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

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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.

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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.
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."

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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 contiguous 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).

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, astrodynamical 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...

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

TM-78125
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

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.
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.

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

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.

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

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.

Spacelab Baseline ECS Trace Contaminant Removal Test Program. C. D. Ray and J. B. Stanely. Structures and Propulsion 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.


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 \( R(uv) \).

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
Film, Containerless Processing of Beryllium, and Contact and Coalescence of Viscous Bodies.

TM-78138 October 1977

This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY 77. It also includes papers of MSFC contractors.

After being announced in STAR or LSTAR, 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.

TM-78139 September 1977

A statistical summary is presented of vertical wind speed data recorded at NASA's 150-Meter Ground Winds Tower Facility on Merritt Island, Kennedy Space Center, Florida. One year of continuous around-the-clock vertical wind speed measurements processed by the Automatic Data Acquisition System (ADAS) is classified as a function of tower level (10, 18, 60, and 150 meters) and period of reference [day, month, season: winter (October through March) and summer (April through September), and annual].

Intensity, frequency, time of occurrence, prevailing conditions, etc., of the daily maximum vertical gusts (i.e., updraft and downdraft) are determined. The results are compared with the vertical gusts associated with the daily maximum horizontal gust. The intent of this summarization of vertical wind speed data is to provide a general description of wind flow in the lower 150 meters of the atmosphere for the identification of hazards involved in wind shear encounters relative to ascent and descent of the Space Shuttle and conventional aircraft.

TM-78140 September 1977

The Image Data Processing System (IDAPS) at the Marshall Space Flight Center has been used to analyze radiographs of metal samples to qualitatively and quantitatively map compositional variations across the samples. When the X-ray radiographs are of samples having thickness variations, corrections must be made to accomplish compositional analysis. A correction technique is described for cylindrical samples and is applied to radiographs of SPAR Experiment 74-18. Uncorrected and corrected images are shown.

TM-78141 November 1977

A technique for simulating atmospheric turbulence that accommodates variability of turbulence properties along an aerospace vehicle trajectory is developed. The technique involves the use of Dryden spectral forms in
which the defining parameters are the standard deviations (σ) and integral scales (L) of turbulence. These spectra are expressed as nondimensional functions of the nondimensional frequency \( \Omega = \omega L/V \) where \( \omega \) is dimensional radian frequency and \( V \) is the true air speed of the aerospace vehicle. The nondimensional spectra are "factored" by standard techniques to obtain nondimensional linear recursive filters in the time domain whereby band-limited white-like noise can be operated upon to obtain nondimensional longitudinal, lateral, and vertical turbulence velocities, \( u/\sigma_u \), \( v/\sigma_v \), and \( w/\sigma_w \), respectively, as functions of nondimensional time, \( tV/L \), where \( t \) is time. Application of the technique to the simulation of the Space Shuttle Orbiter entry flight phase is discussed.

**TM-78142**  
September 1977  
Jerry A. Peoples. Preliminary Design Office.  
N78-14314

The steady-state temperature of a single node which dissipates energy by radiation only is discussed for a non-time-varying thermal environment. Relationships are developed to illustrate how shields can be utilized to represent a louver system. A computer program is presented which can assess periodic temperature characteristics of a single node in a time-varying thermal environment having energy dissipation by radiation only. The computer program performs thermal orbital analysis for five combinations of plate, shields, and louvers.

**TM-78143**  
October 1977  
In-Space Production of Large Space Systems from Extraterrestrial Materials – A Program Implementation Model.  
N78-12112

A program implementation model is presented which covers the in-space construction of certain large space systems from extraterrestrial materials. The model includes description of major program elements and subelements and their operational requirements and technology readiness requirements. It provides a structure for future analysis and development.

**TM-78144**  
October 1977  
Mixing of Two Liquid Metals on SPAR Payload Due to Spin-Up and Spin-Down.  
Charles F. Schafer. Space Sciences Laboratory.  
N78-13090

The work described was motivated by unexpected results from SPAR experiments directed at obtaining fine dispersions of metal systems that in a 1-g environment tend to segregate very rapidly. The SPAR samples exhibited segregation also. The physical processes occurring in fluid samples, such as the SPAR samples before solidification, are shown to be insufficient to produce a well-mixed liquid by the time solidification was initiated. This would result in solidified samples with the type of segregation noted in the SPAR samples. Experimental evidence and analytical arguments are presented.

**TM-78146**  
November 1977  
Candidate Locations for SPS Rectifying Antennas.  
Anne W. Eberhardt. Preliminary Design Office.  
N78-13553

An investigation is made into the feasibility of placing 120 Satellite Power System (SPS) rectifying antenna (rectenna) sites across the U.S. In the investigation, an initial attempt is made to put two land sites in each state using several land site selection criteria. When only 69 land sites are located, it is decided to put the remaining sites in the sea and sea site selection criteria are identified. An estimated projection of
electrical demand distribution for the year 2000 is then used to determine the distribution of these sites along the Pacific, Atlantic, and Gulf Coasts. A future study will also attempt to include the Great Lakes in this distribution.

As a result of this study, a methodology for distributing rectenna sites across the country and for fine-tuning exact locations is developed, and recommendations on rectenna design and operations are made. This developed methodology will be used in the reevaluation of the rectenna sites identified in this preliminary study. It is suggested that the design recommendations be considered in future rectenna design studies.

As a means of accomplishing this objective, an Image Coding Panel was established with members from several NASA Centers who represented different types of image processing interests. The Panel established the evaluation criteria, selected the data sets and algorithms, performed the analyses, and presented the results which were documented in the panel summaries. This report describes the conduct of the algorithm evaluation by Marshall Space Flight Center under approved RTOP 656-21-02-02 and in support of the Image Coding Panel.

A digitized multispectral image, such as Landsat data, is composed of numerous four dimensional vectors, which quantitatively describe the ground scene from which the data are acquired. One of the purposes of this report is to investigate the statistics of unique vectors that occur in Landsat imagery and determine if that information can provide some guidance on reducing image processing costs. A second purpose of this report is to investigate how the vector statistics are changed by various types of image processing techniques and determine if that information can be useful in choosing one processing approach over another.
Commercial O-rings made from 13 different rubber compounds were tested for physical properties when they were received from the manufacturer and after 7 and 12 years of shelf aging. No gross changes were observed in tensile strength, elongation, or compression deflection characteristics.

This report discusses investigations of several problems of gravitation, including some aspects which are related to the Stanford University/Marshall Space Flight Center gyroscope experiment. In addition, the question of the existence of black holes is considered. While black holes like those in Einstein’s theory may not exist in other gravity theories, trapped surfaces implying such black holes certainly do. The theories include those of Brans-Dicke, Lightman-Lee, Rosen, and Yang. A similar two-tensor theory of Yilmaz is investigated and found inconsistent and nonviable. The Newman-Penrose formalism for Riemannian geometries is adapted to general-gravity theories and used to implement a search for twisting solutions of the gravity theories for empty and nonempty spaces. The method can be used to find the gravitational fields for all viable gravity theories. The rotating solutions are of particular importance for strong field interpretation of the Stanford/Marshall gyroscope experiment. Inhomogeneous cosmologies are examined in Einstein’s theory as generalizations of homogeneous ones by raising the dimension of the invariance groups by one more parameter. The nine Bianchi classifications are extended to Rosen’s theory of gravity for homogeneous cosmological models.

8  ** See notation, page 19.
Results are presented from hardware testing and analysis with recommended changes to improve the system.


This report presents elastomeric materials compatibility data in MIL-H-83282 synthetic hydraulic fluid. Acrylonitrile and fluorocarbon compounds were evaluated at various temperatures and time intervals in samples of the fluid obtained from three qualified suppliers.

It was concluded that both polymers can function in the MIL-H-83282 hydraulic fluids within the conditions defined by this study. Hydraulic fluid from each manufacturer was similar in its effect upon each given O-ring material, with one exception. Similarly, there were no striking differences in the resistance of O-rings of the same generic rubber type when provided by the different manufacturers.

A multiple dimension work breakdown structure (WBS) tailored to the unusual requirement of the Satellite Power System (SPS) project is displayed, and each of the WBS terms is defined. The system logic is discussed, and the interrelationship of the various elements of the WBS is described. The resulting WBS, while primarily structured to the unique cost, economic and programmatic requirements, is recommended for general use by all parties involved in the definition and analyses of the SPS project.

