1978

Ames Research Center Publications: A Continuing Bibliography

luation of the Tilt Rotor Concept: The XV-15's Role. Future Requirements and Roles of Computers in Aerodynami
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ɔe and Control for Investigating Aircraft Noise-Impact Reduction. Trajectory Module of the
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.ɟ Applied to a Helicopter in the Hoɟ
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ʾ-15 Tilt Rotor Aircraft in Helicopter Mode. Application of Advanced Technologies to Small Short-Haul
. Large Scale Swivel Nozzle Thrust Deflector. High Angle Canard Missile Test in the Ames 11-Foot Trɑ
. Study of Commuter Airplane Design Optimization. Application of Second-Order Turbulent Modeling tɔ
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ɟamic Stall of an Oscillating Airfoil. A Review of NASA-Sponsored Technology Assessment Projects. Lagrangian Bimolecular Reactiɔ
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ɟynamic Characteristics of an 0.075-Scale F-15 Airplane Model at High Angles of Attack and Sideslip. Response at Subsonic and Transo
Transonic Testing with Splitter Plates. Phenomenological Aspects of Quasi-Stationary Controlled and An Investigation of Wing Buffet

1978
Ames Research Center Publications:
A Continuing Bibliography

NASA

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035

FOREWORD

This sixth annual edition of *Ames Research Center Publications: A Continuing Bibliography* lists Ames-sponsored literature indexed during 1978 in *Scientific and Technical Aerospace Reports* (STAR), *Limited Scientific and Technical Aerospace Reports* (LSTAR) and *International Aerospace Abstracts* (IAA).

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

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

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

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

Betty Sherwood, Compiler

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SECTION I

PUBLICATIONS

OFFICE OF THE DIRECTOR

FORMAL REPORTS

N78-26152*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
**PLANNING FOR AIRPORT ACCESS: AN-ANALYSIS OF
THE SAN FRANCISCO BAY AREA**
Jarir S Dajani, ed (Stanford Univ., Calif), James V Jucker, ed
(Stanford Univ, Calif.), and J Lloyd Jones May 1978 300 p
refs Stanford-NASA-ASEE Summer Faculty Fellowship Program
on Engineering System Design held at Moffett Field, Calif.
1977
(NASA-CP-2044, A-7347) Avail NTIS HC A13/MF A01 CSCL
09E
A multidisciplinary systems analysis of airport access to the
major airports of the San Francisco Bay Area was made Basically,
it was found that there is no major airport access problem The
argument of the report is that commonly perceived airport access
problems are either minor inconvenience magnified out of
proportion by a combination of the traveler's unreasonable
expectations, anxiety over flight departure and lack of information,
or not subject to solutions which do not consider the entire
urban transit system Nine specific conclusions and recommenda-
tions for improvement are presented and discussed   Author

NASA CONTRACTOR REPORTS

N78-10946*# Pepperdine Univ, Los Angeles, Calif   School
of Business and Management
**WHO SHOULD CONDUCT AERONAUTICAL R AND D FOR
THE FEDERAL GOVERNMENT?**
H Harvey Album Aug 1977 219 p refs
(Grant NsG-2159)
(NASA-CR-152021) Avail NTIS HC A10/MF A01 CSCL
05A
It was found that Government laboratories, and especially
NASA laboratories should be the prime national producers of
applied research in aeronautics American aeronautic needs the
new stimulus of markedly increased outputs of broad-based
innovative research from NASA laboratories more than it needs
most of the technology advancement and development-oriented
programs currently underway in these laboratories. The Govern-
ment should use manufacturing companies for the vast bulk of
development and most technology advancement However, the
Government will have to implement programs to encourage the
transfer of full information on technology and research advance-
ments. from the companies that do this work for the Government,
to competing companies Universities should be the primary
sources of basic research Service R&D companies and non-profit
R&D institutions provide valuable, specialized, supplementary
technical capabilities and other unique attributes, which together
span the entire spectrum of-aeronautical R&D   Author

N78-28993*# Operations Research, Inc, Silver Spring, Md.
**PHASE 1: DEFINITION OF INTERCITY TRANSPORTATION
COMPARISON FRAMEWORK. VOLUME 1: SUMMARY**
Final Report
19 Jul 1978 42 p refs
(Contract NAS2-9815)
(NASA-CR-152152-Vol-1, ORI-TR-1298-Vol-2) Avail NTIS
HC A03/MF A01 CSCL 13F
A unified framework for comparing intercity passenger and
freight transportation systems is presented Composite measures
for cost, service/demand, energy, and environmental impact were
determined. A set of 14 basic measures were articulated to
form the foundation for computing the composite measures A
parameter dependency diagram, constructed to explicitly interre-
late the composite and basic measures is discussed Ground
rules and methodology for developing the values of the basic
measures are provided and the use of the framework with existing
cost and service data is illustrated for various freight systems.
A R.H.

N78-29996*# Econergy Inc, Los Angeles, Calif
**A STUDY OF CHARACTERISTICS OF INTERCITY TRANS-
PORTATION SYSTEMS. PHASE 1. DEFINITION OF
TRANSPORTATION COMPARISON METHODOLOGY**
Executive Summary
J. Morley English, Jeffrey L. Smith, and Melvin W Lifson Aug
1978 42 p Sponsored in part by DOT
(Contract NAS2-9814)
(NASA-CR-152153-2) Avail NTIS HC A03/MF A01 CSCL
13F
The objectives of this study are (1) to determine a unified
methodological framework for the comparison of intercity
passenger and freight transportation systems, (2) to review the
attributes of existing and future transportation systems for the
purpose of establishing measures of comparison. These objectives
were made more specific to include (1) development of a
methodology for comparing long term transportation trends arising
from implementation of various R&D programs, (2) definition of
value functions and attribute weightings needed for further
transportation goals   •   G Y

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

A78-36722 *   Space industrialization - Education. K. M.
Joels (NASA, Ames Research Center, Moffett Field, Calif.) In: The
industrialization of space, Proceedings of the Twenty-third Annual

Meeting, San Francisco, Calif., October 18-20, 1977. Part 1 (A78-36701 15-12) San Diego, Calif, American Astronautical Society, Univelt, Inc, 1978, p. 491-499. 18 refs (AAS 77-258)

The components of an educational system based on, and perhaps enhanced by, space industrialization communications technology are considered Satellite technology has introduced a synoptic distribution system for various transmittable educational media. The cost of communications satellite distribution for educational programming has been high. It has, therefore, been proposed to utilize Space Shuttle related technology and Large Space Structures (LSS) to construct a system with a quantum advancement in communication capability and a quantum reduction in user cost. LSS for communications purposes have three basic advantages for both developed and emerging nations, including the ability to distribute signals over wide geographic areas, the reduced cost of satellite communications systems versus installation of land based systems, and the ability of a communication satellite system to create instant educational networks.   G R.

D

ADMINISTRATION

FORMAL REPORTS

N78-27042*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
AMES RESEARCH CENTER PUBLICATIONS-1976
Betty Sherwood May 1978 168 p refs
(NASA-TM-78493; A-7346) Avail. NTIS HC A08/MF A01
CSCL 05B
   Bibliography of the publications of Ames Research Center
authors and contractors, which appeared in formal NASA
publications, journal articles, books, chapters of books, patents,
and contractor reports Covers 1976   Author·

A

AERONAUTICS AND FLIGHT SYSTEMS

FORMAL REPORTS

N78-10019*# National Aeronautics and Space Administration
Ames Research Center Moffett Field. Calif
**LOW SPEED AERODYNAMIC CHARACTERISTICS OF AN
0 075-SCALE F-15 AIRPLANE MODEL AT HIGH ANGLES
OF ATTACK AND SIDESLIP**
Daniel N Petroff, Stanley H Scher, and Lee E Cohen (ARO.
Inc, Moffett Field Calif) Jul 1974 118 p refs
(NASA-TM-X-62360) Avail: NTIS HC A06/MF A01 CSCL
01A

An 0 075 scale model representative of the F-15 airplane
was tested in the Ames 12 foot pressure wind tunnel at a
Mach number of 0 16 to determine static longitudinal and lateral
directional characteristics at spin attitudes for Reynolds numbers
from 1 48 to 16 4 million per meter (0 45 to 5 0 million per
foot) Angles of attack ranged from 0 to +90 deg and from
-40 deg to -80 deg while angles of sideslip were varied from
-20 deg to +30 deg Data were obtained for nacelle inlet ramp
angles of 0 to 11 deg with the left and right stabilators deflected
0. -25 deg. and differentially 5 deg and -5 deg The normal
pointed nose and two alternate nose shapes were also tested
along with several configurations of external stores Analysis of
the results indicate that at higher Reynolds numbers there is a
slightly greater tendency to spin inverted than at lower Reynolds
numbers. Use of a hemispherical nose in place of the normal
pointed nose provided an over correction in simulating yawing
moment effects at high Reynolds numbers' Author

N78-17999*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
**TWO-DIMENSIONAL TRANSONIC TESTING WITH SPLIT-
TER PLATES**
Sanford Davis and Bodapati Satyanarayana Feb 1978 24 p
refs
(NASA-TP-1153 A-7221) Avail NTIS HC A02/MF A01 CSCL
01A

The use of splitter plates for two dimensional transonic testing
in wind tunnels was investigated on a 12% biconvex airfoil section
over the Mach number range 0 6 to 1.0 Measured pressure
distributions were compared to transonic theory and to other
experiments, including an investigation in the same facility without
splitter plates The results of the experiment show the best
agreement with theory over the entire transonic Mach number
range Author

N78-18380*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
**PHENOMENOLOGICAL ASPECTS OF QUASI-STATIONARY
CONTROLLED AND UNCONTROLLED THREE-
DIMENSIONAL FLOW SEPARATIONS**
David J. Peake In AGARD Three Dimensional and Unsteady
Separation at High Reynolds Numbers Feb 1978 52 p refs
(For availability see N78-18375 09-34)
Avail. NTIS HC A11/MF A01 CSCL 20D

Interest in three dimensional flow separation is linked closely
.'with wings of high leading edge sweep and bodies of fineness
ratio operating at large angles of incidence or yaw, that are
typical of many high-speed aircraft and missile layouts The
quasi-steady three dimensional separated flows about practical

flight vehicles are discussed as well as the general character of
the three dimensional attached boundary layer, the concept of
limiting streamlines, and the present understanding of the physics
of three dimensional separation and reattachment The advantages
of swept. sharp edges that generate controlled (or fixed) three
dimensional flow separations on a vehicle because of the
qualitatively unchanging flow field developed throughout the range
of flight conditions are promoted in preference to allowing for
uncontrolled (or unfixed) separations Author

N78-18882*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
**EXCHANGE AND RELAXATION EFFECTS IN LOW-ENERGY
RADIATIONLESS TRANSITIONS**
Mau Hsiung Chen (Oregon Univ, Eugene), Bernd Crasemann
(Oregon Univ, Eugene). Michio Aoyagi. and Hans Mark (Depart-
ment of the Air Force, Washington. D C) [1978] 28 p refs
(Grants NGR-38-003-036, DAAG29-78-G-0010)
(NASA-TM-79383) Avail: NTIS HC A03/MF A01 CSCL 20H

The effect on low-energy atomic inner-shell Coster-Kronig
and super Coster-Kronig transitions that is produced by relaxation
and by exchange between the continuum electron and bound
electrons was examined and illustrated by specific calculations
for transitions that deexcite the [3p] vacancy state of Zn Taking
exchange and relaxation into account is found to reduce, but
not to eliminate the discrepancies between theoretical rates and
measurements Author

N78-19142*# National Aeronautics and Space Administration
Ames Research Center. Moffett Field, Calif
**EVALUATION OF THE TILT ROTOR CONCEPT: THE XV-15'S
ROLE**
James H Brown, Jr, H. Kipling Edenborough (Textron Bell
Helicopter. Fort Worth, Tex), and Kenneth G Wernicke In AGARD
Rotorcraft Design Jan 1978 9 p Prepared in cooperation
with Army Air Mobility Res and Develop. Lab, Moffett Field,
Calif (For availability see N78-19126 10-05)
Avail NTIS HC A15/MF A01 CSCL 01C

The need for an aircraft combining the efficient vertical takeoff
and landing capability of a helicopter with the efficient high
speed characteristics of a fixed wing turboprop is examined
The ability of the tilt rotor concept to fill this requirement and
examples as to its potential usefulness in both military and civil
missions are discussed Author

N78-19786*# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, Calif
**FUTURE REQUIREMENTS AND ROLES OF COMPUTERS
IN AERODYNAMICS** c60
Thomas J Gregory In its Future Computer Requirements for
Computational Aerodynamics Feb 1978 p 102-107 (For
availability see N78-19778 10-59)
Avail NTIS HC A22/MF A01 CSCL 09B

While faster computers will be needed to make solution of
the Navier-Stokes equations practical and useful, most all of

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the other aerodynamic solution techniques can benefit from faster computers There is a wide variety of computational and measurement techniques. the prospect of more powerful computers permits extension and an enhancement across all aerodynamic methods, including wind-tunnel measurement. It is expected that, as in the past. a blend of methods will be used to predict aircraft aerodynamics in the future. These will include methods based on solution of the Navier-Stokes equations and the potential flow equations as well as those based on empirical and measured results. The primary flows of interest in aircraft aerodynamics are identified, the predictive methods currently in -use and/or under development are reviewed and two of these methods are analyzed in terms of the computational resources needed to improve their usefulness and practicality.   Author

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

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

N78-20113*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
A SIMPLE METHOD FOR ESTIMATING MINIMUM AUTO-ROTATIVE DESCENT RATE OF SINGLE ROTOR HELICOP-TERS
Peter D. Talbot and Laurel G Schroers (Army R & T Labs, Moffett Field, Calif.) Mar. 1978 17 p refs
(NASA-TM-78452, A-7134) Avail NTIS HC A02/MF A01 CSCL 01C

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

N78-20176*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
STATIC AND DYNAMIC STABILITY ANALYSIS OF THE SPACE SHUTTLE VEHICLE-ORBITER
Wei J. Chyu, Ralph K. Cavin (Texas A and M Univ, College Station), and Larry L Erickson Mar 1978 62 p refs
(NASA-TP-1179; A-7217) Avail NTIS HC A04/MF A01 CSCL 22B

The longitudinal static and dynamic stability of a Space Shuttle Vehicle-Orbiter (SSV Orbiter) model is analyzed using the FLEXSTAB computer program. Nonlinear effects are accounted for by application of a correction technique in the FLEXSTAB system: the technique incorporates experimental force and pressure data into the linear aerodynamic theory. A flexible Orbiter

model is treated in the static stability analysis for the flight conditions of Mach number 0 9 for rectilinear flight (1 g) and for a pull-up maneuver (2 5 g) at an altitude of 15 24 km. Static stability parameters and structural deformations of the Orbiter are calculated at trim conditions for the dynamic stability analysis, and the characteristics of damping in pitch are investigated for a Mach number range of 0 3 to 1 2. The calculated results for both the static and dynamic stabilities are compared with the available experimental data   Author

N78-20917*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
COMPARISON OF MEASURED AND CALCULATED HELICOPTER ROTOR IMPULSIVE NOISE
Wayne Johnson and Albert Lee (Beam Eng, Inc) Mar 1978 29 p refs
(Contract NAS2-9399)
(NASA-TM-78473; A-7355) Avail NTIS HC A03/MF A01 CSCL 20A

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

N78-21094*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
EFFECT OF HIGH LIFT FLAP SYSTEMS ON THE CONCEP-TUAL DESIGN OF A 1985 SHORT-HAUL COMMERCIAL STOL TILT ROTOR TRANSPORT
Michael D Shovlin and Bruno J Gambucci Apr. 1978 29 p refs
(NASA-TM-78474; A-7364) Avail: NTIS HC A03/MF A01 CSCL 01C

F

The performances of a derivative concept of a 1985 STOL tilt rotor transport, and of a second concept having a complex mechanical flap system similar to a short field 8737 aircraft were compared for a 370 kilometer (200 nautical mile) short haul mission The flap system of the latter allowed lift to be shifted from the rotor system to the wing, permitting a 26 percent reduction in dynamic component weight, while also permitting the use of a smaller wing The wing and disc loading of this concept were 5746 (120 psf) and 1915 (40 psf) newtons per square meter, respectively, while the wing and disc loading of the derivative concept were 4788 (100 psf) and 1197 (25 psf) newtons per square meter, respectively The high-lift wing tilt rotor showed slightly improved fuel usage over its entire operating range and about 6 to 8 percent improvement in direct operating costs, resulting from its improved cruise efficiency and reduced weight. Other advantages include improved reliability with potentially reduced maintenance and better riding quality
Author

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

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

LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A 0.08-SCALE YF-17 AIRPLANE MODEL AT HIGH ANGLES OF ATTACK AND SIDESLIP
Daniel N Petroff, Stanley H Scher, and Carl E Sutton (ARO, Inc, Moffett Field, Calif) Apr 1978 118 p refs
(NASA-TM-78438, A-7214) Avail NTIS HC A06/MF A01 CSCL 01A

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

GENERALIZATION OF HUFFMAN CODING TO MINIMIZE THE PROBABILITY OF BUFFER OVERFLOW
Pierre A Humblet Feb 1978 12 p refs Presented at the 1977 Intern. Symp. on Inform. Theory, Ithaca, N. Y
(Contract N00014-75-C-1183)
(AD-A050974, ESL-P-800) Avail. NTIS HC A02/MF A01 CSCL 09/2

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

F

OPTIMUM HORIZONTAL GUIDANCE TECHNIQUES FOR AIRCRAFT
Heinz Erzberger and Homer Q. Lee In NASA, Washington Fourth Inter-Center Control Systems Conf Jan 1978 p 175-184 refs (For availability see N78-23010 13-99)
Avail NTIS HC A22/MF A01 CSCL 17G

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

QUASI-OPTIMAL CONTROL OF A MOVING-BASE SIMULA- TOR   c09
Elwood C Stewart In NASA, Washington Fourth Inter-Center Control Systems Conf Jan. 1978 p 253-259 refs (For availability see N78-23010 13-99)
Avail NTIS HC A22/MF A01 CSCL 14B

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

OPTIMAL GUIDANCE AND CONTROL FOR INVESTIGATING AIRCRAFT NOISE-IMPACT REDUCTION
Elwood C Stewart and Thomas M. Carson May 1978 58 p refs
(NASA-TP-1237, A-7121) Avail NTIS HC A04/MF A01 CSCL 01C

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

TRAJECTORY MODULE OF THE NASA AMES RESEARCH CENTER AIRCRAFT SYNTHESIS PROGRAM ACSYNT
Michael E. Tauber and John A Paterson Jul 1978 73 p refs
(NASA-TM-78497, A-7480) Avail· NTIS HC A04/MF A01 CSCL 01C

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

A FLIGHT INVESTIGATION OF THE STABILITY, CONTROL AND HANDLING QUALITIES OF AN AUGMENTED JET FLAP STOL AIRPLANE
Richard F. Vomaske, Robert C. Innis, Brian E Swan (Canadian Armed Forces, Ottawa), and Seth W Grossmith (Canadian Dept of Transport, Ottawa) Jun 1978 147 p refs
(NASA-TP-1254, A-7246) Avail NTIS HC A07/MF A01 CSCL 01C

The stability, control, and handling qualities of an augmented jet flap STOL airplane are presented. The airplane is an extensively modified de Havilland Buffalo military transport The modified airplane has two fan-jet engines which provide vectorable thrust and compressed air for the augmentor jet flap and Boundary-Layer Control (BLC). The augmentor and BLC air is cross ducted to minimize asymmetric moments produced when one engine is inoperative The modifications incorporated in the airplane include a Stability Augmentation System (SAS), a powered elevator, and a powered lateral control system. The test gross weight of the airplane was between 165,000 and 209,000 N (37,000 and 47,000 lb) Stability, control, and handling qualities are presented for the airspeed range of 40 to 180 knots The lateral-directional handling qualities are considered satisfactory for the normal

operating range of 65° to 160 knots airspeed when the SAS is functioning With the SAS inoperative, poor turn coordination and spiral instability are primary deficiencies contributing to marginal handling qualities in the landing approach The powered elevator control system enhanced the controllability in pitch, particularly in the landing flare and stall recovery   Author

N78-26741*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
G-SEAT SYSTEM STEP INPUT AND SINUSOIDAL RESPONSE CHARACTERISTICS
Thomas W Showalter and Robert J. Miller Jun 1978 11 p
(NASA-TM-78478; A-7393) Avail NTIS HC A02/MF A01 CSCL 05H
    The step input and sinusoidal response characteristics of a pneumatically driven computer controlled G set are examined in this study The response data show that this system can be modeled as a first order system with an 0.08 sec time lag and a 0 53 sec time constant   Author

N78-27043*# National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif.
APPLICATION OF A COST/PERFORMANCE MEASUREMENT SYSTEM ON A RESEARCH AIRCRAFT PROJECT
James J Diehl Jun. 1978 24 p refs
(NASA-TM-78498, A-7488) Avail NTIS HC A02/MF A01 CSCL 05A
    The fundamentals of the cost/performance management system used in the procurement of two tilt rotor aircraft for a joint NASA/Army research project are discussed The contractor's reporting system and the GPO's analyses are examined The use of this type of reporting system is assessed Recommendations concerning the use of like systems on future projects are included   A R H

N78-27113*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
APPLICATION OF SPECIAL-PURPOSE DIGITAL COMPUTERS TO ROTORCRAFT REAL-TIME SIMULATION
D Brain Mackie and Seth Michelson (Computer Sci Corp Mountain View, Calif) Jul 1978 37 p refs
(NASA-TP-1267, A-7343) Avail NTIS HC A03/MF A01 CSCL 01C
    The use of an array processor as a computational eleme in rotorcraft real-time simulation is studied A multilooping schen.e was considered in which the rotor would loop over its calculations a number of time while the remainder of the model cycled once on a host computer To prove that such a method would realistically simulate rotorcraft, a FORTRAN program was constructed to emulate a typical host-array processor computing configuration The multilooping of an expanded rotor model, which included appropriate kinematic equations, resulted in an accurate and stable simulation   G G

N78-28053*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
WING ANALYSIS USING A TRANSONIC POTENTIAL FLOW COMPUTATIONAL METHOD
P A Henne (McDonnell Douglas Corp, Long Beach, Calif) and R M Hicks Jui 1978 60 p refs
(NASA-TM-78464· A-7308) Avail NTIS HC A04/MF A01 CSCL 01A
    The ability of the method to compute wing transonic performance was determined by comparing computed results with both experimental data and results computed by other theoretical procedures. Both pressure distributions and aerodynamic forces were evaluated Comparisons indicated that the method is a significant improvement in transonic wing analysis capability. In particular, the computational method generally calculated the correct development of three-dimensional pressure distributions from subcritical to transonic conditions Complicated, multiple

shocked flows observed experimentally were reproduced computationally The ability to identify the effects of design modifications was demonstrated both in terms of pressure distributions and shock drag characteristics   G G.

N78-28278# Army Natick Research and Development Command Mass
ACCORDION   SHELTER   HARDWARE   ANALYSIS
Final Report, Feb. 1976 - Aug. 1977
Predrag Shopalovich and Franklin Barca Feb 1978 37 p refs
[DA Proj 1L7-62723-A-42701]
(AD-A053592, NATICK/TR-78/011) Avail. NTIS HC A03/MF A01 CSCL 13/13
    This report presents the results of an investigation into some of the hardware difficulties experienced with the accordion shelter during field tests The accordion shelter is a prototype rigidwall, general purpose, expandable military shelter In the closed, transportation configuration the shelter serves as its own shipping container and conforms to the dimensional and strength requirements of the International Organization for Standardization Type IC freight container In the habitation mode the container expands from both sides to form an enclosed, environmentally controlled, lighted shelter approximately 2 4 metres high by 2 4 metres wide by 15 2 metres long The main problem areas are identified as container jacks, floor jacks, leveling system and expansion system The specific causes of the problems are identified and solutions to the problems are proposed
          Author (GRA)

N78-28402*# National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif
PHENOMENOLOGICAL ASPECTS OF QUASI-STATIONARY CONTROLLED   AND   UNCONTROLLED   THREE-DIMENSIONAL FLOW SEPARATIONS
David J Peake In AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb 1978 52 p refs (For primary document see N78-28397 19-34)
Avail NTIS HC A11/MF A01 CSCL 20D
    Quasi-steady three dimensional separated flows about bodies of large fineness ratio operating at large angles of incidence or yaw are discussed The general character of the three dimensional attached boundary layer, the concept of limiting streamlines, and the physics of three dimensional separation and reattachment are among the factors considered Specific examples are given The advantages of swept, sharp edges that generate controlled (or fixed) three dimensional flow separations on a vehicle, due to the qualitatively unchanging flow field developed throughout the range of flight conditions, are emphasized   J M S

N78-29060*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif
A METHOD FOR THE ANALYSIS OF THE BENEFITS AND COSTS FOR AERONAUTICAL RESEARCH AND TECHNOLOGY   c85
Louis J Williams Herbert H Hoy, and Joseph L Anderson In NASA Langley Res Center CTOL Transport Technol, 1978 1978 p 871-884 refs (For primary document see N78-29046 20-01)
Avail NTIS HC A18/MF A01 CSCL 05A
    A relatively simple, consistent, and reasonable methodology for performing cost-benefit analyses which can be used to guide justify and explain investments in aeronautical research and technology is presented The elements of this methodology (labeled ABC-ART for the Analysis of the Benefits and Costs of Aeronautical Research and Technology) include estimation of aircraft markets, manufacturer costs and return on investment versus aircraft price, airline costs and return on investment versus aircraft price and passenger yield, and potential system benefits--fuel savings, cost savings, and noise reduction The application of this methodology is explained using the introduction of an advanced turboprop powered transport aircraft in the medium range market in 1978 as an example   J M S

F

N78-29061*# National Aeronautics and Space Administration
Ames Research Center Moffett Field, Calif.
SHORT-HAUL CTOL AIRCRAFT RESEARCH   c05
Louis J Williams *In* NASA Langley Res. Center CTOL Transport
Technol. 1978 1978 p 891-908 refs (For primary document
see N78-29046 20-01)
Avail NTIS HC-A18/MF A01 CSCL 01C
   The results of the reduced energy for commercial air
transportation studies on air transportation energy efficiency
improvement alternatives are reviewed along with subsequent
design studies of advanced turboprop powered transport aircraft
The application of this research to short-haul transportation is
discussed The results of several recent turboprop aircraft design
are included The potential fuel savings and cost savings for
advanced turboprop aircraft appear substantial, particularly at
shorter ranges   J M S.

N78-29068*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
CLOSED-FORM EQUATIONS FOR THE LIFT, DRAG. AND
PITCHING-MOMENT COEFFICIENTS OF AIRFOIL SEC-
TIONS IN SUBSONIC FLOW
Roger L. Smith Aug 1978 58 p refs Prepared in cooperation
with the US Army Aviation Research and Development Command,
St Louis. Mo
(NASA-TM-78492. AVRADCOM-TR-78-15(AM) A-7464) Avail:
NTIS HC A04/MF A01 CSCL 01A
   Closed-form equations for the lift, drag. and pitching moment
coefficients of two dimensional airfoil sections in steady subsonic
flow were obtained from published theoretical and experimental
results A turbulent boundary layer was assumed to exist on
the airfoil surfaces The effects of section angle of attack. Mach
number. Reynolds number. and the specific airfoil type were
considered The equations were applicable through an angle of
attack range of -180 deg to +180 deg. however, above about
+ or - 20 deg. the section characteristics were assumed to be
functions only of angle of attack A computer program is presented
which evaluates the equations for a range of Mach numbers
and angles of attack Calculated results for the NACA 23012
airfoil section were compared with experimental data   J A M

F

N78-31739*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
A PILOT EVALUATION OF TWO G-SEAT CUEING
SCHEMES
Thomas W Showalter Aug 1978 34 p refs
(NASA-TP-1255, A-7390) Avail NTIS HC A03/MF A01 CSCL
05H
   A comparison was made of two contrasting G-seat cueing
schemes The G-seat, an aircraft simulation subsystem, creates
aircraft acceleration cues via seat contour changes Of the two
cueing schemes tested. one was designed to create skin pressure
cues and the other was designed to create body position cues.
Each cueing scheme was tested and evaluated subjectively by
five pilots regarding its ability to cue the appropriate accelerations
in each of four simple maneuvers: a pullout, a pushover, an
S-turn maneuver. and a thrusting maneuver. A divergence of
pilot opinion occurred, revealing that the perception and
acceptance of G-seat stimuli is a highly individualistic phenomena
The creation of one acceptable G-seat cueing scheme was,
therefore, deemed to be quite difficult   L S

N78-32044*# 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 S Presley Sep 1978 13 p refs
(NASA-TM-78530, A-7634) Avail· NTIS HC A02/MF A01
CSCL 01A

   Computational results which show the effects of angle of
attack on supersonic mixed compression inlet performance at
four different locations about a hypothetical forebody were
obtained These results demonstrate the power of the computation-
al method to predict optimum inlet location, orientation, and
centerbody control schedule for design and off design performance.
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. The data show that 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   Author

N78-32045*# National Aeronautics and Space Administration
Ames Research Center. Moffett Field Calif.·
SYMMETRICAL AND ASYMMETRICAL SEPARATIONS
ABOUT A YAWED CONE
David J. Peake, F Kevin Owen (Owen Intern. Inc. Palo Alto,
Calif). and Hiroshi Higuchi (Dyn Technol. Inc) Sep 1978
30 p refs Sponsored in part by AFAL
(Contract NAS2-9663)
(NASA-TM-78532. A-7639) Avail. NTIS HC A03/MF A01
CSCL 01A
   Three dimensional flow separations about a circular cone
were investigated in the Mach number range 0.6 - 1.8. The
cone was tested in the Ames 1.8 by 1.8 m wind tunnel at
Reynolds numbers based on the cone length from 4,500,000 to
13,500,000 under nominally zero heat transfer conditions Results
indicate that (1) the lee-side separated flow develops from initially
symmetrically disposed and near-conical separation lines at angle
of incidence/cone semiangle equal to approximately 1, with the
free shear layers eventually rolling up into tightly coiled vortices
at all Mach numbers, (2) the onset of asymmetry of the lee-side
separated flow about the mean pitch plane is sensitive to Mach
number, Reynolds number, and the nose bluntness; and (3) as
the Mach number is increased beyond 1.8, the critical angle of
incidence for the onset of asymmetry increases until at about
$M = 2.75$ there is no longer any significant side force develop-
ment   J M S

N78-32835*# National Aeronautics and Space Administration
Ames Research Center. Moffett Field Calif
A STUDY OF THE NOISE RADIATION FROM FOUR
HELICOPTER ROTOR BLADES
Albert Lee (Beam Eng. Inc) and Marianne Mosher *In* NASA
Langley Res Center Helicopter Acoustics Aug 1978 p 387-402
refs (For primary document see N78-32816 23-71)
Avail NTIS HC A17/MF A01 CSCL 20A
   Acoustic measurements were taken of a modern helicopter
rotor with four blade tip shapes in the NASA Ames 40-by-80-Foot
Wind Tunnel The four tip shapes are rectangular, swept,
trapezoidal, and swept tapered in platform. Acoustic effects due
to tip shape changes were studied based on the dBA level,
peak noise pressure and subjective rating The swept tapered
blade was found to be the quietest' above an advancing tip
Mach number of about 0.9, and the swept blade was the quietest
at low speed The measured high speed impulsive noise was
compared with theoretical predictions based on thickness effects
good agreement was found   J M S

N78-33043*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
LASER-VELOCIMETER SURVEYS OF MERGING VORTICES
IN A WIND TUNNEL: COMPLETE DATA AND ANALYSIS
Victor R Corsiglia, James D. Iversen (Iowa State Univ. Ames),
and Kenneth L Orloff Oct 1978 48 p refs
(NASA-TM-78449; A-7262) Avail: NTIS HC A03/MF A01
CSCL 01A
   The merger of two corotating vortices was studied with a
laser velocimeter designed to measure the two cross-stream
components of velocity Measurements were made at several
downstream distances in the vortex wake shed by two semispan
wings mounted on the wind-tunnel walls The velocity data
provided well-defined contours of crossflow velocity, stream
function, and vorticity for a variety of test conditions Downstream
of the merger point, the vorticity was found to be independent
of the downstream distance for radii smaller than $r/b = 0.05$.

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

NASA CONTRACTOR REPORTS

N78-13765*# Stanford Univ., Calif   Joint Inst for Aeronautics and Acoustics
MULTI-CALCULATION RATE SIMULATIONS Final Report
J David Powell and Mahboob Akhter   Nov. 1977   59 p   refs
(Grant NsG-2250)
(NASA-CR-155335) Avail NTIS   HC A04/MF A01   CSCL 09B

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

N78-14016*# Stanford Univ, Calif.   Dept of Civil Engineering.
ASSESSING THE FUTURE OF AIR FREIGHT Final Technical Report, Feb. - Oct. 1977
Jarir S. Dajani Nov 1977   34 p refs
(Grant NsG-2203)
(NASA-CR-155356) Avail NTIS   HC A03/MF A01   CSCL 01C

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

N78-17061*# Raman Aeronautics Research and Engineering, Inc, Palo Alto, Calif
AN ANALYSIS OF THE ROTOR BLADE STRESSES OF THE THREE STAGE COMPRESSOR OF THE AMES RESEARCH CENTER 11- BY 11-FOOT TRANSONIC WIND TUNNEL Final Report
Jules B. Dods, Jr. Nov. 1977   147 p refs
(Contract NAS2-9112)
(NASA-CR-152083) Avail. NTIS   HC A07/MF A01   CSCL 21E

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

N78-17062*# Boeing Co, Seattle, Wash
LOW SPEED TEST OF A HIGH-BYPASS-RATIO PROPULSION SYSTEM WITH AN ASYMMETRIC INLET DESIGNED FOR A TILT-NACELLE V/STOL AIRPLANE
J Syberg Jan. 1978   115 p refs
(Contract NAS2-9640)
(NASA-CR-152072,   D-180-22888-1)   Avail   NTIS   HC A06/MF A01 CSCL 21E

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

N78-19094*# McDonnell-Douglas Corp, St Louis, Mo.
CONCEPTUAL DESIGN STUDY OF A HARRIER V/STOL RESEARCH AIRCRAFT
Waldemar E Bode, Roger L Berger, Glen A Elmore, and Thomas R Lacey Feb. 1978   293 p
(Contract NAS2-9748)
(NASA-CR-152086) Avail: NTIS   HC A13/MF A01   CSCL 01C

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

N78-19481*# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
STUDY, OPTIMIZATION, AND DESIGN OF A LASER HEAT ENGINE Final Report
12 Jan. 1978   160 p refs
(Contract NAS2-9668)
(NASA-CR-152104,   MSNW-78-1082-1)   Avail: NTIS   HC A08/MF A01 CSCL 20E

Laser heat engine concepts, proposed for satellite applications, were analyzed to determine which engine concepts best meet the requirements of high efficiency (50 percent or better) continuous operation in space. The best laser heat engine for a near-term experimental demonstration, selected on the basis of high overall operating efficiency, high power-to-weight characteristics, and availability of the required technology, is an Otto/Diesel cycle piston engine using a diamond window to admit CO_2 laser radiation. The technology with the greatest promise of scaling to megawatt power levels in the long term is the energy exchanger/gas turbine combination   Author

F

A SOLUTION TO THE SURFACE INTERSECTION PROBLEM
Final Report
An application-independent geometric model within a data base framework should support the·use of. Boolean operators which allow the user to construct a complex model by appropriately combining a series of simple models The use of these operators leads to the concept of implicitly and explicitly defined surfaces With an explicitly defined model, the surface area may be computed by simply summing the surface areas of the bounding surfaces For an implicitly defined model, the surface area computation must deal with active and inactive regions Because the surface intersection problem involves four unknowns and its solution is a space curve, the parametric coordinates of each surface must be determined as a function of the arc length Various subproblems involved in the general intersection problem are discussed, and the mathematical basis for their solution is presented along with a program written in FORTRAN IV for implementation on the IBM 370 TSO system   Author

ROTORCRAFT LINEAR SIMULATION MODEL VOLUME 1: ENGINEERING DOCUMENTATION Final Report, Nov. 1976 - Jan. 1978
A rotorcraft small perturbation linear model is. described Rotor flap, inplane and feathering degrees of freedom, as well as control and augmentation systems are defined in addition to the classical vehicle six degrees of freedom. The primary application was intended to be an analytic tool to assess the handling qualities of a dynamically combined main rotor and body The modeling method retained the higher frequency response properties which aided in evaluating control and stability augmentation systems   Author

F

ROTORCRAFT LINEAR SIMULATION MODEL VOLUME 2: COMPUTER IMPLEMENTATION Final Report, Nov. 1976 - Jan. 1978
A computer program used to process the equations is presented, and a full description of equation implementation is given The model was implemented in the IBM 360 and CDC series computer systems   M V.

