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GEORGE C. MARSHALL SPACE FLIGHT CENTER

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FY 1973 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS

Management Services Office

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA

MSFC - Form 454 (Rev October 1967)

ABSTRACT

This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY 73. It also includes papers of MSFC contractors.

After being announced in STAR or C STAR, all of the NASA series reports listed may be obtained from the Scientific and Technical Information Facility, P.O. Box 33, College Park, Maryland 20740.

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.

FY 1973 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS

Scientific and Technical Information Division
Management Services Office

FOREWORD

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

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

The N numbers shown for the reports listed are assigned by the NASA Scientific and Technical Information Facility, College Park, Maryland, indicating that the material is unclassified and unlimited and is available for public use. The N number should be cited when requesting a document.

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

FY 1973 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS

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(Note: The following four reports were published but not listed in the FY 1972 edition of this publication.)

TM X-64649 June 9, 1972
Precise Linear Sun Sensor. Danny D. Johnston. Astrionics Laboratory.
N72-29468

An evaluation of the precise linear sun sensor relating to future mission applications was performed. The test procedures, data, and results of the dual-axis, solid-state system are included. Brief descriptions of the sensing head and of the system's operational characteristics are presented. A unique feature of the system is that multiple sensor heads with various fields of view may be used with the same electronics.

TM X-64664 May 24, 1972
Design of a Mach 8.0 Axisymmetric Nozzle for a Hypersonic Test Facility. Joseph L. Sims and Robert F. Elkin. Aero-Astrodynamics Laboratory.
N72-27273

An axisymmetric nozzle has been designed to produce test section flow at a Mach number of 8.0 for use in a hypersonic test facility at MSFC. Nominal design conditions used to calculate the viscous correction to the wall contour were selected from the results of a parametric boundary layer investigation so that the widest possible range of satisfactory operating conditions could be obtained. Coordinates for the nozzle are presented in a tabular form suitable for design and manufacturing. The basic analysis techniques have been used to generate results to compare with experimental data from a facility at Langley Research Center. The agreement was reasonably good.

TM X-64666 May 30, 1972
Research Achievements Review. Vol. IV, No. 5. Quality and Reliability Assurance Research at MSFC. J. B. Beal, M. C. McIlwain, T. F. Morris, M. J. Berkebile, and F. Villella. Science and Engineering.
N72-27516

TM X-64669 December 1, 1971
Vibration Manual. Claude Green, ed. Astronautics Laboratory. N72-28901

This document provides guidelines of the methods and applications used in vibration technology at MSFC. Its purpose is to provide a practical tool for coordination and understanding between industry and government groups concerned with vibration of systems and equipments. Topics covered include measuring, reducing, analyzing, and methods for obtaining simulated environments and formulating vibration specifications. Other sections cover methods for vibration and shock testing, theoretical aspects of data processing, vibration response analysis, and techniques of designing for vibration.

TM X-2635 November 1972
Chemical Processing Manual. F. J. Beyerle. Process Engineering Laboratory.
N73-14117

This manual presents all documents directly related to chemical processes that were prepared by the Product Engineering and Process Technology Laboratory and are pertinent to the continuing technology of spacecraft development. Chemical processes presented in this document include cleaning, pickling, surface finishes, chemical milling,

plating, dry film lubricants, and polishing. All types of chemical processes applicable to aluminum, for example, are to be found in the Aluminum Alloy Section. There is a separate section for each category of metallic alloy plus a section for non-metals, such as plastics. The refractories, super-alloys and titanium, are prime candidates for the Space Shuttle; therefore, the chemical processes applicable to these alloys are contained in individual sections of this manual.

TM X-64671 June 8, 1972
Probability of Satellite Collision. James W. McCarter. Aero-Astrodynamics Laboratory. N72-29833

A method is presented for computing the probability of a collision between a particular artificial earth satellite and any one of the total population of earth satellites. The collision hazard incurred by the proposed modular Space Station is assessed using the technique presented. The results of a parametric study to determine what type of satellite orbits produces the greatest contribution to the total collision probability are presented. Collision probability for the Space Station is given as a function of Space Station altitude and inclination. Collision probability was also parameterized over miss distance and mission duration.

TM X-64672 March 1972
Flat Conductor Cable Applications. W. Angele. Process Engineering Laboratory. N72-32222

This report contains brief descriptions, supplemented with artwork, of some of the numerous applications of flat conductor cable (FCC) systems. Both Government and commercial uses have been considered, with described applications designated as either aerospace, military, or commercial. The document is designed to illustrate the number and variety of ways in which FCC is being applied and considered for future designs.

TM X-64673 April 13, 1972
Pulse Performance Analysis for Small Hypergolic Propellant Rocket Engines. Gerald W. Smith and Richard H. Sforzini. Astronautics Laboratory. N72-24823

Small rocket engine tests were conducted for the purpose of obtaining pulse performance data to aid in preliminary design and evaluation of attitude control systems. Both monopropellant and hypergolic bipropellant engines of thrust levels from 1 to 100 lbs were tested. The performance data for the hypergolic propellant rockets are compared with theoretical performance calculated from idealized chamber filling and evacuation characteristics. Electromechanical delays in valve response and heat transfer characteristics were found to cause substantial deviation between theoretical and test performance. The theoretical analysis is modified to obtain a semi-empirical model for hypergolic propellant rockets which is demonstrated to be reasonably accurate for two different engine configurations over a considerable range of duty cycles.

TM X-64674 August 1972
A Catalogue of Normalized Intensity Functions and Polarization From a Cloud of Particles with a Size Distribution of α^{-4}. P. D. Craven and G. A. Gary. Space Sciences Laboratory. N72-28717

The Mie theory of light scattering by spheres is used to calculate the scattered intensity functions resulting from single scattering in a polydispersed collection of spheres. The distribution used behaves according to the inverse fourth power law; graphs and tables for the angular dependence of the intensity and polarization of this law are given. The effects of the particle size range and the integration increment are investigated.

TM X-64675 June 27, 1972

Space Shuttle Earth Orbital Rendezvous Targeting Techniques for Near Circular Target Satellite Orbits. A. W. Deaton. Aero-Astrodynamics Laboratory.

N72-28835

This report develops the targeting techniques required to achieve space shuttle rendezvous with a target satellite in a near circular orbit.

TM X-64676 May 26, 1972

Feasibility Study – Replacement of the Inoperative Decommutating Buffer Subsystem for the Instrumentation Checkout Complex in the Quality and Reliability Assurance Laboratory. James W. Hilliard. Computation Laboratory.

N72-28458

The intent of this document is to describe a general purpose computer system that is necessary for replacement of the present inoperative signal decommutator special purpose computer subsystem of the Instrumentation Checkout Complex in the Quality and Reliability Assurance Laboratory. The present decommutator subsystem has a very poor history of reliability and since April 1970, it has become inoperative because the core memory cannot be repaired. Functions of the present signal decommutator subsystem are to receive, demultiplex, record in real-time, playback in real-time, and output to the SDS-930 control computer for analysis of the telemetry data. Recommendations for replacement of the inoperative telemetry decommutator subsystem are for the purchase of a mini-computer that is described in this document. A review of the General Service Administration Automatic Data Processing Equipment (ADPE) Availability List disclosed no general purpose or special purpose equipment that could meet telemetry decommutator requirements.

TM X-64677 May 1972

Comets and Asteroids – A Strategy for Exploration. Comet and Asteroid Mission Study Panel. N72-33831

Many of the asteroids probably formed near the orbits where they are found today. They accreted from gases and particles that represented the primordial solar system cloud at that location. Comets, in contrast to asteroids, probably formed far out in the solar system, and at very low temperatures; since they have retained their volatile components they are probably the most primordial matter that presently can be found anywhere in the solar system. Exploration and detailed study of comets and asteroids, therefore, should be a significant part of NASA's efforts to understand the solar system. A comet and asteroid program should consist of six major types of projects: ground-based observations; Earth-orbital observations; flybys; rendezvous; landings; and sample returns. A preliminary listing of the primary objectives of each project

type is found in Table I. The Comet and Asteroid Mission Study Panel recommends that planning and implementation of these six types of projects be initiated as soon as practical. Missions of the flyby type could be accomplished with existing conventional propulsion systems. Missions of the other types, however, must be carried out with electric propulsion systems, such as solar-electric propulsion. Some of the scientific instruments for the recommended observations could be adopted from previous planetary and interplanetary projects; some would represent new developments.

TM X-64678 May 15, 1972

A Preliminary Investigation of the Environmental Control and Life Support Subsystems (EC/LSS) for Animal and Plant Experiment Payloads. Hubert B. Wells. Preliminary Design Office, Program Development. N72-29050

This report presents a preliminary study of the environmental control and life support subsystems (EC/LSS) necessary for an earth orbital spacecraft to conduct biological experiments. The primary spacecraft models available for conducting these biological experiments are the Space Shuttle and Modular Space Station. The experiments would be housed in a separate module that would be contained in either the Shuttle payload bay or attached to the Modular Space Station. This module would be manned only for experiment-related tasks, and would contain a separate EC/LSS for the crew and animals. Metabolic data have been tabulated on various animals that are considered useful for a typical experiment program. The minimum payload for the 30-day Space Shuttle module was found to require about the equivalent of a one-man EC/LSS; however, the selected two-man Shuttle assemblies will give a growth and contingency factor of about 50 percent. The maximum payloads for the Space Station mission will require at least a seven-man EC/LSS for the laboratory colony and a nine-man EC/LSS for the centrifuge colony. There is practically no room for growth or contingencies in these areas.

TM X-64679 March 29, 1972

Variational Differential Equations for Engineering Type Trajectories Close to a Planet With an Atmosphere. E. D. Dickmanns. Aero-Astrodynamics Laboratory. N72-27891

A model for trajectory computations for engineering-type application is described. The differential equations for the adjoint variables are derived and coded in FORTRAN. The program is written in a form to either take into account or neglect thrust, aerodynamic forces, planet rotation and oblateness, and altitude dependent winds.

TM X-64680 March 6, 1972

HEAO Star Tracker Search Program. William J. Weiler. Preliminary Design Office, Program Development. N72-28665

The High Energy Astronomy Observatory (HEAO) requires a highly accurate and flexible control system to accommodate its scientific payload. One of the critical elements of this system is the star tracker subsystem, which defines an accurate three-axis attitude reference. A digital computer program has been developed to evaluate the ability of a particular star tracker configuration to meet the

requirements for attitude reference at various vehicle orientations. Used in conjunction with an adequate star catalog, this program provides information availability of stars for each tracker and on the ability of the system to maintain three-axis attitude reference throughout a representative sequence of vehicle orientations. This program was developed to provide information necessary for the selection of baseline and possible alternate star tracker configurations for the HEAO-C mission. It could be adapted, however, to other missions which utilize star tracker systems.

TM X-64681 July 5, 1972

Apollo 15 Contamination Photography. R. J. Naumann. Space Sciences Laboratory. N72-29839

The problem of optical contamination in the form of particulates in the vicinity of a spacecraft has been a source of concern for any astronomical experiment that must be performed in sunlight. This concern prompted a photographic photometric experiment on Apollo 15 to measure the brightness of the residual contamination cloud as well as the cloud produced by dumping waste water overboard. An upper limit of $10^{-12.3}$ $B_\odot$ ($B_\odot$ designates the brightness of the solar disc) was placed on the residual cloud at a 90-deg sun angle, which is comparable to the zodiacal light. The brightness of the cloud produced by the waste dump was estimated to be $10^{-9.2}$ $B_\odot$. It was observed to decrease rapidly to $10^{-11.6}$ $B_\odot$ in minutes, then fluctuate in brightness for at least 25 minutes as additional material left the spacecraft. The cloud was observed to consist of individually resolved particle tracks estimated to be particles ranging from millimeters to centimeters in diameter in addition to a background of unresolved particles with an average diameter of 10.5 microns. Most of the tracks proceeded in straight-line paths from the dump nozzle. Several tracks violated this direction, apparently having been scattered by collisions. A few tracks appeared to have definite curvatures, which are believed to be caused by charged particle interactions.

TM X-64682 August 2, 1972

A Mechanical Property and Stress Corrosion Evaluation of Custom 455 Stainless Steel Alloy. J. W. Montano. Astronautics Laboratory. N73-11509

This report is a continuation of the work reported in NASA TM X-53665, dated October 20, 1967. Presented in this report are the mechanical and stress corrosion properties of vacuum melted Custom 455 stainless steel alloy bar [1.0-inch (2.54 cm) diameter] and sheet [0.083-inch (0.211 cm) thick] material aged at 950°F (510°C), 1000°F (538°C), and 1050°F (566°C). Low temperature mechanical properties were determined at temperatures of 80°F (26.7°C), 0°F (-17.8°C), -100°F (-73°C), and -200°F (-129°C). For all three aging treatments, the ultimate tensile and 0.2 percent offset yield strengths increased with decreasing test temperatures while the elongation held fairly constant down to -100°F (-73°C) and decreased at -200°F (-129°C). Reduction in area decreased moderately with decreasing temperature for the longitudinal round [0.250-inch (0.635 cm) diameter] specimens. Notched tensile strength and charpy V-notched impact strength decreased with decreasing test temperature. For all three aging treatments, no

failures were observed in the unstressed specimens or the specimens stressed to 50, 75, and 100 percent of their yield strengths for 180 days of alternate immersion testing in a 3.5 percent NaCl solution. As indicated by the results of tensile tests performed after alternate immersion testing, the mechanical properties of Custom 455 alloy were not affected by stress or exposure under the conditions of this evaluation.

TM X-64683 July 1972

Optical Depths in the Interstellar and Intergalactic Media. Klaus Schocken. Space Sciences Laboratory. N72-29836

Optical depths of the interstellar and intergalactic media for supernova remnants, stars, and galaxies are presented in tabular form.

TM X-64684 August 18, 1972

Fundamental Concepts of Structural Loading and Load Relief Techniques for the Space Shuttle. R. S. Ryan, D. K. Mowery, and S. W. Winder. Aero-Astrodynamics Laboratory. N72-31881

The prediction of flight loads and their potential reduction, using various control system logics for the Space Shuttle vehicles, is very complex. Some factors not found on previous launch vehicles that increase the complexity are large lifting surfaces, unsymmetrical structure, unsymmetrical aerodynamics, trajectory control system coupling, and large aeroelastic effects. This paper discusses these load-producing factors and load-reducing techniques. Identification of potential technology areas is included.

TM X-64685 September 1, 1972

Manufacture and Quality Control of Interconnecting Wire Harnesses. MSFC AD HOC Committee. Quality and Reliability Assurance Laboratory.

Vol. I N72-33206
Vol. II N72-33207
Vol. III N72-33208
Vol. IV N72-33209

This document has been prepared for use as a standard for manufacture, installation, and quality control of eight types of interconnecting wire harnesses. It is made up of four volumes under one reference number to simplify control and referral on contracts. Each volume can be independently employed should only harnesses within one volume be of interest. The processes, process controls, and inspection and test requirements reflected are based on (a) acknowledgment of harness design requirements defined in MSFC document 40M39582, "Harness, Electrical Design Standard," (b) acknowledgment of harness installation requirements defined in MSFC-SPEC-494, "General Specification for Installation of Harness Assembly (Electrical Wiring), Space Vehicle," (c) identification of the various parts, materials, etc, utilized in harness manufacture, and (d) formulation of a typical manufacturing flow diagram for identification of each manufacturing and quality control process, operation, inspection, and test. The document covers interconnecting wire harnesses defined in the design standard. Volume I covers type I, enclosed in fluorocarbon elastomer convolute tubing; type II, enclosed in TFE convolute tubing lined with fiberglass braid; type III, enclosed in TFE convolute tubing; type V, combination of

types III and IV: Volume II covers type IV, open bundle (not enclosed): Volume III covers type VI, enclosed in TFE heat shrink tubing; type VII, flexible armored: and Volume IV covers type VIII, flat conductor cable. Volume breadth covers installations of groups of harnesses in a major assembly and the associated post installation inspections and electrical tests. All volumes are TM X-64685. Knowledge gained through experience on the Saturn V Program coupled with recent advances in techniques, materials, and processes have been incorporated into this document.

TM X-64686 October 1972
Reliability of Hybrid of Microcircuit Discrete Components. Robert V. Allen and Salvadore V. Caruso. Astrionics Laboratory. N73-16208

Hybrid microcircuit technology has rapidly become a standard technique in development and fabrication of electronic hardware. The most obvious reasons for the rapid acceptance of hybrids are small size, reduced weight and higher reliability. The reliability of a hybrid microcircuit is determined by factors such as wire bonding, interconnection techniques, thick- and thin-film processing, discrete component mounting, and hermetic sealing. Most of these factors can be controlled during fabrication cycles with proper process controls. However, since the hybrid manufacturer has little or no control on the design and fabrication of discrete components, these devices have the most paramount effect on microcircuit reliability. Therefore, each hybrid manufacturer must establish criteria for selection, qualification, and screening of discrete devices. This report details the data accumulated during 4 years of research and evaluation of ceramic chip capacitors, ceramic carrier mounted active devices, beam-lead transistors, and chip resistors. Life and temperature coefficient test data, and optical and scanning electron microscope photographs of device failures are presented and the failure modes are described. Particular interest is given to discrete component qualification, power burn-in, and procedures for testing and screening discrete components. Burn-in requirements and test data will be given in support of 100 percent burn-in policy on all NASA flight programs.

TM X-64687 June 15, 1972
Monolithic Microcircuit Techniques. Bobby W. Kennedy. Astrionics Laboratory. N72-30232

Contained in this report are brief discussions of the techniques used at MSFC and in industry to make dielectric and metal thin-film depositions for monolithic circuits. Silicon nitride deposition and the properties of silicon nitride films are discussed. Deposition of dichlorosilane and thermally grown silicon dioxide are discussed. The deposition and thermal densification of borosilicate, alumino-silicate, and phosphosilicate glasses are discussed. Metallization for monolithic circuits and the characteristics of thin films are also included.

TM X-64688 August 1972
Mask and Pattern Characteristics. Donald E. Routh. Astrionics Laboratory. N72-31288

This document provides the individuals planning to use the mask and pattern facility

with detailed information on equipment accuracy, limitations, and pattern-making capabilities. It also provides insight into potential areas of pattern applications, the sequence of mask making, as well as the possible inputs and outputs available to the user.

TM X-64689 September 1972
Actuator Participation in a Bending Mode Identification System. Zack Thompson and Perry Davis. Astrionics Laboratory. N72-33380

A hydraulic actuator designed for a thrust vector control system used as a shaker for a vehicle to determine the bending mode frequencies is described. The actuator is used as the prime mover and the frequency sensor for the flexible vehicle in a test tower. Advantages in using the actuator piston position with respect to a commanded position to obtain the bending mode frequencies are shown.

TM X-64690 August 1972
Chemical Propulsion Research at MSFC. Research Achievements Review. Vol. IV, No. 6. Science and Engineering. N73-12840

TM X-64691 June 30, 1972
Fabrication and Testing of Scatter Plates for Interferometry. Joseph J. Pour, Sr., and John R. Pitts. Astrionics Laboratory. N72-32473

Scatter plate interferometry has become a reliable method of measuring surface configurations of telescope mirrors and other optical components. The scatter plate used in an instrument should be of optimum quality if the surface it is being used to measure is to be of high accuracy. Tests were performed and results show that, although many scatter plates would function, few were of the optimum quality necessary. These few were of the 180 grit group, using 35- and 30-s exposures, which are figures derived from calculations.

TM X-64692 January 31, 1972
Experiment Pointing Control During Space Shuttle Sortie Missions. P. D. Nicaise. Preliminary Design Office, Program Development. N73-12892

The pointing and stability problems of the Sortie mission are examined from the standpoint of basic Shuttle capability and the techniques that could be used for improving this capability to accommodate a maximum number of experiments. Augmentation of the basic Shuttle control system is proposed to provide an acceptable pointing environment. A stabilized reference base is recommended as a general pointing instrument for certain earth observation and astronomy experiments. Simulation results are presented which were obtained by modeling the Skylab Experiment Pointing Control (EPC) system on a thruster controlled Shuttle.

TM X-64693 August 2, 1972
Two Different Approaches for a Control Law of Single Gimbal Control Moment Gyros. Werner O. Schiehlen. Astrionics Laboratory. N72-31660

In the field of momentum exchange attitude control systems, single gimbal control moment gyros (SGCMG's) are of increasing

interest. This report presents a gimbal angle approach and a gimbal rate approach for the SGCMG control law including the singularity avoidance. Both approaches are compared and some illustrative examples are given.

TM X-64694 September 25, 1972
Closed-Form Solutions for Atmospheric Flight with Applications to Shuttle Guidance. Hugo L. Ingram. Aero-Astrodynamics Laboratory. N73-11677

Closed-form solutions for the motion of a rocket-powered vehicle during atmospheric ascent and closed-form solutions for unpowered atmospheric reentry are developed. These closed-form solutions are then used to develop a simplified guidance scheme and to develop a variation-of-parameters integration of more accurate equations of motion with the closed-form solutions as base solutions. The variation-of-parameters integration of the more accurate equations of motion also allows the transition partial derivative matrices associated with these equations to be easily developed. Then the partial derivative transition matrices are used to develop a guidance scheme based on the more accurate equations of motion instead of the less accurate closed-form solutions.

TM X-64695 August 1972
Flat Conductor Cable Connectors with Individually Sealed Contacts. W. Angele. Process Engineering Laboratory. N72-32231

The report contains information on the latest NASA/MSFC flat conductor cable connectors, a series with individually sealed contacts. Data and artwork are concerned with connector historical development, design requirements, design description, and test and cost data.

TM X-64696 August 15, 1972
User's Manual for MSFC Mask and Display Program. Donald Routh and Dae-Shik Woo. Astrionics Laboratory. N72-33193

This report is intended to serve as the User's Manual for the MSFC Mask and Display Program. All program options and a detailed definition of the format of each input card (with examples) are given. Output options and their applications are detailed. A listing of the main program is provided and all update points are explained. All information required for a designer/draftsman (for program use) is provided, and it will not be necessary to become intimately familiar with the internal operations to effectively use the extensive capability it has to offer.

TM X-64697 September 1, 1972
DDP-116 General Digital Filtering. Jack A. Jones and Ronald J. Graham. Computation Laboratory. N72-33189

This report describes the methods for calibrating, selecting filter weights, filtering, and computing filter response functions. These methods are computed on a Statistical Analyzer (STAN) system with a Honeywell DDP-116 Central Processor. The following filter types are computed:

1. All Pass
2. Low Pass
3. High Pass

4. Band Pass
5. Band Rejection
6. Derivative.

TM X-64698 July 1972

The Pseudonoise Test Set: Communication System's Performance Evaluation Based Upon rms Error Testing. G. R. Wallace, S. S. Gussow, W. E. Salter, and G. D. Weathers. Astrionics Laboratory. N73-12146

A pseudonoise (PN) test set has been built to provide a relatively easy means of accurately determining the end-to-end rms error introduced by a communication system when subjected to wideband data. It utilizes a filtered pseudorandom sequence generator as a wideband data source, providing a convenient means for digitally delaying the input reference signal for comparison with the distorted test communication system output. In addition to providing a means to measure the end-to-end rms error and the average delay of a communication system, the PN test set also provides a means to determine the tested system's impulse response and correlation function. The theory of PN testing is discussed in detail along with the most difficult aspects of implementation, the building of matched filter pairs. Both analytical and empirical results are reported which support the contentions that this is an accurate and practical way to acquire figures of merit for complete communication systems.

TM X-64699 October 4, 1972

Development of a Container for Handling, Testing, and Storing Discrete Microelectronic Components. George L. Filip and Salvadore V. Caruso. Astrionics Laboratory. N72-33485

A container has been developed for handling, testing, burning-in, and storing discrete microelectronic components without removal from the protective package. The package was designed to accommodate the Leadless Inverted Device (LID) and other carrier-mounted active devices and chip-type discrete resistors and capacitors. Before the indicated development, components were handled and tested in various ways, some of which resulted in damage or contamination. The basic design of the container utilizes precision-machined printed circuit boards and chemically milled (photoetched) contact springs. Included in this design for protection is an O-ring-sealed cover. Methods of fabrication and limitations of the current hardware are presented. Current applications of and possible extensions to the technology are discussed.

TM X-64700 March 14, 1972

Experimental Evaluation of the Skylab Orbital Workshop Ventilation System Concept. Steve L. Allums, Leon J. Hastings, and James T. Ralston. Astronautics Laboratory. N73-16875

Extensive testing was conducted to evaluate the Orbital Workship ventilation concept. Component tests were utilized to determine the relationship between operating characteristics at 1 and 0.34 atm. System tests were conducted at 1 atm within the Orbital Workshop full-scale mockup to assess delivered volumetric flow rate and compartment air velocities. Component tests with the Anemostat circular diffusers (plenum- and duct-mounted) demonstrated that the diffuser produced essentially equivalent airflow patterns and velocities in 1- and 0.34-atm environments. The tests also showed that the pressure drop across the diffuser could be

scaled from 1 to 0.34 atm using the atmosphere pressure ratio. Fan tests indicated that the performance of a multiple, parallel-mounted fan cluster could be predicted by summing the single-fan flow rates at a given ΔP. The fan volumetric flow rate and the Orbital Workshop system flow rate at 28 V, 1 atm are equivalent to the flow rates at 26 V, 0.34 atm. The shutdown of one fan in a four-fan cluster resulted in a flow decrease of approximately 40 percent because of the backflow through the inoperative fan. For normal operation at 28 V, the average air velocity in the crew quarters was 6.1 to 15.2 m/min (20 to 50 ft/min) depending upon diffuser flow-pattern. The average air velocity in the forward plenum could be varied from 4.6 to 9.1 m/min (15 to 30 ft/min) with the crew quarters diffusers or from 9.1 to 12.2 m/min (30 to 40 ft/min) with the use of three portable fans. The portable fans could supply $\geqslant$30.5 m/min (100 ft/min) to localized areas.

TM X-64701 October 19, 1972

The Effect of Hot Salt on the Mechanical Properties of Several Superalloys. E. E. Nelson. Astronautics Laboratory. N73-11510

The effect of sodium chloride on unstressed, transverse, tensile, metal specimens at elevated temperatures has been determined. Results indicate, under the conditions of this test, that the mechanical properties of Inconel 718, René 41, Titanium base alloy 13V-11Cr-3Al, Hastelloy X, HS25 (L605), HS188, and TDNiCr suffer degradation in tensile strength and ductility due to hot-salt exposure.

TM X-64702 October 15, 1972

Ultrasonic Scanning System for Inspection of Brazed Tube Joints. J. L. Haynes and N. A. Maurer. Quality and Reliability Assurance Laboratory. N73-11445

Described herein is the Ultrasonic Scanning System used to inspect and evaluate in-place brazed tube joints. Because of the expanding use of brazed fittings in the aerospace field the Ultrasonic Scanning System was designed, developed, and built especially for nondestructive testing. It was selected because of its known response to brazing defects not associated with material density changes. The developed scan system is capable of scanning brazed joints in union, tee, elbow, and cross configuration of 3/16-inch through 5/8-inch diameters. The system is capable of detecting brazed defects as small as 0.008 by 0.010 inch which exceeds the 0.015-inch diameter defect resolution required by specification. The ultrasonic brazed tube scanner is recommended for the evaluation of all brazed tube joints that are within its dimensional capabilities and for which an inspection is desired. This recommendation is based upon the in-place scanning and the rapid inspection time capabilities of the system and the innate ability of ultrasonic test methods to detect defects which are not related to material density changes.

TM X-64703 November 6, 1972

Maskmaking Facilities at the Marshall Space Flight Center. Donald E. Routh. Astrionics Laboratory. N73-10284

This report describes the research and development maskmaking facilities at the Astrionics Laboratory of the Marshall Space Flight Center. Information is provided on the level of cleanliness and the environmental control within the various work areas. The available equipment and its function in the maskmaking process are detailed. Sufficient information is provided so that a competent clean-room builder could duplicate the facility capabilities.

TM X-64704 October 13, 1972
Systems Simulation for an Airport Trailing Vortex Warning System. Harold B. Jeffreys. Aero-Astrodynamics Laboratory. N73-12267

This report documents the approach, development, and limited system studies associated with a system simulation for an Airport Trailing Vortex Warning System (ATVWS). It attempts to show the usefulness of a systems engineering approach to the problem of developing a system, as dictated by aircraft vortices, which will increase air-traffic flow in the takeoff/landing corridors of busy airports while maintaining the required safety factor for each operation. It is felt that the development and integration of a total system simulation computer program are essential to provide the system designers a way to develop proper and realistic ATVWS requirements to meet the objectives of decreasing aircraft spacings on takeoff and landing while maintaining an adequate safety margin. This report documents the capabilities (assumptions and limitations) provided by the Total System Simulation Model. The simulation provides the capability of investigating potential problem areas at a fraction of the cost that would be involved in hardware tests only. The simulation program has been developed in a modular form which permits new, more sophisticated component models, when they become available and are required, to be incorporated into the program with a minimum of program modifications. This report documents a limited system study that has been performed using this Total System Simulation Model. The resulting preliminary system requirements, conclusions, and recommendations are given in Section V.