Rendezvous and docking maneuvers by spacecraft often make use of equi-period orbits. For example, a spacecraft in circular orbit about the Earth's Moon may put an observation module into an elliptical orbit which lowers the perigee for a closer observation of the lunar surface. Use of equi-period orbits will bring the observation module back to rendezvous with the other module which has remained in circular orbit. There will be one rendezvous opportunity each revolution.

This report presents the determination of a set of equations for equi-period orbits work and a set of figures for quick reference.

A welded metal bellows was subjected to a series of vibration tests in a 400 psi oxygen environment to evaluate the effects of the bellows convolutes rubbing on the damper ring in the High Pressure Oxidizer Turbopump of the Space Shuttle Main Engine.

The bellows was subjected to approximately 2 million cycles at 0.007 in. double amplitude displacement during this series of tests, at a frequency of 400 Hz.
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.

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
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
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.
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
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
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
vector is characterized by a constant, nonzero, spectral density function in the frequency interval \( \omega_1 < |\omega| < \omega_0 \) with zero spectral density for all other values of \( \omega \). 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 \( \omega^{-2} \) over the interval \( \omega_1 < |\omega| < \omega_0 \) and zero for all other values of \( \omega \). 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 \( \omega_1 < |\omega| < \omega_0 \); 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
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
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
complexity. Histograms of solar flares as a function of solar longitude have been aligned with Hα 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
decreasing the operating temperature of the air conditioner and/or improving collector performance.

TM-78170  March 1978
Air Analysis of Maximum Horizontal Wind Speeds and Associated Parameters Recorded at NASA's 150-Meter Ground Winds Tower Facility at Kennedy Space Center, Florida. Margaret B. Alexander. Space Sciences Laboratory. N78-24743

This report presents statistical summaries of the daily maximum horizontal wind speed and associated parameters from data recorded at the National Aeronautics and Space Administration's 150-Meter Ground Winds Tower Facility on Merritt Island, Kennedy Space Center, Florida. One year of continuous horizontal wind speed measurements processed by the Automatic Data Acquisition System is classified as a function of tower level (10, 18, 60, and 150 meters) and period of reference [day, month, season: winter (October through March) and summer (April through September), and annual]. Tabulations were made of the daily maximum horizontal wind speed, time of occurrence, and five associated parameters: mean horizontal wind speed, maximum vertical gusts (i.e., updraft and downdraft), and mean and instantaneous directions. Analyses using these data included means, extremes, standard deviations, and frequency distributions. Comparisons of intensity of maximum horizontal wind speeds determined in this year of data are made with maximum values recorded at Kennedy Space Center during another non-hurricane-occurrence year (1967) and with values during 1966 through 1972 when six hurricanes affected the area after the Ground Winds Tower Facility became operational in December 1965. The intent of this report is to provide additional information for the general description of wind flow in the lowest 150 meters of the atmosphere for the identification of hazards involved in wind shear encounter relative to ascent and descent of the Space Shuttle and conventional aircraft.

TM-78171  April 1978

The purpose of this experimental research was to compare Marshall Space Flight Center's (MSFC) electrets with Thiokol's fixed flow samplers during the Demonstration Model (DM-2) static test firing at Thiokol's static test site, January 18, 1978, near Brigham City, Utah.

The measurement of the rocket exhaust effluents by Thiokol's samplers and MSFC's electrets indicated that the Solid Rocket Motor (SRM) had no significant effect on the air quality in the area sampled. Thiokol had only one significant measurement. At Plant 78 (Site 12), approximately 6.43 km at a 330 deg heading from the static test stand, the fixed flow air sampler obtained a trace of contamination of 0.0017 mg/m³ (background) and 0.094 mg/m³ (test). Of this total weight, 0.0017 mg/m³ was of chlorine. Converting this to parts/million (ppm) gives 0.0006 ppm. At this site, from X-ray spectroscopy, the electret had a background count of 1667 and a test count of 2409, resulting in an increase of 742 counts. One of the additional electrets, E13, was closer to the static test site, approximately 585 m at a heading of 325 deg. The chlorine count from the X-ray spectroscopy analysis on this electret was 3576, an increase of 1909 counts. Equating the counts of 742 to 0.0006 ppm, 1909 counts equals 0.0015 ppm. Again, there was no measurement of significant rocket exhaust at the test site.
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

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

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

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

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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

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

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
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

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

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

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 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 chlorophyl 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.
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.

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.

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.

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.

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.
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

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.
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.

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.


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

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

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
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

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

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
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

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

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 Vehicle (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

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.
NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR)

CR-2884 July 1977

CR-2923 November 1977

CR-2926 November 1977

CR-2927 December 1977

CR-2932 December 1977

CR-2934 December 1977
Forecasting Thunderstorms over a 2- to 5-h Period by Statistical Methods. Joseph Allen Zak. NAS8-31773. Texas A&M University. N78-12629

CR-2945 January 1978

CR-2952 January 1978

CR-2953 January 1978

CR-2997 April 1978

CR-2998 April 1978

CR-3002 May 1978
NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR)

CR-3008 May 1978

CR-3012 June 1978
The Verification of Landsat Data in the Geographical Analysis of Wetlands in West Tennessee. John Rehder and Dale Quattrochi. NAS8-31143. Department of Geography. N78-25508

CR-3051 September 1978
Studies of Convection in a Solidifying System with Surface Tension at Reduced Gravity. Basil N. Antar and Frank G. Collins. NAS8-32484. The University of Tennessee Space Institute.

CR-150393 May 31, 1977

CR-150394 May 31, 1977

CR-150395 May 31, 1977

CR-150396 September 13, 1977

CR-150397 July 1977

CR-150398 May 25, 1977

CR-150399 July 27, 1977

CR-150400 July 27, 1977

CR-150401 July 27, 1977

CR-150402 August 31, 1977
CR-150403  August 31, 1977

CR-150404  September 21-22, 1977

CR-150405*  December 1976

CR-150406  July 1976

CR-150407  July 1976

CR-150408  July 1976

CR-150409  July 29, 1977

CR-150410  March 4, 1977

CR-150411  August 1977

CR-150412  September 1977

CR-150413  September 30, 1977

CR-150414  September 30, 1977

CR-150415  September 1977

CR-150416  July 27, 1977
CR-150417 August 1, 1977
N77-34067

CR-150418 May 1976-July 1977
N77-33589

CR-150419 August 1, 1977
N77-33590

CR-150420 August 1977
N77-33349

CR-150421 1977
N78-10929

CR-150422 October 1977
N78-12505

CR-150423 October 11, 1977
N78-12506

CR-150424 June 1976
X77-10195

CR-150425 June 1976
X77-10196

CR-150426 June 1976
X77-10197

CR-150427 June 1976
X77-10198

CR-150428 June 1976
X77-10199

CR-150429 April 1975
X77-10199

CR-150430 April 1975
Multi-Use Mission Support Equipment, Final Report, Volume II, Appendix A,

CR-150431 April 1975

CR-150432 April 1975

CR-150433 April 1975

CR-150434 June 1975

CR-150435 July 1971

CR-150436 September 25, 1977

CR-150437 April 1977

CR-150438 July 1977

CR-150439 December 1976

CR-150440 August 30, 1977

CR-150441 September 1976

CR-150442 September 1976

CR-150443 September 25, 1977

CR-150444 October 9, 1977
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<tr>
<td>CR-150449</td>
<td>October 24, 1977</td>
<td>Load and Dynamic Assessment of B-52B-008 Carrier Aircraft for Configuration 1 and 2 Space Shuttle Solid Rocket Booster Decelerator Subsystem Drop Test Vehicles – Volume II, Airplane Flutter and Load Analysis Results. NAS8-31805. Boeing Co. X77-10140</td>
</tr>
<tr>
<td>CR-150450</td>
<td>October 24, 1977</td>
<td>Load and Dynamic Assessment of B-52B-008 Carrier Aircraft for Configuration 1 and 2 Space Shuttle Solid Rocket Booster Decelerator Subsystem Drop Test Vehicles – Volume III, Pylon Load Date Method 1. NAS8-31805. Boeing Co. X77-10141</td>
</tr>
<tr>
<td>CR-150451</td>
<td>October 24, 1977</td>
<td>Load and Dynamic Assessment of B-52B-008 Carrier Aircraft for Configuration 1 and 2 Space Shuttle Solid Rocket Booster Decelerator Subsystem Drop Test Vehicles – Volume IV, Pylon Load Data Method 2. NAS8-31805. Boeing Co. X77-10142</td>
</tr>
<tr>
<td>CR-150453</td>
<td>February 1977</td>
<td>JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5615. NAS8-31944. DCA Reliability Laboratory. N77-85672</td>
</tr>
<tr>
<td>CR-150454</td>
<td>February 1977</td>
<td>JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5552. NAS8-31944. DCA Reliability Laboratory. N77-85669</td>
</tr>
<tr>
<td>CR-150455</td>
<td>February 1977</td>
<td>JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5622. NAS8-31944. DCA Reliability Laboratory. N77-85670</td>
</tr>
<tr>
<td>CR-150456</td>
<td>March 1977</td>
<td>JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N3637. NAS8-31994. DCA Reliability Laboratory. N77-85668</td>
</tr>
</tbody>
</table>
NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR)