ACOUSTICAL EFFECTS OF BLADE TIP SHAPE CHANGES ON A FULL SCALE HELICOPTER ROTOR IN A WIND TUNNEL
Four tip shapes were tested They were rectangular, swept, tapered, and swept-tapered The measured data covered a wide range of operating conditions The range of advancing tip Mach numbers were between 0 72 to 0 96, and the advance ratios were from 0 2 to 0.375 At low and moderate advancing tip Mach number, the data in the dBA scale appear to indicate the swept tip is the quietest, swept tapered the second, tapered third and rectangular the most noisy Above an advancing tip Mach number of about 0 89, a distinct acoustical pulse can be observed, which dominates the acoustical waveform The pulse shape is symmetric at moderate tip Mach number, changing to a sawtooth shape at high advancing tip Mach numbers Based on the amplitude of the impulsive noise, it appears the swept-tapered tip is the quietest, tapered tip the second, swept tip third and square tip the most noisy The data presented in this report should be useful as data bases for modeling and evaluating helicopter impulsive noise   Author

FACTORS AFFECTING THE RETIREMENT OF COMMERCIAL TRANSPORT JET AIRCRAFT Progress Report
A brief historical background of the technology and economics of aircraft replacement and retirement in the prejet era is presented 'to see whether useful insights can be obtained applicable to the jet era Significant differences between the two periods were demonstated Current technological and operational economic perspectives were investigated in detail Some conclusions are drawn to aircraft retirement policies   Author

FUEL CONSERVATION MERITS OF ADVANCED TURBOPROP TRANSPORT AIRCRAFT Final Report, Jan. - Aug. 1977
The advantages of a propfan powered aircraft for the commercial air transportation system were assessed by the comparison with an equivalent turbofan transport Comparisons were accomplished on the basis of fuel utilization and operating costs, as well as aircraft weight and size Advantages of the propfan aircraft, concerning fuel utilization and operating costs, were accomplished by considering (1) incorporation of propfan performance and acoustic data, (2) revised mission profiles (longer design range and reduction in; and cruise speed), and (3) utilization of alternate and advanced technology engines   Author

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

OPTIMAL CONTROL THEORY (OWEM) APPLIED TO A HELICOPTER IN THE HOVER AND APPROACH PHASE
A major difficulty in the practical application of linear-quadratic regulator theory is how to choose the weighting matrices in quadratic cost functions The control system design with optimal weighting matrices was applied to a helicopter in the hover and approach phase The weighting matrices were calculated to

extremize the closed loop total system damping subject to constraints on the determinants The extremization is really a minimization of the effects of disturbances, and interpreted as a compromise between the generalized system accuracy and the generalized system response speed The trade-off between the accuracy and the response speed is adjusted by a single parameter, the ratio of determinants By this approach an objective measure can be obtained for the design of a control system The measure is to be determined by the system requirements   Author

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

N78-22071*# Systems Technology, Inc., Hawthorne, Calif
DEVELOPMENT OF AUTOMATIC AND MANUAL FLIGHT DIRECTOR LANDING SYSTEMS FOR THE XV-15 TILT ROTOR AIRCRAFT IN HELICOPTER MODE
L. G. Hofmann, Roger Hoh, H , Wayne F. Jewell, Gary L Teper, and Pradip D Patel Jan 1978 254 p refs
(Contract NAS2-9392)
(NASA-CR-152040, TR-1092-1)   Avail: NTIS HC A12/MF A01 CSCL 01E
    The objective of this effort is to determine IFR approach path and touchdown dispersions for manual and automatic XV-15 tilt rotor landings, and to develop missed approach criteria Only helicopter mode XV-15 operation is considered The analysis and design sections develop the automatic and flight director guidance equations for decelerating curved and straight-in approaches into a typical VTOL landing site equipped with an MLS navigation aid These system designs satisfy all known pilot-centered, guidance and control requirements for this flying task Performance data, obtained from nonstationary covariance propagation dispersion analysis for the system, are used to develop the approach monitoring criteria The autoland and flight director guidance equations are programmed for the VSTOLAND 1819B digital computer The system design dispersion data developed through analysis and the 1819B digital computer program are verified and refined using the fixed-base, man-in-the-loop XV-15 VSTOLAND simulation   Author

N78-22074*# Boeing Commercial Airplane Co , Seattle, Wash Preliminary Design Dept.
APPLICATION OF ADVANCED TECHNOLOGIES TO SMALL SHORT-HAUL AIRCRAFT Final Report
D G Andrews, P W. Brubaker, S L Bryant, C W. Clay, B. Gindharadas, M. Hamamoto, T J Kelly, D K Proctor, C E Myron, and R L Sullivan 1 Mar 1978 332 p refs
(Contract NAS2-9506)
(NASA-CR-152089, D6-46320)   Avail.   NTIS HC A15/MF A01 CSCL 01C
    The results of a preliminary design study which investigates the use of selected advanced technologies to achieve low cost design for small (50-passenger), short haul (50 to 1000 mile) transports are reported The largest single item in the cost of manufacturing an airplane of this type is labor. A careful examination of advanced technology to airframe structure was performed since one of the most labor-intensive parts of the

airplane is structures Also, preliminary investigation of advanced aerodynamics flight controls, ride control and gust load alleviation systems, aircraft systems and turbo-prop propulsion systems was performed. The most beneficial advanced technology examined was bonded aluminum primary structure The use of this structure in large wing panels and body sections resulted in a greatly reduced number of parts and fasteners and therefore, labor hours The resultant cost of assembled airplane structure was reduced by 40% and the total airplane manufacturing cost by 16% - a major cost reduction With further development, test verification and optimization appreciable weight saving is also achievable Other advanced technology items which showed significant gains are as follows. (1) advanced turboprop-reduced block fuel by 15 30% depending on range, (2) configuration revisions (vee-tail)-empennage cost reduction of 25%; (3) leading-edge flap addition-weight reduction of 2500 pounds   Author

N78-22100*# Rockwell International Corp , Columbus, Ohio Aircraft Div.
STATIC TESTS OF A LARGE SCALE SWIVEL NOZZLE THRUST DEFLECTOR
John F Federspiel Feb 1978 44 p refs
(Contract NAS2-9176)
(NASA-CR-152091, NR78H-10)   Avail   NTIS HC A03/MF A01 CSCL 21E
    Tests were conducted on a swivel nozzle thrust deflector installed on a 91 centimeter (36 inch) low pressure ratio tip turbine fan Fan power was supplied by a J-85 hot gas generator The configuration was typical of a vertical/short takeoff and landing (V/STOL) aircraft propulsion system employing lift cruise fans The performance was compared to results obtained on an 0.15 scale cold flow model Data were obtained at fan pressure ratios from 1 1 to 1 2 and at nozzle deflections from cruise (0 deg) to VTOL (90 deg) The nozzle thrust performance was in good agreement with small scale VTOL thrust coefficients. Configurations with increased nozzle area showed lower performance Fan operation was routine and nozzle rotation caused no circumferential distortions of the fan exit flow. Nozzle flow characteristics did not repeat small scale model results Measured flow coefficients were smaller on the large scale test It was concluded that lack of simulation of pressure and temperature profiles of the tip driven fan was the most probable cause of the discrepancy   Author

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N78-25057*# Nielsen Engineering and Research, Inc , Mountain View, Calif
HIGH ANGLE CANARD MISSILE TEST IN THE AMES 11-FOOT TRANSONIC WIND TUNNEL
Richard G Schwind Jun 1978 81 p refs
(Contract NAS2-9211)
(NASA-CR-2993, NEAR-TR-134)   Avail   NTIS HC A05/MF A01 CSCL 01A
    Four blunted ogive-cylinder missile models with a length-to-diameter ratio of 10 4 were tested at transonic speeds and large angles of attack The configurations are body, body with tail panels, body with canards, and body with canards and tails Forces and moments from the entire model and each of the eight fins were measured over the pitch range of 20 deg to 50 deg and 0 deg to 45 deg roll Canard deflection angles between 0 deg and 15 deg were tested Exploratory vapor screen flow visualization testing was also performed Sample force and moment data are reported along with observations from the vapor screen tests   Author

N78-25078*# Kansas Univ Center for Research Inc , Lawrence
A STUDY OF COMMUTER AIRPLANE DESIGN OPTIMIZATION Status Report
Bob Van Keppel, Han Eysink, Jim Hammer, Kevin Hawley, Paul Meredith and J. Roskam 12 May 1978 457 p refs
(Grant NsG-2145)
(NASA-CR-157210, KU-FRL-313-5; SR-4)   Avail. NTIS HC A20/MF A01 CSCL 01C
    The usability of the general aviation synthesis program (GASP) was enhanced by the development of separate computer

subroutines which can be added as a package to this assembly of computerized design methods or used as a separate subroutine program to compute the dynamic longitudinal, lateral-directional stability characteristics for a given airplane Currently available analysis methods were evaluated to ascertain those most appropriate for the design functions which the GASP computerized design program performs Methods for providing proper constraint and/or analysis functions for GASP were developed as well as the appropriate subroutines   A-R-H.

N78-25359*# Aeronautical Research Associates of Princeton, Inc, N J
APPLICATION OF SECOND-ORDER TURBULENT MODELING TO THE PREDICTION OF RADIATED AERODYNAMIC SOUND
Alan J Bilanin and Joel E. Hirsh Jun 1978 76 p refs
(Contract NAS2-8832)
(NASA-CR-2994) Avail NTIS HC A05/MF A01 CSCL 20D
    The Ribner formulation of the generation of aerodynamic sound is coupled with predictions of second-order velocity correlations and integral scale to estimate the sound radiated from several complicated jet flows In particular, it is shown that the sound radiated from a cold swirling jet is greater than from its nonswirling equal thrust counterpart. The noise radiated from the flow field of a multitube suppressor was estimated and compared with an equal thrust diameter Gaussian jet It is shown that the multitube concept is indeed quieter.   Author

N78-25824*# Stanford Univ Calif Dept of Civil Engineering
INFRASTRUCTURE DYNAMICS: A SELECTED BIBLIOGRAPHY
Jarir S Dajani and Arturo J Bencosme Jan 1978 25 p refs
(Grant NsG-2203)
(NASA-CR-152162, SU-IPM-5) Avail NTIS
HC A02/MF A01 CSCL 12B
    The term infrastructure is used to denote the set of life support and public service systems which is necessary for the development of growth of human settlements Included are some basic references in the field of dynamic simulation, as well as a number of relevant applications in the area of infrastructure planning The intent is to enable the student or researcher to quickly identify such applications to the extent necessary for initiating further work in the field.   Author

N78-25832*# Massachusetts Inst of Tech, Cambridge Fluid Dynamics Research Lab
THE EFFECT OF TIP VORTEX STRUCTURE ON HELICOPTER NOISE DUE TO BLADE/VORTEX INTERACTION
Thomas L. Wolf and Sheila E Widnall Mar 1978 94 p refs
(Grant NsG-2142)
(NASA-CR-152150, MIT-78-2) Avail NTIS HC A05/MF A01 CSCL 20A
    A potential cause of helicopter impulsive noise, commonly called blade slap, is the unsteady lift fluctuation on a rotor blade due to interaction with the vortex trailed from another blade. The relationship between vortex structure and the intensity of the acoustic signal is investigated The analysis is based on a theoretical model for blade/vortex interaction. Unsteady lift on the blades due to blade/vortex interaction is calculated using linear unsteady aerodynamic theory, and expressions are derived for the directivity, frequency spectrum, and transient signal of the radiated noise An inviscid rollup model is used to calculate the velocity profile in the trailing vortex from the spanwise distribution of blade tip loading A few cases of tip loading are investigated, and numerical results are presented for the unsteady lift and acoustic signal due to blade/vortex interaction The intensity of the acoustic signal is shown to be quite sensitive to changes in tip vortex structure.   Author

N78-26153*# Iowa State Univ of Science and Technology, Ames Dept of Mechanical Engineering
A STUDY OF TEST SECTION CONFIGURATION FOR SHOCK TUBE TESTING OF TRANSONIC AIRFOILS Final Report
William J Cook Jun 1978 70 p refs
(Grant NsG-2152; ISU Proj 1233)
(NASA-CR-157237, ISU-ERI-Ames-78336) Avail: NTIS
HC A04/MF A01 CSCL 14B
    Two methods are investigated for alleviating wall interference effects in a shock tube test section intended for testing two-dimensional transonic airfoils The first method involves contouring the test section walls to match approximate streamlines in the flow. Contours are matched to each airfoil tested to produce results close to those obtained in a conventional wind tunnel. Data from a previous study and the present study for two different airfoils demonstrate that useful results are obtained in a shock tube using a test section with contoured walls The second method involves use of a fixed-geometry slotted-wall test section to provide automatic flow compensation for various airfoils. The slotted-wall test section developed exhibited the desired performance characteristics in the approximate Mach number range 0 82 to 0 89, as evidenced by good agreement obtained between shock tube and wind tunnel results for several airfoil flows   G G

N78-27087*# Boeing Commercial Airplane Co, Seattle, Wash
A MACH LINE PANEL METHOD FOR COMPUTING THE LINEARIZED SUPERSONIC FLOW OVER PLANAR WINGS
F. E Ehlers and Paul E Rubbert May 1978 91 p
(Contract NAS2-7729)
(NASA-CR-152126, D6-46373) Avail NTIS
HC A05/MF A01 CSCL 01A
    A method is described for solving the linearized supersonic flow over planar wings using panels bounded by two families of Mach lines Polynomial distributions of source and doublet strength lead to simple, closed form solutions for the aerodynamic influence coefficients, and a nearly triangular matrix yields rapid solutions for the singularity parameters The source method was found to be accurate and stable both for analysis and design boundary conditions Similar results were obtained with the doublet method for analysis boundary conditions on the portion of the wing downstream of the supersonic leading edge, but instabilities in the solution occurred for the region containing a portion of the subsonic leading edge Research on the method was discontinued before this difficulty was resolved   Author

N78-27094*# California Univ, Berkeley Institute of Transportation Studies
AN INVESTIGATION OF SHORT HAUL AIR TRANSPORTATION IN THE SOUTHEASTERN UNITED STATES
Abib Kanafani and Huey-Shin Yuan Jul 1977 202 p ref
(Grant NsG-2127)
(NASA-CR-152166, UCB-ITS-RR-77-6) Avail NTIS
HC A10/MF A01 CSCL 05C
    The specific objectives of this stage of the study are numerous First, an attempt is made to characterize the travel patterns in the study region, both in terms of origin destination patterns, and connecting and through trip patterns Second, the structure of the air service in the region is characterized in an attempt to develop an understanding of the evolution of the short haul air transportation network Finally, a look is taken at the socioeconomic environment of Atlanta and the region in order to seek an explanation for the historic evolution of short

N78-27105*# Analytical Mechanics Associates, Inc, Mountain View, Calif
DEVELOPMENT AND FLIGHT TESTS OF A KALMAN FILTER FOR NAVIGATION DURING TERMINAL AREA AND LANDING OPERATIONS
Stanley F. Schmidt, Paul F. Flanagan, and John A Sorenson
Jul 1978 136 p refs
(Contract NAS2-8862)
(NASA-CR-3015) Avail NTIS HC A07/MF A01 CSCL 17G
    A Kalman filter for aircraft terminal area and landing navigation was implemented and flight tested in the NASA Ames STOLAND avionics computer onboard a Twin Otter aircraft This

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system combines navaid measurements from TACAN, MODILS, air data, radar altimeter sensors along with measurements from trap-down accelerometer and attitude angle sensors The flight test results demonstrate that the Kalman filter provides improved estimates of the aircraft position and velocity as compared with estimates from the more standard complementary filter The onboard computer implementation requirements to achieve this improved performance are discussed   Author

N78-27128*# Hamilton Standard, Windsor Locks, Conn
PROP-FAN DATA SUPPORT STUDY Final Report
J A Baum P J Dumais, M. G Mayo, F. B. Metzger, A M Shenkman, and G G Walker 28 Feb 1978 111 p
(Contract NAS2-9750)
(NASA-CR-152141) Avail NTIS HC A06/MF A01 CSCL 01C
Updated parametric prop-fan data packages are presented and the rationale used in developing the new prop-fan data is detailed These data represent Hamilton Standard's projections of prop-fan characteristics for aircraft that are expected to be in-service in the 1985 to 1990 time frame. The basic prop-fan configuration was designed for efficient cruise operation at 0 8 Mach number and 10,668M altitude The design blade tip speed is 244 mps and the design power loading is 301 KW/M squared   G G

N78-28083*# Gorham Associates, Thousand Oaks, Calif
STUDY TO DETERMINE OPERATIONAL AND PERFORMANCE CRITERIA FOR STOL AIRCRAFT OPERATING IN LOW VISIBILITY CONDITIONS
John A Gorham May 1978 63 p refs
(Contract NAS2-8790)
(NASA-CR-152164) Avail NTIS HC A04/MF A01 CSCL 01C
The operational and performance criteria for civil CTOL passenger-carrying airplanes landing in low visibilities depend upon the characteristics of the airplane, the nature and use of the ground and airborne guidance and control systems, and the geometry and lighting of the landing field Based upon these criteria, FAA advisory circulars, airplane and equipment design characteristics, and airline operational and maintenance procedures were formulated The documents are selected, described and discussed in relationship to the potential low weather minima operation of STOL aircraft An attempt is made to identify fundamental differences between CTOL and STOL aircraft characteristics which could impact upon existing CTOL documentation Further study and/or flight experiments are recommended
                    G Y

N78-28988*# Washington Univ, Seattle   Dept. of Civil Engineering
EXECUTIVE SUMMARY: BENEFIT-COST EVALUATION OF AN INTRA-REGIONAL AIR SERVICE IN THE BAY AREA AND A TECHNOLOGY ASSESSMENT OF TRANSPORTATION SYSTEM INVESTMENTS Technical Report, 1 Jan. 1977 - 31 Mar. 1978
Lonnie E Haefner 31 Mar 1978 37 p ref
(Grant NsG,2170)
(NASA-CR-152154-1) Avail NTIS HC A03/MF A01 CSCL 05C
The benefits and costs that would result from an intra-regional air service operation in the San Francisco Bay area were determined by utilizing an iterative statistical decision model to evaluate combinations of commuter airport sites and surface transportation facilities in conjunction with service by a given commuter aircraft type in light of area regional growth alternatives and peak and off-peak regional travel patterns The model evaluates such transportation option with respect to criteria of airline profitability, public acceptance, and public and private non-user costs In so doing, it incorporates information on modal split, peak and off-peak use of the air commuter fleet, terminal and airport costs, development costs and uses of land in proximity to the airport sites, regional population shifts, and induced zonal shifts in travel demand The model is multimodal in its analytic capability, and performs exhaustive sensitivity analysis   A R.H

N78-28989*# Washington Univ, Seattle   Dept of Civil Engineering
A TECHNOLOGY ASSESSMENT OF TRANSPORTATION SYSTEM INVESTMENTS
Lonnie E Haefner 31 Mar 1978 206 p refs
(Grant NsG-2170)
(NASA-CR-152154-2) Avail NTIS HC A10/MF A01 CSCL 05C
An abstract technology assessment format, capable of generic evaluation over a heirarchy of city sizes, shapes and modal transportation technology characteristics, using unit cost and impact data is presented The formal analytic model used is Markovian decision theory. The analyst is not required to know or explore the historical data characteristics of the region in depth and can, therefore, rapidly examine sensitivities and boundaries of rational or optimal transportation investments This examination may occur over a group of similar or different regions, and may draw significant conclusions about the mix of transportation technology investments most likely needed and capable of compatible operation   A R H

N78-30070*# Aeronautical Research Foundation, Cambridge, Mass.
REQUIREMENTS FOR REGIONAL SHORT-HAUL AIR SERVICE AND THE DEFINITION OF A FLIGHT PROGRAM TO DETERMINE NEIGHBORHOOD REACTIONS TO SMALL TRANSPORT AIRCRAFT
Kornel Feher, Lynn Bollinger, Jeffrey V Bowles, and Mark H Waters Aug 1978 153 p refs Prepared in cooperation with NASA AMES Res Center, Moffett Field, Calif
(Contract NAS2-9050)
(NASA-CR-152151) Avail NTIS HC A08/MF A01 CSCL 05C
An evaluation of the current status and future-requirements of an intraregional short haul air service is given A brief definition of the different types of short haul air service is given This is followed by a historical review of previous attempts to develop short haul air service in high density urban areas and an assessment of the current status The requirements for intraregional air service, the need for economic and environmental viability and the need for a flight research program are defined A detailed outline of a research program that would determine urban community reaction to frequent operations of small transport aircraft is also given Both the operation of such an experiment in a specific region (San Francisco Bay area) and the necessary design modifications of an existing fixed wing aircraft which could be used in the experiment are established An estimate is made of overall program costs   G Y.

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N78-33113*# General Dynamics/Fort Worth, Tex
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS: PHASE 1: F-111A FLIGHT DATA ANALYSIS. VOLUME 1: SUMMARY OF TECHNICAL APPROACH, RESULTS AND CONCLUSIONS
David B Benepe, Atlee M. Cunningham, Jr. and W David Dunmyer 1978 188 p refs
(Contract NAS2-7091)
(NASA-CR-152109) Avail NTIS HC A09/MF A01 CSCL 01C
The structural response to aerodynamic buffet during moderate to high-g maneuvers at subsonic and transonic speeds was investigated The investigation is reported in three volumes This volume presents a summary of the investigation with a complete description of the technical approach, description of the aircraft, its instrumentation, the data reduction procedures, results and conclusion   G Y

N78-33117*# General Dynamics/Fort Worth, Tex
AN INVESTIGATION OF WING BUFFETING RESPONSE AT SUBSONIC AND TRANSONIC SPEEDS. PHASE 2: F-111A FLIGHT DATA ANALYSIS. VOLUME 2: PLOTTED POWER SPECTRA
David B Benepe, Atlee M Cunningham, Jr, Sam Traylor, Jr, and W. David Dunmyer 1978 724 p refs
(Contract NAS2-7091)

(NASA-CR-152113) Avail NTIS HC A99/MF A01 CSCL 10A

Plotted power spectra for all of the flight points examined during the Phase 2 flight data analysis are presented Detailed descriptions of the aircraft, the flight instrumentation and the analysis techniques are given Measured and calculated vibration mode frequencies are also presented to assist in further interpretation of the PSD data G Y.

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

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

N78-33876*# Nielsen Engineering and Research, Inc, Mountain View, Calif
PROPAGATION OF SOUND THROUGH A SHEARED FLOW Final Report, 30 Aug. 1976 - 1 Jul. 1977
James P. Woolley, Charles A Smith, and Krishnamurty Karamcheti Aug 1978 83 p refs
(Contract NAS2-9357)
(NASA-CR-152196, NEAR-TR-171) Avail NTIS HC A05/MF A01 CSCL 20A

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

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

A78-10455 * # Coplanar tail-chase aerial combat as a differential game. A. W. Merz and D. S. Hague (Aerophysics Research Corp., Mountain View, Calif.) *AIAA Journal,* vol. 15, Oct 1977, p 1419-1423. 5 refs Contract No NAS2-8844

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

A78-12243 * # Advanced Digital Avionics System for general aviation. R K. Smyth (Milco International, Inc, Huntington Beach, Calif.), R. H. Hoh, and G L Teper (Systems Technology, Inc, Hawthorne, Calif.). In: Digital Avionics Systems Conference, 2nd, Los Angeles, Calif., November 2-4, 1977, Collection of Technical Papers. (A78-12226 02-04) New York, American Institute of Aeronautics and Astronautics, Inc., 1977, p. 96-102 Contract No. NAS2-9311. (AIAA 77-1494)

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

A78-14063 * Peripheral processors for high-speed simulation. W. J Karplus (California, University, Los Angeles, Calif) *Simulation,* vol. 29, Nov. 1977, p 143-153. 7 refs. NSF Grant No. ENG-76-07811, Contract No. NAS2-7806.

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

A78-17395 * A fifty channel electrically scanned pressure module. J. R. Mallon (Kulite Semiconductor Products, Inc, Ridgefield, N J). In International Instrumentation Symposium, 23rd, Las Vegas, Nev, May 1-5, 1977, Proceedings (A78-17351 05-35) Pittsburgh, Pa, Instrument Society of America, 1977, p 443-450. 8 refs Contract No. NAS2-8931

A unique miniature pressure sensor system consisting of an array of fifty integrated sensor pressure transducers with integral electronic logic and switching is described. Solid state processing of the piezoresistive array is combined with hybrid microelectronics to produce a very small, dense (80 cc displacement), high reliability pressure measuring system. Application to high speed data acquisition, energy conservation in wind tunnels and flight test is discussed. Test data are presented typifying system performance. (Author)

A78-18059 * Robustness in linear quadratic feedback design with application to an aircraft control problem R V. Patel, B Sridhar, and M Toda (NASA, Ames Research Center, Moffett Field, Calif). In: Annual Asilomar Conference on Circuits, Systems, and Computers, 10th, Pacific Grove, Calif, November 22-24, 1976, Conference Record (A78-18051 05-59) North Hollywood, Calif, Western Periodicals Co., 1977, p 293-300. 9 refs

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

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in the weighting matrices in the LQ design is studied by computer simulations, and appropriate weighting matrices are chosen to obtain 'a reasonable error bound for variations in the system matrix and at the same time meet the practical constraints for the flare maneuver of the AWJSRA Results from the computer simulation of a satisfactory autopilot design for the flare control of the AWJSRA are presented (Author)

A78-20686 * Transonic wing analysis using advanced computational methods P A Henne (Douglas Aircraft Co , Long Beach, Calif) and R M Hicks (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan. 16-18, 1978, Paper 78-105* 10 p. 9 refs

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

A78-20687 * - Laser-velocimeter surveys of merging vortices in a wind tunnel V R Corsiglia, K L Orloff (NASA, Ames Research Center, Moffett Field, Calif), and J D Iversen (NASA, Ames Research Center, Moffett Field, Calif , Iowa State University 'of Science and Technology, Ames, Iowa) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan. 16-18, 1978, Paper 78-107* 10 p. 28 refs

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

A78-22554 * / Measurements of unsteady vortex flow fields F K Owen (Owen International, Inc , Palo Alto, Calif.) and D A Johnson (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-18.* 10 p USAF-supported research; Contract No. NAS2-9168

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

A78-22555 * // Wake vortex measurements of bodies at high angle of attack. F K Owen (Owen International Inc , Palo Alto, Calif.) and D A Johnson (NASA, Ames Research Center, Moffett Field, Calif.) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan. 16-18, 1978, Paper 78-23* 10 p. 7 refs USAF-supported research, Contract No NAS2-9168

Three-dimensional laser velocimeter measurements have been made of the wake vortices of a slender tangent ogive body which had nose and body fineness ratios of 3 5 and 12, respectively Data were obtained for an angle of attack to seminose angle ratio of 2 3 at a free stream Mach number of 0 6 and unit Reynolds number of 2 million/ft Details of the mean flow field are presented and features of the turbulent and unsteady nature of the vortex flow field are discussed Problems associated with obtaining meaningful vortex measurements in high-speed flows are addressed (Author)

A78-22578 * // Measured wake-vortex characteristics of aircraft in ground effect. D. L. Ciffone (NASA, Ames Research Center, Moffett Field, Calif) and B Pedley. *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-109.* 10 p. 13 refs

In support of the NASA wake vortex alleviation program, measurements were made of the influences of a ground plane on vortex trajectories and velocity profiles within lift-generated wakes The wakes were generated by towing 0 61-m (2-ft) span models of two jumbo jets under water in a ship model basin. The models were configured with landing flaps and flight spoilers to investigate the wake characteristics of these aircraft in ground effect at simulated full-scale distances of 19 m (62 ft) to 116 m (380 ft) above the ground The ground plane caused modifications in the vortex trajectories but did not alter vortex interactions and merging patterns in these multiple vortex wakes Some distortions in vortex vertical (tangential) velocity profiles were recorded as a result of vortex lateral motions and vortex interactions with the viscous boundary layer on the ground plane, however, maximum tangential velocities remained unchanged (Author)

A78-22594 * .! Analysis of flight effects on noise radiation from jet flow using a convecting quadrupole model R Dash (NASA, Ames Research Center, Moffett Field, Calif). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan. 16-18, 1978, Paper 78-192* 14 p 29 refs.

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

A78-23883 * New frequency domain methods for system identification. N K Gupta (Systems Control, Inc , Palo Alto, Calif.). In Joint Automatic Control Conference, San Francisco, Calif., June 22-24, 1977, Proceedings Volume 2. (A78-23851 08-63) New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 804 808. 10 refs. Contracts No. N00014-76-C-0420; No. NAS2-8799

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

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A78-23917 * Robustness of linear quadratic state feedback designs in the presence of system uncertainty. R. V. Patel, M. Toda, and B Sridhar (NASA, Ames Research Center, Moffett Field, Calif) In. Joint Automatic Control Conference, San Francisco, Calif, June 22-24, 1977, Proceedings Volume 2. (A78-23851 08-63) New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p 1668-1673 15 refs.

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

A78-24367 * # Comments on 'Feasibility study of a hybrid airship operating in ground effect' M. D Ardema (NASA, Ames Research Center, Moffett Field, Calif). *Journal of Aircraft,* vol. 15, Feb. 1978, p. 126, 127, Author's Reply, p. 127, 128 9 refs

A78-26274 * # Three-dimensional canard-wing shape optimization in aircraft cruise and maneuver environments. B M. E. de Silva and R. L Carmichael (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 14th, Washington, D.C., Feb. 7-9, 1978, Paper 78-99.* 8 p. 39 refs

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

A78-26495 * Use of coherence and phase data between two receivers in evaluation of noise environments. A. G. Piersol (Bolt Beranek and Newman, Inc, Canoga Park, Calif.). *Journal of Sound and Vibration,* vol 56, Jan 22, 1978, p. 215-228 11 refs. Contract No. NAS2-8382.

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

A78-26599 * A uniqueness proof for a transonic flow problem. L. P. Cook (California, University, Los Angeles, Calif.). *Indiana University Mathematics Journal,* vol. 27, Jan.-Feb. 1978, p 51-71. 11 refs. Grant No. NsG-2171

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

A78-29295 * # Flight simulation - A vital and expanding technology in aircraft development. P. A. Reynolds (Calspan Corp, Buffalo, N.Y.) and G. W Hall (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 14th, Washington, D.C., Feb. 7-9, 1978, Paper 78-337* 11 p 28 refs

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

A78-29804 * # Visualization of quasi-periodic unsteady flows. R. A. Kadlec (Colorado, University, Boulder, Colo.) and S. S. Davis (NASA, Ames Research Center, Moffett Field, Calif.) In Structures, Structural Dynamics and Materials Conference, 19th, Bethesda, Md., April 3-5, 1978, Technical Papers (A78-29776 11-39) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 275-281. 10 refs. (AIAA 78-502)

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

A78-31300 * Multichannel electrochemical microbial detection unit. J. R. Wilkins (NASA, Langley Research Center, Hampton, Va.), R. N. Young (NASA, Ames Research Center, Moffett Field, Calif.; Northrop Services, Inc, Hampton, Va), and E H. Boykin (Northrop Services, Inc., Hampton, Va.). *Applied and Environmental Microbiology,* vol. 35, Jan. 1978, p. 214, 215.

The paper describes the design and capabilities of a compact multichannel electrochemical unit devised to detect and automatically, indicate detection time length of bacteria By connecting this unit to a strip-chart recorder, a permanent record is obtained of the end points and growth curves for each of eight channels. The experimental setup utilizing the multichannel unit consists of a test tube (25 by 150 mm) containing a combination redox electrode plus 18 ml of lauryl tryptose broth and positioned in a 35-C water bath.

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Leads from the electrodes are connected to the multichannel unit, which in turn is connected to a strip-chart recorder. After addition of 2 0 ml of inoculum to the test tubes, depression of the push-button starter activates the electronics, timer, and indicator light for each channel. The multichannel unit is employed to test tenfold dilutions of various members of the Enterobacteriaceae group, and a typical dose-response curve is presented. S.D.

A78-31306 * #   Fuel saving potential of Mach 0.8 twin engine prop-fan transports F. J. Davenport (Boeing Commercial Airplane Co., Seattle, Wash). In- Canadian Symposium on Energy Conserving Transport Aircraft, Ottawa, Canada, October 3, 4, 1977, Proceedings. (A78-31301 12-05) Ottawa, Canadian Aeronautics and Space Institute, 1978, p. 5-1 to 5-19 Contract No. NAS2-9104.

The fuel saving and economic potentials of the prop-fan high-speed propeller concept have been evaluated for twin-engine commercial transport airplanes designed for 3333 6 km range, 180 passengers, and Mach 0.8 cruise. A fuel saving of 9.7% at the design range was estimated for a prop-fan aircraft having wing-mounted engines, while a 5.8% saving was estimated for a design having the engines mounted on the aft body. The fuel savings and cost were found to be sensitive to the propeller noise level and to aerodynamic drag effects due to wing-slipstream interaction. Uncertainties in these effects could change the fuel savings as much as plus or minus 50% A modest improvement in direct operating cost was estimated for the wing-mounted prop-fan at current fuel prices. (Author)

A78-32330 * #   The shock tube as a device for testing transonic airfoils at high Reynolds numbers. W. J. Cook (Iowa State University of Science and Technology, Ames, Iowa), L L. Presley, and G. T. Chapman (NASA, Ames Research Center, Aerodynamics Research Branch, Moffett Field, Calif.) In: Aerodynamic Testing Conference, 10th, San Diego, Calif., April 19-21, 1978, Technical Papers (A78-32326 12-09) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 30-39. 16 refs Grant No. NsG-2152. (AIAA 78-769)

A performance analysis of gas-driven shock tubes shows that transonic airfoil flows with chord Reynolds numbers in the range of 100 million can be generated behind the primary shock in a large shock tube. A study of flow over simple airfoils has been carried out at low and intermediate Reynolds numbers to assess the testing technique. Results obtained from schlieren photos and airfoil pressure measurements show that steady transonic flows similar to those observed for the airfoils in wind tunnels can be generated within the available testing time in a shock tube with either properly-contoured test section walls or a properly-designed slotted-wall test section. The study indicates that the shock tube is a useful facility for studying two-dimensional high Reynolds number transonic airfoil flows (Author)

A78-32353 * //   Buried wire gage for wall shear stress measurements V S Murthy and W C Rose (NASA, Ames Research Center, Moffett Field, Calif) In- Aerodynamic Testing Conference, 10th, San Diego, Calif., April 19-21, 1978, Technical Papers (A78-32326 12-09) New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 203-212 18 refs. (AIAA 78-798)

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

A78-32368 * //   Moving ground simulation by tangential blowing J E. Hackett and R. A. Boles (Lockheed-Georgia Co , Marietta, Ga.). In Aerodynamic Testing Conference, 10th, San Diego, Calif ,

April 19-21, 1978, Technical Papers. (A78-32326 12-09) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 330-335. 5 refs. Contracts No. NAS2-6690; No NAS2-8745; No NAS2-9155 (AIAA 78-814)

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

A78-32386 * #   New rotation-balance apparatus for measuring airplane spin aerodynamics in the wind tunnel. G. N Malcolm (NASA, Ames Research Center, Moffett Field, Calif.). In Aerodynamic Testing Conference, 10th, San Diego, Calif., April 19-21, 1978, Technical Papers. (A78-32326 12-09) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 495-502. 7 refs (AIAA 78-835)

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

A78-35371 *   A simplified Mach number scaling law for helicopter rotor noise K S. Aravamudan, A Lee, and W L Harris (MIT, Cambridge, Mass.) Journal of Sound and Vibration, vol. 57, Apr 22, 1978, p 555-570 17 refs Grants No DAAG29-C-027, No. NsG-2095

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

A78-37742 * //   Transonic lifting line theory - Numerical procedure for shock-free flows. R D. Small AIAA Journal, vol 16, June 1978, p 632-634. 12 refs Grant No NSG-2171.

An algorithm for computing transonic lifting line theory without shocks is presented, the numerical procedure relies on two-dimensional analyses developed to solve inviscid flow equations for slender airfoils From a series of solutions to two dimensional problems in which span effects appear parametrically, the three-dimensional potential field characterization is obtained Numerical results are given for a lifting wing with an elliptic (spanwise) distribution of chord and a NACA-0012 cross section (a freestream Mach number of 0 63 and an angle of attack of 2 deg are assumed). J M B.

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A78-38789 *　　　Simulation replay - Implementation and flight simulation applications. D. F. Crane (NASA, Ames Research Center, Moffett Field, Calif.) In: Summer Computer Simulation Conference, Chicago, Ill., July 18-20, 1977, Proceedings. (A78-38776 16-59) Montvale, N.J., AFIPS Press, 1977, p. 731-734.

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

G R.

A78-39184 * #　　　Dual-loop model of the human controller R A Hess (NASA, Ames Research Center, Moffett Field, Calif.). *Journal of Guidance and Control,* vol. 1, July-Aug. 1978, p. 254-260. 12 refs

A dual-loop model of the human controller in single-axis compensatory tracking tasks is introduced This model possesses an inner-loop closure that involves feeding back that portion of controlled element output rate that is due to control activity. A novel feature of the model is the explicit appearance of the human's internal representation of the manipulator-controlled element dynamics in the inner loop. The sensor inputs to the human controller are assumed to be system error and control force The former can be sensed via visual, aural, or tactile displays, whereas the latter is assumed to be sensed in kinesthetic fashion. A set of general adaptive characteristics for the model is hypothesized, including a method for selecting simplified internal models of the manipulator-controlled element dynamics It is demonstrated that the model can produce controller describing functions that closely approximate those measured in four laboratory tracking tasks in which the controlled element dynamics vary considerably in terms of ease of control An empirically derived expression for the normalized injected error remnant spectrum is introduced (Author)

A78-40949 *　　　Numerical solution of a class of integral equations arising in two-dimensional aerodynamics J Fromme and M. A. Golberg (Nevada, University, Las Vegas, Nev.). *Journal of Optimization Theory and Applications,* vol 24, Jan 1978, p 169-206 20 refs. Grant No NsG-2140

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

A78-41885 * #　　　Hot-wire, laser anemometer and force balance measurements of cross-sectional planes of single and interacting trailing vortices. J. D. Iversen, S. Park, D. R Backhus, R A Brickman (Iowa State University of Science and Technology, Ames, Iowa), and V R Corsiglia (NASA, Ames Research Center, Moffett Field, Calif.) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1194.* 14 p 19 refs. Research supported by

the Iowa State University of Science and Technology and NASA

Single and multiple trailing vortices shed from semi-span wings and a transport model in a wind tunnel were studied by means of a laser-velocimeter, hot-wire anemometer, and a trailing model incorporating a 6-component force balance Velocity profile and turbulence data from the laser-velocimeter and hot-wire anemometer are presented and shown to compare well with the Betz inviscid circulation model .Lift and rolling moment measurements on the following model are compared with those predicted from the flow field measurements. (Author)

A78-41886 * #　　　The spanwise lift distribution on a wing from flow-field velocity surveys K. L Orloff (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1195.* 12 p 8 refs.

