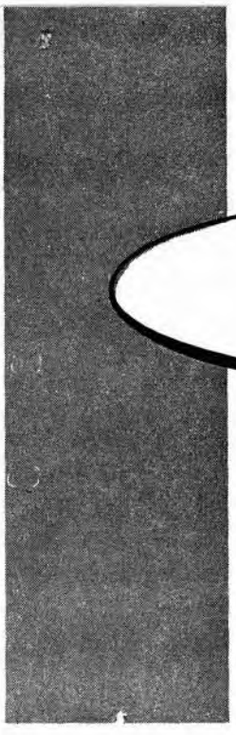

TEST LABORATORY

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MONTHLY

PROGRESS REPORT

May 1, 1967 through May 31, 1967

GEORGE C. MARSHALL SPACE FLIGHT CENTER

HUNTSVILLE, ALABAMA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MSFC - Form 1262 (September 1961)

INDEX

TEST LABORATORY MONTHLY PROGRESS REPORT

May 1, 1967 through May 31, 1967

SYSTEMS TEST DIVISION

COMPONENT AND SUBSYSTEMS DIVISION

TECHNICAL SUPPORT DIVISION

ADVANCED FACILITIES PLANNING OFFICE

GEORGE C. MARSHALL SPACE FLIGHT CENTER
TEST LABORATORY
MONTHLY PROGRESS REPORT
SYSTEMS TEST DIVISION
May 1, 1967 Through May 31, 1967

I. SATURN IB

A. S-IB Stage

1. Test SA-46, a 35.3 seconds test, was performed on Stage S-IB-10 on May 9, 1967. The test was terminated by console operator at expiration of the programmed duration. Functional performance of all systems was satisfactory. No facility or stage damage was sustained. Engine thrust levels, with the exception of Engine Position No. 8 (H-4090) were within specifications. The Engine Position No. 8 gas generator and LOX orifice plate were removed and inspected. Prior to test SA-46 it was reported that the Teflon coating on the fuel duct high pressure test plate appeared scraped and it was considered possible that the gas generator injector fuel holes had become plugged with Teflon and caused the thrust increase. No discrepancies were found in the gas generator and related systems. The gas generator LOX orifice was accordingly resized for the next test.

2. Test SA-47, a 145.7 seconds test, was successfully conducted on Stage S-IB-10 on May 22, 1967. The test was terminated by timers; cutoff of the inboard engines, three seconds after fuel level sensor actuation,was followed by cutoff of the outboard engines three seconds later. This was a deviation from previous LOX depletion terminations since the test was initiated with more LOX on board (1.5% tank ullage). This was done to insure that the fuel level would pass the bottom discrete probes prior to inboard engines cutoff and thereby furnish data for performance evaluation. For additional cutoff safety, two fuel depletion sensors had been installed to augment the two flight type sensors. Functional performance of all systems was satisfactory. No facility or stage damage was sustained. Engine thrust levels were within the specified 205$\pm$3K range. Performance of Engine Position No. 8 responded to the gas generator LOX orifice change as anticipated. The stage is scheduled for shipment from MSFC to the Michoud Assembly Facility on June 8, 1967.

B. H-1 Engine

Two firings with H-1 engine S/N H-7057 were conducted at the Power Plant Test Stand during this report period:

TEST NO.	DATE	DURATION	REMARKS
PI-496	May 1, 1967	40 Seconds	The engine was started with no hydraulic system pressure. Except for pitch actuator performance anomalies encountered during the test, performance was satisfactory.

TEST NO.	DATE	DURATION	REMARKS
PI-497	May 11, 1967	40 Seconds	The hydraulic system accumulator was precharged to determine any effect on the pitch actuator performance; however, control valve feedback potentiometer was erratic during the test.

The actuator feedback potentiometer was found to have an open circuit causing the problems encountered in tests PI-496 and PI-497. Both tests utilized the new type solid propellant gas generator (P/N 651049A). Performance was satisfactory.

C. S-IVB Stage

1. S-IVB-209 was installed in the Beta I Test Stand at the Sacramento Test Center on May 15, 1967. Pre-static checkout is progressing satisfactorily with no known constraints to the June 14, 1967, acceptance firing.

2. S-IVB-208 was taken from storage for the Douglas Aircraft Company (DAC) to perform several minor modifications to the stage. All work is scheduled to be complete prior to the scheduled ship date of July 5, 1967.

3. DAC has received the Authority to Proceed (ATP) on refurbishment of the Beta III Test Stand. Plans are to have the stand ready for S-IVB-210 installation on October 2, 1967.

II. SATURN V

A. S-IC Stage

1. A successful acceptance static firing, 125 seconds mainstage, was conducted by The Boeing Company on the S-IC-4 Stage May 16, 1967. It is expected that the stage will be removed from the MTF Test Stand B-2 on June 1, 1967.

2. The hydrostatic test on the S-IC short LOX tank was accomplished at MSFC on May 26, 1967. The pressure test, 73.8 p.s.i.g. bottom bulkhead, produced no deleterious effect on the tank.

B. F-1 Engine

Tests FW-062 and FW-063 were conducted at the West Area F-1 Test Stand on May 19 and May 22, 1967, with F-1 engine S/N F-5038-1 for mainstage durations of 21 seconds and 41 seconds, respectively. Both tests were terminated by the facility panel operator as planned. Primary purposes of these tests were to establish a baseline for the LOX depletion test series and to evaluate the thrust vector control system with a new servo-actuator filter assembly installed.

C. S-II Stage

1. The S-II-2 Stage post-static checkouts and V2-500 modifications were performed concurrently at MTF and completed on May 13, 1967. S-II-2 was removed from the A-2 Test Stand on May 15, 1967, and moved to the S-II Storage Building for weighing, painting, and packaging. The stage was shipped from MTF to KSC on May 20, 1967.

2. The cryogenic cold shock of the A-I Test Stand LH_2 transfer lines has been temporarily postponed due to the late shipment of S-II-3 from Seal Beach which is undergoing additional modifications and checkouts. Shipment of S-II-3 from Seal Beach is presently scheduled for July 6, 1967.

3. The Phase I drawings, Additions to Cryogenic Storage, for the S-II Structural Test Program at Test Laboratory, were approved on May 9, 1967. Site grading and pouring of the concrete pads for the high pressure hydrogen bottles and re-charger has been accomplished. The Phase II drawings are approximately 90 percent complete. The Phase III Test Assembly structure drawings were approved on May 24, 1967.