CR-150457 October 31, 1977

CR-150458 October 1977
Strapdown Gyro Test Program. NAS8-31909. Teledyne Systems Co. N78-11368

CR-150459 August 1977

CR-150460 August 1977

CR-150461 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N649-1. NAS8-31944. DCA Reliability Laboratory. N78-11300

CR-150462 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5619. NAS8-31944. DCA Reliability Laboratory. N78-11298

CR-150463 March 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5554. NAS8-31944. DCA Reliability Laboratory. N78-11297

CR-150464 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5623. NAS8-31944. DCA Reliability Laboratory. N78-11299

CR-150465 June 1, 1977
Nucleonic Coal Detector with Independent, Hydropneumatic Suspension, Final Report. NAS8-32214. Mississippi State University. N78-11454

CR-150466 October 1977

CR-150467* December 1977
Applications of Remote Sensing to Water Resources. NAS8-32408. ECOsystems International, Inc. N78-13509

CR-150468* December 1977
Weather Assessment and Forecasting. NAS8-32408. ECOsystems International, Inc. N78-14756

CR-150469 July 1977
Analysis of Results of ASTP Experiment in Electrophoresis, Final Report. NAS8-32124. Lehigh University. N78-12168

CR-150470 October 1977

*Printed locally under white cover.
NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR)

CR-150471 October 1977
HEAO-B Hazard Analysis Summary. NAS8-32331. Northrop Services, Inc.
X77-10216

CR-150472 July 1977

CR-150473 November 10, 1977
N78-13365

CR-150474 October 1977
N78-13326

CR-150475 August 8, 1977
N78-90120

CR-150476 November 23, 1977
N78-12169

CR-150477 November 1977
N78-13699

CR-150478 June 30, 1977
N78-13089

CR-150479 September 1977
N78-14346

CR-150480* December 1977
N78-15948

CR-150481

CR-150482* December 9, 1977
N78-14094

CR-150483 January 31, 1971
N78-71275
NASA CONTRACTOR REPORTS
(abstracts for these reports may be obtained from STAR)

CR-150484 November 25, 1977

CR-150485 February 1968

CR-150486 December 1, 1977
Research Study on Stabilization and Control Modern Sampled-Data Control Theory: Analysis of the Annular Suspension Pointing System. NAS8-32358. Systems Research Laboratory. N78-14090

CR-150487 November 19, 1966

CR-150488 November 1977

CR-150489 April 1975
Orbital Decay and Lifetime Estimation. NAS8-21810. Northrop Services, Inc. N78-71265

CR-150490 November 1977

CR-150491 December 1977
Atmospheric Scavenging Exhaust, Final Report. NAS8-31947. IIT Research Institute. N78-15169

CR-150492 February 4, 1974

CR-150493 November 1977

CR-150494* March 1972

CR-150495** November 1977
MSFC Hot Air Collectors - Phase I. R. Losey. NAS8-32036. Wyle Laboratories. N78-17471

CR-150496** November 1977

CR-150497* November 1977

* See notation, page 54.
** See notation, page 54.
CR-150498 December 1977
N78-15139

CR-150499 May 1977

CR-150500 December 30, 1977

CR-150501 March 1976

CR-150502 March 1977

CR-150503 November 1977

CR-150504 December 1977

CR-150505** November 1977

CR-150506** November 1977

CR-150507** November 1977

CR-150508** November 1977

CR-150509** November 1977

CR-150510** November 1977

CR-150511 November 1977
CR-150512** October 12, 1977

CR-150513** June 1, 1977

CR-150514** October 31, 1977
Collation of Quarterly Reports on Air Flat Plate Collectors. NAS8-32261. Life Sciences Engineering Co. N78-17479

CR-150515** December 1977

CR-150516** October 1977

CR-150517 November 19, 1977
Space Transportation System Utilization Program, Final Report. NAS8-31843. IBM Corp. X78-72385

CR-150518 December 1977

CR-150519 August 1977
Cyclic and Low Temperature Effects on Microcircuits. NAS8-31446. McDonnell Douglas Astronautics Co. N78-16264

CR-150520** April 1977

CR-150521** December 1977

CR-150522** January 19, 1978
SIMS Prototype System 1 Test Results Engineering Analysis (AH-45021). NAS8-32036. IBM Corporation, Federal Systems Division. N78-18527

CR-150523** February 15, 1977
Pre-Packaging Concepts for Solar Systems. NAS8-32036. IBM Corp.

CR-150524** December 10, 1976
Installation Package for SIMS System 1A (AH45050). NAS8-32036. IBM Corp. N78-18523


CR-150526 June 15, 1977
CR-150527  July 1977
Listing of Data Systems Elements
Authorities, Technical Report. NAS8-
31488. Teledyne Brown Engineering.
N78-16638

CR-150528  December 1977
Shuttle Derivative Vehicles Study –
Operations, Systems, and Facilities,
Volume I – Executive Summary. NAS8-
32395. Boeing Aerospace Co.

CR-150529  December 1977
Shuttle Derivative Vehicles Study –
Operations, Systems and Facilities, Vol-
ume II, Final Report and Cost Summary.
NAS8-32395. Boeing Aerospace Co.

CR-150530  December 1977
Shuttle Derivative Vehicles Study –
Operations, Systems and Facilities, Vol-
ume III, Supporting Research and
Technology. NAS8-32395. The Boeing
Aerospace Co.

CR-150531  December 1977
Shuttle Derivative Vehicles Study –
Operations, Systems, and Facilities,
Volume IV, Implementation Plan.
NAS8-32395. Boeing Aerospace Co.

CR-150532**  November 1976
Application of Solar Energy to Air
Conditioning Systems. NAS8-32036.
IBM Civil and Space Systems.
N78-17483

CR-150533**  January 1978
Site Dependent Factors Affecting the
Economic Feasibility of Solar Powered
Absorption Cooling. NAS8-32036. IBM
Federal Systems Division, Space Sys-
tems. N78-18524

CR-150534**  December 10, 1976
SIMS Prototype System I – Design Data
Brochure. NAS8-32036. Wyle Labs. for
IBM. N78-17484

CR-150535**  January 1978
System Design and Installation for
RS600 Programmable Control System
for Solar Heating and Cooling. NAS8-
32256. Rho Sigma, Inc. N78-17485

CR-150536**  October 1977
Installation Package for Air Flat Plate
Collector. NAS8-32261. Life Sciences
Engineering. N78-19605

CR-150537**  February 10, 1978
Site Selection for MSFC Operational
Tests of Solar Heating and Cooling
Systems (AH 45027). NAS8-32036. IBM
Corp., Federal Systems Division.
N78-19602

CR-150538  December 1977
Shuttle Derivative Vehicles Study –
Operations, Systems and Facilities, Vol-
ume V, Final Briefing. NAS8-32395.
Boeing Aerospace Co.

