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ARTICLES, PAPERS, AND PRESENTATIONS**

Compiled by O. L. White
Management Services Office



October 1978

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*George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama*

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16. ABSTRACT

This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY 78. It also includes papers of MSFC contractors.

After being announced in STAR or L STAR, all of the NASA series reports may be obtained from the Scientific and Technical Information Facility, P.O. Box 8757, Baltimore/Washington International Airport, Baltimore, MD 21240.

The information in this report will be of value to the scientific and engineering community in determining what information has been published and what is available.

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FOREWORD

In accordance with the NASA Space Act of 1958 the MSFC has provided for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.

Since July 1, 1960, when the George C. Marshall Space Flight Center was organized, the reporting of scientific and engineering information has been considered a prime responsibility of the Center. Our credo has been that "research and development work is valuable, but only if its results can be communicated and made understandable to others."

The N number shown for the reports listed are assigned by the NASA Scientific and Technical Information Facility, Baltimore, Maryland, indicating that the material is unclassified and unlimited and is available for public use. These publications can be purchased from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161. The N number should be cited when ordering.

GEORGE C. MARSHALL SPACE FLIGHT CENTER
Marshall Space Flight Center, Alabama

FY 1978 SCIENTIFIC AND TECHNICAL REPORTS,
ARTICLES, PAPERS, AND PRESENTATIONS

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TM-78118* November 1977
Terrestrial Environment (Climatic) Criteria Guidelines for Use in Aerospace Vehicle Development, 1977 Revision. John W. Kaufman, Editor. Space Sciences Laboratory. N78-13108

This document provides guidelines on terrestrial environment data specifically applicable for NASA aerospace vehicles and associated equipment development. The primary geographic areas encompassed are the Kennedy Space Center, Florida; Huntsville, Alabama; Vandenberg AFB, California; Edwards AFB, California; Honolulu, Hawaii; Guam; Santa Susana, California; Brigham, Utah; New Orleans, Louisiana; Bay St. Louis, Mississippi; Houston, Texas; Wallops Flight Center, Wallops Island, Virginia; and the White Sands Missile Range, New Mexico. In addition, a section has been included to provide information on the general distribution of natural environmental extremes in the conterminous United States that may be needed to specify design criteria in the transportation of space vehicle subsystems and components. Although not considered as a specific vehicle design criterion, a section on atmospheric attenuation has been added since certain earth orbital experiment missions are influenced by the earth's atmosphere. A summary of climatic extremes for worldwide operational needs is also included. This document presents the latest available information on probable climatic extremes and succeeds information presented in TM X-64589 and TM X-64757. Information is included on atmospheric chemistry, seismic criteria, and on a mathematical model to predict atmospheric dispersion of aerospace engine exhaust cloud rise and growth. There is also a new section on cloud phenomena. The information in this report is recommended for use in the development of aerospace vehicle and associated equipment design and operational criteria, unless otherwise stated in contract work specifications.

The environmental data in this report are primarily limited to information below 90 km. Environmental criteria for 90 km and above are documented in NASA Technical Memorandum TM-78119, Space and Planetary Environment Criteria Guidelines for Use in Space Vehicle Development (1977 Revision).

TM-78119* November 1977
Space and Planetary Environment Criteria Guidelines for Use in Space Vehicle Development, 1977 Revision. G. S. West, Jr., J. J. Wright, and H. C. Euler, Editors. Space Sciences Laboratory. N78-15146

This document provides a consolidated presentation of space and planetary natural environment data for use as design criteria guidelines in space vehicle development programs.

Specifically, information is provided in the disciplinary areas of atmospheric and ionospheric properties, radiation, solar cycle predictions, geomagnetic field, astrodynamics constants, and meteoroids for the earth's atmosphere above 90 km, interplanetary space, and the atmospheres and surfaces (when available) of the moon and the planets (other than earth) of this solar system. The current MSFC upper atmosphere model and solar cycle prediction routines are described in detail.

This document succeeds NASA TM X-64627 entitled "Space and Planetary Environment Criteria Guidelines for Use in Space Vehicle Development, 1971 Revision." The information in this new edition is recommended for use in the development of space vehicle and associated subsystem design and operational criteria unless otherwise stated in a given project's engineering specifications.

For regions of the earth's atmosphere below 90 km, terrestrial environment criteria

* See notation, page 19.

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are documented in NASA Technical Memorandum TM-78118 entitled "Terrestrial Environment (Climatic) Criteria Guidelines for Use in Aerospace Vehicle Development, 1977 Revision."

TM 78125* November 1977
Space Processing Applications Rocket Project SPAR II Final Report. Space Processing Applications Rocket Project Office, Special Projects. N78-15145

This document summarizes the experiment objectives, design/operational concepts, and final results of each of six materials science experiments conducted during the second Space Processing Applications Rocket (SPAR) mission flown by NASA May 17, 1976. The six individual SPAR experiments, covering a wide and varied range of materials processing objectives, were entitled:

1. Solidification of Pb-Sb Eutectic
2. Feasibility of Producing Closed-Cell Metal Foams
3. Direct Observation of Dendrite Remelting and Macrosegregation in Castings
4. Agglomeration in Immiscible Liquids
5. Casting Dispersion - Strengthened Composites at Zero Gravity
6. Solidification Behavior of Al-In Alloys under Zero-Gravity Conditions.

TM-78126 July 1977
C-MOS Bulk Metal Design Handbook. Teddy M. Edge. Electronics and Control Laboratory. N77-86193

The LSI standard cell array technique has been used in the fabrication of more than 20 C-MOS custom arrays. This technique consists of a series of computer programs and

design automation techniques implemented at Marshall Space Flight Center and referred to as the Computer Aided Design And Test (CADAT) system that automatically translate a partitioned logic diagram into a set of instructions for driving an automatic plotter which generates precision mask artwork for complex LSI arrays of C-MOS standard cells. The standard cell concept for producing LSI arrays begins with the design, layout, and validation of a group of custom circuits called standard cells. Once validated, these cells are given identification or pattern numbers and are permanently stored. To use one of these cells in a logic design, the user calls for the desired cell by pattern number. The Place, Route in Two Dimension (PR2D) computer program is then used to automatically generate the metalization and/or tunnels to interconnect the standard cells into the required function.

This report contains data sheets that describe the function, artwork, and performance of each of the standard cells, the general procedure for implementation of logic in C-MOS standard cells, and additional detailed design information.

TM-78130 August 1977
Earth Resources - Regional Transfer Activity Contracts Review and Summary. J. Bensko, Jr., J. L. Daniels, S. W. Downs, Jr., N. L. Jones, R. R. Morton, and C. T. Paludan. Data Systems Laboratory. N77-33578

The Earth Resources Office, Data Systems Laboratory, Marshall Space Flight Center, hosted a Regional Transfer Activity Contracts Review on February 15-17, 1977. Twenty-one contracts in the Earth resources field primarily directed toward applications of satellite data and technology in solution of state and regional problems were reviewed.

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This report gives a summary of the progress of each contract. The purpose of the review, and of this report, is to encourage the sharing of experiences of the researchers across a seven-state region. The region includes Missouri, Kentucky, Tennessee, Mississippi, Alabama, Georgia, and North Carolina.

In addition to research in several Earth science disciplines, which included forestry, limnology, water resources, land-use, geology, and mathematical modeling, the use of computers for establishment of information retrieval systems in the several states was emphasized.

TM-78131 September 1977
A Prediction Model to Forecast the Cost Impact from a Break in the Production Schedule. Dr. Leon M. Delionback. Systems Analysis and Integration Laboratory. N77-34044

The losses which are experienced after a break or stoppage in sequence of a production cycle portends an extremely complex situation and involves numerous variables, some of uncertain quantity and quality. There are no discrete formulas to define the losses during a gap in production. The techniques which are employed are therefore related to a prediction or forecast of the losses that take place, based on the conditions which exist in the production environment. Such parameters as learning curve slope, number of predecessor units, and length of time the production sequence is halted are utilized in formulating a prediction model.

The pertinent current publications related to this subject are few in number, but are reviewed to provide an understanding of the problem.

Example problems are illustrated together with appropriate trend curves to show the approach. Solved problems are also given to show the application of the models to actual cases or production breaks in the real world.