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

A78-41887 * #　　　Flying-hot-wire study of two-dimensional mean flow past an NACA 4412 airfoil at maximum lift. D. Coles and A. J Wadcock (California Institute of Technology, Pasadena, Calif.) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1196.* 12 p 10 refs. Grants No. NGL-05 002-229, No NsG-2319

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

A78-43521 * #　　　Effects of inlet airframe integration on the inlet of an upper surface blowing four-engine STOL aircraft. M. D Shovlin (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Joint Propulsion Conference, 14th, Las Vegas, Nev, July 25-27, 1978, AIAA Paper 78-959* 9 p 7 refs.

Inlet and nacelle static pressures were measured on a 0 55-scale model of the Quiet Short-Haul Research Airplane (QSRA) in the Ames Research Center's 40- by 80 Foot Wind Tunnel This model is powered by four JT-15D engines located above the wing with closely spaced adjacent inlets A fifth JT-15D engine in the fuselage provides boundary-layer control air. Each inlet was instrumented with four to eight rows of axial pressure taps located between X/R approximately plus or minus 1. The tests simulated a broad range of aircraft

operating conditions, including engine-out, with lift coefficients from 0 8 to 10.0. Results indicate that the inlets perform well under most operating conditions with little interaction between inlets when the aircraft is moving. Potential problem areas identified are high sideslip angle during approach and an interaction effect between adjacent inlets with high mass flows in static conditions (Author)

A78-43525 * # Estimating maximum instantaneous distortion from inlet total pressure rms measurements. H. C. Melick, Jr., A H. Ybarra (Vought Corp , Dallas, Tex), and D P. Bencze (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Joint Propulsion Conference, 14th, Las Vegas, Nev., July 25-27, 1978, AIAA Paper 78-970.* 15 p. 12 refs. Contracts No. NAS2-6901, No NAS2-8878.

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

A78-45148 * # Theoretical and experimental study of the drag of multielement airfoils L E. Olson (NASA, Ames Research Center; US Army, Aeromechanics Laboratory, Moffett Field, Calif.), W. D. James (Iowa State University of Science and Technology, Ames, Iowa), and P. R. McGowan (Computer Sciences Corp., Mountain View, ·Calif.). *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1223.* 12 p. 17 refs

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

A78-45535 * Numerical experiments on the stability of disklike galaxies. R. H. Miller (NASA, Ames Research Center, Moffett Field, Calif) *Astrophysical Journal, Part 1,* vol 223, Aug 1, 1978, p 811-823 16 refs

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

A78-46011 * Meteorological control of lower stratospheric minor species variations - An observational example. F. N. Alyea and D. M. Cunnold (MIT, Cambridge, Mass.). *Atmospheric Environment,* vol. 12, no. 5, 1978, p. 1075-1080 8 refs Research supported by the ¡Manufacturing Chemists Association; Grants No. NsG-2010, No NsG-2196.

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

A78-46514 * # A historical overview of stall/spin characteristics of general aviation aircraft. S B. Anderson (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Conference on Air Transportation: Technical Perspectives and Forecasts, Los Angeles, Calif., Aug 21-24, 1978, Paper 78-1551* 10 p. 19 refs

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

A78-46545 * # High performance dash-on-warning air mobile missile system. D. S. Hague (Astrophysics Research Corp., Bellevue, Wash) and A D. Levin (NASA, Ames Research Center, Moffett Field, Calif.). In: Atmospheric Flight Mechanics Conference, Palo Alto, Calif., August 7-9, 1978, Technical Papers (A78-46526 20-08) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p 166-172. 10 refs (AIAA 78-1353)

Because fixed missile bases have become increasingly vulnerable to strategic nuclear attack, an air-mobile missile system is proposed, whereby ICBMs can be launched from the hold of large subsonic aircraft following a missile-assisted supersonic dash of the aircraft to a safe distance from their base (about 50 n mi) Three major categories of vehicle design are presented: staged, which employs vertical take-off and a single solid rocket booster similar to that used on the Space Shuttle, unstaged, which employs vertical take-off and four internally-carried reusable liquid rocket engines, and alternative concepts, some using horizontal take-off with duct-burning after-burners Attention is given to the economics of maintaining 200 ICBMs airborne during an alert (about $600 million for each fleet alert, exclusive of acquisition costs). The chief advantages of the system lie in its reduced vulnerability to suprise attack, because it can be launched on warning, and in the possibility for recall of the aircraft if the warning proves to be a false alarm. D M.W.

A78-46560 * # Flight tests of a simple airborne device for predicting clear air turbulence encounters. R. L. Kurkowski, C. E Duller, III (NASA, Ames Research Center, Moffett Field, Calif.), and P M. Kuhn (NOAA, Environmental Research Laboratories, Boulder, Colo). In: Atmospheric Flight Mechanics Conference, Palo Alto, Calif., August 7-9, 1978, Technical Papers. (A78-46526 20-08) New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p 320-324. 6 refs (AIAA 78-1375)

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

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alarms were given about 6% of the time. Several simple algorithms were studied for use as signal output analyzers and for alert triggering (Author)

A78-47354 * On the stability of disklike galaxies in massive halos. R. H. Miller (NASA, Ames Research Center, Moffett Field, Calif.). *Astrophysical Journal, Part 1,* vol. 224, Aug. 15, 1978, p. 32-38. 15 refs.

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

A78-47907 * # Some observations on the mechanism of aircraft wing rock. C Hwang and W. S. Pi (Northrop Corp., Aircraft Div , Hawthorne, Calif). *American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif., Aug. 21-23, 1978, Paper 78-1456.* 11 p. 6 refs Contract No. NAS2-8734.

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

A78-47916 * # Quiet, Short-Haul Research Aircraft - Current status and future plans. J. A Cochrane and A. G. Boissevain (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif., Aug. 21-23, 1978, Paper 78-1468.* 11 p.

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

A78-47927 * # Integrated avionics for future general aviation aircraft. D. G. Denery, C. T. Jackson, Jr , G P. Callas, B. K. Berkstresser, and G. H. Hardy (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and*

Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif., Aug. 21-23, 1978, Paper 78-1482. 13 p. 18 refs.

The program described was initiated in 1975 to provide the critical information for the design of an advanced avionics system suitable for general aviation. Emphasis is on the use of data busing, distributed microsensors, shared electronic displays and pilot entry devices, innovative low-cost sensors, and improved functional characteristics. Design considerations include cost, reliability, maintainability, and modularity. V.P.

A78-47946 * # Studies of aerodynamic technology for VSTOL fighter/attack aircraft. W. P. Nelms (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif., Aug. 21-23, 1978, Paper 78-1511.* 32 p. 17 refs.

The paper summarizes several studies to develop aerodynamic technology for high performance VSTOL aircraft anticipated after 1990. A contracted study jointly sponsored by NASA-Ames and David Taylor Naval Ship Research and Development Center is emphasized. Four contractors analyzed two vertical-attitude and three horizontal-attitude takeoff and landing concepts with gross weights ranging from about 10433 kg (23,000 lb) to 17236 kg (38,000 lb). The aircraft have supersonic capability, high maneuver performance (sustained load factor 6 2 at Mach 0.6, 3048 m (10,000 ft)) and a 4536 kg (10,000-lb) STO overload capability. The contractors have estimated the aerodynamics and identified aerodynamic uncertainties associated with their concept. Example uncertainties relate to propulsion-induced flows, canard-wing interactions, and top inlets Wind-tunnel research programs were proposed to investigate these uncertainties. (Author)

A78-48991 * Lifting line theory for transonic flow. L P. Cook and J. D. Cole (California, University, Los Angeles, Calif.). *SIAM Journal on Applied Mathematics,* vol. 35, Sept. 1978, p 209-228 7 refs. Grant No. NsG-2171.

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

A78-49255 * A preference-ordered discrete-gaming approach to air-combat analysis. H. J. Kelley and L. Lefton (Analytical Mechanics Associates, Inc., Jericho, N.Y.). *(Institute of Electrical and Electronics Engineers, Conference on Decision and Control, New Orleans, La., Dec. 1977.) IEEE Transactions on Automatic Control,* vol. AC-23, Aug. 1978, p. 642-645. 6 refs. Contracts No. NAS2-8738, No. F33615-77-C-3144.

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

A78-49787 * # A method for localizing wing flow separation at stall to alleviate spin entry tendencies. T. W. Feistel, S. B. Anderson (NASA, Ames Research Center, Moffett Field, Calif.), and R. A. Kroeger (Michigan, University, Ann Arbor, Mich.). *American*

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Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif., Aug 21-23, 1978, Paper 78-1476. 8 p.

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

(Author)

A78-49790 * # V/STOL aircraft simulation - Requirements and capabilities at Ames Research Center. D E. Wilcox and H C Quigley (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif, Aug 21-23, 1978, Paper 78-1515.* 12 p

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

A78-49804 * # CO2 laser-driven Stirling engine. G. Lee (NASA, Ames Research Center, Moffett Field, Calif.), R. L Perry (NASA, Ames Research Center, Moffett Field; University of the Pacific, Stockton, Calif.), and B. Carney. *Journal of Energy,* vol 2, July-Aug. 1978, p. 203-209 10 refs.

A 100-W Beale free-piston Stirling engine was powered remotely by a CO2 laser for long periods of time. The engine ran on both continuous-wave and pulse laser input. The working fluid was helium doped with small quantities of sulfur hexafluoride, SF6 The CO2 radiation was absorbed by the vibrational modes of the sulfur hexafluoride, which in turn transferred the energy to the helium to drive the engine. Electrical energy was obtained from a linear alternator attached to the piston of the engine Engine pressures, volumes, and temperatures were measured to determine engine performance. It was found that the pulse radiation mode was more efficient than the continuous-wave mode. An analysis of the engine heat consumption indicated that heat losses around the cylinder and the window used to transmit the beam into the engine accounted for nearly half the energy input. The overall efficiency, that is, electrical output to laser input, was approximately 0.75% However, this experiment was not designed for high efficiency but only to demonstrate the concept of a laser-driven engine. Based on this experiment, the engine could be modified to achieve efficiencies of perhaps 25-30% (Author)

A78-51860 * Applications of algebraic geometry to systems theory - The McMillan degree and Kronecker indices of transfer functions as topological and holomorphic system invariants. C Martin (NASA, Ames Research Center, Moffett Field, Calif) and R. Hermann (Harvard University, Cambridge, Mass). *SIAM Journal on Control and Optimization,* vol 16, Sept. 1978, p 743-755. 16 refs Contract No A-35046-B.

A78-52628 * # An improved higher order panel method for linearized supersonic flow. F. E Ehlers, M A Epton, F. T. Johnson, A E Magnus, and P E. Rubbert (Boeing Commercial Airplane Co , Seattle, Wash) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan. 16-18, 1978, Paper 78-15* 7 p 8 refs Contract No NAS2-7729.

An improved higher order panel method for linearized supersonic flow is described Each panel, defined by four points on the surface, is divided into eight subpanels in such a way that all subpanel and panel edges are contiguous By prescribing a quadratic distribution of the doublet on each subpanel, the doublet strength is made strictly continuous on the paneled surface. A linear source distribution is also used Numerical results are smoother and in better agreement with experiment than the previous method with less strict continuity. A brief discussion of superinclined panels used to eliminate interior interference in nacelles is included (Author)

A78-52630 * # Advanced panel-type influence coefficient methods applied to unsteady three dimensional potential flows. A. R Dusto, M A Epton, and F T Johnson (Boeing Co , Seattle, Wash.) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan 16-18, 1978, Paper 78-229* 9 p. 7 refs Contract No NAS2-7729.

A panel method for solving unsteady, subsonic wind-body-tail flow problems is formulated and partially verified The method is applicable to general aircraft configurations consisting of arbitrary arrangements of wings, bodies, tails, and nacelles The wake may be located arbitrarily and the unsteady, transverse component of vorticity in the wake may be assigned any covection velocity The wake in the unsteady flow problem, therefore, can be given the location and convection velocity of the wake produced by a steady flow which is the mean flow of the unsteady flow problem. The panel method has been used as a basis for expanding the unsteady kernel function in a power series to obtain panel influence coefficients which can be integrated in closed form G R.

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ASTRONAUTICS

FORMAL REPORTS

N78-10148*# Hughes Aircraft Co , El Segundo, Calif Space and Communications Group
PIONEER VENUS SPACECRAFT CHARGING MODEL c15
P A Robinson, Jr and A B Holman *In* NASA Lewis Res Center Proc of the Spacecraft Charging Technol. Conf 24 Feb 1977 p 297-308 refs (For availability see N78-10129 01-12)
(Contract NAS2-8300)
Avail NTIS HC A99/MF A01 CSCL 22B

Five environmental models were constructed to represent the. solar wind and the upper middle, and lower ionosphere of Venus The spacecraft structure was modeled with over 140 passive electrical elements representing structural elements of the spacecraft Electron, ion, secondary electron, and photocurrents to the spacecraft from the plasma were calculated, ignoring sheath effects In all but one case, potentials of interest were less than 1 volt Potential differences between widely separated points on the equipment shelf were less than 1 mV. The one area of concern is the solar panel potential when the orbiter is passing through the bowshock region   Author

N78-13492*# National Aeronautics & J Space Administration. Ames Research Center, Moffett Field, Calif

S **ABSTRACTS FOR THE PLANETARY GEOLOGY FIELD CONFERENCE ON AEOLIAN PROCESSES**
Ronald Greeley, ed (Arizona State Univ) and David Black, ed Jan 1978 63 p refs
(NASA-TM-78455; A-7279) Avail NTIS HC A04/MF A01 CSCL 08G

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

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

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

N78-18274# Army Electronics Command Fort Monmouth, N J. Communications/ADP Lab
LOW PROFILE ANTENNA PERFORMANCE STUDY. PART 2· BROADBAND ANTENNA TECHNIQUES SURVEY Final Report, Sep. 1975 - Mar. 1977
C M. DeSantis Oct 1977 43 p refs
(DA Proj 1T1-61101-A-91A)
(AD-A047992, ECOM-4542-Pt-2) · Avail .NTIS HC A03/MF A01 CSCL 09/5

This report is Part II of a three part series of reports investigating small antennas, their bandwidth and efficiency capabilities Reviews and brief outlines of techniques published in the literature over the past 10-20 years, for broadbanding antennas are provided in this report Experimental results from measurements of the Goubau antenna, a low-profile antenna (=0 05 lambda at the lowest operating frequency) are presented to show that this antenna possesses an octave bandwidth, regarding both impedance and radiation characteristics Numerical results for some top-loaded structures are presented and matching network element variations are determined in order to estimate the bandwidth It is shown that approximately 2 1 and approximately 4 1 increases in bandwidth are achieved when top-loading is applied to the stub and the loop antenna, respectively, and an L-network is used for tuning and matching It is concluded that there may be several small but broadband antenna configurations possible from a clever (but as yet unknown) combination of the ideas and techniques presented in this report   Author (GRA)

N78-18366# Naval Civil Engineering Lab , Port Hueneme, Calif
CABLE STRUMMING SUPPRESSION Technical Note, Apr. - Jun. 1976
B E Hafen and D J Meggitt Sep 1977 107 p refs
(YF52556091)
(AD-A047996; CEL-TN-1499) Avail NTIS HC A06/MF A01 CSCL 13/9

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

N78-18388*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
STATUS AND FUTURE PROSPECTS OF USING NUMERICAL METHODS TO STUDY COMPLEX FLOWS AT HIGH REYNOLDS NUMBERS
Robert W McCormack *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb 1978 14 p refs (For availability see N78-18375 09-34)
Avail NTIS HC A11/MF A01 CSCL 20D

The Navier-Stokes equations adequately describe aerodynamic .flows at standard atmospheric temperatures and pressures If these equations could be efficiently solved, there would be no need for experimental tests to design flight vehicles or other

aerodynamic devices Although much progress has been made toward the solution, including complex unsteady two-dimensional and steady three-dimensional separated flows and have recently made some dramatic improvements in developing numerical methods, the calculation of flow fields past complete aircraft configurations at flight Reynolds numbers are far beyond our reach, perhaps as long as a decade away They await substantial progress in devising accurate and efficient numerical methods, in understanding and modeling the physics of turbulence, and in developing reliable and powerful computer hardware

Author

N78-19029*# Hughes Aircraft Co Culver City Calif
MAGNETOMETER DEPLOYMENT MECHANISM FOR PIONEER VENUS   c19
William L Townsend *In* NASA Goddard Res Center The 11th Aerospace Mech Symp Apr 1977 p 23-33 (For availab. iy see N78-19026 09-99)'
(Contract NAS2-8300)
Avail NTIS HC A11/MF A01 CSCL 14B

A three segment, 15-foot boom mechanism was developed to deploy magnetometers from the Pioneer Venus orbiter spinning shell 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 orbit insertion load while extended The detailed design is described along with test methods developed for qualification in a one g field Author

N78-19056*# 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 Mar 1978 12 p refs Proposed for Presentation at the AGARD Symp. on Dyn, Athens, Greece, 22-24 May 1978
(NASA-TM-78471· A-7328) Avail: NTIS HC A02/MF A01 CSCL 01A

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

N78-19778*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
FUTURE COMPUTER REQUIREMENTS FOR COMPUTATIONAL AERODYNAMICS
Feb 1978 515 p refs Proceedings held at Moffett Field, Calif, 4-6 Oct 1977
(NASA-CP-2032, A-7291) Avail NTIS HC A22/MF A01 CSCL 09B

Recent advances in computational aerodynamics are discussed as well as motivations for and potential benefits of a National Aerodynamic Simulation Facility having the capability to solve fluid dynamic equations at speeds two to three orders of magnitude faster than presently possible with general computers Two contracted efforts to define processor architectures for such a facility are summarized For individual titles, see N78-19779 through N78-19819.

N78-19779*# National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif
COMPUTATIONAL AERODYNAMICS AND THE NUMERICAL AERODYNAMIC SIMULATION FACILITY   c02
Victor L Peterson *In its* Future Computer Requirements for Computational Aerodynamics Feb 1978 p 5-30 (For availability see N78-19778 10-59)
Avail. NTIS HC A22/MF A01 CSCL 09B

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

N78-19781*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
THREE-DIMENSIONAL COMPUTATIONAL AERODYNAMICS IN THE 1980'S   c61
Harvard Lomax *In its* Future Computer Requirements for Computational Aerodynamics Feb 1978 p 33-38 (For availability see N78-19778 10-59)
Avail NTIS HC A22/MF A01 CSCL 09B

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

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N78-19782*# Burroughs Corp, Paoli, Pa
NUMERICAL AERODYNAMICS SIMULATION FACILITY PRELIMINARY STUDY, EXECUTIVE SUMMARY Final Report   c61
In NASA Ames Res Center Future Computer Requirements for Computational Aerodynamics Feb. 1978 p 41-62 (For availability see N78-19778 10-59)
(Contract NAS2-9456)
Avail NTIS HC A22/MF A01 CSCL 09B

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

N78-19783*# Control Data Corp, Minneapolis, Minn
PRELIMINARY STUDY FOR A NUMERICAL AERODYNAMIC SIMULATION FACILITY Summary Report   c61
N. R Lincoln *In* NASA Ames Res Center Future Computer Requirements for Computational Aerodynamics Feb 1978 p 63-79 (For availability see N78-19778 10-59)
(Contract NAS2-9457)
Avail NTIS HC A22/MF A01 CSCL 09B

The state of the art of relevant technologies, of systems and processor architectures, and the measurable computational requirements of the two existing-Navier-Stokes solution programs were assessed by Control Data Corporation to determine the

best approach for designing a system for aerodynamic simulation Standard parts and components were used to identify the support processing system, which is composed of commercially available equipment and software Technological achievements in large scale integration technology and system organization of subcomponents borrowed from the STAR-100C project were used in the design of the Navier-Stokes solver A R H

N78-19797*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
MODELING OF THE REYNOLDS STRESSES c02
Morris W. Rubesin *In its* Future Computer Requirements for Computational Aerodynamics Feb 1978 p 239-247 (For availability see N78-19778 10-59)
Avail NTIS HC A22/MF A01 CSCL 01A

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

N78-20186* Martin Marietta Aerospace, Denver, Colo
FLUID INTERACTION WITH SPINNING TOROIDAL TANKS
D A Fester and J E. Anderson *In* ESA Attitude Control of Space Vehicles Technol and Dyn Probl Assoc. with the Presence of Liquids Dec 1977 p 77-86 refs (For availability see N78-20178 11-18)
(Contract NAS2-7489)
Avail. NTIS HC A10/MF A01 CSCL 22B

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

N78-21193*# National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif
THEORETICAL CONTAMINATION OF CRYOGENIC SATELLITE TELESCOPES
M Murakami (Tokyo Univ, Japan) Apr 1978 49 p refs
(NASA-TP-1177, A-7024) Avail NTIS HC A03/MF A01 CSCL 22A

The state of contaminant molecules, the deposition rate on key surfaces, and the heat transfer rate were estimated by the use of a zeroth-order approximation. Optical surfaces of infrared telescopes cooled to about 20 K should be considered to be covered with at least several deposition layers of condensible molecules without any contamination controls The effectiveness of the purge gas method of contamination controls was discussed This method attempts to drive condensible molecules from the telescope tube by impacts with a purge gas in the telescope tube For this technique to be sufficiently effective, the pressure of the purge gas must be more than 2 x 000001 torr The influence caused by interactions of the purged gas with the particulate contaminants was found to slightly increase the resident times of the particulate contaminants within the telescope field of view Author

N78-21214*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
FIRE RESISTIVITY AND TOXICITY STUDIES OF CANDIDATE AIRCRAFT PASSENGER SEAT MATERIALS
L L. Fewell, Ed Trabold (McDonnell Douglas Corp, Long Beach, Calif.), and H Spieth (McDonnell Douglas Corp, Long Beach, Calif) Mar 1978 44 p refs
(NASA-TM-78468; A-7334) Avail NTIS HC A03/MF A01 CSCL 21B

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

N78-21215*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
CALCULATED RATE CONSTANTS FOR THE REACTION ClO + O YIELDS Cl + O2 BETWEEN 220 AND 1000 DEG K
Richard L Jaffee Apr 1978 69 p refs Submitted for publication
(NASA-TM-78483, A-6613) Avail NTIS HC A04/MF A01 CSCL 07D

Classical trajectory calculations are presented for the reaction ClO + O yields Cl + O2, a reaction which is an important step in the chlorine-catalyzed destruction of ozone which is thought to occur in the 220 and 1000 K The calculated rate constant is 4.36 x 10 to the minus 11th power exp (-191/T)cu cm molecule (-1)s(-1) and its value at 300 K is 2 3 plus or minus 10 to the 11th power cu cm molecule (-1)s(-1) about a factor of 2 lower than recent experimental data The empirical potential energy surface used in the calculations was constructed to fit experimental data for ClO, O2 and ClOO molecules Other important features of this potential surface, such as the barrier to reaction, were varied systematically and calculations were performed for a range of conditions to determine the best theoretical rate constants Results demonstrate the utility of classical trajectory methods for determining activation energies and other kinetic data for important atmospheric reactions Author

N78-21407*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
ON THE PERIOD OF THE COHERENT STRUCTURE IN BOUNDARY LAYERS AT LARGE REYNOLDS NUMBERS
M. A Badri Narayanan and Joseph G Marvin Apr 1978 23 p refs
(NASA-TM-78477, A-7380) Avail NTIS HC A02/MF A01 CSCL 20D

The period of the large coherent structure in a subsonic, compressible, turbulent boundary layer was determined using the autocorrelation of the velocity and pressure fluctuations for Reynolds numbers between 5,000 and 35,000. In low Reynolds number flows the overall correlation period scaled with the outer variables - namely, the free stream velocity and the boundary layer thickness Author

N78-21490*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
SIMPLE TORSION TEST FOR SHEAR MODULI DETERMINATION OF ORTHOTROPIC COMPOSITES
H Theodore Sumsion and Yapa D S Rajapakse Apr. 1978 15 p refs Presented at 2d Intern Conf on Composite Mater, Toronto, 16-20 Apr 1978
(NASA-TM-78485; A-7418) Avail NTIS HC A02/MF A01 CSCL 20K

By means of torsion tests performed on test specimens of the same material having a minimum of two different cross sections (flat sheet of different widths), the effective in-plane (G13) and out-of-plane (G23) shear moduli were determined for

two composite materials of uniaxial and angleply fiber orientations
Test specimens were 16 plies (nominal 2 mm) thick, 100 mm
in length, and in widths of 6.3 9.5, 12.5, and 15.8 mm Torsion
tests were run under controlled deflection (constant angle of
twist) using an electrohydraulic servocontrolled test system.
In-plane and out-of-plane shear moduli were calculated from an
equation derived in the theory of elasticity which relates applied
torque, the torsional angle of twist, the specimen width/thickness
ratio, and the ratio of the two shear moduli G13/G23 Results
demonstrate that torsional shear moduli, G23 as well as G13,
can be determined by simple torsion tests of flat specimens of
rectangular cross section. Neither the uniaxial nor angleply
composite material were transversely isotropic   Author

N78-22055*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
DYNAMIC STALL OF AN OSCILLATING AIRFOIL
Unmeel B Mehta (Stanford Univ, Calif) *In* AGARD Unsteady
Aerodyn Feb 1978 32 p refs Sponsored in part by ARMDL
(For availability see N78-22033 13-02)
(Contract NCA2-or745-602; Grant NSG-2253)

Avail NTIS HC A99/MF A01 CSCL 01A
        Unsteady separated boundary layers and wakes were studied
by investigating flow past an oscillating airfoil which in- part
models the retreating blade stall on the helicopters The
Navier-Stokes equations in terms of the vorticity and stream
function for laminar flow were solved to determine the flow
field around a modified NACA 0012 airfoil After a fully developed
flow was determined at zero incidence, the airfoil was oscillated
in pitch through an angle of attack range from 0 deg to
20 deg. The computed streamlines during this pitch-up motion
are in qualitative agreement with the trajectories of air bubbles
observed in water tunnel experiments conducted with a
NACA 0012 airfoil under the same conditions During the
pitch-down motion of the airfoil, the computed flow patterns
cannot be compared with the experiments because the trajectories
of air bubbles intersect   Author

N78-24000*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field Calif
**A REVIEW OF NASA-SPONSORED TECHNOLOGY ASSESS-
MENT PROJECTS**
Alfred C Mascy, Arthur D. Alexander, III, and Richard D. Wood
May 1978 59 p refs
(NASA-TM-78472 A-7410) Avail NTIS HC A04/MF A01
CSCL 05B
        Recent technology assessment studies sponsored by NASA
are reviewed and a summary of the technical results as well as
a critique of the methodologies are presented The reviews include
Assessment of Lighter-Than-Air Technology Technology Assess-
ment of Portable Energy RDT&P, Technology Assessment of Future
Intercity Passenger Transportation Systems, and Technology
Assessment of Space Disposal of Radioactive Nuclear Waste
The use of workshops has been introduced as a unique element
of some of these assessments Also included in this report is a
brief synopsis of a method of quantifying opinions obtained through
such group interactions Representative of the current technol-
ogy assessments these studies cover a broad range of socio-
political factors and issues in greater depth than previously
considered in NASA sponsored studies In addition to the lessons
learned through the conduct of these studies, a few suggestions
for improving the effectiveness of future technology assessments
are provided   Author

N78-24860*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
**LAGRANGIAN COMPUTATION OF INVISCID COM-
PRESSIBLE FLOWS**
G H. Klopfer May 1978 60 p refs
(NASA-TM-78456, A-7288) Avail NTIS HC A04/MF A01
CSCL 12A
        A Lagrangian method is developed to solve the Euler equations
of gas dynamics The solution of the equations is obtained by a
numerical computation with the well-known Flux-Corrected-
Transport (FCT) numerical method This procedure is modified

so that the boundary treatment is accurate and relatively simple
Shock waves and other flow discontinuities are captured
monotonically without any type of fitting procedures The
Lagrangian method is employed so that the problem of mesh
generation is completely avoided The method is applicable to
all Mach numbers except the low subsonic range where
compressibility effects are small The method is applied to a
one-dimensional Riemann problem (shock tube) and to a
two-dimensional supersonic channel flow with reflecting shock
waves   Author

N78-25017*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
ENGINEERING TESTS OF THE C-141 TELESCOPE
Edwin F Erickson and Donald W Strecker May 1978 9 p
(NASA-TM-78467, A-7323) Avail NTIS HC A02/MF A01
CSCL 20F
        Data on image quality, chopper performance, and the
closed-loop operation of the 91 cm telescope of the Kuiper
Airborne Observatory which were obtained in September 1977
are presented   Author

N78-25101*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
**CALCULATION OF SUPERSONIC VISCOUS FLOW OVER
DELTA WINGS WITH SHARP SUBSONIC LEADING
EDGES**
Yvon C Vigneron (Iowa State Univ., Ames), John V. Rakich,
and John C Tannehill (Iowa State Univ, Ames) Jun 1978
81 p refs Presented at the AIAA 11th Fluid and Plasma
Dynamics Conf, Seattle, 10-12 Jul 1978
(NASA-TM-78500) Avail: NTIS HC A05/MF A01 CSCL 01A
        Two complementary procedures were developed to calculate
the viscous supersonic flow over conical shapes at large angles
of attack, with application to cones and delta wings In the first
approach the flow is assumed to be conical and the governing
equations are solved at a given Reynolds number with a
time-marching explicit finite-difference algorithm. In the second
method the parabolized Navier-Stokes equations are-solved with
a space-marching implicit noniterative finite-difference algorithm
This latter approach is not restricted to conical shapes and provides
a large improvement in computational efficiency over published
methods Results from the two procedures agree very well with
each other and with available experimental data   Author

N78-25106*# National Aeronautics and Space Administration
Ames Research Center, Moffett Field Calif
**COMPUTATIONAL WING OPTIMIZATION AND COMPAR-
ISONS WITH EXPERIMENT FOR A SEMI-SPAN WING
MODEL**
E G. Waggoner (Vought Corp, Dallas Tex), H P. Haney (Vought
Corp, Dallas, Tex), and W F Ballhaus Jun 1978 90 p refs
(NASA-TM-78480, A-7395, AVRADCOM-TR-78-33(AM)) Avail
NTIS HC A05/MF A01 CSCL 01A
        A computational wing optimization procedure was developed
and verified by an experimental investigation of a semi-span
variable camber wing model in the NASA Ames Research Center
14 foot transonic wind tunnel The Bailey-Ballhaus transonic
potential flow analysis and Woodward-Carmichael linear theory
codes were linked to Vanderplaats constrained minimization
routine to optimize model configurations at several subsonic and
transonic design points The 35 deg swept wing is characterized
by multi-segmented leading and trailing edge flaps whose hinge
lines are swept relative to the leading and trailing edges of the
wing By varying deflection angles of the flap segments, camber
and twist distribution can be optimized for different design
conditions. Results indicate that numerical optimization can be
both an effective and efficient design tool The optimized
configurations had as good or better lift to drag ratios at the
design points as the best designs previously tested during an
extensive parametric study   J M S

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N78-26391*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
SOLUTION OF TRANSONIC FLOWS BY AN INTEGRO-DIFFERENTIAL EQUATION METHOD
Wandera Ogana (Nairobi Univ, Kenya) Jun 1978 30 p refs
(NASA-TM-78490, A-7434) Avail NTIS HC A03/MF A01 CSCL 20D

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

N78-26795*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
ON IMPROVING THE ITERATIVE CONVERGENCE PROPERTIES OF AN IMPLICIT APPROXIMATE-FACTORIZATION FINITE DIFFERENCE ALGORITHM
Jean-Antoine Desideri (Iowa State Univ, Ames), J L Steger, and J C Tannehill (Iowa State Univ, Ames) Jun 1978 121 p refs
(NCA2-OR340-706)
(NASA-TM-78495, A-7474) Avail NTIS HC A06/MF A01 CSCL 12A

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

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N78-26796*# National Aeronautics and Space Adm   ion Ames Research Center, Moffett Field, Calif
TECHNIQUES FOR CORRECTING APPROXIMATE FINITE DIFFERENCE SOLUTIONS
David Nixon Jun 1978 19 p refs
(NASA-TM-78499, A-7491) Avail NTIS HC A02/MF A01 CSCL 12A

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

N78-27364*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AN EXPERIMENTAL DOCUMENTATION OF PRESSURE GRADIENT AND REYNOLDS NUMBER EFFECTS ON COMPRESSIBLE TURBULENT BOUNDARY LAYERS
M J -Kussoy, C C Horstman, and M Acharya Jun 1978 114 p refs
(NASA-TM-78488, A-7426) Avail NTIS HC A06/MF A01 CSCL 20D

Attached supersonic turbulent boundary layers with a wide range of adverse pressure gradient strengths, are investigated for Reynolds numbers from 11 7 x 1 million to 314 x 1 million Surface pressure and surface shear measurements were obtained for six flow fields over the entire Reynolds number range In addition two flow fields - one with a moderate pressure gradient and the other with a severe pressure gradient - are thoroughly documented at a single Reynolds number This experimental documentation includes both mean and fluctuating profiles throughout the flow field, and is sufficient to define the complete flow field, including the upstream undisturbed flow region G.G

N78-28173*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
STABILITY OF CHROMIUM (III) SULFATE IN ATMOSPHERES CONTAINING OXYGEN AND SULFUR
K T. Jacob (Lawrence Berkeley Lab Berkeley, Calif.), Bhogeswara D. Rao and Howard G Nelson Jul 1978 21 p refs
(NASA-TM-78504, A-7508) Avail NTIS HC A02/MF A01 CSCL 07D

The stability of chromium sulfate in the temperature range from 880 K to 1040 K was determined by employing a dynamic gas-solid equilibration technique The solid chromium sulfate was equilibrated in a gas stream of controlled $SO3$ potential. Thermogravimetric and differential thermal analyses were used to follow the decomposition of chromium sulfate X-ray diffraction analysis indicated that the decomposition product was crystalline $Cr2O3$ and that the mutual solubility between $Cr2(SO4)3$ and $Cr2O3$ was negligible Over the temperature range investigated, the decomposition pressure were significantly high so that chromium sulfate is not expected to form on commercial alloys containing chromium when exposed to gaseous environments containing oxygen and sulfur (such as those encountered in coal gasification) I S

N78-28410*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
STATUS AND FUTURE PROSPECTS OF USING NUMERICAL METHODS TO STUDY COMPLEX FLOWS AT HIGH REYNOLDS NUMBERS
Robert W. MacCormack In AGARD Three Dimensional and Unsteady Separation at High Reynolds No Feb 1978 2 p
For primary document see N78-28397 19-34)
Avail NTIS HC A11/MF A01 CSCL 20D

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

N78-29067*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
WIND TUNNEL INVESTIGATION OF COMPUTATIONALLY OPTIMIZED VARIABLE CAMBER WING CONFIGURATIONS
E G Waggoner (Vought Corp Dallas), H P Haney (Vought Corp, Dallas), and W. F Ballhaus Jun 1978 140 p refs
Prepared in part by AVRADCOM
(NASA-TM-78479, AVRADCOM-TR-78-32(AM) A-7394) Avail NTIS HC A07/MF A01 CSCL 01A

An experimental investigation was performed in the NASA Ames Research Center 14 foot transonic wind tunnel to determine aerodynamic characteristics for several optimized configurations of a variable camber wing model Camber and twist distributions which were computationally defined using both subsonic and transonic potential flow analysis codes linked to an optimization technique were verified The 35 deg swept wing was characterized by multisegmented leading and trailing edge flaps whose hinge lines are swept relative to the leading and trailing edges of the wing The deflection angles of the flap segments could be varied therefore affording the possibility of optimizing the camber and twist distribution for a given design condition The test configurations were designed using potential flow analysis codes linked to a constrained minimization technique Camber and twist distributions were optimized at lift coefficients of 0 2, 0 4, and 0 6 for Mach numbers of 0 6 and 0 9 B B

N78-29149*# National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif
ON THE POSSIBILITY OF NEGATIVE ACTIVATION ENERGIES IN BIMOLECULAR REACTIONS
Richard L Jaffe Aug 1978 26 p refs
(NASA-TM-78509; A-7537) Avail NTIS HC A03/MF A01 CSCL 06C

The temperature dependence of the rate constants for model

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

N78-29436*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
SYSTEM OPTIMIZATION OF GASDYNAMIC LASERS, COMPUTER PROGRAM USER'S MANUAL
L J Otten III R C Saunders, III, and S J Morris (Langley Research Center, Hampton, Va) Apr 1978 49 p refs
(NASA-TM-73193, A-6865) Avail NTIS HC A03/MF A01 CSCL 20E
The users manual for a computer program that performs system optimization of gasdynamic lasers is provided. Detailed input/output formats are CDC 7600/6600 computers using a dialect of FORTRAN Sample input/output data are provided to verify correct program operation along with a program listing
G Y