TM X-64705 April 1972
A Cosmic X-Ray Astronomy Bibliography: The Astrophysical Journal, 1962 to 1972. Robert M. Wilson. Space Sciences Laboratory. N73-11869

This report presents the results of a survey of the Astrophysical Journal for the time period January 1962 through March 1972 (volumes 135-172). Some 395 references are contained within this document related to cosmic X-ray astronomy.

TM X-64706 September 30, 1972
Assessment of and Standardization for Quantitative Nondestructive Testing. Robert W. Neuschaefer and James B. Beal. Quality and Reliability Assurance Laboratory. N73-14483

This document assesses present capabilities and limitations of Nondestructive Testing (NDT) as applied to aerospace structures during design, development, production, and operational phases. It will help determine what useful structural quantitative and qualitative data may be provided

from raw materials to vehicle refurbishment. This assessment considers metal alloy systems and bonded composites presently applied in active NASA programs or strong contenders for future use. Quantitative and qualitative data has been summarized from recent literature, and in-house information, and presented herein along with a description of those structures or standards where the information was obtained. Examples, in tabular form, of NDT technique capabilities and limitations have been provided. NDT techniques discussed and assessed were radiography, ultrasonics, penetrants, thermal, acoustic, and electromagnetic. Quantitative data is sparse; therefore, obtaining statistically reliable flaw detection data must be strongly emphasized. The new requirements for reusable space vehicles have resulted in highly efficient design concepts operating in severe environments. This increases the need for quantitative NDT evaluation of selected structural components, the end item structure, and during refurbishment operations.

TM X-64707 October 27, 1972

Fast Digital Noise Filter Capable of Locating Spectral Peaks and Shoulders. T. R. Edwards and R. D. Knight. Space Sciences Laboratory. N73-12212

Experimental data frequently have a poor signal-to-noise ratio which one would like to enhance before analysis. With the data in digital form, this may be accomplished by means of a digital filter. A fast digital filter based upon the principle of least squares and using the techniques of convoluting integers is described. In addition to smoothing, this filter also is capable of accurately and simultaneously locating spectral peaks and shoulders. This technique has been adapted into a computer subroutine, and results of several test cases are shown, including mass spectral data and data from a proportional counter for the High Energy Astronomy Observatory.

TM X-64708 September 1972

An Automatic Data Acquisition System for the 150-Meter Ground Winds Tower Facility, Kennedy Space Center. Wilson B. Traver, Jr., Thomas E. Owen, and Dennis W. Camp. Aero-Astrodynamics Laboratory.

This report summarizes the design concepts and operational functions of an automatic meteorological data acquisition system for use with the NASA 150-meter ground winds tower at Kennedy Space Center. The technical approach and system specifications are presented in a generalized manner to give a clear overall view of the automatic system and to suggest methods and guidelines for using similar digital systems in other applications. Samples of the output meteorological data are illustrated together with brief discussions of their applications. References are given for additional details on the 150-meter tower structure as well as the engineering development and computer software programs associated with the automatic system.

TM X-64709 June 26, 1972

Analyses of Solar Viewing Time, Beta Angle, and Doppler Shift for Solar Observations from the Space Shuttle. Judith P. Brandon. Mission and Payload Planning Office, Program Development. N73-14840

Studies of solar physics phenomena are aided by the ability to observe the Sun from Earth orbit without periodic occultation. This report presents charts for the selection of suitable orbits about the Earth at which a spacecraft is continuously illuminated through a period of a few days. Selection of the orbits considers the reduction of Doppler shift and wavefront attenuation due to relative orbital velocity and residual Earth atmosphere.

TM X-64710 June 1972
Photogrammetry and Photo-Interpretation Applied to Analyses of Cloud Cover, Cloud Type, and Cloud Motion. Paul A. Larsen. Aero-Astrodynamics Laboratory. N73-21385

A determination was made of the areal extent of terrain obscured by clouds and cloud shadows on a portion of an Apollo 9 photograph at the instant of exposure. This photogrammetrically determined area was then compared to the cloud coverage reported by surface weather observers at approximately the same time and location, as a check on result quality. Stereograms prepared from Apollo 9 vertical photographs, illustrating various percentages of cloud coverage, are presented to help provide a quantitative appreciation of the degradation of terrain photography by clouds and their attendant shadows. A scheme, developed for the U.S. Navy, utilizing pattern recognition techniques for determining cloud motions from sequences of satellite photographs, is summarized. Clouds, turbulence, haze, and solar altitude, four elements of our natural environment which affect aerial photographic missions, are each discussed in terms of their effects on imagery obtained by aerial photography. Data of a type useful to aerial and orbital photographic mission planners, expressing photographic ground coverage in terms of flying height above terrain and camera focal length, for a standard aerial photograph format, are provided. Two oblique orbital photographs taken during the Apollo 9 flight are shown, and photo interpretations, discussing the cloud types imaged and certain visible geographical features, are provided.

TM X-64711 October 1, 1972
Compatibility of Materials with Liquid Oxygen – Vol. I. C. F. Key. Astronautics Laboratory, X73-10133

The test instrument and procedure developed by Lucas and Riehl (Ref. 1) was used to determine the compatibility of a wide variety of materials with liquid oxygen (LOX). This method is based upon the tendency of materials to react with LOX on impact and is commonly known as the "ABMA Tester." Within the past 15 years' use, over 240,000 individual test drops have been made on approximately 2,000 different materials. Pertinent data from these tests have been compiled, and the findings are presented in this report. Recommendations are made for the guidance of designers and others in the selection of safe materials for use in oxygen systems. Materials are discussed according to the following classifications: (1) lubricants, (2) sealants and threading compounds, (3) thermal and electrical insulation, (4) elastomers, plastics and adhesives, (5) gaskets and packing, (6) metals, alloys and solders, (7) solvents, cleaning solutions, and miscellaneous, and (8) dye penetrants.

TM X-64712 January 4, 1973

Monthly and Annual Percentage Levels of Wind Speed Differences Computed by Using FPS-16 Radar/Jimsphere Wind Profile Data from Cape Kennedy, Florida. Michael Susko and John W. Kaufman. Aero-Astrodynamics Laboratory. N73-14650

This report presents the percentage levels of wind speed differences computed from sequential FPS-16 radar/Jimsphere wind profiles. The results are based on monthly profiles obtained from December 1964 to July 1970 at Cape Kennedy, Florida. The profile sequences contain a series of three to ten Jimspheres released at approximately 1.5-hour intervals. The results given are the persistence analysis of wind speed difference at 1.5-hour intervals to a maximum time interval of 12 hours. Tables 1a through 12e are the monthly percentage levels of wind speed differences and Tables 13a through 13e are the annual percentage of wind speed differences. The percentage levels are based on the scalar wind speed changes calculated over an altitude interval of approximately 50 meters and printed out every 25 meters as a function of initial wind speed within each 5-km layer from near sea level to 20 km. In addition, analyses were made of the wind speed differences for the 0.2- to 1-km layer as an aid for studies associated with take-off and landing of the Space Shuttle. The results may be used as an aid to (1) predict statistical wind speed change limits of lower and upper level winds, (2) provide an understanding of the statistical probabilities of wind speed changes as a function of time, and (3) apply the data in the study of winds aloft for such projects as the Space Shuttle, HEAO, Skylab, and aeronautical vehicles. Information such as this is also important to many aerospace vehicle structural and control system designers in studying the effects of wind speed variations on the prelaunch monitorship and wind biasing schemes. The availability of this type of information is also important in mission planning and operational analyses plus general meteorological forecasting studies.

TM X-64713 January 5, 1973

Natural Environment Design Requirements for the Space Tug. George S. West, Jr. Aero-Astrodynamics Laboratory. N73-14881

Given in this report are the natural environment design requirements for the Space Tug. Since the Space Tug is carried as "cargo" to orbital altitudes in the Space Shuttle bay, orbital environmental impacts and short-period atmospheric density variations are the main concerns of this report.

TM X-64714 January 10, 1973

The Beta Distribution: A Statistical Model for World Cloud Cover. Lee W. Falls. Aero-Astrodynamics Laboratory. N73-14653

Much work has been performed in developing empirical global cloud-cover models. The investigation in this report was made to determine an underlying theoretical statistical distribution to represent worldwide cloud cover. The beta distribution with probability density function,

$$f(x) = \frac{\Gamma(\gamma+\eta)}{\Gamma(\gamma)\Gamma(\eta)} x^{\gamma-1}(1-x)^{\eta-1}$$

$$0 \leqslant x \leqslant 1 \quad , \quad \gamma > 0 \quad , \quad \eta > 0 \quad ,$$

is given to represent the variability of this random variable. It is shown that the beta distribution possesses the versatile statistical characteristics necessary to assume the wide

variety of shapes exhibited by cloud cover. A total of 160 representative empirical cloud-cover distributions were investigated and the conclusion was reached that this study provides sufficient statistical evidence to accept the beta probability distribution as the underlying model for world cloud cover.

TM X-64715 January 10, 1973
Development and Applications of an Orbital Insertion Surface for the Space Shuttle Orbiter/Tug. A. W. Deaton and P. D. Brandon. Aero-Astrodynamics Laboratory. N73-15862

This report develops the concept of a space shuttle orbiter/tug orbital insertion surface and identifies practical applications in the area of ascent targeting, on-orbit rendezvous targeting, payload/OMS propellant off-loading, and mission analysis.

TM X-64716 December 8, 1972
Flat Conductor Cable Symposium, October 10-12, 1972. James D. Hankins (Coordinator). Process Engineering Laboratory. N73-23294

This report documents the proceedings of a Flat Conductor Cable (FCC) Symposium and Hardware Exhibit which was held at Marshall Space Flight Center during October 10, 11, and 12, 1972. A total of 24 (out of 26) papers and presentation outlines are included covering cables, connectors, termination techniques, electrical characteristics, aerospace applications, and non-aerospace applications. Questions and answers during a panel discussion are included plus a listing of vendors that displayed FCC hardware.

TM X-64717 January 1973
Traffic Model for the Space Shuttle. Shuttle Utilization Planning Office, Program Development. X73-71658

The traffic model for the Space Shuttle is presented along with some supporting and summary data. This document and subsequent editions will provide the Shuttle Program and potential Shuttle users with traffic model information.

TM X-64718 January 18, 1973
High Resolution Power Spectra of Daily Zurich Sunspot Numbers. Harold C. Euler, Jr. Aero-Astrodynamics Laboratory. N73-15840

High resolution power spectra of 77 years of Zurich daily sunspot numbers were computed using various lags and data point intervals. Major harmonic peaks of the approximately 124-month period showed up strongly as well as the 27-day solar rotational period.

TM X-64719 January 1973
Recommendations Relative to the Scientific Missions of a Mars Automated Roving Vehicle (MARV). Robert L. Spencer, ed. Mission and Payload Planning Office, Program Development. N73-16219

This document establishes logical scientific objectives, defines specific science systems requirements, and recommends scientific experiment payloads which will effectively accomplish the established

objectives through the utilization of an automated roving vehicle systematically exploring the surface of Mars. No concepts of the roving vehicle itself have been presented or recommended. It is intended that this document be used in the formulation of any such vehicle design concepts.

TM X-64720 November 1972
Ascent Control Studies of the 049 and ATP Parallel Burn Solid Rocket Motor Shuttle. Robert S. Ryan, David K. Mowery, Morris Hammer, and A. C. Weisler. Aero-Astrodynamics Laboratory. N73-17854

The control authority approach is a major problem of the parallel burn solid Shuttle configuration due to the many resulting system impacts regardless of the approach. This report discusses the major trade studies and their results, which led to the recommendation of an SRB TVC control authority approach.

TM X-64721 January 22, 1973
Transient Permeation of Organic Vapors Through Elastomeric Membranes. James E. Curry. Astronautics Laboratory. N73-16112

The permeation of benzene and acetone vapors through sulfur-cured natural rubber was studied by the time-lag method. The experimental results were analyzed by a method suggested by Meares. D_o, the zero concentration diffusion coefficient, was obtained by the early-time method. The Frisch time-lag equation was utilized to estimate both the solubility coefficient (a) and the additional parameter (b) required to define the concentration-dependence of the diffusion coefficient, $D(c) = D_o \exp(bc)$. This form of concentration dependence was manifested by the corresponding permeability coefficient values. At low entering penetrant pressure where the transport coefficients are constant, indirect evidence was obtained that D_o is the mechanistically correct diffusion coefficient. The solubility coefficient values calculated for benzene vapor in natural rubber are in reasonable agreement with published equilibrium sorption data for a similar rubber compound. At higher entering penetrant pressures, average diffusion coefficients obtained at steady state tended to be larger than the corresponding average diffusion coefficients derived from the time-lags. This has been attributed to slow relaxation effects in the swollen membrane which inject an element of time dependence into the transport process.

TM X-64722 March 1973
The Attenuation of X Rays Emitted by Supernovae. Klaus Schocken. Space Sciences Laboratory. N73-21701

The attenuation of X rays in Arnett's C^{12} detonation supernova model is computed. The attenuation of X rays in the filaments of the Crab Nebula is computed using a model for the filaments by Woltjer and a model by Davidson and Tucker. An empirical expression by Gorenstein, Kellogg, and Gursky for the optical thickness of the interstellar medium for three supernova remnants is analyzed.

TM X-64723 February 1973
Research Achievements Review. Vol. IV, No. 7. Process Engineering Research at MSFC. Science and Engineering. N73-22915

TM X-64724 November 1972

Electrophoresis Demonstration on Apollo 16. R. S. Snyder. Astronautics Laboratory. N73-18157

Free fluid electrophoresis, a process used to separate particulate species according to surface charge, size, or shape was suggested as a promising technique to utilize the near-zero-gravity condition of space. Fluid electrophoresis on earth is disturbed by gravity-induced thermal convection and sedimentation. An apparatus was developed to demonstrate the principle and possible problems of electrophoresis on Apollo 14 and the separation boundary between red and blue dye was photographed in space. The basic operating elements of the Apollo 14 unit were used for a second flight demonstration on Apollo 16. Polystyrene latex particles of two different sizes were used to simulate the electrophoresis of large biological particles. The particle bands in space were extremely stable compared to ground operation because convection in the fluid was negligible. Electrophoresis of the polystyrene latex particle groups according to size was accomplished although electro-osmosis in the flight apparatus prevented the clear separation of two particle bands.

TM X-64725 February 28, 1973

Scientific Involvement in Skylab by the Space Sciences Laboratory of the Marshall Space Flight Center. Carl E. Winkler, ed. Space Sciences Laboratory. N73-20886

This report briefly describes the involvement of the Marshall Space Flight Center's Space Sciences Laboratory in the Skylab program from the early feasibility studies through the analysis and publication of flight scientific and technical results. This includes Mission Operations Support, the Apollo Telescope Mount, Materials Science/Manufacturing in Space, Optical Contamination, Environmental and Thermal Design Criteria, and several corollary measurements and experiments.

TM X-64726 December 15, 1972

Large Space Telescope, Phase A Final Report. Vols. I through V. Program Development.

Vol. I N73-18449
Vol. II N73-18450
Vol. III N73-18451
Vol. IV N73-18452
Vol. V N73-18453

This document is a report of the Phase A study of the Large Space Telescope (LST). The study defines an LST concept based on the broad mission guidelines provided by the Office of Space Science (OSS), the scientific requirements developed by OSS with the scientific community, and an understanding of long range NASA planning current at the time the study was performed. The LST is an unmanned astronomical observatory facility, consisting of an optical telescope assembly (OTA), scientific instrument package (SIP), and a support systems module (SSM). The report consists of five volumes: Volume I is an executive summary, Volume II is a summary of the entire report, and Volumes III, IV, and V contain the analyses and conceptual designs of the OTA, SIP, and SSM, respectively. The report describes the constraints and trade off analyses that were performed to arrive at a reference design for

each system and for the overall LST configuration. The LST will be launched into low earth orbit by the Space Shuttle and operated for 10 to 15 years. The Shuttle will also be used to maintain the LST and to update the scientific instrument complement. Several maintenance modes have been investigated, including on-orbit pressurization of the SSM to provide a shirtsleeve environment for maintenance, and earth return of the LST. The LST will provide the scientific community with several fundamentally unique capabilities which will permit the acquisition of new and important observational data. Its location in space permits observations over the entire spectrum from about 100 nm to the far infrared. A low cost design approach was followed in the Phase A study. This resulted in the use of standard spacecraft hardware, the provision for maintenance at the black box level, growth potential in systems designs, and the sharing of Shuttle maintenance flights with other payloads.

TM X-64727 July 17, 1972

A Comparison of CMG Steering Laws for High Energy Astronomy Observatories (HEAOs). Billy G. Davis. Preliminary Design Office, Program Development. N73-20718

This report contains a comparison of six selected control moment gyro (CMG) steering laws for use on the HEAO spacecraft. Basic equations are developed to project the momentum and torque of four skewed, single gimbal CMGs into vehicle coordinates. In response to the spacecraft attitude error signal, six algorithms (steering laws) are derived for controlling the CMG gimbal movements. HEAO performance data were obtained using each steering law and compared on the basis of such factors as accuracy, complexity, singularities, gyro hang-up and failure adaption. Moreover, each law was simulated with and without a magnetic momentum management system. With magnetics, momentum is continuously dumped against the earth's magnetic field and the gimbal angles stay small, thus permitting linear operation of the steering law. The performance of any steering law was enhanced by the magnetic system and all performed equally well. Without magnetics, the gimbal angles get large and there are significant differences in steering law performances due to cross coupling and nonlinearities. The performance of the pseudo inverse law was consistently better than the other laws and is recommended for HEAO.

TM X-64728 October 1972

Termination of Flat Conductor Cable to NASA/MSFC Plugs. W. Angele. Process Engineering Laboratory. N73-20239

The report contains data, supplemented with artwork, on the major steps involved in terminating flat conductor cable (FCC) to MSFC's FCC plugs. Cable and shield preparation steps include material cutting, insulation stripping, and plating of exposed conductors. Methods and equipment required to terminate FCC to each of four MSFC plugs are described.

TM X-64729 March 7, 1973

A Mechanical Property and Stress Corrosion Evaluation of 431 Stainless Steel Alloy. J. W. Montano. Astronautics Laboratory. N73-21441

This report presents the mechanical properties of type 431 stainless steel in two conditions: annealed bar and hardened and tempered bar. Test specimens, manufactured from approximately 1.0 inch (2.54 cm) diameter bar stock, were tested at temperatures of 80°F (+26.7°C), 0°F (-17.8°C), -100°F (-73°C), and -200°F (-129°C). The test data indicated excellent tensile strength, notched/unnotched tensile ratio, ductility, shear, and impact properties at all testing temperatures. Results of the alternate immersion stress corrosion tests on stressed and unstressed longitudinal tensile specimens 0.1250 inch (0.3175 cm) diameter and transverse "C"-ring specimens, machined from 1.0 inch (2.54 cm) diameter bar stock, indicated that the material is not susceptible to stress corrosion cracking when tested in a 3.5-percent NaCl solution for 180 days.

TM X-64730 January 12, 1973

Evaluation of Flexible Ring Baffles for Damping Liquid Oscillations. Frank Bugg. Aero-Astrodynamics Laboratory. N73-21273

An experimental study was undertaken of damping produced by single flexible-ring baffles in a 396-cm diameter tank of liquid nitrogen. Two 24.8-cm wide baffles were tested. One baffle was 0.00635-cm thick type 301 stainless steel and the other 0.0254-cm thick Teflon FEP. Each baffle produced damping of liquid oscillations equal to or greater than that expected from rigid baffles of the same size. The equations used to determine the baffle thickness required were found to be adequate baffle design equations.

TM X-64731 March 1973

Space Shuttle Traffic Model Developed from 1971 Mission Model. Shuttle Utilization Planning Office, Program Development. N73-26878

Traffic model data for the Space Shuttle using the 1971 NASA, DoD, and commercial mission models are presented along with descriptions and schedules for the NASA and commercial payloads used to develop the data.

TM X-64732 January 15, 1973

Structural Control Interaction. Robert S. Ryan, D. K. Mowery, S. W. Winder, and Halsey E. Worley. Aero-Astrodynamics Laboratory. N73-21834

The basic guidance and control concepts that lead to structural control interaction and structural dynamic loads are identified. Space vehicle ascent flight load sources and the load relieving mechanism are discussed, along with the characteristics and special problems of both present and future space vehicles including launch vehicles, orbiting vehicles, and the Space Shuttle flyback vehicle. The special dynamics and control analyses and test problems apparent at this time are summarized. This report is in essence a presentation that was prepared for "NASA Structures and Materials Advisory Committee" as a means of providing information for research planning.

TM X-64733 March 21, 1973

Synthetic Sea Water – An Improved Stress Corrosion Test Medium for

Aluminum Alloys. T. S. Humphries and E. E. Nelson. Astronautics Laboratory. N73-22062

A major problem in evaluating the stress corrosion cracking resistance of aluminum alloys by alternate immersion in 3.5-percent salt (NaCl) water is excessive pitting corrosion. Several methods were examined to eliminate this problem and to find an improved accelerated test medium. These included the addition of chromate inhibitors, surface treatment of specimens, and immersion in synthetic sea water. The results indicate that alternate immersion in synthetic sea water is a very promising stress corrosion test medium. Neither chromate inhibitors nor surface treatment (anodize and alodine) of the aluminum specimens improved the performance of alternate immersion in 3.5-percent salt water sufficiently to be classified as an effective stress corrosion test method.

TM X-64734 February 23, 1973
Microbiological Surveillance of Food Handling at NASA-MSFC. F. J. Beyerle. Process Engineering Laboratory. N73-20127

A microbiological surveillance program of cafeterias and snack bars at MSFC was conducted to supplement the inspections by NASA Medical Center personnel and to gather information for cafeteria management to pinpoint areas of possible contamination. This report summarizes the work conducted under the program from its inception in January, 1972, to its termination on September 15, 1972. Ten food handling facilities were included in the surveillance at NASA-MSFC.

TM X-64735 March 29, 1973
Heat Flow and Convection Demonstration (Apollo 14). Tommy C. Bannister. Space Sciences Laboratory.

Apollo 14 Astronaut Stuart A. Roosa conducted a group of experiments during the lunar flyback on February 7, 1971, to obtain information on heat-flow and convection in gases and liquids in an environment of less than 10^{-6} g. Flow observations and thermal data have shown that (1) as expected, there are convective motions caused by surface tension gradients in a plane liquid layer with a free upper surface; (2) heat flow in enclosed liquids and gases occurs mainly by diffusive heat conductions; and (3) some convective processes, whose characteristics are not fully known, add to the heat transfer. The raw data are presented in this report, and the analysis approach is given.

TM X-64736 February 16, 1973
Microbiological Assay of the MSFC Neutral Buoyancy Simulator. F. J. Beyerle. Process Engineering Laboratory. N73-21127

Personnel safety for divers and astronauts, from the microbiological and medical viewpoint, is the primary reason for monitoring the Neutral Buoyancy Simulator water. Of secondary importance is the detection of microorganisms which may degrade the mockups in the water and the carpeted area around the simulator. A Neutral Buoyancy Program was initiated in 1965 in the Process Engineering Laboratory, MSFC, to perform microbiological studies of the water in the 1.4-million gallon tank. A broad

spectrum of water sampling procedures was performed, and personal communications with mycology experts were conducted to familiarize laboratory personnel with fungal problems in water. With the addition of control procedures and remedial actions taken, the water was considered sanitary and in a safe condition for the divers and astronauts to perform their underwater neutral-buoyancy work.

TM X-64737 April 1973
Preliminary Flight Trajectories for the Apollo Soyuz Test Project. Joe D. Brooks. Aero-Astrodynamics Laboratory.

This report documents preliminary data for a typical launch window opening, a typical in-plane case, and a typical launch window closing trajectory, not necessarily in the same daily launch window, for the Apollo Soyuz Test Project Mission. The Soyuz will be launched first and the Apollo will be launched on the first opportunity, 7 hours 21 minutes later. If the Apollo is unable to be launched on the first opportunity, four additional opportunities are available at 30 hours 56 minutes, 54 hours 31 minutes, 78 hours 05 minutes, and 101 hours 40 minutes. If the Apollo cannot be launched in this time frame, no further attempt will be made to launch and rendezvous with the first Soyuz. Soyuz will then be deorbited; however, a second Soyuz has been made available for the same purposes.

TM X-64738 April 5, 1973
Structural Load Reduction of the Space Shuttle Booster/Orbiter Configuration Using a Load Relief Guidance Technique. A. W. Deaton and P. B. Kelley. Aero-Astrodynamics Laboratory.
N73-21812

A space shuttle booster/orbiter atmospheric ascent guidance algorithm is developed that will reduce the aerodynamically induced structural loads as compared to an open loop guidance algorithm.

TM X-64739 April 1973
1973 NASA Mission Model. Shuttle Utilization Planning Office, Program Development.

The April 1973 NASA Mission Model and the NASA estimate of the April 1973 Non-NASA/Non-DoD Mission Model for calendar years 1973 through 1991 are presented along with summary Mission Model totals for NASA, Non-NASA/Non-DoD, and DoD for calendar years 1980 through 1991.

TM X-64740 December 1972
Phase A Reaction Control System Design for the Large Space Telescope (LST). William B. Price. Preliminary Design Office, Program Development.
N73-21394

In response to a request from the Office of Space Science, a Phase A study of the Large Space Telescope was undertaken by the George C. Marshall Space Flight Center. The design of a Reaction Control System (RCS) for the LST was a part of this study, the results of which are reported in this document. The primary requirement for an RCS on the LST is to serve as an emergency backup control system to the LST primary attitude control system. A regulated gaseous nitrogen RCS was selected, and a description of the operation of the system and its individual components is presented. An on-orbit maintenance procedure for the system is also described. The alternate RCS concepts considered during the study are

summarized. Principal design goals of the RCS for the LST were to minimize contamination effects, make use of existing components, and modularize the system to provide ease in manned orbital maintenance. The RCS described herein will provide a point of departure for a more in-depth Phase B system design study. A summary of this report is presented in NASA TM X-64726, entitled "Large Space Telescope Phase A Report," and reference is made to that report for a description of all aspects of the LST.

TM X-64741 April 13, 1973
Scintillator Handbook with Emphasis on Cesium Iodide. John L. Tidd, Joseph R. Dabbs, and Norman Levine. Program Development and HEAO Project Office. N73-22398

The objective of this report is to provide a background of reasonable depth and reference material on scintillators in general. Particular attention is paid to the cesium iodide scintillators as used in the High Energy Astronomy Observatory (HEAO) experiments. It is intended especially for use by persons such as laboratory test personnel who need to obtain a working knowledge of these materials and their characteristics in a short time.

TM X-64742 March 16, 1973
The Gaertner L119 Ellipsometer and Its Use in the Measurement of Thin Films. Michael Linkous. Space Sciences Laboratory. N73-21392

An introduction to the study of ellipsometry is presented, with special attention given to the Gaertner model L119 ellipsometer and the techniques of measuring thin films with this instrument. Values obtained from the ellipsometer are analyzed by a computer program for a determination of optical constants and thickness of the film.

TM X-64743 February 23, 1973
Hypervelocity Impact Testing of L-Band Truss Cable Meteoroid Shielding on Skylab. David W. Jex. Space Sciences Laboratory. N73-24867

The purpose of this series of tests was to determine if the L-band truss cable meteoroid shielding as currently designed and supplied for Skylab provides adequate protection when it is at the expected space environment temperature of -118°C (-180°F).

TM X-64744 January 1, 1973
Computer User's Manual for a Generalized Curve Fit and Plotting Program. Ronald A. Schlagheck, B. D. Beadle II, B. D. Dolerhie, Jr., and J. W. Owen. Astronautics Laboratory. N73-24213

A Fortran-coded program has been developed for generating plotted output graphs on 8-½ by 11-inch paper. The program is designed to be used by engineers, scientists, and non-programming personnel on any IBM 1130 system that includes a 1627 plotter. The program has been written to provide a fast and efficient method of displaying plotted data without having to generate any additional Fortran instructions. Various output options are available to the program user for displaying data in four different types of formatted plots. These options include discrete, linear, continuous, and histogram graphical outputs. The manual

contains information about the use and operation of this program. Example cases illustrate the sample input and output for five selected plots. A mathematical description of the least-squares "goodness of fit" test is presented. A program listing is also included.

