *


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 materials, radiotracers, and chemicals.

M. L.

A79-12587 *

Instrumentation for controlling and monitoring environmental control and life support systems. P. Y. Yang

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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 on-board 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 used as a basis to develop the respective cockpit instrumentation. The task was to fly a three-degree-of-freedom 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 at pH 9.2, and hydrolysis of these oligomers yields 4,5-dihydroxy-x-pyrromidine, orotic acid, 5-hydroxymethyladene, 4-amino-n-nimidazole-5-carboxamide, and amino-acids. It is suggested that the thermal decomposition of these components 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 the feasibility of a regeneration in generation of HCN from in mission 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 locations such as lunar bases and space manufacturing facilities. It is thought that biological components consisting of plants 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.

M.G.


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 was made to explain the cardiovascular regulatory responses to lower body negative pressure (LBNP) 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 decon- ditioning. Analytical expressions are derived for the responses of mean venous pressure and blood volume pooled in the lower body due to LBNP. An analysis is presented for determining the HPR change due to LBNP 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 (3.4 ppm), and sulfur dioxide (186 ppm). The amounts of water vapor and sulfur dioxide detected are roughly compatible with the requirement 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 major 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.

(Author)


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 bases in a complex, and the dipolar interaction of the complex with the entire medium. 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 configuration 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. ZwiIinski (College of Mount Saint

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Syriposiurri easier. A.A. eluded that with such a procedure, complex mixtures of ammo

acids, with only the beta and gamma-amino acids remaining in the presence of CuCl₂. Excess H₂S was added to precipitate the Cu ²⁺. A method for selectively destroying the alpha amino groups of three noises was presented at three levels in a factorial arrangement to check the additivity hypothesis and estimate the scaling function. Also, a series of phrases of constant level but different parameters for solar and thermal radiation, convective 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 resitivity 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 mola 02 per sq cm/day. (Author)

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. S.D.

A79-27953 * RBC/Cr-S/ half-life and albumin turnover in growing Beagle dogs during chronic radial acceleration. D. A. Beekman, J. W. Evans (California, University, Davis, Calif.), and J. J. deGruyter (California, University, Davis, Calif.). Aviation, Space, and Environmental Medicine, vol. 50, Mar. 1979, p. 212-217. 30 refs. NASA Order 180-508. The effects of chronic centrifugation on growing Beagle dogs exposed to -2 or -2.6 Gx on albumin and RBC turnover rates, albumin concentration and space, and total blood volume were determined and compared with caged and run control animals. Albumin-125 and autologous RBC-Cr-S1 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 (p < 0.01) 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 acts through some as-yet unknown mechanism to affect RBC population kinetics. (Author)

A79-27928 * The response of selected terrestrial organisms to the Martian environment - A modeling study. W. R. Kuhn (Michigan, University, Ann Arbor, Mich.), S. R. Rogers (Michigan, University, Ann Arbor, Mich.), A. Ahumada, Jr (Stanford University, Stanford, Calif.) and D. C. Nagel (NASA, Ames Research Center, Moffett Field, Calif.). American Institute of Aeronautics and Astronautics. Aeracoustics Conference, 5th. Seattle, Wash., Mar. 12-14, 1979. Paper 79-0653. 1 p. 9 refs. 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 were presented at three levels in a factorial arrangement to check the additive hypothesis and to estimate the scaling function. Also, a series of sets of noises 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. S.D.


A79-26436 * Elimination of chromite and novel sulfides as important carriers of noble gases in carbonaceous meteorites. U. Frick (Minnesota, University, Minneapolis, Minn.) and S. Chang (NASA, Ames Research Center, Extraterrestrial Research Div., Moffett Field, Calif.). Meteoritical Society, Annual Meeting. 41st, Sudbury, Ontario, Canada, Aug. 14-17, 1978.) Meteoritics, vol. 13, Dec. 31, 1978, p. 485-490. 14 refs. Abridged. Grants No. NGL-75-003. No. NGL-24-005-225. A79-26436 * Selective photodestruction of alpha-amino acids. N. Levi and J. G. Lawless (NASA, Ames Research Center, Moffett Field, Calif.). Analytical Biochemistry, vol. 90, 1978, p. 796-801. 14 refs. 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 racemic, with one milliliter of solution containing 0.00000025 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 Cu ²⁺ destroyed all the amino acids except the beta and the gamma type. 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.A.