N78-29451*# National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
TORQUING PRELOAD IN A LUBRICATED BOLT
H Lee Seegmiller Aug 1978 14 p refs
(NASA-TM-78501, A-7503) Avail NTIS HC A02/MF A01 CSCL 13I
The tension preload obtained by torquing a 7/8 in diam UNC high strength bolt was determined for lubricated and dry conditions Consistent preload with a variation of + or - 3% was obtained when the bolt head area was lubricated prior to each torque application Preload tensions nearly 70% greater than the value predicted with the commonly used formula occurred with the lubricated bolt A reduction to 39% of the initial preload was observed during 50 torque applications without relubrication Little evidence of wear was noted after 203 cycles of tightening Author

N78-30149*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
NASA/ESA CV-990 SPACELAB SIMULATION (ASSESS 2)
Jul 1977 47 p Prepared in cooperation with ESA Paris
(NASA-TM-78748) Avail NTIS HC A03/MF A01 CSCL 22A
Cost effective techniques for addressing management and operational activities on Spacelab were identified and analyzed during a ten day NASA-ESA cooperative mission with payload and flight responsibilities handled by the organization assigned for early Spacelabs Topics discussed include (1) management concepts and interface relationships, (2) experiment selection, (3) hardware development, (4) payload integration and checkout (5) selection and training of mission specialists and payload specialists, (6) mission control center/payload operations control center interactions with ground and flight problems, (7) real time interaction during flight between principal investigators and the mission specialist/payload specialist flight crew, and (8) retrieval of scientific data and its analysis ARH

N78-30774*# National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif
AN ASSESSMENT OF THE EFFECT OF SUPERSONIC AIRCRAFT OPERATIONS ON THE STRATOSPHERIC OZONE CONTENT
I G Poppoff, R C Whitten, R P Turco (R and D Associates, Marina del Rey, Calif), and L A Capone (San Jose State Univ Calif) Aug 1978 60 p refs
(NASA-RP-1026, A-7399) Avail NTIS HC A04/MF A01 CSCL 13B
An assessment of the potential effect on stratospheric ozone

of an advanced supersonic transport operations is presented This assessment, which was undertaken because of NASA's desire for an up-to-date evaluation to guide programs for the development of supersonic technology and improved aircraft engine designs, uses the most recent chemical reaction rate data From the results of the present assessment it would appear that realistic fleet sizes should not cause concern with regard to the depletion of the total ozone overburden, For example the NOx emission of one type designed to cruise at 20 km altitude will cause the ozone overburden to increase by 0 03% to 0 12%, depending upon which vertical transport is used These ozone changes can be compared with the predictions of a 1 74% ozone decrease (for 100 Large SSTs flying at 20 km) made in 1974 by the FAA's Climatic Impact Assessment Program Author

N78-31030*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif
PIONEER 10 OBSERVATION OF THE SOLAR WIND PROTON TEMPERATURE HELIOCENTRIC GRADIENT
J D Mihalov and J H Wolfe Aug 1978 15 p refs
(NASA-TM-78515 A-7579) Avail NTIS HC A02/MF A01 CSCL 03B
Solar wind isotropic proton temperatures as measured out to 12 2 AU heliocentric distance by the Ames plasma analyzer aboard Pioneer 10 are presented as consecutive averages over three Carrington solar rotations and discussed The weighted least-squares fit of average temperature to heliocentric radial distance, R, yields the power law R sup 52 These average proton temperatures are not correlated as well with Pioneer 10 s heliocentric radial distance (- 85) as are the corresponding average Zurich sunspot numbers R sub z (95). Consequently, it is difficult to isolate the spatial gradient in the Pioneer 10 solar wind proton temperatures using that data alone Author

N78-31508*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
HIGH ALTITUDE PERSPECTIVE
1978 33 p Original contains color illustrations
(NASA-SP-427) Avail NTIS MF A01; SOD HC $1.60 CSCL 14E
The capabilities of the NASA Ames Center U-2 aircraft for research or experimental programs are described for such areas as Earth resources inventories, remote sensing data interpretation electronic sensor research and development, satellite investigative support, stratospheric gas studies, and astronomy and astrophysics The availability of this aircraft on a cost-reimbursable basis for use in high-altitude investigations that cannot be performed by the private sector is discussed ARH

N78-32029*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
CRUSTAL EVOLUTION INFERRED FROM APOLLO MAGNETIC MEASUREMENTS
Palmer Dyal, William D Daily (Eyring Res Inst) and Leonid L Vanyan (Acad of Sci Moscow) Sep 1978 31 p refs
(Grant NsG-2082)
(NASA-TM-78524, A-7608) Avail NTIS HC A03/MF A01 CSCL 03B
Magnetic field and solar wind plasma density measurements were analyzed to determine the scale size characteristics of remanent fields at the Apollo 12, 15, and 16 landing sites Theoretical model calculations of the field-plasma interaction, involving diffusion of the remanent field into the solar plasma, were compared to the data The information provided by all these experiments shows that remanent fields over most of the lunar surface are characterized by spatial variations as small as a few kilometers Large regions (50 to 100 km) of the lunar crust were probably uniformly magnetized during early crustal evolution Bombardment and subsequent gardening of the upper layers of these magnetized regions left randomly oriented, smaller scale (5 to 10 km) magnetic sources close to the surface. The larger scale size fields of magnitude approximately 0.1 gammas are measured by the orbiting subsatellite experiments and the small scale sized remanent fields of magnitude approximately 100 gammas are measured by the surface experiments Author

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N78-32856*# National Aeronautics and Space Administration Ames Research Center. Moffett Field, Calif
PEAKER: AN AUTOMATIC BORESIGHT PEAKING ROUTINE FOR THE C-141 TELESCOPE
Edwin F. Erickson, Kevin Krisciunas (Informatics, Inc. Palo Alto, Calif), and Thomas Mathieson (Informatics, Inc. Palo Alto, Calif) Sep 1978 8 p
(NASA-TM-78516, A-7584) Avail NTIS HC A02/MF A01 CSCL 20F
The operation of an automated procedure is detailed which maximizes the signal from a detector by pointing the telescope at an astronomical source . G G

N78-32947*# National Aeronautics and Space Administration Ames Research Center. Moffett Field, Calif
OPTIMIZING INDIUM ANTIMONIDE (InSb) DETECTORS FOR LOW BACKGROUND OPERATION
Richard R Treffers Sep 1978 18, p refs
(NCA2-OR050-606)
;NASA-TM-73273 A-7149) Avail NTIS HC A02/MF A01 CSCL 03A
The various noise sources that affect InSb detectors (and similar voltaic devices) are discussed and calculated Methods are given for measuring detector resistance photon loading detector and amplifier capacitance amplifier frequency response, amplifier noise, and quantum efficiency A photovoltaic InSb detector with increased sensitivity in the 1 to 5 6 mu region is dicussed A R H

N78-34014*# National Aeronautics and Space Administration Ames Research Center. Moffett Field. Calif
ARE THE STRATOSPHERIC DUST PARTICLES METEOR ABLATION DEBRIS OR INTERPLANETARY DUST?
Maxwell B Blanchard and Frank T Kyte (San Jose State Univ., Calif) Aug 1978 50 p refs
(NASA-TM-78507, A-7524) Avail NTIS HC A0J/MF A01 CSCL 03B
Natural and laboratory created fusion crusts and debris from artificial meteor samples were used to develop criteria for recognizing meteor ablation debris in a collection of 5 to 50 micron particles from the stratosphere These laboratory studies indicate that meteor ablation debris from nickel-iron meteoroids produce spherules containing taenite, wuestite magnetite, and hematite These same studies also indicate that ablation debris from chondritic meteoroids produce spheres and fragmentary debris The spheres may be either silicate rich, containing zoned olivine, magnetite, and glass, or sulfide rich, containing iron oxides (e g , magnetite, wuestite) and iron sulfides (e g , pyrrhotite pentlandite). The fragmentary debris may be either fine-grained aggregates of olivine, magnetite, pyroxene, and occasionally pyrrhotite (derived from the meteorite matrix) or individual olivine and pyroxene grains (derived from meteorite inclusions). A R H

N78-34021*# National Aeronautics and Space Administration. Ames Research Center. Moffett Field, Calif
METEOR ABLATION SPHERES FROM DEEP-SEA SEDIMENTS
M. B Blanchard D E Brownlee (California Inst of Technology, Pasadena), T. E. Bunch, P. W. Hodge (Washington Univ, Seattle), and F T Kyte (San Jose State Univ, Calif) Sep 1978 45 p refs
(NASA-TM-78510, A-7549) Avail NTIS HC A03/MF A01 CSCL 03B
Spheres from mid-Pacific abyssal clays (0 to 500,000 yrs old), formed from particles that completely melted and subsequently recrystallized as they separated from their meteoroid bodies, or containing relict grains of parent meteoroids that did not experience any melting were analyzed The spheres were readily divided into three groups using their dominant mineralogy The Fe-rich spheres were produced during ablation of Fe and metal-rich silicate meteoroids. The glassy spheres are considerably more Fe-rich than the silicate spheres. They consist of magnetite and an Fe glass which is relatively low in Si Bulk compositions and relict grains are useful for determining the parent meteoroid types for the silicate spheres Bulk analyses-of recrystallized spheres show that nonvolatile elemental abundances are similar to chondrite abundances Analysis of relict grains identified high temperature minerals associated with a fine-grained, low

temperature, volatile-rich matrix. The obvious candidates for parent meteoroids of this type of silicate sphere is a carbonaceous chondrite A R H

NASA CONTRACTOR REPORTS

N78-10411*#- Sigma Research, Inc, Richland, Wash
STUDY OF A HIGH PERFORMANCE EVAPORATIVE HEAT TRANSFER SURFACE Final Report
Elric W Saaski and R H Hamasaki 27 May 1977 82 p refs
(Contract NAS2-9120)
(NASA-CR-152008) Avail NTIS HC A05/MF A01 CSCL 20D
An evaporative surface is described for heat pipes and other two-phase heat transfer applications that consists of a hybrid composition of V-grooves and capillary wicking Characteristics of the surface include both a high heat transfer coefficient and high heat flux capability relative to conventional open-faced screw thread surfaces With a groove density of 12 6 cm/1 and ammonia working fluid, heat transfer coefficients in the range of 1 to 2 W/sq cm have been measured along with maximum heat flux densities in excess of 20 W/sq cm. A peak heat transfer coefficient in excess of 2 3 W/sq cm was measured with a 37 8 cm/1 hybrid surface Author

N78-19050*# Burroughs Corp, Paoli, Pa
NUMERICAL AERODYNAMIC SIMULATION FACILITY PRELIMINARY STUDY EXTENSION EXECUTIVE SUMMARY Final Report
Feb 1978 11 p
(Contract NAS2-9456)
(NASA-CR-152106) Avail NTIS HC A02/MF A01 CSCL 01A
An optimized functional design of key elements of the Numerical Aerodynamic Simulation Facility was investigated The following tasks were performed and are discussed (1) develop, optimize, and describe the functional description of the custom hardware, (2) delineate trade-off areas between performance, reliability, availability, serviceability, and programmability. (3) develop metrics and models for validation of the candidate system's performance. (4) conduct a functional simulation of the system design, (5) perform a reliability analysis of the system design, and (6) develop the software specifications to include a user level high level programming language, a correspondence between the programming language and instruction set, and outline the operating system requirements Author

N78-19051*# Burroughs Corp Paoli, Pa
NUMERICAL AERODYNAMIC SIMULATION FACILITY. PRELIMINARY STUDY EXTENSION Final Report
Feb 1978 273 p
(Contract NAS2-9456)
(NASA-CR-152107) Avail NTIS HC A12/MF A01 CSCL 01A
The production of an optimized design of key elements of the candidate facility was the primary objective of this report This was accomplished by effort in the following tasks: (1) to further develop optimize and describe the function description of the custom hardware; (2) to delineate trade off areas between performance, reliability, availability, serviceability, and programmability. (3) to develop metrics and models for validation of the candidate systems performance (4) to conduct a functional simulation of the system design, (5) to perform a reliability analysis of the system design, and (6) to develop the software specifications to include a user level high level programming language a correspondence between the programming language and instruction set and outline the operation system requirements Author

N78-19052*# Control Data Corp, St Paul, Minn Research and Advanced Design Lab
PRELIMINARY STUDY FOR A NUMERICAL AERODYNAMIC SIMULATION FACILITY. PHASE 1: EXTENSION
N R Lincoln Feb. 1978 434 p refs
(Contract NAS2-9457)
(NASA-CR-152108) Avail: NTIS HC A19/MF A01 CSCL 01A

Functional requirements and preliminary design data were identified for use in the design of all system components and in the construction of a facility to perform aerodynamic simulation for airframe design A skeleton structure of specifications for the flow model processor and monitor, the operating system, and the language and its compiler is presented ARH

N78-21223*# Douglas Aircraft Co Inc Long Beach Calif
**AIRCRAFT CARGO COMPARTMENT FIRE TEST SIMULA-
TION PROGRAM Final Report, Oct. 1974 - Jan. 1977**
R E Blumke Jan 1977 84 p refs
(Contract NAS2-8699)
(NASA-CR-151951: MDC-J7471) Avail: NTIS
HC A05/MF A01 CSCL 11D
The objective of the test was to assess fire containment and fire extinguishment in the cargo by reducing the ventilation through the cargo compartment Parameters which were measured included ignition time, burnthrough time, and physical damage to the cargo liner, composition of selected combustible gases, temperature-time histories, heat flux, and detector response The ignitor load was made of a typical cargo consisting of filled cardboard cartons occupying 50% of the compartment volume
Author

N78-22000*# Santa Barbara Research Center. Goleta Calif
**CONTINUED DEVELOPMENT OF DOPED-GERMANIUM
PHOTOCONDUCTORS FOR ASTRONOMICAL OBSERVA-
TIONS AT WAVELENGTHS FROM 30 TO 120 MICROME-
TERS Final Technical Report**
P R Bratt N N Lewis and L E Long 24 Apr 1978 61 p
refs
(Contract NAS2-9599)
(NASA-CR-152125) Avail NTIS HC A04/MF A01 CSCL
03A
The development of doped-germanium detectors which have optimized performance in the 30- to 120-mu m wavelength range and are capable of achieving the objectives of the infrared astronomical satellite (IRAS) space mission is discussed. Topics covered include the growth and evaluation of Ge Ga and Ge Be crystals, procedures for the fabrication and testing of detectors irradiance calculations detector responsivity, and resistance measurements through MOSFET. Test data are presented in graphs and charts.
Author

N78-23117*# Marvex Corp. Saratoga. Calif
**NASA/ESA CV-990 SPACELAB SIMULATION (ASSESS 2)
Final Report**
D R Mulholland G M Androus and J F Reeves Jan 1978
198 p refs
(Contract NAS2-9514)
(NASA-CR-152122) Avail NTIS HC A09/MF A01 CSCL
22A
To test the validity of the ARC approach to Spacelab several missions simulating aspects of Spacelab operations have been conducted as part of the ASSESS Program Each mission was designed to evaluate potential Shuttle/Spacelab concepts in increasing detail For this mission, emphasis was placed on development and exercise of management techniques planned for Spacelab using management participants from NASA and ESA who have responsibilities for Spacelab 1 which will be launched in 198 ? Author

N78-28994*# Operations Research. Inc. Silver Spring. Md
**PHASE 1. DEFINITION OF INTERCITY TRANSPORTATION
COMPARISON FRAMEWORK VOLUME 2: METHODOL-
OGY Final Report**
,9 Jul 1978 251 p refs
Contract NAS2-9815)
NASA-CR-152152-Vol-2, ORI-TR-1298-Vol-2) Avail NTIS
HC A12/MF A01 CSCL 13F
Categories of cost and service measures that will appropriately define the characteristics of all intercity transportation systems were established Previous methods of comparing transportation

systems were reviewed Specific comparison variables, applicable to all modes were defined. and the functional relationships by which these variables are interdependent were explored A framework by which the set of variables may be employed for comparison of data from the individual systems was constructed A R.H.

N78-29146*# Martin Marietta Aerospace Denver Colo.
**EXPERIMENTAL INVESTIGATION OF CONTAMINATION
PREVENTION TECHNIQUES TO CRYOGENIC SURFACES
ON BOARD ORBITING SPACECRAFT**
M A Hetrick R O Rantanen. E B Ress. and J. F Froechtenigt
Aug 1978 96 p refs
(Contract NAS2-9816)
(NASA-CR-152171. MCR-78-578) Avail. NTIS
HC A05/MF A01 CSCL 22B
Within the simulation limitations of on-orbit conditions it was demonstrated that a helium purge system could be an effective method for reducing the incoming flux of contaminant species Although a generalized purge system was employed in conjunction with basic telescope components the simulation provided data that could be used for further modeling and design of a specific helium injection system Experimental telescope pressures required for 90% attenuation appeared to be slightly higher (factor of 2 to 5). Cooling the helium purge gas and telescope components from 300 to 140 K had no measurable effect on stopping efficiency of a given mass flow of helium from the diffuse injector J A M

N78-32991*# National Aeronautics and Space Administration.
Ames Research Center, Moffett Field Calif
ACCELERATION AND HEATING OF THE SOLAR WIND
Aaron Barnes In JPL A Close-up of the Sun 1 Sep 1978
p 334-344 refs (For primary document see N78-32964 23-92)
Avail NTIS HC A25/MF A01 CSCL 03B
Some of the competing theories of solar wind acceleration and heating are reviewed, and the observations that are required to distinguish among them are discussed In most cases what is required is measurement of plasma velocity and temperature and magnetic field, as near the sun as possible- and certainly inside 20 solar radii, another critical aspect of this question is determining whether a turbulent envelope exists in this inner region, and if so, defining its properties Plasma and magnetic observations from the proposed Solar Probe mission would thus yield a quantum jump in our understanding of the dynamics of the solar wind
Author

N78-33127*# McDonnell-Douglas Astronautics Co. St Louis,
Mo
**PIONEER JUPITER ORBITER PROBE MISSION 1980,
PROBE DESCRIPTION**
R E DeFrees 8 Nov 1974 51 p ref
(Contract NAS2-8377)
(NASA-CR-137591) Avail. NTIS HC A04/MF A01 CSCL
22A
The adaptation of the Saturn-Uranus Atmospheric Entry Probe (SUAEP) to a Jupiter entry probe is summarized This report is extracted from a comprehensive study of Jovian missions, atmospheric model definitions and probe subsystem alternatives
G G

N78-33379*# TRW Defense and Space Systems Group Redondo
Beach. Calif
**EXTENDED DEVELOPMENT OF VARIABLE CONDUCTANCE
HEAT PIPES Final Report**
D Antoniuk. D K Edwards and E C. Luedke Sep 1978
56 p

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(NASA-CR-152183 TRW-31183-6001 RU-00) Avail NTIS
HC A04/MF A01 CSCL 20D

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

N78-33384*# Rockwell International Corp, Downey, Calif
Satellite Systems Div
**DEVELOPMENT OF A CRYOGENIC ROTATING HEAT PIPE
JOINT Final Report, Nov. 1977 - Sep 1978**
Sep 1978 72 p refs

The performance of two critical technology components
required for a continuously rotatable heat pipe (1) a low-leakage
rotatable coupling for the heat pipe pressure vessel, and (2) a
rotatable internal wick, is reported Performance and leakage
requirements were established based on 12 months operation
of a cryogenic rotatable heat pipe on a satellite in earth orbit
                                                                        G Y

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

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A78-10405 *   Simultaneous determination of rotational and
translational temperatures of OH/2 Pi/ in a gas discharge. C. C. Wang
(Ford Motor Co, Dearborn, Mich) and D K. Killinger (Michigan,
University, Ann Arbor, Mich.) *Physical Review Letters,* vol 39, Oct.
10, 1977, p 929-932 15 refs NSF-supported research, Contract No.
NAS2-8797

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

A78-10587'*   Occultation of Epsilon Geminorum by Mars II
- The structure and extinction of the Martian upper atmosphere. J. L.
Elliot, R G. French, E Dunham, P J Gierasch, J. Veverka, C
Church, and C Sagan (Cornell University, Ithaca, N Y) *Astro-
physical Journal, Part 1,* vol 217, Oct 15, 1977, p 661-679 32 refs
NSF Grant No. MPS-75-06670, Grants No. NsG-7243, No.
NGR-33-010-082, No. NGR-33-010-186, No NsG-2174, No
NsG-7126

The occultation of Epsilon Geminorum by Mars on April 8,
1976, was observed at three wavelengths and 4-ms time resolution
with the 91-cm telescope aboard NASA's G. P. Kuiper Airborne
Observatory Temperature, pressure, and number-density profiles of
the Martian atmosphere were obtained for both the immersion and
emersion events Within the altitude range 50-80 km above the mean
surface, the mean temperature is about 145 K, and the profiles
exhibit wavelike structures with a peak-to-peak amplitude of 35 K
and a vertical scale of about 20 km. The ratio of the refractivity of
the atmosphere at 4500 A and 7500 A is consistent with the
atmospheric composition measured by Viking 1 From the 'central
flash' - a bright feature in the light curve midway between immersion
and emersion - an optical depth at 4500 A of 3.3 + or - 1.7 per km
atm (about 0 23 per equivalent Martian air mass) is found for the
atmosphere about 25 km above the mean surface near the south
polar region This large value and its weak wavelength dependence
rule out Rayleigh scattering as the principal cause of the observed
extinction   (Author)

A78-11403 *   Some Martian volcanic features as viewed from
the Viking orbiters. M. H Carr (U S. Geological Survey, Branch of
Astrogeology, Menlo Park, Calif.), R Greeley (NASA, Ames Re-
search Center, Moffett Field, Calif.), K R Blasius (Planetary Science
Institute, Pasadena, Calif.), J. E Guest, and J B. Murray (London,
University, Observatory, Mill Hill, Middx, England) *Journal of
Geophysical Research,* vol 82, Sept 30, 1977, p 3985-4015. 32
refs

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

A78-13752 *   On the relative locations of the bow shocks of the terrestrial planets. C T Russell (California, University, Los Angeles, Calif) *Geophysical Research Letters,* vol 4, Oct 1977, p. 387-390. 21 refs. Contract No NAS2-8808; Grant No NGR-05-007-004.

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

A78-13845 *   Demand-type gas supply system for rocket borne thin-window proportional counters. L W Acton, R Caravalho, R. C. Catura, and E G Joki (Lockheed Research Laboratories, Palo Alto, Calif). *Review of Scientific Instruments,* vol. 48, Nov. 1977, p 1504-1506. Research supported by the Lockheed Independent Research Program, Contracts No. NAS2-6723, No. NASw-2660.

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

A78-14622 * #   The instability of the thin vortex ring of constant vorticity S E. Widnall (MIT, Cambridge, Mass) and C ·Y Tsai (NASA, Ames Research Center, Moffett Field, Calif , MIT, Cambridge, Mass.). *Royal Society (London), Philosophical Transactions, Series A,* vol. 287, no 1344, Oct. 13, 1977, p 273 305. 22 refs NSF Grant No ENG-7414978

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

A78-14651 *   Diagrammatic evaluation of the density operator for nonlinear optical calculations S Y Yee, T K Gustafson (California, University, Berkeley, Calif), S A. J. Druet, and J.-P E. Taran (ONERA, Châttillon-sous-Bagneux, Hauts de-Seine, France). *Optics Communications,* vol 23, Oct 1977, p 1-7 11 refs NSF Grant No ENG-72-03860-A01, Grants No DAHC04-75-C-0095, No NsG-2151

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

A78-14655 *   Collisionless dissociation of SF6 using two resonant frequency CO2 laser fields M. C. Gower and T. K Gustafson (California, University, Berkeley, Calif.). *Optics Communications,* vol 23, Oct. 1977, p 69-72. 22 refs Grants No NsG-2151; No NCA2-OY-050-701

The collisionless dissociation of SF6 has been studied using simultaneous irradiation by two frequencies from a CO2 laser which are both nearly resonant with the SF6nu3 absorption band. It was found that the dissociation was enhanced, and occurred over a wider frequency range, than for single frequency dissociation No threshold effect was observed for a weak resonant and a much higher energy field pumping slightly off-resonance. For such two frequency irradiation, the peak in the dissociation curve was found to be shifted to lower frequencies with respect to that for single frequency dissociation. (Author)

A78-15204 *   Food and oxygen requirements for growing mice and turtles after hypergravitational development. C C Wunder, W. J. Moressi (Iowa, University, Iowa City, Iowa), C H Dodge (Library of Congress, Washington, D C), and K. M Cook (Coe College, Cedar Rapids, Iowa). In Life sciences and space research XV, Proceedings of the Open Meeting of the Working Group on Space Biology, Philadelphia, Pa, June 8-19, 1976 [A78-15177 04-51] Oxford and New York, Pergamon Press, 1977, p. 245-249 24 refs Grants No NIH-GM-10093; No. NGR-16-001-031, Contract No NAS2-6064

A78-15267 *   Survey of adaptive image coding techniques. A Habibi (TRW Defense and Space Systems Group, Redondo Beach, Calif) *IEEE Transactions on Communications,* vol. COM-25, Nov 1977, p. 1275-1284 45 refs. Contract No NAS2-8394.

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

A78-16180 * #   Effect of a nonconstant C/m-alpha/ on the stability of rolling aircraft. B. Davari (NASA, Ames Research Center, Moffett Field, California, University, Berkeley, Calif.) and E V Laitone (California, University, Berkeley, Calif.) *Journal of Aircraft,* vol 14, Dec 1977, p 1169-1174. 15 refs Grant No NGR-05-003-451.

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

A78-16454 * #   Quantum mechanical theory of a structured atom diatom collision system - A + BC/1-Sigma/. P L DeVries (Rochester, University, Rochester, N Y.) and T F. George *Journal of Chemical Physics,* vol. 67, Aug. 15, 1977, p. 1293-1301 23 refs NSF Grant No. CHE-75-06775-A01, Contract No. F44620-74-C-0073, Grant No NsG-2198

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

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freedom (plus spin-orbit interaction), coupled scattering equations are derived in both space-fixed and body-fixed coordinate systems Coefficients, analogous-to Percival-Seaton coefficients, are obtained Approximations to the exact equations, including angular momenta decoupling approximations, are discussed for both the space-fixed and body-fixed formalisms. (Author)

A78-17612 * # Displacement thickness distributions in transonic flows about 3-D wings. W. Kordulla (NASA, Ames Research Center, Moffett Field, Calif) In Conference on Numerical Methods in Fluid Mechanics, 2nd, Cologne, West Germany, October 11-13, 1977, Proceedings (A78-17601 05-34) Cologne, Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, 1977, p. 81-88 13 refs

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

A78-17837 * # Absorption measurements of OH using a CW tunable laser. D K Killinger and C C. Wang (Ford Motor Co., Dearborn, Mich). Chemical Physics Letters, vol. 52, Dec. 1, 1977, p. 374-376 7 refs. NSF-supported research; Contract No. NAS2-8797

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

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A78-17881 * Toroidal tank evaluation D. A Fester and J. E Anderson (Martin Marietta Aerospace, Denver, Colo.) Society of Allied Weight Engineers, Annual Conference, 36th, San Diego, Calif , May 9-12, 1977, Paper 9 refs Contract No NAS2-7489

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

A78-18173 * The Pioneer 11 imaging experiment of Jupiter W Swindell and J. Fountain (Arizona, University, Tucson, Ariz) In. Space research XVII; Proceedings of the Open Meetings of Working Groups on Physical Sciences, June 8-19, 1976 and Symposium on Minor Constituents and Excited Species, Philadelphia, Pa , June 9, 10, 1976 (A78-18101 05-42) Oxford and New York, Pergamon Press, 1977, p. 687-701. 8 refs. Contract No. NAS2-6265

Pioneer 11 flew by Jupiter in December 1974 and obtained several hundred images of the planet It is presently targeted for encounter with Saturn in 1979. The imaging photopolarimeter recorded spin-scan images with high photometric accuracy It also recorded polarimetric and zodiacal-light data Careful design of the instrument resulted in excellent performance in the Jovian radiation environment Imaging data were displayed to maintain the proper shape of the planet. Color images were made by synthesizing green data from red and blue data Pictures created from Pioneer 11

imaging data show complex detail within the Red Spot is well as indications of flow around it Bright spots with trailing plumes are seen in the Equatorial Zone The North Polar Region is devoid of belt structure, but numerous irregular cells are seen in red light. The Galilean satellites were imaged with a resolution of several hundred kilometers (Author)

A78-18274 * # Unsteady transonic flow computations .A R. Seebass, N. J. Yu, and K -Y. Fung (Arizona, University, Tucson, Ariz.). NATO, AGARD, Symposium on Unsteady Aerodynamics, Ottawa, Canada, Sept 26-28, 1977, Paper 18 p 31 refs Grants No AF-AFOSR-76-29548; No NsG-2112; Contract No. N0014-76-C-0182

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

A78-18732 * On determining magnetospheric diffusion coefficients from the observed effects of Jupiter's satellite Io. M F Thomsen, C. K. Goertz, and J. A. Van Allen (Iowa, University, Iowa City, Iowa) Journal of Geophysical Research, vol 82, Dec 1, 1977, p 5541-5550 41 refs NSF Grant No. ATM-72-01282; Contract No. NAS2-6553

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

A78-18874 * The composition of Phobos - Evidence for carbonaceous chondrite surface from spectral analysis. K. D. Pang (Planetary Science Institute, Pasadena, Calif), J. B Pollack (NASA, Ames Research Center, Moffett Field, Calif), J Veverka (Cornell University, Ithaca, N.Y), A. L. Lane, and J. M Ajello (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.) Science, vol 199, Jan 6, 1978, p 64-66 35 refs NASA-supported research

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

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

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Calif), J Veverka (Cornell University, Ithaca, N Y.), K. Pang (Planetary Science Institute, Pasadena, Calif), A L Lane, and J M. Ajello (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) *Science,* vol 199, Jan 6, 1978, p 66 69 16 refs

The reflectivity of Phobos has been determined in the spectral region from 0.4 to 1 1 micrometers from images taken with a Viking lander camera. The reflectivity curve is flat in this spectral interval and the geometric albedo equals 0 05 + or - 0 01 These results, together with Phobos's reflectivity spectrum in the ultraviolet, are compared with laboratory spectra of carbonaceous chondrites and basalts The spectra of carbonaceous chondrites are consistent with the observations, whereas the basalt spectra are not. These findings raise the possibility that Phobos may be a captured object rather than a natural satellite of Mars   (Author)

A78-19768 * -   Radiation pressure and Poynting-Robertson drag for small spherical particles S Soter (Cornell University, Ithaca, N Y), J A Burns (NASA, Ames Research Center, Moffett Field, Calif), and P L Lamy (CNRS, Laboratoire d'Astronomie Spatiale, Marseille, France) In: Comets, asteroids, meteorites. Interrelations, evolution and origins, Proceedings of the Thirty-ninth International Colloquium, Lyons, France, August 17-20, 1976 (A78-19751 06 88) Toledo, Ohio, University of Toledo, 1977, p 121-125 5 refs.

Robertson's expression for the velocity-dependent effect of solar radiation on the motion of small particles is difficult because of its dependence on relativistic considerations, and it is also deficient in that it assumes perfectly absorbing particles The present paper gives a heuristic derivation of the Poynting-Robertson effect. Robertson's expression for perfectly absorbing particles is obtained but on a much simpler physical basis, and an expression is also obtained for a particle that in general scatters, transmits, and absorbs light Some numerical results on the solar radiation forces felt by small particles of cosmochemically important compositions are given
P T.H.

A78-19895 *   The prediction of toxic atmospheres from decomposing polymers. A Buchler and C J. Hilado (San Francisco, University, San Francisco, Calif). *Journal of Fire and Flammability,* vol 8, Oct 1977, p 478 493 5 refs Grants No NsG-2039; No NsG-2164

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

A78-20223 *   Signal-to-noise ratios for stellar occultations by the rings of Uranus, 1977-1980. J L Elliot (Cornell University, Ithaca, N Y.). *Astronomical Journal,* vol 82, Dec 1977, p 1036-1038 13 refs Grants No NsG-2174, No NsG-7126.

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

A78-20630 *   On implicit finite-difference simulations of three dimensional flow. T. H. Pulliam and J L Steger (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-10* 12 p 31 refs

An implicit finite difference procedure for unsteady three-dimensional flow capable of handling arbitrary geometry through the use of general coordinate transformations is described Viscous effects are optionally incorporated with a 'thin layer' approximation of the Navier-Stokes equations An implicit approximate factoriza-

tion technique is employed so that the small grid sizes required for spatial accuracy and viscous resolution do not impose stringent stability limitations. Results obtained from the program include transonic inviscid and laminar-turbulent solutions about simple body configurations Comparisons with existing theories and experiments are made Numerical accuracy and the effect of three dimensional coordinate singularities are also discussed   (Author)

A78-20632 * ᵈ   Calculation of unsteady transonic flows using the integral equation method D Nixon (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan. 16-18, 1978, Paper 78-13* 12 p. 13 refs

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

A78-20730 * ᶦ   Aerothermodynamic environment for Jovian entry with silica heat shield. M. J Green (NASA, Ames Research Center, Moffett Field, Calif.) and W. E. Nicolet (Acurex Corp, Mountain View, Calif.) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan. 16-18, 1978, Paper 78-186* 16 p. 15 refs

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

A78-20741 * #   Reynolds number and pressure gradient effects on compressible turbulent boundary layers. M Acharya, M. I Kussoy, and C. C Horstman (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-199.* 17 p 29 refs.

A detailed investigation of attached supersonic turbulent boundary layers over an extensive range of Reynolds numbers (12 x 10 to the 6th to 314 x 10 to the 6th) is presented Experimental measurements were obtained for adverse pressure gradients ranging in magnitude from those of previous investigations to those approaching separation The measurements include mean values of surface pressure and skin-friction, mean-flow profiles, and profiles of the three turbulent velocity fluctuation components and turbulent shear stress Numerical solutions, employing three turbulence models of various degrees of complexity have been compared with the details of the measured flow fields Generally, it was found that the more sophisticated turbulence models are superior to a mixing length model for predicting the Reynolds number and pressure gradient effects However, some details of the turbulent fluctuations as well as the exact Reynolds number trends indicated by the data were not accurately predicted with any of the turbulence models considered
(Author)

A78-20776 * ≐   Thin-layer approximation and algebraic model for separated turbulent flows B Baldwin and H. Lomax (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-257.* 9 p 13 refs

An algebraic turbulence model for two- and three dimensional separated flows is specified that avoids the necessity for finding the

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flow over an airfoil. Separation and reattachment points from numerical Navier-Stokes solutions agree with experiment within one boundary-layer thickness Use of law-of-the-wall boundary conditions does not alter the predictions significantly. Applications of the model to other cases are contained in companion papers   (Author)

A78-21624 *   Thermodynamic processes-induced-by coherent radiation M Garbuny (Westinghouse Research and Development Center, Pittsburgh, Pa) *Journal of Chemical Physics*, vol. 67, Dec 15, 1977, p. 5676-5687. 29 refs. Contract No. NAS2-9185

It is shown by quantum statistics that under certain stated conditions the entropy of coherent radiation is zero and it is still negligible for multimode laser operation. This makes possible gas kinetic processes which, to a small extent, have already been observed or even utilized, but which can be greatly enhanced by an optimized choice of molecular structures and radiation conditions. Radiative cooling of gases is discussed in detail The conditions for maximum heat withdrawal are derived, and it is proposed that the processes of cooling and relaxation heating can be sufficiently separated in time to achieve certain effects and thermodynamic cycles One of these is the complete conversion, possible in principle, of coherent radiation into work This concept is based on a heat pump process followed by heat-to-work conversion, the heat rejected being just equal to that withdrawn by radiation. The conditions for complete conversion turn out to be the same as for maximum heat withdrawal. The feasibility of these processes depends on the degree to which practical conditions can be met, and on the validity of certain assumptions which have to await experimental verification.
(Author)

A78-22575 * #   Computational wing optimization and wind tunnel test of semi-span model H P Haney, E. G. Waggoner (Vought Corp , Dallas, Tex.), and W F. Ballhaus (NASA, Ames Research Center, Computational Fluid Dynamics Branch, U S Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-102.* 7 p. 13 refs.