TM X-64745 May 9, 1973

Offgassing of Non-Metallic Materials in 5 psia Oxygen. F. T. Wells and D. R. Hamilton. Astronautics Laboratory.

N73-23631

Offgas analyses results of non-metallic materials to determine their conformance with MSFC-SPEC-101B, "Flammability, Odor, and Offgassing Requirements and Test Procedures for Materials in Environments Which Support Combustion," are reported. This report contains results obtained since early 1969 to the present time. Only results of Test No. 7 of MSFC-SPEC-101B are shown in this report. A brief test and analysis description including procedure development is also presented.

TM X-64746 January 12, 1973

Skylab Attitude Control and Angular Momentum Desaturation with One Double-Gimbaled Control Moment Gyro. Hans F. Kennel. Astrionics Laboratory.

N73-23851

In case two control moment gyros fail, attitude control of Skylab can be maintained with the thruster attitude control system. This results, however, in a severely increased fuel consumption, depleting the fuel in a few days. A reduction in fuel consumption can be achieved by allowing the attitude reference to yield with the gravity-gradient torques at twice orbital frequency. For an ideal case, fuel consumption can be drastically reduced, but any unanticipated disturbance torques and principal moment-of-inertia axes misalignments will again increase the fuel consumption sizeably. Therefore, an alternate concept was developed, which does not have large fuel consumption under any circumstances. In this concept the attitude reference is commanded to oscillate in the orbital plane with twice the orbital frequency and the remaining control moment gyro controls about orbital north and about the minimum moment-of-inertia axis, while the thruster attitude control system controls rate only about the remaining axis. This rate control in conjunction with the restoring torque due to the gravity gradient will keep bounded the excursion of the minimum moment-of-inertia axis out of the orbital plane. This alternate concept has the additional advantage that it needs no information on the principal moment-of-inertia axes misalignment and is completely insensitive to star tracker failure. Proper phasing of the attitude reference oscillation even allows angular momentum desaturation, which is responsible for the insensitivity of the thruster fuel consumption to unknown disturbances, like vent torques, magnetic torques, etc.

TM X-64747 May 10, 1973

X-Ray Reflection Efficiency of Nickel-Coated Quartz Optical Flats. John M. Reynolds, Stanley A. Fields, and Robert M. Wilson. Space Sciences Laboratory.

N73-24694

Results of tests to determine the reflection efficiency of quartz optical flats vacuum coated with 1000-Å nickel are

presented. Of the three vacuum-coated samples tested, two had been contaminated during the firing of the Lunar Module Reaction Control System in the JSC vacuum chamber (Chamber A). Measurements were made for 1.54-, 1.79-, and 2.29-Å incident radiation. The reflection efficiency of the contaminated samples was reduced by as much as 50 percent for some angles of incidence.

TM X-64748 August 1972

A Model for Estimating the Cost Impact of Schedule Perturbations on Aerospace Research and Development Programs. Donald F. Bishop. Engineering Cost Group, Program Development.

N73-24948

The problem of determining the cost impact attributable to perturbations in an aerospace R&D program schedule is becoming increasingly important as the availability of R&D funds diminishes. This memorandum develops the methodology from which a model is presented for updating aerospace R&D cost estimates as a function of perturbations in program time.

TM X-64749 February 16, 1973

A Simple Performance Calculation Method for LH_2/LOX Engines with Different Power Cycles. Robert H. Schmucker. Astronautics Laboratory.

N73-24786

A simple method for the calculation of the specific impulse of an engine with a gas generator cycle is presented. The solution is obtained by a power balance between turbine and pump. Approximate equations for the performance of the combustion products of LH_2/LOX are derived. Performance results are compared with solutions of different engine types.

TM X-64750 April 16, 1973

Flat Conductor Cable Design, Manufacture, and Installation. W. Angele and James D. Hankins. Process Engineering Laboratory.

This report presents pertinent information for hardware selection, design, manufacture, and quality control necessary for flat-conductor cable interconnecting harness application. Detailed information is provided on cable, connectors, and support hardware that has been developed on various programs conducted and funded by the National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Alabama. The relation of this hardware to the new MIL-C-55543 and MIL-C-55544 specifications for flat-conductor cable and flat-conductor cable connectors is defined. Comparisons are made between round-wire cable and flat-conductor cable. The flat conductor cable interconnecting harness systems show major cost, weight, and space savings, plus increased system performance and reliability. The design application section includes electrical characteristics, harness design and development, and a full treatise on EMC considerations. Manufacturing and quality control sections pertain primarily to the NASA/MSFC developed conductor-contact connector system and special flat-conductor cable to round-wire cable transitions. This report presents flat-conductor cable technology as of June 1968, and predicts the role of flat-conductor cables in interconnecting harness applications for future programs.

TM X-64751 July 1973

The 1973 Space Shuttle Traffic Model. Shuttle Utilization Planning Office, Program Development. N73-26845

Traffic model data for the Space Shuttle for calendar years 1980 through 1991 are presented along with some supporting and summary data. This model was developed from the 1973 NASA Payload Model and the NASA estimate of the 1973 Non-NASA/ Non-DoD Payload Model. The estimates for the DoD flights included in this document are based on the 1971 DoD Mission Model.

TM X-64752 July 1973

The 1973 Expendable Launch Vehicle Traffic Model. Shuttle Utilization Planning Office, Program Development.

Traffic model data for current expendable launch vehicles (assuming no Space Shuttle) for calendar years 1980 through 1991 are presented along with some supporting and summary data. This model was based on a payload program equivalent in scientific return to the 1973 NASA Payload Model, the NASA estimated non NASA/non DoD Payload Model, and the 1971 DoD Mission Model.

TM X-64753 June 8, 1973

Phased-Array Laser Radar: Concept and Application. Kenneth A. Kadrmas. Aero-Astrodynamics Laboratory. N73-25561

Basic principles of laser radar, LIDAR, have been documented by numerous authors. In spite of this intensity of effort, present day system concepts have not been sufficiently concentrated on improving the "optical compatibility" of the LIDAR transmitter-receiver combination. A unique new approach has been undertaken in the design and construction of a coaxial transmitter-receiver combination. Major emphasis has been placed on simple permanent optical alignment, transmitter-receiver field of view matching, use of a pulsed gas laser as a transmitter, maximum optical efficiency, complete digital control of data acquisition, and optical mount pointing and tracking. Also, a means of expanding the coaxial transmitter-receiver concept to allow phased-array LIDAR, par-LIDAR, is described.

TM X-64754 May 1, 1973

Vamistor Resistor Investigation. Quality and Reliability Assurance Laboratory.

This report presents the results of the failure investigation conducted by MSFC on resistors produced by the Vamistor Division, Wagner Electric Corporation. This failure investigation included: failure analyses, chemical and metallurgical analyses, failure mechanism studies, seal leak analyses, and nondestructive stress tests. The data, information, conclusions, and recommendation presented herein can be helpful in assessing current usage of these resistors.

TM X-64755 February 1, 1973

Guidelines for Selection and Application of Tantalum Electrolytic Capacitors at MSFC. A. M. Holladay, Leon C. Hamiter, Jr., and Benton A. Vizzier, Sr. Quality and Reliability Assurance Laboratory. N73-26200

This document presents guidelines for selection and application of three types of

tantalum electrolytic capacitors in current use at MSFC in the design of electrical and electronic circuits for manned space flight missions. In addition, the guidelines supplement requirements of existing Military Specifications used in procurement of capacitors. A need exists for these guidelines, to assist designers in preventing some of the recurring, serious problems experienced with tantalum electrolytic capacitors in the recent past. The three types of capacitors covered by these guidelines are: solid (CSR), wet foil (CLR 25, 27, 35, and 37), and wet slug (CLR 65).

TM X-64756 June 26, 1973

Hot and Cold Atmospheres for Vandenberg AFB, California (1973 Version). D. L. Johnson. Aero-Astrodynamics Laboratory.

Extreme atmospheres, pertaining to summer (hot) and winter (cold) conditions for Vandenberg Air Force Base, California, are presented from 0- to 90-km altitudes. Computed values of pressure, e, kinetic temperature, virtual temperature, density, and relative differences [percentages from Vandenberg Reference Atmosphere, 1971 (VRA 71)] of the atmospheric parameters versus altitude are tabulated in increments of 250 m. Hydrostatic and gas law equations were used in conjunction with radiosonde and rocketsonde thermodynamic data in determining the vertical structure of the two atmospheric models. The summer-type density profile deviated from -9.0 percent (of the VRA-71) at the ground to 28.4 percent at 74.5-km altitude. The winter density profile went from 5.2 percent at the surface to -31.4 percent at 72 km.

TN D-6824 August 1972

Experimental Findings From Zero-Tank Net Positive Suction Head Operation of the J-2 Hydrogen Pump. Henry P. Stinson and Raymond J. Strickland. Astronautics Laboratory. N72-29807

The results of a series of liquid hydrogen turbopump tests to demonstrate the feasibility of zero-tank net positive suction head are presented. A J-2 engine hydrogen pump and S-IVB stage fuel feed system were used for this investigation. The pump was operated at flows and speeds equivalent to normal J-2 engine operating conditions and at hydrogen bulk temperatures between 39 and 45°R. These tests show zero-tank net positive suction head to be a realistic operating mode that should be considered for future applications.

TN D-6825 July 1972

Wall Temperature Distribution Calculation for a Rocket Nozzle Contour. Satoaki Omori, Klaus W. Gross, and Alfred Krebsbach. Astronautics Laboratory. N72-30773

The JANNAF Turbulent Boundary Layer (TBL) computer program, applicable to rocket nozzles, requires a wall temperature distribution among other input parameters to determine boundary layer behavior, heat transfer, and performance degradation. The inclusion of a complete regenerative cooling cycle model with associate geometry, material and fluid property data provides a capability to internally calculate wall temperature profiles on the hot gas and coolant flow-side, as well as the coolant flow bulk temperature variation. Besides the regular heat transfer and performance degradation calculations, the new concept can be used to optimize the cooling cycle, coolant flow requirements, and cooling jacket geometry.

TN D-6829 July 1972

Spherical Balloon Response to Three-Dimensional Time-Dependent Flows. George H. Fichtl. Aero-Astrodynamics Laboratory. N72-27001

The dynamic response of a balloon to atmospheric flow is a function of the aerodynamic drag and lift forces, virtual mass effects, the Archimedean buoyancy forces, and dynamic buoyancy forces. The equations of motion for a spherical balloon which include these effects are derived by examining the various forces that can act on a spherical balloon in relation to the atmospheric equations of motion. It is assumed that the atmosphere affects the balloon but the balloon does not affect the atmosphere. An analysis shows that Coriolis effects in the balloon equations of motion can be neglected for most rising or falling balloons. The concept of the Lagrangian displacement of a balloon is introduced. It is shown that the general balloon response problem is extremely complicated because the wind-forcing functions in the balloon equations of motion are functions of the wind velocity vector and its Eulerian first derivatives evaluated at the location of the balloon. The balloon location is the dependent variable of the problem. The linear perturbation equations for a spherical balloon are derived by perturbing the components of velocity of the balloon about a terminal velocity state which is in equilibrium with a space-time invariant mean horizontal flow. The atmospheric flow is also

perturbed such that the resulting equations can be used to analyze the responses of spherical balloons to three-dimensional time-dependent flows. The wind field is represented in terms of a four-fold Fourier integral that involves three orthogonal wave numbers and a frequency, while the balloon components of velocity are represented as Fourier integrals involving a frequency which, in turn, is a function of the wind field wave numbers and frequency and the unperturbed flow components of velocity. The general nonstationary spectra of the balloon components of velocity are obtained in terms of integrals of the nonhomogeneous and nonstationary spectra of the wind field. The flow associated with a statistically stationary and homogeneous atmospheric velocity field is treated as a special case. The introduction of Taylor's frozen eddy hypothesis reduces the response integrals to algebraic equations which are relatively simple forms for the balloon transfer functions.

TN D-6868 July 1972

Mass Influx Obtained from LLLTV Observations of Faint Meteors. Robert J. Naumann and K. Stuart Clifton. Space Sciences Laboratory. N72-28830

Since the advent of low light level television (LLLTV) systems, it has been recognized that such devices offer the ability to observe meteors as faint as 10^{th} magnitude which allows the extension of optical meteor data to masses as small as 10^{-4} gram. The Space Sciences Lab at Marshall Space Flight Center has been actively engaged in such observations using image orthicons and intensified SEC vidicons. The results of these observations are presented along with an interpretation in terms of mass-flux. This interpretation includes the development of a relationship between peak luminosity of a meteor and mass, velocity, and zenith angle that was derived from single body meteor theory and compares favorably with results obtained from the Artificial Meteor Program. Also included in the mass flux interpretation is an analysis of the observation response of a LLLTV system to fixed and moving point sources.

TN D-6873 October 1972

A Workload Model and Measures for Computer Performance Evaluation. H. Kerner and K. Kuemmerle. Computation Laboratory. N72-33195

A generalized workload definition is presented which constructs measurable workloads of unit size from workload elements, called Elementary Processes. An Elementary Process makes almost exclusive use of one of the processors, CPU, I/O processor, etc., and is measured by the cost of its execution. Various kinds of user programs can be simulated by quantitative composition of Elementary Processes into a Type. The character of the Type is defined by the weights of its Elementary Processes and its structure by the amount and sequence of transitions between its Elementary Processes. A set of Types is batched to a Mix. Mixes of identical cost are considered as equivalent amounts of workload. These formalized descriptions of workloads allow investigators to compare the results of different studies quantitatively. Since workloads of different composition are assigned a unit of cost, these descriptions enable determination of cost effectiveness of different workloads on a

machine. Subsequently performance parameters such as Throughput Rate, Gain Factor, Internal and External Delay Factors are defined and used to demonstrate the effects of various workload attributes on the performance of a selected large scale computer system.

TN D-6901 September 1972

Atmospheric Electricity Criteria Guidelines for Use in Aerospace Vehicle Development. Glenn E. Daniels. Aero-Astrodynamics Laboratory. N72-31617

Lightning has always been of concern for aerospace vehicle ground activities. The unexpected triggering of lightning discharges by the Apollo 12 space vehicle shortly after launch and the more recent repeated lightning strikes to the launch umbilical tower while the Apollo 15 space vehicle was being readied for launch have renewed interest in studies of atmospheric electricity as it relates to space vehicle missions. This report reflects some of the results of these studies with regard to updating the current criteria guidelines.

TN D-6930 September 1972

Optimum Runway Orientation Relative to Crosswinds. L. W. Falls and S. C. Brown. Aero-Astrodynamics Laboratory. N72-30250

Specific magnitudes of crosswinds may exist that could be constraints to the success of an aircraft mission such as the landing of the proposed space shuttle. A method is required to determine the orientation or azimuth of the proposed runway which will minimize the probability of certain critical crosswinds. Two procedures for obtaining the optimum runway orientation relative to minimizing a specified crosswind speed are described and illustrated with examples. The empirical procedure requires only hand calculations on an ordinary wind rose. The theoretical method utilizes wind statistics computed after the bivariate normal elliptical distribution is applied to a data sample of component winds. This method requires only the assumption that the wind components are bivariate normally distributed. This assumption seems to be reasonable. Studies are currently in progress for testing wind components for bivariate normality for various stations. The close agreement between the theoretical and empirical results for the example chosen substantiates the bivariate normal assumption.

TN D-7061 October 1972

The Optical Properties of Platinum and Gold in the Vacuum Ultraviolet. Roger C. Linton. Space Sciences Laboratory. N72-33662

The optical constants of platinum and gold thin films have been determined in the spectral region of 40 to 200 nm by reflection measurements. The highly polarized continuum of synchrotron radiation emitted by the 240-MeV electron storage ring at the Physical Sciences Laboratory of the University of Wisconsin was used as a light source for the spectrum below 120 nm, while a windowless discharge lamp coupled to a normal incidence monochromator provided a source for the longer wavelengths. Optical constants were determined by a computer program based on iterative solutions to the Fresnel equations for reflection as a function of the angle of incidence.

TN D-7091 January 1973

Longitudinal Oscillation of Launch Vehicles. Rudolf F. Glaser. Astronautics Laboratory. N73-15924

During powered flight a vehicle may develop longitudinal self-excited oscillations, so-called "POGO" oscillations, of its structure. The energy supplying the vibration is tapped from the thrust by the activity of the system itself; that is, oscillation of the structure causes oscillation of the propellant system, especially of the pumps. In this way an oscillating thrust can be created that, by a feedback loop, may sustain the structural oscillation under certain circumstances. Two special features of the system prove to be essential for creation of instability. One is the effect of the inherent time interval that the thrust oscillation is lagging behind the structural oscillation. The other is the decrease of system mass caused by the exhausting of gas. The latter feature may cause an initially stable system to become unstable. To examine the stability of the system, a single mass-spring model, which is the result of a one-term Galerkin approach to the equation of motion, has been considered. The Nyquist stability criterion leads to a stability graph that shows the stability conditions in terms of the system parameter and also demonstrates the significance of time lag, feedback magnitude, and loss of mass. An important conclusion can be drawn from the analysis: large relative displacements of the pump-engine masses favor instability. This is also confirmed by flight measurements. During some of the Apollo flights, severe POGO oscillations of the S-II stage occurred. The relative soft support of the center engines by a pin-ended crossbeam led to this situation. Data obtained at the time the oscillation occurred show extremely large displacements of the crossbeam at the attachment point.

TN D-7115 December 1972

Minimum Weight Design of Structures Via Optimality Criteria. J. Kiusalaas. Astronautics Laboratory. N73-14901

This report reviews the state of the art of automated structural design through the use of optimality criteria, with emphasis on aerospace applications. The contents include constraints on stresses, displacements, and buckling strengths under static loading, as well as lower bound limits on natural frequencies and flutter speeds. It is presumed that the reader is experienced in finite element methods of analysis, but is not familiar with optimal design techniques.

TN D-7159 February 1973

Development and Application of Vibroacoustic Structural Data Banks in Predicting Vibration Design and Test Criteria for Rocket Vehicle Structures. H. J. Bandgren and W. C. Smith. Astronautics Laboratory. N73-20914

This report presents a method of predicting broadband random vibration criteria for components on space vehicles. Large amounts of vibration and acoustic data obtained from flights and static firing tests of space vehicles were formulated into vibroacoustic data banks for structural categories of ring frame, skin stringer, and honeycomb. The vibration spectra with their associated acoustic spectra are normalized to a reference acoustic spectrum. The individual normalized

spectra are grouped according to definite structural characteristics and statistically analyzed to form the vibroacoustic data banks in this report. These data banks represent the reference vibration criteria available for determining the new vehicle vibration criteria.

TN D-7178 February 1973

Hypervelocity Impact Testing of Cables. David W. Jex, Albert B. Adkinson, James E. English, and Carl E. Linebaugh. Space Sciences Laboratory. N73-16186

This report presents the physics and electrical results obtained from simulated micrometeoroid testing of certain Skylab cables. The test procedure, electrical circuits, test equipment, and cable types utilized are also explained.

TN D-7195 March 1973

Calculation of Energy Deposition Distributions for Simple Geometries. John W. Watts, Jr. Space Sciences Laboratory. N73-17832

When high-energy charged particles pass through a thin detector, the ionization energy loss in that detector is subject to fluctuations or "straggling" which must be considered in interpreting the data. This problem has been treated by Landau, Symon, Vavilov, and others. Under many conditions, which depend upon the charge and energy of the incident particle and the detector geometry, the ionization energy lost by the particle is significantly different from the energy deposited in the detector. Since most detectors respond according to the ionization energy deposited, the difference between energy lost in the detector and energy deposited there must be considered. This difference is caused by high-energy secondary electrons produced in the ionization process that travel far from their point of production, often leaving the detector. This problem divides naturally into a calculation of the energy loss that results in excitation and low-energy secondary electrons which do not travel far from their production points, and a calculation of energy loss that results in high-energy secondary electrons which can escape from the detector. The first calculation is performed using a modification of the Vavilov energy loss distribution. A cutoff energy is introduced above which all electrons are ignored and energy transferred to low energy particles is assumed to be equivalent to the energy deposited by them. For the second calculation, the trajectory of the primary particle is considered as a source of secondary high-energy electrons. The electrons from this source are transported using Monte Carlo techniques and multiple scattering theory, and the energy deposited by them in the detector is calculated. The results of the two calculations are then combined to predict the energy deposition distribution. The results of these calculations are used to predict the charge resolution of parallel-plate pulse ionization chambers that are being designed to measure the charge spectrum of heavy nuclei in the galactic cosmic-ray flux.

TN D-7200 March 1973

Proposal for Hierarchical Description of Software Systems. H. Trauboth. Computation Laboratory. N73-21200

The programming of digital computers has developed into a new dimension full of difficulties, because the hardware of

computers has become so powerful that more complex applications are entrusted to computers. The costs of software development, verification, and maintenance are outpacing those of the hardware and the trend is toward further increase of sophistication of application of computers and consequently of sophistication of software. To obtain better visibility into software systems and to improve the structure of software systems for better tests, verification, and maintenance, a clear, but rigorous description and documentation of software is needed. The purpose of this report is to extend the present methods in order to obtain a documentation that better reflects the interplay between the various components and functions of a software system at different levels of detail without losing the precision in expression. This is done by the use of block diagrams, sequence diagrams, and cross-reference charts. In the appendices, examples from an actual large software system, i.e., the Marshall System for Aerospace Systems Simulation (MARSYAS), are presented. The proposed documentation structure is apt to automation of updating significant portions of the documentation for better software change control. This report should also stimulate research into new practical methods and principles for the development, verification, and maintenance of complex software systems.

TN D-7240 May 1973

Retrieval of Dispersive and Convective Transport Phenomena in Fluids Using Stationary and Nonstationary Time Domain Analysis. J. Briscoe Stephens and Robert M. St. John. Aero-Astrodynamics Laboratory. N73-25284

Simultaneously occurring dispersive and convective components of fluid kinematics are obtained by a time domain analysis of optically retrieved temporal histories of the transport phenomena. Utilizing triangulation of collimated optical fields of view from two radiometers to obtain the temporal histories of the intensity fluctuations associated with the transport phenomena has enabled investigators to retrieve the local convective transport by employing correlation statistics. The location of the peak in the covariance curve determines the transit time from which the convection velocity is calculated; whereas, the change in shape of the peak in the covariance curve determines the change in average frequency of the wave packet from which the dispersion velocity is calculated. Thus, our two-component analysis requires the maximum possible enhancement of the delineation for the transport. The convection velocity is the result of a fixed reference frame calculation; whereas, the dispersion velocity is the result of a moving reference frame calculation. This moving reference frame is constrained to move along the common streamline at the convection velocity. The transport probability has been developed as an estimate of whether the transport phenomena have been measured along the common stream, and also provides an indication of whether the period of stationarity is sufficient to provide adequate information enhancement. The time information is suppressed by the utilization of a fourth-order autocovariance curve. This moving frame delineation is analyzed in the time domain with the wave packet algorithm for the dispersion parameters. The effectiveness of these models is demonstrated on empirical data sets obtained in glow discharge

investigations, cold jet experiments, and air quality investigations.

TN D-7263 June 1973

A Study of Zodiacal Light Models. G. A. Gary and P. D. Craven. Space Sciences Laboratory. N73-26843

This report presents a review of the basic equations used in the analysis of photometric observations of zodiacal light. A survey of the methods used to model the zodiacal light in and out of the ecliptic is given. Results and comparison of various models are presented, as well as recent results by the authors.

TN D-7312 May 1973

Unsupervised Spatial Clustering with Spectral Discrimination. Robert R. Jayroe, Jr. Aero-Astrodynamics Laboratory. N73-24410

The recent development of manned and unmanned space vehicles has brought about an almost unprecedented advance in studies of remotely sensed earth observations. These observations require a multidisciplinary study which includes such fields as agriculture, forestry, geography, demography, cartography, geology, meteorology, hydrology, oceanography, environmental quality, ecology, sensor technology, and interpretation techniques development. With this unprecedented advance comes an unprecedented amount of data. The problem arises of how to analyze and extract information from such large volumes of data in an efficient manner. The main emphasis of this work is the development of a computer program for extracting features from remotely sensed data presented in digital image form. This computer program requires no human supervision or prejudgment and operates unassisted on the raw digital data. The presentation of this work also includes a condensed general background on remote sensing of earth features and a short synopsis on some of the most commonly used types of feature extraction techniques. This discussion is followed by a presentation of results obtained from the unsupervised feature extraction computer program along with a description and listing of the computer program.

TN D-7317 June 1973

Measurements of the Performance of Multiwire Proportional Chambers. R. W. Austin, A. Aglitis, J. C. Gregory, S. A. Metzger, T. A. Parnell, H. F. Rutledge, W. Selig, and N. P. Cumings. Space Sciences Laboratory. N73-24816

This report presents data that may be useful in formulating engineering specifications and test procedures for the proportional counter hodoscope to be flown as part of the High Energy Cosmic Ray Experiment on the High Energy Astronomy Observatory (HEAO), Mission A. A collection of preliminary data taken in laboratory tests of multiwire counters with an anode wire spacing of 5 mm and cathode gap spacing of 1 cm is presented. The data are from laboratory development models or counters for balloon flights and were selected to illustrate several aspects of proper and improper counter performance. Most of the data were taken from a large area proportional counter hodoscope which has an active area of 0.5 by 0.5 m and 104 wires per plane.

TN D-7318 June 1973

Axisymmetric Oscillation of a Partially Liquid-Filled Cylindrical Shell Container Having Hemispherical Bulkheads. Rudolf F. Glaser. Astronautics Laboratory.

N73-25925

The longitudinal oscillations of launch vehicles represent an area of concern. During ignition liftoff or cutoff, longitudinal vibrations occur as transients and may cause considerable dynamic loads. However, longitudinal oscillation can also be excited during powered flight. From experience it is well known that under certain circumstances energy can be tapped by the activity of the system itself and can produce very undesirable self-excited oscillation, the so-called "pogo" oscillation of the vehicle structure. Thus, it is understandable that the longitudinal dynamics of vehicles have received continued attention over the last years. A simplified vehicle model must be used to analyze the longitudinal dynamic behavior of vehicles or, in other words, to determine the longitudinal frequencies and mode shapes. Usually only a few of the fundamental modes are of interest; thus, only significant dynamic properties must be considered. The liquid propellants constitute a high percentage of the overall vehicle masses throughout much of the powered flight time and, coupled with the solid vehicle masses and springs, may generate the fundamental modes of the entire vehicle. Thus, the correct comprehension of the liquid oscillation inside the elastic container is extremely important. In this report a spring-supported, cylindrical container of the length l having hemispherical bulkheads is considered. The analysis, however, is also valid for $l = 0$, which represents the cases of sphere and hemisphere. A computer program and numerical evaluation of the analysis contained in this report can be found in the contractor report, Axisymmetric Oscillation of a Partially Liquid-Filled Cylindrical Shell Container Having Hemispherical Bulkheads: Computer Program and Numerical Evaluation, by Dwight Caughfield of the Department of Mathematics, Abilene Christian College, Abilene, Texas.

TR R-387 August 1972

Maximum Range Three-Dimensional Lifting Planetary Entry. E. D. Dickmanns. Aero-Astrodynamics Laboratory. N72-29845

Variational equations for maximum range three-dimensional quasisteady glide are given. Nonlinear oscillatory maximum range trajectories obtained with a refined gradient program are approximated by a superposition of quasisteady glide and linearized perturbation equation results. A "basic" control law is found which is closely followed for maximum cross-range trajectories. The effect of a reradiative heating constraint involving velocity, altitude and angle of attack on a maximum cross-range trajectory for a Space Shuttle orbiter-type vehicle reentering the earth's atmosphere is investigated numerically.

TR R-393 December 1972

A Study of the Microstructure and Optical Properties of Thin Lead-Dielectric Cermet Films. Robert B. Owen. Astrionics Laboratory. N73-12811

A transmission electron microscopy study involving direct and replicating techniques is directed to a definition of the microstructure of radio frequency-sputtered, thin lead-dielectric cermet films. Once defined, this microstructure is used to obtain theoretical film refractive indices. The Maxwell Garnett theory provides a basis for the theoretical results. Measurements of film transmission and reflectivity are used to obtain rough experimental values for film refractive indices by the Tekucheva method. More exact values are obtained via ellipsometry. The rough Tekucheva values are used to determine the range over which computer calculations interpreting the ellipsometric results must be made. This technique yields accurate values for the film refractive indices. The films are radio frequency-sputtered from lead glass targets with varying amounts of lead attached to their faces. Three different targets are used, resulting in three sets of films, each containing a different percentage of lead. The lead content of the films is measured by microprobe analysis as well as visual inspection of micrographs. The lower content lead films are seen to consist of tiny balls of lead embedded in the dielectric, as are the intermediate lead content films, but the higher lead content films form metallic networks throughout the dielectric. The lower and intermediate lead content films have indices which agree with the predictions of the Maxwell Garnett theory, but the higher lead content films, whose structure fails to conform to the Maxwell Garnett configuration, have indices whose values diverge from the Maxwell Garnett predictions. It is thus shown that the theory of Maxwell Garnett is valid for thin cermet films whose structure consists of tiny metal balls embedded in a dielectric medium.

