

X.9.

MSFC PROJECTS INDEX

BY LABORATORY  
1967

1.

date  
~~10-27-67~~  
11-16-67



Advanced Systems Office

1. Low Acceleration Space Transportation Systems
2. Design Requirements for Reactor Power Systems for Lunar Exploration

X.9

B. Aero-Astrodynamic Laboratory

1. Mechanical Analog of Liquid Propellant in Low and Zero g Gravity Fields
2. Experimental Evaluation of Reynolds Number Effects on Body of Revolution Viscous Cross-Flow Phenomena
3. Aerodynamic Properties of Exhaust Plumes
4. Stability Derivatives of Slowly Oscillating Bodies of Revolution in Supersonic Flow
5. Panel Flutter Aerodynamics
6. Experimental Modeling of Apollo-Saturn Hypersonic Aerodynamic Flow Fields
7. Study of Theoretical Methods as Applied to Steady Aerodynamic Analysis of Saturn Vehicle Shapes
8. A Parametric Fin Study to Determine Thickness Effects of Delta and Trapezoidal Fin Shapes

9. Effects of a Nonuniform Spanwise Velocity Profile on Fin Efficiency
10. Study and Refinement of High Angle of Attack Wind Tunnel Model Testing Techniques
11. Parametric Study of the Aerodynamic Characteristics of Solid Propellant "Strap-On" Thrust Assist as Applied to Saturn-Class Vehicle
12. Normal Force Characteristics of Right Circular Cylinders of Various Fineness Ratios at 90 degree Angle of Attack
13. Experimental Investigation of Nonlinear Lift of Bodies with Changing Cross Section
14. Study of Numerical Solution of Special Flow Problems for Saturn Vehicles
15. Study to Evaluate Flow Coefficients for Flat Plate Outlets Discharging Transverse to an External Stream
16. Experimental Measurements Using the Laser Doppler Velocity Instrument
17. Base Flow and Separation Studies
18. Analytical Investigation of Plume Afterburning

19. Research Related to Application of Shock Tube Techniques to the Study of Base Thermal Environment of Rocket-Propelled Vehicles (Base Heating Research)
20. Calculation of Three-Dimensional Interaction Regions in Multi-Rocket Vehicles
21. Recirculation of Gases Along the Base
22. Base Flow and Separation Studies
23. Short Duration Base Heating Model Research
24. Analysis of Ablator Effects on RF Attenuation
25. Study on Exhaust Plume Radiation Predictions
26. Aerodynamic Noise Research
27. Investigation of Noise Generation Mechanisms of Deflected and Unde-flected Supersonic Rocket Exhaust
28. Sound Propagation Prediction
29. Sound Propagation and Acoustic Danger Points

30. Acoustic Model Studies of Rocket Exhaust Flows
31. Sound and Shear Wave Interaction with Oblique Shock Fronts
32. Analysis of Detailed Vertical Wind Profile
33. Effect of Shock Induced Separation on Vehicle Dynamics
34. Theoretical Analysis of Meteorological Tower Data
35. Theoretical Research on the Pressure Distribution on Nonspinning Multi-stage Spacecraft Performing Bending Oscillations
36. Study of the Solution of Nonlinear Algebraic Equations
37. Fuel Sloshing Studies
38. Dynamic Response of Vehicle to Detail Wind Profiles and the Construction of a Synthetic Profile Based on These Detail Profiles
39. Analysis of Fuel Sloshing
40. Three Dimensional Analysis of Launch Vehicles Including Shell Degrees of Freedom

41. Environment Design Criteria  
Studies (Terrestrial)
42. Environmental Design Criteria  
(Space)
43. Design Criteria for Control of  
Space Vehicles During Launch  
Phase of Flight
44. Design Criteria for Flight  
Evaluation
45. Design Criteria for Guidance,  
Flight Mechanics and Trajectory  
Optimization
46. Design for Aerodynamic Analysis  
of Launch Vehicles
47. Stability of Guidance Systems
48. Optimum Rendezvous Guidance  
Systems
49. Application of Restricted Three-  
Body Model to Interplanetary  
Transit Studies
50. High Precision Interplanetary  
Trajectory Program
51. Lunar Swing-By Transits for  
Interplanetary Flight Missions

52. The Determination of Earth-Moon Trajectories for Maximum Mass In Lunar Orbit
53. Low Thrust Guidance Equations
54. Optimum Powered Flight (High or Low Thrust) Trajectory Formulation and Integration (Earth Orbit to Mars Orbit Low Thrust Trajectory Formulation and Integration)
55. Solutions for the Adjoint Variables in Trajectory Problems
56. Development of an Indirect Method for Solving Two-Point Boundary Value Problems Arising in Multistage Optimization, Interplanetary Low Thrust, Optimization Problems
57. Investigation of Problems of Optimum Orbit Transfer
58. Development of Rapidly Converging Optimization Techniques
59. Research on System Configuration Synthesis
60. Research on the Minimax Control Problem