A79-26805 * The annoyance of multiple noisy events. A. Ahumada, Jr (Stanford University, Stanford, Calif.) and D. C. Nagel (NASA, Ames Research Center, Moffett Field, Calif.). American Institute of Aeronautics and Astronautics. Aeracoustics Conference, 5th. Seattle, Wash., Mar. 12-14, 1979. Paper 79-0653. 1 p. 9 refs. 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 were presented at three levels in a factorial arrangement to check the additive hypothesis and to estimate the scaling function. Also, a series of sets of noises 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. S.D.


A79-28047 * Selective photodestruction of alpha-amino acids. N. Levi and J. G. Lawless (NASA, Ames Research Center, Moffett Field, Calif.). Analytical Biochemistry, vol. 90, 1978, p. 796-801. 14 refs. 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 racemic, with one milliliter of solution containing 0.00000025 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 Cu ²⁺ destroyed all the amino acids except the beta and the gamma type. 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.A.
A79-29925 * Effect of electroconvulsive shock on mono-
aminergic receptor binding sites in rat brain. D. A. Bergstrom and K.
NCA2-01926-701.

A79-29938 * Prebiotic nucleotide oligomerization in a fluc-
tuating environment - Effects of kaolin and cyanamide. D. G.
Odom, N. Lahav, and S. Chang (NASA, Ames Research Center,
Extraterrestrial Research Div., Moffett Field, Calif.). Journal of

The clay kaolinite was tested for its ability to promote nucleo-
tide oligomerization in model prebiotic systems. Heterogeneous mix-
tures 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 oligomera-
tion of nucleotides at detectable levels. Cycling of clay in combina-
tion 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 reac-
tions. (Author)

A79-30175 * Effects of aeriation on formation and localiza-
tion of the acetyl coenzyme A synthetases of Saccharomyces cerevi-
siae. H. P. Klein and L. Jahneke (NASA, Ames Research Center,
Moffett Field, Calif.). Journal of Bacteriology, vol. 137, Jan. 1979,
p. 179-184. 20 refs.

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 synthetases simultaneously in yeast
homogenates. The data presented confirm the possibility of simul-
taneous 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.)

A79-30624 * Effect of sodium and calcium ingestion on
thermoregulation during exercise in man. J. E. Greenleaf, P. J. Brook,
J. T. Morse, W. Van Beumont, L. D. Montgomery, V. A.
Convertino, and G. R. Mangseh (NASA, Ames Research Center,
Moffett Field, Calif.). In: New trends in thermal physiology. Paris,
Masson, 1979, p. 157-160. 8 refs.

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 hyper-
tonic 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 tem-
perature change, although calcium caused a reduction of blood flow
in the extremities. (A.L.W.)

A79-31337 * COS in the stratosphere. E. C. Y. Inn, J. F.
Vedder, B. J. Tyson (NASA, Ames Research Center, Moffett Field,
Calif.), and D. O’Hara (LFE Corp., Richmond, Calif.). Geophysical

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 measure-
ments 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)

A79-31981 * Apparent cooperativity of amino acid trans-
port in Halobacterium halobium - Effect of electrical potential. J. K.
Lanyi (NASA, Ames Research Center, Extraterrestrial Biology Div.,
Moffett Field, Calif.). Archives of Biochemistry and Biophysics, vol.

Active serine accumulation in cell envelope vesicles from
Halobacterium halobium proceeds by co-transport with Na+ and
is 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 dif-
fERENCE 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)

A79-32252 * An optimized potential function for the calcu-
lation of nucleic acid interaction energies. I - Base stacking. R. L.
Ornstein (Roswell Park Memorial Institute, Buffalo, N.Y.), R. Rein
(New York, State University, Buffalo, N.Y.), D. L. Brenn (Auburn
University, Auburn, Ala.), and R. D. MacElroy (NASA, Ames
NSG-3705; No. PHS-CA-17609.