D. S-IVB Stage

1. A successful 444 seconds duration acceptance firing of Stage S-IVB-503 (New) was conducted by Douglas Aircraft Company on May 3, 1967. An attempt to fire the O_2/H_2 burner as a part of the stage acceptance firing was aborted due to an instrumentation failure and facility gas shortages and was re-scheduled for May 8, 1967, when a successful 230 seconds burner re-pressurization test was conducted. The stage was removed from the test stand on May 11, 1967, and transported to the Vertical Checkout Laboratory for post-static checkout.

2. Two firings utilizing J-2 engine S/N J-2048 were conducted at the MSFC S-IVB Battleship Test Stand as listed below:

TEST NO.	DATE	DURATION	REMARKS
SIVB-043	May 2, 1967	150 Seconds	All parameters appeared normal and all objectives were met.
SIVB-044	May 18, 1967	4.7 Seconds	Cutoff was given by observer due to unusual appearance of the start transient.

Following test SIVB-043 a cold helium sphere passivation test was conducted. Data from this test are being evaluated.

3. The O_2/H_2 burner, used for tests at MSFC, was shipped to SACTO for modification to latest flight configuration and re-calibration.

III. APOLLO APPLICATIONS

A. Lunar Drill Program

1. Drilling continued at the Howell, Tennessee structure with the Longyear commercial drilling system. Due to the unforeseen difficulties, drilling at this location will continue into June 1967.

2. Phase II contract negotiations with the Northrop Space Laboratories were held on May 22, 1967. The contract is being finalized by PR-RM.

3. Several tests were conducted at MSFC on the modified piston type compressor assembly used by the percussive type drill. The target flow-rate of 20 s.c.f.m. was attained by increasing the intake valve flow area. The last test was terminated after approximately 30 minutes of operation due to a bearing failure which resulted from lubrication breakdown.

4. Two field trucks, upon which the engineering drill models will be mounted, were received from the Corps of Engineers and checked out completely. Minor deficiencies were found in the electrical systems, but repairs have been made and all equipment is operational.

B. LSSM Project

1. Both the General Motors (GM) and Bendix MTA's have been serviced, assembled, and checked out. They are both operable; however, the GM wheels have not arrived and two electrical components have to be installed in the Bendix steering electronics. The instrumentation on both MTA's has been checked for continuity. The Bendix MTA was sent to R-P&VE on May 26, 1967, for static and dynamic characteristic determinations. Due to an increased test program in this area the power consumption tests are now scheduled to start August 7, 1967.

2. The final presentation by General Motors on the lunar wheel and drive experimental test program was held on May 4 and 5, 1967.

3. The final review by MSFC of the specified LSSM communications subsystem study by Boeing was held on May 15, 1967.

4. The first test in the Bendix nutator drive experimental test program at Ann Arbor, Michigan, is scheduled for the week of May 29, 1967.

IV. SUPPORTING RESEARCH AND TECHNOLOGY

Final drawing corrections for the Hydrogen Embrittlement Tests are being completed by the Design Branch. The necessary Aminco compressor tubing and high pressure valves were ordered.

V. VEHICLE STORAGE PROGRAM

On May 22, 1967, a Working Group for Stage Storage was established and approved by the directors of R-QUAL, R-ME, R-ASTR, R-P&VE and R-TEST.

On May 25, 1967, a meeting of this group developed five major action items; the primary ones concerned the initial establishment of Laboratory Guidelines and the initiation of a study to evaluate past aerospace experience during periods of storage. It was also agreed that several group members would attend the storage plan presentation by Douglas scheduled for about June 20, 1967, and at the same time review the existing Douglas storage facilities.

Daniel H. Driscoll, Jr.

GEORGE C. MARSHALL SPACE FLIGHT CENTER
TEST LABORATORY
MONTHLY PROGRESS REPORT
COMPONENTS & SUBSYSTEMS DIVISION
May 1, 1967, through May 31, 1967

I. SATURN IB

A. S-IB Stage

1. 200K H-1 Turbopump Testing

The H-1 Turbopump Facility supports R-P&VE in S-IB propellant feed system studies. The facility provides S-IB vehicle system simulation including prevalves, suction ducts, turbopump, high pressure ducts, and main engine valves.

No tests were conducted during this reporting period. Fuel additive test data is presently being reviewed with Western Company, manufacturers of the FR-3 friction reduction additive, and R-P&VE personnel in an effort to determine the reason that the additive has not improved feed system performance and to revise the test plan as may be required. Testing is scheduled to resume the second week of June.

II. SATURN V

A. S-IC Stage

1. F-1 Turbopump Testing

The F-1 Turbopump Facility provides the capability to perform checkout, calibration, qualification, and development tests on S-IC/F-1 Turbopump propellant feed systems. This facility contains a gas generator driven F-1 Turbopump which is mounted on a thrust chamber and simulates the S-IC flow system from the suction duct inlets to the main shutoff valves of the engine.

The green run was conducted on the R&D 6 X 6 impeller turbopump at Rocketdyne during week of May 22, 1967. This pump will be shipped to MSFC in June for testing at the F-1 Turbopump Test Facility.

Three flow tests were conducted during this period utilizing S-IC Lox Flowmeter S/N WC17-1A installed in a Whittaker Prevalve S/N 038 and a Flexonics S-IC Lox Outboard PVC. The

primary objectives of these tests were to calibrate the flowmeter, obtain data on the new teflon bearing design and to flow test Flexonics S-IC lox Outboard PVC S/N 106 BB 128.

Additional tests will be conducted through the month of June.

2. F-1 Gas Generator Development Tests

A project was established to conduct tests on an F-1 gas generator with different injector configurations. The objectives of the program are to alleviate detrimental pressure oscillations, reduce continued combustion in the turbine manifold, and to increase gas generator performance.

One test of 30 seconds duration was conducted during this report period which completed the data requirements of R-P&VE-PAC. A report to close out and document this program is in preparation and the test stand will remain in a standby condition. This project will not be reported in the future.

3. LOX Stratification

This program was requested by R-P&VE to verify analytics used to predict lox stratification in spherical containers using LN_2 for simulation. An attempt will be made to correlate lox stratification with LN_2 stratification data.

Testing was completed the week of April 7, 1967, as scheduled. Test data evaluation indicated data correlation was successful. The report is now in progress. This project will no longer appear in the progress report.

4. LOX Depletion Testing

The purpose of this test program is to support R-TEST-SP in a study of the lox depletion characteristics of the F-1 Engine shutdown sequence. The ultimate goal of the test program is to predict lox depletion characteristics of the S-IC stage engine system .

The facility buildup is in progress. The test start date has slipped to July 3, 1967, due to testing on the adjacent LH_2 Slosh Facility.