CR-150539  November 16, 1977
Development of Surfaces Optically Suit-
able for Flat Solar Panels, Quarterly
Progress Report No. 2. NAS8-32481.
University of Alabama. N78-17477
CR-150540 January 15, 1978

CR-150541 January 30, 1978

CR-150542** November 11, 1977

CR-150543 January 1978

CR-150544** January 1978
SIMS Prototype System 2 Test Results Engineering Analysis. NAS8-32036. IBM Federal Systems Division. N78-19604

CR-150545** February 1978

CR-150546 November 1977

CR-150547 December 1977

CR-150548 November 1977

CR-150549 November 1977

CR-150550 December 1977

CR-150551 December 1977

CR-150552 October 1977

CR-150553** January 3, 1978

CR-150554 January 1978

CR-150555 January 15, 1978
CR-150556   December 1977

CR-150557   December 1977

CR-150558** December 1977

CR-150559** February 22, 1978

CR-150560** January 1978
Collation of Quarterly Reports - Solar Heating Systems. NAS8-32255. Houston Chemical Co., Div. of PPG Ind. N78-20606

CR-150561 February 15, 1978

CR-150562 February 9, 1978

CR-150563 February 10, 1978

CR-150564 January 1978

CR-150565 September 1971

CR-150566 November 1971

CR-150567 January 10, 1972

CR-150568 November 1971
CR-150569** March 1978

CR-150570** March 1978

CR-150571** March 1978

CR-150572** January 1978
Indoor Test for Thermal Performance Evaluation of the SOLARON (Air) Solar Collector. NAS8-32036. IBM Corp. N78-19652

CR-150573** December 1977
Indoor Test for Thermal Performance Evaluation of Sunworks (Liquid) Solar Collector. NAS8-32036. IBM Corp. N78-19650

CR-150574** January 1978

CR-150575** October 1977

CR-150576** December 1978

CR-150577** November 1977

CR-150578** November 1977

CR-150579** October 29, 1977
Site Data Acquisition Subsystem Mod 1 (SDAS), Installation, Operation and Maintenance Manual. NAS8-32036. IBM Federal Systems Division. N78-20608

CR-150580* September 29, 1976

CR-150581** October 17, 1977
CR-150582 February 20, 1978
N78-19509

CR-150583 July-December 1977
N78-19393

CR-150584 January 27, 1978
N78-19260

CR-150585 February 28, 1978
N78-73148

CR-150586 February 28, 1978
N78-73149

CR-150587** March 1978
Systems Integration of Marketable Subsystems, Collection of Monthly Progress Reports, January 77-January 78. NAS8-32036. IBM Federal Systems Division.
N78-21594

CR-150588** September 1977
N78-20609

CR-150589** October 1977
N78-20610

CR-150590** January 1977
N78-20611

CR-150591** January 1978
N78-21591

CR-150592** January 1977
N78-20612

CR-150593** January 1977
N78-20613

CR-150594** May 25, 1976
N78-20604

CR-150595** March 1978
N78-20622

CR-150596 February 1978
Dual Hologram Design Study (Final Report). NAS8-32147. Lumin, Inc.
N78-19470
CR-150597 December 1977
Reliability Evaluation of Hermetic Dual
In-Line and Flat Microcircuit Packages,
McDonnell Douglas Astronautics Co.
N78-19395

CR-150598 March 1978
Critical Items List for High Energy
Astronomy Observatory (HEAO).
NAS8-32331. Northrop Services, Inc.

CR-150599 March 1978
Liquid Flat Plate Collector and Pump for
Solar Heating and Cooling Systems.
NAS8-32253. Calmac Manufacturing Co.
N78-20614

CR-150600** March 1978
Design Data Brochure for CSI Series V
Solar Heating and Cooling System.
NAS8-32243. Contemporary Systems,
Inc. N78-20615

CR-150601** January 1977
Preliminary Design Review Package on
Air Flat Plate Collector for Solar Heating
and Cooling System. NAS8-32261. Life
Sciences Engineering Company.
N78-20616

CR-150602 January 25, 1978
A Study of Some Economic Factors
Relating to the Development and Imple-
mentation of a Satellite Power System.
NAS8-32698. Econ, Inc. N78-19654

CR-150603 February 1978
Passive Propellant Management System,
Final Report. NAS8-31808. McDonnell
Douglas Astronautics Co.

CR-150604** December 7, 1977
Pump/Control System Minimum Oper-
atng Cost Testing. NAS8-31564. Depar-
tment of Mechanical Engineering,
Tennessee Technological University.
N78-20617

CR-150605** November 1976
Preliminary Design Package for Sunspot
Domestic Hot Water Heating System.
NAS8-32245. Elcam, Inc. N78-27518

CR-150606** March 1978
System Design Package for Solar Heating
and Cooling Site Data Acquisition
System Mod 1. NAS8-32036. IBM
Federal Systems Division. N78-21593

CR-150607 August 1977
Characterization of Silicon-Gate CMOS-
SIS Integrated Circuits Processed with
Ion Implantation, Final Report. NAS8-
31986. RCA Corporation, Solid State
Technology Center. N78-77789

CR-150608 February 17, 1978
Concept Development of an Inflatable
Heat Shield Support for the Solid
Rocket Booster, Final Report. NAS8-
32696. Goodyear Aerospace Corp.

CR-150609 May 5, 1976
Multiple Compartment Venting Through
Pipes and Orifices Including the Effects
of Heat Transfer, Volume I: Methodol-
ogy and Users Guide. NAS8-31401.
Rockwell International.

CR-150610 May 5, 1976
Multiple Compartment Venting Through
Pipes and Orifices Including the Effects
of Heat Addition, Volume II: Program
Listing. NAS8-31402. Rockwell Inter-
national.

CR-150611** Subsystem Design Package for Solar II
Collector. NAS8-32261. Life Sciences
Engineering. N78-21602
NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR.)

CR-150612**
N78-21592

CR-150613**
January 1977
N78-27534

CR-150614**
February 1977
N78-21589

CR-150615**
November 23, 1976
N78-24610

CR-150616**
January 1977
N78-27536

CR-150617**
December 1977
N78-21603

CR-150618**
January 1978

CR-150619**
December 1976
Preliminary Design Package for Solar Heating and Hot Water System. NAS8-32242.

CR-150620**
April 1978
Preliminary Design Package for Maxitherm Heat Exchanger Module. NAS8-32260. Sigma Research, Inc. N78-22473

CR-150621
December 22, 1977

CR-150622
March 1, 1978
CAT Lidar Wind Shear Studies. NAS8-28424. Advanced Development Laboratory.
N78-24753

CR-150623
March 1, 1978

CR-150624
February 28, 1978

CR-150625
January 20, 1978

CR-150626
January 1978

CR-150627**
January 1978
Development of Prototype Air/Liquid Solar Collector Subsystem (Quarterly
CR-150628** January 1978
N78-24611

CR-150629** April 1978
Preliminary Design Package for Programmable Controller and Hydronic Energy Package. NAS8-32257. Sunkeeper Control Corp.
N78-24612

CR-150630** April 1978
N78-22472

CR-150631** September 1977
Indoor Thermal Performance Evaluation of the SEPCO Air Collector. NAS8-32036.
N78-22466

CR-150632** January 6, 1978
Extensions to Analysis of Ignition Transients of Segmented Rocket Motors, Final Report.

CR-150633 March 31, 1978

CR-150634 April 1978
N78-90354

CR-150635 1978

CR-150636 March 10, 1978

CR-150637 March 1978

CR-150638 January 1978

CR-150639** January 1978
Installation Package - for SIMS Prototype System 2 - Solar Hot Water. NAS8-32036. International Business Machines Corp. N78-22474

CR-150640** March 10, 1978

CR-150641** March 1978
NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR)

CR-150642 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N645-1. NAS8-31944. DCA Reliability Laboratory. N78-75704

CR-150643 March 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N937B. NAS8-31944. DCA Reliability Laboratory. N78-75705

CR-150644 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N972B. NAS8-31944. DCA Reliability Laboratory. N78-75413

CR-150645 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N981B. NAS8-31944. DCA Reliability Laboratory. N78-75706

CR-150646 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N1202A. NAS8-31944. DCA Reliability Laboratory. N78-75707

CR-150647 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N3031. NAS8-31944. DCA Reliability Laboratory. N78-74954

CR-150648 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N2970B. NAS8-31944. DCA Reliability Laboratory. N78-75708

CR-150649 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N2989B. NAS8-31944. DCA Reliability Laboratory. N78-74955

CR-150650 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N3893. NAS8-31944. DCA Reliability Laboratory. N78-74956

CR-150651 March 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N4570A. NAS8-31944. DCA Reliability Laboratory. N78-75709

CR-150652 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5415. NAS8-31944. DCA Reliability Laboratory. N78-75710

CR-150653 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5420. NAS8-31944. DCA Reliability Laboratory. N78-75711
CR-150654 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N2605. NAS8-31944. DCA Reliability Laboratory.
N78-75712

CR-150655 March 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5550. NAS8-31944. DCA Reliability Laboratory.
N78-75712

CR-150656 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5614. NAS8-31944. DCA Reliability Laboratory.
N78-75713

CR-150657 March 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N5618. NAS8-31944. DCA Reliability Laboratory.
N78-75714

CR-150658 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N2060. NAS8-31944. DCA Reliability Laboratory.
N78-75420

CR-150659 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N2432A. NAS8-31944. DCA Reliability Laboratory.
N78-75414