A79-32920 # Kinetics of spreading and contact interaction
in systems with the formation of intermediate phases (Kinetika
rozrikannia i kontaktna vzaemodiia v sistemakh z utverenniam
718-744. 44 refs. In Ukrainian.

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- Mo. In-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 spread 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.

A.L.W.


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° 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.

S.D.


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 liver and silk tissue and fruits, 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 erythropoietic and musculoskeletal systems of rats.

A.A.


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 in temperate (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.

S.D.


The thermostructural response of three candidate carbon-carbon composites for the Jovian entry probe heatshield was investigated. The analysis for the three materials, Sandia Field, 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 reeding 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 Field and Carbitex 700 materials, respectively. The 4-D wave material showed no failures over the entire entry. (Author)


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, dopamine 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. (Author)


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


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/g 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/g 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.


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 elements would have been required for the development of the first replicating systems subject to the process of biological evolution. V.P.


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 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 kPa/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 apomorphine-induced behavior, a behavior primarily controlled by dopaminergic neurotransmission, was investigated in rats fed on a low tryptophan diet since weaning. It was found that reductions in brain serotonin (5-HT) produced by diet result in decreased stereotypy after apomorphine administration. This indicates that although stereotyped behavior is primarily mediated by dopaminergic mechanisms, it can also be modulated by other neurotransmitters 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, chloride 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. Comparisons 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)


Unrestrained rats were exposed to cold for 1 h during and immediately after exposure to hypergravity (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 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 fiberglass 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, inflight 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 continuous physiological experimentation on nonhuman primates in the Spacelab environment.

S.D.

A simple physiological model of mortality kinetics is used to test 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 homeostatic 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.), Aviat. 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-1001000 graph. 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 resulting from 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, for 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 connecting 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 mechanisms seem more responsive to the thermoregulatory stress 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 process for tilt is different than for torsion, since summation for torsion is spared in stereoscopic 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-h long 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 Cohr 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 agents 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 bacteriorhodopsin-containing vesicles at different light intensities, and the rate and extent of Na(+) transport 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 different 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.


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.


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. Dilation of the pupils without the use of mydriatics was accomplished by dark-adaptation of the subject. Pictures were obtained without pupil constriction by the use of a high speed strobe light. This method also has applications for clinical medicine. (Author)


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 sources 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.


Results of the ASSESS experiment on payload specialist workloads conducted as part of the ASSESS II airborne simulation of Spacelab conditions are reported. Subjects were fitted with temperature probes and ECG, EOG and EOG electrodes, and hormone and electrolyte extractions were monitored 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 bioinstrumentation 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.
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.

PREPARATION OF DIELECTRIC COATING OF VARIABLE DIELECTRIC CONSTANT BY PLASMA POLYMERIZATION


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 recurr ising video fields. The real-time contour detector and data acquisition system includes track and hold circuits, a reference level analog computer circuit, an analog comparator, a digital processor, a field memory, and a computer interface.

Official Gazette of the U.S. Patent Office

N79-1184# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.

SUBCUTANEOUS CHANNELING PROBE Patent Application


The subcutaneous channeling probe 15 provided an instrument for use in the placement of biosensors with long leads in animals. The probe channeled 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 0.38 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

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

GASTRIC ULCERATION CONTROL Patent Application


Gastric ulcers caused by the ingestion of indomethacin by subjects under stress are significantly reduced by administering to the subjects, together or in sequence, such antihistaminic drugs as pyrilamine promethazine or cimetidine. The dosages may range from 25 to 200 mg daily for the antihistaminic and from 200 mg to 1.5 g daily for the antibacterial.

Official Gazette of the U.S. Patent Office

N79-1478# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.

INDOMETHACIN-ANTIHISTAMINE COMBINATION FOR GASTRIC ULCERATION CONTROL Patent Application


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, 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 radio frequency source 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.

N79-1624# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.

ELECTRIC DISCHARGE FOR TREATMENT OF TRACE CONTAMINANTS 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 may be made ready for use as electrophoretic media or impregnated with various specific substrates and dyes.

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

N79-1808* National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif.