B. S-II Stage

1. S-II Insulation

B-Cell Position 1 - 70" Tank Insulation and Thermal Ullage Study:

The combined test programs were requested by P&VE Laboratory to (1) determine if the Dual Seal Insulation field repair techniques are structurally adequate under thermal cycling, (2) determine what effect tank geometry and insulation close-outs have on the thermal performance and structural integrity of the insulation under simulated aerodynamic heating, and (3) conduct a LH_2 ullage thermodynamic study.

The LH_2 Thermodynamic Ullage Memorandum Report was completed in May. This test program is complete and will no longer be reported.

B-Cell Position 1 - Foam Insulation (70" Tank):

This test program was requested by P&VE Laboratory to evaluate the structural integrity and thermal performance of an S&ID, CPR-369-3 foam insulation system.

One fill and drain test has been conducted, however, this test program has been interrupted for the present time becuase R-ME-DPP was unsuccessful in repairing some structural failures which occurred during the fill and drain test. The tank has been returned to M.E. for rework of repairs.

B-Cell Position 1 - Linde Insulation (70" Tank):

The general objective of this test program is to evaluate a Linde pre-evacuated, panel-type insulation system for possible application to liquid hydrogen booster stages.

The facility buildup is approximately 50 per cent complete. Testing is scheduled to begin the latter part of June.

2. S-II LOX Prevalve Flow Test

Requestor: R-TEST-SS

This project is to determine the acceptability and operating characteristics of the S-II lox prevalve for shutdown conditions at various flowrates.

The test facility was checked out May 22, 1967, and a test, consisting of six test runs, was conducted May 23, 1967. Testing is expected to be completed by June 6, 1967.

The scope of the program has been expanded to include lox flow tests on the S-IVB (lox) prevalve. Information on this phase of testing and the test hardware is being obtained and test buildup will be started after completion of the S-II Prevalve Flow Test.

C. S-IVB Stage

1. J-2X Turbopump Test

Requestor: R-P&VE-PAC

This project was requested to further the development and verify the performance of advanced J-2 turbopumps and subsystems. Test Position 501 is being prepared for this testing.

The shop is still actively working on the piping systems and is about 65 per cent complete. The bobtail engine (cut off chamber with turbopumps) was installed May 24, 1967, for mockup purposes. The 100,000-gallon LH_2 storage tank has been cleaned and is being dried. It is scheduled for activation in June. Present schedules call for completion of the shop work on T.S. 501 by July 1, 1967.

2. J-2X Thrust Chamber Throttling Tests

Requestor: R-P&VE-PA

This program was established to evaluate the throttling characteristics of J-2 thrust chambers. Engine thrust excursions of 5K to 200K (Sea Level) are contemplated. This will be accomplished in a 2-phase program.

Phase 1 consists of facility design, facility activation, and initial J-2X testing. The facility utilizes pressurized propellant tanks and throttle valves to control the engine thrust level. The activation test firings will include ignition, partial transition, full transition, and mainstage of a tubular wall J-2 thrust chamber with a ceramic coating to increase combustion zone durability.

The initial J-2X testing will utilize a J-2 thrust chamber with tapoff capability. The thrust chamber will be evaluated at steady state conditions, four to six mixture ratios, and between 5K and 200K SL thrust levels (no dymanic throttling).

Phase II will consist of dynamic throttling of J-2 thrust chamber with and without hot gas tapoff capabilities, at four to six mixture ratios, and between 5K and 200K SL thrust. These tests will define engine and facility operating capabilities and will permit thrust chamber and tapoff optimization.

During this reporting period, two ignition tests and three mainstage tests were conducted. The total mainstage test time at 300 psi chamber pressure was 31 seconds. These tests were conducted to determine facility pressure drops and check out valve sequencing.

After one additional test on June 1 at a chamber pressure of 300 psi, the chamber pressure will be increased to 700 psi.

3. J-2 Engine Telescoping Nozzle

This project will evaluate the feasibility of a proposed J-2 Engine Telescoping Nozzle concept. This proposal consists of a retractable engine nozzle skirt which will stow in the existing stage interface envelope. After stage separation, the nozzle can be extended to obtain optimum engine expansion ratio.

The test fixture and test items will be furnished by P&VE and will be delivered approximately June 6, 1967. Instrumentation will primarily consist of strain gauges and accelerometers.

4. LH_2 Slosh Testing

This program supports P&VE in the areas of LH_2 and Lox propellant feed systems studies in an ellipsoidal tank.

The S-IVB fuel prevalve tests were completed May 2. Four flow tests were conducted on this date to evaluate the valve response and closing characteristics. The tests were made at approximately 8500 gpm with closing times of 87, 857, 882, and 1529 milliseconds. This program was completed. The next test will be with a 10" vent valve for use on the S-II structural test program.

5. S-IVB Auxiliary Propulsion System Testing

The S-IVB Auxiliary Propulsion System Test Program was requested by P&VE Laboratory for conducting tests on upper stage ullage and attitude control engines at simulated vacuum environments.

Three S-IVB configuration C-1 engines, installed in a Saturn V/S-IVB APS Module, were tested through a series of pulse mode firing cycles to evaluate engine and system performance. A pressure environment of 140,000 feet was maintained during these firings. All systems appeared to function normally and data is being evaluated to determine if further testing with C-1 engine is required. Testing with feed system accumulators in S-IVB APS to be accomplished after completion of C-1 engine system evaluation.

D. Ground Support Equipment

Ground Support Equipment testing includes development and acceptance test programs of Saturn V launch vehicle support hardware under the design cognizance of both MSFC and KSC. Launch environments are simulated as closely as possible for both types of test programs although launch support equipment to be installed later at the launch complex is used for acceptance test programs only.

For vehicle service arm tests, the swing arms are mounted in a tower which duplicates the launch umbilical tower at KSC. The ground umbilical is connected to the vehicle umbilical plate that is mounted in a simulated vehicle skin panel. This panel is mounted on a random motion simulator which simulates the relative motions between the launch vehicle and launch tower. For inflight disconnect arms, the panel is connected to the random motion simulators through an elevator system so vehicle lift-off accelerations can be duplicated. In addition, the equipment is exposed to wind, rain, and cryogenic temperatures to include worst case design conditions.

In the test programs, component checkout tests are conducted after installation of the test hardware in the test facility. This phase of the program is followed by sub-system checkouts and subsequently, complete systems tests simulating launch environments. A description of hardware undergoing tests and the results of these tests follows:

1. LC-39 Service Arms

a. S-IC Intertank (Set III) - This preflight arm supplies the vehicle S-IC stage with lox fill and drain service, as well as personnel access to the vehicle. The arm has automatic capbilities to allow reconnection in case of a mission hold or abort.

The special tests on retraction system simplification have been completed and a report is now in progress. The tests being conducted for P&VE using a chilled skin panel (-60°F) and cryogenics have been suspended to allow a water flow test to be run. Prior to suspension of the P&VE tests, an umbilical purge was added and one reconnect was accomplished.