CR-150660 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N2605. NAS8-31944. DCA Reliability Laboratory.
N78-75715

CR-150661 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N2905A. NAS8-31944. DCA Reliability Laboratory.
N78-75716

CR-150662 March 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N2920. NAS8-31944. DCA Reliability Laboratory.
N78-75717

CR-150663 January 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Dual Transistor 2N3811. NAS8-31944. DCA Reliability Laboratory.
N78-75718

CR-150664 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N4150. NAS8-31944. DCA Reliability Laboratory.
N78-75416

CR-150665** February 1978
Indoor Test for Thermal Performance Evaluation on Life Sciences Engineering (Air) Solar Collector. NAS8-32036. IBM Corp.
N78-25547

CR-150666** January 1978
Indoor Test for Thermal Performance Evaluation on the Sunworks (Air) Solar Collector. NAS8-32036. IBM Corp.
N78-24613
NASA CONTRACTOR REPORTS
(Abstracts from these reports may be obtained from STAR)

CR-150667  March 1978

CR-150668  March 1978

CR-150669  November 1977

CR-150670  March 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Diode 1N759A. NAS8-31944. DCA Reliability Laboratory. N78-22297

CR-150671  March 1978

CR-150672  April 9, 1978

CR-150673** May 1978

CR-150674** May 1978

CR-150675** March 14, 1978
Outdoor Thermal Efficiency Evaluation of the Ying Solar Collector. NAS8-32036. IBM Corp. N78-24614

CR-150676  May 1, 1978

CR-150677  April 1978

CR-150678  March 21, 1978

CR-150679  April 1978

CR-150680  April 1978
CR-150681 April 1978

CR-150682 April 1978

CR-150683 April 1978

CR-150684 April 1978

CR-150685 April 1978

CR-150686**

CR-150687**

CR-150688 May 1, 1978

CR-150689 April 1978

CR-150690 July 30, 1978

CR-150691** April 1977

CR-150692** July 1977

CR-150693** October 1977

CR-150694** January 1978
<table>
<thead>
<tr>
<th>Contract Number</th>
<th>Date</th>
<th>Description</th>
<th>Agency</th>
<th>Report Code</th>
</tr>
</thead>
</table>
CR-150711 May 1978

CR-150712 May 1978

CR-150713** May 1978

CR-150714** May 1978

CR-150715 May 19, 1978

CR-150716 June 1978
Integration and Interface Failure Mode Effects Analysis (FMEA) and Composite Critical Items List for High Energy Astronomy Observatory (HEAO) Mission C, Volume I. NAS8-32331. Northrop Services, Inc.

CR-150717 May 1978
Integration and Interface Failure Mode Effect Analysis (FMEA) and Composite Critical Items List for High Energy Astronomy Observatory (HEAO) Mission C, Volume II. NAS8-32331. Northrop Services, Inc.

CR-150718 February 1977
JAN Transistor and Diode Characterization Test Program, Final Report for JANTX Transistor 2N2605. NAS8-31944. DCA Reliability Laboratory. N78-25320

CR-150719 March 1978

CR-150720 April 14, 1978

CR-150721 April 14, 1978

NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR)


CR-150738 July 1, 1978

CR-150739 June 30, 1977

CR-150740** July 1978

CR-150741** March 1978
Design and Installation Package for the Sunmat Flat Plate Collector. NAS8-32253. Calmac Manufacturing.

CR-150742** July 1978
System Integration of Marketable Subsystems (Second Collection of Progress Reports). NAS8-32036. IBM Corp.

CR-150743** July 1978
Installation Package for 77-180 Solarstat and 77-171 Controller. NAS8-32258. Solar Control Corporation (Zia).

CR-150744** July 1978
Quarterly Reports for RS600 Programmable Controller. NAS8-32256. Rho Sigma.

CR-150745 June 6, 1978

CR-150746 April 1978

CR-150747** August 1978

CR-150748** August 1978
Solar Heating and Cooling System for an Office Building at Reedy Creek Utilities. DOE Contract No. EX-76-C-01-2401. Reedy Creek Utilities, Inc.

CR-150749 May 1978

CR-150750 June 30, 1978
SSME Plume Heating Rates. NAS8-32160. Remtech, Inc.

CR-150751 July 1978
SRB Surface Roughness Heating. NAS8-32675. Remtech, Inc.

CR-150752 April 15, 1978
Space Industrialization, Final Report,
NASA CONTRACTOR REPORTS
(Abstracts for these reports may be obtained from STAR)

Volume 1 — An Overview. NAS8-32197.
Science Applications, Inc. N78-28136

CR-150753 April 15, 1978
Space Industrialization, Final Report,
Vol. 2, Opportunities, Markets and
Programs. NAS8-32197. Science Applica-
tions, Inc. N78-28137

CR-150754 April 15, 1978
Space Industrialization, Final Report,
Volume 3, World and Domestic Implica-
N78-28138

CR-150755 April 15, 1978
Evaluation of Rocket Engines for Boost
and Cruise Propulsion of the National
Hypersonic Flight Research Facility,

CR-150757** August 1978
Installation Package for a Solar Heating
and Hot Water System. NAS8-32242.
Colt, Inc.

CR-150758** August 1978
SIMS Prototype System 3 Test Results —
Engineering Analysis. NAS8-32036. IBM
Federal Systems Division.

CR-150759** August 1978
SIMS Prototype System 4 — Design Data
Brochure. NAS8-32036. IBM Federal
Systems Division.

CR-150760** August 1978
Installation Package for a Domestic Solar
Heating and Hot Water System. NAS8-
32246. Solafern Ltd.

CR-150761 June 1978
Preliminary Study of the Reliability of
Imaging Charge Coupled Devices, Final
Report. NAS8-32641. Martin Marietta
Corporation. N78-29352

CR-150762 July 1978
Mathematical Models of Continuous
Flow Electrophoresis, Bi-Monthly Prog­
NAS8-32614. Princeton University.

CR-150763 July 1, 1978
Expanded Efforts on an Information
System for the East Mississippi Council
Area, Final Report for NAS8-31785,
Modification 1. NAS8-31785. Mississippi
State University.

CR-150764 June 17, 1976
Space Station Systems Analysis Study
Program Review. NAS8-31993. Grumman Aerospace Corp.

CR-150765 August 1978
Modification of the Continuous Flow
Diffusion Chamber for Use in Zero-
Desert Research Institute. N78-29123

CR-150766 December 1977
SPAR Project: Counter Current Distribu-
tion of Biologicals, Final Report. NAS8-
32353. University of Oregon Health
Sciences. N78-29182

CR-150767 July 14, 1978
MMES Self-Test Hardware. NAS8-
32405. M&S Computing, Inc.
CR-150768 May 1978

CR-150769 July 1978

CR-150770** July 18, 1977

CR-150771** August 1978
Solar Control Design Package. NAS8-32258. Solar Control Corp.

CR-150772 May 24, 1978

CR-150773 July 1978
Structural Attachments for Large Space Structures, Task 1 Report, Development of Attachment Concepts. NAS8-32654. Martin Marietta Corp.

CR-150774 July 1978

CR-150775 July 1978

CR-150776* August 1978

CR-150777* August 1978
Analysis of Wind Bias Change with Respect to Time at Cape Kennedy, Florida, and Vandenberg AFB, California. NAS8-32226. Science Applications, Inc.

CR-150778* August 1978

CR-150779* August 1978
Analysis of Vector Wind Change with Respect to Time for Cape Kennedy, Florida. Science Applications, Inc.

CR-150780** August 1978

CR-150781* July 1978

CR-150782* August 1978

CR-150783* September 1978
High Speed CMOS/SOS Standard Cell Notebook. NAS8-31325. RCA, Advanced Tech Lab.

CR-150784** September 1978
Certification and Verification for Calmac
Flat Plate Solar Collector. NAS8-32253. Calmac Manufacturing Co.

CR-150785** April 1978
Prototype Solar Heating and Hot Water Systems. Colt, Inc. of Southern California.

CR-150786** July 1978

CR-150787** July 1978
Development and Fabrication of a Concentrating Solar Collector Subsystem, Quarterly Reports. NAS8-32251. Northrop, Inc.

CR-150788** August 1978

CR-150789 July 1978

CR-150790 August 16, 1978

CR-150791 August 7, 1978

CR-150792 August 7, 1978

CR-150793 August 7, 1978

CR-150794** September 1978

CR-150795** September 1978
Design Package for a Complete Residential Solar Space Heating and Hot Water System. NAS8-32246. Solafern, Ltd.