OXYGEN POST-TREATMENT OF PLASTIC SURFACE
RESEARCH SUPPORT

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
E. P. McCutcheon, R. Miranda, T. B. Fryer, G. Hodges, B. D. Newson, and N. Pace In NASA- Goddard Space Flight Center Ninth Conf. on Space Simulation 1977 p 141-153 refs (For primary document see N79-21374 12-37)
Avail: NTIS HC A11/ MF A01 CSCL 028
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
Expendable, slug-type calorimeter probes were developed for measuring high heat-flux levels of 10-30 kW/sq cm in electric-arcjet 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
Michael J. O'Spring and Ronald E. Mancini In its The 12th Aerospace Mech. Symp. Apr. 1979 p 131-141 (For primary document see N79-21352 12-37)
Avail: NTIS HC A11/MF A01 CSCL 20K
A method of obtaining test 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
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.

Avail. NTIS HC A11/ MF A01 CSCL 20K

N79-21391*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TWO-DIMENSIONAL OSCILLATING AIRFOIL TEST APPARATUS
Frank L. Gibson, Andrew J. Hucker, Jr., and Dennis S. Matsuihro In NASA-Goddard Space Flight Center The 11th Aerospace Mech. Symp. 28 Apr. 1977 p 177-184 (For primary document see N79-21374 12-37)
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 an 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.M.A.

N79-21822*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASF TRANSPosition NETWORK: A COMPUTING NETWORK FOR UNSCRAMBLING P-ORDERED VECTORS
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.
N79-22647# 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 83-89 (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.

N79-22647# 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 83-89 (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.

N79-28762# 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
GORDON F. LUND (SAN JOSE STATE UNIV), RICHARD M. WESTBROOK, THOMAS B. FRYER, AND RAFAEL F. MIRANDA MAY 1979 74 P. REFS
(NASA-TM-78590 A-7824) AVAIL NTIS HC A04/ MF A01 CSCL 06B
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 output interval modulation. This modulation scheme includes first and last calibration intervals for a reference by ratio with the temperature intervals to achieve good accuracy even over longer 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
(NASA-CR-158653 REPT1) 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 66 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 TRANSonic FLOW GOVERNED BY THE CONSERVATIVE FULL POTENTIAL EQUATION USING AN ALTERNATING DIRECTION IMPLICIT ALGORITHM
PETER M. GOONAN JUN 1979 48 P. REFS
(Contract NAS2-9891) 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 preferred for residue checking. Two methods of residue generation are described: the standard method of using modulo m adders and the method of using a self-testing residue tree. A simple single-bit parity-check code is described for checking the logical operations of XOR, OR, and AND, and also the arithmetic operations of complement, shift, and rotate. For checking complement, shift, and rotate, the single-bit parity-check code is simpler to implement than the residue codes.

N79-22645# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN OF A PIEZOELECTRIC SHAKER FOR CENTRIFUGE TESTING
JEFFREY G. CANCELLINI 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.

N79-12417# Control Technology Associates, Cupertino, Calif.
LABORATORY DEMONSTRATION OF AIRCRAFT ESTIMATION USING LOW-COST SENSORS Final Report
JOHN A. SORENSEN [1978] 84 P. REFS
(Contract NAS2-9382) NASA-CR-152049 AVAIL NTIS HC A05/ MF A01 CSCL 148
Four nonlinear state estimators were devised which provide techniques for obtaining the angular orientation (attitude) of the aircraft. An extensive FORTRAN computer program was developed to demonstrate and evaluate the estimates by using recorded flight test data. This program simulates the estimator operation, and it compares the state estimates with actual state measurements. The program was used to evaluate the state estimators with data recorded on the NASA Ames CV-580 and CESSNA 402B aircraft. A preliminary assessment was made of the memory, word length, and timing requirements for implementing the selected state estimator on a typical microcomputer.

N79-22645# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN OF A PIEZOELECTRIC SHAKER FOR CENTRIFUGE TESTING
JEFFREY G. CANCELLINI 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.
from a thickening and subsequently, thinning airfoil. 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.M.


FEASIBILITY STUDY FOR A NUMERICAL AERODYNAMIC SIMULATION FACILITY, VOLUME 3: FMP LANGUAGE SPECIFICATION/USER MANUAL Final Report


(Contract NAS2-9698)

N79-152289

Avail: NTIS HC A12/MF A01 CSCL 148

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 allow access to any machine instruction.