TR R-401 December 1972

Mobility Performance of the Lunar Roving Vehicle: Terrestrial Studies – Apollo 15 Results. Nicholas C. Costes, John E. Farmer, and Edwin B. George. Space Sciences Laboratory and Astrionics Laboratory. N73-16817

The constraints of the Apollo 15 mission dictated that the average and limiting performance capabilities of the first manned

Lunar Roving Vehicle, when operated on the lunar surface, be known or estimated within narrow margins. For this reason, extensive studies were conducted during the year preceding the Apollo 15 launch and are described herein. The results of these studies are compared with the actual performance of the Lunar Roving Vehicle during the Apollo 15 mission. From this comparison, conclusions are drawn relating to the capabilities and limitations of current terrestrial methodology in predicting the mobility performance of lunar roving vehicles under in-situ environmental conditions, and recommendations are offered concerning the performance of surface vehicles on future missions related to lunar or planetary exploration.

TR R-404 March 1973

The Techniques of Holographic Particle Sizing. Robert L. Kurtz. Space Sciences Laboratory. N73-18448

Depending on the mechanism of particle production, the resultant particle size and velocity distribution may range over several orders of magnitude. In general, if particle size information is desired from a given type generator, one must resort to some form of experimental determination of the distribution. If the source of particle production is a dynamic one involving a reasonable volume, holography provides a tailor-made particle size and velocity distribution detector. This is evidenced by the fact that holography allows the entire volume to be recorded on one exposure without any interference with the volume of interest. Herein lies a very important characteristic of the holographic particle detection technique: It provides a holographic nondestructive testing technique in the fullest sense of the definition of nondestructive testing. This report provides a description of three different systems useful in this technique and includes the experimental results from one of the holographic systems which was used to detect particle size and velocity distribution from the Skylab waste tank.

TR R-410 June 1973

Classical Eighth- and Lower-Order Runge-Kutta-Nyström Formulas with a New Stepsize Control Procedure for Special Second-Order Differential Equations. Erwin Fehlberg. Computation Laboratory. N73-24614

New Runge-Kutta-Nyström formulas of the eighth, seventh, sixth, and fifth order are derived for the special second-order (vector) differential equation $\ddot{x} = f(t,x)$. In contrast to Runge-Kutta-Nyström formulas of an earlier NASA report by this author, these formulas provide a stepsize control procedure based on the leading term of the local truncation error in $\dot{x}$. This new procedure is more accurate than the earlier Runge-Kutta-Nyström procedure of this author (with stepsize control based on the leading term of the local truncation error in x) when integrating close to singularities. Two central orbits are presented as examples. For these orbits, the accuracy and speed of the formulas of this report are compared with those of Runge-Kutta-Nyström and Runge-Kutta formulas of earlier NASA reports by this author.

TR R-414 June 1973

Digital Simulation of the Serpentuator Using MARSYAS. Sudarshan P. Singh. Computation Laboratory. N73-25210

Serpentuator is a serpentine teleoperator device for intravehicular and extravehicular activities in space. The serpentuator is simulated using the digital simulation software system MARSYAS and using the Component-Connection Simulation model and the Direct Simulation model. A comparison of the results for the two cases shows that under identical conditions, simulation execution time in the Component-Connection model case is reduced by a factor of the order of 100. A visual display of the serpentuator positions is obtained using the AMTRAN system on the Datacraft DC 6024 computer.

SP-299 1973

Holography and Optical Filtering. Proceedings of a conference sponsored by the National Aeronautics and Space Administration and the Optical Society of America and held at the Marshall Space Flight Center, Huntsville, Alabama, May 24-25, 1971. N73-25540

SP-313 1972

Space for Mankind's Benefit. Proceedings of a space congress held November 15-19, 1971, at Huntsville, Alabama, sponsored by the National Aeronautics and Space Administration and the Huntsville Association of Technical Societies. Jesco von Puttkamer and Thomas J. McCullough, eds. Center Plans and Resources Control Office.

N73-13829

CONTRACTOR REPORTS

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

CR-2072 July 1972
Correlation of Stress-Wave-Emission Characteristics with Fracture in Aluminum Alloys. Final Report. NAS8-21405. Aerojet Solid Propulsion Co. N72-30470

CR-2078 August 1972
Project Fog Drops, Part I: Investigations of Warm Fog Properties. NASW-2126. Cornell Aeronautical Lab. N72-30554

CR-2160 January 1973
Extravehicular Activities Guidelines and Design Criteria. NAS8-27502. URS/Matrix Co. N73-15858

CR-2162 December 1972
Evaluation of Cryogenic Insulation Materials and Composites for Use in Nuclear Radiation Environments. NAS8-18024. Convair Div. of General Dynamics. N73-14707

CR-2173 January 1973
Computer Programs for the Solution of Systems of Linear Algebraic Equations. NCA8-44. Memphis State University. N73-17181

CR-2182 January 1973
A Boundary Layer Approach to the Analysis of Atmospheric Motion Over a Surface Obstruction. NAS8-27387. The University of Tennessee Space Inst. N73-16244

CR-2189 January 1973
Atmospheric Energetics as Related to Cyclogenesis over the Eastern United States. NAS8-26751. Texas A&M University. N73-16607

CR-2192 January 1973
An Investigation of the Sutcliffe Development Theory. NAS8-26751. Texas A&M University. N73-16605

CR-2193 February 1973
Processing for Spaceborne Synthetic Aperture Radar Imagery. NAS8-21805. Computer Sciences Corp. N73-18202

CR-2201 February 1973
A Field Investigation and Numerical Simulation of Coastal Fog. NAS8-27999. Cornell Aeronautical Lab. N73-18648

CR-2203 February 1972
Short and Long Period Atmospheric Variations Between 25 and 200 km. NAS8-26658. Georgia Inst. of Technology. N73-17504

CR-2212 March 1973
Computerized Logic Design of Digital Circuits. NAS8-21812. Sperry Rand Corp. N73-19230

CR-2213 April 1973
Digital Processing of Radiographic Images. NAS8-21805. Computer Sciences Corp. N73-22135

CR-2223 March 1973
Specification of Mesospheric Density, Pressure, and Temperature by Extrapolation. NAS8-21810. Northrop Services, Inc. N73-21364

CR-2248 May 1973
An Innovative Approach to Compensator Design. Final Report. NAS8-21377. Mississippi State University. N73-25651

CR-2269 May 1973
A Numerical Solution for Thermo-acoustic Convection of Fluids in Low Gravity. NAS8-27015. Lockheed Missiles and Space Co. N73-26289

CR-2280 June 1973
Estimation in a Modified Binomial Distribution. NAS8-29286. Appalachian State University. N73-25678

CR-120003 October 1972
Aerodynamic Stability and Control Characteristics of the TBC Shuttle Booster AR-11981-3. NAS8-4016. Chrysler Corp. N72-33871

CR-120008 June 1972
Space Shuttle: Space Shuttle Abort Separation Pressure Investigation. Vol. I; Parts A and B: Booster Data at Mach 5. NAS8-4016. Chrysler Corp.
Part A N72-27924
Part B N72-27925

CR-120023 October 1972
An Investigation of the Landing Characteristics of the NASA-MSC August 1969 Baseline Orbiter Configuration in Ground Effect. NAS8-4016. Chrysler Corp. N72-33869

CR-120025 July 1972
Heat Transfer Rate Distribution on McDonnell Douglas Delta Wing Orbiter Determined by Phase-Change Paint Technique for Nominal Mach Number 8. NAS8-4016. Chrysler Corp. N72-30908

CR-120034 January 1973
Pressure Investigation of a Space Shuttle Launch Configuration Consisting of a Delta-Wing Orbiter and Swept-Wing Booster with Canard and Tip Fins. NAS8-4016. Chrysler Corp.
Vol. 1, Part A N73-20891
Vol. 1, Part B N73-20892

CR-120056 August 1972
Aerodynamic Characteristics of a 156-Inch Solid Rocket Motor at Angles of Attack from -10° to 190°. NAS8-4016. Chrysler Corp. X72-10609

CR-120057 August 1972
Aerodynamic Characteristics of a Double Delta Wing Space Shuttle Orbiter (M = 0.6 – 5.0). NAS8-4016. Chrysler Corp. N72-29875

CR-120058 March 1973
Space Shuttle: An Investigation of the Load Distribution Over the SRB and External Tank of a 0.004 Scale Model of the 0.49 Space Shuttle Launch Configuration. NAS8-4016. Chrysler Corp. N73-23872

CR-120061 June 1972
Space Shuttle: Space Shuttle Abort Separation Pressure Investigation. Vol. 2: Orbiter Data at Mach 5. NAS8-4016. Chrysler Corp. Part A N72-28877
Part B N72-27926

CR-120062 June 1972
Space Shuttle: Space Shuttle Abort Separation Pressure Investigation. Vol. 3: Booster Data at Mach 3. NAS8-4016. Chrysler Corp. N72-27927

CR-120063 June 1972
Space Shuttle: Space Shuttle Abort Separation Pressure Investigation. Vol. 4:

Orbiter Data at Mach 3. NAS8-4016. Chrysler Corp. N72-27928

CR-120064 June 1972
Space Shuttle: Space Shuttle Abort Separation Pressure Investigation. Vol. 5: Booster Data at Mach 2. NAS8-4016. Chrysler Corp. N72-27929

CR-120065 June 1972
Space Shuttle: Space Shuttle Abort Separation Pressure Investigation. Vol. 6: Orbiter Data at Mach 2. NAS8-4016. Chrysler Corp. N72-27930

CR-120066 January 1973
Space Shuttle: Preliminary Pressure Distributions on the 049 Orbiter, Orbiter in Presence of H/O Tank and Orbiter in Launch Configuration. NAS8-4016. Chrysler Corp. N73-20890

CR-120070 November 1972
Space Shuttle: Aerodynamic Stability, Control Effectiveness and Drag Characteristics of a Shuttle Orbiter Configuration at Mach Numbers from 0.6 to 4.96. NAS8-4016. Chrysler Corp. N73-12923

CR-120071 June 1972
Ascent Heat Transfer Rate Distribution on the North American Rockwell Delta Wing Orbiter and the General Dynamics/ Convair Booster at a Mach Number of 8 (Not Mated). NAS8-4016. Chrysler Corp. N72-29865

CR-120072 July 1972
Space Shuttle: Heat Transfer Distributions on the LMSC 040C and 040-L4 Delta Orbiters (M = 8). NAS8-4016. Chrysler Corp. N72-27935

CR-120073 October 1972
Space Shuttle: Stability and Control Effectiveness at High and Low Angles of Attack and Effects of Variations in Engine Shroud, Fin and Drag Petal Configurations for the Boeing 0.008899-Scale Pressure-Fed Ballistic Recoverable Booster Model 979-160. NAS8-4016. Chrysler Corp. N73-11896

CR-120074 October 1972
Space Shuttle: Performance, Static Stability, and Control Effectiveness of a Parametric Space Shuttle Launch Vehicle. NAS8-4016. Chrysler Corp. N72-33870

CR-120075 December 1972
Space Shuttle: Static Surface Pressures of the 0.004 Scale 049 Orbiter in the Launch Configuration. NAS8-4016. Chrysler Corp. N73-14879

CR-120076 September 1972
Space Shuttle: Static Stability and Control Effectiveness of the 040A Delta Wing Orbiter (M = 0.6 to 4.96). NAS8-4016. Chrysler Corp. X72-10612

CR-120078 September 1972
Space Shuttle: Re-Entry Stability in Nose Forward and Base Shield-Forward Orientations and the Effectiveness of Drag Devices for the Boeing 0.00694-Scale Ballistic Recoverable Booster, Model 979-071. NAS8-4016. Chrysler Corp. X72-10654

CR-120080 October 1972
Space Shuttle: A Comparison of Wind Tunnel Facility Data on the Grumman H-33 Delta Wing Orbiter. NAS8-4016. Chrysler Corp. N73-10889

CR-120081 October 1972
Space Shuttle: A Comparison of Wind Tunnel Facility Data on the 040A Space Shuttle Orbiter Configuration. NAS8-4016. Chrysler Corp. N73-10894

CR-120082 November 1972
Space Shuttle: Longitudinal Aerodynamic Characteristics of Low Aspect Ratio Wing Configuration in Ground Effect for a Moving and Stationary Ground Surface. NAS8-4016. Chrysler Corp. N73-11895

CR-120083 October 1972
Space Shuttle: Aerodynamic Characteristics of Various MDAC Space Shuttle Ascent Configurations With Parallel Burn Pressure-Fed and SRM Boosters. Vol. 1: Tanks T1 and T2 Ascent Configurations. NAS8-4016. Chrysler Corp. N73-11901

CR-120084 October 1972
Space Shuttle: Aerodynamic Characteristics of Various MDAC Space Shuttle Ascent Configurations with Parallel Burn Pressure-Fed and SRM Boosters. Vol. 2: Tank T3 Configurations. NAS8-4016. Chrysler Corp. N73-11902

CR-120085 October 1972
Space Shuttle: Aerodynamic Characteristics of Various MDAC Space Shuttle Ascent Configurations with Parallel Burn Pressure-Fed and SRM Boosters. Vol. 3: Tank T4 Configurations. NAS8-4016. Chrysler Corp. N73-11903

CR-120086 October 1972
Space Shuttle: Aerodynamic Characteristics of Various MDAC Space Shuttle Ascent Configurations with Parallel Burn Pressure-Fed and SRM Boosters. Vol. 4: Ascent Configuration Plume Studies and Model Buildup. NAS8-4016. Chrysler Corp. N73-11904

CR-120087 October 1972
Space Shuttle: Aerodynamic Characteristics of Various MDAC Space Shuttle Ascent Configurations with Parallel Burn Pressure-Fed and SRM Boosters. Vol. 5: Orbiter, Tanks and Booster Alone Configurations. NAS8-4016. Chrysler Corp. N73-11905

CR-120088 December 1972
Aerodynamic Static Stability and Control Effectiveness of a Parametric Shuttle Launch Configuration. NAS8-4016. Chrysler Corp. N73-13910

CR-120089 April 1973
Space Shuttle (ATP Configuration) Abort Staging Investigation. NAS9-13247. Chrysler Corp. N73-21831

CR-120090 March 1973
Space Shuttle: Aerodynamic Characteristics of a 162-Inch Diameter Solid Rocket Booster With and Without Strakes. NAS9-13247. Chrysler Corp. N73-20888

CR-120092 March 1973
Results of Investigations on a 0.0405 Scale Model ATP Version of the NR-SSV

Orbiter in the North American Aeronautical Laboratory Low Speed Wind Tunnel. NAS9-13247. Chrysler Corp. N73-21832

CR-120179 August 1972
Space Shuttle: Aerodynamics in Nose-First, Nozzle-First, and Tumbling Re-Entry Modes and Effectiveness of Several Drag Devices for the Boeing 0.0144 Scale Parallel Burn Solid Rocket Motor, Model 979-185. NAS8-4106. Chrysler Corp. X72-10605

CR-123719 April 1972
Space Station Executive Summary. NAS8-25140. McDonnell Douglas Astronautics Co. N72-27912

CR-123720 May 1972
Conjugate Gradient Optimization Programs for Shuttle Reentry. Final Report. NAS8-26929. University of Michigan. N72-26716

CR-123721 July 12, 1972
Suppression of Combustion Oscillations With Mechanical Damping Devices. Final Report. NAS8-21310. Pratt and Whitney Aircraft. N72-26958

CR-123723 November 1971
Sounding Rocket Flight Report MUMP 9 and MUMP 10. NAS8-21086. University of Michigan.

CR-123724 June 1972
Summary of Moderate Depth Lunar Drill Development Program from its Conception to 1 July, 1972. NAS8-26487. Westinghouse Electric Corp. N72-27526

CR-123725 June 1, 1972
Establishment of Design Criteria for Acceptable Failure Modes and Fail Safe Considerations for the Space Shuttle Structural System. Final Report. NAS8-27269. North American Rockwell Corp. N72-28889

CR-123726 January 1972
Research on Bearing Lubricants for Use in High Vacuum. Annual Summary Report. NAS8-26619. Midwest Research Inst. X72-10444

CR-123727 March 10, 1972
A 156-in-dia SRM Mass Properties Report. NAS8-28428. Aerojet Solid Propulsion Co. N72-28789

CR-123728 March 1972
Study of Solid Rocket Motor for Space Shuttle Booster. Vol. 2, Book 3, Appendix A. NAS8-28430. Thiokol Chemical Corp. N73-24799

CR-123729 March 15, 1972
Study of Solid Rocket Motor for Space Shuttle Booster. Vol. 2, Technical Book 1 of 5. NAS8-28430. Thiokol Chemical Corp.

CR-123730 March 15, 1972
Study of Solid Rocket Motor for Space Shuttle Booster. Vol. 2, Technical Book 5, Appendices E thru H. NAS8-28430. Thiokol Chemical Corp. N73-24801

CR-123731 August 20, 1971
Apollo 14 Composite Casting Demonstration. Final Report. NAS8-26637. Arthur D. Little, Inc.

CR-123732 September 1971
Test and Evaluation of Apollo 14 Composite Casting Demonstration Specimens 6, 9, and 12. Final Report. NAS8-27085. TRW, Inc.

CR-123733 May 12, 1972
Research and Applications Modules (RAM) Phase B Study. Executive Summary. NAS8-27539. Convair Div. of General Dynamics. N72-27919

CR-123734 December 1972
Long Life High Reliability Thermal Control Systems Study Data Handbook. NAS8-26252. General Electric Co. N72-28913

CR-123735 June 1972
Shuttle Operations Simulation Model Programmers/Users Manual. Summary Report. NAS8-21804. Teledyne Brown Engineering. N72-28200

CR-123736 May 17, 1972
Reliability Techniques for Computer Executive Programs. Summary Report. NAS8-26669. Information Research Associates. N72-28196

CR-123737 March 1972
Life Sciences Payload Definition and Integration Study. Vol. 3: Appendices. NAS8-26468. General Dynamics. N72-28089

CR-123738 March 1972
Life Sciences Payload Definition and Integration Study. Vol. 1: Management Summary. NAS8-26468. General Dynamics. N72-28087

CR-123739 March 1972
Life Sciences Payload Definition and Integration Study. Vol. 2: Requirements and Design Studies. NAS8-26468. General Dynamics. N72-28088

CR-123740 June 13, 1972
Study of the Production of Unique New Glasses. Final Report. NAS8-28014. North American Rockwell Corp. N72-28564

CR-123741 April 1972
Teleoperator Technology and System Development. Final Report. Vol. 1. NAS8-27021. Bell Aerospace Corp. N72-28090

CR-123742 May 15, 1972
Development of Chip Passivated Monolithic Complementary MISFET Circuits With Beam Leads. Final Report. NAS8-26498. General Electric Co. N72-28497

CR-123743 May 15, 1972
Research Study on Stellar X-Ray Imaging Experiment. Vol. 1. NAS8-24385. American Science and Engineering Corp. N72-29465

CR-123744 April 1972
The Use of Linear Programming Techniques To Design Optimal Digital Filters for Pulse Shaping and Channel Equalizations. NAS8-20172. University of Alabama. N72-29194

CR-123745 March 31, 1972
Determination of Design Allowable Strength Properties of Elevated

Temperature Alloys. Part 1: Coated Columbium Alloys. NAS8-26325. Battelle Memorial Inst. N72-29891

CR-123746 May 1972
Prototype Data Terminal Multiplexer Demultiplexer. Final Report. NAS8-27538. Martin Marietta Corp. N72-29115

CR-123747 April 30, 1972
An Innovative Approach to Compensator Design. Interim Report. NAS8-21377. Mississippi State University. N72-29160

CR-123748 April 1972
Teleoperator Technology and System Development. Final Report. Vol. 2: Appendix E. NAS8-27021. Bell Aerospace Co. N72-31236

CR-123749 June 23, 1972
In-Space Propellant Logistics and Safety in Space Propellant Logistics. Vol. 3: Trade Studies. NAS8-27692. North American Rockwell Corp. N72-30802

CR-123750 April 1972
Study of Requirements for Assembly and Docking of Spacecraft in Earth Orbit. Vol. 2: Handbook of Orbital Assembly and Docking Requirements. NAS8-27860. Grumman Aerospace Corp. X72-10578

CR-123751 March 10, 1972
Extravehicular Activities Guidelines and Design Criteria. NAS8-27502. Matrix Corp.

CR-123752 May 1972
Investigation of Characteristics of Feed System Instabilities. Final Report. NAS8-26266. Martin Marietta Corp. N72-29772

CR-123753 February 1972
Space Station User's Handbook. NAS8-25140. McDonnell Douglas Astronautics Co. N72-29860

CR-123754 June 1972
Teleoperator System Man-Machine Interface Requirements for Satellite Retrieval and Servicing. Vol. 1: Requirements. NASw-2220. Essex Corp. N72-29829

CR-123755 June 1972
Teleoperator System Man-Machine Interface Requirements for Satellite Retrieval and Servicing. Vol. 2: Design Criteria. NASw-2220. Essex Corp. N72-29830

CR-123756 June 28, 1972
Beryllium Heat Shield Technology in the Area of Thermal Protection Devices. NAS8-27016. Martin Marietta Corp. N72-30947

CR-123757 1971
Development of Thermally Resistant Phosphonitrile Polymers. NAS8-25184. Horizons, Inc. X72-10568

CR-123758 January 1972
Space Station User's Handbook. NAS8-25140. McDonnell Douglas Astronautics Co. N72-29859

CR-123759 December 1972
Modular Space Station Program Option. Summary Report. NAS8-25140. McDonnell Douglas Astronautics Co. N72-32842

CR-123760 June 19, 1972
Space Station Data Flow. NAS8-26798. IBM Corp. N72-29862

CR-123761 June 26, 1972
Study of Effects of Uncertainties on Comet and Asteroid Encounter and Contact Guidance Requirements. NAS8-27664. Auburn University. X72-10581

CR-123762 June 1972
Design, Manufacture, Development, Test, and Evaluation of Boron/Aluminum Structural Components for Space Shuttle. NAS8-27738. Convair Div. of General Dynamics. X72-10565

CR-123763 June 1, 1972
Establishment of Design Criteria for Acceptable Failure Modes and Fail Safe Considerations for the Space Shuttle Structural System. Final Report. NAS8-27269. North American Rockwell Corp.

CR-123764 June 23, 1972
In Space-Propellant Systems Safety. Vol. 1: Executive Summary. NAS8-27692. North American Rockwell Corp. N72-30797

CR-123765 June 23, 1972
In-Space Propellant Logistics. Vol. 5: Cost Estimates. NAS8-27692. North American Rockwell Corp. X72-10582

CR-123766 June 23, 1972
In-Space Propellant Systems Safety. Vol. 2: System Safety Guidelines and Requirements. NAS8-27692. North American Rockwell Corp. N72-30798

CR-123767 June 23, 1972
In-Space Propellant Logistics. Vol. 2: Technical Report. NAS8-27692. North American Rockwell Corp. N72-30801

CR-123768 June 23, 1972
In-Space Propellant Logistics. Vol. 4: Project Planning Data. NAS8-27692. North American Rockwell Corp. N72-30803

CR-123769 June 23, 1972
In-Space Propellant Systems Safety. Vol. 3: System Safety Analysis. NAS8-27692. North American Rockwell Corp. N72-30799

CR-123770 May 1972
Dynamic Holographic Storage in Lithium Niobate. NAS8-26635. Isomet Corp. N72-30444

CR-123771 June 1972
Infrared and Photoelectric Photometer Development. Final Report. NAS8-26344. Teledyne Brown Engineering. X72-78847

CR-123772 May 1972
Materials Data Handbook: Aluminum Alloy 6061. NAS8-26644. Western Applied Research and Development, Inc. N72-30458

CR-123773 April 1972
Materials Data Handbook: Aluminum Alloy 7075. NAS8-26644. Western

Applied Research and Development, Inc. N72-30459

CR-123774 April 1972
Materials Data Handbook: Inconel Alloy 718. NAS8-26644. Western Applied Research and Development, Inc. N72-30460

CR-123775 May 1972
Materials Data Handbook: Titanium 6Al-4V. NAS8-26644. Western Applied Research and Development, Inc. N72-30464

CR-123776 June 1972
Materials Data Handbook: Stainless Steel Alloy A-286. NAS8-26644. Western Applied Research and Development, Inc. N72-30463

CR-123777 March 1972
Materials Data Handbook: Aluminum Alloy 2219. NAS8-26644. Western Applied Research and Development, Inc. N72-30461

CR-123779 May 1972
Materials Data Handbook: Aluminum Alloy 2014. NAS8-26644. Western Applied Research and Development, Inc. N72-31535

CR-123780 April 1972
Materials Data Handbook: Stainless Steel Type 301. NAS8-26644. Western Applied Research and Development, Inc. N72-30462

CR-123781 June 1972
Fatigue of Boron/Aluminum Composites. Final Report. NAS8-27437. Convair Div. of General Dynamics.

CR-123782 June 1972
Fabrication, Test, and Demonstration of Critical Environment Monitoring System. NAS8-27300. Lockheed Missiles and Space Co. N72-30389

CR-123783 December 1971
Digital Control System Development for Optical Mirror Figure Control. NAS8-27620. Massachusetts Inst. of Technology. X72-10559

CR-123784 June 23, 1972
In-Space Propellant Logistics. Vol. 1: Executive Summary. NAS8-27692. North American Rockwell Corp. N72-30800

CR-123785 May 12, 1972
Research and Applications Modules (RAM), Phase B Study. NAS8-27539. General Dynamics. N72-30861

CR-123786 June 1972
Application of the QSDC Procedure to the Formulation of Space Shuttle Design Criteria. Vol. 2: Applications Guide. NAS8-26918. Technology, Inc. N72-30857

CR-123787 June 1972
Application of the QSDC Procedure to the Formulation of Space Shuttle Design Criteria. Vol. 1: Study Effort. NAS8-26918. Technology, Inc. N72-30856

CR-123788 December 1971
A Method for Determining the Response

of Space Shuttle to Atmospheric Turbulence. Vol. 2. NAS8-26363. General Dynamics. N72-30859

CR-123789 July 1972
Simulation of a Flexible Spinning Vehicle. Final Report. NAS8-26700. McDonnell Douglas Astronautics Co. N72-30855

CR-123790 June 1972
Solenoid Valve, Type 1, NASA P/N 20M32258-1 (Carleton P/N 2426-0001-1). NAS8-26348. Carleton Controls Corp. N72-30425

CR-123791 June 1972
Synthesis of Shuttle Vehicle Damping Using Substructure Test Results. NAS8-27569. Southwest Research Inst. N72-30860

CR-123792 June 1972
Shuttle Free-Flying Teleoperator System Experiment Definition. Vol. 3: Program Development Requirements. NAS8-27895. Bell Aerospace Co. N72-30217

CR-123793 June 1972
Shuttle Free-Flying Teleoperator System Experiment Definition. Vol. 1: Executive Summary. NAS8-27895. Bell Aerospace Co. N72-30216

CR-123794 May 26, 1972
Chemical Analysis of Outgassing Contaminants. Final Report. NAS8-28058. Athens College. X72-10545

CR-123795 July 4, 1972
Design and Control of Remote Manipulators. NAS8-28055. Massachusetts Inst. of Technology. N72-30424

CR-123796 May 1972
Development of AMTRAN on the Datacraft DC6024. NAS8-26756. Teledyne Brown Engineering. N72-30190

CR-123797 May 1972
Electromagnetic Damper System for Ground Wind Load Studies. NAS8-26774. Lockheed Missiles and Space Co. N72-30388

CR-123798 June 1, 1972
Design and Development of Polyphenylene Oxide Foam as a Reusable Internal Insulation for LH_2 Tanks, Phase One, Progress Report. NAS8-27566. Convair Div. of General Dynamics. X72-10566

CR-123799 April 15, 1972
Unsupervised Classification of Remote Multispectral Sensing Data. NAS8-27364. Northrop Services, Inc. N72-27204

CR-123800 1967
Early Lunar Shelter Design and Comparison Study. Vol. 4. NAS8-20261. AiResearch Manufacturing Co. N72-74858

CR-123801 1967
Early Lunar Shelter Design and Comparison Study. Vol. 6. NAS8-20261. AiResearch Manufacturing Co. N72-75210

CR-123802 February 1972
Neutron Radiographic Viewing System. Final Report. NAS8-30070. Zenith Radio Corp. N72-30398

CR-123803 July 1972
Space Vehicle Engine and Heat Shield Environment Review. NAS8-27802. Teledyne Brown Engineering.