TM-78132 August 1977
Large-Size Monodisperse Latexes as a Commercial Space Product. Dale M. Kornfeld. Space Sciences Laboratory. N78-10293

Dr. John W. Vanderhoff of Lehigh University has proposed Orbital Flight Tests and Spacelab experiments leading to the production of large-size (2 to 40 μm diameter) monodisperse latexes in microgravity. Explanations are given as to why monodisperse particles in this size range are not currently available. The four main topics discussed are: (1) the potential uses of these large particle size latexes, (2) why it is necessary for the particles to have a very narrow size distribution, (3) why large amounts of these monodisperse latexes are needed, and (4) why it is necessary to go to microgravity to prepare these latexes.

TM-78133 October 1977
A Fast Routine for Computing Multidimensional Histograms. Robert R. Jayroe, Jr. Data Systems Laboratory. N77-85837

This report describes a routine for calculating multidimensional histograms of multivariate data using a combination table look-up and search procedure. The software was originally developed to compute four-dimensional histograms from Landsat multispectral imagery, but the concept can be used on other types of data and the program can be modified for the desired type of output information.

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TM-78134 September 1977
Advanced Spacecraft Thermal Control
Techniques. Carl H. Fritz. Preliminary
Design Office. N78-10414

The problems of rejecting large amounts of heat have been significantly studied during the past decade. Shuttle Space Laboratory heat rejection uses 1 kW_e for pumps and fans for every 5 kW_t heat rejection. This is rather inefficient, and for future programs more efficient methods must be developed.

This review is based on a 1971 Grumman Aerospace Corporation study with slight changes and improvements. Two advanced systems were studied and compared to the present pumped-loop system. The advanced concepts are the air-cooled semipassive system, which features rejection of large percentage of the load through the outer skin, and the heat pipe system, which incorporates heat pipes for every thermal control function.

Other systems should be reviewed to find the most efficient heat rejection system for payloads in the 1990's. The system selected must use standardized components to reduce test requirements. Paints and other materials used for long-life duration must also be found.

TM-78135 September 1977
Spacelab Baseline ECS Trace Contaminant
Removal Test Program. C. D. Ray
and J. B. Stanely. Structures and Pro-
pulsion Laboratory and Test Laboratory.
N78-10197

"Off-the-shelf" components which have been demonstrated to offgas considerable quantities of trace contaminant gases will be flown as a part of Spacelab payload equipment. An estimate of the Spacelab Baseline Environmental Control System's

contaminant removal capability was required to allow determination of the need for a supplemental trace contaminant removal system. Results from a test program to determine this removal capability are presented.

TM-78136 September 1977
Ground Winds and Winds Aloft for
Edwards, AFB, California. D. L. Johnson
and S. C. Brown. Space Sciences
Laboratory. N78-11637

This report presents ground-level runway wind statistics for the Edwards AFB, California area. Crosswind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the two major Edwards AFB runways. Also presented are Edwards AFB bivariate normal wind statistics for a 90 degree flight azimuth for altitudes 0 through 27 km. Wind probability distributions, synthetic vector wind profiles, and statistics for any rotation of axes can be computed from the five given parameters: \bar{u} , \bar{v} , $S(u)$, $S(v)$, and $R(uv)$.

TM-78137* January 1978
Space Processing Applications Rocket
Project SPAR III Final Report. Space
Processing Applications Task Team.
N78-21189

This document presents the engineering report and science payload III test report and summarizes the experiment objectives, design/operational concepts, and final results of each of five scientific experiments conducted during the third Space Processing Applications Rocket (SPAR) flight flown by NASA in December 1976. The five individual SPAR experiments, covering a wide and varied range of scientific materials processing objectives, were entitled: Liquid Mixing, Interaction of Bubbles with Solidification Interfaces, Epitaxial Growth of Single Crystal

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Instrumentation of the test specimen revealed no significant heat buildup caused by the rubbing of the bellows convolutes on the damper ring.

A final destruct test was made to determine if a fire would result if the bellows ruptured in the 400 psi oxygen environment, thus exposing a fresh metal surface. The vibration input was changed to 0.8 in. double amplitude displacement of 20 Hz to intentionally rupture the bellows. Failure occurred after 2.5 sec (50 cycles); no fire or heat buildup was encountered.

TM-78158 February 1978
High-Resolution, Continuous-Flow
Electrophoresis in Microgravity. Percy H.
Rhodes. Space Sciences Laboratory.
N78-19234

Although the possibility of using the reduced gravity of space as a means to enhance the performance of certain electrophoresis devices has been considered for several years, there has been no serious attempt to quantitatively compare electrophoresis performance on the ground with that anticipated in space. The computer mathematical models of various proposed electrophoresis systems that have been devised do not lend themselves to parameter optimization as do analytical expressions. Moreover, there has been no attempt to quantitatively determine the limits imposed on ground-based operation by thermal convection. This report derives approximate expressions which will allow estimation of performance enhancement in reduced gravity and also will direct optimization of the various design parameters for a continuous flow electrophoresis system.

TM-78159 February 1978
1977 Progress Report on Manufacturing
Techniques for Gravity Probe B Gyroscopes. John R. Rasquin. Materials and
Processes Laboratory. N78-19468

The purpose of this report is to present additional and improved techniques for the manufacture of Gravity Probe B gyroscopes. Improvements discussed include the redesign of the housings, new techniques for indentation of the electrode surfaces, and a new rotor ball lapping machine. These three items represent a significant improvement in operation of the gyroscope and also make possible the fabrication of a gyroscope which will meet flight requirements.

TM-78160 March 1978
Ground Winds and Winds Aloft for
Edwards, AFB, California (1978
Revision). D. L. Johnson and S. C.
Brown. Space Sciences Laboratory.
N78-19730

This report presents ground-level runway wind statistics for the Edwards AFB, California area. Crosswind, headwind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the two major Edwards AFB runways. Also presented are Edwards AFB bivariate normal wind statistics for a 90 degree flight azimuth for altitudes 0 through 27 km. Wind probability distributions and statistics for any rotation of axes can be computed from the five given parameters: \bar{u} , \bar{v} , $S(u)$, $S(v)$, and $R(uv)$. This document supersedes NASA TM-78136 and should be used in place of it.

TM-78161 March 1978
Thick Section Aluminum Weldments for
SRB Structures. E. Bayless and J.
Sexton. Materials and Processes Laboratory.
N78-19537

The Space Shuttle Solid Rocket Booster (SRB) forward and aft skirts were designed with fracture control considerations used in the design data. Fracture control is based on reliance upon nondestructive evaluation (NDE) techniques to detect potentially critical flaws.

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In the aerospace industry, welds on aluminum in the thicknesses (0.500 to 1.375 in.) such as those encountered on the SRB skirts are normally welded from both sides to minimize distortion. This presents a problem with the potential presence of undefined areas of incomplete fusion and the inability to detect these potential flaws by NDE techniques. To eliminate the possibility of an undetectable defect, weld joint design was revised to eliminate blind root penetrations. Weld parameters and mechanical property data were developed to verify the adequacy of the new joint design.

TM-78162

March 1978

An Evaluation of Grease Type Ball Bearing Lubricants Operating in Various Environments (Status Report No. 3). E. L. McMurtrey. Materials and Processes Laboratory. N78-20335

Because many future spacecraft or space stations will require mechanisms to operate for long periods of time in environments which are adverse to most bearing lubricants, a series of tests is continuing to evaluate 29 grease type lubricants in R-4 size bearings in five different environments for a 1 year period. Four repetitions of each test are made to provide statistical samples. These tests have also been used to select four lubricants for 5 year tests in selected environments with five repetitions of each test for statistical samples. At the present time, 65 test sets have been completed and 23 test sets are underway. Two (5 year) tests have already been started in (1) continuous operation and (2) start-stop operation, with both in vacuum at ambient temperatures. To date, in the 1 year tests, the best results in all environments have been obtained with a high viscosity index perfluoroalkylpolyether grease.

TM-78163**

March 1978

Owens-Illinois Liquid Solar Collector Materials Assessment. R. L. Nichols. Materials and Processes Laboratory.

N78-21597

The Marshall Space Flight Center (MSFC) was requested by the Energy Research and Development Agency (ERDA) to assess the general suitability of the design and materials and to investigate certain failure modes of the Owens-Illinois (O-I) Sunpak solar energy collector system. The primary problem was the violent fracture of collector tubes, with attendant scattering of glass fragments, under boilout conditions.