61. Application of Optimal Control to Launch Vehicles
62. Launch Vehicle Adaptive Control System Synthesis Problem
63. A Worst Disturbance Design Criterion in the Theory of Analytical Control System Synthesis.
64. Use of Optimal Control Theory to Study Load Relief Control Systems
65. Two-Body Prediction Deck
66. Space Tracking Study Program (SPATS)
67. Development of a Doppler Heterodyne Technique for Measurement of Local Gas Velocity
68. Development of High Response Ballon-Borne Temperature Sensor
69. The Performance of a Hydrogen-Fluorine Rocket Motor
70. Interplanetary Tracking Analysis Program

71. Analysis of Extraterrestrial Atmospheres and Lifetime Prediction for Orbiting Vehicles
72. Orbital Lifetime
73. Orbital Correction Methods
74. Postflight Trajectory Determination Methods
75. Orbit Error Analysis (Improved Satellite Orbit Prediction and Tracking Methods)
76. Graphic Method of Lifetime Prediction for Extraterrestrial Orbits
77. The Development of Improved Orbit Tracking Methods
78. Radiation Pressure
79. Computation of Space Flight Trajectories
80. The Development of Improved Orbit Tracking Methods



81. High Altitude Wind Measurements
82. Rocket Ambient Environment  
Measurement Study
83. Range and Structure of  
Atmospheric Thermodynamic  
Quantities
84. Analysis of Satellite  
Navigation and Traffic Control  
Techniques
85. Advance Statistical Techniques  
to Establish Aerospace Vehicle  
Design Criteria
86. Extension of Knowledge of  
Solar Cycle Characteristics
87. A Study of Ionospheric Disturbances  
Following Static Test Firings and  
Thunderstorms
88. N-Satellite Program
89. N-Satellite Program
90. Geomagnetic and Geopotential  
Fields of the Earth and Moon
91. Bending Feedback Suppression  
and/or Active Control

92. Aerodynamic and Base Heating  
Tests for Advanced Saturn  
Configurations

93. Analysis of Base Heating Data  
from Solid Strap-On Tests

C. Astrionics Laboratory

1. Radioisotope Thermoelectric  
System (RTE) SNAP 19 Life Testing
2. Study of RTG Application to Saturn
3. Solar Cell Array
4. High Performance Zinc-Silver Oxide  
Battery
5. Zinc-Oxygen Primary Cell
6. Barium Electrode Batteries
7. Fuel Cell Systems
8. Fuel Cell Technology
9. Heat and Mass Transfer in an  
Electrochemical System
10. Electrolysis System

11. Integrated Circuit Power Amplifier
12. Design Analysis and Performance Evaluation of Electrical Contact
13. Electrical Control and Distribution System
14. Inverter for Motors
15. High Current Switching Device Implementing New Actuation Concepts
16. Component Radiation Testing
17. Radiation Resistant Semi-Conductor Devices
18. Design, Install and Fabricate Irradiation System
19. Testing of Telemetry, Sensors, and Signal Conditioning-Nuclear Environment
20. Development of Gyro Test Methods
21. Cryogenic Gyro (Project SPIN)
22. Integrated Gas Bearing Research
23. Body-Fixed Three Axis Reference Systems

24. Rate Sensing Using Optical Maser Techniques
25. Analysis, Design, and Prototype Development of Squeeze-Film Bearings for AB-5 Gyros
26. Development of an AB5 Gyro
27. Evaluation of an Angular Rate Sensor
28. Grease (Self-sealing) Bearing
29. Hydrodynamic Gyro Squeeze Film Bearing
30. Investigation of a Strapped-Down Inertial System
31. Short Term Frequency in a Gas Laser
32. Optical Guidance Techniques for Rendezvous
33. Advanced Spaceborne, Detection, and Navigation Sensor Requirements, NASS-20358
34. Step Recovery Diode Application
35. Nucleonic Techniques for Spacecraft Range and Tracking

36. Interplanetary Navigation Computer Specifications
37. Applications of Markov Chains to Guidance and Navigation Theory
38. Lunar Surface Navigation Study  
NAS8-20322
39. On-board Determination of Orbital Parameters
40. Studies in the Theory of Statistical Filters and their Applications to Selected Problems in Guidance, Control and Navigation of Space Vehicles.
41. Studies in the Theory and Application of Statistical Filter Theory to Selected Problems of Guidance, Control and Navigation of Space Vehicles
42. Computational and Display Requirements for Human Control of Space Vehicle Boosters
43. Study of Vision During Manned Booster Operation
44. Orbital and Interplanetary Navigation Simulation
45. Electrical to Fluid Converter