CR-123804 October 1971
Dynamic Testing of a Single Degree of Freedom Strapdown Gyroscope. NAS12-2033. Massachusetts Inst. of Technology. N72-30583

CR-123805 April 1972
Study of Requirements for Assembly and Docking of Spacecraft in Earth Orbit. Vol. 1: Executive Summary. NAS8-27860. Grumman Aerospace Corp. X72-10590

CR-123806 April 1972
Study of Requirements for Assembly and Docking of Spacecraft in Earth Orbit. Vol. 3: Simulation Plan. NAS8-27860. Grumman Aerospace Corp. X72-10579

CR-123807 March 1972
Study of Requirements for Assembly and Docking of Spacecraft in Earth Orbit. Vol. 4: Appendices. NAS8-27860. Grumman Aerospace Corp.

CR-123810 May 24, 1972
Aeronautical Noise Suppression at Transonic Mach Numbers. Final Report. NAS8-27503. Chrysler Corp. N72-30245

CR-123811 July 1972
Precision Star-Tracking Telescope. NAS8-25705. Stanford University. N72-30390

CR-123812 July 1972
Air Data Measurement System for Space Shuttle. NAS8-26326. Honeywell, Inc. N72-30863

CR-123813 June 1972
Thermal Support for Space Shuttle. Interim Final Report. NAS8-25569. Lockheed Missiles and Space Co. N72-31876

CR-123814 March 5, 1971
Development of Optimized Techniques and Requirements for Computer Enhancement of Structural Weld Radiographs. Vol. 1: Technical Report. ESL, Inc. N72-32490

CR-123815 November 30, 1971
Survey, Analysis and Evaluation Test on High Voltage/Current Pulse Transmission Cables. NAS8-21298. General Laboratory Associates, Inc. N72-32221

CR-123816 May 15, 1972
Research Study on Stellar X-Ray Imaging Experiment. Vol. 2. NAS8-24385. American Science and Engineering, Inc.

CR-123817 August 15, 1972
Optimal Braking Studies. Final Summary Report. NAS8-28230. University of Missouri. N72-31279

CR-123818 1972
Television Broadcast Satellite Systems. Vol. 1. NAS8-24878. Auburn University. N72-31176

CR-123819 January 21, 1972
Microstrip Technology and Its Application to Phased Array Compensation. NAS8-25894. University of Alabama. N73-11222

CR-123820 January 1972
Phased Array Antenna Matching Simulation and Optimization of a Planar Phased Array of Circular Waveguide Elements. Final Report. NAS8-25894. University of Alabama. N73-11139

CR-123821 June 30, 1972
Study of Uncertainties of Predicting Space Shuttle Thermal Environment. NAS8-26699. McDonnell Douglas Astronautics Co. X72-10592

CR-123822 January 1972
Manned Space Flight Nuclear System Safety. Vol. 1; Part 2. NAS8-26283. General Electric Co. N72-33843

CR-123823 October 1, 1963
Apollo Study Report. Vol. 2. NAS8-5276. IBM Corp. N72-75111

CR-123824 October 1, 1963
Apollo Study Report. Vol. 1. NAS8-5296. IBM Corp. N72-75110

CR-123825 April 1972
Investigate Optimum Way of Adding Wideband Capability and Recommend a Design for Modification of One Government Furnished AM Baseband Demultiplexer, Phase 1. NAS8-29039. Martin Marietta Corp. N73-32172

CR-123826 August 8, 1972
Space LOX Vent System. NAS8-26972. General Dynamics. N72-32844

CR-123827 June 1972
Materials Data Handbook: Aluminum Alloy 5456. NAS8-26644. Western Applied Research and Development, Inc. N72-30457

CR-123828 June 1972
Development of Lightweight Material Composites to Insulate Cryogenic Tanks for 30-Day Storage in Outer Space. Final Report. NAS8-26006. McDonnell Douglas Astronautics Co. N72-30495

CR-123829 June 30, 1972
Properties of Materials in High Pressure Hydrogen at Room and Elevated Temperatures. NAS8-26191. Pratt and Whitney Aircraft. N72-32145

CR-123830 March 31, 1972
Study of Dense Aluminum Plasmas. Final Report. NAS8-25055 and NAS8-26773. University of Alabama. N72-32690

CR-123831 April 10, 1972
A Method of Hardware Qualification for Flight by Analyses Similarity and Integrated Testing. NAS8-21811. Planning Research Corp. N72-52843

CR-123832 April 30, 1972
Study of Mission Modes and Systems

Analysis for Lunar Exploration (MIMOSA). NAS8-20262. Lockheed Missiles and Space Co. N72-75118

CR-123833 April 30, 1967
Study of Mission Modes and Systems Analysis for Lunar Exploration (MIMOSA). Vol. 1. NAS8-20262. Lockheed Missiles and Space Co. N72-75115

CR-123834 April 30, 1967
Study of Mission Modes and Systems Analysis for Lunar Exploration (MIMOSA). Vol. 3. NAS8-20262. Lockheed Missiles and Space Co. N72-75117

CR-123835 April 30, 1967
Study of Mission Modes and Systems Analysis for Lunar Exploration (MIMOSA). Vol. 2: Candidate Lunar Exploration Programs. NAS8-20262. Lockheed Missiles and Space Co. N72-75116

CR-123837 June 26, 1972
Investigation of Structural Factors of Safety for the Space Shuttle. NAS8-27048. Convair Div. of General Dynamics. N72-32845

CR-123838 January 1972
Manned Space Flight Nuclear System Safety. Vol. 2; Part 1. NAS8-26283. General Electric Co. N73-11695

CR-123839 January 1972
Manned Space Flight Nuclear System Safety. Vol. 3; Part 2. NAS8-26283. General Electric Co. N73-11697

CR-123840 June 1972
Design, Fabrication and Delivery of an Improved Single Elastic Mobility System (ELMS). Vol. 1. NAS8-27737. Lockheed Missiles and Space Co. N72-33243

CR-123841 July 1972
Design, Fabrication and Delivery of an Improved Single Elastic Mobility System (ELMS). Vol. 2. NAS8-27737. Lockheed Missiles and Space Co. N72-33244

CR-123842 January 1972
Manned Space Flight Nuclear System. Vol. 1. NAS8-26283. General Electric Co. N73-11694

CR-123843 January 1972
Manned Space Flight Nuclear System Safety. Vol. 5; Part 2. NAS8-26283. General Electric Co. N73-11702

CR-123844 January 1972
Manned Space Flight Nuclear System Safety. Vol. 3; Part 1. NAS8-26283. General Electric Co. N73-11696

CR-123845 January 1972
Manned Space Flight Nuclear System Safety. Vol. 3; Part 2A. NAS8-26283. General Electric Co. N73-11698

CR-123846 January 1972
Manned Space Flight Nuclear System Safety. Vol. 3; Part 3. NAS8-26283. General Electric Co. N73-11699

CR-123847 January 1972
Manned Space Flight Nuclear System Safety. Vol. 4; Part 1. NAS8-26283. General Electric Co. N73-11700

CR-123848 January 1972
Manned Space Flight Nuclear System Safety. Vol. 5; Part 1. NAS8-26283. General Electric Co. N73-11701

CR-123849 January 1972
Manned Space Flight Nuclear System Safety. Vol. 6. NAS8-26283. General Electric Co. N73-11703

CR-123850 January 1972
Manned Space Flight Nuclear System Safety. Vol. 7; Part 1. NAS8-26283. General Electric Co. N73-11704

CR-123851 March 1973
Space Shuttle – Results of Investigations on a 0.0405 Scale Model PRR Version of the NRSSV Orbiter in the North American Aeronautical Laboratory Low Speed Wind Tunnel. NAS9-13247. Chrysler Corp. N73-21829

CR-123901 February 8, 1967
Early Lunar Shelter Design and Comparison Study. NAS8-20261. AiResearch Mfg. Co. N72-75858

CR-123902 June 28, 1968
Orbital Astronomy Support Facility (OASF) Study. Vol. 3; Book 1. NAS8-21023. McDonnell Douglas Astronautics Co. N72-75710

CR-123903 February 1966
Saturn IB/V Instrument Unit Switch Selector, Model 2. NAS8-14000. IBM Corp. N72-75854

CR-123904 June 1, 1966
Saturn IB/V Instrument Unit Instrumentation System Description. NAS8-14000. IBM Corp. N73-70013

CR-123905 August 1972
Auxiliary Engine Digital Interface Unit (DIU). NAS8-27323. Electronic Communications, Inc. N72-33231

CR-123906 July 1972
Power Supply Standardization and Optimization Study. NAS8-27798. Teledyne Brown Engineering. N72-33055

CR-123907 June 1972
Space Vehicle Electrical Power Processing Distribution and Control Study. Final Report. Vol. 1: Summary. NAS8-26270. TRW Systems. N72-33053

CR-123908 June 1972
Space Vehicle Electrical Power Processing Distribution and Control Study. Technical Report. Vol. 2. NAS8-26270. TRW Systems. N72-33054

CR-123909 1972
Television Broadcast Relay System. Vol. 2. NAS8-24818. Auburn University. N73-10214

CR-123910 July 1, 1972
A Preliminary Design Study for a Cosmic X-Ray Spectrometer. NAS8-24585. Massachusetts Inst. of Technology. N72-33378

CR-123911 September 15, 1972
Analysis of Requirements for Computer Control ADN Data Processing Experiment Subsystems. NAS8-25471. System Development Corp. N73-10232

CR-123912 June 30, 1972
Study of Structural Active Cooling and Heat Sink Systems for Space Shuttle. NAS8-27708. McDonnell Douglas Astronautics Co. N73-10884

CR-123913 August 1972
Analysis of Propellant Feeding Dynamics. NAS8-25919. Southwest Research Inst. N73-11785

CR-123914 September 1972
Application of Engineering Cost Analysis. Vol. 1. NAS8-21823. Planning Research Corp. X72-82252

CR-123915 September 1972
Application of Engineering Cost Analysis. Vol. 6. NAS8-21823. Planning Research Corp. X72-82254

CR-123916 September 1972
Application of Engineering Cost Analysis. Vol. 5. NAS8-21823. Planning Research Corp. X72-82253

CR-123917 August 31, 1972
Magnitude Error Bounds for Sampled Data Frequency. NAS8-21377. Mississippi State University. N73-11573

CR-123918 July 1972
On Charged Particle Tracks in Cellulose Nitrate and Lexan. NAS8-26758. San Francisco University. N73-11725

CR-123919 August 23, 1972
Development of High Temperature Fasteners Using Directionally Solidified Eutectic Alloys. NAS8-27358. United Aircraft Research Lab. N73-11437

CR-123920 June 24, 1972
Convectionless Electrophoretic Separation of Biological Preparations. NAS8-27797. General Electric Co. N73-11055

CR-123921 August 1972
Feasibility of Wake Vortex Monitoring Systems for Air Terminals. NAS8-26668. Lockheed Missiles and Space Co. N73-11229

CR-123922 August 18, 1972
Inflight Nuclear Vehicle Radiation Environment Study, Phase III. Final Report. NAS8-26811. Lockheed Missiles and Space Co. X73-10025

CR-123923 April 16, 1970
Space Shuttle Impact on Large Telescope Experiment Program. NAS8-21497. Perkin-Elmer Corp. N73-11386

CR-123924 September 4, 1972
Long Life Valve Design Concepts. NAS8-28518. Fairchild Stratos Corp. N72-75830

CR-123925 August 1972
Application of AVCO Data Analysis and Prediction Techniques (ADAPT) to Prediction of Sunspot Activity. NAS8-28087. AVCO Corp. N73-11811

CR-123926 March 15, 1972
Study of Solid Rocket Motor for Space Shuttle Booster. Vol. 2; Book 2. NAS8-28430. Thiokol Chemical Corp. N73-24798

CR-123928 June 1972
Development of Advanced Materials Composites for Use as Insulations for LH_2 Tanks. NAS8-25973. McDonnell Douglas Astronautics Co. N73-11547

CR-123929 August 13, 1970
Experiment Module Concepts Study Review. NAS8-25051. Convair Div. of General Dynamics. X72-75838

CR-123930 January 1967
Specified Local Scientific Survey Module for Apollo Applications Program. NAS8-20378. Lockheed Missiles and Space Co. X72-82680

CR-123932 June 1972
Application of Rochrome Liquid Crystal Tapes for Thermographic Testing of Bonded Structures. NAS8-26848. Hoffman-LaRoche, Inc. N73-12451

CR-123933 1969
Intermediate-20 Launch S-IC/S-IVB. NAS8-30506. The Boeing Co. X73-70129

CR-123934 September 30, 1972
Dual Mode Nuclear Rocket Applications Study. Vol. 2. NAS8-28119. TRW Systems Group. X73-10027

CR-123935 September 30, 1972
Dual Mode Nuclear Rocket Applications Study. Vol. 1. NAS8-28119. TRW Systems Group. X73-10026

CR-123936 September 30, 1972.
Development of Unique Wet Tantalum Slug, Tantalum Cased Capacitor. NAS8-27686. Aerotron, Inc. X73-10019

CR-123937 September 1972
Development of Explosively Bonded TZM Wire Reinforced Colombian Sheet Composites. NAS8-27277. Denver University. N73-12490

CR-123938 July 28, 1972
Cryogenic Insulation Development. NAS8-26129. General Dynamics. N73-12606

CR-123939 August 31, 1972
Study of Cavitating Inducer Instabilities. NAS8-27625. Pratt and Whitney Aircraft. N73-13299

CR-123940 September 29, 1972
Evaluation of the Trash Rocket Concept. NAS8-27324. United Technology Center. X73-10053

CR-123941 September 1972
Analytical and Experimental Study of Axisymmetric Truncated Plug Nozzle Flow Fields. NAS8-25601. Notre Dame University. N73-12282

CR-123942 October 31, 1972
Design and Development of Pressure and Repressurization Purge System for Reusable Space Shuttle Multilayer Insulation Systems. NAS8-27419. General Dynamics. N73-12914

CR-123943 October 1972
Design, Processing and Testing of LSI Arrays For Space Station. NAS12-2207. RCA Corp. N73-13732

CR-123944 July 22, 1968
Development of Checkout Specifications for New Telemeter. NAS8-21205. The Boeing Company. N73-70345

CR-123945 July 19, 1972
High Temperature Insulation Materials for a Radiative Thermal Protection System. NAS8-26115. McDonnell Douglas Astronautics Co. N73-12957

CR-123946 October 1972
Purification Kinetics of Beryllium During Vacuum Induction Melting. NAS8-27891. Grumman Aerospace Corp. N73-13512

CR-123947 June 1972
Study of Low Gravity Propellant Transfer. NAS8-26236. Convair Div. of General Dynamics. N73-13764

CR-123948 September 1970
Random Experiment Program Resource Impact (REPRI) Program. NAS8-20082. Northrop Corp. N73-12174

CR-123949 October 1972
Space Vehicle Engine and Heat Shield Environment Review. Teledyne Brown Engineering.

CR-123950 September 1971
Nonelastic Nuclear Reactions and Accompanying Gamma Radiation. NAS8-25534. Teledyne Brown Engineering.

CR-123951 July 1972
Economic Analysis of Crystal Growth in Space. NAS8-27942. General Electric Co. N73-12806

CR-123952 September 15, 1972
Space Shuttle Ascent Flight Turbulence Response. NAS8-26363. Convair Div. of General Dynamics. N73-12913

CR-123953 January 1972
Space Shuttle Avionics: A Redundant IMU On-Board Checkout and Redundancy Management System. NAS8-27624. Massachusetts Inst. of Technology. N73-12676

CR-123954 January 21, 1972
The Effect of Gravity Induced Free Convection Upon the Melting Phenomena of Finite Paraffin in Slab for Thermal Control. NAS8-30511. Colorado School of Mines. N73-13130

CR-123955 September 15, 1972
Design and Development of Polyphenylene Oxide. NAS8-27566. Convair Div. of General Dynamics. N73-14586

CR-123956 August 1972
Long Life High Reliability Thermal Control Systems Study. NAS8-26252. General Electric Co. N73-13950

CR-123957 June 1972
A Comparative Analysis of Digital Baseband Signals. NAS8-20172. University of Alabama. X73-70058

CR-123958 September 25, 1972
Vacuum Jacketed Ducting Technology Investigation. NAS8-27504. Convair Div. of General Dynamics. X73-10022

CR-123959 September 29, 1972
Development and Fabrication of a Graphite Polyimide Box Beam. NAS8-24511. North American Rockwell Corp. N73-13923

CR-123960 August 31, 1972
Cost Analysis of Carbon Dioxide

Concentrators. NAS8-28377. McDonnell Douglas Astronautics Co. N73-13971

CR-123961 September 1972
Shock Wave Oscillation Driven by Turbulent Boundary Layer Fluctuations. NAS8-26919. Wyle Labs, Inc. N73-12281

CR-123962 February 18, 1972
ACS Avionics System Review. NAS8-26362. Lockheed Missiles and Space Co. N73-12449

CR-123963 July 1972
Empirical Evaluation of Pump Inlet Compliance. NAS8-27731. Aerospace Corp. N73-13468

CR-123964 June 1972
Prototype GaAs Bipolar Transistors. NAS8-27086. RCA Corp. X73-10018

CR-123965 June 20, 1969
S-2-8 Static Firing. Vol. 2. Final Report. NAS7-200. North American Rockwell Corp. N73-70010

CR-123966 September 10, 1972
Development and Characterization of Lubricants. NAS8-25318. Hughes Aircraft Co. N73-13654

CR-123967 November 1972
Design of a Contaminate Control Subsystem and Study of Checkout Controls and Instrumentation for Integrated Water and Oxygen Recovery. NAS8-27690. Hamilton Standard Div. of United Aircraft Corp. X73-10080

CR-123968 June – September 1972
Development of Techniques and Associated Instrumentation for High Temperature Emissivity Measurements. Quarterly Progress Report. NAS8-26304. Lockheed Missiles and Space Co. N73-13421

CR-123969 May 1972
A Study of Thermal Expansion Characteristics of Ceramic Chip Capacitors and Alumina Substrates. NAS8-28571. Vanderbilt University. X73-10092

CR-123970 November 1972
Evaluation of Absorption Cycle for Space Station Environmental Control System. NAS8-25986. Lockheed Missiles and Space Co. N73-14859

CR-123971 August 1972
Degradation and Reuse of Radiative-Thermal-Protection-System Materials for the Space Shuttle. NAS8-26205. Battelle Memorial Inst. X73-10097

CR-123972 October 1972
Preparative Electrophoresis Experiment Design. NAS8-28474. Beckman Instruments, Inc. N73-14090

CR-123974 February 1966
Saturn S-2 Derivatives. NAS8-20265. North American Aviation, Inc. X73-70362

CR-123975 October 15, 1972
Apollo/Saturn 5 Postflight Lunar Impact Trajectory AS-511 S-4B/IU. NAS8-5608. The Boeing Co. N73-14826

CR-123976 September 3, 1970
Nuclear Shuttle System Definition Study, Phase 3. NAS8-24715. Lockheed Missiles and Space Co. X73-70153

CR-123977 May 19, 1970
Nuclear Flight Systems Definition Study: Final Briefing. NAS8-24715. Lockheed Missiles and Space Co. X73-70154

CR-123978 October 6, 1969
Nuclear Flight Systems Definition Study: First Interim Briefing. NAS8-24715. Lockheed Missiles and Space Co. X73-70371

CR-123979 December 16, 1970
Nuclear Shuttle System Definition Study, Phase 3. Interim Review. NAS8-24975. North American Rockwell Corp. X73-70372

CR-123980 September 1972
Optimal Trajectory Generation for Mechanical Arms. NAS8-28055. Massachusetts Inst. of Technology. N73-14470

CR-123981 September 1971
Study to Determine Instrumentation Requirements for Fault Isolation Computer Methods. Revision 3. NAS8-26244. Lockheed Missiles and Space Co. X71-10832

CR-123982 May 10, 1971
Study to Determine Instrumentation Requirements for Fault Isolation Computer Methods. NAS8-26244. Lockheed Missiles and Space Co.

CR-123983 April 1, 1971
Study to Determine Instrumentation Requirements for Fault Isolation Computer Methods. NAS8-26244. Lockheed Missiles and Space Co. X71-10892

CR-123984 March 23, 1971
Study to Determine Instrumentation Requirements for Fault Isolation Computer Methods. Revision B. NAS8-26244. Lockheed Missiles and Space Co. X71-10950

CR-123985 June 1970
Study to Determine Instrumentation Requirements for Fault Isolation Computer Methods. NAS8-26244. Lockheed Missiles and Space Co. X71-10949

CR-123986 March 1971
Study to Determine Instrumentation Requirements for Fault Isolation Computer Methods. Revision 1. NAS8-26244. Lockheed Missiles and Space Co. X72-10151

CR-123987 September 30, 1971
Spaceborne Computer Multi-Element System Configuration Architecture Refinement. Task 1 Report. NAS8-26698. Computer Sciences Corp. N71-37737

CR-123988 August 30, 1971
Instruction Manual for the Laboratory Model of the Contamination System. Final Report. NAS8-26132. Convair Div. of General Dynamics. X72-10059

CR-123989 October 1971
Space Vehicle Engine and Heat Shield Review. NAS8-27802. Teledyne Brown Engineering. X72-10174

CR-123990 October 1, 1973
Development of a Method for Fabrication of Metallic Matrix Composites Shapes by Continuous Mechanical Process. NAS8-27010. Computer Sciences Corp.

CR-123991 October 1971
Study of Bonding Methods for Flip Chip and Beam Leaded Devices. Final Report. NAS8-25615. Electronic Communications, Inc.

CR-123992 October 1972
Analysis of Thermal Environment in the Thrustor Cavity of Space Vehicles, Modification Number 1. University of Alabama.

CR-123993 October 1972
Evaporative Segregation in 80 Percent Ni – 20 Percent Cr and 60 Percent Fe – 40 Percent Ni Alloys. NAS8-27891. Grumman Aerospace Corp. N73-14562

CR-123994 October 1, 1971
Redesign of Ground Winds Model and Damper System for the Saturn 5/Dry Workshop Simulation. Final Report. NAS8-25319. Lockheed Missiles and Space Co. X72-10150

CR-123995 March 17, 1971
Study to Determine Instrumentation Requirements for Fault Isolation Computer Methods. NAS8-26244. Lockheed Missiles and Space Co.

CR-123996 August 1971
An Experimental Study of the Launch Environment of a Saturn 5 Booster Utilizing Solid Propellant Strap-Ons. NAS8-20027. Cornell Aeronautical Lab, Inc. X71-10955

CR-123997 October 31, 1972
Results of a Study of Mach Number and Reynolds Number Effects on the Lee Side Vortex Flow Field Characteristics of an Ogive-Cylinder-Frustrum-Cylinder at Angles of Attack to 25 Degrees. NAS8-24391. Chrysler Corp.
Vol 1 N73-15307
Vol 2 N73-15308

CR-123998 November 14, 1971
Electron Transport and Space Shielding Handbook. NAS8-26753. Science Applications, Inc. N73-15722

CR-123999 October 1969
Nuclear Flight System Definition, Potential Flight Test and Early Operational Payloads: Phase 1 Review. NAS8-24975. North American Rockwell Corp. X73-71551

CR-124000 July 1972
Results of a Space Shuttle Plume Impingement Investigation at Stage Separation in the NASA MSFC Impulse Base Flow Facility. NAS8-HREC D225839. Lockheed Missiles and Space Co. N73-15949

CR-124001 October 12, 1972
LOXT Mirror Design Study. NAS8-27795. American Science and Engineering, Inc. N73-19424

CR-124002 May 2, 1972
Technical Report Analysis and Design: Study of Solid Rocket Motors for a Solid Rocket Booster. Vol. 2, Book 1, Supplement 1. Final Report. NAS8-28429. Lockheed Propulsion Co.
N73-16769

CR-124003 September 24, 1972
Development of Space Stable Thermal Control Coatings for Use on Large Space Vehicles. NAS8-26791. IIT Research Inst.
N73-16922

CR-124004 October 1972
Correlation Signature of WER Soils and Snows. NAS8-26797. IIT Research Inst.

CR-124005 August 1972
Thermal Elastoplastic Structural Analysis of Nonmetallic Thermal Protection Systems. NAS8-27792. University of Alabama.
N73-15948

CR-124006 November 1972
Mathematical Characterization of Mechanical Behavior of Porous Frictional Granular Media. NAS8-25102. University of Alabama.
N73-15368

CR-124007 October 1972
Measurements of Electron Bremstrahlung Coincidence Rates at Intermediate Electron Energies. NAS8-27866. Advanced Technology Center, Inc.
N73-15723

CR-124008 June 1972
Development of Thermally Stable Phosphonitrile Elastomers for Advanced Aerospace Structures. NAS8-25184. Horizons, Inc.
N73-15593

CR-124009 September 30, 1972
Evaluation of Beryllium for Space Shuttle Components. NAS8-27739. Lockheed Missiles and Space Co.

CR-124010 January 28, 1970
Nuclear Flight Stage and Payloads Study. NAS8-24975. North American Rockwell Corp.
X73-71552

CR-124011 November 8, 1972
Discrete Device Qualification Testing, Part No. IN944B. Final Report. NAS8-27357. SCI Systems, Inc.
X73-71084

CR-124012 October 31, 1972
Discrete Device Evaluation Testing, Part No. SPC 5001. NAS8-27357. SCI Systems, Inc.
X73-73500

CR-124014 November 8, 1972
Discrete Device Qualification Testing, Part No. 2N37320. NAS8-27357. SCI Systems, Inc.
X73-73502

CR-124015 November 8, 1972
Discrete Device Qualification Testing, Part No. IN827A. NAS8-27357. SCI Systems, Inc.
X73-73501

CR-124016 October 31, 1972
Discrete Device Evaluation Testing, Part No. SP4908. NAS8-27357. SCI Systems, Inc.

CR-124017 November 8, 1972
Discrete Device Qualification Testing, Part No. IN939A. NAS8-27357. SCI Systems, Inc.
X73-70633

CR-124018 November 8, 1972
Discrete Device Qualification Testing, Part No. 2N2034A. NAS8-27357. SCI Systems, Inc. X73-73503

CR-124019 October 1972
Improved Burn-in Test Methods Study for TTL. NAS8-28515. Martin Marietta Corp. X73-70617

CR-124020 September 1972
Scanning Electron Microscope: Microelectronic Inspection Criteria Report. NAS8-28515. Martin Marietta Corp. X73-10126

CR-124021 June 1972
Prototype Ultrasonic Instrument for Quantitative Testing. NAS8-26931. Parametrics, Inc. N73-17562

CR-124022 May 1972
LH_2 and LO_2 Turbopump Assemblies Program. NAS8-27794. Rocketdyne Div. of North American Rockewell Corp.

CR-124023 February 11, 1972
Space Tug Point Design Study. NAS7-200. North American Rockwell Corp.

CR-124024 February 23, 1970
Saturn Workshop No. 2 Alternate Mission: Artificial Gravity Experiment Study. McDonnell Douglas Astronautics Co. X73-71088

CR-124025 June 6, 1972
Modification Static Testing and Delivery of One Servoactuator. NAS8-27928. Hydraulic Research and Manufacturing Co. N73-20524

CR-124026 November 28, 1972
Multiprocessing System Study. NAS8-27359. M&S Computing, Inc. N73-16873

CR-124027 September 12, 1972
Design and Evaluation of an Electrohydraulic Servoactuator Using Active Standby Redundancy. NAS8-27821. Bertea Corp. N73-16515

CR-124028 June 25, 1972
Design and Fabrication of an Experimental Image Forming Light Modulator. NAS8-27375. Georgia Inst. of Technology. X73-10122

CR-124029 August 1965
Contribution of Combustion Noise to Overall Rocket Exhaust Jet Noise. NAS8-11150. Ohio State University.