This report presents the data and information generated during the materials analysis segment of this effort. These data were obtained during pressure testing of the individual tubes, performance testing of a complete array of tubes on the MSFC solar simulator apparatus, and in other investigations as noted. The information herein represents only the data directly associated with materials analysis and is not a comprehensive presentation of all the data compiled during the MSFC test program.

TM-78164

February 1978

Simplified Model of Statistically Stationary Spacecraft Rotation and Associated Induced Gravity Environments. George H. Fichtl and Robert L. Holland. Space Sciences Laboratory.

N78-21198

A simplified stochastic model of spacecraft motion is developed. The model is based on the assumption that the net torque vector due to crew activity and rocket thruster firings is a statistically stationary Gaussian vector process. The process has zero ensemble mean value, and the components of the torque vector are mutually stochastically independent. Each component of the torque

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vector is characterized by a constant, nonzero, spectral density function in the frequency interval $\omega_1 < |\omega| \leq \omega_0$ with zero spectral density for all other values of ω . The linearized rigid-body equations of motion are used to derive the autospectral density functions of the components of the spacecraft rotation vector which are shown to be proportional to ω^{-2} over the interval $\omega_1 < |\omega| \leq \omega_0$ and zero for all other values of ω . The cross-spectral density functions of the components of the rotation vector vanish for all frequencies so that the components of rotation are mutually stochastically independent. The autospectral and cross-spectral density functions of the induced gravity environment imparted to scientific apparatus rigidly attached to the spacecraft are calculated from the rotation rate spectral density functions via linearized inertial frame to body-fixed principal axis frame transformation formulae. The autospectral and cross-spectral densities of the induced gravity vector components are equal to nonzero constants over the frequency interval $\omega_1 < |\omega| \leq \omega_0$; however, the cross-spectral density functions are less than zero, thus indicating negative correlation between any two unlike induced gravity components in the principal axis frame of the vehicle. The induced gravity process is a Gaussian one with zero mean value. Transformation formulae are used to rotate the principal axis body-fixed frame to which the rotation rate and induced gravity vectors are referred to a body-fixed frame in which the components of the induced gravity vector are stochastically independent.

Rice's theory of exceedances is used to calculate expected exceedance rates of the components of the rotation and induced gravity vector processes. Application of the assumption that the number of exceedances of rotation rate and induced gravity over a given duration time T are Poisson distributed permits calculation of the risks associated with the components of the rotation rate and

induced gravity vectors exceeding specified critical values at least once as a function of experiment duration time.

TM-78165** April 1978
Use of the Marshall Space Flight Center Solar Simulator in Collector Performance Evaluation. William R. Humphries. Structures and Propulsion Laboratory. N78-21605

Details of the Marshall Space Flight Center (MSFC) solar simulator construction and operating characteristics are presented. Actual measured values from simulator checkout tests are detailed. Problems encountered during initial startup are discussed and solutions described. Techniques utilized to evaluate collector performance from simulator test data are given. Performance data generated in the simulator are compared to equivalent data generated during natural outdoor testing. Finally, a summary of collector performance parameters generated to date as a result of simulator testing are given.

TM-78166 April 1978
Solar Activity During Skylab - Its Distribution and Relation to Coronal Holes. David M. Speich, Jesse B. Smith, Jr., Robert M. Wilson, and Patrick S. McIntosh. Space Sciences Laboratory. N78-22994

Solar active regions observed during the period of Skylab observations (May 1973-February 1974) have been examined for properties that varied systematically with location on the Sun, particularly with respect to the location of coronal holes. Approximately 90 percent of the optical and X-ray flare activity occurred in one solar hemisphere (136-315 heliographic degrees longitude). Active regions within 20 heliographic degrees of coronal holes were below average in lifetimes, flare production, and magnetic

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complexity. Histograms of solar flares as a function of solar longitude have been aligned with H α synoptic charts on which active region serial numbers and coronal hole boundaries have been added.

TM-78167 April 1978
Space Processing Applications Bibliography. N78-23115

This document is a bibliography of articles, papers, and reports which discuss various aspects of the use of the space environment for materials science research or for commercial enterprise. Since the use of the space environment for materials science is a relatively new undertaking, it is the intent of this document to provide a consolidated reference for those new to the field.

The references are arranged chronologically, and several cross references are provided, as well as instructions for procurement of references.

TM-78168 April 1978
Shear Strength of Fillet Welds in Aluminum Alloy 2219. Charles V. Lovoy. Materials and Processes Laboratory. N78-21495

Fillet welds in aluminum alloy 2219 (2319 filler) are used in the fabrication and assembly of components for the Solid Rocket Booster (SRB) forward and aft skirts, External Tank (ET), and other support equipment. The fillet weld size is normally specified on the engineering drawing and is a theoretical dimension. In this report fillet size is discussed in terms of theoretical or design dimensions versus as-welded dimensions, drawing attention to the inherent conservatism in the design load sustaining capabilities of fillet welds.

Problems associated with inspection of fillet welds are addressed and a comparison is

drawn between defect counts obtained by radiographic inspection and by visual examination of the fracture plane.

Fillet weld quality is related lineally to ultimate shear strength. Correlation coefficients are obtained by simple straight line regression analysis between the variables of ultimate shear strength and accumulative discontinuity summation. Shear strength allowables were found to be equivalent to 57 percent of butt weld "A" allowables (F_{tu}).

TM-78169** May 1978
Design and Operation of a Solar Heating and Cooling System for a Residential Size Building. N78-25546

The first year of operation of the Marshall Space Flight Center's Solar House is discussed. Selected design information, together with a brief system description, is included. The house is equipped with an integrated solar heating and cooling system which uses fully automated state-of-the-art equipment. Overall performance for the first year is summarized. In addition, information pertaining to modifications made to improve performance is provided, and problems encountered during operation are discussed.

Evaluation of data from the first year of operation indicates that the MSFC solar house heating and cooling system is capable of supplying nearly 100 percent of the thermal energy required for heating and approximately 50 percent of the thermal energy required to operate the absorption cycle air conditioner. The lower percentage of energy provided for the cooling mode as compared to the heating-mode is due to the significantly higher temperature needed to operate the air conditioner, requiring the solar collector to operate at low efficiencies due to the higher inlet temperatures. Operation of the facility in the cooling mode has shown the need for basic subsystem improvements such as

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The results show that the electrets (a passive device which needs no power) can be used effectively alongside existing measuring devices (which need power).

By placing electrets in areas where no power is available, measurements may be obtained. Consequently, it is a valuable complementary instrument in measuring rocket exhaust effluents in areas where other measuring devices may not be able to assess the contaminants.

TM-78172** May 1978
Hardware Problems Encountered in Solar Heating and Cooling Systems. Mitchell Cash. Solar Heating and Cooling Project Office. N78-25539

Marshall Space Flight Center personnel have worked for several years with the development and demonstration of solar heating and cooling systems in support of the Department of Energy. In this work, they have encountered numerous problems in the design, production, installation, and operation of the solar energy systems. Many of these problems have been seen in more than one system. This report describes the hardware problems, which range from simple to obscure and complex, and their resolution. It is intended to provide personnel in the solar energy field with information that will help prevent the installation of solar heating and cooling systems that will not operate satisfactorily or that will not last for the design lifetime.

TM-78173 May 1978
Spacelab Mission 1 Experiment Descriptions. Paul D. Craven, Editor. Space Sciences Laboratory.

This document presents brief descriptions of experiments and facilities planned for Spacelab 1. These experiments and facilities were selected from the responses to the Announcement of Opportunity for the first Spacelab mission.

TM-78174 April 1978
Solid Rocket Booster Thrust Vector Control Subsystem Test Report (D-1). Boris Pagan. Structures and Propulsion Laboratory. N78-25128

This report presents the results of the sequence of tests performed on the Space Shuttle Solid Rocket Booster thrust vector control subsystem by the Marshall Space Flight Center, Huntsville, Alabama. The tests were performed between July and December 1976.

The operational characteristics of the thrust vector control subsystem components, as determined from the tests, are discussed. Special analyses of fuel consumption, basic steady-state characteristics, GN₂ spin, and actuator displacement are presented which will aid in understanding the performance of the auxiliary power unit. The possibility of components malfunction is also discussed.

TM-78175 May 1978
Descriptions of Experiments Selected for the Space Transportation System (STS) Materials Processing in Space Program. Robert J. Naumann, Editor. Space Sciences Laboratory. N78-25103

This report presents the experiment description summaries for the first group of materials processing experiments planned for a Shuttle mission. The summaries give the objectives, the approach, the rationale for the use of space, and the anticipated results for each experiment. These experiments form the nucleus of the Materials Processing in Space program in the Shuttle era and provide the science requirements for the definition of the space processing facilities being developed for the Spacelab Module and Pallet.