KSC has initiated a program to qualify the lox lines on arms 1, 4, and 6. Test Laboratory was asked to cold shock, to hydrostat, and to run long term water-flow tests

(simulating lox flow) on the lines. Other parts of the qualification program are being accomplished by others. Arm 1 has successfully completed the hydrostat and cold shock tests. Approximately 32 hours of the 50-hour water-flow test (5,750 g.p.m. at 190 p.s.i.g.) have been completed.

The lox line qualification tests are due to be accomplished by June 1, 1967, at which time the arm will be reinstalled in the tower and testing resumed.

b. S-IC Forward (Set III) - This preflight arm supplies the forward end of the S-IC stage with electrical, pneumatic, air conditioning services and personnel access.

During this reporting period fifty (50) instrumented reliability tests were conducted. The withdrawal lanyard and carrier left arm were damaged during the reliability tests. The withdrawal lanyard was damaged due to carrier lag at arm retraction. Carrier arm damage resulted from impact with the bumper during withdrawal. Modifications are being performed to eliminate the lanyard problem and carrier arm problems. Flight umbilical testing should be completed during next report period.

c. S-II Intermediate (Set II) - This inflight service arm provides air conditioning, electrical, pneumatic, LH_2 lox services to the S-II stage. The lox and LH_2 lines have independent connections to the stage while the remainder of the service lines in the arm are connected to the stage through one common carrier. The AA-04-02 arm was modified at MSFC by installing a lanyard withdrawal system for the main umbilical to replace the dual cylinder withdrawal system used on AA-04-01 and AA-04-03. R&D tests on the lanyard withdrawal system are now underway. At the conclusion of the R&D testing on the lanyard system, it is planned to retrofit the lanyard system on AA-04-01 and AA-04-03.

The lanyard withdrawal system is presently being redesigned; therefore, no umbilical tests were conducted. Tests have been conducted to simulate the additional weight of the revised lox coupler. These tests cause a peak load of 4,800 lbs. in the lox withdrawal cable. The revised LH_2 coupler adds approximately 57½ lbs. to the original coupler. This additional weight adds no significant load to the LH_2 coupler withdrawal cable.

KSC has initiated a program to qualify the lox lines on arms 1, 4, and 6. Test Laboratory was asked to cold

shock, to hydrostat, and to run long term water-flow tests (simulating lox flow) on the lines. Other parts of the qualification program are being accomplished by others. Arm 4 has successfully completed the hydrostat and cold shock tests. After approximately 5 hours of the required 35-hour of water-flow tests (5,750 g.p.m. at 170 p.s.i.g.) a leak was found in the inner line of the arm/vehicle flexible, vacuum-jacketed lox line. A failure analysis of this line is in process. The failed line was replaced with a new line on the arm and the water-flow test resumed.

The S-II Intermediate Service Arm was removed from the Test Area on May 15, 1967, in order to conduct the lox line qualification tests. These tests should be completed June 1, 1967, at which time the arm will be returned to the GSE Test Area.

d. S-II Forward (Set I) - This inflight service arm provides air conditioning, electrical, and pneumatic services, plus a GH_2 vent for the S-II Stage. All connections to the stage are through a common carrier.

Premature lift-off on 5-5-67 caused minor damage to the S-II Forward test facility equipment and swing arm. Delay of about three (3) days resulted.

Kickoff and withdrawal tests continued until 5-10-67, using various pressures for both kickoff and withdrawal. The carrier plate still drops off and swings under the boom end allowing the hydrogen vent line to impact the first horizontal cross member on the arm. This has created excessive damage to the vent line and transmits undesirable loads into the vent disconnect on the A7-42 carrier plate.

The primary lanyards are being frayed and stretched during withdrawal operations.

The static lanyard as originally designed and installed is unsuitable. A modification has been released by KSC-Design to correct this problem.

e. S-IVB Aft (AA-06-01) - This inflight service arm provides lox and LH_2 fill and drain services to the S-IVB stage. AA-06-01 was returned to MSFC after being used at KSC in the Saturn V 500F wet test. The service arm was modified to a lanyard withdrawal system which replaced the dual cylinder withdrawal system tested on AA-06-02 and AA-06-03.

To date, over 100 disconnect and withdrawal tests have been made on the lanyard system including 85 full systems tests. Based on test results thus far, a satisfactory solution to the problem of higher-than-recommended lanyard loads has been found. However, incorporation of the modification to the line handling systems has been temporarily interrupted by the removal of the arm from the tower for a flow test on the lox propellant lines.

Arm rotation tests have been completed, with the production cam and modified deceleration valve. These tests revealed that the cam setting required to produce rotation by the secondary system against a retarding wind, in a maximum of 5.7 seconds, results in consistently fast times (under 4.0 seconds) with the primary system. However, a recent KSC decision to relax the pressure requirements (i.e., that the secondary system should not be tapped during primary system rotation) will permit the retesting of the rotation system, and allow the primary system pressure to be lowered, thereby increasing primary system retraction to over 4.0 seconds.

KSC has initiated a program to qualify the lox lines on arms 1, 4, and 6. Test Laboratory was asked to cold shock, to hydrostat, and to run long term water-flow tests (simulating lox flow) on the lines. Other parts of the qualification program are being accomplished by others. Arm 6 has successfully completed the hydrostat and cold shock tests. Approximately 39 hours of the 50-hour water-flow test (1,150 g.p.m. at 120 p.s.i.g.) have been completed.

The arm is scheduled to be reinstalled on the tower simulator on June 3, 1967. Testing will resume at that time.

f. S-IVB Forward (AA-07-01) - This inflight service arm provides air conditioning, electrical, pneumatic, water glycol, and LH_2 venting services to the S-IVB stage and to the instrument unit (IU). The arm also supports the Lunar Excursion Module(LEM) umbilical carrier.

Approximately 375 tests have been conducted on this service arm. These include the umbilical disconnect and withdrawal tests, "T" head tracking tests, arm rotation tests, and part of the full systems tests.

During this report period, the vehicle tracking tests and the testing of the SA-502 flight umbilical carrier have been successfully completed. Systems tests are in progress.

g. Service Module - The service module arm is an inflight arm and provides air conditioning, electrical, GH_2 venting, and water-glycol cooling services to the Apollo Service Module umbilical connection.