CR-124030 November 1972
A Study of Multiplex Data Bus Techniques for the Space Shuttle. NAS8-26378. SCI Systems, Inc. N73-16874

CR-124031 October 30, 1970
Development of a Highly Reliable Composite Board for Printed Circuitry for Use in Space Environment. NAS8-21424. Battelle Memorial Inst. N72-12137

CR-124032 April 1968
Quasi-Slender Body Theory for Unsteady Linearized Transonic Flow Past Pointed Bodies of Revolution. NAS8-20082. Lockheed Missiles and Space Co. N73-71011

CR-124033 February 1971
Calculation of Stability Derivatives for Slowly Oscillating Bodies of Revolution at Mach 1.0. NAS8-20082. Lockheed Missiles and Space Co. N73-16249

CR-124034 November 10, 1972
A Study on Teleoperator Systems Performance Requirements. Vol. 2. NAS8-27013. Matrix Corp. X73-10116

CR-124035 November 18, 1972
A Study on Teleoperator Systems Performance Requirements. Vol. 1. NAS8-27013. Matrix Corp. X73-10115

CR-124036 September 1972
Improvement of Screening Methods for Silicon Planar Semiconductor Devices. NAS12-2197. Philco Ford Corp. N73-16516

CR-124037 December 5, 1971
Reliability Improvement of 1 Mil Aluminum Wire Bonds for Semiconductors. NAS8-26636. Motorola, Inc. N73-18469

CR-124038 July 31, 1972
M553 Sphere Forming and M554 Composite Casting Experiments. Summary Report. NAS8-28735. Georgia Inst. of Technology. N73-70936

CR-124039 August 10, 1972
Investigation of Solidification in Zero-Gravity Environment. NAS8-28734. University of Connecticut. N73-70935

CR-124040 November 1972
Normal Evaporation of Binary Alloys. NAS8-27891. Grumman Aerospace Corp. N73-16558

CR-124041 July 1972
Airborne Electronically Steerable Phase Array. NAS8-25847. Texas Instruments, Inc. N73-18219

CR-124042 September 1972
Astronomy Sortie Missions Definition Study. Vol. 1. NAS8-28144. Martin Marietta Corp. N73-19851

CR-124043 September 1972
Astronomy Sortie Missions Definition Study. Vol. 2; Book 1. NAS8-28144. Martin Marietta Corp. N73-18842

CR-124044 September 1972
Astronomy Sortie Missions Definition Study. Vol. 3, Book 2, Appendix. NAS8-28144.

CR-124045 September 1972
Astronomy Sortie Missions Definition Study. Vol. 2, Book 2, Appendix. NAS8-28144. Martin Marietta Corp. N73-18843

CR-124046 September 1972
Astronomy Sortie Missions Definition Study. Vol. 4. NAS8-28144. Martin Marietta Corp.

CR-124047 September 1972
Astronomy Sortie Missions Definition Study. Book 1. NAS8-28144. Martin Marietta Corp.

CR-124048 March 15, 1972
Detection of Aircraft Trailing Vortices Using Laser Doppler Instrumentation. Final Report. NAS8-30514. Raytheon Co. X73-10167

CR-124049
Flight Mechanics Analysis of the AS-205/CSM-101. NAS8-4016. Chrysler Corp.

CR-124050 March 1972
Control System Optimization Studies. Vol. 1. NAS8-30515. Lockheed Missiles and Space Co. N73-18860

CR-124051 March 1972
Control System Optimization Studies. Vol. 2. NAS8-30515. Lockheed Missiles and Space Co. N73-18861

CR-124052 November 1971
Design Improvement Qualification Testing Purge and Vent Investigations, Fabrication and Documentation of a GAC-9 Insulation System. NAS8-26091. Goodyear Aerospace Corp. N73-18565

CR-124053 August 4, 1972
Improvement of Reusable Surface Insulation (RSI) Materials. Final Report. NAS8-27688. McDonnell Douglas Astronautics Co. N73-17646

CR-124054 April 30, 1967
MIMOSA: Study of Mission Modes and System Analysis for Lunar Exploration. Final Report. NAS8-20262. Lockheed Missiles and Space Co. N73-71700

CR-124055 March 1972
Study on Propellant Dynamics During Docking. Final Report. NAS8-25712. Lockheed Missiles and Space Co. N73-18268

CR-124056 December 12, 1972
System for Measuring Turbine Blade Temperatures. NAS8-28952. Kollsman Instrument Corp. N73-17805

CR-124057 April 12, 1972
Space Tug Aerobraking Study. NAS8-27501. The Boeing Co. N73-18827

CR-124058 December 1972
Convection Phenomena in Electrophoresis Separation. NAS8-27015. Lockheed Missiles and Space Co. X73-10120

CR-124059 December 1972
Conceptual Design Study for a Teleoperator Visual System. NAS8-29024. Martin Marietta Corp. N73-17117

CR-124060 August 1972
A Millimeter Wave Mixer. NAS8-28295. Westinghouse Electric Corp. N73-17581

CR-124061 January 31, 1972
Phenomena After Meteoroid Penetration of a Bumper Plant. NAS8-26773. University of Alabama. N73-17894

CR-124062 January 1973
Theory of Zone Radiometry. NAS8-28089. Lockheed Missiles and Space Co. N73-17555

CR-124063 November 1972
The Development of a Residential Heating and Cooling System Using NASA Derived Technology. NAS8-24986. Lockheed Missiles and Space Co. N73-17911

CR-124064 September 30, 1968
Preliminary AS-503 C′ Mission Launch Vehicle Operational Trajectory: Basic Mission. NAS8-5608. The Boeing Co.
N73-71300

CR-124065 December 1972
Investigation of Crystal Growth in Zero Gravity Environment and Investigation of Metallic Whiskers. NAS8-24512 and NAS8-26793. University of Alabama.
N73-17778

CR-124066 July 12, 1972
Space Shuttle Attitude Control System (ACS) Thruster Penetration Heating. NAS8-27683. Convair Div. of General Dynamics. X73-10209

CR-124067 May 1972
Preparation of Pigments for Space-Stable Thermal Control Coatings. NAS8-21317. Ohio State University. N73-18144

CR-124068 July 30, 1969
Saturn 5 AS-507 Launch Vehicle Operational Abort and Malfunctioned Flight Analysis. The Boeing Co.

CR-124069 February 1972
Kinetic Theory Analysis of Rarefied Gas Flow Through Finite Length Slots. NAS8-21432. University of California.
N73-18265

CR-124070 April 1972
Study of Propellant Dynamics in a Shuttle Type Launch Vehicle. NAS8-27012. Lockheed Missiles and Space Co. N73-17801

CR-124071 December 1972
The Response of the Thermosphere Due to a Geomagnetic Storm; A MHD Model. NAS8-25750. University of Alabama.
N73-17498

CR-124072 December 12, 1972
Analytical Study of Spacecraft Deposition Contamination. NAS8-28533. Teledyne Brown Engineering.
N73-17645

CR-124073 November 22, 1972
Study of Large Flexible Tunnel for Shuttle Payload Interface. NAS8-28951. Goodyear Aerospace Corp. N73-17879

CR-124074 1972
Development of High Temperature Heat Radiation Resistant Silicon Semiconductors. NAS8-25917. Solitron Devices, Inc. N73-17777

CR-124075 February 1973
Isogrid Design Handbook. NAS8-28619. McDonnell Douglas Astronautics Co.
N73-19911

CR-124076
Study of Techniques for Reduction of Creep in Plated Wire Memories. Reports 1, 2 and 3. NAS8-21151. Honeywell, Inc.

CR-124077 November 15, 1972
Re-Entry Guidance Scheme Development and Analysis. Vol. 1. NAS8-28612. IBM Corp. X73-10177

CONTRACTOR REPORTS

CR-124078 November 15, 1972
Re-Entry Guidance Scheme Development and Analysis. Vol. 2. NAS8-28612. IBM Corp. X73-10178

CR-124079 December 1972
Acoustic Fatigue and Sound Transmission Characteristics of a RAM Composite Panel Design. NAS8-29146. Wyle Labs, Inc. N73-22529

CR-124080 February 1972
Environmental Impact Statement for SRM Boosters in Conjunction With the Space Booster Program. NAS8-28429. Lockheed Missiles and Space Co.

CR-124081 November 1, 1972
An Investigation of a Movable Mass Attitude Stabilization System for Artificial G Space. NAS8-27952. University of Louisville. N73-17880

CR-124082 October 1972
Studies Relating to FM Television and Telemetry Transmitters. NAS8-26193. Auburn University. N73-18171

CR-124083 November 1972
Optical Memory Development. Vol. 2. NAS8-26808. RCA Corp. N73-18681

CR-124084 November 1972
Optical Memory Development. Vol. 1. NAS8-26808. RCA Corp. N73-18680

CR-124085 November 1972
Optical Memory Development. Vol. 3. NAS8-26808. RCA Corp. N73-18682

CR-124086 January 1973
Mathematical Representations of Turbulent Mixing. NAS8-28089. Lockheed Missiles and Space Co. N73-18267

CR-124087 December 8, 1972
Multivariable Control Theory Applied to Hierarchical Attitude Control for Planetary Spacecraft. NAS8-27827. Auburn University. N73-18859

CR-124088 September 2, 1970
Nuclear Shuttle System Definition, Study Phase 3. NAS8-24975. North American Rockwell Corp. X73-72274

CR-124089 December 31, 1972
Design and Fabrication of an Engineering Model Fiber Optics Detector. NAS8-28215. Georgia Inst. of Technology. N73-18683

CR-124090 December 31, 1972
Summary of Results of Parametric Studies of Space Shuttle Booster, Orbiter and Launch Vehicles Concepts. NAS8-26370. Lockheed Missiles and Space Co. N73-18862

CR-124091 June 30, 1971
Single Stage Earth Orbital Reusable Vehicle. NAS8-26341. Chrysler Corp. N73-18858

CR-124092 June 30, 1971
Single-Stage Earth Orbital Reusable Vehicle Space Shuttle Feasibility Study. Vol. 5. NAS8-26341. Chrysler Corp. X73-10183

CR-124093 January 1973
Study of High Altitude Plume Impingement. NAS8-38057. Lockheed Missiles and Space Co. N73-19940

CR-124094 December 1972
Directional Solidification of Eutectic Composites in Space Environment. NAS8-26402. University of California. N73-18527

CR-124095 February 21, 1973
Correlation of Materials Properties with the Atomic Density Concept. Report 5 for 27 December, 1972 – 21 February, 1973. NAS8-28517. Nevada Engineering and Technology Corp. N73-18156

CR-124096 February 27, 1972
Development of Beryllium Honeycomb Sandwich Composite for Structural and Other Related Applications. NAS8-21215. International Harvester Co.

CR-124097 November 19, 1972
Study of Mathematical Modeling of Communication Systems Transponders and Receivers. NAS8-28148. Georgia Inst. of Technology. N73-18172

CR-124098 December 15, 1972
Cost Analysis of Water Recovery System. NAS8-28377. McDonnell Douglas Astronautics Co. N73-18134

CR-124099 1971
Power-On Base Pressure for Space Shuttle Launch Configurations. Final Report. NAS8-26466. Lockheed Missiles and Space Co. X73-72260

CR-124100 August 1968
Structure of Shock Waves with Nonequilibrium Radiation and Ionization. Final Report. NGR-15-005-063. Purdue University. N73-71889

CR-124101 1972
Centrifugal Shower Separator of the Orbital Workshop Habitability Support System. NAS8-27927. Hamilton Standard Div. of United Aircraft Corp.

CR-124102 May 1972
Generation and Application of the Equations of Condition for High Order Runge-Kutta Methods. NAS8-27931. University of Texas.

CR-124103 November 14, 1972
Eutectic Experiment Development for Space Processing. NAS8-21905. Westinghouse Research Lab. N73-18526

CR-124104 January 18, 1973
Extended Definition Feasibility Study for a Solar Electric Propulsion Stage. Vol. 3. NAS8-27360. North American Rockwell Corp. X73-10174

CR-124105 January 18, 1973
Extended Definition Feasibility Study for a Solar Electric Propulsion Stage. Vol. 1. NAS8-27360. North American Rockwell Corp. X73-10173

CR-124106 November 1972
Development of Techniques and Instrumentation for the Nondestructive Evaluation of Multilayer Insulation. NAS8-27479. Battle Pacific Northwest Lab. N73-18567

CR-124107 January 1973
A Study of Methods for Lowering Aerial Environmental Survey Cost. NAS8-29074. SCI Systems, Inc. N73-18369

CR-124108 February 1973
Shuttle Free-Flying Teleoperator System Experiment Definition. Vol. 1. NAS8-29153. Bell Aerospace Co. X73-10162

CR-124109 February 1973
Shuttle Free-Flying Teleoperator System Experiment Definition. Vol. 2. NAS8-29153. Bell Aerospace Co. X73-10163

CR-124110 July 24, 1972
Time Exposure Studies on Stress Corrosion Cracking of Aluminum 2014-T6, Aluminum 7075-T651, and Titanium 6Al-4V. NGR-19-011-009. Grambling College. N73-18525

CR-124111 January 20, 1972
The Study and Development of an Active Scattering Particle Size Spectrometer for Space Environments. NAS8-28297. Particle Measuring Systems. N73-19425

CR-124112 July 1968
Sound Wave Shear Wave Interaction with Oblique Shock Fronts. NGR-15-005-056. Purdue University.

CR-124113 June 30, 1972
Combined Loading Criteria Influence on Structural Performance. NAS8-26916. General Dynamics. N73-20874

CR-124114 February 15, 1973
Characteristics of a Gelled Liquid Hydrogen Polyphenylene Oxide PPO Foam Open Cell Insulation System. NAS8-27203. General Dynamics. N73-18568

CR-124115 October 1972
Protective Overlay for Low Power TTL Integrated Circuits. NAS8-20896. Texas Instruments, Inc. X73-10166

CR-124116 December 1, 1971
Development of a Plan for Automating Integrated Circuit Processing. NAS8-26909. Motorola, Inc. N73-18465

CR-124117 December 20, 1972
Switch, Toggle, Hermetically Sealed. Final Technical Progress Report. NAS8-27441. McGraw-Edison Co. X73-10165

CR-124118 June 1968
Stored Program Concepts for Analog Computers. Final Report. NAS8-21228. Electronic Associates, Inc. N73-72024

CR-124119 December 1972
Electromagnetic Radiation Screening of Semiconductor Devices for Long Life Applications. NAS8-28937. Hughes Aircraft Co. N73-18757

CR-124120 January 10, 1973
Optimum Mission Profile Designs: Documentation of Programs POPS. NAS8-28146. Martin Marietta Corp. X73-10179

CR-124121 November 14, 1969
S-2 Terminal Stage Analysis Dry Workshop Launch Vehicle. Final Report. NAS7-200. North American Rockwell Corp. X73-72809

CR-124122 September 1966
Welding Commercial Base-Plate Investigation. Final Report. NAS8-20303. Battelle Memorial Inst.

CR-124123 July 14, 1972
Design, Manufacture and Install Sample Holder in X-Ray Reflectometer and Perform Data Analysis of Results. NAS8-27605. Visidyne, Inc.

CR-124124 December 1972
Automated Design and Optimization of Flexible Booster Autopilots via Linear Programming. Vol. 1. NAS8-28482. Martin Marietta Corp. N73-19621

CR-124125 December 1972
Automated Design and Optimization of Flexible Booster Autopilots via Linear Programming. Vol. 2. NAS8-28482. Martin Marietta Corp. N73-19622

CR-124126 June 30, 1970
Analysis of Strapdown Sensor Testing, Phase II. NAS12-678. The Analytic Sciences Corp. N73-19641

CR-124127 December 1972
Prototype Data Terminal Multiplexer Demultiplexer. NAS8-27538. Martin Marietta Corp. N73-19203

CR-124128 February 15, 1972
Advanced Technical Studies. NAS7-200. North American Rockwell Corp.

CR-124129 August 9, 1972
Apollo/Saturn 5 Postflight Trajectory AS-511. NAS8-5608. The Boeing Co. N73-72531

CR-124130 1972
Analytical Treatment of Gas Flows Through Multilayer Insulation, Project 1. University of Alabama. N73-19281

CR-124131 January 1973
Mass Transport Contamination Study. NAS8-26554. Lockheed Missiles and Space Co. N73-20875

CR-124132
Inert Gas Weldment Effects Study, Phase 1; July 1965 – November 1965. NAS8-20168. The Boeing Co.

CR-124133 January 10, 1973
Metrication Study for Large Space Telescope. NAS8-29318. Battelle Memorial Inst. N73-19426

CR-124134 December 22, 1972
Electromagnetic Free Suspension System for Space Manufacturing. NAS8-27228. General Electric Co. N73-20522

CR-124135 January 19, 1973
Design, Fabrication, Testing and Delivery of a Prototype Self Locking Actuator. NAS8-28247. Aerojet Liquid Rocket Co. N73-19459

CR-124136 December 1972
Definition of Experiments and Instruments for a Communications/Navigation Research Laboratory. Vol. 1. NAS8-27540. TRW Systems Group. N73-20273

CR-124137 May 1972
Definition of Experiments and Instruments for a Communications/Navigation Research Laboratory. Vol. 2. NAS8-27540. TRW Systems Group. N73-20274

CR-124138 July 1972
Definition of Experiments and Instruments for a Communications/Navigation Research Laboratory. Vol. 3. NAS8-27540. TRW Systems Group. N73-20275

CR-124139 October 1972
Definition of Experiments and Instruments for a Communications/Navigation Research Laboratory. Vol. 4. NAS8-27540. TRW Systems Group. N73-19268

CR-124140 March 1972
Lubrication Handbook for Use in the Space Industry. NAS8-27662. Midwest Research Inst. X73-73512

CR-124141 September 15, 1972
S-IC Stage Vertical Internal Access Equipment Technical Manual. NAS8-5608. The Boeing Co. N73-72063

CR-124142 June 1972
Space Tug Economic Analysis Study. Vol. 1. NAS8-27709. Lockheed Missiles and Space Co. N73-20899

CR-124143 May 1972
Space Tug Economic Analysis Study. Vol. 2; Part 1. NAS8-27709. Lockheed Missiles and Space Co. N73-20900

CR-124144 May 1972
Space Tug Economic Analysis Study. Vol. 2; Part 2. NAS8-27709. Lockheed Missiles and Space Co. N73-20901

CR-124145 May 15, 1970
Ground Wind and Wind Tunnel Velocity Measurements. Vol. 1. NAS8-21293. Raytheon Co. X73-73553

CR-124146 May 1972
Space Tug Economic Analysis Study. Vol. 2: Appendix. NAS8-27709. Lockheed Missiles and Space Co. N73-20902

CR-124147 May 1972
Space Tug Economic Analysis Study. Vol. 3. NAS8-27709. Lockheed Missiles and Space Co. N73-20903

CR-124148 May 1972
Space Tug Economic Analysis Study (U). Vol. 3; Copy S-3. Secret. NAS8-27709. Lockheed Missiles and Space Co. X73-75494

CR-124149 November 27, 1972
Testing to Determine the Vacuum Ultraviolet Degradation Rate of Thermal Control Coatings. NAS8-28765. IIT Research Inst. N73-20608

CR-124150 October 31, 1972
Cybernetic Integration of Experiments into the CVT System. NGR-43-001-117. University of Tennessee. N73-21136

CR-124151 November 1972
Multiprocessor Architectural Study. NAS8-28605. Intermetrics, Inc. N73-20219

CR-124152 June 30, 1971
Single Stage Earth Orbital Reusable Vehicle Space Shuttle Feasibility Study. Vol. 4: Appendix. NAS8-26341. Chrysler Corp.

CR-124153 June 30, 1971
Single Stage Earth Orbital Reusable Vehicle Space Shuttle Feasibility Study. Vol. 3: Appendix. NAS8-26341. Chrysler Corp.

CR-124154 January 18, 1973
Extended Definition Feasibility Study for a Solar Electric Propulsion Stage. Vol. 2; Part 1. NAS8-27360. North American Rockwell Corp. X73-10230

CR-124155 January 18, 1973
Extended Definition Feasibility Study for a Solar Electric Propulsion Stage. Vol. 2; Part 2. NAS8-27360. North American Rockwell Corp. X73-10231

CR-124156 November 21, 1967
Low Acceleration Space Transportation System Study. Vol. 1. NAS8-21030. General Electric Co. X73-72714

CR-124157 January 27, 1970
Nuclear Flight System Definition Study. Interim Briefing No. 2. NAS8-24714. McDonnell Douglas Astronautics Co. X73-73519

CR-124158 January 15, 1968
Proposed Payload for ATM B for Observing High Energy Celestial Sources. NAS8-20166. Teledyne Brown Engineering.

CR-124159 December 1972
Mathematical Model of a Flexible Space Shuttle Vehicle. NAS8-25708. Honeywell, Inc. N73-20876

CR-124160 February 28, 1973
Investigation of Crystal Growth from Solutions. NAS8-28098. University of Alabama. X73-10228

CR-124161 September 1972
Dynamic Errors in a Tuned Flexure-Mounted Strapdown Gyro. NAS12-670. Analytic Science Corp. N73-20682

CR-124162 January 26, 1973
Further Reduction and Analysis of Skylab, SL-1 Ground Winds Loads Test Data. NAS8-28118. Baganoff Associates, Inc. X73-10244

CR-124163 December 1972
Study of the Dynamics of Orbital Assemblies Including Interactions with Geometrical Appendages, Unified Flexible Spacecraft Simulation Program (UFSSP) Users Manual. NAS8-26131 and NAS8-28169. TRW Systems Group. X73-10298

CR-124164 April 14, 1972
S-IC Stage Transporting and Handling. NAS8-5608. The Boeing Co. N73-72022

CR-124165 November 1972
Investigation of Extendable Nozzle Concepts. NAS8-21476. Goodyear Aerospace Corp. N73-20300

CR-124166 October 1972
Survey of Digital Filtering. NAS8-20163. Auburn University. N73-20256

CR-124167 November 1972
Detection of Lack of Fusion Using Opaque Additives (Phase 1). NAS8-28708. McDonnell Douglas Astronautics Co. N73-20536

CR-124168 December 1972
Study of the Dynamics of Orbital Assemblies Including Interactions with Geometrical Appendages. NAS8-26131. TRW Systems Group. N73-20878

CR-124169 December 1972
Study of the Dynamics of Orbital Assemblies Including Interactions with Geometrical Appendages. NAS8-26131 and NAS8-28169. TRW Systems Group. N73-20220

CR-124170 December 1972
Study of the Dynamics of Orbital Assemblies Including Interactions with Geometrical Appendages. NAS8-26131 and NAS8-28169. TRW Systems Group. N73-20877

CR-124171 March 1, 1973
Design of a Modular Digital Computer System. NAS8-27926. Hughes Aircraft Co. X73-10198

CR-124172 January 1973
Preparation of Composite Materials in Space. NAS8-27806. General Dynamics. N73-20609

CR-124173 June 30, 1971
Single-Stage Earth-Orbital Reusable Vehicle Space Shuttle Feasibility Study. Vol. 2. NAS8-26341. Chrysler Corp. X73-10295

CR-124174 June 30, 1971
Single-Stage Earth-Orbital Reusable Vehicle Space Shuttle Feasibility Study. Vol. 1. NAS8-26341. Chrysler Corp. X73-10294

CR-124175 February 28, 1973
Cost Analysis of Oxygen Recovery System. NAS8-28377. McDonnell Douglas Astronautics Co. N73-21137

CR-124176 December 31, 1972
Evaluation of a 40 to 1 Scale Model of a Low Pressure Engine. NAS8-28899. Lockheed Missiles and Space Co. N73-21690

CR-124177 November 1972
Design, Fabrication, Assembly and Delivery of a Laboratory Prototype of a Residual Gas Analyzer. Final Report. NAS8-27877. National Research Corp. N73-21386

CR-124178 February 28, 1973
Evaluation of a High Response Electro-hydraulic Digital Control Valve. NAS8-28379. Bertea Corp. N73-20523

CR-124179 January 1973
Investigation of KC-135 Flight Samples Solidified in Near Zero Gravity. NAS8-28728. Grumman Aerospace Corp. N73-20610

CR-124180 February 23, 1973
Feasibility Study of a Solar Electric Propulsion Stage for Geosynchronous Equatorial Mission. Vol. 2; Part 2. NAS8-27360. North American Rockwell Corp. X73-10287

CR-124181 February 23, 1973
Feasibility Study of a Solar Electric Propulsion Stage for Geosynchronous Equatorial Mission. Vol. 2; Part 1. NAS8-27360. North American Rockwell Corp. X73-10286

CR-124182 February 23, 1973
Feasibility Study of a Solar Electric Propulsion Stage for Geosynchronous Equatorial Mission. Vol. 1. NAS8-27360. North American Rockwell Corp. X73-10285

CR-124183 February 1973
Control of a Flexible Space Shuttle Vehicle. NAS8-25708. Honeywell, Inc. N73-21824

CR-124184 January 1973
Types of Natural Convection in Space Manufacturing Processes. Summary Report. NAS8-25577. Lockheed Missiles and Space Co. X73-10208

CR-124185 February 1973
Nuclear Stage System Definition Study, Phase 4. Vol. 1. NAS8-27951. McDonnell Douglas Astronautics Co. X73-10279

CR-124186 February 1973
Nuclear Stage System Definition Study, Phase 4. Vol. 3. NAS8-27951. McDonnell Douglas Astronautics Co. X73-10281

CR-124187 February 1973
Nuclear Stage System Definition Study, Phase 4. Vol. 2. NAS8-27951. McDonnell Douglas Astronautics Co. X73-10280

CR-124188 February 1973
Nuclear Stage System Definition Study, Phase 4. Vol. 4. NAS8-27951. McDonnell Douglas Astronautics Co. X73-10282

CR-124189 February 15, 1973
Study of Design and Control of Remote Manipulators. Part 2: Vibration Considerations in Manipulator Design. NAS8-28055. Massachusetts Inst. of Technology. N73-20138

CR-124190 February 15, 1973
Study of Design and Control of Remote Manipulators. Part 4: Experiments in Video Camera Positioning with Regard to Remote Manipulation. Final Report. NAS8-28055. Massachusetts Inst. of Technology. N73-20139

CR-124191 February 15, 1973
Study of Design and Control of Remote Manipulators. Part 1: Summary and Conclusions. NAS8-28055. Massachusetts Inst. of Technology. N73-22046

CR-124192 June 1972
LO_2 and LH_2 Turbopump Assemblies Program. NAS8-27794. Rocketdyne Div. of North American Rockwell Corp.

CR-124193 August 1972
Turbopumps for Cryogenic Upper Stage Engines. NAS8-27794. Rocketdyne Div. of North American Rockwell Corp.

CR-124194 August 1972
LH_2 and LO_2 Turbopump Assemblies Program Test Plan and Facilities Review. NAS8-27794. Rocketdyne Div. of North American Rockwell Corp. N73-26476

CR-124195 October 1972
Turbopumps for Cryogenic Upper Stage Engines. NAS8-27794. Rocketdyne Div. of North American Rockwell Corp.

CR-124200 January 31, 1973
Application of RL10 Engine for Space Tug Propulsion. Vol. 4. NAS8-29314. Pratt and Whitney Aircraft. X73-10289

CR-124201 January 31, 1973
Application of RL10 Engine for Space Tug Propulsion. Vol. 3. NAS8-29314. Pratt and Whitney Aircraft. X73-10288

CR-124202 November 1972
Space Ultrareliable Modular Computer (SUMC) Instruction Simulator. NAS8-26698. Computer Sciences Corp. N73-21194

CR-124203 March 14, 1973
Investigation of Empirical Damping Laws for the Space Shuttle. NAS8-28513. Applied Dynamics Research Corp. N73-21828

CR-124205 November 1972
C-MOS Array Design Techniques. NAS12-2233. Advanced Technology Lab. N73-21195

CR-124206 February 6, 1972
Thermal Design of Composite Material High Temperature Attachments. NAS8-27041. North American Rockwell Corp. N73-21469

CR-124207 March 1973
Study of Dual Channel Infrared Spectroradiometer System. NAS8-21144. Rocketdyne Div. of North American Rockwell Corp. N73-21387

CR-124208 March 12, 1973
Noncontacting Devices to Indicate Deflection and Vibration of Turbopump Internal Rotating Parts. NAS8-26903. Battelle Memorial Inst. N73-21408

CR-124209 March 1973
Prediction of Shuttle Vehicle Damping from Component Test Results. NAS8-27569. Southwest Research Inst.

CR-124210 January 1972
LOGSIM. NAS8-25621. M and S Computing, Inc.

CR-124211 February 1973
Establishment of Quality, Reliability and Design Standards for Low, Medium and High Power Microwave Hybrid Microcircuits. NAS8-25616. Texas Instruments, Inc. N73-22419

CR-124212 March 21, 1973
Study of Single Crystals of Metal Solid Solutions. NAS8-29077. Eagle-Picher Industries. N73-22476

CR-124213 November 1972
Design Verification Tests of New Silver Zinc Battery, Eagle Picher Part No. 4368, Saturn S-IB. NAS8-27182. Chrysler Corp.

