TEST LABORATORY

MONTHLY

PROGRESS REPORT

September 1, 1967 through September 30, 1967

GEORGE C. MARSHALL SPACE FLIGHT CENTER

HUNTSVILLE, ALABAMA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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SYSTEMS TEST DIVISION

COMPONENTS AND SUBSYSTEMS DIVISION

TECHNICAL SUPPORT DIVISION

ADVANCED FACILITIES AND PLANNING OFFICE

GEORGE C. MARSHALL SPACE FLIGHT CENTER
TEST LABORATORY
MONTHLY PROGRESS REPORT
SYSTEMS TEST DIVISION
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I. SATURN IB

A. S-IB Stage

S-IB-11 is tentatively scheduled to arrive at MSFC on October 27, 1967.

B. H-1 Engine

Because of the self-induced short instability burst experienced during test P1-506 at the Power Plant Test Stand, engine H-4067 was removed from the test stand on September 1, 1967, for disassembly and inspection. No discrepancies were found. Engine H156-4D, which had experienced a rough combustion cutoff at Neosho due to combustion instability, was installed on September 5, 1967, and tests P1-507 through P1-515 were performed as a part of the H-1 engine combustion stability program. Engine H156-4D was removed on September 23, 1967, since all "bomb" induced instability dampened within specification limits. Engine H-4067 (205K) was installed on September 25, 1967, and tested twice. Engine operation was satisfactory and all "bomb" induced instability on engines H156-4D and H-4067 dampened within specification limits during the following tests:

ENGINE H156-4D

TEST NO.	DATE	DURATION (SECONDS)	REMARKS
P1-507	September 8, 1967	15	Calibration
P1-508	September 11, 1967	15	Bomb
P1-509	September 13, 1967	15	Calibration
P1-510	September 14, 1967	15	Bomb
P1-511	September 15, 1967	15	Bomb
P1-512	September 18, 1967	15	Bomb
P1-513	September 19, 1967	15	Bomb
P1-514	September 20, 1967	15	Bomb
P1-515	September 21, 1967	15	Bomb

ENGINE H-4067

P1-516	September 27, 1967	15	Calibration
P1-517	September 29, 1967	15	Bomb

C. S-IVB Stage

Beta III Test Stand, which is presently undergoing rebuild from the S-IVB-503 explosion, is expected to be ready for use by mid-October.

Stage S-IVB-206 will be reinstalled on this test stand for a complete post-static checkout. The purpose of the test will be to checkout the newly rebuilt Beta III Test Stand and to repeat the stage post-static checkout. An unusually large number of modifications to S-IVB-206 has been made since completion of the first post-static checkout.

II. SATURN V

A. S-IC Stage

1. S-IC-5

The S-IC-5 stage was removed from the test stand at MTF on September 11, 1967. The delivery of the S-IC-6 stage to MTF has been delayed indefinitely due to schedule changes.

B. F-1 Engine

Tests FW-069 and FW-070 were conducted at the West Area F-1 Test Stand with F-1 engine S/N F-5038-1 on September 1, and September 28, 1967, respectively. Primary purpose of these tests was to establish engine baseline performance for the LOX depletion test series.

C. S-II Stage

1. S-II-3

A LOX-LH_2 loading test of S-II-3 positioned in the A-1 Test Stand at MTF was attempted on September 2, 1967, but was scrubbed at 5:30 p.m. prior to initiation of the terminal countdown. A blowdown test on the sidewall insulation under cryogenic conditions was planned in conjunction with this test. As expected, when using a new facility for the first time, numerous small problems encountered with support and facility hardware prevented the countdown from proceeding on schedule. NASA and NAA/SD had previously agreed to postpone the test if the terminal countdown was not started prior to 3 p.m.

The LOX-LH_2 loading and static firing mode sequence test was accomplished on September 6, 1967. A failure of the LH_2 sidewall insulation facing sheet prevented successful completion of the sidewall insulation cryogenic blowdown test.

The insulation facing sheet failed when the LOX tank level reached approximately 30% at a fill rate of 3,800 g.p.m. Slow chill of the LH_2 tank at GH_2 flowrates of 0.7 and 1.6 lb./min. had also been in progress for approximately 40 minutes. The failure consisted of peeling off a 6' X 4' piece of the facing sheet which exposed the honeycomb insulation, allowing the purge outlet pressure to drop to 0.3 p.s.i.g. This was the first time the new slow LH_2 tank chill method was used at MTF and was also the first time a S-II stage had been tested with higher sidewall insulation purge pressure (2.6 p.s.i.g.) under cryogenic conditions.

After completion of LOX tanking to the 100% level, an inspection was conducted and temporary repairs were made to the facing sheet by taping a piece of polyethylene over the exposed area to guard against moisture and to maintain the purge pressure at 0.3 p.s.i.g. The fuel tank was filled only to the 10% level due to this failure and the static firing mode sequence test was performed successfully. A stage-facility compatibility static firing was successfully performed on September 19, 1967, for a duration of 65 seconds. The sidewall insulation blowdown test was not successfully accomplished due to failure of the sidewall purge pressure to stabilize at the specified 4 p.s.i.g. after the outlet vent was closed and back flow was initiated. Two of the three in-flight vent covers failed to release when the lanyards were pulled which completely negated the blowdown test. No significant damage was sustained by the insulation.