46. Electrical to Fluid Interface
47. Ground Station Requirements for Optical Communications Satellite
48. Optical Superheterodyne Receiver
49. Phase Variation Characteristics of Low Frequency Transmission
50. Investigation and Analysis of Advanced Telemetry Systems
51. Short Term Phase Stability Study
52. Optical Fine Tracking and Laser Transmitter System
53. Laser Component and Technique Development
54. Frequency Stabilization and Control
55. Broadband Narrow Beam Optical Communication
56. Optical Networks Synthesis Using Birefringent Materials
57. Experimental Measurement of Angular Deviations of a Laser Beam
58. 10.6 Micron Laser Communication Development

59. Frequency Controlled and Frequency Stable Lasers
60. Optical Communications and Tracking Techniques
61. High Temperature Crystal Oscillator
62. Various Materials for Optical Maser Action
63. Development of Coherent GaAs Arrays
64. Suitability of Laser Crystal Material
65. Study of Materials for Optical Maser Action'
66. Theoretical Analysis of Atmospheric Effects on Optical Propagation
67. Frequency Doubling Laser Advice
68. Phased Array Development
69. Electro-optic Techniques for Controlling the Direction of a Laser Beam

70. Tracking System Using Coherent Light Techniques
71. Random Noise Ranging
72. Antenna Pattern Range and Recording Techniques
73. C-Band Transponder Development
74. Optical Design and Measurements
75. Mechanical Design of Optical Systems
76. Hybrid Servo Loop Design
77. Precision Tracking Technique Development
78. Optical Component Fabrication
- 79 High Precision Tracking Mount
80. Optical Doppler Velocity Recording System
81. Transceiver of Saturn V Optical Tracking System
82. Digital Servoloop Design
83. Optical to Digital Interface Electronics
84. Optical Modulator Development



85. Coherent Infrared Detector  
Development
86. Development of a Stable Monolithic  
Operational Amplifier
87. Magneto-optic memory System
88. Magneto-optic Memory with Photon  
Excitation
89. High Bit Density Memory Matrix
90. Strain Gage Accelerometer
91. Vibration Spectrum Analyzer
92. Development of Solid State Image  
Converter of Radical Design
93. Infrared Sensing System for  
Lunar Temperature Studies
94. State of the Art of Pressure  
Transducers
95. Energy Beam Fabrication to  
Improve Junction Topography
96. Development of Multilayer Epitaxy  
for High Reliability Transistors

97. Flexible Interconnect Pattern  
for Silicon Monolithic Circuits
98. Development of Ferroelectric MOS-  
Transistors
99. Process Studies in Fabricating  
Monolithic Circuits
100. Etch Rate Enhancement of  $\text{SiO}_2$   
by Irradiation
101. Development of Tables for Use  
In Celestial Navigation on the  
Lunar Surface
102. Application of Holography  
to Strain Analysis
103. SS/PM Ground Station
104. Coaxial Switch for Space  
Environments
105. AROD Systems
106. Data Characteristics and  
Telemetry System Accuracy  
Analyses
107. UHF Telemetry Development
108. Onboard Data Storage for  
Telemetry Systems

109. Adaptive PCM System for Data Acquisition
110. Addressable Time Division Multiplexer System
111. Thermoelectric Cooling
112. Effects and Operating Characteristics of Flat Conductor Cable
113. Operating Characteristics of Flat Conductor Cable
114. Adaptive Control System Studies
115. Jet Pipe Servovalve Development
116. Electromechanical Servoactuator Development
117. Redundant Servoactuator Development

118. Pneumatic Actuator, J-2 Engine  
Flight Configuration
119. Design of Flat Cable Plugs with  
Solder Tabs for Flat Cable  
Connections
120. Design and Development of Molded  
Type High Density Flat Conductor  
Cable Plugs
121. Development of Universal Flat  
Cable Laminating and Testing  
Machine
122. Engineering Study for Application  
of Flat Cable System in S-IVB  
Stage
123. Development of High Temperature  
Environmentally Sealed Flat  
Cable Connectors
124. D. C. Amplifier
125. Investigation of Thin Film Dielectrics  
in Electric Fields Utilizing Electron  
Mincroscope.
126. Microminiaturized Flight Control  
Computer
127. Reduction of Electrical Noise and  
Cross-talk in Guidance Systems  
Components

128. Development of High-Accuracy,  
Long-Life Gyros
129. Development of High-Accuracy  
Long-Life Gyros
130. Development of High-Accuracy,  
Long-Life Gyros
131. Improvement of ST-124M  
Stabilized Platform  
Electrical/Electronic System
132. Improvement of ST-124M  
Stabilized Platform  
Electrical/ Electronic System
133. Development of Integrated  
Circuit Pulse Width Modulated  
D. C. Amplifiers
134. Model Reference Adaptive  
Flight Control System
135. Advanced Microminiaturized  
Switch Selector
136. Microminiaturized Control  
Signal Processor
137. Development of Platform Monitoring  
Selector System
138. Development of Microminiature  
Gas Bearing Gyro Servoloops