G.Y.

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


Experiments at the Arc Jet Tunnel at Ames Research Center have typical run times of 5-10 sec during which the test model is subjected to an environment simulating reentry into Jupiter. Previous real-time determination of mass flow required off-line manual computations from taprd or strip chart data. The present paper describes a computer which provides personnel with real-time computations of mass flow. Using an 8-bit microprocessor and standard TTL interface circuitry, the unit interrogates temperature and pressure instruments with other parameters to compute mass flow.

B.J.


Using a simplified, approximate 'Lagrangian-mean' dynamical formulation, the mean meridional mass circulation of the stratosphere and mesosphere is discussed. Under solsticial conditions, it is shown that this Lagrangian-mean circulation may be inferred, as a first approximation, from the Eulerian-mean diabatic heating. Diabatic heating rates for the solutions, originally derived by Murgatroyd and Grovec (1958), result in Lagrangian mean rising motion at the tropical tropopause, subsidence across the extra tropical tropopause, and a very strong summer-to-winter pole flow in the mesosphere. This circulation is directly obtained by Murgatroyd and Singleton (1961) for the solutions. Those authors, however, attempted to identify this circulation as the Eulerian-mean motion, and were later criticized for their neglect of the meridional eddy heat flux in the calculation, which proved to be extremely important in the winter hemisphere. The present study, nevertheless, indicates that Murgatroyd and Singleton's circulation may in fact represent the actual air parcel motions in the stratosphere and mesosphere.


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 NI. 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 along the orbital trajectory: Information on sharp and diffuse shock structures and on 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.


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.

(Author)

A79-28074* Data processing in infrared astronomy. R. F. Peizmann, 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 the information flow from the telescope aperture to the computer center. This paper reviews the primary elements of this end-to-end
concept and the impact of each of these elements on the data processing algorithms, including the division between onboard and ground processing for scientific measurements. B.J.


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 the 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 Steps 2, 3 and 4. (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 approximately 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 batteries, providing unlimited operating life. The described system uses a capacitive pressure transducer with excellent long-term stability. Once detected with the transducer and converted 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 microwatt 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 Kelvin and mixed Rossby-gravity waves with the mean flow. The proposed model involves a semiprobabilistic 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.


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
NASA Case ARC 11035 1 US Patent 4 109 644
A miniature echosonometer adapted for implantation in the interior of an animal for imaging the internal structure of an organ, tissue or vessel is presented. The echosonometer includes a receiver/transmitter circuit which is coupled to an ultrasonic transducer. Power is coupled to the echosonometer by electromagnetic induction through the animal's skin. Imaging signals from the echosonometer are electromagnetically transmitted through the animal's skin to an external readout apparatus.

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

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 - 06. p 0786
NASA Case ARC 10994 2 US Patent 4 154 230
US Patent Class 73 6261 US Patent Class 126 2 1A US Patent and Trademark Office CSCL 06A
The combination of a C mode scan electronics in a portable battery powered biomedical ultrasoundoscope having A and M mode scan electronics. The C mode scan electronics comprises a plurality of transducer elements arranged in a row and adapted to be positioned on the skin of the patient's body for (1) converting a pulsed electrical signal to a pulsed ultrasonic signal. (2) radiating the ultrasonic signal into the patient's body, (3) picking up the echoes reflected from interfaces in the patient's body, and (4) converting the echoes to electrical signals. Each transducer is coupled to a respective transducer for transmitting a pulsed electrical signal and for transmitting the converted electrical echo signals directly to the receiver.

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

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.

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Application of theories, as well as special methods of procedures applicable to performance prediction are illustrated first on an example of the conventional helicopter and then winged and tandem configurations. Performance prediction of conventional helicopters in hover and vertical ascent are investigated. Various approaches to performance prediction in forward translation are presented. Performance problems are discussed only this time, a wing is added to the baseline configuration, and both aircraft are compared with respect to their performance. This comparison is extended to a tandem. Appendices on methods for estimating performance guarantees and growth of aircraft concludes this volume.