A computational transonic wing design procedure has been developed and verified by a wind tunnel test of a variable camber semi-span wing model. The Bailey-Ballhaus transonic potential flow analysis code linked to Vanderplaat's constrained minimization routine was used to optimize test configurations at 0 9 Mach number Based on wind tunnel test results, computationally optimized designs were as efficient as the best configurations determined by previous parametric testing and performed better at off-design points. Wind tunnel wing pressures agreed well with predictions from the improved Bailey-Ballhaus code at moderate CL's. Computational optimization was shown to be an effective transonic wing design tool.
(Author)

A78-22583 * #   The response of heat shield materials to intense laser radiation. J. H Lundell and R R Dickey (NASA, Ames Research Center, Entry Technology Branch, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-138* .9 p. 13 refs

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

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

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

A78-22595 * #   Behavior of a turbulent boundary layer subjected to sudden transverse strain. H. Higuchi (Dynamics Technology, Inc , Torrance, Calif) and M. W Rubesin (NASA, Ames Research Center, Moffett Field, Calif.) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-201* 20 p 12 refs

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

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

Emission spectroscopy of shock-heated atomic silicon was performed in the spectral range 180 to 300 nm, in an environment simulating the ablation layer expected around a Jovian entry probe with a silica heat shield. From the spectra obtained at temperatures from 6000 to 10,000 K and electron number densities from 1 quadrillion to 100 quadrillion per cu cm, the Lorentzian line-widths were determined The results showed that silicon lines are broadened significantly by both electrons (Stark broadening) and hydrogen atoms (Van der Waals broadening), and the combined line-widths are much larger than previously assumed. From the data, the Stark and the Van der Waals line-widths were determined for 34 silicon lines. Radiative transport through a typical shock layer was computed using the new line-width data The computations showed that silicon emission in the hot region is large, but it is mostly absorbed in the colder region adjacent to the wall
(Author)

A78-22606 * #   Airborne infrared interferometric observations and analysis of stratospheric trace constituents. L L Smith and T. Hilgeman (Grumman Aerospace Corp., Bethpage, N Y.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala , Jan 16-18, 1978, Paper 78-252.* 3 p. Contract No. NAS2-8664

Infrared interferometric observations of key trace constituents of the stratosphere have been obtained. The NASA Lear Airborne Observatory with the Grumman airborne interferometer system was flown in the lower stratosphere at an altitude of 13 7 km to obtain transmission spectra in the 2800-6000 per cm region at a resolution of 2.5 per cm using the moon as a source An atmospheric modeling program and the AFGL line parameter atlas are used to identify H_2O, CH_4, O_3 and other trace constituents and to derive stratospheric column densities (molecules/sq cm)
(Author)

A78-22608 * #   Navier-Stokes calculations for laminar and turbulent hypersonic flow over indented nosetips J. V. Rakich (NASA, Ames Research Center, Moffett Field, Calif.), Y C Vigneron, and J. C Tannehill (Iowa State University of Science and Technology, Ames, Iowa) *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan 16-18, 1978, Paper 78-260.* 11 p. 11 refs

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

A78-23083 *   Generation of a parallel X-ray beam and its use for testing collimators. J H Underwood (Aerospace Corp, Los Angeles, Calif). *Space Science Instrumentation,* vol. 3, Nov. 1977, p 259-270. 15 refs Contracts No. NAS2-8684, No F04701-75-C 0076

A technique is described, by which a glass strip may be bent to match any curve of large radius of curvature, to a high degree of accuracy, so that it may be used as a glancing incidence X-ray or extreme ultraviolet optical element The desired match is obtained by applying the optimum combination of end couples and by varying the cross-sectional moment of inertia along the length of the strip A particular case, that of a parabola for use as a laboratory X-ray collimator, is considered in detail. The analysis predicts that a collimation of one or two arc seconds should be obtainable in practice, with simple and inexpensive apparatus A prototype collimator to be used for the testing of space payloads using geometric (McGrath) collimators is described and laboratory results presented   (Author)

A78-23124 *   Measuring the velocity of individual atoms in real time. C Y. She (Colorado State University, Fort Collins, Colo), K W Billman (NASA, Ames Research Center, Moffett Field, Calif), and W M Fairbank, Jr. *Optics Letters,* vol 2, Feb. 1978, p. 30-32 9 refs

It is proposed that the thermal velocity of a single atom could be measured in real time using a laser time-of-flight velocimeter (LTV) operating on the principle of laser resonance fluorescence. Theoretical data are presented for several atomic species that have resonances within the range of available dye laser systems. It is shown that measurements in the subsonic region are certainly feasible The atoms could be either in vacuum or in a buffer gas, e g, at atmospheric pressure Measurements in the transonic and supersonic region also appear possible One potential application is the measurement of flow speeds in wind tunnels, perhaps as high as Mach 45.   (Author)

A78-23164 *   Analysis of stellar occultation data - Effects of photon noise and initial conditions. R. G French, J L Elliot, and P. J Gierasch (Cornell University, Ithaca, N Y.). *Icarus,* vol 33, Jan. 1978, p 186-202. 16 refs Grants No. NGL-33-010-086, No NsG-7126; No. NsG-2174.

An occultation light curve can be analyzed to provide information about a planetary atmosphere Temperature, pressure, and number density profiles for the atmosphere of Mars are derived from a series of boundary layer equations, which invert equal increments of altitude (as opposed to time) in order to predict the noise quality of the occultation Numerical results are given for a noisy isothermal light curve, with special attention to error analysis   D.M.W.

A78-23450 *   Effects of potassium titanate fiber on the wear of automotive brake linings M. L Halberstadt, J. A. Mansfield, and S K Rhee (Bendix Corp, Southfield, Mich) In: Wear of materials - 1977; Proceedings of the International Conference, St Louis, Mo, April 25-28, 1977. (A78-23426 08-37) New York, American Society of Mechanical Engineers, 1977, p 560-568. 7 refs Contract No. NAS2-7758

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

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

Exospheric neutral and electron temperatures have been estimated for the primitive upper atmosphere and ionosphere with various oxygen content in the scheme of our previous model (Shimizu and Shimazaki, 1976) The exospheric neutral temperature has been shown to be rather, insensitive to the change of oxygen content, justifying our previous assumption for the temperature variation, while the exospheric electron temperature has been found to be quite sensitive to the compositional change, mainly owing to the strong dependence of electron density on the oxygen concentration   (Author)

S

A78-23576 *   Quantum mechanical theory of collisional ionization in the presence of intense laser radiation. J. C Bellum (Rochester, University, Rochester, N.Y) and T F. George. *Journal of Chemical Physics,* vol 68, Jan 1, 1978, p 134-144. 64 refs NSF Grant No. CHE-75-06775-A01; Contracts No. F44620-74-C-0073, No F49620-78-C 0005, Grant No. NsG-2198

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

A78-23610 *   Lower stratosphere measurements of variation with latitude of CF2Cl2, CFCl3, CCl4, and N2O profiles in the northern hemisphere J. F Vedder, B J. Tyson, R B Brewer, E C Y Inn (NASA, Ames Research Center, Moffett Field, Calif), and C. A Boitnott *Geophysical Research Letters,* vol 5, Jan 1978, p 33-36 15 refs

Measurements were made from a U-2 aircraft of profiles of CF2Cl2, CFCl3, CCl4 and N2O in the lower stratosphere in a meridional survey at a longitude of 159 deg W during the period October 1 to November 14, 1976. The latitude distributions obtained show a marked decrease in mixing ratio with increasing

latitude from about 7 deg N in the Intertropical Convergence Zone to about 79 deg N. The results suggest the importance of meridional transport and mixing in the stratosphere in accounting, at least in part, for the observed profile variation with latitude The contaminants C2F4Cl2, C2F3Cl3, CHCCl3 and SF6 were also detected but their mixing ratios were small and no accurate standards were prepared for them   B J.

A78-23646 *   The rings of Saturn J. B. Pollack (NASA, Ames Research Center, Moffett Field, Calif) American Scientist, vol 66, Jan.-Feb. 1978, p 30-37. 29 refs.

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

A78-25264 *   Microparticle accelerator of unique design J F. Vedder (NASA, Ames Research Center, Moffett Field, Calif.) Review of Scientific Instruments, vol. 49, Jan. 1978, p. 1-7 23 refs

A microparticle accelerator has been devised for micrometeoroid impact and cratering simulation; the device produces high-velocity (0 5-15 km/sec), micrometer-sized projectiles of any cohesive material. In the source, an electrodynamic levitator, single particles are charged by ion bombardment in high vacuum. The vertical accelerator has four drift tubes, each initially at a high negative voltage After injection of the projectile, each tube is grounded in turn at a time determined by the voltage and charge/mass ratio to give four acceleration stages with a total voltage equivalent to about 1 7 MV.   B J.

A78-25295 *   Airborne photometric observations between 1.25 and 3 25 microns of late-type stars. H. L. Nordh, S. G. Olofsson (Stockholms Observatorium, Saltsjobaden, Sweden), and G. C. Augason (NASA, Ames Research Center, Astrophysics Branch, Moffett Field, Calif). Astronomical Journal, vol. 83, Feb 1978, p. 188-193. 30 refs. Swedish Board for Space Activities Grant No. DR-1148.

The stars Alpha Aur (G5 III + G0 III), Alpha Boo (K2 IIIp), Alpha Ori (M1-M2 Ia-Ib), Alpha Sco (M1.5 Iab), Mu Gem (M3 III), and Alpha Her (M5 Ib-II) have been observed using interference filters in five photometric bands between 1.25 and 3 25 microns during seven flights with NASA's Lear Jet Infrared Observatory. The filters were designed to measure molecular features, primarily from CN and CO, and continuum fluxes. By calibrating the photometer in the laboratory against a stabilized blackbody source, relative flux curves have been derived. The energy distributions and the strength of molecular features are discussed The most interesting result obtained is that the fluxes from Mu Gem and Alpha Her in the filter centered at 3.25 microns seem to be depressed by at least some tenths of a magnitude. Tentatively this depression is proposed to be due to the wings of the two vibration-rotation bands (about 2 7 microns) of hot water vapor. Since water vapor is an important opacity source and its abundance is a sensitive C/O indicator, the proposed interpretation makes renewed efforts to detect water bands in early M stars highly desirable.   (Author)

A78-25676 *   Saturn's rings Particle composition and size distribution as constrained by microwave observations. I - Radar observations. J. N. Cuzzi and J. B. Pollack (NASA, Ames Research Center, Space Sciences Div, Moffett Field, Calif). Icarus, vol. 33, Feb. 1978, p 233-262 84 refs   ·

The radar backscattering characteristics of compositional and structural models of Saturn's rings are calculated and compared with

observations of the absolute value, wavelength dependence, and degree of depolarization of the rings' radar cross section (reflectivity). The doubling method is used to calculate reflectivities for systems that are many particles thick using optical depths derived from observations at visible wavelengths If the rings are many particles thick, irregular centimeter- to meter-sized particles composed primarily of water ice attain sufficiently high albedos and scattering efficiencies to explain-the-radar observations. In that case, the wavelength independence of radar reflectivity implies the existence of a broad particle size distribution; a narrower size distribution is also a possibility Particles of primarily silicate composition are ruled out by the radar observations. Purely metallic particles may not be ruled out on the basis of existing radar observations A monolayer of very large ice 'particles' that exhibit multiple internal scattering may not yet be ruled out.   (Author)

A78-26079 *   Dynamic MHD modeling of the solar wind disturbances during the August 1972 events. M Dryer, Z. K. Smith (NOAA, Space Environment Laboratory, Boulder, Colo.), R. S Steinolfson (Alabama, University, Huntsville, Ala), E. J. Smith (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), J. H. Wolfe, J. D. Mihalov (NASA, Ames Research Center, Moffett Field, Calif), P. Rosenau (New York University, New York, N.Y), and C. Candelaria Journal of Geophysical Research, vol. 83, Feb 1, 1978, p. 532-540 26 refs. Grant No. AF-AFOSR-76-2881

A time-dependent one-dimensional MHD theoretical model is tested by using plasma and magnetic field observations of Pioneer 9 and Pioneer 10 during the August 1972 events on the sun and in the interplanetary medium These spacecraft were nearly aligned along a common heliocentric radius during these events, considered now to be the most spectacular and best-documented events during solar cycle 20 The observations of Pioneer 9 at 0 78 AU were used as input for the theoretical model. The plasma and magnetic field forcing functions were superimposed upon a preexisting ambient solar wind at this inner boundary, and the response was simulated as far as 8 AU. The simulated output at 2.2 AU is compared directly with the Pioneer 10 observations at 2.2 AU Qualitative comparison is good, although several limitations of the one-dimensional theory are noted.   (Author)

A78-26080 *   The interplanetary modulation and transport of Jovian electrons T F Conlon (Chicago, University, Chicago, Ill.). Journal of Geophysical Research, vol 83, Feb. 1, 1978, p 541-552. 29 refs Contract No NAS2-6551, Grant No. NGL-14-001-006.

Based on simultaneous measurements by Pioneer 11 of the 3-6 MeV Jovian electron flux, interplanetary magnetic field magnitude, and solar wind speed, the interplanetary transport of energetic particles is studied. It is found that corotating interaction regions (CIR's) greatly inhibit electron transport across the average field direction. Cross-field transport is also influenced by the degree of compression of the solar wind since CIR's are areas of compressed solar wind plasma. The propagation of Jovian electrons is studied by a model that includes the effects of CIR's The model tests whether or not the three-dimensional convection-diffusion theory adequately describes the cross-field transport of electrons. The model is also valid for Jovian electron observations from earth-orbiting satellites. The model may be further applied to 1 AU from the sun where it is found that the cross-field diffusion of electrons explains why Jovian electrons are detected at the earth even during periods when the interplanetary magnetic field does not connect the earth directly to Jupiter.   S.C.S

A78-26081 *   Energetic protons associated with interplanetary active regions 1-5 AU from the sun. M. E. Pesses, J. A Van Allen, and C K. Goertz (Iowa, University, Iowa City, Iowa). Journal of Geophysical Research, vol. 83, Feb. 1, 1978, p. 553-562. 36 refs. Contract No. NAS2-6553.

Pioneer 11 has yielded data on approximately 100 energetic proton events at heliocentric distances between 1 and 2 AU. Measurements of absolute intensities, anisotropies, and crude energy

spectra are studied in connection with interplanetary active regions (IAR's). It is found that in close vicinity to IAR's, the number of events observed per unit time interval is 10 times greater than in other areas of interplanetary space, and that the frequency of events has a maximum at plus or minus 5 hours of the time IAR edges are crossed. It is also noted that events in IAR vicinity have greater particle densities, softer energy spectra, and smaller time widths than other events. For many events associated with IAR's, particle anisotropies correspond to the net flow of particles along the interplanetary magnetic field toward the sun This suggests that a mechanism in MHD shocks is responsible for local acceleration in the interplanetary medium. S C S

A78-26350 * An integral solution to a nonlinear diffusion problem M. Y. Hussaini (NASA, Ames Research Center, Moffett Field, Calif.) and K. J Devasia (NASA, Ames Research Center, Moffett Field, Calif.; Indian Space Research Organization, Ahmedabad, India) *Computer Methods in Applied Mechanics and Engineering*, vol. 13, Jan. 1978, p. 119-123.

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

A78-27743 * A new concept in laser-assisted chemistry The electronic-field representation. T F. George, I H Zimmerman, J.-M Yuan, J R. Laing, and P. L. DeVries (Rochester, University, Rochester, N.Y.). *Accounts of Chemical Research*, vol 10, 1977, p 449-455 22 refs. NSF Grant No CHE-75-06775-A01; Grant No . NsG-2198; Contract No. F44620-74-C-0073.

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

A78-27744 * Semiclassical approach to collision-induced emission in the presence of intense laser radiation - An aspect in the study of cooperative chemical and optical pumping K.-S Lam, I H. Zimmerman, J-M. Yuan, J R Laing (Rochester, University, Rochester, N Y.), and T F. George *Chemical Physics*, vol. 26, Dec 15, 1977, p. 455-486 54 refs. NSF Grant No CHE-75 06775-A01, Grant No. NsG-2198, Contract No F44620-74-C 0073

A78-28926 * Characteristics of integrated MOM junctions at dc and at optical frequencies. M Heiblum, S Wang, J R. Whinnery, and T. K. Gustafson (California, University, Berkeley, Calif.). *IEEE Journal of Quantum Electronics*, vol QE-14, Mar 1978, p. 159-169 38 refs NSF Grant No ENG-72-03960-A01, Contract No F44620-76-C-0100, Grant No. NsG-2151

A new metal-oxide-metal device (Ni-NiO-Ni, Edge MOM) which is stable, reproducibly fabricated, and with a 10 to the -10th sq cm tunneling area is presented. Performing detection experiments, the device's nonlinear I-V characteristic is shown to be invariant at audio frequencies, 10 6, 3 39, and 0.6328 microns. Similar devices with 10 to the -8th sq cm tunneling areas perform as well as the Edge MOM's in the visible and the near-infrared range, but deteriorate in performance at the 10-micron range A dominant competing effect is a thermal-induced signal, which increases with frequency and temperature. Coupling mechanisms at the various regimes are investigated. The device can serve- as a broad-band detector and mixer, and might in the future be a basic element of broad-band amplifiers and oscillators (Author)

A78-29472 * On the apparent source depth of planetary magnetic fields. R. C. Elphic and C. T. Russell (California, University, Los Angeles, Calif). *Geophysical Research Letters*, vol 5, Mar 1978, p. 211-214 14 refs Contract No. NAS2-8808; Grant No. NGR-05-007-004.

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

A78-29489 * The co-adsorption of copper and oxygen on a tungsten 100 plane-type surface. E. Bauer (Clausthal, Technische Universitat, Clausthal-Zellerfeld, West Germany), H. Poppa (NASA, Ames Research Center, Moffett Field, Calif.), P. R Davis (NASA, Ames Research Center, Moffett Field; Stanford University, Stanford, Calif), and Y. Viswanath (NASA, Ames Research Center, Moffett Field, Calif.; Amoco Research Center, Naperville, Ill). *Surface Science*, vol. 71, no 3, Feb 1978, p. 503-518 5 refs Grants No. NsG-2071; No NCA2-OR450-602. NASA Order R-05-030-001.

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

S

A78-29532 * An analytic study of impact ejecta trajectories in the atmospheres of Venus, Mars, and earth M E. Tauber, D. B. Kirk, and D E. Gault (NASA, Ames Research Center, Moffett Field, Calif) *Icarus*, vol 33, Mar 1978, p 529-536. 10 refs

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

A78-29684 * Acceleration of nucleons in the interplanetary space and the modulation of Jupiter electrons in the interval from 1 to 10 A.U. by corotating regions of solar origin. C W Barnes, D. L. Chenette, T. F. Conlon, K R. Pyle, and J. A. Simpson (Chicago, University, Chicago, Ill) *(Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia*, vol 41, Feb 1977, p. 303-321) *Academy of Sciences, USSR, Bulletin, Physical Series*, vol 41, no 2, 1977, p 58-71 46 refs Contract No. NAS2-6551; Grant No NGL-14-001-006.
(For abstract see issue 14, p 2453, Accession no. A77-32859)

A78-30071 * A comprehensive model of the Venus iono-sphere. R. H Chen and A. F Nagy (NOAA, Space Physics Research Laboratory, Ann Arbor, Mich). *Journal of Geophysical Research,* vol 83, Mar. 1, 1978, p. 1133-1140 53 refs NSF Grant No. ATM-75-21049; Grant No. NGR-23-005-015; Contract No. NAS2-9130

Coupled time-dependent continuity-momentum and energy balance equations for the Venus ionosphere were simultaneously solved for $CO_2(+)$, $O_2(+)$, $O(+)$, $He(+)$, and $H(+)$ densities and electron and ion temperatures for an altitude range of 120-500 km. Values of the solar zenith angle varied from 0 deg (subsolar point) to 90 deg (terminator). The calculations include the horizontal bulk transport of ions by neutral winds but not the horizontal diffusion. The two-stream photoelectron transport method was used to find the heating rates for the ambient electrons. Different boundary conditions were considered, and a nightside ionosphere was calculated. The results of these model calculations are in good agreement with measurements in the region of maximum electron density. Characteristics of topside and nightside densities and temperatures discussed. M.L

A78-30078 * On the observation of a flare-generated shock wave at 9.7 AU by Pioneer 10. M. Dryer (NOAA, Space Environment Laboratory, Boulder, Colo), M. A Shea, D F. Smart (USAF, Geophysics Laboratory, Bedford, Mass.), H R. Collard, J D. Mihalov, J H Wolfe (NASA, Ames Research Center, Moffett Field, Calif.), and J W. Warwick (Colorado, University, Boulder, Colo.) *Journal of Geophysical Research,* vol. 83, Mar. 1, 1978, p. 1165-1168 23 refs

An apparent solar-flare-generated shock wave detected by Pioneer-10 at 9 7 AU on April 9, 1976 is discussed The shock wave may be correlated with a radio emission burst from Jupiter not associated with Io (March 30). The fact that solar flares observed on March 20 were at the central meridian with respect to Jupiter and Pioneer-10 and the fact that solar activity was very low before March 20 contribute to the argument that a shock wave had propagated to the region of the spacecraft J.M.B.

S

A78-30647 * Stimulated emission of surface plasmons by electron tunneling in metal-barrier-metal structures. D. P Siu and T. K Gustafson (California, University, Berkeley, Calif) *Applied Physics Letters,* vol. 32, Apr. 15, 1978, p. 500-502. 14 refs. NSF Grant No ENG-76-84532, Grant No NsG-2151.

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

A78-30690 * # Influence of spin rate on side force of an axisymmetric body R. L Kruse (NASA, Ames Research Center, Moffett Field, Calif) *AIAA Journal,* vol 16, Apr 1978, p 415, 416.

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

A78-30691 * Radiometer system to map the cosmic background radiation M V. Gorenstein, R. A Muller, G F Smoot (California, University, Berkeley, Calif), and J. A Tyson *Review of Scientific Instruments,* vol 49, Apr. 1978, p. 440-448. 15 refs Grant No. NsG-2125, Contract No. W-7405-eng-48.

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

A78-30893 * Coefficient matrices for implicit finite difference solution of the inviscid fluid conservation law equations. J. L Steger (NASA, Ames Research Center, Moffett Field, Calif). *Computer Methods in Applied Mechanics and Engineering,* vol 13, Feb. 1978, p 175-188 22 refs.

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

A78-31108 * The quiet coronal X-ray spectrum of highly ionized oxygen and nitrogen. D L. McKenzie, H R Rugge, J. H. Underwood, and R M Young (Aerospace Corp, Space Sciences Laboratory, Los Angeles, Calif.) *Astrophysical Journal, Part 1,* vol 221, Apr 1, 1978, p 342-349. 27 refs Research supported by the Aerospace Corp, Contract No NAS2-8684

A78-31921 * # Earth reencounter probabilities for aborted space disposal of hazardous nuclear waste. A L Friedlander and H Feingold (Science Applications, Inc, Schaumburg, Ill.). *American Astronautical Society and American Institute of Aeronautics and Astronautics, Astrodynamics Specialist Conference, Jackson Hole, Wyo, Sept. 7-9, 1977, Paper.* 51 p 14 refs Contract No. NAS2-9272.

A quantitative assessment is made of the long-term risk of earth reencounter and reentry associated with aborted disposal of hazardous material in the space environment. Numerical results are presented for 10 candidate disposal options covering a broad spectrum of disposal destinations and deployment propulsion systems Based on representative models of system failure, the probability that a single payload will return and collide with earth within a period of 250,000 years is found to lie in the range 0002- 006. Proportionately smaller risk attaches to shorter time intervals Risk-critical factors related to trajectory geometry and system reliability are identified as possible mechanisms of hazard reduction. (Author)

A78-32467 * Bar-driven spiral waves in disk galaxies J M. Huntley (NASA, Ames Research Center, Moffett Field, Calif ; Virginia, University, Charlottesville, Va.), R H Sanders (Pittsburgh, University, Pittsburgh, Pa.), and W. W. Roberts, Jr. (Virginia,

University, Charlottesville, Va.). *Astrophysical Journal, Part 1*, vol. 221, Apr. 15, 1978, p. 521-525, 527, 529 (7 ff.). NSF Grant No. AST-72-05124A04.

The response of rotating disks of gas to barlike perturbations in galactic gravitational fields is investigated. In particular, two-dimensional time-dependent numerical hydrodynamical calculations have been performed in order to determine the steady-state response of disks of gas to rotating barlike perturbations. Two types of barlike perturbations are considered: oval distortions in the axisymmetric gravitational field of the disk, and heterogeneous prolate spheroids. The calculations reveal that in the absence of gaseous self-gravity, a viscous differentially rotating disk of gas responds to a rotating barlike perturbation by forming a central gas bar with two trailing spiral waves. The local phase of the gas response is primarily a function of the number and spacing of the principal resonances in the disk. This result may be understood in terms of particle orbit theory. The gas response to barlike perturbations also depends on the relative strength and the effective axial ratio of the bar. In these calculations strong narrow bars produce offset shocks in the central Disc cosmologies (as well as for 'tre-light' cosmologies) are enormous. The Planckian (or near-Planckian) spectral form for the microwave radiation provides a crucial test, failed by such cosmologies. (Author)

A78-34137 * Low energy ionizing collisions between N2 and CO beam molecules and CO, N2, NO, CH4, and CO2 target molecules N G. Utterback (TRW, Inc., Redondo Beach, Calif.) and B. Van Zyl (Denver, University, Denver, Colo.). *Journal of Chemical Physics*, vol. 68, Mar. 15, 1978, p 2742-2752. 18 refs Contracts No. NAS2-4924; No. DA-01-021-AMC-113592.

Absolute total negative charge production cross sections for N2 + CO, CO + N2, CO + CO, N2 + NO, N2 + CH4, and N2 + CO2 collisions are reported, and a simple model of collisions is discussed. The cross sections were measured to within about 1 eV of their thresholds. Specific reaction channels were investigated by referring to mass spectrometric identification of the product ions scattered in the forward direction, and these product ion identifications were used to explain characteristic structures in the total charge production cross sections in the near-threshold regions. The extent of the importance of dissociative ionization and 'simple' ionization in the studied collisions at low energy is considered, and charge transfer cross sections for (CO)+ + CO, CO(+) + CH4, and N2(+) + CH4 are presented. M.L.

A78-34352 * A note on the diurnal averaging of aeronomical models. R. P. Turco (R & D Associates, Marina del Rey, Calif.) and R. C. Whitten (NASA, Ames Research Center, Moffett Field, Calif.). *Journal of Atmospheric and Terrestrial Physics*, vol. 40, Jan. 1978, p. 13-20. 5 refs.

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

A78-34506 * Analysis of ablation debris from natural and artificial iron meteorites. M. B. Blanchard (NASA, Ames Research Center, Moffett Field, Calif.) and A. S. Davis (San Jose State

University, San Jose, Calif.). *Journal of Geophysical Research*, vol 83, Apr. 10, 1978, p 1793-1808. 24 refs Contracts No. NAS2-6006; No. NCAR-675-414.

Iron and nickel-iron samples subjected to treatment by an arc-heated plasma of ionized air were used to model meteor ablation The artificial ablation debris and fusion crusts were compared to the fusion crusts of three natural iron meteorites and to magnetic spherules from deep-sea manganese nodules An outer discontinuous crust of magnetite and wustite, followed by an unoxidized metallic zone, was observed in the artificially produced samples. Fractionation of less volatile elements was also noted. J M B.

A78-34567 * Quiet time interplanetary cosmic ray anisotropies observed from Pioneer 10 and 11. W.-H. Ip, W. Fillius, A. Mogro-Campero (California, University, La Jolla, Calif.), L J. Gleeson (Monash University, Clayton, Victoria, Australia), and W. I. Axford (Max-Planck-Institut fur Aeronomie, Katlenburg, West Germany). *Journal of Geophysical Research*, vol 83, Apr. 1, 1978, p. 1633-1640. 21 refs. Contract No. NAS2-6552, Grant No. NGR-05-009-081.

Cerenkov counters on the Pioneer 10 and 11 spacecraft, capable of detecting alpha particles and protons with energies up to 480 MeV, and nucleons and electrons with energies up to 6 MeV, have yielded data on cosmic ray anisotropies during periods of low solar activity. Observations from Pioneer 11 place east-west anisotropy at 0.41 plus or minus 0 11%, and the north-south anisotropy at near zero; Pioneer 10 results show east-west anisotropy to be approximately 0.59 plus or minus 0.18%, and the north-south component at 0.25 plus or minus 0 08%. It is noted that the Pioneer 10 observations were obtained at the 6 AU range, while those from Pioneer 11 originated closer to the sun (1.1 to 2.7 AU). Attention is given to the ratio of the perpendicular to parallel components of the diffusion coefficient, and to the large north-south anisotropy reported by Pioneer 10, an effect due possibly to gradient drift, and to an additional streaming independent of the magnetic field polarity. D.M.W.

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A78-34682 * Semiclassical theory of unimolecular dissociation induced by a laser field. J.-M Yuan (Rochester, University, Rochester, N.Y.) and T F. George. *Journal of Chemical Physics*, vol. 68, Apr. 1, 1978, p 3040-3052. 72 refs. NSF Grant No CHE-75-06775-A01; Contracts No. F44620-74-C-0073; No. F49620-78-C-0005, Grant No. NsG-2198.

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

A78-35403 * Geographical variations of NO and O3 in the lower stratosphere. M. Loewenstein, W. J Borucki, H. F. Savage, J. G. Borucki, and R. C. Whitten (NASA, Ames Research Center, Moffett Field, Calif). *Journal of Geophysical Research*, vol. 83, Apr 20, 1978, p. 1875-1882. 14 refs.

Nitric oxide and ozone concentrations in the lower stratosphere have been measured from a high-altitude research aircraft using in situ measuring techniques Results of several geographical surveys are presented along with predictions of two two-dimensional stratospheric models. Meridional and zonal data were obtained in June

1974 and in June, July, and August 1975. At longitudes 122-158 deg W the meridional data taken between 5 and 80 deg N latitude show an increasing NO concentration with latitude, by a factor of 4 at 21-km altitude and a less marked increase at 18 km. The minimum NO concentration at 21 km is observed at 5 deg N latitude and is about 6 x 10 to the 8th power/cu cm. Zonal data at latitudes 22-38 deg N taken from 55 to 176 deg N longitude show little variation of the NO and O3 concentrations with longitude.   (Author)

A78-35601 * # Investigation of a cryogenic thermal diode. R. J. Williams (NASA, Ames Research Center, Moffett Field, Calif). In International Heat Pipe Conference, 3rd, Palo Alto, Calif., May 22-24, 1978, Technical Papers. (A78-35576 14-34) New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p. 177-183. 7 refs (AIAA 78-417)

This paper describes a series of parametric investigations to determine the effect of various fluid charges on the performance of a 0.635-cm-diameter spiral-artery, liquid-trap diode in both the forward and reverse modes. Specific parameters such as forward- and reverse-mode conductances, shutdown times and energies, and recovery to forward-mode operation, are evaluated for ethane as a working fluid in the temperature range 170 K to 220 K. Results indicate that the heat pipe will not reliably start up in the forward mode. However, startup can be initiated when preceded by a diode reversal. Also concluded are data which show the susceptibility of the diode to fluid charge and tilt. The optimum fluid charge was found to be 2.67 g, and transport capability at this charge was in excess of 1200 W-cm at 200 K. The diode in the reverse mode exhibited a rapid shutdown (within 9 min) with a shutdown energy of 1150 J (0.32 Wh)   (Author)

A78-35603 * # A re-entrant groove hydrogen heat pipe. J. Alario, R. Kosson (Grumman Aerospace Corp., Bethpage, N Y.), and C McCreight (NASA, Ames Research Center, Moffett Field, Calif.). In. International Heat Pipe Conference, 3rd, Palo Alto, Calif., May 22-24, 1978, Technical Papers. (A78-35576 14-34) New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p 194-202. 7 refs. (AIAA 78-420)

This paper extends the development of reentrant groove technology to hydrogen heat pipes. Parametric analyses are presented which optimize the theoretical design while considering the limitations of state-of-the-art extrusion technology. Acceptable production-type runs of extruded lengths (over 300 m) could only be achieved at the expense of a wider nominal groove opening than specified (0.33 mm vs. 0.20 mm). However, dimensional variations of other critical dimensions were within 0.05 mm, which exceeded expectations. The 6063-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-diam vapor core. Each axial groove is 0.775-mm-diam with a 0 33 mm opening An excess vapor reservoir is provided at the evaporator to minimize the pressure containment hazard during ambient storage Details of the instrumentation and helium-cooled test installation are also presented.   (Author)

A78-35622 * # Jet pump assisted arterial heat pipe. W. B. Bienert, A S Ducao, and D S Trimmer (Dynatherm Corp, Cockeysville, Md) In International Heat Pipe Conference, 3rd, Palo Alto, Calif, May 22-24, 1978, Technical Papers. (A78-35576 14-34) New York, American Institute of Aeronautics and Astronautics, Inc, 1978, p. 335-345. 12 refs. Contract No. NAS2-9233. (AIAA 78-443)

This paper discusses the concept of an arterial heat pipe with a capillary driven jet pump. The jet pump generates a suction which pumps vapor and noncondensible gas from the artery. The suction also forces liquid into the artery and maintains it in a primed condition. A theoretical model was developed which predicts the existence of two stable ranges Up to a certain tilt the artery will prime by itself once a heat load is applied to the heat pipe At higher tilts, the jet pump can maintain the artery in a primed condition but self-priming is not possible. A prototype heat pipe was tested which self-primed up to a tilt of 1.9 cm, with a heat load of 500 watts The heat pipe continued to prime reliably when operated as a VCHP, i e., after a large amount of noncondensible gas was introduced (Author)

A78-35997 * // A method for determining structural properties of RCC thermal protection material. R M Wakefield and K. R Fowler (NASA, Ames Research Center, Moffett Field, Calif) American Institute of Aeronautics and Astronautics and, American Society of Mechanical Engineers, Thermophysics and Heat Transfer Conference, 2nd, Palo Alto, Calif., May 24-26, 1978, AIAA Paper 78-869 12 p

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

A78-36040 * Chemisorption of CO on Pd particles supported on mica M Thomas, H Poppa (NASA, Ames Research Center, Moffett Field, Calif), J T. Dickinson (NASA, Ames Research Center, Moffett Field, Calif ; Washington State University, Pullman, Wash.), and G. M Pound (NASA, Ames Research Center, Moffett Field; Stanford University, Stanford, Calif.). (American Vacuum Society, National Symposium, 24th, and Conference on Microbalance Techniques, 15th, Boston, Mass, Nov. 8-11, 1977.) Journal of Vacuum Science and Technology, vol 15, Mar.-Apr. 1978, p. 568-571. 8 refs. Contracts No. NCS2-OR840-701; No. NCA2-OR745-711.

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

A78-36596 * ALC/50/ values for some polymeric materials. C J Hilado, H J Cumming, J. E. Schneider (San Francisco, University, San Francisco, Calif.), D. A. Kourtides, and J. A. Parker (NASA, Ames Research Center, Moffett Field, Calif). Journal of Combustion Toxicology, vol 5, Feb. 1978, p. 5-10 5 refs. Grant No. NsG-2039.

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

A78-36717 * Satellite mirror systems for providing terrestrial power - System concept K. W Billman, W. P Gilbreath (NASA, Ames Research Center, Moffett Field, Calif.), and S W. Bowen. In: The industrialization of space; Proceedings of the Twenty-third Annual Meeting, San Francisco, Calif., October 18-20, 1977. Part 1 (A78-36701 15-12) San Diego, Calif, American Astronautical Society, Univelt, Inc., 1978, p. 391-414. 11 refs. (AAS 77-240)

A system of orbiting reflectors, SOLARES, has been studied as a possible means of providing terrestrial power with a space system of minimum mass-and complexity The key impact that such a system,

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providing continuous and slightly concentrated insolation, makes on the economic viability of solar farming is demonstrated New developments in solar sailing are incorporated to reduce mirror mass and transportation cost The system is compatible with incremental implementation and continual expansion to produce the world's power needs Key technology, environmental, and economic issues and payoffs are identified SOLARES appears to be economically superior to other advanced, and even conventional, energy systems and could be scaled to completely abate our fossil fuel usage for power generation. (Author)

A78-36776 *   A theoretical study of the electronic transition moment for the C2 Swan band system. J. O. Arnold and S. R. Langhoff (NASA, Ames Research Center, Computational Chemistry Group, Moffett Field, Calif.). *Journal of Quantitative Spectroscopy and Radiative Transfer,* vol 19, May 1978, p. 461-466 26 refs

Large-scale self-consistent-field plus configuration-interaction calculations have been performed for the a 3Pi u and d 3Pi g states of C2 The theoretical potential curves are in good agreement with those found by a Klein-Dunham analysis of measured molecular constants in terms of shape and excitation energy. The sum of the squares of the theoretical transition moments between the states at 2 44 bohr is 4.12 a.u which agrees with the results of shock tube measurements The variation in the sum of the squares of the theoretical moments with internuclear separation agrees with the values of Danylewych and Nicholls (1974). Based on the data for C2 and mother molecules, it is suggested that CI calculations using near Hartree-Fock quality Slater basis sets produce highly reliable transition moments.   -   S.C.S.

A78-36809 *   Synthesis of N-substituted bisitaconimide monomers for use as thermosetting polyimide resins. S. L. Hartford, S Subramanian, and J A Parker (NASA, Ames Research Center, Moffett Field, Calif.) *Journal of Polymer Science, Part A - Polymer Chemistry,* vol 16, 1978, p 137-153 19 refs

A78-37270 * #   Jupiter probe heatshield configuration optimization R. B. Dirling, Jr and J D Binder (Science Applications, Inc, Santa Ana, Calif) *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Thermophysics and Heat Transfer Conference, 2nd, Palo Alto, Calif., May 24-26, 1978, AIAA Paper 78-843* 10 p. 18 refs Contract No. NAS2-9363

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

A78-37273 * #   Carbonaceous materials subjected to extreme heating - A comparison of numerical simulation and experiments. W. C. Davy, G. P. Menees, J H Lundell, and R R. Dickey (NASA, Ames Research Center, Moffett Field, Calif). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Thermophysics and Heat Transfer Conference, 2nd, Palo Alto, Calif., May 24-26, 1978, AIAA Paper 78-866* 9 p. 22 refs.