CR-124214 March 1971
Thermal Control and Heat Storage by Melting and Freezing. NAS8-25183. Lockheed Missiles and Space Co. N73-22894

CR-124215 July 7, 1972
Extended Life Testing Evaluation of Complementary MOS Integrated Circuits. NAS8-25897. DCA Reliability Lab, Inc. N73-22422

CR-124216 January 1973
Fluid and Particle Dynamic Effects in Low-g Composite Casting. NAS8-27015. Lockheed Missiles and Space Co. X73-10283

CR-124217 July 1971
Calibration of Propulsion Simulation Nozzles for Space Shuttle Booster and Orbiter Models for the Abort Separation Staging Experimental Program. NAS8-20082. Lockheed Missiles and Space Co. N73-22814

CR-124218 January 1973
Ground Wind Load Forcing Functions Analysis Program. NAS8-28266. Unidev, Inc.

CR-124219 1973
Design and Construction of a Remote Sensing Apparatus. Final Report. NGL-19-001-068. Louisiana State University. N73-22393

CR-124220 January 31, 1973
Application of RL10 Engine for Space Tug Propulsion. Vol. 2. NAS8-29814. Pratt and Whitney Aircraft. X73-10291

CR-124221 June 1968
Development of S-13 G. Thermal Control Coating Based on Silicate-Treated ZNO. NAS8-26751. Illinois Inst. of Technology.

CR-124222 July 1972
Development of Advanced Material Composites for Use as Internal Insulation for LH_2 Tanks (Gas Layer Concept). NAS8-25974. Martin-Marietta Corp. N73-22528

CR-124223 April 1973
Research Study on Stabilization and Control. NAS8-28584. Systems Research Lab. N73-22815

CR-124224 March 28, 1973
Large Space Telescope Pointing and Control Study. Final Summary Volume. NAS8-29152. Bendix Corp.

CR-124225 March 15, 1973
LED Pumped NdYAG Laser Development Program. Final Report. NAS8-27563. IBM Corp. N73-22445

CR-124226 December 8, 1971
Saturn 5 AS-511 Launch Vehicle Operational Flight Trajectory. NAS8-5608. The Boeing Co. X73-75454

CR-124227 March 26, 1973
Chemical Analysis of Outgassing Contaminants. NAS8-28058. Athens College. N73-22061

CR-124228 March 28, 1973
Large Space Telescope Pointing and Control Study. Summary Report. NAS8-29152. Bendix Corp.

CR-124229 March 28, 1973
Large Space Telescope Pointing and Control Study. Technical Volume, Part 1. NAS8-29152. Bendix Corp.

CR-124230 April 1973
Large Space Telescope Pointing and Control Study. Technical Volume; Part II. NAS8-29152. Bendix Corp.

CR-124231 1973
Investigation into Reversion of Polyurethane Encapsulant. NAS8-5608. The Boeing Co.

CR-124232 April 1973
Method for Structural Design at Elevated Temperatures. NAS8-28170. Lockheed Missiles and Space Co. N73-22851

CR-124233 January 19, 1973
Low Speed Inducers For Cryogenic Upper Stages. NAS8-29189. Rocketdyne Corp. N73-22722

CR-124234 April 1973
Competitive Evaluation of Failure Detection Algorithms for Strapdown Redundant Inertial Instruments. NAS8-27335. TRW Systems. N73-22608

CR-124235 December 1972
Unified Flexible Spacecraft Simulation Program Generalized Control System Addition. NAS8-28169. TRW Systems. X73-10300

CR-124236 March 15, 1972
Study of Solid Rocket Motor for Space Shuttle Booster. Vol. 1. NAS8-28430. Thiokol Chemical Corp.

CR-124237 March 15, 1973
Study of Solid Rocket Motor for Space Shuttle Booster. Vol. 2; Book 4. NAS8-28430. Thiokol Chemical Corp. N73-24800

CR-124238 March 15, 1972
Study of Solid Rocket Motor for Space Shuttle Booster. Vol. 3. NAS8-28430. Thiokol Chemical Corp.

CR-124239 March 15, 1972
Study of Solid Rocket Motor for Space Shuttle Booster. Vol. 4. NAS8-28430. Thiokol Chemical Corp. N73-24802

CR-124240 February 16, 1973
Literature Survey for Suppression of Scattered Light in Large Space Telescopes. NAS8-27804. University of Arizona. N73-23531

CR-124241 April 1973
Study of Hypervelocity Meteoroid Impact on Orbital Space Station. NAS8-28473. Lockheed Missiles and Space Co. N73-23841

CR-124242 March 10, 1973
Design, Process, Development, Manufacture, Test and Evaluation of Boron Aluminum for Space Shuttle Components. NAS8-27735. McDonnell Douglas Astronautics Co. N73-23873

CR-124243 May 7, 1970
Evaluation of a New Penetrating Sporicide Potentially Useful in Spacecraft Sterilization. NAS8-20157. McDonnell Douglas Astronautics Co. N73-72894

CR-124244 April 2, 1973
H-Engine H7080 and H7083 Flight Worthiness Verification Program. NAS8-25156. Rocketdyne Div. of North American Rockwell Corp.

CR-124245 January 23, 1972
Brazing of Beryllium for Structural Applications, Compression Panel, Compression Tube. NAS8-28029. Solar Div. of International Harvester Co.

CR-124246 March 1973
Digital Capacitance Measuring System. NAS8-27657. SCI Electronics, Inc. N73-24218

CR-124247 January 31, 1973
Autonomous Target Relative Navigation. NAS8-28251. University of Tennessee.

CR-124248 March 1973
Geyser Characteristics of Feedline Configuration Having Both Vertical and Non-Vertical Sections. NAS8-29079. Martin-Marietta Corp.

CR-124249 April 10, 1973
Thermally Resistant Polymers for Fuel Tank Sealants. NAS8-21401. Monsanto Research Corp. N73-23635

CR-124250 1973
Frequency Division Multiplexer Code 04236, Serial No. 001, Phase 2. Final Report. NAS8-25987. Martin-Marietta Corp. N73-23293

CR-124251 May 1973
Detection of Lack of Fusion Using Opaque Additives, Phase II. NAS8-20708. McDonnell Douglas Astronautics Co. N73-24515

CR-124252 April 1973
Approach to Rapid Mission Design and Planning. NAS8-26578. Lockheed Missiles and Space Co.

CR-124253 December 14, 1972
Development of Continuous Forming and Curing Techniques for Production of Circular Structural Composite Shapes for Space Vehicle Application. NAS8-26900. Engineering, Inc. N73-2453N

CR-124254 1972
Particle-Fluid Interaction Corrections for Flow Measurements with a Laser Doppler Flowmeter. NAS8-21397. Arizona State University. N73-23379

CR-124255 April 17, 1973
Photoheliograph Thermal Concepts Study. Vol. 2. NAS8-28520. Itek Corp. N73-24492

CR-124256 April 15, 1973
Thermolectric Thin Film Thermal Coating Systems. NAS8-2851. Ohio Semitronics, Inc. N73-24935

CR-124257 March 30, 1973
Space Shuttle Wind Tunnel Tests Utilizing the Ground Winds Data Reduction Device. NAS8-28611. Baganoff Associates Inc.

CR-124258 April 1973
Modal Analysis for Liapunov Stability of Rotating Elastic Bodies. NAS8-28358. University of California. N73-24904

CR-124259 February 5, 1973
Computer Program for the Load and Trajectory Analysis of Two DOF Bodies Connected by an Elastic Tether. User's Manual. NAS8-29144. Goodyear Aerospace Corp. N73-24903

CR-124260 December 10, 1972
Study for Identification of Beneficial Uses of Space, Phase 1. Vol. 1. NAS8-28179. General Electric Co. N73-25988

CR-124261 April 1973
Large Space Telescope Engineering Scale Model Optical Design, Phase 1. Vol. 1. NAS8-29312. Perkin-Elmer Corp.

CR-124262 May 7, 1973
Liquid Hydrogen Turbopump Rapid Start Program. NAS8-27608. Rocketdyne Div. of North American Rockwell Corp. N73-25522

CR-124263 February 1973
Determination of the Distribution of Sound Source Intensities in Subsonic and Supersonic Jets. NAS8-27011. IIT Research Inst.

CR-124264 November 15, 1965
LVDC Equation Defining Document for the AS-204 Flight Program. NAS8-14000. IBM Corp. X73-76995

CR-124265 December 15, 1964
LVDC Equation Defining Document for the AS-201 Flight Program. NAS8-14000. IBM Corp. X73-76996

CR-124266 May 1, 1973
Engineering Design Manual of Parachute Decelerator Characteristics for Space Shuttle Solid Rocket Booster Recovery. NAS8-29144. Goodyear Aerospace Corp. N73-25072

CR-124267 April 1973
Investigate Optimum EAY of Adding Wideband Capability and Recommend a Design for Modification of One Government-Furnished AM Baseband Demultiplexer. NAS8-29039. Martin-Marietta Corp. N73-25182

CR-124268 April 17, 1973
Photoheliograph Thermal Concepts Study. Vol. 1. NAS8-28520. Itek Corp. N73-25483

CR-124269 April 30, 1973
Design, Fabrication and Testing of a 5-Hz Acoustic Exciter System. NAS8-29184. Applied Dynamics Research Corp. N73-25482

CR-124270 March 1965
Mission Oriented Advanced Nuclear System Parameters Study. Vol. 1. NAS8-5371. TRW Space Technology Lab. N73-72962

CR-124271 April 1973
Remote Analysis of Planetary Soils: X-ray Diffractometer Development. NAS8-27336. University of Alabama. N73-25879

CR-124272 April 1973
Dynamics and Control of Advanced Space Vehicles. Vol. 1. NAS8-28358. University of California. N73-25908

CR-124273 April 1973
Conceptual Design Study for a Teleoperator Visual System, Phase 2. NAS8-29024. Martin-Marietta Corp. N73-25133

CR-124274 December 1972
The Role of Process History, Phase Morphology and Interface Strength upon the Mechanical Properties of Dispersion Strengthened Alloys. NAS8-26007. Rensselaer Polytechnic Inst. N73-25600

CR-124275 March 1965
Mission Oriented Advanced Nuclear System Parameters Study. Vol. 3. NAS8-5371. TRW Space Technology Lab.

CR-124276 June 30, 1972
Habitability Study, Earth Orbital Space Stations. NAS8-28362. Loewy/Snaith, Inc. N73-25132

CR-124277 May 1973
Experimental Investigation of Liquid Propellant Dynamics in a Double Cylindrical Tank. NAS8-28086. Southwest Research Inst. N73-25287

CR-124278 January 1973
Monolayer Boron-Aluminum Compacted Sheet Material. NAS8-27626. Martin-Marietta Aluminum, Inc. N73-25601

CR-124279 March 1973
Evaluation of Forming and Manufacturing Characteristics of Boron/Aluminum Materials. NAS8-29081. Americom, Inc. N73-25523

CR-124280 November 30, 1964
Saturn 5 Launch Vehicle Digital Computer. Vol. 2. NAS8-11561. IBM Corp. N73-73084

CR-124281 November 30, 1964
Saturn 5 Launch Vehicle Digital Computer. Vol. 1. NAS8-11561. IBM Corp. N73-73083

CR-124282 March 5, 1965
Saturn Launch Vehicle Digital Computer and Launch Vehicle Adapter Test Equipment. Vol. 4. NAS8-11561. IBM Corp.

CR-124283 April 1973
Design, Fabrication, Testing and Delivery of Improved Beam Steering Devices. NAS8-26846. GTE Labs., Inc. N73-25246

CR-124284 March 1973
Digital Capacitance Measuring System. NAS8-27657. SCI Electronics, Inc.

CR-124285 May 1973
Image Processing Techniques and Applications to the Earth Resources Technology Satellite Program. NAS8-28545. University of Alabama. N73-25910

CR-124286 May 1973
Active Control of Primary Mirror of an Orbiting Telescope with Thermal Excitation. NAS8-28019. University of Alabama N73-26449

CR-124287 April 1973
Handbook on Passive Thermal Control Coatings. NAS8-25900. Teledyne Brown Engineering. N73-25969

CR-128754 March 1973
Hypersonic Aerodynamic Characteristics of the NR-ATP Orbiter, Orbiter with External Tank, and Ascent Configuration. NAS9-13247. Chrysler Corp. N73-21838

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ADMIRE, JOHN R. S&E-ASTN-AAD
(co-authors)
A Dynamic Transformation Method for Modal Synthesis Solution of Selected System Modes. September 19, 1972. AIAA/ASME/SAE 14th Structure Structural Dynamics/Material Conference of AIAA Dynamics Specialist Conference, Williamsburg, Virginia.

ALLEN, ROBERT V. S&E-ASTR-RMH
Reliability Requirements for Thick-Film Hybrid Microcircuits. March 16, 1973. 1973 Electronic Components Conference, Washington, D.C.

ALLEN, R.V. S&E-ASTR-RMH
CARUSO, S.V. S&E-ASTR-RMH
(co-author)
Reliability Characterization of Capacitor Chip Bonding Techniques. March 16, 1973. International Microelectronics Symposium, San Francisco, California.

ALLEN, R.V. S&E-ASTR-RMH
GRAFF, S.M. S&E-ASTR-RMH
Environmental and Electrical Characterization of Laser Trimmed Thick-Film Resistors. March 16, 1973. International Microelectronics Symposium, San Francisco, California.

ANDRESSEN, C.E., JR. A&PS-DIR
Management Information System (MIS). February 21, 1973. Short Course on Critical Elements of Management of Large Government/Industry Projects, Tullahoma, Tennessee.

ATKINS, HARRY L. S&E-SSL-TE
MRAZEK, W.A. PD-DIR
Metrication-NASA/MSFC. December 19, 1972. American Association for the Advancement of Science (AAAS), Washington, D.C.

BALLANCE, JAMES O. PD-MP-S
DONOVAN, JARRELL PD-MP-S
Radiation Configuration Factors for Annular Rings and Hemispherical Sectors. October 4, 1972. Publication in Transactions of the ASME.

BALLANCE, J.O. S&E-AERO-YS
SMITH, ROBERT E. S&E-AERO-YS
(co-author)
On the Effects of Atomic Oxygen During Thermospheric Density Measurements with a Cryogenic Gauge. September 20, 1972. Publication in the Journal of Geophysical Research.

BAUGHER, CHARLES R. S&E-SSL-TE
Solar Radio Observations. July 20, 1972. Southeastern Regional Convention of the Astronomical League, Huntsville, Alabama.

BAXTER, DAVID K. S&E-AERO-G
BURNS, ROWLAND E. S&E-AERO-G
Singular Arc Guidance for Low Thrust Mission Analysis. August 4, 1972. AIAA 11th Aerospace Sciences Meeting, Washington, D.C.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

BIANCA, C.J. S&E-ASTN-ASP
The Boron-Epoxy Bolted Joint Test Program at MSFC. August 17, 1972. NASA/Contractor Structural Composites Mini-Symposium, Huntsville, Alabama.

BRANTLEY, WHIT PD-DO-E
HAMILTON, EDWARD C. PD-DO-E
LST Communication and Power Phase A Results. October 31, 1972. LST Review to Industry, MSFC, Alabama.

BROUSSARD, P.H. S&E-ASTR-GC
MASTIN, WILLIAM C. S&E-ASTR-GC
A Study of Remote Guidance and Control for Planetary Surface Vehicles. August 31, 1972. First National Conference on Remotely Manned Systems, Pasadena, California.

BROWN, HARROLD E. S&E-ASTR-SGA
(co-authors)
Failure Detection and Isolation of Redundant Inertial Systems for Space Shuttle. July 20, 1972. Fifth IFAC Symposium – Automatic Control in Space, Genoa, Italy.

BROWN, RICHARD L. SP-MI-MGR
Project Management Planning. April 2, 1973. Critical Elements in Management of Large Government/Industry Projects meeting, Tullahoma, Tennessee.

BUCHER, GEORGE C. AD-S
How the Newcomer Adjusts to the Organization. May 9, 1973. Publication in Harvard Business Review.

BURNS, ROWLAND E. S&E-AERO-G
See Baxter, David K.

BUTLER, JOHN M. PD-DO-SI
LST Current Phase A Concept. October 31, 1972. LST Review to Industry, MSFC, Alabama.

CAMP, DENNIS W. S&E-AERO-YA
FICHTL, GEORGE H. S&E-AERO-YA
Spectral Structure of Tropospheric Vertical Temperature Profiles Over Cape Kennedy, Florida. January 16, 1973. Publication in the Journal of Geophysical Research.

CAMP, DENNIS W. S&E-AERO-Y
KAUFMAN, JOHN W. S&E-AERO-Y
TURNER, ROBERT E. S&E-AERO-Y
The Maxometer – A Peak Wind Speed Sensor. November 2, 1972. Publication in the Journal of the American Meteorological Society.

CAMPBELL, RICHARD A. S&E-ASTR-GM
(co-author)
Optimal Braking Studies. August 28, 1972. Publication in IEEE Trans Vehicular Technology.

CARUSO, S.V. S&E-ASTR-RMH
See Allen, R.V.

CHANG, FENG-CHENG S&E-ASTR-R
An Explicity Formula for a Function of Matrix. October 20, 1972. Publication in Proceedings of the IEEE.

The Explicity Expression for LaGrange-Sylvester Interpolation Polynomial. October 31, 1972. Publication in American Mathematics Monthly.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

Recursive Formulas for the Partial Fraction Expansion of a Rational Function with Multiple Poles. February 8, 1973. Publication in Proceedings of the IEEE.

CHANG, FENG-CHENG S&E-ASTR-R
(co-author)
Partial Fraction Expansion and Inverse LaPlace Transform of a Rational Function with Real Coefficients. June 7, 1973. 1973 Conference on Decision and Control, San Diego, California.

Depolarization of an Uncollimated Laser Beam in a Turbulent Medium. June 7, 1973. Publication in Journal of the Franklin Institute.

Design of Stepped Impedance Transformers. May 2, 1973. Publication in Journal of the Franklin Institute.

CHUBB, W.B. S&E-ASTR-SGD
LIU, T.C. S&E-ASTR
SELTZER, SHERMAN M. S&E-ASTR-A
THOMPSON, ZACK S&E-ASTR-SGA
Optimal Control of the Variable Spin Speed CMG System to Achieve High Accuracy Attitude Control for a Space Vehicle. May 10, 1973. 1973 IEEE Conference on Decision and Control, San Diego, California.

CLIFF, WILLIAM C. S&E-AERO-AF
(co-authors)
Simultaneous Comparison of Gas Turbulent Fluctuations Measured with a Laser Doppler Velocimeter and a Hot Wire Anemometer. October 10, 1972. Publication in AIAA Journal.

Correlation Between the Outer Flow and the Turbulent Production in a Boundary Layer. November 21, 1972. Publication in Physics of Fluids.

CLIFTON, K. STUART S&E-SSL-PA
Television Studies of Faint Meteors. January 12, 1973. Publication in Journal of Geophysical Research.

CLOTFELTER, W.N. S&E-ASTN-MER
RISCH, E.R. S&E-ASTN-MER
Ultrasonic Measurement of Stress in Metroliner Wheels. April 16, 1973. Nondestructive Evaluation of Materials and Structures used in Transportation, Defense, and the Power Industry, San Antonio, Texas.

COLLEY, CARL E. PD-DO-SA
LST Structures Presentation. October 31, 1972. LST Review to Industry, MSFC, Alabama.

COSTES, NICHOLAS C. S&E-SSL-N
(co-authors)
Terrain-Vehicle Dynamic Interaction Studies of a Mobility Concept (ELMS) for Planetary Surface Exploration. September 26, 1972. AIAA Dynamics Specialist Conference, Williamsburg, Virginia.

COSTES, NICHOLAS C. S&E-SSL-N
Regional Variations in Physical and Mechanical Properties of Lunar Surface

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

Regolith. January 29, 1973. Fourth Lunar Sciences Conference, Houston, Texas.

COUNTER, DUANE E. S&E-ASTR-M
FAILE, GWYN C. S&E-ASTR-M
(co-author)

Dynamic Passivation of a Spinning and Tumbling Satellite Using Free Flying Teleoperators. July 3, 1972. Publication in proceedings of 1st National Conference on Manipulator Systems, Pasadena, California.

CUMMINGS, ROBERT E. S&E-AERO-F
(co-author)

An Unsupervised Classification Technique for Multispectral Remote Sensing Data. August 28, 1972. Eighth International Symposium on Remote Sensing of Environment, Ann Arbor, Michigan.

CURRY, J.E. S&E-ASTN-MN
(co-authors)

Copolymers and Elastomers with Alternating Dioxysilphenylene and Silane Units. August 21, 1972. Publication in Journal of Applied Polymer Science.

CURRY, J.E. S&E-ASTN-MN
McKINLEY, M.D. S&E-ASTN-MN

Transient Permeation of Organic Vapors Through Elastomeric Membranes. March 28, 1973. Publication in Journal of Applied Polymer Science.

DALINS, ILMARS S&E-SSL-N
(co-authors)

Observations of Early Arriving Seismic Signals from Apollo 16 Launch. July 20, 1972. Atmospheric Acoustics and Noise Propagation Symposium, Gaithersburg, Maryland.

Analysis of Incident and Reflected Components of Audible and Infrasonic Atmospheric Waves Generated by Saturn V Launch. July 20, 1972. Atmospheric Acoustics and Noise Propagation Symposium, Gaithersburg, Maryland.

A Study of the Effectiveness of the Standard Surface Cleaning Techniques as Applied to Ni(111), Ni(100) and Ni Sheet Using Auger Electron Spectroscope (AES). March 8, 1973. Publication in Journal of Vacuum Science and Technology.

DALINS, ILMARS S&E-SSL-N
HORGAN, A.M. S&E-SSL-N

Absorption of Hydrogen, Carbon Monoxide and Oxygen on Vacuum Degassed Stainless Steel 304 at 20°C. July 20, 1972. Publication in Journal of Vacuum Science and Technology.

Chemical Shifts in the Auger Spectrum and Characteristic Loss Spectrum: Oxygen Absorption on Ni(111). July 20, 1972. Publication in Surface Science.

DARBRO, W. S&E-SSL-PM

On the Mathematics Profession. June 6, 1973. Publication in Mathematical Monthly.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

DARWIN, CHARLES R. PD-DO
MURPHY, JAMES T. PD-DIR
Refurbishment-Module Replacement as a Means to Keep Payload Costs Down. January 30, 1973. Publication in Aeronautics and Astronautics.

DONOVAN, JARRELL PD-MP-S
See Ballance, James O.

DOZIER, JAMES B. S&E-SSL-PX
Solar Astronomy on Skylab. July 26, 1972. Southeastern Regional Convention of the Astronomical League, Huntsville, Alabama.

EBY, P.B. S&E-SSL-N
MORGAN, S.H., JR. S&E-SSL-N
Corrections to the Bethe-Bloch Formula for Average Ionization Energy Loss of Relativistic Heavy Nuclei – Close Collisions. October 5, 1972. Publication in Nuclear Instruments and Methods.

EBY, PETER B. S&E-SSL-N
MORGAN, S.H., JR. S&E-SSL-N
PARNELL, T.A. S&E-SSL-N
Calculation of Energy Loss by Highly Charged Particles and the Interpretation of Cosmic Ray Data. April 23, 1973. 13th International Cosmic Ray Conference, Denver, Colorado.

EDWARDS, THOMAS R. S&E-SSL-PA
A Mini-Midi Computer Link for a CCIS Quadrupole RGA. November 21, 1972. 6th International Mass Spectroscopy Conference, Edinburgh, Scotland.

Image Reproduction with Interactive Graphics. June 20, 1973. Publication in R/D Magazine.

EDWARDS, THOMAS R. S&E-SSL-PA
KNIGHT, R.D. S&E-SSL-PA
A Fast Digital Noise Filter Capable of Locating Spectral Peaks and Shoulders. November 21, 1972. Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Cleveland, Ohio.

EDWARDS, T.R. S&E-SSL-PA
McCOY, J.C. S&E-COMP-SE
An Absolute Pressure Detecting Circuit for Automatic Protection of a Mass Spectrometer. August 21, 1972. Publication in Analytical Chemistry.

ELLSWORTH, J.D. S&E-ASTR-SGA
THOMPSON, Z. S&E-ASTR-SGA
(co-authors)
Identification of Comet Nucleus from Comet Coma. October 17, 1972. IEEE Region 3 Convention, Louisville, Kentucky.

Autonomous Target Relative Navigation. June 22, 1973. Publication in Navigation.

EMANUEL, GARVIN PD-MP-A
Telescope Optics. November 1, 1972. LST Industry Briefing, MSFC, Alabama.

ENGLER, E.E. S&E-ASTN-ES
The Application of Composite Materials. April 10, 1973. Design and Fabrication

of Aerospace Structures Using Composite Materials Conference, Tullahoma, Tennessee.

ESPY, PATRICK N. S&E-SSL-PO
Stress Investigation of Material Properties by Holographic Spacial Filtering Techniques. April 10, 1973. 50th Meeting of the Alabama Academy of Science, Huntsville, Alabama.

FAILE, GWYN C. S&E-ASTR-M
See Counter, Duane E.

FALLS, LEE W. S&E-AERO-YT
The Beta Distribution: A Statistical Model for World Cloud Cover. January 19, 1973. Publication in Journal of Applied Meteorology.

FARMER, JOHN E. S&E-ASTR-SD
Private Rapid Transit (PRT) – Considerations for Control and Command System Development. September 26, 1972. Local Group of IEEE, Huntsville, Alabama.

FICHTL, GEORGE H. S&E-AERO-YA
Probability Distribution of Vertical Longitudinal Shear Fluctuations. July 18, 1972. Publication in Journal of Applied Meteorology.

See Camp, Dennis D.

FICHTL, GEORGE H. S&E-AERO-YA
KUMAR, PREM S&E-AERO-YA
The Response of a Propeller Anemometer to Turbulent Flow with the Mean Wind Vector Perpendicular to the Axis of Rotation. March 2, 1973. Publication in International Journal of Boundary-Layer Meteorology.

FIELDS, STANLEY A. S&E-SSL-TR
REYNOLDS, JOHN M. S&E-SSL-TR
A Study of the Reflection of X-Rays by Optical Surfaces. March 15, 1973. Presentation and publication at the Annual Meeting and Journal of the Alabama Academy of Science, Huntsville, Alabama.

The Use of a Vacuum X-Ray Reflectometer to Determine Optical Properties of Materials. June 7, 1973. 20th National Vacuum Symposium, American Vacuum Society, New York, New York.

FISHER, R.R. S&E-ASTN-PTB
(co-authors)
Aerothermodynamics of the Space Shuttle Reaction Control System. January 8, 1973. AIAA 11th Aerospace Sciences Meeting, Washington, D.C.

FLOYD, HENRY B. SL-DP
The Skylab Student Project. March 9, 1973. Tenth Space Congress, Cocoa Beach, Florida.

FRITZ, CARL G. PD-DO-MT
LST Thermal Control. October 31, 1972. LST Review to Industry, MSFC, Alabama.

FULMER, CLARENCE R. A&PS-CP-S
SHIPMAN, DAVID L. A&PS-CP-S
Autoscan: Technique for Scanning Masses of Data to Determine Potential

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

Areas for Detailed Analysis. October 19, 1972. AIIE Conference, Chicago, Illinois.

GARY, GILMER ALLEN S&E-SSL-TT
Zodiacal Light and the Gegenschein. July 5, 1972. Southeast Regional Astronomical League Convention, Huntsville, Alabama.

GATES, DANIEL W. S&E-SSL-TT
(co-author)
Atomic Density as a Parameter for Characterizing Materials. July 20, 1972. Fall Meeting of the American Ceramic Society, Ceramic-Metal Systems, Annapolis, Maryland.

Improved Zn_2TiO_4 Thermal Control Pigment. June 22, 1973. 26th Pacific Coast Meeting of the American Ceramic Society, San Francisco, California.

GODFREY, R.E. SP-MGR
Space Shuttle Booster Recovery Planning. April 12, 1973. Aerodynamic Deceleration System Conference, Palm Springs, California.

GOULD, J.M. S&E-ASTR-RD
JUERGENSEN, K. S&E-ASTR-RD
The NASA Computer Aided Design and Test System. April 13, 1973. XXV AGARD Avionics Panel Technical Meeting on Computer Aided Design, Lyngby, Denmark.

GRAFF, CHARLES B. S&E-ASTR-EP
Space Power Systems. October 31, 1972. Louisville Section of IEEE, Louisville, Kentucky.