TM-78176 June 1978
Weld Peaking on Heavy Aluminum Structures. E. Bayless, R. Poorman, and J. Sexton. Materials and Processes Laboratory. N78-25427

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Weld peaking is usually undesirable in any welded structure. In heavy structures, the forces involved in the welding process become very large and difficult to handle. With the Shuttle's Solid Rocket Booster, the weld peaking resulted in two major problems: (1) reduced mechanical properties across the weld joint and (2) fit-up difficulties in subsequent assembly operation. Peaking from the weld shrinkage forces can be fairly well predicted in simple structures; however, in welding complicated assemblies, the amount of peaking is unpredictable because of unknown stresses from machining and forming, stresses induced by the fixturing, and stresses from welds in other parts of the assembly.

When excessive peaking is encountered, it can be corrected using the shrinkage forces resulting from the welding process. Application of these forces is discussed in this report.

TM-78177 May 1978
An Analysis of Maximum Horizontal
Wind Speeds Recorded Since 1961 at
Kennedy Space Center, Florida.
Margaret B. Alexander. Space Sciences
Laboratory. N78-26702

This report presents tabulations of maximum horizontal wind speed values recorded at the Kennedy Space Center since the Space Sciences Laboratory's Atmospheric Sciences Division began monitoring the winds in the area at Launch Complex 34 in 1961. Monitoring programs and beginning dates also include Launch Complex 37 in 1963, NASA's 150-Meter Ground Winds Tower Facility in 1965, Launch Complex 39A in 1967, and Launch Complex 39B in 1968. As expected, maximum wind speeds were recorded during the eight hurricanes which have affected the area - Cleo in August 1964 through Agnes in June 1972. Detailed tabulations and frequency distributions of daily maximum horizontal wind speeds recorded at NASA's

150-Meter Ground Winds Tower Facility at nine levels from December 1965 through March 1970 are also included.

TM-78179** July 1978
Final Report on MSFC Assessment of
Owens-Illinois SUNPAK™ Collector
Problems. Bernhard L. Wiesenmaier.
Associate Director for Engineering
Office.

Responding to a request from Energy Research and Development Agency (ERDA), Marshall Space Flight Center (MSFC) conducted an in-depth assessment of problems encountered with the Owens-Illinois SUNPAK™ collector installed in several ERDA solar system demonstration sites. The assessment included analysis and independent tests of the collector in the MSFC Solar Simulator where the system failure conditions were duplicated. The assessment showed the basic design of the SUNPAK™ collector to be sound; however, material limitations dictate that near-term applications constraints be recognized by system designers. MSFC recommendations were presented to ERDA in March 1977. Subsequent retrofit activity by Owens-Illinois appears to have been effective in demonstrating the integrity of the SUNPAK™ collector.

TM-78180** August 1978
Corrosion Inhibitors for Solar Heating
and Cooling Systems. T. S. Humphries.
Materials and Processes Laboratory.

This is a continuation of the test program, that was previously reported (NASA TN D-8409, February 1977), to find suitable and effective inhibitors for solar heating and cooling systems. Inhibitors which appeared promising in the previous tests and additional inhibitors including several proprietary products were selected for evaluation. Evaluation of the inhibitors was based on corrosion protection afforded an

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aluminum-mild steel-copper-stainless steel assembly in a hot corrosive water. Two inhibitors were found to be effective and show promise for protecting multimetallic solar heating systems.

TM-78181 July 1978
Ground Winds for Kennedy Space Center, Florida (1978 Version). D. L. Johnson and S. C. Brown. Space Sciences Laboratory.

This report presents ground-level runway wind statistics for the Kennedy Space Center, Florida area. Crosswind, headwind, tailwind, and headwind reversal percentage frequencies are given with respect to month and hour for the Kennedy Space Center Space Shuttle runway. This document supersedes NASA CR-128995 and should be used in place of it.

TM-78182** July 1978
Development, Testing, and Certification of Life Sciences Engineering Solar Collector — Final Report. John M. Caudle. Solar Heating and Cooling Projects Office.

This document summarizes final results of Contract NAS8-32255 for the development of an air flat plate collector for use with solar heating, combined heating and cooling, and hot water systems. The contract was for final development, testing, and certification of the collector, and for delivery of a 320 ft² collector panel.

TM-78183 August 1978
Apollo Telescope Mount — A Partial Listing of Scientific Publications and Presentations, Supplement 2. Space Sciences Laboratory.

This report supplements NASA TMX-73300 and NASA TM X-73393. These reports are compilations of bibliographies from the principal investigator groups of the

Apollo Telescope Mount (Skylab solar observatory facility) that gathered data from May 28, 1973, to February 8, 1974. The analysis of these data is presently under way and is expected to continue for several years.

The publications listed in this report are divided into the following categories: (1) Journal Publications, (2) Journal Publications Submitted, (3) Other Publications, (4) Presentations — National and International Meetings, and (5) Other Presentations. An author index is included together with errata for the first report.

TM-78184 August 1978
Some Observations About Landsat Digital Analysis. Robert R. Jayroe, Jr. Data Systems Laboratory.

The results reported in this study support several hypotheses concerning Landsat data that need to be verified further or disproved by examining additional data and by independent investigation performed by other Landsat data users. The hypotheses are as follows:

1) Landsat does not discriminate vegetation types, but mostly sees chlorophyll and canopy cover.

2) A majority of the features in the ground scene possess linearly proportional amounts of "color" from each spectral band.

3) The data are continuous and as a result there is no true separability of ground scene features in the data, but some features possess an excess of color in a particular band pair.

4) There are relatively few features present in the spectral data, and these do not correspond to the conventional definitions that are used.

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5) Aside from seasonal effects, in a distributional sense all Landsat data are essentially the same. The only difference is the way the data are spatially arranged in the image.

TM-78185 July 1978
Sizing Tube-Fin Space Radiators. Jerry A. Peoples. Preliminary Design Office.

Temperature and size considerations of the tube-fin space radiator are characterized by charts and equations. An approach of accurately assessing rejection capability commensurate with a phase A/B level output is reviewed using the analytical techniques developed by Donald B. Mackey. A computer program, based on Mackey's equations, is also presented which sizes the rejection area for a given thermal load. The program also handles the flow and thermal considerations of the film coefficient.

TM-78187 August 1978
SRB Materials and Processes Assessment from Laboratory and Ocean Environmental Tests. Materials and Processes Laboratory.

The Materials and Processes Laboratory at the Marshall Space Flight Center recognized early in the Shuttle program that material performance on a long-term basis would be critical to the success of the Shuttle and its goal of reusable components. The laboratory instituted, in-house, a comprehensive series of materials tests simulating exposure of the refurbishable components of the propulsion system to expected flight and marine environments. These tests were subsequently expanded to include ocean environment exposure of these laboratory type samples. An Integrated Test Bed of 3.048 m (10 ft) diameter by 2.438 m (8 ft) high was also fabricated in support of this program. The Integrated Test Bed allowed large scale evaluation of principal manufacturing, insulating, cleaning and refurbishment methods.

This report gives the results and an assessment of the series of ocean environment tests that were conducted at Panama City and Kennedy Space Center, Florida, during the Spring and Summers of 1976 and 1977.

TM-78188* September 1978
The MSFC Complementary Metal Oxide Semiconductor (Including Multilevel Interconnect Metallization) Process Handbook. David L. Boulding, Richard W. Eastes, William R. Feltner, Ben R. Hollis, and Donald E. Routh. Electronics and Control Laboratory.

The fabrication techniques and procedure details for creation of Complementary Metal Oxide Semiconductor integrated circuits at George C. Marshall Space Flight Center are described. A unique feature of the MSFC process has been included, i.e., the use of multilevel metal interconnect patterns. Examples of C-MOS integrated circuits fabricated at MSFC with functional descriptions of each are given. Typical electrical characteristics of both P-channel Metal Oxide Semiconductor and N-channel Metal Oxide Semiconductor discrete devices under given conditions are provided. A general description of MSFC design, mask making, packaging, and testing procedures is included.

The capabilities described in this report are being utilized in: (1) research and development of new technology, (2) education of individuals in the various disciplines and technologies in the field of microelectronics, and (3) fabrication of many types of specially designed integrated circuits, which are not commercially feasible in small quantities, for in-house research and development programs.