139. Booster Recoverable,  
Control System

140. Microminiature Rate Gyro

D. Computation Laboratory

1. New Methods and Applications  
of Analog Computations
2. Studies in Qualitative Aspects  
of Hamiltonian Systems

E. Engineering Computation Division

1. Integration Subroutine for  
Second Order Differential  
Equations
2. To Search for Good Algorithms  
to Discrete Optimization Problems
3. Research on Numerical Integration  
of Second Order Differential  
Equations
4. Development of Numerical Solutions  
for Partial Differential Equations  
Describing Two-Dimensional Moving  
Boundary Problems

F. Manufacturing Engineering Laboratory

1. Manufacturing Technology Development  
for Lightweight Insulation Systems

2. Development of Solid State Bonding Techniques
3. Fusion Spot Welding System (Hybrid MIG-TIG)
4. Development of Technology Using Composite Sandwich Structures
5. Methods and Techniques for Fabrication Assembly and Modification in Space
6. Development of Technology for High Energy Rate Forming
7. Technology for Shaping and Thermal Treating Advanced High Strength Alloys
8. Torus & Semi-Toroidal Tank Manufacturing Technology
9. Development of Advanced Strain Measuring Technology
10. Magnetomotive Shock Wave Studies
11. General Purpose Laser
12. Vacuum Sealing by Magnetic Pressure
13. Vacuum Sealing by Magnetic Pressure

14. Evaluation of Magnetomotive Versus  
Conventional Metal Working and Forming
15. Investigate and Checkout of MIG and  
TIG Welding in Vacuum
16. Particulate and Biological Matter  
Challenge System for Validation  
Of Sterility within a Sterile Assembly  
System
17. Process Control Element for  
Sterilization by Heating During  
and After Manufacturing of  
Hardware
18. Handbook on Biological Aspects  
for the Development of Manufacturing  
Procedures for Planetary Spacecraft to  
be sterilized by Heating.
19. Common Bulkhead and Manufacturing  
Technology Improvement Program for  
Saturn Stages
20. Development of Magnesium-Lithium  
Alloy Honeycomb Core
21. Develop Means of Manufacturing  
Bonded and Pressure Sealing Joints  
with Uniform Stress Distribution



22. Development of Advanced Flight Strain Measuring Techniques
23. Miniaturization Development for Welding Controls Utilized for Welding of Saturn Components
24. Weld Monitoring System to Continuously Analyze Spectroscopically, Weld Contamination Gases
25. Technology Improvement Program for Closed Die Forgings
26. Development of Explosive Forming Techniques for Saturn V Components
27. Technology Development of Beryllium Fasteners
28. Development of Beryllium End Fittings for Beryllium Structural Tubing
29. Intermolecular Bonding of Various Metals and Alloys by Thermochemical Decomposition
30. Development of a Bonded Cylindrical Structure
31. Development of Welded and Brazed Tube Connector

32. Intense Magnetic Fields for High Energy Forming and Structural Assembly of saturn V Components
33. High Energy Density Capacitor Study
34. Cryogenic Capacitor System Development
35. Development of High Energy Density Storage System
36. Induction Calculations for Coils
37. Development of High Current Switch
38. Development of Plasma Electron Beam Welding Unit
39. Electron Beam Welding of Unusual Saturn V Structural Components
40. Manufacturing and Assembly Techniques for Separable Fluid System Connections

41. Application of Ultrasonic Energy to Mechanical Tube Connections
42. Critical Electronic Manufacturing Technology and Equipment Improvement
43. Investigation of Power Supply Wave Shape & Frequency on Strength of Weld Joint
44. Elimination of Weld Porosity by Hydrogen Getters
45. Welding Base Metal Investigation Relative to Commercial Plate
46. Quantitative Analysis of Effects of Shielding Gases
47. Design, Develop & Fabricate a Magnetic Arc Shaper and Molten Puddle Stirrer
48. Development of Saturn Manufacturing Technology for Welding Methods and Techniques
49. Development of Chemical Precision Milling Techniques
50. Development of High-Frequency Resistance Welding for Saturn V Tank Skins