GRAFF, S.M. S&E-ASTR-RM
See Allen, R.V.

GREENWOOD, TERRY E. S&E-AERO-AT
SEYMOUR, D.C. S&E-AERO-AT
(co-authors)
A Study of the Plume Impingement Environment Experienced by the Booster During the Space Shuttle Nominal Staging Maneuver. August 21, 1972. AIAA/SAE 8th Joint Propulsion Specialist Conference, New Orleans, Louisiana.

GUEST, STANLEY H. S&E-AERO-AU
(co-authors)
Sound Source Measurement in Air Jets using the Crossed Beam Correlation Technique. February 16, 1973. AGARD Fluid Dynamics Meeting, Belgium.

GUEST, STANLEY H. S&E-AERO-AU
SLONE, ROBERT M., JR. S&E-AERO-AU
Propagation of Intense Sounds Resulting from Static Testing of Large Rocket Engines and Claims of Damage Resulting Therefrom. July 20, 1972. Acoustical Society of America – National Bureau of Standards Joint Symposium, Gaithersburg, Maryland.

HAMILTON, EDWARD C. PD-DO-E
See Brantley, Whit.

HARBISON, J.E. S&E-ASTN-ADL
(co-author)
POGO Technology Review. July 18, 1972. Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee, Langley Research Center, Hampton, Virginia.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

HIRSCH, O.M. A&PS-DIR

Evolution of Government Contracting and Contract Types. March 27, 1973. Short Course on Critical Elements in Management of Large Government/ Industry Projects, Tullahoma, Tennessee.

HOCHMAIR, ERWIN S. S&E-ASTR-R

Integrated P-Channel MOS Gyrator. August 28, 1972. IEEE Journal of Solid-State Circuits.

Power Gyrators. August 28, 1972. IEEE Journal of Solid-State Circuits.

A Complementary MOS Gyrator. August 31, 1972. IEEE Journal of Solid-State Circuits.

HODGES, BOBBY S&E-COMP-SD

Crew/Computer Communication Techniques in Control and Checkout of Shuttle Payloads. September 5, 1972. Shuttle Payload Control and Checkout Conference, Huntington Beach, California.

Image Processing for Space Applications. February 5, 1973. IEEE Computer Society, Houston, Texas.

HODGES, BOBBY S&E-COMP-SD
(co-author)

Image Data Processing for ATM Experiment S-056. October 20, 1972. AIAA Computer Conference, Huntsville, Alabama.

Techniques for Automatic Interpretation of Multispectral Imagery. October 27, 1972. Electronics Industries Association Third Annual Symposium, Washington, D.C.

Discrete Simulation of a Computer System Executive. February 20, 1973. Southeastern Regional Meeting of the Society for Computer Simulation, Orlando, Florida.

A Simulator for the Space Ultrareliable Modular Computer with Host Independence. April 10, 1973. Symposium on the Simulation of Computer Systems, Gaithersburg, Maryland.

Simulation as a Computer Design Aid. July 25, 1973. AIAA/NASA/ASTM/IES Seventh Space Simulation Conference, Los Angeles, California.

HODGES, BOBBY C. S&E-COMP-SD
THOMAS, D.T. S&E-COMP-SD
(co-authors)

Image Analysis Techniques Associated with Automatic Data Base Generation. January 9, 1973. AIAA Computer Network Systems Conference, Huntsville, Alabama.

Image Analysis Techniques Associated with Automatic Data Base Generation. March 19, 1973. AIAA Computer Networks Systems Conference, Huntsville, Alabama. Publication in Conference Proceedings.

HOLLAND, ROBERT L. S&E-SSL-PM

Radial Step Integration of Ordinary Differential Equations. January 8, 1973.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

Publication in SIAM Journal on Numerical Analysis.

HOLLAND, WAYNE B. S&E-ASTN-ADL
(co-author)
Skylab Experience with Apollo Docking/Latching Loads. May 22, 1973. AIAA/ASME/SAE Space Mission Planning and Execution Meeting, Denver, Colorado.

HOOVER, RICHARD B. S&E-ASTR-RPO
Gravitational Collapse, Pulsars, Neutron Stars, Black Holes, and Cosmic X-Ray Astronomy. July 28, 1973. Southeastern Regional Convention of the Astronomical League, Huntsville, Alabama.

Telescopes and Techniques for Imaging Cosmic X-Ray Sources. July 28, 1972. Southeastern Regional Convention of the Astronomical League, Huntsville, Alabama.

Was the Universe Created? October 31, 1972. Publication in the Proceedings of the American Philosophical Society.

HOOVER, RICHARD B. S&E-ASTR-RPO
(co-authors)
Imaging Characteristics of the Hyperbolic-Aspheric Channel of a Three-Mirror X-Ray Telescope. September 20, 1972. 1972 Fall meeting of SESAPS, Birmingham, Alabama.

HORGAN, A.M. S&E-SSL-N
See Dalins, Ilmars.

JAIN, A.C. S&E-AERO-A
(co-author)
Hypersonic Merged Stagnation Shock Layers Part I: Adiabatic Wall Case; Part II: Cold Wall Case. February 7, 1973. Publication in AIAA Journal.

JEX, DAVID WILLIAM S&E-SSL-PA
Light Gas-Plasma Accelerator. August 28, 1972. 23rd Aeroballistics Association Congress, Vernon, France.

JOHNSTON, MARY HELEN
S&E-ASTN-MEV
Influence of Gravity on Growth Orientations of Tin Single-Crystals. August 28, 1972. Publication in Journal of Crystal Growth.

JUERGENSEN, K. S&E-ASTR-RD
See Gould, J.M.

KAUFMAN, JOHN W. S&E-AERO-YA
See Camp, Dennis W.

KAUFMAN, JOHN W. S&E-AERO-YA
SUSKO, MICHAEL S&E-AERO-YA
The Dynamics of Exhaust Cloud Rise and Growth Phenomena for Apollo Saturn Engines. July 12, 1972. Publication in the Journal of Spacecraft and Rockets.

KEY, C.F. S&E-ASTN-M
SCHWINGHAMER, R.J. S&E-ASTN-M
High Pressure Oxygen Test Evaluation. March 9, 1973. AICHE – Oxygen Utilization Under Pressure Symposium, New Orleans, Louisiana.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

KIEFLING, LARRY S&E-AERO-DDS
(co-authors)
Methods and Application of System Identification in Shock and Vibration. September 20, 1972. ASME Winter Annual Meeting, New York, New York.

KLINGMAN, EDWIN E., III S&E-SSL-PA
Implementation of a "Frog's Eye" Type Discriminator, Responsive Only to Pattern Changes, as a Pre-Processor for Visual Data. March 19, 1973. 19th Annual Meeting Institute of Environmental Sciences, Anaheim, California.

KNIGHT, R.D. S&E-SSL-PA
See Edwards, Thomas R.

KRAUSE, FRITZ R. S&E-AERO-T
Potential Remote Precipitation Surveys of Showers. January 29, 1973. National ASCE Water Resources Engineering Meeting, Washington, D.C.

Infrared Change Detection Concepts for Remote Surveys of Local Moisture Exchange. February 7, 1973. 2nd Annual Remote Sensing of Earth Resources Conference, Tullahoma, Tennessee.

Potential Moisture Balance Surveys of Storms. July 3, 1973. Publication in Journal of Atmospheric Sciences.

KROES, ROGER L. S&E-SSL-TR
Photoluminescence and Optical Transmission of Diffusion-Pump Oil. August 21, 1972. Publication in the Journal of the Optical Society of America.

KROES, R.L. S&E-SSL-TR
LINTON, ROGER C. S&E-SSL-TR
(co-author)
Optical Properties of INBI. December 19, 1972. Publication in Bulletin of the American Physical Society.

KUMAR, PREM S&E-AERO-YA
First-Order Reactant in Homogeneous Turbulence Before the Final Period of Decay. September 11, 1972. Publication in the Physics of Fluids Journal.

On First-Order Reactants in Homogeneous Turbulence. September 11, 1972. Publication in Journal of Applied Mathematics and Physics.

Statistical Properties of Lateral Shear Along the Vertical. September 14, 1972. Publication in Journal of Applied Meteorology.

Statistical Properties of Vertical Shear of Lateral Velocity. March 7, 1973. Publication in Journal of Applied Meteorology.

See Fichtl, George H.

KURTZ, ROBERT L. S&E-SSL-PO
A Holographic Motion Picture Camera Which Allows Front Surface Detail to be Recorded in Real Time Using a Continuous Wave Laser. January 11, 1973. Publication in Applied Optics.

Author's Reply to Comments on: Experimental Investigation of a Holographic System that Records Front

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

Surface Detail from a Scene Moving at High Velocities. February 21, 1973. Publication in Applied Optics.

An Introduction of Several Measuring Techniques New to the Field of Nondestructive Testing. March 28, 1973. Publication in International Journal of Nondestructive Testing.

LINTON, ROGER C. S&E-SSL-TR
The Optical Properties of Zirconium Diboride Thin Films. April 17, 1973. Publication in Journal of Physics of Thin Solid Films.

See Kroes, R.L.

LIU, T.C. S&E-ASTR
See Chubb, W.B.

LIU, T.C. S&E-ASTR-SGA
THOMPSON, ZACK S&E-ASTR-SGA
New Scheme to Suppress Nonlinear Limit Cycle for Space Vehicle Control. January 16, 1973. Fifth Annual Southeastern Symposium on System Theory, Raleigh, North Carolina.

Blending Effects for Limit Cycle Control. April 5, 1973. Twelfth Annual ISA Huntsville Conference, Huntsville, Alabama.

LOOSE, JACK D. S&E-ASTN-PTC
(co-authors)
Development of a High Capacity Variable Conductance Heat Pipe. February 7, 1973. AIAA 8th Thermophysics Conference, Palm Springs, California.

LOVINGOOD, J.A. S&E-AERO-D
RYAN, ROBERT S. S&E-AERO-D
Computation of Launch Vehicle System Requirements Using a Hybrid Computer. February 2, 1973. 1973 Summer Computer Simulation Conference, Montreal, Canada.

LUCAS, WILLIAM DEP-T
LST Introduction to Industry Briefing. October 31, 1972. LST Briefing to Industry, MSFC, Alabama.

MacPHERSON, J.F. S&E-ASTN-ADD
(co-author)
Skylab Payload Assembly Vibroacoustic Test Program. November 9, 1972. Publication in Shock and Vibration Bulletin.

MARSHALL, WILLIAM R. PD-DO-DIR
Sortie Lab Experiment Operations. September 14, 1972. First Conference on Shuttle Payload Control and Checkout, Huntington Beach, California.

MASTIN, WILLIAM C. S&E-ASTR-GC
See Broussard, P.H.

McCOY, J.C. S&E-COMP-SE
See Edwards, Thomas R.

McKINLEY, M.D. S&E-ASTN-MN
See Curry, J.E.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

McPEAK, B.J. S&E-ASTR-EBC
SOUTHER, C.H. S&E-ASTR-EBC
Unplated Copper Hook-Up Wire. October 10, 1972. Publication in Insulation/ Circuits.

MICHLOVIC, JOSEPH E. S&E-SSL-TE
Optical Tidbits. July 5, 1972. Southeastern Regional Astronomical League Convention, Huntsville, Alabama.

MOORE, W. WALDING, JR. S&E-SSL-PO
NISEN, DANIEL B. S&E-SSL-PO
TASHBAR, PHILIP W. S&E-SSL-PO
A Modified Quadrupole Mass Spectrometer with Custom RF Link Rods Driver for Remote Operation. October 5, 1972. Publication in Review of Scientific Instruments.

A Remote-Operation Quadrupole Mass Spectrometer Using a Custom RF Link Approach. March 6, 1973. Publication in Applied Spectroscopy.

MORGAN, S.H., JR. S&E-SSL-NA
See Eby, P.B.

MRAZEK, W.A. PD-DIR
See Atkins, Harry L.

MURPHY, JAMES T. PD-DIR
See Darwin, Charles R.

NAUMANN, ROBERT J. S&E-SSL-P
Dynamics of Spacecraft Contamination. March 10, 1972; IES-NASA AIAA/ ASTM 6th Space Simulation Conference, New York, New York. July 11, 1972; Submitted for publication in Journal of Environmental Sciences.

Design Principles for Contamination Abatement in Scientific Satellites. August 2, 1972. 23rd International Astronautical Congress, Vienna, Austria.

NICHOLS, J.J. S&E-ASTN-ADS
(co-authors)
Use of Generalized Mass Contributions in Correlation of Test and Analytical Vibration Modes. July 31, 1972. 43rd Shock and Vibration Symposium, Pacific Grove, California.

Skylab Modal Survey Testing. July 31, 1972. 43rd Shock and Vibration Symposium, Pacific Grove, California.

NISEN, DANIEL B. S&E-SSL-PO
See Moore, W. Walding, Jr.

NYBO, LELYN W. MT-AE-E
Omega Windfinding System Designed to Meet Accuracy Requirements of GARP Atlantic Tropical Experiments. April 27, 1973; 8th Technical Conference on Hurricanes and Tropical Meteorology, Key Biscayne, Miami, Florida. July 3, 1973; Publication in the Bulletin of the AMS.

O'DELL, C.R. PD-LST
The Large Space Telescope Program. October 16, 1972. Publication in Sky and Telescope.

Large Space Telescope (LST). April 27, 1973. COSPAR, Konstanz, West Germany.

Nuclei of Planetary Nebulae. May 2, 1973. Extraordinary General Assembly,

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

International Astronomical Union, Warsaw, Poland.

ODOM, JIM PM-SP
Solid Rocket Motors for the Space Shuttle Booster. July 14, 1972. SAE National Aerospace Engineering and Manufacturing Meeting, San Diego, California.

OLIVIER, JEAN PD-LST
Introduction and Summary for LST. November 1, 1972. LST Industry Briefing, Huntsville, Alabama, MSFC.

ORAN, WILLIAM A. S&E-SSL-NP
On Systems that Simulate the Ionospheric-Satellite Interaction. September 5, 1972. Publication in Journal of Applied Physics.

ORAN, W.A. S&E-SSL-NP
STONE, N.H. S&E-SSL-NP
(co-author)
Laboratory Simulation of the Structure of Disturbed Zones Around Bodies in Space. January 29, 1973. Publication in Journal of Atmospheric and Terrestrial Physics.

ORAN, W.A. S&E-SSL-NP
STONE, N.H. S&E-SSL-NP
A Laboratory Simulation of the Spacecraft-Ionospheric Plasma Interaction. March 28, 1973. American Geophysical Union Meeting, Washington, D.C.

ORILLION, ALFRED G. PD-SA-V
Space Tug Checkout Considerations. September 14, 1972. Shuttle Payload Control and Checkout Conference, Huntington Beach, California.

PALUDAN, CHARLES T. N. S&E-EA-DIR
The Uses of ERTS Data in Land-Use Study. April 5, 1973. Annual Meeting of the Association of Geographers, Atlanta, Georgia.

PARKHIE, MUKUND R. S&E-ASTN-SM
Hypothalamic Growth Hormone Releasing Factor; Release and Synthesis after Exposures to a High Ambient Temperature. January 8, 1973. Publication in Proceedings of the Society for Experimental Biology and Medicine.

PARKS, P.G. S&E-PE-MW
(co-author)
Welding of Aluminum 2219 Alloy with M934 Filler Wire. July 3, 1973. Publication in Welding Journal.

PARNELL, T.A. S&E-SSL-NA
(co-authors)
Measurements of Cosmic Ray Trajectories with a Proportional Counter Hodoscope. April 24, 1973. 13th International Cosmic Ray Conference, Denver, Colorado.

PARNELL, T.A. S&E-SSL-NA
See Eby, Peter B.

PETERS, PALMER N. S&E-SSL-NP
Mobility of Sulfur on a Ni(100) Surface. October 13, 1972. Southeastern Section of the American Physical Society, Birmingham, Alabama.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

PETERS, P.N. S&E-SSL-NP
(co-author)
Application of Internal Reflection Spectroscopy to the Study of Spacecraft-Type Contaminants. June 20, 1973. Publication in Research and Development Magazine.

POE, JAMES W. S&E-AERO-AU
(co-authors)
Ground Wind Loads on Skylab Launch Vehicles. September 12, 1972. AIAA/ASME/SAE 14th Structures, Structural Dynamics and Materials Conference, Williamsburg, Virginia, and AIAA Dynamics Specialist Conference, Williamsburg, Virginia.

REECE, O.Y. S&E-ASTN-MM
(co-authors)
Shock Wave Synthesis and Characterization of NB_3SN. March 8, 1973. Publication in the Journal of Less Common Metals.

REICHMANN, EDWIN J. S&E-SSL-TE
Solar Flare Brightness Distribution. July 5, 1972. Southeastern Regional Astronomical League Convention, Huntsville, Alabama.

REYNOLDS, JOHN M. S&E-SSL-TR
See Fields, Stanley A.

RISCH, E.R. S&E-ASTN-MER
See Clotfelter, W.N.

RUSSELL, DEAN M. S&E-SSL-PO
WILLIAMS, JOHN R. S&E-SSL-PO
Particle Analysis by Active Scattering Particle Spectrometry. November 21, 1972. Instrument Society of America National Aerospace Symposium, Las Vegas, Nevada.

RYAN, ROBERT S. S&E-AERO-D
See Lovingood, J.A.

SCHIEHLEN, WERNER O. S&E-ASTR-A
Fine Pointing System for a LST Spacecraft. February 5, 1973. EUROMECH 38 (Gyrodynamics), Louvain-la-Neuve, Belgium.

A Fine Pointing System for Large Orbiting Telescopes. February 20, 1973. AIAA Guidance and Control Conference, Key Biscayne, Florida.

SCHOCKEN, KLAUS S&E-SSL-T
The Attenuation of X Rays Emitted by Supernovae. December 19, 1972. Publication in Astronomy and Astrophysics.

Structure of the Crab Nebula. July 5, 1972. Southeastern Regional Astronomical League Convention, Huntsville, Alabama.

The Attenuation of X Rays from the Crab Nebula. January 8, 1973. Publication in Science.

SCHULTZ, DAVID N. PD-DO-ES
Attitude Control System/Reliability. October 31, 1972. LST Review to Industry, MSFC, Alabama.

SCHWINGHAMER, R.J. S&E-ASTN-M
See Key, C.F.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

SELTZER, SHERMAN M. S&E-ASTR-A
(co-authors)

Attitude Control of a Spinning Skylab. February 4, 1972; AIAA Guidance and Control Conference, Stanford, California. August 21, 1972; Publication in AIAA Journal of Spacecraft and Rockets.

Attitude Control of a Spinning Flexible Spacecraft. April 3, 1973. Publication in Automatica.

SELTZER, SHERMAN M. S&E-ASTR-A
See Chubb, W.B.

SEYMOUR, D.C. S&E-AERO-AT
See Greenwood, Terry E.

SHIPMAN, D.L. A&PS-CP-S

A Simulation Model for Allocating Resources in a Project Type Environment. October 2, 1972. AIIE Conference, Huntsville, Alabama.

SHIPMAN, D.L. A&PS-CP-S
See Fulmer, Clarence R.

SHRIVER, EDWARD L. S&E-SSL-PA
(co-author)

Magnetogasdynamic Compression of a Coaxial Plasma Accelerator Flow for Micrometeoroid Simulation. July 7, 1972. Publication in Journal of Applied Physics.

SIEBEL, MATHIAS P. S&E-PE-DIR

Manufacturing in Space. July 3, 1972. 1972 SAE National Aerospace Engineering and Manufacturing Meeting, San Diego, California.

SIMS, JOSEPH L. S&E-AERO-AF
(co-authors)

Simulation of Space Shuttle Main Propulsion System Exhaust Plumes at Ascent Trajectory Test Points. September 26, 1972. JANNAF 7th Plume Technology Meeting, Redstone Arsenal, Alabama.

An Investigation of Exhaust Plume Simulation and Its Effect on Plume Induced Boundary Layer Separation. September 26, 1972. JANNAF 7th Plume Technology Meeting, Redstone Arsenal, Alabama.

SINGH, S.P. S&E-COMP-SA
TRAUBOTH, H. S&E-COMP-SA

MARSYAS – A Software System for Digital Simulation of Large-Scale Dynamical Systems. April 10, 1973. Publication in IEEE Circuit Theory Newsletter.

SLONE, ROBERT M., JR. S&E-AERO-AU
See Guest, Stanley H.

SMITH, ORVEL E. S&E-AERO-YT

Counting Things (Analysis of Runs: Statistical Concepts and Applications). February 13, 1973. Alabama Chapter of the American Statistical Association, Birmingham, Alabama.

SMITH, ROBERT E. S&E-AERO-YS
(co-authors)

Long Wavelength Acoustic Modes in the Topside Ionosphere. October 27, 1972. Publication in Journal of Geophysical Research.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

Characteristics of Ionospheric Waves Generated by Rocket Launches. November 10, 1972. Publication in Journal of Geophysical Research.

Observational Evidence of Acoustic Waves on the Ionospheric Sounding Records. December 19, 1972. Publication in Journal of the Acoustical Society of America.

Propagation of Hydromagnetic Waves in Upper F2 Region. December 19, 1972. Publication in Planetary and Space Science.

SMITH, ROBERT E. S&E-AERO-YS
See Ballance, James O.

SMITH, ROBERT E. S&E-AERO-YS
SWENSON, GARY R. S&E-AERO-YS
Ground Based OI 6300 A Doppler Temperature Measurements During August 4, 1972 Storm Period. September 20, 1972. American Geophysical Union, San Francisco, California.

SNODDY, WILLIAM C. S&E-SSL-T
RCAA Talk on "Real Time Solar Magnetograph." May 9, 1973. RCAA, Huntsville, Alabama.

SNYDER, R.S. S&E-ASTN-MTE
Electrophoresis Demonstration on Apollo 16. August 11, 1972. Gordon Conference on Separation and Purification, New London, New Hampshire.

Apollo 16 Electrophoresis. February 21, 1973. Physics Society Annual Meeting, Fredonia, New York.

Electrophoresis at Zero Gravity on Apollo 16. May 8, 1973. Publication in Science.

SOUTHER, C.H. S&E-ASTR-EBC
See McPeak, B.J.

STEPHENS, JAMES B. S&E-AERO-F
Retrieval of a Dual Description for Kinematics from Local Temporal Information. November 9, 1972. Colloquium to Physics Department, Oklahoma University, Norman, Oklahoma.

Impact of Physics on Lead Research for Land Inventories, Air Quality and Hydrological Investigations. November 9, 1972. Colloquium to Physics Department, Ft. Hays Kansas State College, Hays, Kansas.

STEPHENS, J. BRISCOE S&E-AERO-F
ST. JOHN, R.M. S&E-AERO-F
Recognition of Dispersion and Convection Patterns of Transport Phenomena in Stationary and Nonstationary Fluids. November 9, 1972. Oklahoma Academy of Science, Weatherford, Oklahoma.

STEWART, RODNEY D. A&PS-PR-G
Lecture: New Approaches in Government Cost Estimating. February 13, 1973. Short Course on Critical Elements in Management of Large Government/ Industry Projects, Tullahoma, Tennessee.

ST. JOHN, R.M. S&E-AERO-F
See Stephens, J. Briscoe

STONE, N.H. S&E-SSL-NP
See Oran, W.A.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

STUCKEY, JAMES M. S&E-ASTN-MNM
(co-author)
Development and Evaluation of Graphite and Boron Polyimide Composites. September 19, 1972. 4th National SAMPE Technical Conference, Palo Alto, California.

STUHLINGER, ERNST AD-S
Space Exploration During the Next Twenty Years. July 17, 1972. Paper presented at the Max Planck Institute for Extraterrestrial Physics, Munich; the University of Tübingen, Tübingen, West Germany; the Institute of Technology, Stuttgart, Garmish, West Germany, and a high school in Stuttgart.

SUSKO, MICHAEL S&E-AERO-YA
See Kaufman, John W.

SWEARINGEN, C.N. S&E-ASTR-C
(co-authors)
Highly Reliable Processor System for Space Application. March 6, 1973. Biennial Computer Group National Conference on Computer Network Systems, Huntsville, Alabama.

SWENSON, GARY R. S&E-AERO-YS
See Smith, Robert E.

TASHBAR, PHILIP W. S&E-SSL-PO
See Moore, W. Walding, Jr.

TAVASSOLI, A.A. S&E-ASTN-MM
Mechanical Properties of Columbium Alloy SU31. July 18, 1972. Publication in Metallurgical Transactions.

Elevated Temperature Tensile Properties of Silicide Slurry Coated Columbium Alloys. July 26, 1972. Publication in Journal of Materials.

THOMAS, D.T. S&E-COMP-SD
See Hodges, Bobby.

THOMASON, H.E. SP-EM-MGR
Space Shuttle System Solid Rocket Booster. May 22, 1973. AIAA/ASME/SAE Space Mission Planning and Execution Meeting, Denver, Colorado.

THOMPSON, ZACK S&E-ASTR-SGA
See Chubb, W.B.; Ellsworth, J.D.; and Liu, T.C.

TRAUBOTH, H. S&E-COMP-SA
MARSYAS – User's Manual. January 30, 1973. Copy of manual presented to COSMIC Library, University of Georgia, Athens, Georgia.

Real-Time Computer Systems. February 5, 1973. University of Notre Dame, Notre Dame, Indiana.

Guidelines for the Documentation of Scientific Software Systems. April 10, 1973. IEEE Symposium on Computer Software Reliability, New York, New York.

See Singh, S.P.

TRENKLE, J.J. S&E-SSL-TR
WILKES, D.R. S&E-SSL-TR
Optical Contamination Effects Due to Outgassed Products from Thermal

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

Control Surfaces. April 2, 1973. 1973 Conference on Environmental Systems, San Diego, California.

TURNER, ROBERT E. S&E-AERO-Y
See Camp, Dennis W.

URBAN, EUGENE W. S&E-SSL-N
Magnetic Flux Annihilation in Type II Superconductors. October 13, 1972. Southeastern Section of the American Physical Society, Birmingham, Alabama.

VAUGHAN, OTHA H. S&E-AERO-YE
VAUGHAN, WILLIAM W. S&E-AERO-Y
Zero-Gravity Research Potential in Cloud Physics and Weather Modification. March 15, 1973. Publication in Bulletin of the American Meteorological Society.

VAUGHAN, WILLIAM W. S&E-AERO-Y
See Vaughan, Otha H.

VILLELLA, F. S&E-QUAL-QT
(co-author)
Thermal Excursions Cause Transistor Failures. November 30, 1972. Publication in Circuits Manufacturing.

VON PRAGENAU, GEORGE L.
S&E-ASTR-A
Status and Present Development of Space Vehicle Steering. August 16, 1972. Publication in Osterreichische Ingenieur Zeitschrift.

WALLACE, G.R. S&E-ASTR-IA
(co-authors)
Statistical Properties of Filtered Pseudo-random Digital Sequences Formed from the Sum of Maximum Length Sequences. April 16, 1973. Transactions on IEEE, Communication Technology.

WAMSTEKER, WILLEM S&E-SSL-TE
The Wavelength Dependence of the Albedo of Uranus and Neptune from 0.3μ to 1.1μ. April 12, 1973. Publication in Astrophysical Journal.

WDOWIAK, THOMAS J. S&E-SSL-TE
(co-author)
Photometry of Supernova 1972 in NGC 5253. August 21, 1972. Publication in Astrophysical Journal Letters.

On the Recent Supernova in NGC 5253 and the Supernova Rate. December 19, 1972. Publication in Nature.

WEAVER, LEON B. PD-DO-MC
Maintenance of the Large Space Telescope. September 14, 1972. Shuttle Payload Control and Checkout Conference, Long Beach, California.

WELLS, ERNEST H. S&E-SSL-PA
Water on Mars, and Martian Blue Haze and Flash Phenomena. July 24, 1972. Southeast Astronomical League, Huntsville, Alabama.

WHITE, J.B., Jr. S&E-ASTR-CA
The Effect of Modularity on a Reconfigurable Architecture for Either Ultra-Reliability or Multiprocessing. November 10, 1972. Publication in IEEE Transactions on Computers.

MSFC PAPERS CLEARED FOR PRESENTATION
(Available only from authors. Dates are clearance dates.)
(Only MSFC authors listed. "Co-author" indicates non-MSFC author.)

WILKES, D.R. S&E-SSL-TR
See Trenkle, J.J.

WILLIAMS, JOHN R. S&E-SSL-PO
See Russell, Dean M.

ZOLLER, LOWELL K. SP-ET-MGR
Space Shuttle External Tank. September 26, 1972. AIAA Space Shuttle Short Course, Boulder, Colorado.