The full duration acceptance firing was successfully completed on September 27, 1967, for a duration of 358 seconds. Manual cutoff was initiated two seconds after the two percent LOX level sensor was uncovered. Preliminary data indicated that all objectives were accomplished with the exception of the sidewall insulation blowdown test. The sidewall insulation purge pressure again failed to stabilize at the specified pressure and one of the three vent spout covers failed to release.

The newly modified stage LOX fill and drain line was installed prior to the test giving the capability to tank LOX at the originally designed flowrate (5,000 g.p.m.). Final review of test data is in progress to fully evaluate the acceptance testing of S-II-3 and assure that the A-I Test Stand is fully operational for S-II stage testing.

2. S-II Structural Test Program

The access tower was erected during the week of September 10, 1967. The facility construction is progressing on schedule. The present R-ME schedule reflects the stage structural test specimen delivery to R-TEST on March 4, 1968.

D. S-IVB Stage

1. S-IVB-504 (New)

S-IVB-504 (New) was removed from the Beta I Test Stand at the Sacramento Test Center (SACTO) on August 31, 1967, and placed in storage at the Vertical Checkout Laboratory.

2. S-IVB-505 (New)

Stage S-IVB-505 (New) was installed on Beta I Test Stand at SACTO on September 1, 1967, and has been undergoing pre-static checkout in preparation for a full duration static firing on October 11, 1967. This is anticipated to be the last static firing at SACTO for six or seven months.

3. S-IVB-BS-2000

A LOX and hydrogen loading test was accomplished at the MSFC S-IVB Battleship Test Stand on September 6, 1967, to investigate the LH_2 depletion level sensor cycling. A second loading test was performed on September 12, 1967. Data obtained during the loading tests indicated that LH_2 loading can and does cause intermittent depletion level sensor cyclings.

On September 13, 14 and 15, 1967, a series of LOX and LH_2 pre-valve cycle tests were conducted to provide data on various actuation control methods.

Start tank emergency chilldown tests were conducted on September 21 and 28, 1967. These tests were conducted to verify a method of controlling the start tank pressure in case of a start tank vent and relief valve failure at KSC. Data obtained during these tests indicated that the start tank results can be controlled by engine helium tank chilldown.

III. APOLLO APPLICATIONS

A. Lunar Drill Program

1. Rotary Concept

The status of the rotary type drill is the same as reported last month since the funding situation has not permitted awarding of a contract with Westinghouse Electric Corporation.

2. Percussive Concept

In-house testing on the hammer assembly has been postponed until early October 1967, due to relocation of the Lunar Drill Shop to Building 4649.

A design review was held with Northrop and R-TEST-BDM on the drill string drive. Several changes were incorporated by Northrop and the drawings released to the shop for fabrication.

The new Northrop hammer design was received in-house and is being reviewed by R-TEST-BDM. The drawing has been released to the shop for fabrication.

A meeting was held with Northrop to discuss the design of the surface unit assembly. Northrop was directed to follow a more economical design.

B. LSSM Project

The General Motors and Bendix mobility test articles were moved to Building 4649 and steering tests were conducted by R-P&VE.

The test course design layout was completed by R-TEST-F and presented to the Advanced Systems Office for the allocation of funds required for construction.

C. ATM Solar Panel Deployment Tests

Initial testing has been completed on the 10-foot test beam. No further tests are anticipated until Astrionics Laboratory delivers their complete test fixture. Preliminary estimates place this hardware delivery in the month of November 1967.

D. S-IVB Orbital Workshop

The general test plan for the S-IVB Orbital Workshop has been received and is presently being reviewed by Laboratory personnel.

IV. VEHICLE STORAGE PROGRAM

During this period, five meetings of the R&DO Stage Storage Committee were held to resolve storage problems and to develop additional storage guidelines.

Storage action items resolved during this period were as follows:

ITEM	
80-67-10	Structural requirements for storage.
98-67-2	Requirement for 35% relative humidity minimum.
98-67-3	Temperature requirements for battery storage.
100-67-1	Evaluation of proposals for an industry-wide storage study.
80-67-12	Guidelines for storage.
104-67-1	Review of S-IB Storage Plan 60C06032.

Six proposals for an industry-wide storage study were received and evaluated by the Stage Storage Committee. Evaluations were forwarded to the Purchasing Office.

The Stage Storage Committee is now beginning to develop MSFC standards for storage of each Saturn stage. Previously developed storage guidelines will be incorporated into an approved MSFC format and will serve as a baseline for future Saturn storage procedures. These MSFC standards will then be expanded or amended as required to keep abreast with future storage problems.