51. Development of Continuously Monitored X-Ray Examination of Weldments by Television Viewing
52. Digital Control of Saturn V Welding Machines
53. Improvement of Protective Coatings for the Saturn V Vehicle
54. Development of Technology for Installation of Mechanical Fasteners
55. Saturn V Electronic Connection Improvement Research
56. Development of Titanium S-IC Y-Ring
57. Development of Titanium S-IC Gore
58. Titanium S-IC Thrust Structure Development
59. Develop Techniques for Age Forming 2014 Aluminum S-II Tank Skins
60. Development of Techniques for Fabricating Titanium S-IC Fuel Tank
61. Tooling Concept for Manufacturing Operations in Space (Serpentuator)

62. Development of Simulation Techniques and Capability in Support of Apollo Applications
  63. Supporting Development for Space Welding Experiments
  64. Shrouds and Separation Systems Fabricating Technology Development
  65. Development of Adhesive Bonding Technology for In-Flight Repair of Space Vehicles
- G. Propulsion and Vehicle Engineering Laboratory
1. Determination of Flammability of Specific Propellant Combinations Under Varying Environmental Conditions
  2. LH<sub>2</sub> Submerged Shut-Off Valve
  3. Cryogenic Propellant Venting Under Low Pressure Conditions
  4. Evaluation of Cryogenic Insulation Materials and Composites for Use on Nuclear Radiation Environment
  5. Reliquefaction of Cryogenic Propellants
  6. Emergency Propulsive Propellant Venting System Concepts

7. Development of a Vent and Relief Valve for Cold and Hot Flow
8. Study of Computation of Induced Neutron Activation
9. 200-Inch Multicell Tank Study
10. Environmental Testing of Lightweight Multilayer Insulation
11. Thermal Protection Systems for Cryogenic Propellants on Interplanetary Space Vehicles
12. Insulation Development for Liquid Hydrogen Tankage
13. Cryogenic Insulation Research
14. Development of High Performance Insulation Systems
15. Thermal Design Criteria for Inflatable Solar Shields
16. Development of High Performance Insulation Systems for Long Term Storage

17. Space Radiation Effects on Materials
18. Investigation of the Combined Effects of Space Environmental Parameters on Space Vehicle Materials
19. Development of Techniques for Measuring Thermal Diffusivity
20. Synthesis and Evaluation of New High Temperature Resistant Polymers for Coating Applications
21. Radiation of Gases
22. Study of Absorption of Low Audio Frequency Acoustic Energy in the Atmosphere Media
23. Development of Structural Test Articles from New and Unconventional Materials
24. Study of Polymers Containing Silicon-nitrogen Bonds
25. Test Tank Slosh Progress
26. Structural Design with New Materials
27. Influence of Meteoroid Protection Requirements on Structural Design
28. Development of a System for Pretressing Brittle Materials

29. Honeycomb Test Cylinder Program
30. Testing of Al Alloy Welds Subjected to Biaxial Stress
31. Cryogenic Burst Test Program of 2014-T651 and 2219-T87 Cylinders and Hemispherical Bulge Specimens
32. Reverse Pressure Tests
33. Monocoque Bulkhead Hoop Compression
34. Establishment of Guidelines for Random and Sinusoidal Vibration Correlation
35. Axial Transmissibility Characteristics for Typical Rocket Vehicle Structures
36. Study of Non-linear Dynamic Behavior of Liquids in Cylindrical Elastic Containers
37. Studies of Liquid-Behavior in Randomly Excited Tanks
38. Mobile Acoustic Research Laboratory (MARL) Utilization
39. Vibration Qualification Test-Damage Criteria Study



40. Microphone Vibration Sensitivity
41. Theoretical and Experimental Investigation of Shear Lag in Stiffened Shells and the Stress Analyses of Cone Frustrums and Segments
42. Study of Stability of Unpressurized Shell Structures Under Static Loading
43. Buckling Tests of Eccentrically Stiffened Cylinders
44. Collection of Material Property Data and Presentation of Said Data in the Form of Material Data Handbooks
45. Lunar Surface Scientific Mission Simulation
46. Man-System Locomotion Control and Display Criteria for Extraterrestrial Vehicles - Phase III
47. Man-System Task Analysis for Lunar Surface Experiments
48. Evaluation of Plug Multi-Chamber Concept
49. Evaluation of Advanced High Thrust Booster Propulsion Systems
50. Feasibility Evaluation of Toroidal Hoop Combustion

51. Design Criteria for Zero Leakage Connectors for Launch Vehicles
52. Investigation of Positive Type Shaft Seals
53. Minimum Pressure Loss in High Flow Duct Systems
54. Cryogenic Slush Utilization
55. Slush Hydrogen Fluid Characterization and Instrumentation Analysis
56. Cryogenic Propellant Stratification Reduction Techniques
57. U-High Chamber Pressure Rocket Engine Cooling
58. Experimental Investigation of Combustion Stability Characteristics at Hi Pc
59. Thermodynamic Improvements in Liquid Hydrogen Turbopumps
60. Cryogenic Single and Two Phase Flow Instability