TM-78189 August 1978
Radiative and Gas Cooling of Falling Molten Drops. Michael B. Robinson. Space Sciences Laboratory.

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This report calculates the supercooling rate and solidification time for molten drops of niobium, copper, and lead. Calculations for both radiation and helium gas cooling are presented in order to estimate the influence that the presence of helium gas would have upon the cooling rate of falling drops in the Marshall Space Flight Center space processing drop tube.

TM-78190

August 1978

Instruments for Measuring the Amount of Moisture in the Air. Dale L. Johnson. Space Sciences Laboratory.

This report presents a summarization and discussion of the many systems available today for measuring moisture in the atmosphere. Conventional methods used in the field of meteorology and methods used in the laboratory are discussed. Performance, accuracies, and response of the instruments are presented as well as the advantages and disadvantages of each. Methods of measuring humidity aloft by instrumentation onboard aircraft and balloons are given, in addition to the methods used to measure moisture at the Earth's surface. Much of the information contained in this report has been summarized from books, papers, and documents available in the open literature which are included as references.

TM-78191

August 1978

Evaluation of AAFE Apparatus to Measure Residual and Transient Convection in Zero-Gravity. R. C. Ruff, B. R. Facemire, and W. K. Witherow. Space Sciences Laboratory.

This report presents the results of an evaluation of an apparatus built by the Jet Propulsion Laboratory under Advanced Applications Flight Experiment (AAFE) program funding. The results are expected to contribute to an improved design for a Fluid

Experiments System (FES) planned for Spacelab 3. The detailed results are presented in four categories: (1) human factors, (2) electrical and mechanical, (3) optical performance, and (4) thermal performance.

*Blue cover reports printed at Langley.

**DOE/NASA reports.

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TP-1071 November 1977
Development of a Procedure to Model High-Resolution Wind Profiles from Smoothed or Low-Frequency Data. Dennis W. Camp. Space Sciences Laboratory. N78-11642

The FPS-16 radar/Jimsphere system used to obtain wind profile data for the altitude layer between the surface and approximately 18 km provides the most accurate and detailed wind measurements currently available. Therefore, this type of data has proven to be of exceptional value for use in aerospace research and development programs. With the advent of the Space Shuttle program, the importance of this type of data was again noted. However, the quantity of data necessary to provide the reliable high-resolution wind profiles for one of the possible launch sites, Vandenberg Air Force Base, California, was not available. The fact that sufficient time to obtain the data did not exist posed the problem of how the high-resolution wind profiles needed for the Space Shuttle program were to be developed. The method used to resolve this problem is the subject of this report; that is, the derivation of simulated Jimsphere wind profiles from low-frequency rawinsonde data and a generated set of white noise data. A computer program is developed to model high-resolution wind profiles based on the statistical properties of data from the Kennedy Space Center, Florida. Comparison of the measured Jimsphere data, rawinsonde data, and the simulated profiles shows excellent agreement. These simulated Jimsphere wind profiles will be used in design verification studies of the Space Shuttle operation for Vandenberg Air Force Base, California.

TP-1073 November 1977
Research in the Use of Electrets in Measuring Effluents from Rocket

Exhaust of the Space Shuttle (6.4 Percent Scaled Model) and Viking I Launch. Michael Susko. Space Sciences Laboratory. N78-11517

The purpose of this experimental research was to investigate electrets, a new device used to detect the chemical composition of rocket exhaust effluents. In assessing the effectiveness of electrets, comparisons were made with hydrogen chloride measuring devices from chamber and field tests and computed results from the NASA/MSFC Multilayer Diffusion Model.

The experimental data used in this investigation were obtained from the 18 static test firings at Marshall Space Flight Center, Huntsville, Alabama, chamber tests at Arnold Engineering Development Center, Tullahoma, Tennessee, and the Viking I launch to Mars on August 20, 1975, from Kennedy Space Center, Florida.

The results show that electrets have multipollutant measuring capabilities, simplicity of deployment, and speed of assessment. The electrets compared favorably with other hydrogen chloride measuring devices. The summary of the measured data from the electrets and the hydrogen chloride detectors is within the upper and lower bounds of the computed hydrogen chloride concentrations from the NASA/MSFC Multilayer Diffusion Model.

TP-1074 November 1977
A Design Handbook for Phase Change Thermal Control and Energy Storage Devices. William R. Humphries and Edwin I. Griggs. Structures and Propulsion Laboratory. N78-15434

This document gives a comprehensive survey of the thermal aspects of phase change

material devices. Fundamental mechanisms of heat transfer within the phase change device are discussed. Performance in zero-g and one-g fields are examined as it relates to such a device. Computer models for phase change materials, with metal fillers, undergoing conductive and convective processes are detailed. Using these models, extensive parametric data are presented for a hypothetical configuration with a rectangular phase change housing, using straight fins as the filler, and paraffin as the phase change material. These data are generated over a range of realistic sizes, material properties, and thermal boundary conditions. A number of illustrative examples are given to demonstrate use of the parametric data. Also a complete listing of phase change material property data are reproduced herein as an aid to the reader.

TP-1088 November 1977
Performance Analysis of Grazing Incidence Imaging Systems. Carl E. Winkler and Dietrich Korsch. Space Sciences Laboratory. N78-11812

An exact expression relating the coordinates of a point on the incident ray, a point of reflection from an arbitrary surface, and a point on the reflected ray is first derived. The exact relation is then specialized for the case of grazing incidence, and first-order and third-order systematic analyses are carried out — first for a single reflective surface and then for a combination of two surfaces. The third-order treatment yields a complete set of primary aberrations for single-element and two-element systems. The importance of a judicious choice for a coordinate system in showing field curvature to clearly be the predominant aberration for a two-element system is discussed. The validity of the theory is verified through comparisons with the exact ray-trace results for the case of the telescope.

TP-1164 February 1978
Analysis of Data Systems Requirements for Global Crop Production Forecasting

in the 1985 Time Frame. Sanford W. Downs, Paul A. Larsen, and Dietwald A. Gerstner. Data Systems Laboratory.

N78-18497

Starting with the description for the Global Crop Production Forecasting objective as given in "Outlook for Space," Marshall Space Flight Center undertook the task to define the data systems concepts that would be needed to implement this objective in an orderly transition from experimental to operational status in the 1985 time frame. The objective was carefully examined with consideration of the data system implications. Cognizant personnel were interviewed; data processing facilities were surveyed; the impact of future technology development was assessed; pertinent documentation was studied; and previous and current activities in this objective area were evaluated. This investigation served as the foundation for quantifying the objective by obtaining from the most important users their projected information needs. These information needs were then converted into data system requirements, and the influence of these requirements on the formulation of a conceptual data system was analyzed. Any potential problem areas in meeting these data requirements were then identified in an iterative process whereby the scoped objective was further refined as the analysis continued and recommended solutions and alternatives were developed.

TP-1220 April 1978
Evaluation of Materials for High Performance Solar Arrays (Status Report No. 1). A. F. Whitaker, C. F. Smith, Jr., C. L. Peacock, Jr., and S. A. Little. Materials and Processes Laboratory.

N78-22233

A program has been underway to evaluate materials for advanced solar arrays which are required to provide power to weight ratios up to 100 W/kg. Severe mission environments together with the lack of

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knowledge of space environmental materials degradation rates require the generation of irradiation and outgassing engineering data for use in the initial design phase of the flight solar arrays. Therefore, approximately 25 candidate array materials were subjected to selected mission environments of vacuum, UV, and particle irradiation, and their mechanical and/or optical properties were determined where appropriate.

TP-1225 May 1978
Nuclear Waste Disposal in Space. R. E. Burns, W. E. Causey, W. E. Galloway, and R. W. Nelson. Systems Analysis and Integration Laboratory. N78-23571

This report presents a summary of a work on nuclear waste disposal in space conducted by the George C. Marshall Space Flight Center, National Aeronautics and Space Administration, and the following contractors: Battelle, Inc.; Northrop Services, Inc.; and Science Applications, Inc. From the aggregate studies, it is concluded that space disposal of nuclear waste is technically feasible.

The preferred baseline is as follows:

Kind of waste considered – Domestic civilian.

Waste mix to be carried – All wastes excluding unburned uranium and reactor cladding hulls. Carrying plutonium is optional.

Waste form – Calcine or calcine in metal matrix.