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

A78-37275 * #   Thermal design and development of a planetary probe - Pioneer Venus large probe. L A Hennis and M. N Varon (Hughes Aircraft Co, El Segundo, Calif). *American Institute of Aeronautics and Astronautics and American Society of Mechanical Engineers, Thermophysics and Heat Transfer Conference, 2nd, Palo Alto, Calif., May 24-26, 1978, AIAA Paper 78-916.* 10 p. Contract No. NAS2-8300.

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

A78-37354 *   Rigidity-independent coronal propagation and escape of solar protons and alpha particles. C. Perron, V. Domingo, R. Reinhard, and K -P. Wenzel (ESA, Space Science Dept, Noordwijk, Netherlands) *Journal of Geophysical Research,* vol 83, May 1, 1978, p. 2017-2029. 42 refs. Contract No. NAS2-6551.

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

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A78-37649 *   Nova-driven winds in globular clusters. E. H Scott (NASA, Ames Research Center, Theoretical and Planetary Studies Branch, Moffett Field, Calif) and R. H Durisen (NASA, Ames Research Center, Theoretical and Planetary Studies Branch, Moffett Field, Calif.; Indiana, University, Bloomington, Ind.). *Astrophysical Journal, Part 1,* vol 222, June 1, 1978, p. 612-620. 53 refs.

Recent sensitive searches for H-alpha emission from ionized intracluster gas in globular clusters have set upper limits that conflict with theoretical predictions. It is suggested that nova outbursts heat the gas, producing winds that resolve this discrepancy. The incidence of novae in globular clusters, the conversion of kinetic energy of the nova shell to thermal energy of the intracluster gas, and the characteristics of the resultant winds are discussed Calculated emission from the nova-driven models does not conflict with any observations to date. Some suggestions are made concerning the most promising approaches for future detection of intracluster gas on the basis of these models. The possible relationship of nova-driven winds to globular cluster X-ray sources is also considered.   (Author)

A78-37732 * #   Notes on the transonic indicial method. D Nixon (NASA, Ames Research Center, Moffett Field, Calif) *AIAA Journal,* vol. 16, June 1978, p 613-616.

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

A78-38228 * Zodiacal light as an indicator of interplanetary dust. J L Weinberg (New York, State University, Albany, N.Y.) and J G Sparrow (Weapons Research Establishment, Aeronautical Research Laboratories, Melbourne, Australia). In Cosmic dust (A78-38226 16-90) Chichester, Sussex, England and New York, Wiley-Interscience, 1978, p. 75-122 191 refs. Grants No NsG-7093; No. NsG-8040, Contract No NAS2-7963.

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

A78-38569 * ISAs and the dwarf content of the inner nuclear regions of M31. B J. Taylor (NASA, Ames Research Center, Moffett Field, Calif) and S. A Kellman. *Astrophysical Journal Supplement Series,* vol 37, May 1978, p 101-115 90 refs

A78-39448 * C3 and infrared spectrophotometry of Y Canum Venaticorum. J. H Goebel, J. D. Bregman, D. W. Strecker, F C Witteborn, and E F Erickson (NASA, Ames Research Center, Space Sciences Div, Moffett Field, Calif.). *Astrophysical Journal, Part 2 - Letters to the Editor,* vol 222, June 15, 1978, p. L129-L132 30 refs

The 1 2- to 5.6-micron spectrum of the carbon star Y CVn is presented and discussed The observations were made from the Kuiper Airborne Observatory at an altitude of 12.5 km, thereby avoiding most of the absorption due to terrestrial water vapor. Comparison of Y CVn near 5 microns with laboratory spectra provides possible evidence for the presence of the linear triatomic molecule C3 For the first time in a carbon star the clearly formed band heads of the CN red system between 1.2 and 2.3 microns are observed Corroborative evidence for the presence of the molecules HCN and C2H2 is presented, and the relative contributions of C3, HCN, and C2H2 to the 3 1-micron absorption band are discussed Spectra of two other carbon stars, TX Psc and S Cep, are presented for comparison
(Author)

A78-40838 * # Carbon vaporization into a nonequilibrium, stagnation-point boundary layer. T. Suzuki (NASA, Ames Research Center, Moffett Field, Calif). *AIAA Journal,* vol 16, July 1978, p 754-756 8 refs

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

A78-41074 * On the modulation of the Jovian decametric radiation by Io. I - Acceleration of charged particles R. A. Smith (Paris, Observatoire, Meudon, Hauts-de-Seine, France) and C. K Goertz (Iowa, University, Iowa City, Iowa). *Journal of Geophysical Research,* vol. 83, June 1, 1978, p 2617-2627 26 refs Research supported by the National Research Council, Centre National de la

Recherche Scientifique, and Délégation Générale à la Recherche Scientifique et Technique; NSF Grant No. ATM-72-01282, Contracts No NAS2-5603; No. NAS2-6553.

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

A78-41123 * Stratospheric NO and HNO3 observations in the Northern Hemisphere for three seasons. M. Loewenstein, W. L Starr (NASA, Ames Research Center, Moffett Field, Calif), and D. G. Murcray (Denver, University, Denver, Colo.). *Geophysical Research Letters,* vol 5, June 1978, p. 531-534. 12 refs

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

A78-41124 * Interhemispheric gradients of CF2Cl2, CFCl3, CCl4, and N2O. B J Tyson, J. C Arvesen, and D O'Hara (NASA, Ames Research Center, Moffett Field, Calif) *Geophysical Research Letters,* vol 5, June 1978, p 535 538 13 refs

Direct real-time gas chromatographic measurements of CF2Cl2, CFCl3, CCl4, and N2O were made at latitudes from 74 deg N to 62 deg S aboard a NASA Convair 990 as part of the 1976 NASA CV-990 Latitude Survey Mission between Alaska and New Zealand A difference was found in the average mixing ratios of CF2Cl2 and CFCl3 between the Northern and Southern Hemispheres, but no differences were noted for CCl4 and N2O The results support some of the previous studies of interhemispheric tropospheric gradients and suggest the lack of any significant tropospheric sinks (Author)

A78-41213 * Relative toxicity of the pyrolysis products from some thermoplastic and thermoset polymers. D. A Kourtides, W J. Gilwee, Jr. (NASA, Ames Research Center, Moffett Field, Calif.), and C J. Hilado (San Francisco, University, San Francisco, Calif) *Polymer Engineering and Science,* vol. 18, June 1978, p. 674-676.

Relative toxicity data on the pyrolysis products of a variety of thermoplastic and thermoset polymers are presented The data are presented in terms of time to incapacitation and time to death with a fixed sample weight of 1 0 g, and in terms of the apparent lethal concentration required to produce 50 percent mortality within a fixed exposure period of 30 min.
(Author)

A78-41753 * Interpreting statistics of small lunar craters. P. H. Schultz, D. Gault (Lunar and Planetary Institute, Houston, Tex.), and R. Greeley (Santa Clara, University, Moffett Field, Calif.). In: Lunar Science Conference, 8th, Houston, Tex , March 14-18, 1977, Proceedings. Volume 3. (A78-41551 18-91) New York, Pergamon Press, Inc., 1977, p 3539 3564 22 refs Contract No. NSR-09-051-001.

Some of the wide variations in the crater-size distributions in lunar photography and in the resulting statistics were interpreted as different degradation rates on different surfaces, different scaling laws in different targets, and a possible population of endogenic craters These possibilities are reexamined for statistics of 26 different regions. In contrast to most other studies, crater diameters

as small as 5 m were measured from enlarged Lunar Orbiter framelets According to the results of the reported analysis, the different crater distribution types appear to be most consistent with the hypotheses of differential degradation and a superposed crater population Differential degradation can account for the low level of equilibrium in incompetent materials such as ejecta deposits, mantle deposits, and deep regoliths where scaling law changes and catastrophic processes introduce contradictions with other observations.

G R

A78-41796 *   Influence of temperature and the role of chromium on the kinetics of sulfidation of 310 stainless steel D. B Rao (NASA, Ames Research Center, Materials and Physical Sciences Research Branch, Moffett Field, California, University, Lawrence Radiation Laboratory, Berkeley, Calif) and H G Nelson (NASA, Ames Research Center, Materials and Physical Sciences Research Branch, Moffett Field, Calif). *Oxidation of Metals,* vol 12, Apr 1978, p. 111-138 14 refs ERDA-NASA-sponsored research

A78-41826 * ↳   An implicit algorithm for the conservative transonic full potential equation using an arbitrary mesh T L Holst (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1113* 13 p 19 refs

A new, implicit approximate factorization (AF) algorithm designed to solve the conservative full-potential equation for the transonic flow past arbitrary airfoils has been developed The new algorithm uses an upwind bias of the density coefficient to provide stability in supersonic regions This allows the simple two- and three-banded matrix form of the AF scheme to be retained over the entire flow field, even in regions of supersonic flow A numerical transformation is used to establish an arbitrary body-fitted finite-difference mesh Airfoil pressure distributions have been computed and are in good agreement with independent results.   (Author)

A78-41839 * ⁓   Computation of the viscous supersonic flow over symmetrical and asymmetrical external axial corners P. Kutler (NASA, Ames Research Center, Computational Fluid Dynamics Branch, Moffett Field, Calif), T H. Pulliam, and Y. C. Vigneron (NASA, Ames Research Center, Moffett Field, Calif., Iowa State University of Science and Technology, Ames, Iowa) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1135* 10 p. 10 refs Research supported by the Iowa State University of Science and Technology and NASA.

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

A78-41841 * ⌗   Calculation of supersonic viscous flow over delta wings with sharp subsonic leading edges Y C Vigneron, J. C Tannehill (NASA, Ames Research Center, Moffett Field, Calif., Iowa State University of Science and Technology, Ames, Iowa), and J V. Rakich (NASA, Ames Research Center, Moffett Field, Calif.) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1137* 20 p 32 refs Research supported by the Iowa

State University of Science and Technology; Grant No. NGR-16-002-038

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

A78-41859 * ·   An evaluation of several compressible turbulent boundary-layer models - Effects of pressure gradient and Reynolds number C C Horstman, M I Kussoy, and M. J. Lanfranco (NASA, Ames Research Center, Moffett Field, Calif). *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1160.* 11 p. 12 refs

Computations, employing several turbulence models, are compared with a series of attached supersonic turbulent boundary-layer experiments over an extensive range of Reynolds numbers (11.7 x 10 to the 6th to 314 x 10 to the 6th). These experiments included measurements of surface pressure and skin friction for adverse pressure gradients ranging in magnitude from those of previous investigations to an order of magnitude greater. The turbulence models evaluated include algebraic and two-equation eddy-viscosity models and two full Reynolds stress models In general all the models tested performed well independently of the magnitude of the pressure gradient or Reynolds number and could predict the measured skin friction for most cases with sufficient accuracy for engineering purposes.   (Author)

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A78-41863 * „   Comparison of multiequation turbulence models for several shock-separated boundary-layer interaction flows. J R Viegas and C C Horstman (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1165* 21 p 27 refs

Several multiequation eddy viscosity models of turbulence are used with the Navier-Stokes equations to compute three classes of experimentally documented shock-separated turbulent boundary-layer flows The types of flow studied are (1) a normal shock at transonic speeds in both a circular duct and a two-dimensional channel; (2) an incident oblique shock at supersonic speeds on a flat surface, and (3) a two-dimensional compression corner at supersonic speeds. Established zero-equation (algebraic), one-equation (kinetic energy), and two equation (kinetic energy plus length scale) turbulence models are each utilized to describe the Reynolds shear stress for the three classes of flows These models are assessed by comparing the calculated values of skin friction, wall pressure distribution, velocity, Mach number, and turbulent kinetic energy profiles with experimental measurements Of the models tested the two-equation model results gave the best overall agreement with the data   (Author)

A78-41865 * ⌗   A detailed study of attached and separated compression corner flowfields in high Reynolds number supersonic flow G S. Settles, T J. Fitzpatrick, and S M. Bogdonoff (Princeton University, Princeton, N.J.). *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash, July 10-12, 1978, Paper 78-1167* 10 p. 21 refs. Contract No. F44620-75-C-0080, Grant No NSG-2114.

An experimental study has been carried out to detail the interaction of a compressible turbulent boundary layer with shock waves of varying strengths. The interaction was produced by two-dimensional compression corners of 8, 16, 20, and 24 deg angles The incoming boundary layer had an edge Mach number of 2.85 and

a Reynolds number of 1.7 million based on overall thickness. Detailed mean-flow and surface measurements are presented for the four corner angles. The 8 deg corner flow was found to be fully attached, while the 16 deg case was near incipient separation Both the 20 deg and 24 deg corners produced significant flow separation regions. In the discussion of these results, emphasis is placed on the development of flowfield properties from attached to separated conditions. Comparisons made with a computational solution of the Navier-Stokes-equations-show good-agreement-when the corner flow is not separated (Author)

A78-41866 * # Injection slot location for boundary-layer control in shock-induced separation. P. R. Viswanath (NASA, Ames Research Center, Moffett Field, Calif), L. Sankaran (Hindustan Aeronautics, Ltd., Bangalore, India), P. M. Sagdeo, R. Narasimha, and A Prabhu (Indian Institute of Science, Bangalore, India) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1168.* 10 p 15 refs.

An experimental investigation of the effect of tangential air injection, when the injection slot is located inside of what would otherwise have been the dead air zone in a separated flow, in controlling shock-induced turbulent boundary layer separation is presented. The experiments were carried out at a free-stream Mach number of 2 5 in the separated flow induced by a compression corner with a 20 deg angle. The observations made were wall static pressures, pitot profiles, and schlieren visualizations of the flow. The results show that the present location for injection is more effective in suppressing boundary-layer separation than the more conventional one, where the slot is located upstream of where separation would occur in the absence of injection (Author)

A78-41875 * # Computation of transonic flow past projectiles at angle of attack. R P. Reklis, W B. Sturek (U S Army, Ballistics Research Laboratory, Aberdeen Proving Ground, Md), and F R Bailey (NASA, Ames Research Center, Moffett Field, Calif). *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1182.* 9 p 11 refs.

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

A78-42460 * Primitive atmosphere and implications for the formation of channels on Mars. Y. L. Yung (California Institute of Technology, Pasadena, Calif) and J P Pinto (NASA, Goddard Institute for Space Studies, New York, N.Y.) *Nature,* vol. 273, June 29, 1978, p 730-732. 23 refs. Grants No. NsG-2283; No. NsG-5163

It is suggested that, if primitive Mars had a reducing atmosphere composed mainly of methane, this atmosphere could be polymerized by solar ultraviolet radiation to produce higher hydrocarbons These compounds, which would be low-viscosity liquids at present temperatures on Mars, could have contributed to the formation of channels. The Martian atmosphere model used in the analysis is similar to Sagan's (1977), except that ammonia is omitted. Major reactions in this early Martian atmosphere are examined, and the number densities of the lighter alkanes in the lower atmosphere of Mars are determined. Since the photochemical mechanism investigated here would provide only a modest amount of fluid for a comparatively

brief period of time (10-100 million years), liquid alkanes would not be the major factor in the formation of the channels, although their derivatives could contribute to the greenhouse effect or depress the freezing point of water M.L.

A78-42818 * Computational study of a molecular collision process- in the presence of an, intense radiation field - Enhanced quenching of F by Xe in the 248-nm light of the KrF laser P L. DeVries, M S Mahlab, and T F. George (Rochester, University, Rochester, N Y) *Physical Review A - General Physics, 3rd Series,* vol. 17, Feb 1978, p. 546 550. 36 refs NSF Grant No CHE-75-06775-A01, Grant No NsG-2198; Contracts No. F44620-74-C-0073; No F49620-78-C-0005.

A78-43384 * Controlled vapor growth of small particles of Pd and Fe on thin Al2O3 substrates. H Poppa, E. H. Lee, and R D. Moorhead (NASA, Ames Research Center, Institute for Surface and Microstructural Research, Moffett Field, Calif.). *(American Vacuum Society and Institute of Electrical and Electronics Engineers, Symposium on Electron, Ion, and Photon Beam Technology, 14th, Palo Alto, Calif., May 25-27, 1977.) Journal of Vacuum Science and Technology,* vol. 15, May-June 1978, p. 1100-1104. 10 refs.

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

A78-44033 * Application of high explosion cratering data to planetary problems. V. R. Oberbeck (NASA, Ames Research Center, Moffett Field, Calif) In Impact and explosion cratering Planetary and terrestrial implications; Proceedings of the Symposium on Planetary Cratering Mechanics, Flagstaff, Ariz, September 13-17, 1976. (A78-44030 19-91) New York, Pergamon Press, Inc., 1977, p 45-65. 33 refs

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

A78-44108 * Hydrogen attack - Influence of hydrogen sulfide. D. Eliezer and H. G. Nelson (NASA Ames Research Center, Moffett Field, Calif.). *National Association of Corrosion Engineers, International Corrosion Forum Devoted Exclusively to the Protection and Performance of Materials, Houston, Tex., Mar. 6-10, 1978, Paper.* 9 p. 9 refs.

An experimental study is conducted on 12.5-mm-thick SAE 1020 steel (plain carbon steel) plate to assess hydrogen attack at room temperature after specimen exposure at 525 C to hydrogen and a blend of hydrogen sulfide and hydrogen at a pressure of 3.5 MN/sq m for exposure times up to 240 hr. The results are discussed in terms of tensile properties, fissure formation, and surface scales. It is shown that hydrogen attack from a high-purity hydrogen environment is severe, with the formation of numerous methane fissures and bubbles along with a significant reduction in the room-temperature tensile

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yield and ultimate strengths. However, no hydrogen attack is observed in the hydrogen/hydrogen sulfide blend environment, i.e. no fissure or bubble formation occurred and the room-temperature tensile properties remained unchanged. It is suggested that the observed porous discontinuous scale of FeS acts as a barrier to hydrogen entry, thus reducing its effective equilibrium solubility in the iron lattice. Therefore, hydrogen attack should not occur in pressure-vessel steels used in many coal gasification processes.   S.D.

A78-44773 *   The ionosphere and airglow of Venus - Prospects for Pioneer Venus. T E Cravens, A F Nagy (Michigan, University, Ann Arbor, Mich), R. H Chen, and A. I. Stewart (Colorado, University, Boulder, Colo.) *Geophysical Research Letters,* vol. 5, July 1978, p. 613 616 34 refs Grant No. NGR-23-005 015; Contracts No. NAS2-9130; No. NAS2-9477
    The paper presents model calculations for the Cytherean nighttime and daytime ionosphere. It is shown how some of the proposed mechanisms can be tested with the aid of the Pioneer Venus observations scheduled for December 1978. Theoretical calculations of the energetics of the Cytherean ionosphere are performed, and it is concluded that the Project Venus measurements will find elevated ion and electron temperatures, resulting primarily from energy fluxes associated in some manner with the solar wind. According to this model, the energy flux will act directly on the ion gas Ultraviolet dayglow intensities were calculated, and it is anticipated that hundreds of kR's of CO2-related emission features such as the CO Cameron bands will be observed Nightside ionosphere calculations were made assuming the precipitation of energetic electrons as an ionization source, and the intensities of some of the resulting emission features are calculated.   M L

A78-44775 *   Correction to 'Recirculation of energetic particles in Jupiter's magnetosphere'. D D Sentman, J A Van Allen, and C. K. Goertz (Iowa, University, Iowa City, Iowa) *Geophysical Research Letters,* vol 5, July 1978, p 621, 622. 6 refs Navy-supported research, Contract No. NAS2-6553
    An error in Pioneer 11 data reduction software has, when present, caused a phase shift of 180 deg in the assignment of spacecraft roll angles. The corrected analysis of the pitch angle distributions of energetic particles in Jupiter's magnetosphere reveals significant proton anisotropies directed toward the planet in the southern hemisphere, contrary to the authors' (1975) original report. In the northern hemisphere, both proton and electron anisotropies are directed away from the planet, as reported previously The revised data show that the claim of direct evidence for the hypothesis of recirculation of energetic particles in the Jovian magnetosphere is invalid. It is suggested that indirect evidence still supports the hypothesis, although the recirculation process must be weaker than originally envisioned and obscured by other processes   M.L.

A78-45126 *   A view toward future fluid dynamics computing. F R Bailey (NASA, Ames Research Center, Moffett Field, Calif) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1112* 11 p 10 refs
    Advances in computational fluid dynamics are paced by simulation methodology and computer resources Examples of three-dimensional fluid dynamic simulations are presented to illustrate recent developments in equation modeling and numerical methods and to point out the need for increased computer power Electronic technology dictates that to fill this need, computers will be based on parallel processing principles. The identification of parallelism in three dimensions is illustrated by examining an implicit, approximate-factorization approach to the Navier-Stokes equations. Finally, two computer concepts aimed at satisfying the demands of the three dimensional Reynolds averaged Navier-Stokes simulations are discussed.   (Author)

A78-45127 *   A new method for designing shock-free transonic configurations. H. Sobieczky, N J Yu, K.-Y. Fung, and A R. Seebass (Arizona, University, Tucson, Ariz) *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1114* 35 p. 21 refs. Grants No. AF-AFOSR-76-2954E, No NsG-2112, Contract No N00014-76-C-0182.
    A new method for the design of shock-free supercritical airfoils, wings, and three-dimensional configurations is described. Results illustrating this procedure in two and three dimensions are given. They include modifications to part of the upper surface of an NACA 64A410 airfoil that will maintain shock-free flow over a range of Mach numbers for a fixed lift coefficient, and the modifications required on part of the upper surface of a swept wing with an NACA 64A410 root section to achieve shock-free flow. While the results are given for inviscid flow, the same procedures can be employed iteratively with a boundary layer calculation in order to achieve shock-free viscous designs. With a shock-free pressure field the boundary layer calculation will be reliable and not complicated by the difficulties of shock-wave boundary-layer interaction.   (Author)

A78-45139 *   Computation of supersonic laminar viscous flow past a pointed cone at angle of attack in spinning and coning motion. R Agarwal and J V Rakich (NASA, Ames Research Center, Moffett Field, Calif). *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash , July 10-12, 1978, Paper 78-1211* 12 p. 8 refs.
    Computational results obtained with a parabolic Navier-Stokes marching code are presented for supersonic viscous flow past a pointed cone at angle of attack undergoing a combined spinning and coning motion. The code takes into account the asymmetries in the flow field resulting from the motion and computes the asymmetric shock shape, crossflow and streamwise shear, heat transfer, crossflow separation and vortex structure. The side force and moment are also computed Reasonably good agreement is obtained with the side force measurements of Schiff and Tobak Comparison is also made with the only available numerical inviscid analysis It is found that the asymmetric pressure loads due to coning motion are much larger than all other viscous forces due to spin and coning, making viscous forces negligible in the combined motion   (Author)   **S**

A78-45144 *   Numerical solution of two-dimensional turbulent blunt body flows with an impinging shock. J. C Tannehill, Y C. Vigneron (Iowa State University of Science and Technology, Ames, Iowa), and J. V. Rakich (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Fluid and Plasma Dynamics Conference, 11th, Seattle, Wash., July 10-12, 1978, Paper 78-1209* 16 p 20 refs Grant No. NGR-16-002-038.
    An implicit finite-difference method has been developed to compute two-dimensional, turbulent, blunt body flows with an impinging shock wave. The full time-averaged Navier-Stokes equations are solved with algebraic eddy viscosity and turbulent Prandtl number models employed for shear stress and heat flux. The irregular-shaped bow shock is treated as a discontinuity across which the Rankine-Hugoniot equations are applied. A Type III turbulent shock interference flow field has been computed and the numerical results compare favorably with existing experimental data. In addition, comparisons are made between the present implicit code and a previous explicit code   (Author)

A78-45188 *   Whistler mode noise in Jupiter's inner magnetosphere. D D Sentman and C. K. Goertz (Iowa, University, Iowa City, Iowa). *Journal of Geophysical Research,* vol 83, July 1, 1978, p. 3151-3165 50 refs NSF Grant No ATM-76-82739; Contract No. NAS2-6553
    A study is made of the amplitude and spectral extent of whistler mode noise in the inner magnetosphere of Jupiter. It is found that the 'hat-shaped' pitch angle distributions of energetic electrons (21 and 31 MeV at L=3) are consistent with those predicted in the presence of a band-limited spectrum of whistler mode noise The equatorial maximum linear growth rate of parallel propagating whistlers are consistent with those necessary to limit the energetic electron intensities by the whistler mode instability. It is noted that

the wave phase speeds before wave reflection can occur at high latitudes and that wave growth is limited to a disk-like region centered around the magnetic equator. The frequency extent of the whistler mode noise spectrum may be estimated by the range of frequencies maximally unstable to equatorial linear growth A value is found for the spectral density of the broadband whistler mode noise necessary to balance radial diffusion of energetic electrons above the critical range, and an expression is derived for the energetic electron system response to fluctuations about the limiting flux value   S C S

A78-45475 *   The relative fire resistance of select thermoplastic materials D. A. Kourtides and J. A. Parker (NASA, Ames Research Center, Moffett Field, Calif). *Plastic Design and Processing,* Apr 1978 11 p 11 refs

The relative thermal stability, flammability, and related thermochemical properties of some thermoplastic materials currently used in aircraft interiors as well as of some candidate thermoplastics were investigated Currently used materials that were evaluated include acrylonitrile butadiene styrene, bisphenol A polycarbonate, polyphenylene oxide, and polyvinyl fluoride Candidate thermoplastic materials evaluated include: 9,9-bis(4-hydroxyphenyl)fluorene polycarbonate-poly(dimethylsiloxane) block polymer, chlorinated polyvinylchloride homopolymer, phenolphthalein polycarbonate, polyethersulfone, polyphenylene sulfide, polyarylsulfone, and polyvinylidene fluoride   M.L

A78-45963 *   Semirigorous bounds for the dipole moments and transition moments of the LiH molecule S R. Langhoff and D P Chong (NASA, Ames Research Center, Moffett Field, Calif.). *Journal of Chemical Physics,* vol 69, July 1, 1978, p. 194-199 42 refs

Semirigorous error limits for the dipole moments and transition moments of LiH at R = 3.015 bohr are reported. Weinhold's formula for the upper and lower bounds to transition moments is extended to include transitions between states of the same symmetry, and Chong's (1976) semirigorous expression for the lower bound to the overlap between the approximate and the true wavefunctions is applied to the calculation. The semirigorous theory of Chong was also generalized in the sense that the zeroth-order wavefunction was allowed to contain many configuration state functions instead of just the Hartree-Fock or first natural configuration state function   M L.

A78-46360 *   The numerical solution of viscous flows at high Reynolds number. R W MacCormack (NASA, Ames Research Center, Computational Fluid Dynamics Branch, Moffett Field, Calif) In Heat Transfer and Fluid Mechanics Institute, Meeting, 26th, Pullman, Wash., June 26-28, 1978, Proceedings (A78-46351 20-34) Stanford, Calif., Stanford University Press, 1978, p 218-221. 16 refs.

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

A78-46557 * #   Entry dynamics performance predictions for Pioneer Venus probes. R D McCloy (General Electric Co , Re-Entry and Environmental Systems Div , Philadelphia, Pa.) In Atmospheric Flight Mechanics Conference, Palo Alto, Calif., August 7-9, 1978, Technical Papers (A78-46526 20 08) New York, American Institute of Aeronautics and Astronautics, Inc , 1978, p. 285-293. 8 refs Contract No. NAS2-8300 (AIAA 78-1370)

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

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

A78-47273 *   A short history of Pulkovo Observatory. K. Krisciunas (NASA, Ames Research Center, Moffett Field, Calif). *Vistas in Astronomy,* vol. 22, pt 1, 1978, p 27-37 9 refs.

A78-48112 *   The radii of Uranian rings alpha, beta, gamma, delta, epsilon, eta, 4, 5, and 6 from their occultations of SAO 158687. J. L. Elliot, E. Dunham (Cornell University, Ithaca, N Y), L H Wasserman, R. L. Millis (Lowell Observatory, Flagstaff, Ariz), and J. Churms (South African Astronomical Observatory, Observatory, Republic of South Africa). *Astronomical Journal,* vol 83, Aug 1978, p. 980-992. 30 refs. NSF Grant No. AST-76-14832, Grants No. NsG-2174, No NGR-03-003-001

All available timing data for the occultations of SAO 158687 on March 10, 1977, by the cited rings of Uranus are analyzed Least-squares fits to the data are performed using a model which postulates that rings alpha, beta, gamma, and delta are circular and coplanar A solution obtained under the assumption that the ring plane coincides with the plane of the satellite orbits is adopted which yields radii of 44,844 km for ring alpha, 45,799 km for ring beta, 47,746 km for ring gamma, and 48,423 km for ring delta. The uncertainties in these values are discussed along with the apparent shapes and inclinations of these main rings The mean radii estimated for the other rings are 47,323 km for ring eta, 42,663 km for ring 4, 42,360 km for ring 5, and 41,980 km for ring 6   F.G M.

A78-48281 *   The spiral field inhibition of thermal conduction in two-fluid solar wind models. S. Nerney and A Barnes (NASA, Ames Research Center, Space Sciences Div , Moffett Field, Calif) *Journal of Geophysical Research,* vol. 83, Aug 1, 1978, p. 3729-3739 28 refs

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

A78-48425 *   Intensities, self-broadening, and broadening by Ar and N2 for the 301/III/ - 000 band of CO2 measured at different temperatures. C B Suarez and F P. J Valero (NASA, Ames Research Center, Moffett Field, Calif) *Journal of Molecular Spectroscopy,* vol 71, June 15, 1978, p. 46 63. 32 refs.

A78-48835 *   Experimental temperature distribution and heat load characteristics of rotating heat pipes. T. C Daniels (Swansea, University College, Swansea, Wales) and R J Williams (NASA, Ames Research Center, Moffett Field, Calif.). *International Journal of Heat and Mass Transfer,* vol 21, Feb. 1978, p 193-201 8 refs.

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

A78-49231 *   Comparison between infrared Martian disk spectra and optical properties of terrestrial analogs. W. G. Egan, T. Hilgeman, and L L Smith (Grumman Aerospace Corp., Bethpage, N.Y.). *Icarus*, vol. 35, Aug 1978, p 209-226. 44 refs Contract No. NAS2-8664.

Medium spectral resolution (20 kaysers) infrared measurements of the Martian disk made between 2900 and 5600 kaysers from the NASA Lear Airborne Observatory have been successfully compared with predictions derived from a model of the Martian soil and atmosphere. Modeling of the Martian atmosphere permitted the extraction of Martian soil reflectance in the CO2 bands centered at 3657 kaysers. Three Martian soil analogs previously considered acceptable - limonite, montmorillonite, and basalt - were analyzed to determine the optical complex indices of refraction in the same range as the airborne observations, for mathematical modeling A characteristic surface particle size approximately 1 to 3 microns diameter is indicated. It is concluded that the Martian soil surface near-infrared optical properties are consistent with a soil composition similar to montmorillonite or limonite, mixed with a basalt. (Author)

A78-49471 *   Evolution of rotating interstellar clouds. III - On the formation of multiple star systems P Bodenheimer (NASA, Ames Research Center, Space Science Div., Moffett Field; Lick Observatory, Santa Cruz, Calif.) *Astrophysical Journal, Part 1,* vol 224, Sept 1, 1978, p 488-496. 60 refs. NSF Grant No. AST-76-17590, Grant No. NCA2-0R660-703.

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

A78-49475 *   Infrared excesses in early-type stars - Gamma Cassiopeiae. J. D. Scargle, E. F. Erickson, F. C. Witteborn, and D. W. Strecker (NASA, Ames Research Center, Space Sciences Div, Moffett Field, Calif.). *Astrophysical Journal, Part 1,* vol 224, Sept. 1, 1978, p. 527-534 39 refs.

Spectrophotometry of the classical Be star Gamma Cas (1-4 microns, with about 2% spectral resolution) is presented. These data, together with existing broad-band observations, are accurately described by simple isothermal LTE models for the IR excess which differ from most previously published work in three ways (1) hydrogenic bound-free emission is included, (2) the attenuation of the star by the shell is included, and (3) no assumption is made that the shell contribution is negligible in some bandpass It is demonstrated that the bulk of the IR excess consists of hydrogenic bound-free and free-free emission from a shell of hot ionized hydrogen gas, although a small thermal component cannot be ruled out. The bound-free emission is strong, and the Balmer, Paschen, and Brackett discontinuities are correctly represented by the shell model with physical parameters as follows a shell temperature of approximately 18,000 K, an optical depth (at 1 micron) of about 0 5, an electron density of approximately 1 trillion per cu cm, and a size of about 2 trillion cm Phantom shells (i.e., ones which do not alter the observed spectrum of the underlying star) are discussed. (Author)

A78-49693 *   Assessment of relative flammability and thermochemical properties of some thermoplastic materials. D. A Kourtides and J. A. Parker (NASA, Ames Research Center, Moffett Field, Calif.). *Polymer Engineering and Science,* vol 18, Aug 1978, p. 855-860. 10 refs

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

A78-50240 * #   Post-Viking models for the structure of the summer atmosphere of Mars A. Seiff (NASA, Ames Research Center, Moffett Field, Calif.) In. The Mars reference atmosphere, Proceedings of the Twenty-first Plenary Meeting, Innsbruck, Austria, May 29-June 10, 1978 (A78-50239 23-91) Pasadena, Calif., California Institute of Technology, Jet Propulsion Laboratory, 1978, p. 1-20 11 refs.

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

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A78-50488 *   Absolute intensity measurements at different temperatures of the C-12/O-16/2 bands 30 0 1 I--00 0 0 and 30 0 1 IV--00 0 0 C B. Suárez and F P. J Valero (NASA, Ames Research Center, Moffett Field, Calif.) *Journal of Quantitative Spectroscopy and Radiative Transfer,* vol. 19, June 1978, p. 569-578 13 refs.

A78-50489 *   Measurement at different temperatures of absolute intensities, line half-widths, and broadening by Ar and N2 for the 30 0 1 II--00 0 0 band of CO2 F. P J Valero (NASA, Ames Research Center, Moffett Field, Calif) and C. B Suárez. *Journal of Quantitative Spectroscopy and Radiative Transfer,* vol 19, June 1978, p. 579-590. 30 refs.

Vibration-rotation line intensities, self-broadening coefficients, and foreign-gas-broadening (Ar and N2) coefficients were measured at 197, 233, and 294 K for the 30 0 1 II--00 0 0 band of CO2 at 6348/cm. Values for the total band intensity, purely vibrational transition moment, and vibration-rotation interaction factor were deduced from the measurements P T.H

A78-50909 *   The general solution to the classical problem of the finite Euler-Bernoulli beam. M. Y Hussaini (NASA, Ames Research Center, Moffett Field, Calif) and C. L Amba-Rao (NASA, Ames Research Center, Moffett Field, Calif., Indian Space Research Organization, Vikram Sarabhai Space Centre, Trivandrum, India). *Zeitschrift für angewandte Mathematik und Physik,* vol 29, July 25, 1978, p. 704-710 8 refs

An analytical solution is obtained for the problem of free and forced vibrations of a finite Euler-Bernoulli beam with arbitrary (partially fixed) boundary conditions. The effects of linear viscous

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

A78-51067-* A cesium plasma TELEC device for conversion of laser radiation to electric power. E. J. Britt, N. S Rasor (Rasor Associates, Inc., Sunnyvale, Calif.), G. Lee, and K. W. Billman (NASA, Ames Research Center, Moffett Field, Calif.) *Applied Physics Letters*, vol. 33, Sept. 1, 1978, p. 384-386 11 refs. Contract No. NAS2-9109.

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

A78-51811 * Nitric oxide production by Tunguska meteor. C Park (NASA, Ames Research Center, Moffett Field, Calif.) *Acta Astronautica*, vol. 5, July-Aug. 1978, p. 523-542. 40 refs

The nonequilibrium chemical processes of nitric oxide formation are computed for the wake of the Tunguska meteor of 1908 The wake characteristics are derived by carrying out an optically-thick radiation field analysis for ablation of the meteoroid The wake flow field is approximated by a one-dimensional, well-stirred reactor model. Known characteristics of the Tunguska event are imposed as constraints, and three controlling parameters - chemical composition, density, and velocity - are varied over a range around the values derived by Korobeinikov et al. (1976) and Petrov and Stulov (1975). The calculation shows that at least 19 million tons of nitric oxide is produced between the altitudes of 10 and 50 km. The anomalous atmospheric phenomena following the event are attributed to the reactions involving nitric oxide thus produced and atmospheric ozone. It is speculated that the nitric oxide produced by the event fertilized the area near the fall, causing the observed rapid plant growth. (Author)

A78-51838 * Fire resistivity and toxicity studies of candidate aircraft passenger seat materials. L L. Fewell (NASA, Ames Research Center, Moffett Field, Calif.), E L. Trabold, and H H. Spieth (Douglas Aircraft Co., Long Beach, Calif.). *Journal of Fire and Flammability*, vol. 9, July 1978, p 377-402 8 refs.

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

A78-51870 * Thermal rearrangements in 1,2-poly/1,4-hexadiene/s. M A Golub (NASA, Ames Research Center, Moffett Field, Calif.). *Journal of Polymer Science, Part B - Polymer Letters*, vol 16, 1978, p. 253-260. 6 refs.