61. Acoustic Absorber Evaluation  
at High Thrust
62. Transpiration Cooling Liquid  
Rocket Chambers
63. Surface Profile, Experimental  
and Analytical Studies
64. Bubble Dynamics
65. Flow and Thermal Studies of  
Cryogenic Fluid, Vertical  
Two-Phase Flow.
66. Fundamental Study of Inclusions,  
Phases, and Precipitates in  
Aluminum Alloy Weldments
67. Research and Development of High  
Temperature Resistant Polymers
68. Silicon-nitrogen Polymer Studies
69. Research on the Synthesis and  
Evaluation of a new Class of  
Inorganic, Linear, Double-chain,  
Ladder-type Polymers
70. Degradation of Materials Under  
Ultrahigh Vacuum

71. Development and Characterization of Dry Film Lubricants for Use in Vacuum
72. Development of Analytical Techniques to Analyze Micro Areas by Use of "Laser" Spectrographic Methods
73. Nondestructive Evaluation of Residual Stress
74. Investigation of Conduction Phenomena in Organic Semiconductors
75. Development of Methods and Techniques for Controlled Growth of Large, High Purity, Single Crystals
76. Development of electrical Contact (Brush) Materials for use in the environment of Space
77. Development of Improved Thermo-Electric Materials for Spacecraft
78. Development of Improved Potting and Encapsulating Compounds for Space Applications
79. Advanced Engine Design Study (Bell)
80. High Pressure  $\text{LH}_2$  Pump Evaluation

81. Advanced Liquid Oxygen Turbopump
82. Systems and Dynamics Investigation  
(Aerospike)
83. Advanced Engine Design Study  
(Aerospike)
84. Experimental Evaluation of  
Toroidal Combustion Chambers
85. Investigation of a Tandem Row-High  
Head Pump Inducer
86. Development of Combustion  
Termination Design Criteria and  
Integration of Malfunction Sensors  
With Combustion Terminations
87. Solid Propellant Gas Generator  
Concepts
88. A Study of Teflon Bladder Design  
Criteria for Use in the Expulsion  
Propellant Tanks of the Apollo-Saturn  
and Lunar Orbiter Vehicles
89. Study of Hydrogen Embrittlement of  
Various Alloys
90. Development of Improved Semiorganic  
Structural Adhasives for Elevated  
Temperature Applications

91. Development of High Strength Reinforced Aluminum Casting Alloys
92. Techniques for Determining the Response of Launch Vehicle Structures to the Acoustic Environment Produced by the Booster
93. Development of High Strength Magnesium Alloys for Low Temperature Use
94. Development of High Strength Aluminum Alloy, Readily Weldable in Plate Thickness, and Suitable for Application at -423 degrees F (-253 degrees C)
95. Development of Solid State Techniques for Joining Dissimilar Metals
96. Development of Structural Adhesives for Use with Liquid Oxygen
97. Nonmetallic Parts for Launch Vehicles and Space Vehicle Structures
98. Development of Ultrahigh Strength, Low Density Aluminum Plate Composites
99. Development of High Strength Brazed Aluminum Honeycomb Sandwich Composites for Both Elevated and Cryogenic Temperature Applications

100. A Study to Advance the "State-of-the-Art" in the Design of Vacuum Jacketed Ducts, Lines and Bellows
101. Process Development and Pilot Plant Production of Silane Polymers of diols
102. Study of Vibrations Induced in Thin Walled Pipes Under Varying Flow Conditions
103. Study on Cryogenic Container Thermodynamics During Propellant Transfers
104. Investigation of the Behavior of Polymeric Materials at Cryogenic Temperatures
105. Investigation of the Sensitivity of Materials with Liquid Oxygen
106. Development of Vulcanizable Elastomers Suitable for Use with Liquid Oxygen
107. Zero-Leakage Design for Duct and Tube Connections for Deep-Space Travel.
108. Advanced Studies of Stationary Processes

109. Design, Development, Fabrication and Testing of a Type "B" High Temperature, Confined Detonating Fuse (CDF) Assembly, Tee and Ordnance Manifold
110. Combustion Oscillation Damping Devices Investigations
111. Improved J-2 Engine Experimental Program
112. Impact on the S-II Stage of an Improved J-2 Engine
113. Impact on the S-IVB Stage of an Improved J-2 Engine
114. Shrouds and Separation Systems
115. Development of Bearing Lubricants for Use in High Vacuum

#### H. QUALITY AND RELIABILITY ASSURANCE LABORATORY

1. Acceleration Factor Determination for Metal Film Resistors
2. Evaluation of Encapsulating Compounds Suitable for Space Vehicle Applications
3. Single Parameter Testing
4. Develop and Evaluate New Flowmeters for Stage and Component Checkout