Launch site – Kennedy Spaceflight Center or a remote complex.

Launch vehicle – Space Shuttle.

Upper stage – LOX/H₂ high performance OTV.

Space destination – Lunar crater or solar orbit.

Safety philosophy – Work around to all system failures.

It is assumed that this report will be used in conjunction with the contractor reports.

TP-1227 May 1978
A Numerical Solution of the Navier-Stokes Equations for Chemically Nonequilibrium, Merged Stagnation Shock Layers on Spheres and Two-Dimensional Cylinders in Air. Kenneth D. Johnston and William L. Hendricks. Systems Dynamics Laboratory. N78-23390

Results of solving the Navier-Stokes equations for chemically nonequilibrium, merged stagnation shock layers on spheres and two-dimensional cylinders are presented. The effects of wall catalysis and slip are also examined. The thin shock layer assumption is not made, and the thick viscous shock is allowed to develop within the computational domain. The results show good comparison with existing data. Due to the more pronounced merging of shock layer and boundary layer for the sphere, the heating rates for spheres become higher than those for cylinders as the altitude is increased.

TP-1279 July 1978
Low Toxic Corrosion Inhibitors for Aluminum in Fresh Water. T. S. Humphries. Materials and Processes Laboratory. N78-28226

Combinations of chemical compounds that reportedly reduce the corrosion of

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aluminum in fresh water were evaluated. These included combinations of borates, nitrates, nitrites, phosphates, silicates, and mercaptobenzothiazole. Eight of fifty inhibitor combinations evaluated gave excellent corrosion protection and compared favorably with sodium chromate, which has generally been considered standard for many years.

TP-1280 July 1978
Thermodynamic and Chemical Parameters of the Exhaust Effluents from the HARPOON Booster Motor. J. Briscoe Stephens and Arnold I. Goldford. Space Sciences Laboratory. N78-28682

The exhaust products from the HARPOON booster motors have been analyzed using both thermodynamic analysis and finite-rate chemistry. The resulting constituents are presented together with a discussion of the techniques employed.

TP-1313 August 1978
Disposal of Radioactive Iodine in Space. Rowland E. Burns and J. Gregory Defield. Systems Analysis and Integration Laboratory.

The possibility of space disposal of iodine waste from nuclear power reactors is investigated. The space transportation system utilized relies upon the Space Shuttle, a liquid hydrogen/liquid oxygen Orbit Transfer Vehi-

cle (OTV), and a solid propellant final stage. The iodine is assumed to be in the form of either an iodide or an iodate, and calculations assume that the final destination is either solar orbit or solar system escape.

It is concluded that space disposal of iodine is feasible.

TP-1328 September 1978
The Effects of Curvature and Viscosity on Baroclinic Instability – A Two-Layer Model. William W. Fowlis and Salvador Arias. Space Sciences Laboratory.

A linear stability analysis of a baroclinic zonal current contained between two parallel rigid boundaries is presented. Curvature is included by performing the analysis on a β -plane and viscosity by allowing for the effects of Ekman layers on the rigid boundaries. A two-layer model is used. This calculation was carried out to assist in the design of a spherical model of the general circulation of the Earth's atmosphere for Spacelab. In the low-gravity environment on an orbiting vehicle, a dominant radial dielectric body force, analogous to planetary gravity, can be achieved over a volume of liquid held between two concentric spheres. The results show the Eady short wavelength cutoff, and long wavelength cutoffs due to Ekman damping and curvature.

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nology. September 10-12, 1978. Presen-
tation at the IAFC Annual Conference
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| <p>LANIER, J. R., JR. EC12
KAPUSTKA, ROBERT E. EC12
PERRY, EUGENE EC12
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kW Power Module. June 13-15, 1978.
Presentation at the Power Electronics
Specialists Conference to be held at
Syracuse, New York.</p> | <p>LIFER, C. E. EP41
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An Electrical Power System for a 25/100
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Presentation at the Power Electronics
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Syracuse, New York.</p> | <p>LOMBARDO, J. A. EP21
BLOUNT, D. H. EP24
Continuous Mode Propulsion: An Exten-
sion of Mixed Mode Optimization.
February 13-16, 1978. Presentation at
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rence to be held at Incline Village,
Nevada.</p> |

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- LUNDQUIST, C. A. ES01
JOHNSON, W. G. ES01
SMITH, J. B. NOAA
Modulation of Atmospheric Ionization Corresponding to ^{14}C Production Variations. May 29 - June 19, 1978. Presentation at the 21st COSPAR Meeting, International Symposium on Solar Terrestrial Physics to be held at Innsbruck, Austria.
- LUNDQUIST, CHARLES A. ES01
VAUGHAN, WILLIAM W. ES81
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- McDONOUGH, G. F. EF01
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- McMILLAN, R. S. ES62
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TAPIA, S. University of Arizona
Discovery of Linearly Polarized Continuum Light Scattered by the Shell Around Alpha Orionis. Published in the Bulletin of the AAS, 152nd Meeting of the AAS.
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TAPIA, S. University of Arizona
Discovery of Polarized Light Scattered by Dust Around Alpha Orionis. Published in Astrophysical Journals (Letters) Center for Astrophysics.
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An Evaluation of Grease Type Ball Bearing Lubricants Operating in Various Environments (Status Report No. 3). October 1978. Presentation at the ASLE Annual Conference to be held in Minneapolis, Minnesota.
- MEEGAN, C. A. ES62 (NAS/NRC)
FISHMAN, G. J. ES62
HAYMES, R. C. Rice University
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- MIDDLETON, ROBERT L. FA33
Solar Heating and Cooling Commercial Demonstration Program at MSFC - Some Problems and Conclusions. April 27, 1978. Presentation at the Fifteenth Space Congress to be held at Cape Canaveral, Florida.
- MILLER, EDGAR R. ES64
Shuttle Induced Environment Contamination Monitors. March 7-9, 1978. Presentation at the International Spacecraft Contamination Conference to be held at Colorado Springs, Colorado.

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BOLTZ, ROBERT C.
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- TODD, PAUL Pennsylvania State University
KUKULINSKY, NANCE E.
Pennsylvania State University
A Citrate Buffer System for Isoelectric
Focusing and Electrophoresis of Living
Mammalian Cells. Submitted to Mono-
graph, Electrophoresis 1978.
- MITCHELL, ROYCE E. EE11
Recovery Subsystem: An Overview.
March 5-7, 1979. Presentation at the
Sixth Aerodynamic Decelerator Con-
ference, AIAA, to be held at Houston,
Texas.
- MORDAN, G. W. PF10
24 kW Power Module: The First Step
Beyond the Baseline STS. September
27-29, 1978. Presentation at the AIAA
Conference on Space Platforms: Future
Needs and Capabilities to be held at Los
Angeles, California.
- MOSES, JAMES L. EP45
FOGAL, GORDON I. General Electric
SCOLLON, THOMAS R. General Electric
Atmospheric Cloud Physics Laboratory
Thermal Control. July 10-13, 1978.
Presentation at the 8th Intersociety
Conference on Environment Systems to
be held at San Diego, California.
- NAUMANN, ROBERT J. ES71
Materials Processing in Space: A Strategy
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Processing in Space. May 29 - June 19,
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Meeting, Working Group 8, Materials
Science in Space, to be held at
Innsbruck, Austria.
- NICOLAS, DAVID P. EC43
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Microscope in Microcircuit Failure Anal-
ysis. December 11-15, 1978. Presenta-
tion at the ASME winter Annual Meeting
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FOUNTAIN, WALTER F. ES62
GARY, G. A. ES62
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Presentation at the 152nd Meeting of the
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- ODOM, JAMES B. SA31
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Technology Down to Earth. May 16,
1978. Presentation at CRYO 1978 to be
held at Oak Brook, Illinois.
- OONK, R. L. Solaron Corporation
SHAW, L. E. Solaron Corporation
CASH, MITCHELL FA32
HUGHES, P. J.
Solar Energy Laboratory, Univ. of Wisconsin
MITCHELL, J. W.
Solar Energy Laboratory, Univ. of Wisconsin
Performance of Solar-Desiccant Cooling
Systems in New York City. August
28-30, 1978. Presentation at the
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SHAW, L. E.	Solaron Corp.	ASKINS, BARBARA	ES52
CASH, M.	FA32	Potential Reduction of X-Ray Exposure through Autoradiographic Intensification of Underexposed Radiographs. Published in Medical Imaging.	
	Simulation of Air Based Solar Desiccant Cooling System. February 14-16, 1978. Presentation at the Solar Cooling Workshop to be held at San Francisco, California.		
OWEN, ROBERT B.	ES83	REASONER, DAVID L.	ES53
LIU, HUA-KUANG		Substorm-Associated Worm Plasmas of Ionospheric Origin Observed at Synchronous Orbit. February 8-11, 1978. Presentation at the NASA/American Geophysical Union Solar-Terrestrial Coupling Conference to be held at Yosemite National Park, California.	
	University of Alabama in Huntsville A Coherent Optical Correlation Study of Surface Displacement: Submitted to Applied Optics.		
PALUDAN, C. T. N.	EF02	REYNOLDS, J. M.	ES61
CSATI, E.	Budapest, Hungary	FIELDS, S. A.	ES61
	Eulusmap, an International Land Resources Map Utilizing Satellite Data. October 1-8, 1978. Presentation at the XXIX Congress, International Astronautical Federation to be held at Dubrovnik, Yugoslavia.	HOLLAND, R. L.	ES61
		X-Ray Reflectometer for Optical Efficiency and Scatter Measurements. Published in The Review of Scientific Instruments.	
PETERS, P. N.	ES63	RICE, WILLIAM C.	SA41
HOLDEMAN, L. B.	NBS	Economics of the Solid Rocket Booster for Space Shuttle. October 1-8, 1978. Presentation at the XXIX IAF - Congress 1978 to be held at Dubrovnik, Yugoslavia.	
	Superconducting Properties of Iridium Thin Films. August 23-29, 1978. Presentation at the 15th International Conference on Low Temperature Physics to be held at Grenoble, France.		
PRICE, JOHN M.	FA31	RUFF, R. C.	ES74
	Rankine Cycle Machine for Solar Cooling. November 27-29, 1978. Presentation at the AIAA Conference on Solar Energy: Technology Status to be held at Phoenix, Arizona.	ORAN, W. A.	ES74
		RATHZ, T.	ES74
		Mass Spectrometer for IECM. March 7-9, 1978. Presentation at the International Spacecraft Contamination Conference to be held at Colorado Springs, Colorado.	
		RUNKLE, ROY E.	EP14
		Space Shuttle Solid Rocket Booster Decelerator Subsystems - Air Drop Test	