The normal test program was resumed on March 30, 1967, after a special series of tests were conducted for KSC on the modified deceleration valve and cam C. During system tests, the withdrawal system air-motor became inoperable and due to the unavailability of a spare air-motor, testing had to be suspended. A replacement air-motor should be available from KSC on June 6 and testing will resume immediately thereafter.

h. LC-39 Command Module Access Arm - The LC-39 command module access arm is a preflight arm which supports an environmentally conditioned chamber through which the astronauts and service personnel can enter the Apollo spacecraft. The arm also provides a support structure for air conditioning and space suit checkout lines.

Extensive redesign of the entire command module access arm system is in work at KSC. It is anticipated that the arm now in the test area will be reworked to the new configuration and tested. The period of testing is not known at the present time. Currently the arm is in standby condition.

2. Saturn V Damping, Retract, and Reconnect System(DRRS)

The DRRS is a system for primary purpose of damping the Saturn V vehicle oscillation due to vortex shedding. The system has the capability of automatic extension, connection, disconnect, and retraction as well as damping oscillations. The test program is being conducted for P&VE Lab to qualify the system prior to its use on LC-39.

The redundant hoist structure was received by Test Laboratory on May 1 and installed on May 2 and 3. The upper sheaves were found to be too large. The replacements were received on May 5, modified and installed on May 6.

The redundant hoist console was received on May 2 and installed.

Download tests were performed on May 9. Each redundant hoist cable was loaded to 23,000 pounds. The total downward deflection of the arm was 8 inches with a permanent set of 4 inches.

All tests except the console purge test were completed on May 26. The console purge was performed on May 27 after removal of instrumentation cables. Special dynamic load tests were performed on May 22 through May 26, to determine the maximum loads on the Apollo LES tower legs exerted by the damper system. P&VE Lab structures Division personnel are evaluating the data.

The required test program was successfully completed and the arm structure, kickoff cylinders, redundant hoist structure, latches, and kickoff panel were removed from the tower on May 27 for shipment to ME Laboratory.

3. LC-39 Tail Service Masts (Set I) -

The three service masts (lox, fuel, and environmental) are located on the deck of the Mobile Launcher and are used to service the S-IC stage tail section. Mast retraction is initiated by vehicle lift-off.

Special tests, requested by KSC, were conducted May 17 through May 19 to determine the effect of a stiffer hydraulic return line (fuel mast) and lox dome purge line (lox mast) on the umbilical carrier kickoff characteristics.

Test results indicated that the stiffer flex lines caused no detrimental effects on carrier kickoff characteristics.

Additional tests requested by KSC to evaluate the performance of the TSM retract capability with the gravity drain valve open and no accumulator pressure and with the cylinder supply valve failed in the closed position were conducted May 23 through May 29. Testing will continue during the next report period.

4. LC-39 Mobile Launcher Holddown Arms

The purpose of this test program for KSC is to verify the physical and functional integrity of the Saturn V holddown arms prior to installation on the mobile launcher. Twelve holddown arms have been structurally tested and shipped to KSC. Structural testing of the final set of arms (fourth set) began August 11, 1966, and was successfully completed November 2, 1966.

This fourth set of arms is a spare set and is being retained at MSFC to serve as test bed for development of the holddown arm secondary release system and blast shield.

Concept evaluation of a secondary (explosive) release system (to be used as a back-up release to the normal, pneumatic release system) was successfully conducted between April 3 and April 14, 1967. A test report, Internal Note-Test-14-67, has been prepared.

During testing of the secondary (explosive) release system, cracks were discovered in the base castings (in the general area of the upper arm pivot point) of arms 002, 003, 004, and 006. Subsequent dye-penetrant and ultrasonic inspections of the arms revealed that crack depth was significant (reference Memorandum R-QUAL-AVP-2469-67, Subject: "Nondestructive Testing of Saturn V Holddown Arm Base Castings, P/N 75M05793, S/Nos. 002, 003, 004, and 006"). At the request of KSC Design, R-ME is repairing the cracks in accordance with document 76K02512, "Holddown Arm Repair Procedure for Launch Complex 39". It is planned to load test the arms after the cracks have been repaired. Arms 003 and 002 have been repaired and returned to Test Laboratory. Arms 004 and 006 are at R-ME being repaired. The arms will be load tested during the next report period.

Present plans for further testing of the holddown arms include installation (on arm 003) and testing of a hood for vehicle engine exhaust blast protection. Parts required for the hood installation were to be available by May 1, 1967, but, as yet, all parts have not been received. KSC indicates all components were shipped as of 5-23-67.

5. Saturn V Lift-Off Switches

This program is being conducted for KSC to ensure that the lift-off switch actuator arms can signal initiation of the umbilical disconnect and service arm rotation at the required vertical distance of vehicle lift-off.

Testing on a modified primary actuator assembly will begin on June 12, 1967. Test procedure is now being prepared.

6. Q-Ball Cover Removal System

The purpose of the test program was to demonstrate operational reliability of the system for removing the cone cover from the vehicle nose.

Tests were conducted in conjunction with the Primary Damper System to verify that a KSC modification would eliminate an interference problem between the damper arm and the Q-ball cover pneumatic line. The modification was satisfactory. The final report has been submitted.

7. High Pressure Test Facility

Anderson Greenwood and Company Relief Valves -

The purpose of this testing is to evaluate the operating characteristics of two pneumatic pressure relief valves for the Mississippi Test Facility (I-MT-EF).

(1) P/N 3518G23-S - Testing was completed April 7, 1967, on this valve which had pulsating flow characteristics. MTF will send MSFC an identical valve, except for enlarged ports, for evaluation. Testing will be conducted on this valve and a report will be written to cover the original and modified valves.

(2) P/N 81C68-4 - Testing is complete on this valve. During the cycle test, galling was encountered between the valve spindle, guide, and nozzle. The report should be complete by June 23, 1967.

8. S-IVB Aft Withdrawal Cylinder Life Cycle Test

The purpose of this test program, for KSC, is to determine the ability of one withdrawal mechanism to "track" vehicle motion for 1,100,000 cycles. Testing began November 22, 1966, and should be completed by June 1, 1967. Nine (9) additional cylinders were functionally tested for use on LC-39.

Cycling of the pneumatic withdrawal cylinder continued during this report period. The cylinder, to the latest design configuration, has successfully completed 1,000,000 cycles.

9. Flush and Purge Truck

This test program is being conducted (for P&VE) to ensure that the truck will service the F-1 engine as required.

Testing was initiated December 16, 1966, and the tests have been completed according to the original test procedure. P&VE has requested additional testing with minor modifications to the unit to determine if increased outputs can be achieved.

The additional testing is in progress. Final completion date will be June 9, 1967, subject to receipt of special test fluids by June 2, 1967.

10. Hydrogen Embrittlement Test

The purpose of this test program is to determine the hydrogen embrittlement effects of gaseous hydrogen on the yield point and ultimate strength of various materials being used in high pressure hydrogen containers; to provide comparative data to enable R-P&VE-MM to study the material nilductibility transition temperature, elongation of the material, change in cross sectional area, and radiographic and fractographic analysis of the fracture surfaces.