CR-150796 August 15, 1978

CR-150797 July 1978

CR-150798 June 6, 1978
CR-150799 August 1978
C-MOS Array Design Techniques, Quarterly Report No. 2. NAS12-2233. RCA Advanced Technology Laboratories.

CR-150800 August 1980
FETSIM User's Manual and Example. NAS8-31325. RCA.

CR-150801 August 1978
Design, Development, Fabrication and Delivery of Register and Multiplexer Units. NAS8-25582. RCA.

CR-150802** September 1978

CR-150803** September 1978

CR-150804** July 1978
Indoor Test for Thermal Performance Evaluation on the Northrop Concentrating Solar Collector. NAS8-32036. IBM.

CR-150805 September 1978

CR-150806** September 1978

CR-150807 September 1, 1978

CR-150808 September 1978

CR-150809 August 23, 1978

CR-150810 April 1977

CR-150811 July 1978

CR-150812** July 1978

CR-150813** October 1978

CR-150814** August 7, 1978

*White cover reports published at MSFC.
**DOE/NASA reports.
ALEXANDER, MARGARET B. ES82
LOGAN, E. Arizona State University
CHANG, J. Arizona State University

ANG, CHO-HYI ES74
LACY, LEWIS L. ES74

ARTHUR, CARLENE W. ES53
(NAS ASSOCIATE)
Pc4 Magnetic Pulsations at Synchronous Orbit, ATS-6. December 4-8, 1978. Presentation at the AGU 1978 Fall Meeting to be held at San Francisco, California. Submitted to EOS Transactions, AGU.

ARTHUR, CARLENE W. ES53
Statistical Studies of Pc3 and Pc4 Magnetic Pulsations at Synchronous Orbit. Published in EOS, Transactions of the American Geophysical Union.

ASKINS, BARBARA S. ES52
Autoradiographic Enhancement of Mammograms: Investigations of a Possible Dose Reduction. Published in Radiology.

ASKINS, BARBARA S. ES52
Beta Radiation Autoradiography as a Technique for Restoring Faded Photographic Images. April 6-8, 1978. Presentation at the Alabama Academy of Science 55th Annual Meeting to be held at Troy State University, Montgomery, Alabama.

ASKINS, BARBARA S. ES52
A Nuclear Chemistry Technique for Restoring Faded Photographic Images. Published in American Archivist.

ASKINS, BARBARA, et al. ES52

ASKINS, BARBARA S. ES52
A Demonstration of the Effect of Reduced Scatter on Information Content and Patient Exposure. August 1-3, 1978. Presentation at the American Association of Physicists in Medicine, Annual Meeting to be held at San Francisco, California.

AUSTIN, ROBERT E. PS04
WOLFE, MALCOLM G.
Aerospace Corporation

BACCHUS, D. L. ED32
MOOG, R. D. Martin Marietta Corp.
UTREJA, LAJPAT R.
Northrop Services, Inc.
Aerodynamic Decelerator and Balloon Technology Conference to be held at Houston, Texas.

BAUGHER, CHARLES R. ES53

BAUGHER, C. R. ES53
SHELLEY, E. G. Lockheed YOUNG, D. T. Univ. of Bern-Switzerland

BILBRO, J. W. EC32

BILBRO, JAMES W. EC32
CALHOUN, MALCOLM D.
Mississippi State University

BILBRO, JAMES W. EC32
POLGE, R. J. UAH

BILBRO, JAMES W. EC32
VAUGHAN, WILLIAM W. ES81

BILBRO, JAMES W. EC32
VAUGHAN, WILLIAM W. ES82

BLAIR, JAMES C. ED11

BRANTLEY, LOTT W. PD14

CAMP, DENNIS W. ES82
ALEXANDER, MARGARET B. ES82
CAMP, DENNIS W. ES82
FROST, WALTER FWG Associates, Inc.

CAMP, DENNIS W. ES82
FROST, WALTER FWG Associates, Inc.
REDDY, RAVI Univ. of Tennessee Space Institute

CAMP, DENNIS W. ES82
FROST, WALTER FWG Associates, Inc.
WANG, S. T. University of Tennessee Space Institute

CARUSO, SALVADORE V. EC42
Some Aspects of Contamination Detection, Analyses and Control in Microcircuits for the NASA Space Shuttle Program. April 24-26, 1978. Presentation at the 1978 Electronic Components Conference to be held at Anaheim, California.

CASH, MITCHELL FA32

CASH, MITCHELL FA32

CASH, MITCHELL FA32

CHAPPELL, C. R. ES53
The New World of Thermal Plasma Research. December 4-8, 1978. Presentation at the American Geophysical Union Fall Meeting to be held at San Francisco, California.

CHAPPELL, CHARLES R. ES53

CHAPPELL, CHARLES R. ES53
MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are presentation dates.)

CLIFTON, K. S.     ES64
MILLMAN, P. M.
Herzberg Institute of Astrophysics
Video Analysis of Cometary Debris.
Submitted to Sky and Telescope.

CLIFTON, KENNETH STUART    ES64
OWENS, JERRY KEITH      ES64
Monitoring of Particulate Contamination
and Background Brightness from IECM
Based Instrumentation. October 16-18,
1978. Presentation at the 10th Space
Simulation Conference to be held at
Bethesda, Maryland.

CLIFTON, K. S.     ES64
REESE, R. W., Jr.    ES64
DAVIS, C. W.       ES64
Video Detection and Analysis of Transient
Astronomical Phenomena. Submitted to
Optical Engineering.

COFFEY, RUSSELL     EF13
High Rate Data Acquisition from
Presentation at the National Telecommu-
nications Conference to be held at
Birmingham, Alabama.

COFIELD, KESTER L., JR.    NA51
A Unique Opportunity for Black Participa-
Presentation at the National Technical
Association Conference "Black Roots in
Technology" to be held at New York,
New York.

CRABTREE, WILLIAM L.  EC12
Technology Needs for Earth Orbital
Presentation at the Technology Require-
ments for Future Orbital Power Systems
Symposium to be held at Lewis Research
Center, Cleveland, Ohio.

CRAFT, HARRY G., JR.    JA12
First Spacelab Mission – A Status
October 18-20, 1978. Presentation at the
29th Congress of the International
Astronautical Federation (IAF) to be
held at Dubrovnik, Yugoslavia.

DAVIDSON, MIRT C.    ES72
Crystal Growth in Space. October 18-20,
1977. Presentation at the American
Astronautical Society Conference to be
held at San Francisco, California.

DAVIDSON, MIRT C.    ES72
HOLLAND, LAWRENCE R.   ES72
Narrow Zone Heating by a New
Radiation Focusing Technique: Toroidal
Ellipsoid Furnace. Published in Review
of Scientific Instruments.

DEATON, A. W.     EL23
KHATIB, A. R.    JPL
Shuttle/IUS Trajectory Design for Planetary
Missions. August 7-9, 1978. Presentation at the 1978 AIAA/AAS Astro-
dynamics Conference to be held at Palo
Alto, California.

DOWNS, SANFORD W., JR.     EF02
BIESBROCK, JOSEPH A.
North Georgia College
Application of Remote Sensing Tech-
niques to Study Southern Pine Beetle
Infestations in the Georgia Piedmont.
March 27-29, 1978. Presentation at the
Seventh Annual Remote Sensing of
Earth Resources Conference to be held at
University of Tennessee Space Insti-
tute, Tullahoma.

DOWNS, SANFORD W., JR.     EF02
FAUST, N. L.  Georgia Inst. of Technology
The Use of Landsat Data to Inventory
Cotton and Soybean Acreage in North
Alabama. March 27-29, 1978. Presentation at the 7th Annual Remote Sensing of Earth Resources Conference to be held at the University of Tennessee Space Institute, Tullahoma, Tennessee.

EDGE, TEDDY M. EC45
The Standard Transistor Array Radix (STAR). November 14-16, 1978. Presentation at the GOMAC (Government Microcircuit Applications Conference) to be held at Monterey, California.

FACEMIRE, BARBARA ES73
BOURGEOIS, S. V. Lockheed Missiles & Space Co.

FELIX, A. RICHARD ED35
Effect of Sound Suppression Screens on Transonic Mach Number Distribution in the MSFC 14-Inch Trisonic Wind Tunnel. April 17-18, 1978. Presentation at the 49th Meeting of the Supersonic Tunnel Association to be held at El Segundo, California.

FISHMAN, G. J. ES62
HEAO-1 Observations. Published in IAU Circulars.