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- Vehicle/B-52 Design. March 5-7, 1979. Presentation at the AIAA 6th Aerodynamic Decelerator Conference to be held at Houston, Texas.
- RUNKLE, ROY E. EP14
Space Shuttle Solid Rocket Booster Decelerator Subsystem Drop Test 3 - Anatomy of a Failure. March 5-7, 1979. Presentation at the AIAA 6th Aerodynamic Decelerator Conference to be held at Houston, Texas.
- RUTLAND, CARY H. PS04
Skylab Rehabilitation. September 27-29, 1978. Presentation at the AIAA Conference on Large Space Platforms, Future Needs and Capabilities to be held at Los Angeles, California.
- SCHUTZENHOFER, L. A. ED23
HOWARD, P. W. ED23
CLEVER, W. W. ED23
GUEST, S. H. ED23
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- SCOTT, FRANCES E. MSFC
ZACHARY, A. University of Maryland
TAYLOR, M. E. University of Maryland
COLWELL, R. R. University of Maryland
A Method for Rapid Evaluation of Materials for Susceptibility to Marine Biofouling. Submitted to the International Biodeterioration Bulletin (England).
- SELTZER, S. M. ED12
Brief Description of Instrument Pointing System Dynamics and Control. March 10-14, 1978. Presentation at the Rocky Mountain Guidance and Control Conference to be held at Keystone, Colorado.
- SELTZER, S. M. ED12
Panel Discussion: Dynamics and Control of Large Space Structures. March 10-14, 1978. Presentation at the Rocky Mountain Guidance and Control Conference to be held at Keystone, Colorado.
- SELTZER, S. M. ED12
LIKINS, PETER W. Columbia University
Satellite Instrument Flexibility Specification Using Parameter Plane Stability Analysis. June 1978. Presentation at the 8th U.S. National Congress of Applied Mechanics to be held at Los Angeles, California.
- SFORZINI, RICHARD H. Auburn University
FOSTER, W. A., JR. Auburn University
SHACKELFORD, BENJAMIN W., JR. EP25
Effects of Solid-Propellant Temperature Gradients on the Internal Ballistics of the Space Shuttle. July 25-27, 1978. Presentation at the AIAA/SAE 14th Joint Propulsion Conference to be held at Las Vegas, Nevada. Published in the Journal of Spacecraft and Rockets.
- SHELTON, BILLY W. PD24
Advanced Earth-to-Orbit Transportation System/Candidate Propulsion Systems. July 24-26, 1978. Presentation at the 16th AIAA/SAE Joint Propulsion Conference to be held at Las Vegas, Nevada.
- SHIPMAN, DAVID L. EL12
Payload Specialist Training Scheduler (Pacts). December 4-6, 1978. Presentation at the 1978 Winter Simulation Conference to be held at Miami Beach, Florida.

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SMITH, J. B., JR.	ES52	SMITH, R. E.	ES81
SPEICH, D. M.	ES52	HUNG, R. J.	UAH
WILSON, R. M.	ES52	PHAN, T.	UAH
REICHMANN, E. J.	ES52	Correlation of Convective Overshooting Turrets and Gravity Waves Associated with Severe Storms. December 1977. Presentation at the AGU Fall Meeting 1977 to be held at San Francisco, California.	
Long Duration Soft X-Ray Transients: Physical Parameters and Morphology. Published in the Proceedings of the L. D. deFeiter Memorial Symposium on the Study of Traveling Interplanetary Phenomena.			
SMITH, R. E.	ES81	SMITH, R. E.	ES81
HUNG, R. J.	UAH	HUNG, R. J.	UAH
Environmental Forecasting by Using Ionospheric Observations on Acoustic-Gravity Waves Associated with Severe Storms. January 7-8, 1978. Presentation at "Effects of Ionosphere on Space and Terrestrial Systems" to be held at Arlington, Virginia.		PHAN, T.	UAH
		Doppler Sounder as Remote Sensing for Detection and Prediction of Severe Storms. January 16-18, 1978. Presentation at the AIAA 16th Aerospace Sciences Meeting to be held at Huntsville, Alabama.	
SMITH, R. E.	ES81	SMITH, R. E.	ES81
HUNG, R. J.		HUNG, R. J.	
University of Alabama in Huntsville		University of Alabama in Huntsville	
Ray Tracing of Medium Scale Traveling Ionospheric Disturbances (Gravity Waves) Associated with Both a Group of Tornadoes and Isolated Tornadoes. July 31 - August 8, 1978. Presentation at the XIXth General Assembly USRI to be held at Helsinki and Espoo, Finland.		PHAN, T.	
		University of Alabama in Huntsville	
		Ionospheric Doppler Sounder for Detection and Prediction of Severe Storms. Submitted to the AIAA Journal.	
SMITH, R. E.	ES81	SMOLLEN, J. W., III	EG23
HUNG, R. J.	UAH	Transfer of Remote Sensing Technology to New Orleans Planning Organizations. April 11, 1978. Presentation at the Association of American Geographers Annual Meeting to be held at New Orleans, Louisiana.	
KUO, J. P.	UAH		
Speculation of Gravity Waves from Hurricane Eloise. December 1977. Presentation at the 11th Hurricane Conference to be held at Miami, Florida.		SNODDY, WILLIAM C.	ES51
		Scientific and Technical Application of a Tethered Satellite System. January 15-17, 1979. Presentation at the AIAA 17th Aerospace Sciences Meeting to be held at New Orleans, Louisiana.	