Buildup for this test is 98% complete. The test procedure is in progress. Testing should begin during the next report period.

III. SUPPORTING RESEARCH AND TECHNOLOGY

A. Zero-Gravity Test Facility

The Zero Gravity Drop Tower is utilized to assist P&VE in the study of low gravity fluid mechanics and thermodynamics phenomena. The facility is located in the Saturn V Dynamic Stand.

Seven tests were conducted this month in a continuation of the orbital slosh program. Problems with the drag shield hoist system prevented tests during the last half of May. Testing will resume the first week of June.

B. S-IC Model Drop

This test program was requested by R-AS to evaluate the S-IC booster recovery concept as proposed by the Boeing Company. Testing is to be accomplished on scale models impacting on water. This first series of tests consists of vertical drops of a 1/10th scale S-IC model from heights of 18 ft. to 154 ft.

Tests C-035-24 through C-035-42 were successfully conducted during this report period. Data transmittal covering tests C-035-10 through C-035-20 was distributed to R-AS May 8, 1967. Testing will continue during the next report period with a heavier model. (Adding weights to change c.g. and moment of inertia).

C. Liquid Hydrogen Super Insulation

This program, requested by P&VE, consists of studying the effectiveness of "super insulated" LH_2 tanks in a simulated space environment of 10^{-6} torr pressure.

Test Tank No. 3 is at ME Laboratory for insulation bag repairs.

30-Inch Calorimeter: This program is being delayed due to higher priority work (Orbital Workshop).

D. Storable Propellant Space Engine Testing

This program was requested by R-P&VE-P to provide support for testing (1) engines to be used on Project Thermo, and (2) advanced technology engines.

Three 1-hour duration altitude firings were conducted on the Rocketdyne 20 pound thrust beryllium engine during this reporting period, resulting in a total burn time at MSFC of 314 minutes. This concluded the test program for this engine which demonstrated long life time capability. The engine throat diameter on delivery was 0.421 inch and on completion of testing 0.422 inch.

Two 40 pound thrust Kidde monopropellant engines were delivered on May 16, and are scheduled for testing in mid-June.

E. Jet Impingement on Water (½K Cluster Phase)

This program was requested by KSC to study the feasibility of launching large flight vehicles of the Saturn V and NOVA classes from off-shore sites.

Tests C-002-20C through C-002-22C were conducted during this report period. The estimated test completion date is October 1, 1967.

F. Helium Turbine LH_2 Pump Test

A special test was conducted at the LH_2 Slosh Facility on a helium turbine-driven LH_2 pump for P&VE. The purpose of the test was to verify satisfactory operation of the turbine-pump assembly before shipment from Marshall to the National Bureau of Standards to pump slush hydrogen. The pump and turbine operated satisfactorily and were shipped to NBS.

G. Combustion Dynamics

Requestor: R-P&VE-PA

This project investigates, at an intermediate thrust level, the combustion stability theories which have been developed analytically or at a very small thrust level. The main areas of interest are combustion stability of lox/RP-1 and lox/H_2 systems at the 30K and 15K thrust levels respectively.

One test with the new nickel injector was conducted during this reporting period. As on the previous test, the TEA blew out, and the injector was burned in this area. Failure was caused by a faulty check valve in the TEA engine purge line.

Approximately seven tests will be conducted on an existing solid copper injector. Testing will resume in early June.

P&VE has requested that testing at high chamber pressure levels with the 15K engine be temporarily suspended in order that a few research tests with liquid hydrogen at low pressure levels might be conducted. All of the fuel (LH_2) is to be injected through the transpiration-cooled wafers and the lox will be injected through a slightly modified injector. The purpose of the tests is to measure the temperature at the combustion chamber wall, near the injector, so that the phase of the combustion products might be determined.

Five tests were conducted. The chamber wall temperature was measured on three tests and chamber gases were tapped off for two tests. The data indicated that the tapped off gas was free hydrogen rather than combustion products as desired. Wall temperatures were approximately -300°F. These tests were discussed with a P&VE representative and it was agreed that three to five additional tests will be conducted with a new injector face. This injector face will impinge lox on lox in an attempt to improve the combustion efficiency of the engine. These tests will conclude this special test effort. Testing will resume when the new injector face is available. Estimated delivery of the injector face is June 15, 1967.

H. Pump Inducer Development Project

Requestor: R-P&VE-PAC

This project has been requested by P&VE in an effort to develop the hubless inducer for use on future turbopumps.

The test facility is now in a standby condition, awaiting program direction from P&VE.

I. Acoustic Studies

Requestor: R-P&VE-SVR and R-AERO-AU

Acoustic Studies currently being performed at AMTF are to investigate, analyze, and evaluate the noise generating mechanisms and the resultant acoustic fields of aerodynamic flows, i.e., rocket exhaust flows. These flow fields are generated by launch vehicle propulsion systems which are large in size and power; consequently, very severe acoustic environments are created. Techniques for estimating these adverse environments in many instances are very crude or non-existent. Therefore, it is necessary that prediction techniques be developed and verified that will adequately define the associated acoustic environment.

These test programs cannot be conducted using full-scale flow fields, but by careful consideration of dynamic similarity principles and valid scaling procedures, scale model test programs of these flow fields can be successfully performed, to accomplish the above staged objectives.

Specific programs now planned at the AMTF are:

(1) Comparison of acoustic environmental characteristics of a cone and bell-shaped engine nozzle with duplicate exit diameters.

(2) Acoustic environmental variations due to nozzle exit pressure variations for a single engine.

(3) Ground plane acoustic environment (amplitude) for static and flight operation of a 1/20th scale Saturn V vehicle configuration.

(4) Vehicle acoustic environment (phase and amplitude) for the launch condition of a 1/20th scale Saturn V vehicle configuration.

(5) Acoustic source location study of a single, undeflected, rocket exhaust flow.

(6) Saturn V, MLV acoustic environmental definition for strap-on configurations.

(7) Supplementary study of cluster effects as a function of engine separation distance and cluster diameter.

(8) Study of the three dimensional acoustic field developed by a rocket exhaust flow impingement on a deflector (uni- and bi-directional flow).

Tests to determine the effects of varied engine exit pressure were completed during this reporting period. The data is presently being reduced and preliminary evaluation should be completed by June 9, 1967.

If no repeat tests are indicated from preliminary data evaluation, the test stand will be modified to begin a study to determine cluster effects as a function of engine separation and cluster diameter.