FISHMAN, G. J. ES62
The Nuclear Radiation Monitor for the Spacelab/Shuttle. Published in the proceedings of the Symposium on Gamma-Ray Spectroscopy in Astrophysics which was held at NASA, Goddard Space Flight Center.

FISHMAN, G. J. ES62
MEEGAN, C. A. ES62
WATTS, J. W. ES62
DERRICKSON, J. H. ES62

FOUNTAIN, JAMES A. ES64
WEST, EDWARD A. ES62

FISHMAN, G. J.
MEEGAN, C. A.
WATTS, J. W.
DERRICKSON, J. H.

FOUNTAIN, JAMES A.
WEST, EDWARD A.

FOUNTAIN, J. A. ES64
WEST, E. A. ES64
HORAI, K. Columbia University
WINKLER, J. L. Lockheed Electronic Corp.
KEIHM, S. J. Columbia University
LANGSETH, M. G. Columbia University

FOWLIS, WILLIAM W. ES82

FROST, WALTER
University of Tennessee Space Institute
HUTTO, MARSHALL
University of Tennessee Space Institute
CAMP, DENNIS W. ES82
Atmospheric Turbulence Spectra Behind Large Aspect Ratio Rectangular Blocks.


GOLDEN, HARVEY \( \text{EF21} \) NEIERS, JAMES General Electric
“Global Crop Production Forecasting” a Simulation Analysis of the Data System Problems and Their Solution. December 4-6, 1978. Presentation at the 1978 Winter Simulation Conference to be held at Miami Beach, Florida.

GOLDEN, HARVEY \( \text{EF21} \) NEIERS, JAMES W. General Electric

GRAVES, JIM \( \text{EC12} \) LANIER, J. ROY \( \text{EC12} \) LENOX, HERB \( \text{EC12} \) A Modular Load Center Converter Power Supply. June 13-15, 1978. Presentation at the Power Electronics Specialists Conference to be held at Syracuse, New York.

GRODZKA, P. G. Lockheed Missiles & Space Co., Inc.
FACEMIRE, BARBARA \( \text{ES73} \) Chemical Reactions in Low-G. January 18, 1978. Presentation at the AIAA 16th Aerospace Sciences Meeting to be held at Huntsville, Alabama.


HAGYARD, M. J. \( \text{ES52} \) REICHHMANN, E. J. \( \text{ES52} \) SMITH, J. B. \( \text{NOAA-ES52} \) SPEICH, D. M. \( \text{NOAA-ES52} \) Preflare Enhancements in Soft X-Rays. May 29 - June 10, 1978. Presentation at the 21st Plenary Meeting of COSPAR to be held at Innsbruck, Austria.


MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are presentation dates.)

HALL, RAYMOND R. JA41
RIVES, JAMES M. JA71

HALL, STEPHEN BOYD PD24

HAMPTON, EDWARD C. PD01
CAREY, W. T. PD01

HAMITER, LEON EC43
VILLELLA, FELMINIO EC43
JOHNSON, GORDON M. McDonnell Douglas Astronautics Co.

HANKINS, JAMES D. FA33

HARRISON, JAMES K. PS03
Large Space Structures Activities at MSFC. September 27-29, 1978. Presentation at the AIAA Conference on Space Platforms: Future Needs and Capabilities to be held at Los Angeles, California.

HASTINGS, L. J. EP43
ALLUMS, S. L. EP43

HEALEY, HENRY M. EP45
CLARK, DAVID C. EP45

HOOPER, JAMES W. EF24
PINER, JOHN R. EF24
Data System Dynamic Simulation. October 18, 1977. Presentation at the MSFC/UAH Data Management Symposium to be held at MSFC.

HORWITZ, J. L. ES53

HORWITZ, J. L. ES53
BAUGHER, C. R. ES53
SHELLEY, E. G.
Lockheed Palo Alto Research Lab
PHYSIKALISCHES INSTITUT, UNIV. VON BERN
Conical Pitch Angle Distributions of Low-Energy Ion Fluxes: Evidence for Cyclotron Acceleration. December 4-8,
1978. Presentation at the AGU 1978 Fall Meeting to be held at San Francisco, California. Submitted to the EOS Transactions, AGU.

HORWITZ, J. L.  ES53
CHAPPELL, C. R.  ES53

HSU, J. P.  ES63
Renormalizable Quantum Gravity and Dual Character of Space-Time. Submitted to General Relativity and Gravitation.

HSU, J. P.  ES63

HSU, J. P.  ES61
Observable Phase Factors and Symmetry of Electric and Magnetic Charges. Published in Foundations of Physics.

HSU, J. P.  ES63

HSU, J. P.  ES63

HSU, J. P.  ES63
Gravity as Yang-Mills’ Space-Time Gauge Fields. Published in Physical Review.

HSU, J. P.  ES63
Static Yang-Mills Field with a Finite Energy and Its Physical Implications. Submitted to Physical Review D.

HSU, J. P.  NRC-ES61
SHERRY, T. N. University of Texas at Austin
Critical Comments on “On the Constancy of the Speed of Light.” Submitted to Foundations of Physics.

HSU, J. P.  ES63
Analysis of Weak Interactions and Eötvös Experiments. Published in Physical Review Letters.

HSU, J. P.  ES63

HSU, J. P.  ES63
SHERRY, T. N. University of Texas at Austin
Common Time in a Four-Dimensional Symmetry Framework. Submitted to Foundations of Physics.

HSU, J. P.  NRC-ES61
TERRY, T. N. University of Texas at Austin
CHIU, C. B. University of Texas at Austin
The Speed of Light as Measured by Two Terrestrial Stable Clocks. Submitted to Physical Review.

HSU, J. P.  ES63
UNDERWOOD, J. A.
University of Texas at Austin
General Flat Four-Dimensional World Pictures and Clock Systems. Submitted to Foundations of Physics.
HUMPHRIES, WILLIAM R.  

JOHNSON, GORDON M.  
McDonnell Douglas Astronautics Co.
VILLELLA, FELMINIO  

JOHNSTON, J. DWIGHT  
BRITTON, W. R.  
Martin Marietta Aerospace 

JOHNSON, WILLIAM G.  
PARNELL, THOMAS A.  
VAUGHAN, W. W.  

JOHNSTON, MARY HELEN  

JOHNSTON, M. H.  
PARR, R. A.  

JONES, CHARLES O.  

KAUFMAN, JOHN W.  
Wind Wheel Electric Power Generator (WWEFG). November 28 - December 2, 1977. Presentation at the Short Course on Wind Machines at the University of Tennessee Space Institute, Tullahoma, Tennessee.

KIEFLING, LARRY A.  
Solution of Shuttle Dynamics Problem Using SPAR. April 4-6, 1979. Presentation at the 20th Structures, Structural Dynamics and Materials conference to be held at St. Louis, Missouri.

KING, H. MARSHALL  
LEGGETT, H.  
Hughes Aircraft Co.  

KRALL, K. R.  

KROSS, D. A.  
Space Shuttle solid Rocket Booster Decelerator Subsystem Drop Test Results. March 5-7, 1979. Presentation at the AIAA 6th Aerodynamic Decelerator Conference to be held at Houston, Texas.
KROSS, D. A. ED22
Space Shuttle Solid Rocket Booster Decelerator Subsystem Rocket Sled Test Program. March 5-7, 1979. Presentation at the AIAA 6th Aerodynamic Decelerator Conference to be held at Houston, Texas.

KRUPNICK, ALBERT C. FA32

LACY, L. L. ES74
ROBINSON, M. B. ES74
RATHZ, T. J. ES74

LANGFORD, J. ES53
HORWITZ, J. L. ES53
Inferring Trapped Plasma Distributions Along a Magnetic Field Line from Equatorial Measurements. April 18-21, 1978. Presentation at the AGU 1978 Spring Meeting to be held at Miami Beach, Florida.

LANIER, J. R., JR. EC12
KAPUSTKA, ROBERT E. EC12
PERRY, EUGENE EC12

LANZEROTTI, L. NRC-ES53
WEBB, D. University of New York
ARTHUR, C. W. ES53
Geomagnetic Field Fluctuations at Synchronous Orbit. 2. Particle Radial Diffusion. Published in the Journal of Geophysical Research.

LAUE, JAY H. PS01

LEVINSON, JOHN EL03

LEVINSON, JOHN R. EL03
Project Fires — Improved Protective Equipment through Space Age Technology. September 10-12, 1978. Presentation at the IAFC Annual Conference to be held at Cincinnati, Ohio.