5. Design and Develop Fast-Scan Infrared Detection and Measuring Instrument
6. Vehicle Systems Failure Analysis
7. Development of Leak Detection Techniques for Use in Space Environments
8. Establishment of Standards for Compatibility of Printed Circuit and Component Lead Materials
9. Development of Methods and Equipment for Quality Assurance of Hi-performance Insulation (Thermo)
10. Hermetic Seal Evaluation for Electronic Components
11. Infrared Testing of Electronic Components
12. Freon Injection for Saturn Systems Leak Check
13. Improvement in Control of Automated Stage Checkout-Test Conductor Data System Study

14. Nondestructive Testing for  
Space Application -- Feasibility  
and Preliminary Design Study
15. Improvement in Automatic Check-  
out of Microelectronics
16. Nondestructive Testing for  
Evaluation of Strength of  
Bonded Materials (Metallic)
17. Development of the Ultrasonic  
Delta Technique for Aluminum  
Welds and Materials
18. Design, Development, Fabrication  
and Delivery of Sensor Head  
Assembly as a Time Sharing Leak  
Detector
19. Leak Detection Improvement Study  
for Space Vehicles

## I. RESEARCH AND DEVELOPMENT OPERATIONS

1. Study of Numerical Differentiation  
and Numerical Aspects of Finite  
Difference Methods
2. Development of the AMTRAN on-line  
Computer System
3. Development of the AMTRAN On-Line  
Computer System

4. Development of an AMTRAN  
Interpreter Compiler
5. Development of Non-Linear  
Digital Filters and Filtering  
Techniques
6. A Study of New Mathematical  
Methods for the N-Body Problem  
and Related Problems of Orbital  
Mechanics
7. Development of Automatic Mathematical  
Techniques

J. RESEARCH PROJECTS LABORATORY

1. Surface Physics with Applications to  
Ion Rocket Problems
2. Analysis of Electrical Propulsion  
Power Conditioning Component Technology
3. Distribution of Cesium in Porous Tungsten
4. Detailed Study of Ionizer Materials with  
LEED Method
5. Synthesis and Evaluation of Calculation  
Methods for Design and Optimization of  
Nuclear Rocket Shield Systems
6. Design and Analysis of Radiation Shields  
for Nuclear Rocket Systems

7. Mission Planning and Scientific Objectives
8. Electron Shielding Studies
9. Scaling Laws for Superconducting Magnets
10. Shielding Data Generation and Calculation Techniques
11. Investigation of Factors Limiting Construction of Superconducting Magnets for Space Shielding
12. Evaluation of Simulated Radiation Shields
13. Research on Applications of Superconductivity to Active Radiation Shielding Problems
14. Plasma Shielding Studies
15. Cross-Section Calculations and the Study of Space Vehicle Radiation Shielding
16. Investigation of Factors Limiting Construction of Superconducting Magnets
17. Investigation of Factors Limiting Construction of Superconducting Magnets for Space Shielding

18. Analysis of Radiation Effects  
on Composite Structures
19. Mapping of Satellite Orbits  
in Radiation Belts and Dose  
Calculations
20. Investigation of Electron  
Interaction in Matter
21. Study of Charged Particle Motions  
in Magnetic Radiation Shielding  
Fields
22. Canadian Meteor Data Analysis
23. Experimental Hypervelocity Impact  
Research (Transient Phenomena From  
Strong Shocks in Solids)
24. Meteoroid Detector Development  
and Calibration
25. Theoretical Impact Calculation
26. Development of a Hypervelocity  
Facility
27. Meteoroid Field Patterns
28. Experimental Hypervelocity Impact  
Research (Advanced Accelerator Concepts)
29. Experimental Hypervelocity Impact  
Research Program

30. Study of Interfacial Thermal Contact Conductance
31. Study of the Radiative Emissivity of Metals - a. Theoretical
32. Directionally Reflective Surface Study
33. Study of Micrometeoroid Damage to Thermal Control Materials
34. Thermal Design Studies (Thermal Similitude) Applicable to Spacecraft
35. Thermal Similitude
36. Spectral Reflectance and Infrared Detection Under Cryogenic Conditions
37. Theory of Thermal and Electrical Conductivity in Bulk Material and at the Interface of Solid Conducting Specimens
38. Use of Thermal Models for Environmental Testing
39. Analysis and Correlation of Known Thermal Interface Conductance Experimental
40. Theoretical Thermal Similitude Studies