While the cluster study is being performed on the test stand pad area, a 1:20 Saturn V model will be installed in the stand for the ground plane and vehicle acoustic environment tests.

J. Flame Study

Requestor: R-TEST-C

This project is to obtain free stream and disturbed stream calorimetric, temperature, and pressure data from existing Test Laboratory model rocket engines, which will be useful in predicting full scale rocket engine plume environments.

Tests have been conducted with measurements at the 50-engine exit diameters (350-inch) plane. Exposed thermocouples and "static" temperature measurements were measured. New total pressure probes of ½-inch diameter copper have been fabricated and one test has been conducted with them. The new tests will be conducted with instrumentation at the 40-engine exit diameter (280-inch) plane. The data processing and plotting program is being written by Computation Laboratory. The computer program is expected to be completed June 30, 1967. Instrumentation is trying to get an earlier date.

K. Improved Saturn V Launch Facilities (VLF-39) Model Study

Requestor: KSC

This program is a specific study of existing facility capabilities (VLF-39) necessitated by the proposed use of improved Saturn V Boosters which will use five uprated F-1 engines and 4-each "Strap-Ons" 120-inch or 156-inch Solid Rocket Motors. This study will be used to establish the extent of launch facility (VLF-39) capability and/or modifications required when

using the improved Saturn V Booster Configuration.

The test program, utilizing 1/58 scale model facilities, has the following objectives:

a. Determine the environment of vehicle base and facility elements during holddown and initial liftoff.

b. Determine the environment of the mobile launcher and umbilical tower for maximum vehicle drift.

c. Determine the extent of facility modification necessary for compatibility with improved Saturn V vehicles.

The test program will be conducted in four phases. A 1:58 scale model of the Saturn V Booster will be utilized for all four phases of the test program.

The first phase will be conducted using the Basic Saturn V Booster scale model and will serve to establish baseline data. Phase II tests will use the same scale model booster but with the uprated F-1 engines. Phase III will utilize uprated Saturn V scale model with 120-inch simulated solid motor strap-ons. Phase IV will use the uprated Saturn V scale model with 156-inch simulated solid motor strap-ons.

Baseline testing of the lower portion covers liftoff from 0 to 232 feet full scale and the upper portion covers liftoff from 212 feet to 454 feet full scale.

One test was conducted during this report period which simulated maximum vehicle drift without tower interference. This completed baseline testing for the lower portion of the tower (120 feet).

The engine cluster was then raised four feet to enable baseline testing for the upper portion of the tower.

A simulated vertical lift-off test was conducted. This was the first of six baseline tests for the tower upper portion.

Testing will continue on the upper portion to encompass baseline data for the vertical lift-off, Case #5, 1.25 yaw and maximum drift without tower interference.

Initial delivery of 12 scale model 120-inch solid strap-on motors is scheduled for late June 1967. Installation and testing with 120-inch scale model strap-on motors will begin immediately after delivery.

L. LH_2 Seal Evaluation Tests

Requestor: R-P&VE-PM

The purpose of this test is to evaluate the sealing capability of the Conoseal and Naflex seal installed in an 18-inch diameter manhole cover of a liquid hydrogen tank.

Test results have proven the Conoseal to perform satisfactorily. The Naflex seal, however, did not meet the requirements. The Naflex seal's secondary seal is very poor and elimination of the leakage there is mandatory if the leakage rates of the primary seal are to be accurately determined. It was therefore decided to obtain new Naflex seals with improved Teflon coating and also modify the test fixture to provide the possibility of measuring primary and secondary seal leakage rates. This will be accomplished in a followup program.

The test tank has been shipped to the Manufacturing Engineering Laboratory to accomplish the modifications required for the evaluation of the 18-inch Naflex seal. This program as such will no longer be reported.

M. Tektite Study

Requestor: R-AERO-AT

This project was initiated to support Goddard Space Flight Center through R-AERO-AT on an experimental and theoretical program involving a study of tektites. Tektites are black rocks that have been found in localized deposits in several parts of the world. Markings on the tektites appear to have been caused by ablation as might occur upon entry through the earth's atmosphere.

This program was initiated to see if the markings can be duplicated on synthetic tektites using a lox-hydrogen engine to simulate entry temperatures and velocities.

Six tests were conducted during this report period: one ignition test, three photographic tests, one heat transfer measurement test, and one tektite test. The photographic coverage was good, both color and infrared; the heat transfer test obtained usable data, although the calorimeter was destroyed; the tektite test was partially successful, although the tektite sample sheared off and fell to the ground at cutoff. The next test will be conducted June 1.

IV. APOLLO APPLICATION

A. S-IVB Workshop

1. Quick Release Manhole Cover, S-IVB Orbital Workshop

Requestor: R-P&VE-VSA

The purpose of this test is to evaluate and qualify a Quick Release Manhole Cover for the Forward Fuel Bulkhead on the AS-209 S-IVB Stage for the SAA-209 Orbital Workshop Mission. The manhole cover is mounted to the Forward Fuel Bulkhead. The manhole cover is attached to the adapter ring by 24 sliding wedges. The wedges are drawn into place by means of 12 turnbuckles. After final adjustment the turnbuckle is secured by a locknut tightened against the turnbuckle. The cover is removed by the Astronaut while in orbit.

The test will functionally evaluate the wedge-cam retaining device; establish installation procedure and torque requirements for the manhole cover; evaluate the structural integrity of the manhole cover, while being subjected to the required environments; qualify the manhole cover seal with respect to minimum leakage rates; and qualify the seal used to prevent hydrogen leakage through the adapter ring bolt holes.

The test fixture was cold shocked and leak checked before installation of foam insulation by the Manufacturing Engineering Laboratory. Installation of the manhole cover in the test fixture was completed on May 15 and the test fixture was moved to T.P. 115 on May 16.

On May 25, during a system leak check, severe leaks were discovered at the seal joining the manhole cover and the adapter ring. Investigation revealed that a dimensional error in the wedge-latch mechanism probably prevented proper sealing of the cover. P&VE is effecting a quick-fix to enable the testing to proceed.

B. S-IVB Workshop Environmental Control System

This program, requested by R-P&VE-P is required to support the thermal design of the S-IVB Orbital Workshop environmental control system. Tests are scheduled for a condensation model and a 1/8 segment of the workshop compartment liner. The condensation model tests will be used to confirm the analytical model being used to investigate condensation effects. Results from the 1/8 segment will provide data on heat transfer coefficients, fan performance, wall temperature, condensation rates, and curtain temperatures.

Twelve tests were conducted this month on the condensation model. Testing was then stopped because of the discovery of a highly turbulent flow pattern in the model. Testing will be resumed next month and the first half of the model test program should be completed.