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| STEWART, RODNEY D. | EL02 | TANDBERG-HANSSSEN, E. | ES51 |
| The Uses of Manhour and Material-Based Industrial Engineering Type Independent Cost Estimates. Submitted to The Government Executive. | | STEINOLFSON, R. S.
University of Alabama in Huntsville | |
| SUSKO, MICHAEL | ES84 | WU, S. T. | |
| Electrets Used in Measuring Effluents from Space Shuttle Model and Viking I Launch. Submitted to the Journal of Geophysical Research. | | University of Alabama in Huntsville
Dryer, M. NOAA/ERL | |
| SUTHERLAND, P. G. | ES62 | Magnetohydrodynamic Models of Coronal Transients in the Meridional Plane, I. The Effect of the Magnetic Field. Published in the Astrophysical Journal. | |
| WEISSKOPF, M. C. | ES62 | TAYLOR, KENNETH R. | PS06 |
| CANIZARES, C. R. | ES62 | Requirements and Resources for Materials Processing in Space. September 27-29, 1978. Presentation at the AIAA Conference on Space Platforms to be held at Los Angeles, California. | |
| Time Variability of Cygnus X-1 from SAS-3 Data. September 12-14, 1978. Presentation at the 1978 Annual HEAD Meeting on X-Ray and Gamma-Ray Astronomy to be held at La Jolla, California. | | TEUBER, D. L. | ES51 |
| TANDBERG-HANSSSEN, E. | ES51 | BREWER, G. A. | ES51 |
| COMFORT, R. H. | ES51 | HAGYARD, M. J. | ES51 |
| WU, S. T. | | REICHMANN, E. J. | ES51 |
| University of Alabama in Huntsville
Non-Force-Free Solar Magnetic Fields in Magnetohydrostatic Equilibrium. Submitted to Astrophysical Journal. | | Image Data Processing for Displaying Correlations Between Coronal Holes and Extrapolated Solar Magnetic Fields. May 29 - June 3, 1978. Presentation at the International Symposium on Solar Terrestrial Physics to be held at Innsbruck, Austria. Published in Solar Physics. | |
| TANDBERG-HANSSSEN E. | ES51 | TEUBER, D. | ES51 |
| NAKAGAWA, Y. | UAH | Principal Component Analysis of Solar Flares in the Soft X-Ray Flux. May 29 - June 3, 1978. Presentation at the International Symposium on Solar-Terrestrial Physics to be held at Innsbruck, Austria. Submitted to the Journal of Physics and Astrophysics. | |
| WU, S. T. | | | |
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| TANDBERG-HANSSSEN, E. | ES51 | | |
| SHEELEY, N. R. | | | |
| U.S. Naval Research Laboratory | | | |
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- THOMAS, CHARLES N. FA32
Domestic Hot Water System for the Southeast. April 17-19, 1978. Presentation at the Third Southeastern Conference on Application of Solar Energy, Short Course on Energy Conservation and Exhibitions to be held at Huntsville, Alabama.
- THOMAS, CHARLES N. FA31
Results of Operational Testing on Direct and Indirect Types of Solar Domestic Hot Water Systems. August 28-31, 1978. Presentation at the Annual Meeting of American Section of International Solar Energy Society to be held at Denver, Colorado.
- THOMAS, CHARLES N. FA32
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- TURNER, JAMES R. PD21
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Super Fluid Plug as a Control Device for Helium Coolant. Published in the Proceedings of the 71st Annual Meeting: American Institute of Chemical Engineers.
- VAUGHAN, OTHA H., JR. ES83
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- VAUGHAN, O. H. ES83
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Numerical Simulation of Warm Fog and Its Application to Warm Fog Prediction and Modification. November 13-17, 1978. Presentation at the AMS/AIAA Conference on Atmospheric Environment of Aerospace Systems and Applied Meteorology to be held at New York, New York.
- VON TIESENHAUSEN, GEORG F. PS01
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- WAITES, HENRY B. ED12
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| Rankine Cycle Machine for Solar Cooling. July 10-15, 1978. Presentation at the First International Conference on Energy and Community Development to be held at Athens, Greece. | | SMITH, J. B., JR. | ES52 |
| | | SPEICH, D. M. | ES52 |
| | | Physical Parameter Determination of the 9 August 1973 Subflare. Published in the Astrophysical Journal (Letters). | |
| WEISSKOPF, M. C. | ES61 | WITHEROW, WILLIAM K. | ES74 |
| SUTHERLAND, P. G. | ES62 | A High Resolution Holographic Particle Sizing System. Submitted to Optical Engineering. | |
| The Short-Term Time Variability of Circinus X-1 - A Comparison with Cygnus X-1. September 12-14, 1978. Presentation at the 1978 Annual HEAD Meeting on X-Ray and Gamma-Ray Astronomy to be held at La Jolla, California. Published in the Bulletin of the American Astronomical Society. | | WOJTALIK, FRED S. | EE71 |
| | | High Energy Astronomy Observatory Program (HEAO). June 12-16, 1977. Presentation at the Seventh IFAC World Congress to be held at Helsinki, Finland. | |
| WEISSKOPF, M. C. | ES61 | WU, S. T. | ES52 |
| SUTHERLAND, P. G. | MIT | REICHMANN, E. J. | ES52 |
| CANIZARES, C. R. | MIT | SMITH, J. B. | ES52 |
| A Measurement of the Time Sense of the Shot Noise Pulses from Cygnus X-1. Published in the Bulletin of the American Astronomical Society. | | HAGYARD, M. J. | ES52 |
| | | Energy Budget, Morphology and Evolution of McMath 14953. May 31, 1978. Presentation at the UAG Report to be held at Boulder, Colorado. | |
| WEST, EDWARD A. | ES52 | WYMAN, CHARLES L. | EE01 |
| Extending the Field of View of KD*P Electro-Optic Modulators. Published in Applied Optics. | | An Ultraviolet Polarimeter for the Solar Maximum Mission. Submitted to Optical Engineering, Journal of SPIE. | |
| WILSON, R. M., et al. | ES52 | WYMAN, CHARLES L. | EE01 |
| Magnetohydrodynamic Models of Coronal Transients in the Meridional Plane II. Simulation of the Coronal Transient of 1973 August 21. Submitted to the Astrophysical Journal. | | A Measurement Program to Examine Scattering and Reflection Characteristics of X-Ray Optics. Submitted to Optical Engineering, Journal of SPIE. | |
| WILSON, R. M. | ES52 | YOUNG, LEIGHTON E. | EC12 |
| SMITH, J. B. | ES52 | Development and Test of Solar Cells for Solar Electric Propulsion. June 5-8, 1978. Presentation at the IEEE Photovoltaics Specialists Conference to be held at Washington, D.C. | |
| SPEICH, D. M. | ES52 | | |
| Physical Parameters Analysis of an Intense Compact Sub-Flare. Submitted to Astronomy and Astrophysics (Europe). | | | |

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YOUNG, Leighton E. EC12
BARAONA, COSMO R.

Lewis Research Center
Status of Wraparound Contact Solar
Cells and Arrays. August 20-25, 1978.
Presentation at the 13th Intersociety
Energy Conversion Engineering Con-
ference to be held at San Diego,
California.

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- CP-2019 May 11-12, 1977
ASPE/MSFC Symposium Engineering
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Technology. N77-30273
- CP-2024 February 14-16, 1977
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Conducted at the Utah State University,
Logan, Utah. Prepared by Space Sciences
Laboratory. N77-32549
- CP-2026 May 26-27, 1976
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- CP-2027 September 20-21, 1977
Microelectronics for the Nineteen
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Valley Chapter. Conducted at MSFC.
- CP-2028 March 1977
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ological and Environmental Inputs to
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- CP-2037 October 13-17, 1977
Guntersville Workshop on Solar-
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papers from a University of Alabama in
Huntsville/NASA Workshop. Conducted
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vention Center, Guntersville, Alabama.
- CP-2039 March 7-9, 1978
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national Spacecraft Contamination Con-
ference. Conducted at Colorado Springs,
Colorado. Published jointly with USAF
(printed by USAF).
- CP-2040 October 18-19, 1977
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posium. Albert Castelli, Editor.
- CP-2056 April 10-11, 1978
Exploratory Meeting on Atmospheric
Electricity and Severe Storms. Con-
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William W. Vaughan, Editor.
- CP-2057 March 28-30, 1978
Proceedings: Second Annual Workshop
on Meteorological and Environmental
Inputs to Aviation Systems. Conducted
at University of Tennessee Space Insti-
tute. Walter Frost and Dennis Camp,
Editors.
- CP-2062 September 1978
Seventh NASTRAN User's Colloquium,
Papers to be presented at MSFC first
week in October 1978. Bob McComas.

APPROVAL

FY1978 SCIENTIFIC AND TECHNICAL REPORTS,
ARTICLES, PAPERS, AND PRESENTATIONS

Compiled by O. L. White

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

A handwritten signature in cursive script, appearing to read "J. T. Shepherd", is written over a solid horizontal line.

J. T. SHEPHERD

Director, Administration and Program Support