LIFER, C. E. EP41
Aerospace Structures Highlights of 1978. (One paragraph to be included in article by the Structures Technical Committee of the AIAA). Published in the Aeronautics and Aeronautics Magazine.

LOMBARDO, J. A. EP21
BLOUNT, D. H. EP24
MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are presentation dates.)

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

McDONOUGH, G. F. EF01

McMILLAN, R. S. ES62
Are Long Wavelengths of Maximum Interstellar Polarization Due to Water Ice Mantles on Grains? Published in Astrophysical Journal (Letters).

McMILLAN, R. S. ES62

McMILLAN, R. S. ES62

McMILLAN, R. S. ES62
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.

McMILLAN, ROBERT S. ES62
TAPIA, S. University of Arizona
Discovery of Polarized Light Scattered by Dust Around Alpha Orionis. Published in Astrophysical Journals (Letters) Center for Astrophysics.

McMURTREY, E. L. EH14
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
Spectrum of Cygnus X-1 from $\sim 50$ keV to $\sim 3$ MeV. Published in the AAS Bulletin and Presentation at the AAS 151st Meeting.

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
MILLER, TERESA Y. ES73
BOLTZ, ROBERT C.
Universities Space Research Association

TODD, PAUL Pennsylvania State University
KUKULINSKY, NANCE E. Pennsylvania State University

MITCHELL, ROYCE E. EE11

MORDAN, G. W. PF10

MOSES, JAMES L. EP45
FOGAL, GORDON L. General Electric
SCOLLON, THOMAS R. General Electric

NAUMANN, ROBERT J. ES71

NAUMANN, ROBERT J. ES71

NICOLAS, DAVID P. EC43

O'DELL, C. R. DS30
FOUNTAIN, WALTER F. ES62
GARY, G. A. ES62

ODOM, JAMES B. SA31

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
OONK, R. L. Solaron Corp.
SHAW, L. E. Solaron Corp.
CASH, M. FA32

OWEN, ROBERT B. ES83
LIU, HUA-KUANG University of Alabama in Huntsville A Coherent Optical Correlation Study of Surface Displacement: Submitted to Applied Optics.

PALUDAN, C. T. N. EF02

PETERS, P. N. ES63

PRICE, JOHN M. FA31

RAO, GOPALA ES52
ASKINS, BARBARA ES52 Potential Reduction of X-Ray Exposure through Autoradiographic Intensification of Underexposed Radiographs. Published in Medical Imaging.

REASONER, DAVID L. ES53
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.

REYNOLDS, J. M. ES61
FIELDS, S. A. ES61

RICE, WILLIAM C. SA41

RUFF, R. C. ES74
ORAN, W. A. ES74
RATHZ, T. ES74

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are presentation dates.)


RUNKLE, ROY E. EP14

RUTLAND, CARY H. PS04

SCHUTZENHOFER, L. A. ED23
HOWARD, P. W. ED23
CLEVER, W. W. ED23
GUEST, S. H. ED23

SCOTT, FRANCES E. MSFC
ZACHARY, A. University of Maryland
TAYLOR, M. E. University of Maryland
COLWELL, R. R. University of Maryland

SCHUTZENHOFER, L. A. ED23
HOWARD, P. W. ED23
CLEVER, W. W. ED23
GUEST, S. H. ED23

SELTZER, S. M. ED12

SCHUTZENHOFER, L. A. ED23
HOWARD, P. W. ED23
CLEVER, W. W. ED23
GUEST, S. H. ED23

SELTZER, S. M. ED12

SELTZER, S. M. ED12

SSELTON, BILLY W. PD24

SHELTON, BILLY W. EL12
Payload Specialist Training Scheduler (Pacts). December 4-6, 1978. Presentation at the 1978 Winter Simulation Conference to be held at Miami Beach, Florida.
SMITH, J. B., JR. ES52
SPEICH, D. M. ES52
WILSON, R. M. ES52
REICHHMANN, E. J. ES52

SMITH, R. E. ES81
HUNG, R. J. UAH

SMITH, R. E. ES81
HUNG, R. J. UAH
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.

SMITH, R. E. ES81
HUNG, R. J. UAH
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.

SMITH, R. E. ES81
HUNG, R. J. UAH
PHAN, T. UAH
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.

SMITH, R. E. ES81
HUNG, R. J. UAH
PHAN, T. UAH

SMITH, R. E. ES81
HUNG, R. J. University of Alabama in Huntsville
PHAN, T.
Speculation of Gravity Waves from Hurricane Eloise. December 1977. Presentation at the AGU Fall Meeting 1977 to be held at San Francisco, California.

SMOLLEN, J. W., III EG23

SNODDY, WILLIAM C. ES51
STEWART, RODNEY D. EL02
The Uses of Manhour and Material-Based Industrial Engineering Type Independent Cost Estimates. Submitted to The Government Executive.

SUSKO, MICHAEL ES84

SUTHERLAND, P. G. ES62
WEISSKOFF, M. C. ES62
CANIZARES, C. R. ES62
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.

TANDBERG-HANSEN, E. ES51
COMFORT, R. H. ES51
WU, S. T.
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TANDBERG-HANSEN, E. ES51
NAKAGAWA, Y. High Altitude Observatory
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SMITH, J. B., JR.
NOAA

TANDBERG-HANSEN, E. ES51
STEINOLFSON, R. S.
University of Alabama in Huntsville
WU, S. T.
University of Alabama in Huntsville
Dryer, M. NOAA/ERL

TAYLOR, KENNETH R. PS06
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.

TEUBER, D. L. ES51
BREWER, G. A. ES51
HAGYARD, M. J. ES51
REICHEIMANN, E. J. ES51

TEUBER, D. ES51
TEUBER, D. L. ES52
REICHMANN, E. J. ES52
WILSON, R. M. ES52

THOMAS, CHARLES N. FA32

THOMAS, CHARLES N. FA31

THOMAS, CHARLES N. FA32

TURNER, JAMES R. PD21
DeROACHER, W. L. PD21

URBAN, EUGENE ES63
KARR, G. R.
University of Alabama in Huntsville 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
VAUGHAN, O. H. ES83
HUNG, R. J.

VON TIESENHAUSEN, GEORG F. PS01

WAITES, HENRY B. ED12
WEATHERS, HOYT M. FA33

WEISSKOPF, M. C. ES61
SUTHERLAND, P. G. ES62
CANIZARES, C. R. MIT

WEST, EDWARD A. ESS2
Extending the Field of View of KD*P Electro-Optic Modulators. Published in Applied Optics.

WILSON, R. M., et al. ES52

WILSON, R. M. ES52
SMITH, J. B. JR. ES52
SPEICH, D. M. ES52

WITHEROW, WILLIAM K. ES74
A High Resolution Holographic Particle Sizing System. Submitted to Optical Engineering.

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.

WU, S. T. ES52
REICHMANN, E. J. ES52
SMITH, J. B. ES52
HAGYARD, M. J. ES52

WYMAN, CHARLES L. EE01

WYMAN, CHARLES L. EE01
A Measurement Program to Examine Scattering and Reflection Characteristics of X-Ray Optics. Submitted to Optical Engineering, Journal of SPIE.

YOUNG, LEIGHTON E. EC12
YOUNG, Leighton E. EC12
BARAONA, COSMO R.
Lewis Research Center
MSFC CONFERENCE PUBLICATIONS

CP-2019 May 11-12, 1977
ASPE/MSFC Symposium Engineering and Productivity Gains from Space Technology. N77-30273

CP-2024 February 14-16, 1977
NASA Workshop on Solar-Terrestrial Studies from a Manned Space Station. Conducted at the Utah State University, Logan, Utah. Prepared by Space Sciences Laboratory. N77-32549

CP-2026 May 26-27, 1976

CP-2027 September 20-21, 1977
Microelectronics for the Nineteen Eighties. International Society for Hybrid Microelectronics Tennessee Valley Chapter. Conducted at MSFC.

CP-2028 March 1977
Proceedings of the First Annual Meteorological and Environmental Inputs to Aviation Systems Workshop. Published jointly with NOAA and FAA. Printed by FAA.

CP-2037 October 13-17, 1977

CP-2039 March 7-9, 1978

CP-2040 October 18-19, 1977
The MSFC/UAH Data Management Symposium. Albert Castelli, Editor.

CP-2056 April 10-11, 1978

CP-2057 March 28-30, 1978

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.

J. T. SHEPHERD
Director, Administration and Program Support