C. S-IVB Workshop Insulation Flammability Study

This program was requested by R-P&VE-M to define and study the fire retardency of the S-IVB internal cryogenic insulation in a habitation environment.

Seven ploy urethane foam, 2 mil aluminum covered, samples were tested during this reporting period. These 36-inch diameter samples were tested in a 3-foot diameter by 5-foot long tank which was installed in the 8500 cubic foot vacuum chamber located at Building 4750. A 100% oxygen pressure of 5.5 p.s.i. was maintained in the test tank under flow conditions, with the vacuum chamber pressure maintained at 0.5 p.s.i.a. A nichrome wire was utilized as the igniter. Various size cuts were made in the aluminum covering for these tests. The nichrome wire was placed approximately 3/16 inch above these cuts.

Four of the first six samples were ignited, with burn areas up to 6 inches in diameter. The insulation exposures ranged from 1/2 inch X 1 1/2 inch up to a 2 inch diameter circle. Ignition did not occur when there was no cut in the covering, nor did it occur when a 1/16 inch slit was made.

There was no attempt to simulate flow velocity across the insulation surface in the tests described above. However, on the test sample #7, a blower was placed inside the test tank and velocity of 140 ft/min was obtained at the insulation center (point of ignition). A 2-inch circular exposure was used, and ignition occurred within a few seconds after the igniter was turned on. The 1-inch thick insulation was burned completely through over about 30% of the total surface area. A cone-shaped area was burned out, in a direction away from the blower. Testing to continue with additional samples as supplied by R-P&VE-M. A number of various test conditions and materials remain to be tested to complete the investigation of the flammability of the S-IVB O.W.S insulation.

W. L. Grafton

GEORGE C. MARSHALL SPACE FLIGHT CENTER
TEST LABORATORY
MONTHLY PROGRESS REPORT
TECHNICAL SUPPORT DIVISION
May 1, 1967 through May 31, 1967

I. SATURN IB

Fabrication of the second Saturn IB Nose Cone Transporter was completed.

Support provided for S-IB-10 fixings, H-1 Turbopump Tests, and H-1 Engine Test in area of propellants, high-pressure gases and high pressure industrial water.

II. SATURN V

A. S-IC Testing

Installed and removed fuel tank, S-II Adaptor Ring, and LOX Tank for tests at S-1C Stand.

Continued buildup of Super Insulation Test Facility - 40% complete.

Continued buildup of 501 Test Facility - 50% complete.

Continued work on Acoustical Facility - various phases 20-95% complete.

B. S-II-504 Structural Test Pad

Design 70% complete. Material procurement lists for all systems were released. Preliminary drawings were released to the shop and layout and fabrication has begun.

Modifications to high pressure gas vessels continued.

C. S-IVB Testing

Field erection, fabrication, propellant and high-pressure gas service furnished as required.

Hydrogen systems at Test Position 501 (J-2X) were activated.

D. GSE Testing

Designed systems, fabricated and installed flow systems, and provided cryogenic and high-pressure industrial water support for flow testing three swing arms at S-1C stand.

E. Transportation of Stages

The Forward Handling Rings for S-1C-T and flight stages are being fabricated by Progressive Welders. Components were received at MSFC and completion of the first ring is expected in June.

Interface Control Documentation prepared by The Boeing Company was reviewed.

Technical monitoring of the Barge "Orion" modification by the Diamond Manufacturing Company was continued. Test procedures for the nitrogen pressurization system on the "Orion" were completed.

Cargo Lift Trailer Manuals were distributed and revisions to S-1C Transporter drawings and manuals were continued.

III. Supporting Research and Technology

A. In-House Applied Research and Development

Design was continued on 1/10 scale model of S-1C stage and the equipment for rotational drop.

Continued project to test models of Protective Blast Shields at Edwards Air Force Base.

Completed Fabrication of 78" diameter and 114" diameter cryogenic burst tanks for Edwards Air Force Base.

Design of Hydrogen Embrittlement Test Arrangement progressed to 75% completion. Investigation made on availability of seamless, forged-end (no welding) vessels for gaseous hydrogen service.

IV. Other Programs

A. S-IVB Orbital Workshop

Design of a condensation model to be used in support of Environmental Control System design was completed.

B. Lunar Drill

Continued design of improved components to replace prototype.

W E Marsalis

William E. Marsalis

GEORGE C. MARSHALL SPACE FLIGHT CENTER
TEST LABORATORY
MONTHLY PROGRESS REPORT
ADVANCED FACILITIES PLANNING OFFICE
May 1, 1967 through May 31, 1967

I. FACILITIES

A. R&A Projects

1. The brick and mortar design portion of Project 7072, Additions to Cryogenic Storage, has been completed. Piping design for storage tanks is scheduled for completion July 1, 1967. The foundation for Hydrogen gas bottles and recharger pad has been poured. Storage tank foundations are being poured. Overall site work is approximately 10% complete.

2. Project 7076—S-II 504 Structural Test Pad is expected to be approved by Headquarters during week of June 5, 1967. Foundation design has been completed.

3. Design started on June 6, 1967 for the helium line extension to Bldg. 4650— Project 8004.

4. Project 8003—High pressure Air Pipeline and Project 8008—Installation of Steam Ejector System (Bldg. 4557) have not been approved, but are expected to be approved during week of June 12, 1967.

5. The contract for Fire Detector System has not been awarded as yet. Considerable contractual problems are delaying the award. This project is funded from miscellaneous C of F projects and no problem is expected on loss of funds due to award date slipping past 1 July 1967.

6. Construction has started on the following projects:

a. Project 7056 - Lox Trailer Parking Area

b. Project 6255 - Pavement Addition, Bldg. 4653

c. Project 7021 - GH_2 Transmission System

d. Project 7023 - GH_2 Pipeline System, CTL Area

e. Project 7031 - Modification to Test Stand 300

f. Project 6635 - Elevator at Liquid Hydrogen Test Stand

g. Project 7068 - Cable Tray nstallation, East Test Area

h. Project 7008 - Additional Lox Storage for all Test Positions, Bldg. 4583

i. Project 7009 - Firex System Addition, Test Stand 115

j. Project 7013 - Elevator for Test Stand 500

k. Project 7018 - Transformer Substation, Test Stand 500

l. Project 7017 - Modification to Scale House, Bldg. 4659

B. NUCLEAR GROUND TEST MODULE

The study of Hydrogen Gas Disposal System has been deferred pending further definition of operational requirements for the Cold Flow Test Program.

C. S-II-504-STRUCTURAL TESTS

The design of test assembly is progressing on schedule.

D. INTERMEDIATE VACUUM CHAMBER

A set of 30% criteria drawings are being reviewed during week of June 5, 1967.

J. B. CARRINGTON