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

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

A78-52137 * # Transport of contaminants in the planetary boundary layer. I Y Lee and P. R. Swan (NASA, Ames Research Center, Theoretical and Planetary Studies Branch, Moffett Field, Calif.) In Joint Conference on Applications of Air Pollution Meteorology, Salt Lake City, Utah, November 29-December 2, 1977, Preprints. (A78-52079 24-45) Boston, Mass., American Meteorological Society, 1978, p. 392-399. 10 refs

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

A78-52388 * Comments on the note by Ariè et al. on the transition moment of the CO2 band near 7740 kaysers. F P. J Valero and R. W. Boese (NASA, Ames Research Center, Moffett Field, Calif). *Journal of Quantitative Spectroscopy and Radiative Transfer*, vol 20, Oct 1978, p 427.

A78-52482 * Europa - Ultraviolet emissions and the possibility of atomic oxygen and hydrogen clouds. F -M Wu, D. L Judge, and R. W. Carlson (Southern California, University, Los Angeles, Calif.). *Astrophysical Journal, Part 1*, vol 225, Oct 1, 1978, p 325-334. 39 refs Contract No NAS2-6558

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

A78-52504 * # The radial dependences of the interplanetary magnetic field between 1 and 5 AU - Pioneer 10. R. L Rosenberg, M G. Kivelson, P. J. Coleman, Jr. (California, University, Los Angeles, Calif), and E J Smith (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) *Journal of Geophysical Research*, vol 83, Sept 1, 1978, p 4165-4176 46 refs. Contract No. NAS2-7251; Grants No NsG-7276; No. NsG-7295.

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

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the tangential component of the field, and the characteristics of a, subset corresponding to a relatively low average solar wind velocity are reported. M.L.

·A78-52522 * Dynamic MHD modeling of solar wind corotating stream interaction regions observed by Pioneer 10 and 11. M. Dryer, Z. K. Smith (NOAA, Space Environment Laboratory, Boulder, Colo.), E. J. Smith (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), J D. Mihalov, J. H. Wolfe (NASA, Ames Research Center, Moffett Field, Calif.), R. S. Steinolfson, and S. T. Wu (Alabama, University, Huntsville, Ala.). *Journal of Geophysical Research,* vol. 83, Sept. 1, 1978, p. 4347-4352. 23 refs. Contract No. NAS7-100.

The use of the Pioneer 10 and 11 projects to test an MHD one-dimensional time-dependent model of corotating solar wind streams during the period from Sept. 30 to Nov. 25, 1973 is ·described. During this period, five or six corotating interaction regions streamed past the two spacecraft, and, as a result of multiple-spacecraft radial alignment and temporally varying conditions at the solar wind source, the pattern predicted by the Steinolfson et al. (1975) model could be compared with observations. The results, in general, support the validity of the model, although the neglect of thermal energy exchange leads to incorrect .values for the proton temperature. A detailed analysis of a stream is discussed. M.L.

A78-52547 * Arrhenius' law in turbulent media and an equivalent tunnel effect. S. Tsuge (NASA, Ames Research Center, Moffett Field, Nielsen Engineering and Research, Inc., Mountain View, Calif.) and K. Sagara (Tokyo, University, Tokyo, Japan) *Combustion Science and Technology,* vol. 18, no. 5-6, 1978, p. 179-189. 21 refs Contract No. NAS2-9535.

The indeterminacy inherent to the formal extension of Arrhenius' law to reactions in turbulent flows is shown to be surmountable in the case of a binary exchange reaction with a sufficiently high activation energy. A preliminary calculation predicts that the turbulent reaction rate is invariant in the Arrhenius form except for an equivalently lowered activation energy. This is a reflection of turbulence-augmented molecular vigor, and causes an appreciable increase in the reaction rate. A similarity to the tunnel effect in quantum mechanics is indicated. The anomaly associated with the mild ignition of oxy-hydrogen mixtures is discussed in this light. (Author)

A78-53674 * Fire detector response in aircraft applications. S J Wiersma and R G. McKee (SRI International, Menlo Park, Calif.) *Aviation Engineering and Maintenance,* vol. 2, Aug -Sept. 1978, p 12, 13, 18 Contract No. NAS2-8583.

Photoelectric, ionization, and gas sensors were used to detect the signatures from the radiant heat or flame of various aircraft materials. It was found that both ionization and' photoelectric detectors are about equally capable of detecting products of pyrolysis and combustion of synthetic polymers, especially those containing fire-retardant additives Ionization detectors alone appeared to be sensitive to combustion products of simple cellulosic materials A gas sensor detector appeared to be insensitive to pyrolysis or combustion products of many of the materials. P T.H

PATENTS

N78-22154*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SYNTHESIS OF MULTIFUNCTION TRIARYLTRIFLUORO-ETHANES Patent Application
William P. Kray (Talladega Coll, Ala.) and Robert·W Rosser, inventors (to NASA) (Talladega, Coll, Ala.) Filed 30 Mar. 1978
17 p Sponsored by NASA
(NASA-Case-ARC-11097-1; US-Patent-Appl-SN-891872) Avail
NTIS HC A02/MF A01 CSCL 07C

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

N78-22155*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
SYNTHESIS OF MULTIFUNCTION TRIARYLTRIFLUORO-ETHANES Patent Application
William P Kray (Talladega Coll., Ala) and Robert W. Rosser, inventors (to NASA) (Talladega Coll, Ala) Filed 30 Mar. 1978
10 p Sponsored by NASA
(NASA-Case-ARC-11097-2; US-Patent-Appl-SN-891875) Avail:
NTIS HC A02/MF A01 CSCL 07C

The 1,1,1-triaryl 2,2,2-trifluoro ethanes, in which the aryl radicals have nitrogen containing substituents such as the amino, nitrile, and acetamido groups, were prepared by the acid catalyzed. condensation of trifluoro acetophenones with aromatic substrates containing amino groups. The amino groups may then be converted to nitriles, acetamides, and other derivatives by standard procedures The products obtained may be used as monomers or as crosslinking agents in polymer formation. NASA

N78-22156*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
CATALYSTS FOR IMIDE FORMATION FROM AROMATIC ISOCYANATES AND AROMATIC DIANHYDRIDES Patent Application
Salvatore Riccitiello, Paul M. Sawko, and Carlos A Estrella, inventors (to NASA) Filed 24 Feb. 1978 16 p
(NASA-Case-ARC-11107-1; US-Patent-Appl-SN-883961) Avail:
NTIS HC A02/MF A01 CSCL 07C

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

N78-27180* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
INTUMESCENT-ABLATOR COATINGS USING ENDOTHER-MIC FILLERS Patent
Paul M Sawko and Salvatore R Riccitiello, inventors (to NASA) Issued 9 May 1978 11 p Filed 23 Dec 1976 Supersedes N77-14372 (15 - 05, p 0609)
(NASA-Case-ARC-11043-1; US-Patent-4,088,806;
US-Patent-Appl-SN-753964, US-Patent-Class-428-332,
US-Patent-Class-260-33.6EP, US-Patent-Class-260-33 6PQ,
US-Patent-Class-260-33 8EP, US-Patent-Class-260-33.8UA;
US-Patent-Class-260-37EP; US-Patent-Class-260-42 43,
US-Patent-Class-260-45.7R; US-Patent-Class-260-45 75W,
US-Patent-Class-260-45.85N; US-Patent-Class-260-45 9R;
US-Patent-Class-427-386; US-Patent-Class-427-388A,
US-Patent-Class-428-313; US-Patent-Class-428-921) Avail US Patent Office CSCL 11D

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

Official Gazette,of the U S Patent Office

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N78-27184*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
LOW DENSITY BISMALEIMIDE-CARBON MICROBALLOON COMPOSITES Patent Application
Demetrius A. Kourtides and John A Parker, inventors (to NASA) Filed 30 Jun 1978 25 p
(NASA-Case-ARC-11040-2; US-Patent-Appl-SN-920878) Avail: NTIS HC A02/MF A01 CSCL 11D

A process is described for constructing for a composite laminate structure which exhibits a high resistance to heat and flame provides safer interior structures for aircraft and submarine compartments Composite laminate structures are prepared by the bismaleimide resin preimpregnation of a fiberglass cloth to form a face sheet which is bonded with a bismaleimide hot melt adhesive to a porous core structure selected from the group consisting of polyamide paper and bismaleimide-glass fabric which is filled with carbon microballoons The carbon microballoons are prepared by pyrolyzing phenolic micro-balloons in the presence of nitrogen A slurry of the carbon microballoons is prepared to fill the porous core structure The porous core structure and face sheet are bonded to provide panel structures exhibiting increased mechanical capacities and lower oxygen limit values' and smoke density values   NASA

N78-28178*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
STRUCTURAL WOOD PANELS WITH IMPROVED FIRE RESISTANCE Patent Application
Paul M Sawko, inventor (to NASA) Filed 28 Jul 1978 13 p
(NASA-Case-ARC-11174-1; US-Patent-Appl-SN-929086) Avail NTIS HC A02/MF A01 CSCL 11D

Wood paneling or other molded wood compositions are prepared from lignocellulosic particles such as finely divided wood chips, flour, or strands, by bonding such particles with 10 to 33% by weight of a modified novolac resin The resin prepolymer and a hardening agent such as hexamethylene tetramine are sprayed onto the particles and the mix is hot pressed to form the panel or other article and cure the prepolymer to form the resin The prepolymer is formed from an alkaryl ether or halide, e g , 1,4-dimethoxy-methylbenzene, and a phenol. By using the modified resins, panels are formed that have a burn-through time of about 450 seconds as opposed to about 280 seconds, when tested under the same condition. The incorporation of certain inorganic fillers into the prepolymer will decrease the flame spread index of panels in which this is done, from less than 200 to 60 or 70. The preferred fillers are ammonium phosphate or a mixture of that with ammonium oxalate Such panels, meet Class 2 standards of the Unified Building Code.
                    NASA

N78-31232* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
POLYMERIC FOAMS FROM CROSS-LINKABLE POLY-N-ARYLENEBENZIMIDAZOLES Patent
Edward S. Harrison (Whittaker Corp , San Diego), Chadwick B Delano (Whittaker Corp , San Diego), and Salvatore R. Riccitello, inventors (to NASA) (Whittaker Corp , San Diego) Issued 30 May 1978 10 p Filed 26 Jul 1976 Supersedes N76-28421 (14 19 p 2447) Sponsored by NASA
(NASA-Case-ARC-11008-1, US-Patent-4,092,274; US-Patent-Appl-SN-708951, US-Patent-Class-260-2 5N, US-Patent-Class-260-47CP, US-Patent-Class-260-63N; US-Patent-Class-260-78 41) Avail US Patent Office CSCL 07D

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

N78-32189*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
FIBROUS REFRACTORY COMPOSITE INSULATION Patent Application

Daniel B Leiser (Stanford Univ), Howard E Goldstein, and Marnell Smith, inventors (to NASA) Filed 8 Sep. 1978 17 p
(NASA-Case-ARC-11169-1; US-Patent-Appl-SN-940688) Avail · NTIS HC A02/MF A01 CSCL 11D

A high temperature insulating material suitable for reusable reentry heat shielding was prepared from silica fibers and aluminosilicate fibers in a weight ratio ranging from 1·19 to 19:1, and about 0 5% to 30% boron oxide, based on the total fiber-weight. Aluminoborosilicate fibers and additional free boron oxide, up to the 30% limit, may be substituted for the aluminosilicate fibers and boron oxide requirements Small quantities of refractory opacifiers, such as silicon carbide, may be added The composites are characterized by the absence of nonfibrous matrix   ` NASA

N78-32260* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
REACTION CURED GLASS AND GLASS COATINGS Patent
Howard E. Goldstein (Stanford Univ), Daniel B Leiser (Stanford Univ.), and Victor W. Katvala, inventors (to NASA) (Stanford Univ) Issued 6 Jun 1978 8 p Filed 29 Oct 1976 Supersedes N77-10201 (15 - 01, p 0031) Sponsored by NASA
(NASA-Case-ARC-11051-1; US-Patent-4,093,771; US-Patent-Appl-SN-736910, US-Patent-Class-428-312; US-Patent-Class-65-30R, US-Patent-Class-65-60D, US-Patent-Class-106-48, US-Patent-Class-106-54, US-Patent-Class-427-215; US-Patent-Class-427-376A US-Patent-Class-427-376B; US-Patent-Class-427-379, US-Patent-Class-427-380, US-Patent-Class-428-325; US-Patent-Class-428-331, US-Patent-Class-428-341; US-Patent-Class-428-427, US-Patent-Class-428-428, US-Patent-Class-428-446; US-Patent-Class-428-920; US-Patent-Class-428-406) Avail US Patent Office CSCL 11B

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

N78-32434*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
SPRAY COATING APPARATUS HAVING A ROTATABLE WORKPIECE HOLDER Patent Application
Marnell Smith, Victor W Katvala, and Ernest E. Porter, inventors (to NASA) Filed 22 Sep 1978 12 p
(NASA-Case-ARC-11110-1; US-Patent-Appl-SN-945040) Avail. NTIS HC A02/MF A01 CSCL 13H

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

LIFE SCIENCES

FORMAL REPORTS

N78-19444*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
A COMPUTER PROGRAM FOR CALCULATING LAMINAR AND TURBULENT BOUNDARY LAYERS FOR TWO-DIMENSIONAL TIME-DEPENDENT FLOWS
Tuncer Cebeci (Calif State Univ, Long Beach) and Lawrence W Carr Mar 1978 62 p refs
(NASA-TM-78470, A-7340) Avail NTIS HC A04/MF A01 CSCL 20D

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

N78-21019*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
A BIBLIOGRAPHY ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE
Eugene F Mallove (Analytic Sci Corp, Reading, Mass), Mary M Connors, Robert L Forward (Hughes Res Labs, Malibu, Calif), and Zbigniew Paprotny (Orzeszkowej, Poland) Mar. 1978 135 p refs
(NASA-RP-1021) Avail NTIS HC A07/MF A01 CSCL 05B

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

N78-25071*# National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Apr. - 30 Jun. 1977
Apr 1978 62 p Prepared in cooperation with Battelle Columbus Labs Mountain View Calif

(NASA-TM-78476 A-7373 QR-5) Avail NTIS HC A04/MF A01 CSCL 02A

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

N78-26740*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
SPACE ECOSYNTHESIS: AN APPROACH TO THE DESIGN OF CLOSED ECOSYSTEMS FOR USE IN SPACE
R D MacElroy and M M. Averner (California Univ. at Berkeley) Jun 1978 41 p refs
(NASA-TM-78491) Avail NTIS HC A03/MF A01 CSCL 06K

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

N78-26973*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
CRITICAL REVIEW OF AMES LIFE SCIENCE PARTICIPATION IN SPACELAB MISSION DEVELOPMENT TEST 3: THE SMD 3 MANAGEMENT STUDY
Robert Helmreich (Texas Univ., Austin), John Wilhelm (Texas Univ., Austin) Trieve A Tanner, Joan E. Sieber (Calif. State Univ, Hayward), and Susan Burgenbauch Jun 1978 84 p refs
(NASA-TM-78494, A-7471) Avail. NTIS HC A05/MF A01 CSCL 05A

A management study was conducted to specify activities and problems encountered during the development of procedures for documentation and crew training on experiments, as well as during the design, integration and delivery of a life sciences experiment payload to Johnson Space Center for a 7 day simulation of a Spacelab mission Conclusions and recommendations to project management for current and future Ames' life sciences projects are included Broader issues relevant to the conduct of future scientific missions under the constraints imposed by the environment of space are also addressed   A R H

N78-27736*# National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
CV 990 INTERFACE TEST AND PROCEDURE ANALYSIS OF THE MONKEY RESTRAINT, SUPPORT EQUIPMENT, AND TELEMETRY ELECTRONICS PROPOSED FOR SPACELAB
Bernard D Newsom Jun 1978 85 p refs
(NASA-TM-78484, A-7417) Avail NTIS HC A05/MF A01 CSCL 06C

A biological system proposed to restrain a monkey in the Spacelab was tested under operational conditions using typical metabolic and telemetered cardiovascular instrumentation Instrumentation, interfaced with other electronics, and data gathering during a very active operational mission were analyzed for adequacy of procedure and success of data handling by the onboard computer   G G

N78-28979*# National Aeronautics and Space Administration
Ames Research Center. Moffett Field. Calif.
PROJECT PLAN FOR JOINT FAA/NASA HEAD-UP DISPLAY CONCEPT EVALUATION
R F Haines Aug 1978 16 p Sponsored in part by DOT
(NASA-TM-78512; `HUD-1: A-7562) Avail NTIS HC A02/MF A01 CSCL 05A

Head-Up Display (HUD) concept for large commercial turbojet transport aircraft is considered for the its contribution to aviation safety in the form of improved performance during the approach and landing phase flight. The basic reearch areas represent fundamental questions that are still unresolved and which were considered important to the effective use of the HUD by pilots Project documentation and management responsibilities are outlined G G

N78-32075*# National Aeronautics and Space Administration
Ames Research Center. Moffett Field. Calif
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report. 1 Jul. - 30 Sep. 1977
Jul 1978 62 p refs Prepared in cooperation with Battelle Columbus Labs. Mountain View. Calif
(NASA-TM-78511, A-7559. QR-6) Avail NTIS HC A04/MF A01 CSCL 01C

An analytical study of reports relating to cockpit altitude alert systems was performed A recent change in the Federal Air Regulation permits the system to be modified so that the alerting signal approaching altitude has only a visual component, the auditory signal would continue to be heard if a deviation from an assigned altitude occurred Failure to observe altitude alert signals and failure to reset the system were the commonest cause of altitude deviations related to this system Cockpit crew distraction was the most frequent reason for these failures. It was noted by numerous reporters that the presence of altitude alert system made them less aware of altitude- this lack of altitude awareness is discussed Failures of crew coordination were also noted It is suggested that although modification of the altitude alert system may be highly desirable in short-haul aircraft. it may not be desirable for long-haul aircraft in which cockpit workloads are much lower for long periods of time In these cockpits, the aural alert approaching altitudes is perceived as useful and helpful If the systems are to be modified, it appears that additional emphasis on altitude awareness during recurrent training will be necessary. it is also possible that flight crew operating procedures during climb and descent may need examination with respect to monitoring responsibilities. A selection of alert bulletins and responses to them is presented B.B

NASA CONTRACTOR REPORTS

N78-10684*# Pittsburgh Univ. Pa Vestibular Function Research Lab
FURTHER INVESTIGATION OF THE SPONTANEOUS AND EVOKED ACTIVITY OF THE PRIMARY NEURONS OF STATORECEPTORS (AND OTHER RECEPTORS) OF THE LABYRINTH OF THE BULLFROG BEFORE, DURING AND AFTER AN EXTENDED PERIOD OF WEIGHTLESSNESS, INCLUDING ALTERNATIVE INTERVALS OF ARTIFICIAL GRAVITY Final Report, 15 Dec 1976 - 15 Oct. 1977
15 Oct 1977 24 p ref
(Grant NsG-2197)
(NASA-CR-154507) Avail NTIS HC A02/MF A01 CSCL 06C

Vestibular neuron activity was examined by studying nerve stimulation and evoked response A cooling element, applied to the nerve consisted of a silver hook through which a coolant fluid flowed Temperature changes were recorded via microtermistors on an eight channel brush recorder, together with response Diffusion of the cooling effect was measured, recovery time was assessed, and the nerve was then studied hystologically and ultrastructurally. Problems in frog preparation were discussed along with problems in maintaining healthy specimens and bacteria controlled aquaria Author

N78-16620*# SRI International Corp. Menlo Park Calif
STUDY TO DESIGN AND DEVELOP REMOTE MANIPULATOR SYSTEMS Annual Report, 1 Aug 1976 - 30 Nov. 1977
J W Hill and J K Salisbury, Jr Nov 1977 121 p refs
(Contract NAS2-8652; SRI Proj 4055)
(NASA-CR-152092, AR-2) Avail NTIS HC A06/MF A01 CSCL 05H

A description is given of part of a continuing effort both to develop models for and to augment the performance of humans controlling remote manipulators The project plan calls for the performance of several standard tasks with a number of different manipulators controls. and viewing conditions using an automated performance measuring system, in addition. the project plan calls for the development of a force-reflecting joystick and supervisory display system Author

N78-21235*# Life Systems, Inc Cleveland. Ohio
ADVANCED SOLID ELECTROLYTE CELL FOR CO2 AND H2O ELECTROLYSIS Final Report
J W Shumar and T A Berger Mar 1978 52 p refs
(Contract NAS2-7862)
(NASA-CR-152093, ER-190-25) Avail NTIS HC A04/MF A01 CSCL 07D

A solid electrolyte cell with improved sealing characteristics was examined A tube cell was designed, developed fabricated, and tested Design concepts incorporated in the tube cell to improve its sealing capability included minimizing the number of seals per cell and moving seals to lower temperature regions The advanced tube cell design consists of one high temperature ceramic cement seal, one high temperature gasket seal, and three low temperature silicone elastomer seals The two high temperature seals in the tube cell design represent a significant improvement over the ten high temperature precious metal seals required by the electrolyzer drum design For the tube cell design the solid electrolyte was 8 mole percent yttria stabilized zirconium oxide slip cast into the shape of a tube with electrodes applied on the inside and outside surfaces Author

N78-22723*# Life Systems Inc. Cleveland, Ohio
TECHNOLOGY ADVANCEMENT OF THE ELECTROCHEMICAL CO2 CONCENTRATING PROCESS Annual Report
F H Schubert R R Woods, T M Hallick, and D B Heppner Mar 1978 75 p refs
(Contract NAS2-8666)
(NASA-CR-152098, LSI-ER-258-11) Avail NTIS HC A04/MF A01 CSCL 06K

The overall objectives of the present program are to (1) improve the performance of the electrochemical CO2 removal technique by increasing CO2 removal efficiencies at pCO2 levels below 400 Pa, increasing cell power output and broadening the tolerance of electrochemical cells for operation over wide ranges of cabin relative humidity, (2) design, fabricate, and assemble development hardware to continue the evolution of the electrochemical concentrating technique from the existing level to an advanced level able to efficiently meet the CO2 removal needs of a spacecraft air revitalization system (ARS), (3) develop and incorporate into the EDC the components and concepts that allow for the efficient integration of the electrochemical technique with other subsystems to form a spacecraft ARS, (4) combine ARS functions to enable the elimination of subsystem components and interfaces, and (5) demonstrate the integration concepts through actual operation of a functionally integrated ARS Author

N78-23748*# Life Systems. Inc. Cleveland. Ohio
EVALUATION OF A SPACECRAFT NITROGEN GENERATOR Final Report
R D Marshall, M K Lee, and F H Schubert Apr. 1978 51 p refs
(Contract NAS2-8732)
(NASA-CR-152097. ER-251-6) Avail NTIS HC A04/MF A01 CSCL 06K

A research and development program was successfully completed towards the development of a method of generating nitrogen for cabin leakage makeup aboard space vehicles. The

nitrogen generation concept used liquid hydrazine as the stored form of nitrogen. This reduced tankage and expendables weight associated with high pressure gaseous and cryogenic liquid nitrogen storage The hydrazine was catalytically dissociated to yield a mixture of nitrogen and hydrogen. The latter was separated to provide the makeup nitrogen The hydrogen will be used in the reduction of metabolic carbon dioxide   Author

N78-25767*#   Lockheed Missiles and Space Co, Sunnyvale, Calif
AN INVESTIGATION OF THE REDUCTION OF CARBON DIOXIDE IN A SILENT ELECTRIC DISCHARGE   Final Report
Robert S Luce and Barbara Greenough, ed   Jun 1978   63 p refs
(Contract NAS2-9551)
(NASA-CR-152146,   LMSC-D626407)   Avail   NTIS HC A04/MF A01   CSCL 06K
   The reduction of CO2 to O2 and CO in a silent electric discharge was studied It was found that current alone (in the ionized plasma induced by the silent electric discharge) was reponsible for the CO2 reduction process Voltage and frequency were important only in so far as they induced current in the plasma Pressure and temperature were of minimum influence in the process The large power consumption in the process was recognized as resulting from the low power factor of the reactor vessel which electrically behaved like a capacitor The power factor was subsequently improved-by adding an inductive element to make the reactor vessel capacitance part of a resonant circuit It was found that the CO2 reduction process was most efficient in terms of power vs reduction rate when a voltage was employed that was only slightly higher than that needed to induce the plasma   Author

N78-28807*#   Life Systems, Inc, Cleveland, Ohio
ADVANCED INSTRUMENTATION CONCEPTS FOR ENVIRONMENTAL CONTROL SUBSYSTEMS   Final Report, Jul. 1976 - Jun 1978
P Y Yang   F H Schubert, J R Gyorki, and R A Wynveen   Jun 1978   59 p   refs
(Contract NAS2-9251)
(NASA-CR-152100, ER-309-6)   Avail: NTIS   HC A04/MF A01 CSCL 05H
   Design, evaluation and demonstration of advanced instrumentation concepts for improving performance of manned spacecraft environmental control and life support systems were successfully completed Concepts to aid maintenance following fault detection and isolation were defined A computer-guided fault correction instruction program was developed and demonstrated in a packaged unit which also contains the operator/system interface   G.G

N78-29699*#   Systems Technology, Inc   Mountain View, Calif
SIMULATION AND ANALYSIS OF WIND SHEAR HAZARD Final Report, Jun. 1976 - Oct 1977
John M Lehman, Robert K Heffley, and Warren F Clement   Dec 1977   156 p   refs
(Contract NAS2-8889)
(NASA-CR 157470, AD-A052435, STI-TR-1063-3, FAA-RD-78-7)   Avail NTIS   HC A08/MF A01   CSCL 01B
   The results of an unmanned simulation and an analysis of wind shear hazard are presented The study involved the application of mathematical models of four diverse passenger aircraft types ranging from a small STOL commuter aircraft to a jumbo jet and of pilot models appropriate to each flight situation The hazard to each aircraft was evaluated for both approach and takeoff in three severe wind shear profiles The effects of varying operational techniques and propulsion system features were investigated and explained with the aid of a simplified linear analysis No direct correspondence was found between wind shear hazard and aircraft size or type per se Instead, the main factors affecting sensitivity to wind shear were shown to be airspeed, flight path regulation, and airspeed regulation. Also, the shear dependency as modeled in the simulation was found to be important   Author

N78-30808*#   Florida Agricultural and Mechanical Univ, Tallahassee   School of Pharmacy
REGULATION OF THE ADRENAL CORTEX FUNCTION DURING STRESS   Annual Report
Karam F A Soliman   1 Sep 1978   53 p   refs
(Grant NsG-2183)
(NASA-CR-157397)   Avail NTIS   HC A04/MF A01   CSCL 06S
   A proposal to study the function of the adrenal gland in the rat during stress is presented In the proposed project, three different phases of experimentation will be undertaken The first phase includes establishment of the circadian rhythm of both brain amines and glucocoticoids, under normal conditions and under chronic and acute stressful conditions The second phase includes the study of the pharmacokinetics of glucocorticoid binding under normal and stress conditions The third phase includes brain uptake and binding under different experimental conditions In the outlined experiments brain biogenic amines will be evaluated, adrenal functions will be measured and stress effect on those parameters will be studied It is hoped that this investigation can explain some of the complex relationships between the brain neurotransmitter and adrenal function Author

N78-32106*#   Systems Technology, Inc, Mountain View, Calif
COMPUTED RESPONSES OF SEVERAL AIRCRAFT TO ATMOSPHERIC TURBULENCE AND DISCRETE WIND SHEARS   Final Report
Wayne F. Jewell. Robert L. Stapleford, and Robert K Heffley   Feb 1977   79 p   refs
(Contract NAS2-8889)
(NASA-CR-152185,   STI-TR-1063-2)   Avail   NTIS HC A05/MF A01   CSCL 01C
   The computed RMS and peak responses due to atmospheric turbulence and discrete wind shears, respectively, are presented for several aircraft in different flight conditions The responses are presented with and without the effects of a typical second order washout filter. A complete set of dimensional stability derivatives for each aircraft/flight condition combination evaluated is also presented   Author   **L**

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

A78-25560 *   Chemical interpretation of Viking Lander 1 life detection experiment E. V. Ballou, P C. Wood (San Jose State University, San Jose, Calif), T Wydeven, M E Lehwalt, and R E Mack (NASA, Ames Research Center, Moffett Field, Calif). *Nature,* vol 271, Feb 16, 1978, p 644, 645. 9 refs
   An earth based evaluation of the Viking Lander 1 life detection experiments was conducted using a radiofrequency glow discharge in a simulated Martian atmosphere. The Gas Exchange Experiment conducted in the humid mode released substantial amounts of CO2, O2, N2, Ar, and CO into the atmosphere, indicating that these substances were adsorbed onto the Martian soil An adsorption potential plot is given, graphing quantity of gas against time (d) For a model surface area of 17 squares meters per gram of measured substance, oxygen adsorption was found to be relatively high, a result which tends to confirm the hypothesis that Martian oxygen exists largely in chemisorbed states or in active oxygen compounds, e g, peroxide, superoxide, hydroperoxide   D M W.

A78-27124 *   Effects of exercise and excitement on mesenteric and renal dynamics in conscious, unrestrained baboons. S F. Vatner (Harvard University, Peter Bent Brigham Hospital; Children's Hospital Medical Center, Boston, New England Regional Primate Research Center, Southboro, Mass). *American Journal of Physiology,* vol 234, Feb 1978, p H210-H214. 24 refs. Research supported by the American Heart Association, Grants No PHS-HL-15416; No. NsG-2136
   Radiotelemetry was used to measure arterial pressure and mesenteric and renal blood flows from nine unrestrained, conscious

baboons during periods of rest, moderate exercise, and extreme excitement. A description of the experiments hardware is presented, including artificial depressants phenylcyclidine hydrochloride, 0 5-1.0 mg/kg, and pentobarbital sodium, 15 mg/kg, and an ultrasonic telemetry flow meter. Results showed rising heart rate and arterial pressure coupled with a reduction of mesenteric and renal flows as the level of exercise was increased. These findings are compared with mesenteric_and_renal flows.somewhat-above-control level, but relatively stable heart rate and arterial pressure, post-prandially. Attention is given to a quantitative analysis of the experimental results   D M.W

A78-29562 *   Responses of articular and epiphyseal cartilage zones of developing avian radii to estrone treatment and a 2-G environment. J. A Negulesco and T. Kossler (Ohio State University, Columbus, Ohio). *Aviation, Space, and Environmental Medicine,* vol 49, Mar. 1978, p 489-494. 42 refs. Research supported by the Ohio State University, Contract No. NAS2-6634, Grant No. NIH-5409.

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

A78-32673 *   Human problem solving performance in a fault diagnosis task W B Rouse (Illinois, University, Urbana, III) *IEEE Transactions on Systems, Man, and Cybernetics,* vol SMC-8, Apr 1978, p 258-271 52 refs Grant No NsG-2119

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

A78-33522 *   Extent of utilization of the Frank-Starling mechanism in conscious dogs D H Boettcher (Harvard University, Harvard Medical School, Boston, Mass), S F. Vatner (Peter Bent Brigham Hospital, Boston, Mass.), G R. Heyndrickx (Children's Hospital Medical Center, Boston, Mass), and E. Braunwald (New England Regional Primate Research Center, Southborough, Mass) *American Journal of Physiology,* vol 234, Apr. 1978, p. H338-H345 36 refs Research supported by the American Heart Association, Grants No. PHS-HL-15416, No PHS-HL-17459; No PHS-HL-17665, No NsG-2136

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

A78-34503 *   Light element geochemistry of the Apollo 12 site. J F Kerridge, I. R. Kaplan, C C. Kung, D. A. Winter, D. L Friedman (California, University, Los Angeles, Calif.), and D. J. DesMarais (NASA, Ames Research Center, Extraterrestrial Biology Div., Moffett Field, Calif.). *Geochimica et Cosmochimica Acta,* vol 42, Apr. 1978, p. 391-402. 59 refs. Grant No. NGR-05-007-289.

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

A78-36602 *   Fluid-electrolyte shifts and maximal oxygen uptake in man at simulated altitude /2,287 m/. J E. Greenleaf, E. M Bernauer, W. C. Adams, and L Juhos (NASA, Ames Research Center, Laboratory of Human Environmental Physiology, Moffett Field; California, University, Davis, Calif). *Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology,* vol 44, May 1978, p 652-658. 33 refs.

Experiments were conducted on six trained distance runners (21-23 yr) subjected to an eight-day dietary control at sea level, followed by an eight-day stay in an altitude chamber (2287-m altitude) and a four-day recovery at sea level. Fluid and electrolyte shifts during exercise at altitude were evaluated to gain insight into the mechanism of reduction in working capacity. The results are discussed in terms of resting fluid volumes and blood constituents, maximal exercise variables, and maximal exercise fluid-electrolyte shifts. Since there are no significant changes in fluid balance or resting plasma volume (PV) at altitude, it is concluded that neither these nor the excessive PV shifts with exercise contribute to the reduction in maximal oxygen uptake at altitude. During altitude exposure the percent loss in PV is found to follow the percent reduction in maximal oxygen uptake, however, on the first day of recovery the percent change in PV remains depressed while maximal oxygen uptake returns to control levels   S D.

A78-37055 *   Stratospheric measurements of CF2Cl2 and N2O. B. J. Tyson, J. F. Vedder, J. C Arvesen (NASA, Ames Research Center, Moffett Field, Calif), and R. B. Brewer *Geophysical Research Letters,* vol 5, May 1978, p. 369-372 21 refs

Concentrated samples of stratospheric air were obtained at pressure altitudes of 18 3 km and 21 3 km aboard U-2 aircraft, and at 28 3 km and 35.9 km aboard a balloon platform. The mixing ratios of CF2Cl2 and N2O are reported for locations in California, Oregon, Texas, and Quebec, Canada. The observed mixing ratios compare within a factor of 2 to those reported by other investigators and show a more rapid decrease with altitude than predicted by a two-dimensional model.   (Author)

A78-37130 *   A model of human decisionmaking in a fault diagnosis task W B. Rouse (Illinois, University, Urbana, Ill.). *IEEE Transactions on Systems, Man, and Cybernetics,* vol. SMC-8, May 1978, p. 357-362. Grant No. NsG-2119.

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

A78-39746 *   The Viking biological experiments on Mars H P Klein (NASA, Ames Research Center, Moffett Field, Calif.) *Icarus*, vol. 34, June 1978, p 666 674. 24 refs

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

A78-41162 *   Hormonal indices of tolerance to +Gz acceleration in female subjects J Vernikos-Danellis, M F Dallman, P Forsham, A L Goodwin, and C S Leach (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, California, University, San Francisco, Calif ; NASA, Johnson Space Center, Biomedical Research Div., Houston, Tex.). *Aviation, Space, and Environmental Medicine*, vol 49, July 1978, p. 886 889 17 refs

As a possible predictive test for screening Space Shuttle passengers, the secretions of the pituitary adrenal system and the adrenal medulla have been studied in conjunction with exposure to gravitational acceleration three times the normal level. The 12 female subjects in the test were divided into ambulatory and bedrest groups Before bedrest, a high tolerance to centrifugation appeared to be linked to increases in plasma ACTH and cortisol This relationship did not hold after bedrest The correlation between tolerance to centrifugation and 24-hour urinary epinephrine-to-norepinephrine ratios was not significant.   J M B.

A78-41164 *   Space colonization - Some physiological perspectives. L H Winkler (NASA, Ames Research Center, Moffett Field, Calif) *Aviation, Space, and Environmental Medicine*, vol 49, July 1978, p 898-901. 15 refs

Physiological criteria determining the design of the habitat for a space colony with 10,000 people are discussed Centrifugally generated earth-normal gravity, maximum ionizing radiation dose standards less than or equal to 0 5 rem/year (obtained with passive shielding), and an atmosphere with reduced nitrogen partial pressures were established as design requirements for the habitat. However, further research is needed to determine whether humans experience complete adaptation to weightlessness and whether there are long-term effects of breathing various atmospheric mixtures and pressures   J.M B

A78-42817 *   Physiologic regulation of body energy storage G C Pitts (Virginia, University, Charlottesville, Va) *Metabolism*, vol. 27, Apr 1978, p 469-478 57 refs Grants No NGR-47-005-213, No NsG-2225

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

A78-44131 *   Simulator evaluation of three situation and guidance displays for V/STOL aircraft zero-zero landing approaches. M. R. Murphy, E A. Palmer, T E. Wempe (NASA, Ames Research Center, Man-Vehicle Systems Research Div , Moffett Field, Calif.), L

A McGee, and C H. Paulk (NASA, Ames Research Center, Flight Systems Research Div , Moffett Field, Calif) *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-8, July 1978, p 563 571 5 refs

A simulator study was undertaken to compare and evaluate the design features of the electronic displays for possible use in V/STOL aircraft. a combined transition display (Display A), a perspective display (Display B), and a hover display (Display C). Display B presents height information via integrated elements, Displays A and C present information similarly except that Display C presents vertical and lateral guidance via conventional cross pointers. High pilot work load was attained by evaluating the displays only as situational guidance displays in a simulated vehicle without stability augmentation. Glide slopes of 6 and 15 deg were used, and steady-state and no-wind conditions were randomly presented Six pilots participated, and fifty-five objective performance measures were taken along with pilot opinions   P T H

A78-48574 *   Calcium transport in Halobacterium halobium envelope vesicles. J W Belliveau and J. K Lanyi (NASA, Ames Research Center, Extraterrestrial Biology Div , Moffett Field, Calif.). *Archives of Biochemistry and Biophysics*, vol 186, Feb 1978, p. 98-105. 42 refs.