41. Transient Thermal Contact Resistance
42. Development of Space-Stable Thermal Control Coatings (Paints with Low Solar Absorptance/Emittance Ratios)
43. Solar-Radiation-Induced Damage to Optical Properties of ZnO Type Pigments
44. Study of In Situ Degradation of Thermal Control Surfaces.
45. Study of the Radiative Emissivity of Metal-b. Experimental
46. Effects of Solar Wind on Thermal Control Surfaces
47. Laser Technology as Applied to Space Science And Missions
48. Development of an Electric Field Meter for Space Application
49. Radiative Heat Flux Measurements Using Thermoelectric Devices
50. Ultraviolet Flight Instrumentation Study
51. Development of a Compact Mass Spectrometer Type of Gas Analyzer

52. Experimental Investigation of the Electron-Phonon Interaction in III-V Semiconductors
53. Generation, Detection, and Propagation of Very-High-Frequency Stress Waves in Solids
54. Electromagnetic Interactions of Atoms/Molecules in a Low Density Environment
55. High Vacuum Spectroscopic Studies of Low Atomic Weight Atoms or Molecules
56. Study of Instrumentation Testing in a Simulated Lunar Atmosphere
57. Studies of Sticking Coefficient with a Molecular Beam in Field Emission Microscope
58. Detailed Investigation of Piezo-Electric Crystals as a Detector of Absorbed Atoms
59. Preparation of Study of Powder Size Particles with Atomically Clean Surfaces
60. Study of Coldwelding in Ultrahigh Vacuum as a Function of Surface Contamination



61. Magnetic and Electrical Properties of Various Solid State Materials
62. Detailed Study of Epitaxial Nucleation in Chemical Vapor Deposition (CVD)
63. A Study of Certain Low Work Functions Surfaces with a LEEN Method
64. Study of Certain Mechanisms that affect Whisker Formation
65. Study of the Basic Modes of Heat Transfer in Particulate Materials
66. Study of Voltage Breakdown in Space Research
67. A Study of Epitaxial Growth Under Large Stress
68. Experimental Study of Mineralogical Characteristics of Simulated Lunar Materials
69. Filter-Detector Combinations for Solar Observations
70. Measurement of the Solar Constant

71. Study of Impact Characteristics of Selected Non-Metallic Materials in Vacuum Environment
72. Research on Lunar Resources
73. Development of Lunar Radiometric Models
74. Experimental Study of the Effects of Vacuum Conditioning on the Physical Properties of Selected Materials
75. Investigation of Simulated Lunar Materials in the Far-Infrared
76. Measure of Radiation from the Moon
77. Measurement of the Angular Infrared Radiation from Simulated Extraterrestrial Materials
78. Elemental and Gas Analysis of Simulated Lunar Materials
79. Natural Perturbing Effects on Satellites
80. Research in the Analysis of Dynamical Systems
81. Research on the Motions of Artificial Satellites
82. Mathematical Aspects of Dimensional Analysis and Similitude (Mathematics of

Thermal Similitude)

83. Solution of the Boltzmann-Vlasov Equations
84. A Mathematical Expression for the Radiation Intensity and Reflectivity of the Lunar Surface
85. Application of Dimensional Analysis and Group Theory to the Solution of Systems of Coupled Ordinary And Partial Differential Equations
86. Investigation of Chemical Kinetics in the Upper Atmosphere
87. Jovian Radio Observations at Low Frequencies
88. Development of a Farvitron Type Flight Mass Spectrometer
89. Space Flight Effects on Optical Surfaces Suitable for Astronomy Flight Experiments
90. Ionization From Hypervelocity Impact
91. Solar Burst Observations at Low Radio Frequencies
92. Ionospheric Electron Content

93. Investigation of the Ionospheric Perturbations Made by a Satellite
94. Analysis of Pegasus Electron Spectrometer Data
95. Environmental Contamination Analyzer for Manned Orbital Laboratories
96. Radiation Measurements in Near-Earth and Synchronous Orbits
97. Phase Change Thermal Radiator Flight Experiment (formerly "Fusible Material Space Radiator")
98. Seismic Measurements of Earth Tremors Produced as a Result of Large Rocket Firings

K. TEST LABORATORY

1. Development of a High Capacity Load Cell
2. Development of an Improved Digital Measuring System
3. Development of a Direct Digital Output Pressure Transducer
4. Study and Investigate Adaptation of Mossbauer Effect to Transducers
5. Research and Investigation of a Digital Temperature Transducer

6. Study and Investigate Adaptation of Mossbauer Effect to Different Instrumentation
7. Investigate Temperature Response and Compensation on Pressure Transducers
8. Vibration Transducer for Extremely Small Amplitude, High Frequency Vibrations
9. Development of a Cryogenic Mass Flowmeter
10. Research and Development of High Frequency, High Temperature Pressure Transducer for Combustion Instability Studies
11. Development of a Cryogenic Pressure Transducer
12. Improvement of Digital Measuring System to Provide Higher Accuracy of Data Transmission Techniques
13. Development of a Thermoelectric Cryogenic Thermometer