N79-22039# Boeing Vertol Co., Philadelphia, Pa

ROTARY WING AERODYNAMICS VOLUME 1: BASIC THEORIES OF ROTOR AERODYNAMICS WITH APPLICATION TO HELICOPTERS


(Contract NAS2-7007)  (NASA CR-3082)  (For primary document see N79-17475 p. 851)

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 physicomathematical 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.

L. S.

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.
AEROMECHANICS LABORATORY

FORMAL REPORTS

N79-10864* # National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
AEROACOUSTIC RESEARCH: AN ARMY PERSPECTIVE
refs Prepared in cooperation with Army Res. and Technol. Labs., Fort Eustis. Va. (For primary document see N79 10843 01 711;
Avail. NTIS. HC A19/MF A01 CSL 20A).

A short perspective of the Army aeroacoustic 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
refs Prepared in cooperation with Army Aviation Res. and Devel-
opment Command, Moffett Field, Calif. (For primary document see
N79-15973 07 09).
Avail. NTIS. HC A14/MF A01 CSL 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. J Y.

N79-10863# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. Aeronautics Lab.
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 CSL 01A

The aerodynamic lift, drag, and pitching moment characteristics 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

NASA CONTRACTOR REPORTS

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: ANALYSIS OF THE ACOUSTIC FIELD
R Parasa raththy and K. Karamcheti. Sep 1972 75 p refs
Sponsored in part by Army Mobility Res. and Develop. Com-
mand (Contract NAS2-6158)
(ANASA CR 152261) Avail. NTIS. HC A03/MF A01 CSL
01A

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-focussing flexible mount is developed.
The aeroelastic 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

AERODYNAMIC SOUND GENERATION DUE TO VORTEX-
AEROFOL INTERACTION. PART 2: ANALYSIS OF THE ACOUSTIC FIELD
R Parasa raththy and K. Karamcheti. Sep 1972 75 p refs
Sponsored in part by Army Mobility Res. and Develop. Com-
mand (Contract NAS2-6158)
(NASA CR 152231) Avail. NTIS. HC A04/MF A01 C5L
02A

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 incoherent 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 Joukowski
airfoil for the vortex airfoil interaction. Sound radiation in cp plane,
far field simplification, and computation of the sound field are
discussed. A R H

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JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS


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 with no 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. (Author)


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. (Author)


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 aeroelastic 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 obtuse unswept, however, the critical mode is bending torsion-ailerons flutter. The latest version of the NASTRAN computer code, as well as the Ames PASSFLUT program, was used in these studies. (Author)


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


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 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 amplifications are critically dependent on the support dynamics. (Author)
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. B.J.

A79-49060  

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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0 Airfoil profiles

0 Airfoils

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Multi-delta wings

Multi-extraneously blown fins

Multi-flaps (control surfaces)

Multi-flexible wings

Multi-horizontal tail surfaces

Multi-jet fins

Multi-laminating airfoils

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Multi-lifting rotors

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Airfoils

Airfoil sections; U airfoil profiles

0 Airfoil thickness

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Multi-alarmed

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Multi-extraneously blown fins

Multi-flaps (control surfaces)

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The SOLAR NEBULA is a complex system that interacts with the SOLAR SYSTEM. Solar nebulae are thought to be the birthplaces of planets, and they are studied using solar probes and solar plasma probes.

The SOLAR NEBULA is also known for its solar reflectors, solar spectra, and solar system. Solar reflectors are used to collect and reflect sunlight, while solar spectra are used to study the composition of the SOLAR NEBULA.

The SOLAR NEBULA is also known for its SOLAR PROBES, which are spacecraft designed to study the SOLAR NEBULA. SOLAR PROBES are used to study the SOLAR NEBULA's composition, structure, and dynamics.

The SOLAR NEBULA is also known for its solar radiation, solar plasma, and solar plasmas. Solar radiation is the energy emitted by the SOLAR NEBULA, and it is responsible for heating the SOLAR SYSTEM. Solar plasmas are ionized gases that are found in the SOLAR NEBULA.

The SOLAR NEBULA is also known for its solar probes, solar plasma, and solar plasmas. SOLAR PROBES are used to study the SOLAR NEBULA's composition, structure, and dynamics. Solar plasma probes are used to study the SOLAR NEBULA's plasma, which is a key component of the SOLAR NEBULA.

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