A78-48577 *   Synthesis of porous polyaromatic column packings for GC analysis of extraterrestrial atmospheres. F H Woeller and G. E Pollock (NASA, Ames Research Center, Moffett Field, Calif.). *Journal of Chromatographic Science*, vol. 16, Apr. 1978, p 137-140. 8 refs

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

A78-48578 *   Illumination-dependent changes in the intrinsic fluorescence of bacteriorhodopsin R A Bogomolni, L Stubbs, and J K Lanyi (NASA, Ames Research Center, Extraterrestrial Biology Div , Moffett Field, California, University, San Francisco, Calif) *Biochemistry*, vol. 17, no 6, 1978, p 1037-1041. 27 refs Grants No. NIH-1-R01-GM-23651-01, No NsG-7151

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

A78-48579 *   Methionine transport in Halobacterium halobium vesicles - Noncompetitive, asymmetric inhibition by L-Cysteine. S L Helgerson (California, University, San Francisco, Calif) and J. K. Lanyi (NASA, Ames Research Center, Extraterrestrial Biology Div , Moffett Field, Calif) *Biochemistry*, vol 17, no. 6, 1978, p 1042-1046 24 refs

A78-48581 *   Spectrophotofluorometric and electron micro-scopic study of Lipofuscin accumulation in the testis of aging mice. J. Miquel, P. R Lundgren (NASA, Ames Research Center, Biomedical Research Div, Moffett Field, Calif), and J. E. Johnson, Jr (National Institutes of Health, National Institute on Aging, Baltimore, Md). *Journal of Gerontology*, vol 33, no 1, 1978, p. 5-19 55 refs

A78-48671 * //   Gravity as a biochemical determinant. S. M. Siegel (Hawaii, University, Honolulu, Hawaii) *COSPAR, Plenary Meeting, 21st, Innsbruck, Austria, May.29-June 10, 1978, Paper.* 20 p. 67 refs Grant No NGR-12-001-053; Contracts No NAS2-6624, No NAS2-8687.

Hypogravity effects on the biochemistry of living organisms are surveyed, and the differences found under orbital, clinostat, and flotation conditions are examined Changes can be transient - such as altered serum hormone and electrolyte levels in man - and disappear shortly after return to earth, or changes can be more persistent or permanent, as seems to be the case for changes in the skeletal system mineral and protein constituents for humans who have been in space. While plant ethylene and peroxidase both increase under orbital, clinostat, or flotation conditions, 3-PGA-dehydrogenase increases under orbital but not clinostat conditions and cytochrome C reductase and malic dehydrogenase are affected by clinostat but not actual free fall conditions Reasons for these discrepancies are considered.   M.L.

A78-48717 * //   Carbon suboxide polymer, an explanation for the wave of darkening on Mars. V. I Oyama, B. J Berdahl, and F. Woeller (NASA, Ames Research Center, Moffett Field, Calif.). *COSPAR, Plenary Meeting, 21st, Innsbruck, Austria, May 29-June 10, 1978, Paper.* 14 p. 30 refs

The carbon suboxide thermal polymer or its irradiated product is affected by water vapor. The polymerized carbon suboxide simulates the Martian wave of darkening on the inner wall of a glass tube when humidified by passage of water vapor through the tube. The polymer was visibly darkened by the advancing vapor front. With increasing polymer thickness and/or water vapor concentration the wave of darkening similarly intensifies simulating the dark fringe in the Martian circumpolar areas Surfaces are lightened constantly being renewed by particulate material settling from the atmosphere. It is hypothesized that light and dark areas have polymer coatings, but light areas have small particles which scatter white light more effectively and appear brighter on the surface of Mars   (Author)

A78-48719 * //   Continuous metabolic and cardiovascular measurements on a monkey subject during a simulated 6-day Spacelab mission. N Pace, D F Rahlmann, R C Mains, A M Kodama (California, University, Berkeley, Calif), and E. P. McCutcheon (NASA, Ames Research Center, Biomedical Research Div, Moffett Field, Calif.). *COSPAR, Plenary Meeting, 21st, Innsbruck, Austria, May 29-June 10, 1978, Paper.* 6 p 6 refs Grant No NsG-7262

An adult male pig-tailed monkey (Macaca nemestrina) with surgically implanted biotelemetry unit was inserted into a fiberglass pod system which was installed in a Spacelab mock-up to simulate a 6-day mission during which extensive physiological measurements were obtained. The purpose of the pod was to make possible the study of respiratory gas exchange. Body temperature and selected cardiovascular parameters were recorded continuously for 2.6 days prior to 'launch', 6.3 days during 'flight', and 1 8 days after 'landing' The results are surveyed, and it is concluded that it is feasible to perform sound physiological experiments on nonhuman primates in the Spacelab environment.   M.L

A78-49780 * //   Space habitats. R. D. Johnson (NASA, Ames Research Center, Moffett Field, Calif.). In: Our extraterrestrial heritage: From UFO's to space colonies, Proceedings of the Joint Symposium, Los Angeles, Calif., January 28, 1978. (A78-

49776 22-12) Los Angeles, American Institute of Aeronautics and Astronautics, Inc, 1978, p. 76-84. 8 refs.

Differences between space industrialization and space colonization are outlined along with the physiological, psychological, and esthetic needs of the inhabitants of a space habitat The detrimental effects of zero gravity on human physiology are reviewed, and the necessity of providing artificial gravity, an acceptable atmosphere, and comfortable relative humidity and temperature in a space habitat is discussed. Consideration is also given to social organization and governance, supply of food and water, and design criteria for space colonies.   B J

A78-51225 *   Inhibition of bone formation during space flight E. R Morey (NASA, Ames Research Center, Biomedical Research Div, Moffett Field, Calif.) and D J Baylink (U.S Veterans Administration Hospital, Tacoma, Washington, University, Seattle, Wash) *Science*, vol 201, Sept. 22, 1978, p. 1138-1141. 20 refs. Grant No NIH-DE-02600 NASA Order RA-18698-B

Parameters of bone formation and resorption were measured in rats orbited for 19.5 days aboard the Soviet Cosmos 782 biological satellite. The most striking effects were on bone formation During flight, rats formed significantly less periosteal bone than did control rats on the ground An arrest line at both the periosteum and the endosteum of flight animals suggests that a complete cecessation of bone growth occurred During a 26-day postflight period, the defect in bone formation was corrected No significant changes in bone resorption were observed.   (Author)

A78-51346 *   Digital filter structures having low errors and simple hardware implementation A I. Abu-El-Haija (IBM Thomas J Watson Research Center, Yorktown Heights, N Y.), K. Shenoi (Telecommunications Center, Stamford, Conn), and A M Peterson (Stanford University, Stanford, Calif) *IEEE Transactions on Circuits and Systems*, vol. CAS-25, Aug 1978, p. 593-599 20 refs Grants No. NGL-05-020 014, No NsG-2121, No NCA2-OR745-614, Contract No N00014-75-C-0601

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

A78-51886 *   Square   Ising   ferromagnetic   and antiferromagnetic lattices in a magnetic field - A new perturbation approach. S Aronowitz (NASA, Ames Research Center, Chemical Evolution Branch, Moffett Field, Calif). *Physical Review B - Solid State, 3rd Series*, vol 17, Mar 1, 1978, p 2305-2315 15 refs Contract No A-3994-B.

A78-53400 *   Computer display and manipulation of biological molecules. Y Coeckelenbergh, R D. MacElroy (NASA, Ames Research Center, Extraterrestrial Biology Div, Moffett Field, Calif), J Hart (NASA, Ames Research Center, Computation Div, Moffett Field, Calif), and R. Rein (Roswell Park Memorial Institute, Buffalo, N Y.). *Computers and Graphics*, vol 3, 1978, p 9-16. 20 refs

This paper describes a computer model that was designed to investigate the conformation of molecules, macromolecules and subsequent complexes. Utilizing an advanced 3-D dynamic computer display system, the model is sufficiently versatile to accommodate a large variety of molecular input and to generate data for multiple purposes such as visual representation of conformational changes, and calculation of conformation and interaction energy. Molecules can be built on the basis of several levels of information. These include the specification of atomic coordinates and connectivities

and the grouping of building blocks and duplicated substructures using symmetry rules found in crystals and polymers such as proteins and nucleic acids. Called AIMS (Ames Interactive Molecular modeling System), the model is now being used to study pre-biotic molecular evolution toward life   (Author)

A78-53874 *   Degradation of biochemical activity in soil sterilized by dry heat and gamma radiation. K L. Shih and K A. Souza (NASA, Ames Research Center, Extraterrestrial Biology Div, Moffett Field, Calif.). Origins of Life, vol. 9, Sept. 1978, p 51-63 16 refs

The ·effect of soil sterilization by dry heat (0.08% relative humidity), gamma radiation, or both on soil phosphatase, urease, and decarboxylase activity was studied. Soil sterilized by a long exposure to dry heat at relatively low temperatures (eight weeks at 100.5 C) retained higher activities than did soil exposed to a higher temperature (two weeks at 124.5 C), while all activity was destroyed by four days at 148 5 C Sterilization with 7 5 Mrads destroyed less activity than did heat sterilization. The effect of several individually nonsterizing doses of heat radiation is described   ·   M.L.

A78-53875 *   Chemical evolution and the origin of life - Bibliography supplement 1976. M. W. West, R. A. Koch (San Jose State University, San Jose, Calif.), and S. Chang (NASA, Ames Research Center, Moffett Field, Calif.). Origins of Life, vol. 9, Sept. 1978, p. 67-74. 125 refs. Grant No. NCA2-0A675-707

PATENTS

N78-14104*   National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
AUTOMATIC MULTIPLE-SAMPLE APPLICATOR AND ELECTROPHORESIS APPARATUS Patent
Benjamin W Grunbaum inventor (to NASA) (Calif Univ, Berkeley) Issued 6 Dec 1977 7 p Filed 24 Nov 1976 Supersedes N77-12157 (15 - 03, p 0305) Sponsored by NASA
(NASA-Case-ARC-10991-1, US-Patent-4,061,561;
US-Patent-Appl-SN-744574, US-Patent-Class-204-299R,
US-Patent-Class-204-180G) Avail US Patent Office CSCL 07D

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

N78-18763*#   National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
SPACESUIT MOBILITY JOINTS Patent Application
Hubert C Vykukal, inventor (to NASA) Filed 3 Mar. 1978 45 p
(NASA-Case-ARC-11058-2; US-Patent-Appl-SN-883094) Avail NTIS HC A03/MF A01 CSCL 05H

A·spacesuit is presented having a waist joint, shoulder joints, elbow joints, hip joints, and ankle joints Each of the joints includes at least one pair of annuli supported for pivotal displacement about paralleling axes and a flexible, substantially impermeable diaphragm of a tubular configuration spanning the distance between the annuli and connected thereto in a hermetically sealed relationship The diaphragm includes at least one rolling convolution having a crown disposed in a fixed relation with an axis about which one of the annuli pivots The knee joint is constructed slightly different from the other joints. A curved tubular shell is

disposed between two circular bellows. Cables are secured to the rings, shell, and bellows. The cables limit the motion.of the bellows when the suit is pressurized   NASA

N78-22720*#   National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif
SWEAT COLLECTION CAPSULE Patent Application
John·E. Greenleaf and Robert W Delaplaine, inventors (to NASA) Filed 19 Apr. 1978 10 p
(NASA-Case-ARC-11031-1, US-Patent-Appl-SN-897828) Avail NTIS HC A02/MF A01 CSCL 06B

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

N78-27275*#   National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
·CHELATE-MODIFIED POLYMERS FOR ATMOSPHERIC GAS CHROMATOGRAPHY Patent Application
Warren W Christensen, Ludwig A Mayer (San Jose State Univ, Calif), and Fritz H. Woeller, inventors (to NASA) (San Jose State Univ, Calif) Filed 30 Jun 1978 20 p Sponsored by NASA · (NASA-Case-ARC-11154-1; US-Patent-Appl-SN-921626) Avail. NTIS HC A02/MF A01 CSCL 07D

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

L

N78-27733*   National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
TREAD DRUM FOR ANIMALS Patent
Wayne H Howard, inventor (to NASA) Issued 9 May 1978 7 p Filed 31 Mar 1976 Supersedes N76-20485 (14 - 11, p 1394)
(NASA-Case-ARC-10917-1; US-Patent-4,088,094,
US-Patent-Appl-SN-672223; US-Patent-Class-119-29) Avail US Patent Office CSCL 06B

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

N78-31233*   National Aeronautics· and Space Administration. Ames Research Center, Moffett Field, Calif.
BORON TRIFLUORIDE COATINGS FOR THERMOPLASTIC MATERIALS AND METHOD OF APPLYING SAME IN GLOW DISCHARGE Patent
Ronald Michael Kubacki, inventor (to NASA) (Bell and Howell,

Chicago) Issued 23 May 1978 4 p Filed 17 Jun 1977
Supersedes N77-26308 (15 - 17, p 2243) Sponsored by
NASA
(NASA-Case-ARC-11057-1; US-Patent-4,091,166,
US-Patent-Appl-SN-807762, US-Patent-Class-428-411,
US-Patent-Class-350-165; US-Patent-Class-350-175NG,
US-Patent-Class-427-40, US-Patent-Class-427-41,
US-Patent-Class-427-164; US-Patent-Class-428-412,
US-Patent-Class-428-422, US-Patent-Class-428-447,
US-Patent-Class-428-515, US-Patent-Class-428-523
U S-Patent-Class-428-538) Avail US Patent Office CSCL
07D

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

Official Gazette of the U S Patent Office

N78-31735* National Aeronautics and Space Administration
Ames Research Center, Moffett Field Calif
SPACESUIT MOBILITY JOINTS Patent
Hubert C Vykukal, inventor (to NASA) Issued 30 May 1978
22 p Filed 23 Dec 1976 Supersedes N77-15641 (15 - 06
p 0789)
(NASA-Case-ARC-11058-1, US-Patent-4,091,464,
US-Patent-Appl-SN-753965; US-Patent-Class-2-2 1A,
US-Patent-Class-285-235) Avail US Patent Office CSCL
05H

Joints for use in interconnecting adjacent segments of an
hermetically sealed spacesuit which have low torques, low leakage
and a high degree of reliability are described Each of the joints
is a special purpose joint characterized by substantially constant
volume and low torque characteristics Linkages which restrain
the joint from longitudinal distension and a flexible, substantially
impermeable diaphragm of tubular configuration spanning the
distance between pivotally supported annuli are featured The
diaphragms of selected joints include rolling convolutions for
balancing the joints while various joints include wedge-shaped
sections which enhance the range of motion for the joints

Official Gazette of the U.S Patent Office

N78-31736* National Aeronautics and Space Administration
Ames Research Center, Moffett Field Calif.
SPACESUIT TORSO CLOSURE Patent
Bruce W Webbon and Hubert C Vykukal, inventors (to NASA)
Issued 30 May 1978 8 p Filed 23 Mar 1977 Supersedes
N77-25784 (15 - 16, p 2170)
(NASA-Case ARC-11100 1; US-Patent 4,091,465,
US-Patent-Appl-SN-780569; US-Patent-Class-2-2 1A) Avail US
Patent Office CSCL 05H

A simple, economical and reliable entry closure is described
for joining opposite halves of a torso section for a pressure suit
in a manner which simplifies self-donning A single coupling
joins coaxially aligned, axially separable, tubular segments of a
hard spacesuit along an angulated zone of separation, adapted
to be mated in an hermetically sealing relation A releasable
C section clamp secures the members in their mated relation-
ship Official Gazette of the U S Patent Office

N78-32854* National Aeronautics and Space Administration
Ames Research Center, Moffett Field, Calif
**PROCESS FOR PRODUCING A WELL-ADHERED DURABLE
OPTICAL COATING ON AN OPTICAL PLASTIC SUBSTRATE
Patent**
Ronald M Kubacki, inventor (to NASA) (Bell and Howell Chicago)
Issued 20 Jun 1978 7 p Filed 15 Dec 1976 Sponsored by
NASA
(NASA-Case-ARC-11039-1 US-Patent-4 096 315
US-Patent-Appl-SN-750655; US-Patent-Class-428-412;
US-Patent-Class-351-166, US-Patent-Class-427-38;
US-Patent-Class-427-41; US-Patent-Class-427-44,
US-Patent-Class-427-164, US-Patent-Class-427-302,
US-Patent-Class 427-322, US-Patent-Class-427-387,
US-Patent-Class-428-447) Avail US Patent Office CSCL
20F

A low temperature plasma polymerization process is described
for applying an optical plastic substrate, such as a polymethyl
methacrylate lens, with a single layer abrasive resistant coating
to improve the durability of the plastic

Official Gazette of the U.S. Patent Office

RESEARCH SUPPORT

FORMAL REPORTS

N78-19808*# National Aeronautics and Space Administration Ames Research Center Moffett Field, Calif.
A SINGLE USER EFFICIENCY MEASURE FOR EVALUATION OF PARALLEL OR PIPELINE COMPUTER ARCHITECTURES c60
W P Jones *In its* Future Computer Requirements for Computational Aerodynamics Feb 1978 p 363-371 (For availability see N78-19778 10-59)
Avail NTIS HC A22/MF A01 CSCL 09B

A precise statement of the relationship between sequential computation at one rate, parallel or pipeline computation at a much higher rate, the data movement rate between levels of memory, the fraction of inherently sequential operations or data that must be processed sequentially the fraction of data to be moved that cannot be overlapped with computation, and the relative computational complexity of the algorithms for the two processes, scalar and vector, was developed The relationship should be applied to the multirate processes that obtain in the employment of various new or proposed computer architectures for computational aerodynamics The relationship, an efficiency measure that the single user of the computer system perceives, argues strongly in favor of separating scalar and vector processes, sometimes referred to as loosely coupled processes, to achieve optimum use of hardware. Author

N78-19901# California Univ, Los Angeles Dept of Physics
NON-LINEAR PARAMETRIC GENERATION OF SOUND BY RESONANT MODE CONVERSION Interim Report
Steven Lurie Garrett Dec 1977 201 p refs
(Contract N00014-75-C-0246)
(AD-A049157, TR-39) Avail NTIS HC A10/MF A01 CSCL 20/1

When non-linear terms are included in the two fluid hydrodynamic description of superfluid helium-4, first sound and second sound are coupled The interaction of two second sound waves to produce a propagating first sound wave is shown to occur at a specific angle which makes the point of intersection of the second sound waves travel at the speed of first sound An experiment to observe this mode conversion process in a waveguide of rectangular cross-section is described Measurements show that the resonant conversion occurs at the theoretically predicted frequency The amplitude of the mode converted first sound is found to exhibit a quadratic dependence on the amplitude of the primary wave which is characteristic of a second order effect. A new application of the reciprocity calibration technique allowed an absolute calibration of the pressure microphones in situ Absolute measurements of the coupling of first sound to second sound agree with theory. This agreement is a direct confirmation of the importance of the additional, intrinsically non-linear, Galilean invariant variable, in the thermohydrodynamics of superfluid helium. The theoretical formalism is applied to the parametric amplification of second sound by high intensity first sound and the results are in disagreement with a previous calculation by Khokhlov and Pushkina Author (GRA)

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

and Bill A. Williams (San Jose State Univ, Calif) May 1978 43 p refs
(Grant NsG-2293)
(NASA-TM 78486, A-7423) Avail NTIS HC A03/MF A01 CSCL 06B

An implant telemetry system for the simultaneous monitoring of temperature activity, and EKG from small animals, such as rats, was designed with the feature that instead of a battery the system is energized by an inductive field A 250 kHz resonant coil surrounds the cage (30 x 30 x 20 cm) and provides the approximately 100 microns 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 8-10 MHz band which allows the use of a simple, essentially single IC chip, receiver Author

N78-24364# California Univ, Berkeley Dept of Chemical Engineering
STRESS-STRAIN BEHAVIOR OF SOME ACRYLIC GRADIENT POLYMERS
C F Jasso, S D Hong, and M. Shen 10 Feb 1978 17 p refs
(Contract N00014-75-C-0955)
(AD-A052617, TR-17) Avail NTIS HC A02/MF A01 CSCL 11/9

Multicomponent polymers whose structure or composition varies as a function of position in the sample are called gradient polymers One way to prepare gradient polymers is-to permit a guest monomer to diffuse into a host polymer network The resulting profile of the diffusion gradient is fixed by polymerizing the monomer in situ In this work we used 2-chloroethyl acrylate as the monomer and poly(methyl methacrylate) as the polymer matrix Both gradient polymers and interpenetrating networks were prepared It was found that the stress-strain behavior of gradient polymers is quite different from that of the interpenetrating networks of comparable composition The former shows a yield point, and considerably enhanced fracture strain. The latter is essentially rubber in character Possible mechanisms for the unique properties of gradient polymers are discussed Author (GRA)

N78-30862*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif.
A DECODING PROCEDURE FOR THE REED-SOLOMON CODES
Raymond S Lim Aug 1978 25 p refs
(NASA-TP-1286; A-7372) Avail NTIS HC A02/MF A01 CSCL 09B

A decoding procedure is described for the (n,k) t-error-correcting Reed-Solomon (RS) code, and an implementation of the (31,15) RS code for the I4-TENEX central system. This code can be used for error correction in large archival memory systems The principal features of the decoder are a Galois field arithmetic unit implemented by microprogramming a microprocessor, and syndrome calculation by using the $g(x)$ encoding shift register Complete decoding of the (31,15) code is expected to take less than 500 microsecs The syndrome calculation is performed by hardware using the encoding shift register and a modified Chien search The error location polynomial is computed by using Lin's table, which is an interpretation of Berlekamp's iterative algorithm The error location numbers are calculated by using the Chien search Finally, the error values are computed by using Forney's method L S

59

N78-33784*# Informatics-PMI, Inc, Palo Alto, Calif.
X10: A FORTRAN DIRECT ACCESS DATA MANAGEMENT SYSTEM
David P. Roland *In* NASA Langley Res. Center Eng and Sci. Data Management 1978 p 155-182 (For primary document see N78-33776 24-61)
(Contract NAS2-6914)
Avail NTIS HC A12/MF A01 CSCL 09B

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

NASA CONTRACTOR REPORTS

N78-32731*# Technology Development Corp, Sunnyvale, Calif
THE ILLIAC IV MEMORY SYSTEM: CURRENT STATUS AND FUTURE POSSIBILITIES
David Stevenson 8 May 1978 142 p Prepared in cooperation with Lear Siegler, Inc., Santa Monica, Calif and Computer Sci. Corp, Los Angeles
(Contracts NAS2-8870; NAS2-8728; NAS2-9359)
(NASA-CR-152177) Avail NTIS HC A07/MF A01 CSCL 09B

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

PATENTS

N78-27425* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
ROTARY LEVELING BASE PLATFORM Patent
Robert W Delaplaine and Daniel L Mossolani, inventors (to NASA) Issued 9 May 1978 5 p Filed 2 Nov. 1976 Supersedes N77-10498 (15 - 01, p 0069)
(NASA-Case-ARC-10981-1; US-Patent-4,088,291; US-Patent-Appl-SN-738218, US-Patent-Class-248-186, US-Patent-Class-248-178) Avail: US Patent Office CSCL 13I

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

N78-32395* National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
ANGLE DETECTOR Patent
Gilbert T Parra, inventor (to NASA) Issued 13 Jun. 1978 8 p Filed 10 Nov 1976 Supersedes N77-11364 (15 - 02, p 0194)
(NASA-Case-ARC-11036-1, US-Patent-4,094,073, US-Patent-Appl-SN-740457; US-Patent-Class-33-366) Avail US-Patent-Office CSCL 14B

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

N78-33717*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MICRO-FLUID EXCHANGE COUPLING APPARATUS Patent Application
John E Johnson (San Francisco Univ, Calif) and Paul F Swartz, inventor (to NASA) Filed 16 Oct. 1978 13 p
(NASA-Case-ARC-11114-1, US-Patent-Appl-SN-951422) Avail: NTIS HC A02/MF A01 CSCL 06B

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

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FEDERAL AVIATION ADMINISTRATION

FORMAL REPORTS

N78-14033# Federal Aviation Administration, Moffett Field, Calif
Flight Simulation Branch
CERTIFICATION STUDY OF A DERIVATIVE MODEL OF A SMALL JET TRANSPORT AIRPLANE USING A PILOTED RESEARCH SIMULATOR Final Report
Raymond D Forrest Jun 1977 86 p refs
(AD-A046442, FAA-RD-77-105) . Avail NTIS
HC A05/MF A01 CSCL 01/3

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

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U.S. ARMY RESEARCH AND TECHNOLOGY LABORATORIES AND AEROMECHANICS LABORATORY

FORMAL REPORTS

N78-17000*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
DYNAMIC STALL EXPERIMENTS ON THE NACA 0012 AIRFOIL
Kenneth W. McAlister, Lawrence W. Carr, and William J McCroskey Jan. 1978 166 p refs
(NASA-TP-1100, A-7096) Avail NTIS HC A08/MF A01 CSCL 01A
The flow over a NACA 0012 airfoil undergoing large oscillations in pitch was experimentally studied at a Reynolds number of 2.5 million and over a range of frequencies and amplitudes Hot-wire probes and surface-pressure transducers were used to clarify the role of the laminar separation bubble, to delineate the growth and shedding of the stall vortex, and to quantify the resultant aerodynamic loads. In addition to the pressure distributions and normal force and pitching moment data that have often been obtained in previous investigations, estimates of the unsteady drag force during dynamic stall have been derived from the surface pressure measurements Special characteristics of the pressure response, which are symptomatic of the occurrence and relative severity of moment stall, have also been examined.
Author

N78-18043*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
AEROMECHANICAL STABILITY OF HELICOPTERS WITH A BEARINGLESS MAIN ROTOR. PART 1: EQUATIONS OF MOTION
Dewey H Hodges Feb. 1978 102 p refs Prepared in cooperation with Army Aviation Res and Develop Command, Moffett Field, Calif
(NASA-TM-78459; A-7301-Pt-1) Avail NTIS HC A06/MF A01 CSCL 01C
Equations of motion for a coupled rotor-body system were derived for the purpose of studying air and ground resonance characteristics of helicopters that have bearingless main rotors For the fuselage, only four rigid body degrees of freedom are considered longitudinal and lateral translations, pitch, and roll The rotor is assumed to consist of three or more rigid blades Each blade is joined to the hub by means of a flexible beam segment (flexbeam or strap). Pitch change is accomplished by twisting the flexbeam with the pitch-control system, the characteristics of which are variable Thus, the analysis is capable of implicitly treating aeroelastic couplings generated by the flexbeam elastic deflections, the pitch-control system, and the angular offsets of the blade and flexbeam. The linearized equations are written in the nonrotating system retaining only the cyclic rotor modes; thus, they comprise a system of homogeneous ordinary differential equations with constant coefficients All contributions to the linearized perturbation equations from inertia, gravity, quasi-steady aerodynamics, and the flexbeam equilibrium deflections are retained exactly. Author

N78-18381*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
INTRODUCTION TO UNSTEADY ASPECTS OF SEPARATION IN SUBSONIC AND TRANSONIC FLOW
W. J. McCroskey In AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 8 p refs
(For availability see N78-18375 09-34)
Avail. NTIS HC A11/MF A01 CSCL 20D
Almost any flow that separates will have some degree of unsteadiness. In some cases, the fluctuations will be almost complete stochastic; in others it will be highly organized; and in still others, it will be a combination of random and periodic components Some peculiar unsteady phenomena are reviewed and several classes of flow problems are discussed Flow visualization and pressure measurements are used to explore external flows past fluff bodies, unsteady separation on slender bodies, and internal flows
A R H

N78-18383*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif
SOME UNSTEADY SEPARATION PROBLEMS FOR SLENDER BODIES
W J McCroskey In AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 11 p refs
(For availability see N78-18375 09-34)
Avail NTIS HC A11/MF A01 CSCL 20D
The development of reliable prediction techniques for engineering purposes requires a fundamental and detailed understanding of the unsteady flow fields on wings and rotating blades. Some of the peculiar features of unsteady separated flows that are not simple analogs or extensions of quasi-steady flows are discussed. These include the unsteady Kutta-Joukowski condition, dynamic stall on oscillating airfoils (with applications to helicopter rotor blades) and unsteady shock wave-boundary layer interaction
Author

N78-18387*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF UNSTEADY SEPARATED FLOWS ON OSCILLATING AIRFOILS
W. J. McCroskey In AGARD Three Dimensional and Unsteady Separation at High Reynolds Numbers Feb. 1978 8 p refs
(For availability see N78-18375 09-34)
Avail NTIS HC A11/MF A01 CSCL 20D
Calculating the flow around an airfoil undergoing dynamic stall is a task which has not yet been accomplished at high Reynolds numbers, although several approximate analytical methods have been proposed. The most promising of those methods seems to be either a combination of the discrete potential vortex and thin boundary layer approaches, or a significantly improved version of the strong viscous-inviscid interaction approach The former may prove to be superior for low speed, high amplitude flows, but the latter seems likely to be more suitable for airfoils that operate under supercritical transonic flow conditions and for cases that do not penetrate deeply into stall. At the present time, the engineer who is faced with the need to predict the aerodynamic forces and moments on oscillating airfoils would be better advised to turn to one of the empirical correlation techniques, or perhaps to utilize more than one method and average the results In any event, these methods permit the essential features of dynamic stall to be described, even though further improvements are highly desirable Future efforts will probably see more use made of the two-dimensional theoretical analyses, while experiments can be expected to play the major role in assessing the importance of the three-dimensional effects that are likely to be encountered in practice. Author

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

X,Y

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

Kenneth W. McAlister and Lawrence W. Carr Mar 1978 84 p refs
(NASA-TM-78446; A-7232) Avail NTIS HC A05/MF A01 CSCL 01A

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

N78-28403*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
INTRODUCTION TO UNSTEADY ASPECTS OF SEPARATION IN SUBSONIC AND TRANSONIC FLOW
W. J McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No Feb 1978 8 p refs (For primary document see N78-28397 19-34)
Avail NTIS HC A11/MF A01 CSCL 20D

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

N78-28405*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
SOME UNSTEADY SEPARATION PROBLEMS FOR SLENDER BODIES
W J McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No Feb-1978 11 p refs (For primary document see N78-28397 19-34)
Avail NTIS HC A11/MF A01 CSCL 20D

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

N78-28409*# National Aeronautics and Space Administration Ames Research Center, Moffett Field Calif
PREDICTION OF UNSTEADY SEPARATED FLOWS ON OSCILLATING AIRFOILS
W J McCroskey *In* AGARD Three Dimensional and Unsteady Separation at High Reynolds No. Feb 1978 8 p refs (For primary document see N78-28397 19-34)
Avail NTIS HC A11/MF A01 CSCL 20D

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

N78-29044*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AN EXPERIMENTAL INVESTIGATION OF HINGELESS HELICOPTER ROTOR-BODY STABILITY IN HOVER
William G Bousman Jun 1978 49 p refs Prepared in cooperation with US Army Aviation Research and Development Command, St Louis, Mo.
(NASA-TM-78489; AVRADCOM-TR-78-17(AM); A-7430) Avail NTIS HC A03/MF A01 CSCL 02A

Model tests of a 1 62 m diameter rotor were performed to investigate the aeromechanical stability of coupled rotor-body systems in hover Experimental measurements were made of modal frequencies and damping over a wide range of rotor speeds Good data were obtained for the frequencies of the rotor lead-lag regressing mode The quality of the damping measurements of the body modes was poor due to nonlinear damping in the gimbal ball bearings Simulated vacuum testing was performed using substitute blades of tantalum that reduced the effective lock number to 0 2% of the model scale value while keeping the blade inertia constant The experimental data were compared with theoretical predictions and the correlation was in general very good   Author

N78-32831*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
HOVERING IMPULSIVE NOISE: SOME MEASURED AND CALCULATED RESULTS ·
D A Boxwell (AVRADCOM Res and Technol Labs), Y. H. Yu (AVRADCOM Res and Technol Labs), and F H Schmitz (AVRADCOM Res and Technol Labs) *In* NASA Langley Res Center Helicopter Acoustics Aug 1978 p 309-322 refs (For primary document see N78-32816 23-71)
Avail NTIS HC A17/MF A01 CSCL 20A

In-plane impulsive noise radiating from a hovering model rotor was measured in an anechoic environment The hover acoustic signature was compared with existing theoretical prediction models with previous forward flight experiments using the same model rotor These hover tests showed good experimental consistency with forward flight measurements, both in pressure level, and waveform character, over the range of Mach numbers tested (0 8 to 1.0) Generally poor correlation, however, was confirmed with current linear theory prediction efforts Failure to predict both the peak pressure levels and the shape was reported, especially with increasing tip Mach number   J M S

X,Y

N78-33289*# National Aeronautics and Space Administration Ames Research Center, Moffett Field, Calif
AN APPROXIMATE SOLUTION FOR THE FREE VIBRATIONS OF ROTATING UNIFORM CANTILEVER BEAMS
David A Peters Sep 1973 43 p refs Revised
(NASA-TM-X-62299; A-5137) Avail NTIS HC A03/MF A01 CSCL 20K

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

NASA CONTRACTOR REPORTS

N78-10117*# Systems Technology, Inc Mountain View, Calif.
THE DETERMINATION OF SOME REQUIREMENTS FOR A HELICOPTER FLIGHT RESEARCH SIMULATION FACILITY
J B Sinacori Sep 1977 59 p refs
(Contract NAS2-9421)
(NASA-CR-152066; TR-1097-1) Avail NTIS HC A04/MF A01 CSCL 14B

Important requirements were defined for a flight simulation facility to support Army helicopter development In particular requirements associated with the visual and motion subsystems

of the planned simulator were studied The method used in the motion requirements study is presented together with the underlying assumptions and a description of the supporting data Results are given in a form suitable for use in a preliminary design. Visual requirements associated with a television camera/model concept are related The important parameters are described together with substantiating data and assumptions Research recommendations are given   Author

N78-19155*# Cincinnati Univ., Ohio   Dept. of Aerospace Engineering and Applied Mechanics
THEORETICAL AND EXPERIMENTAL STUDY OF AERODYNAMICS, HEAT TRANSFER AND PERFORMANCE OF A RADIAL TURBINE Final Report, 1 Oct. 1973 - 30 Oct. 1977
W. Tabakoff Sep 1975 56 p refs Sponsored in part by Army Air Mobility Res and Develop Lab
(Contract NAS2-7850)
(NASA-CR-152105) Avail NTIS HC A04/MF A01 CSCL 21E
    A two-dimensional finite difference numerical technique is presented to determine the temperature distribution in a solid blade of a radial turbine guide vane. A computer program is written in FORTRAN 4 for the IBM 370/165 computer. The computer results obtained from these programs have a similar behavior and trend as those obtained by experimental results
                                                          Author

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

X,Y

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

JOURNAL ARTICLES, BOOKS AND CHAPTERS OF BOOKS

A78-22570 * #   Stress analysis study in cooled radial inflow turbine. A Hamed, Y Sheorán, and W Tabakoff (Cincinnati, University, Cincinnati, Ohio). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan. 16-18, 1978, Paper 78-94.* 10 p. 9 refs Contract No. NAS2-7850.
    With increased turbine inlet temperatures, numerical methods of thermal and stress analysis are becoming more valuable in the design of air-cooled turbines This paper presents a study of the stresses associated with different cooling patterns in a radial inflow turbine rotor. The finite element method is used in the stress calculations taking into consideration centrifugal, thermal and aerodynamic loading. The effects of temperature distribution and the presence of internal cooling passages are discussed   (Author)

A78-47930 * #   Application of advanced high speed turboprop technology to future civil short-haul transport aircraft design. J. A Conlon (U.S. Army, Research and Technology Laboratories, Moffett Field, Calif.) and J. V. Bowles (NASA, Ames Research Center, Moffett Field, Calif.). *American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif., Aug. 21-23, 1978, Paper 78-1487* 13 p 8 refs.

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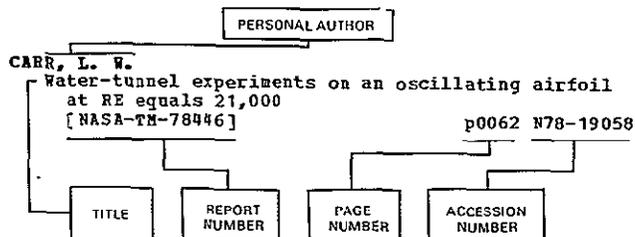
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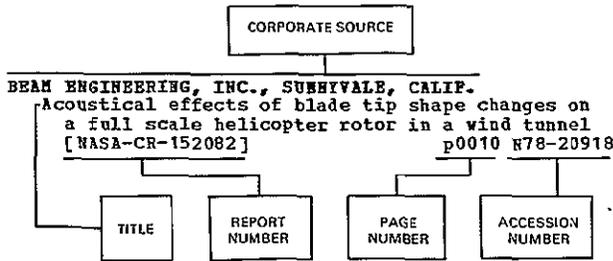
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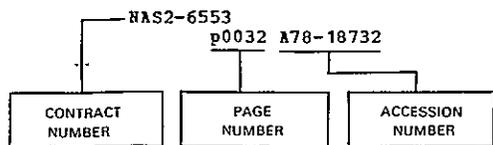
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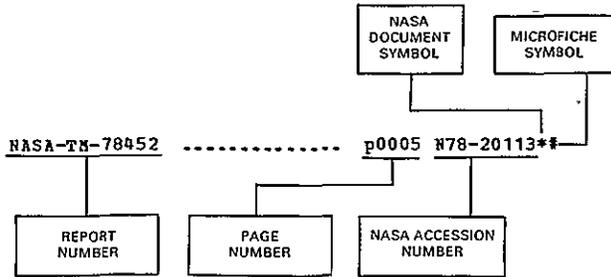
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16 Abstract

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