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I. SATURN IB

A. Ground Support Equipment

1. Saturn IB Apollo Access Arm

The Apollo Command Module Access Arm supports an environmentally conditioned cab through which astronauts and service personnel enter the Apollo spacecraft. The arm and the environmental chamber were recently redesigned to accommodate the new spacecraft hatch design and also to incorporate changes that provide more reliable and faster egress routes.

The LC-34 configuration of the command module prototype arm testing was completed on September 16, 1967. From the tests it was determined that the hood and APD areas needed modification to acquire proper operation.

The LC-34 flight arm was shipped to the MSFC test area on September 19 and installed for testing from September 19 to September 26, 1967. Instrumentation, pre-checks, and manual operations are complete and automatic checks are now in progress.

On October 9, a team of KSC (Bendix) personnel will come to MSFC to modify the APD lifting beam and APD centering device assemblies to correct the discrepancies noted on the LC-34 Environmental Chamber (prototype).

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.

R&D 6 + 6 Turbopump S/N 4072224 has been installed in the F-1 Turbopump Test Facility and the high pressure ducts aligned and fitted. Facility buildup has been completed and the turbopump is currently being instrumented. Testing will be delayed until November 1967 because of the test schedule of higher priority projects.

S-IC 17-inch LOX flowmeter S/N WE17-35 has been installed and will be tested starting in November 1967.

2. 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 Ground Stage Engine System and Saturn V flight vehicle.

The facility buildup is in progress. General cleaning of the LOX system has slipped the test start date to November 17, 1967.

B. S-II Stage

1. S-II Insulation

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.

Corrections to internal tank fill system are in progress. Testing has not been rescheduled.

B-Cell Position 1 - Foam Insulation (7X7 Calorimeter)

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.

Preliminary planning has been initiated; however, test plan and start date have not been established.

B-Cell Position 2 - S-II Insulation 24" Calorimeter

This test program was requested by P&VE Laboratory to evaluate the effective conductance of the S-II stage common bulkhead.

Four tests (C-047-1 through 4) were accomplished during this report period. Preliminary results indicate conductance higher than expected. Re-evaluation of program objectives is in progress.

2. S-II and S-IVB LOX Prevalve Flow Tests

Requestor: R-TEST-SS

The test objectives for the S-II and S-IVB LOX Prevalves are to determine the acceptability and operating characteristics of the valves under shutoff conditions at various closing rates and LOX flowrates.

The initial scope of the program has been changed to include LOX flow tests on the S-IVB Prevalve. The S-IVB Prevalve and its test requirements are to be furnished by R-TEST-SS.

The S-II LOX Prevalve tests which have been conducted are being documented in a memorandum report. The data obtained in these tests is probably not typical for this valve as a valve bearing galled during testing. The memorandum report will be transmitted in early October 1967.

Due to unavailability of new hardware, no further testing is contemplated at this time. This project will not be included in subsequent Monthly Progress Reports.

C. S-IVB Stage

1. J-2X Turbopump Test

Requestor: R-P&VE-PAC

This project was requested by P&VE to further the development of existing and advanced J-2 turbopumps and subsystems. Test Position 501 is being prepared for this testing.

The shop, R-TEST-BS, is about 99% complete. The last major item, the LH_2 sump, is complete except for x-ray

inspection of two flange welds. Several other items still have to be x-rayed; some are new welds, others are repairs of x-ray rejects. The 100,000-gallon LH_2 storage tank is being checked out with LN_2 and will be ready for liquid hydrogen in October. Because of the embrittlement problem, additional x-ray and repair have been required which has delayed buildup. Target date for beginning of testing in Test Position 501 is now December 20, 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 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.

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

Phase II will consist of dynamic throttling of a 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.

No tests were conducted during this reporting period.

Because of hydrogen embrittlement the gaseous hydrogen system welds have been radiographically inspected and have not passed at this date. Also, the GH_2 rechargers and the intra-area GH_2 system (which will be used to pressurize the T.S. 500 GH_2 batteries) are not serviceable yet.

Static throttling tests will begin after the above problems are resolved. At this time, the test resumption date is estimated to be October 12 or 17.

3. J-2 Engine Telescoping Nozzle

Requestor: R-P&VE-PA

The test objective is to evaluate the feasibility of the proposed J-2 Engine Telescoping Nozzle design. 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 project will utilize a working mockup (non-flight hardware) to evaluate the design proposal.

Strain gauges and accelerometers have been installed and four checkouts completed on August 27, 1967. These checkouts revealed that counterweight equalization improved nozzle deployment; testing continues.

4. LH_2 Slosh Testing

This program supports P&VE and Test Laboratory in areas of LH_2 propellant feed system studies and LOX studies in an ellipsoidal tank.

No tests were conducted during this report period. Stand modifications are awaiting hardware from the shop. Testing is to be resumed after the vacuum facility tests.

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 and systems at simulated vacuum environments.

Three Tapco engines were installed in the Saturn V/IVB APS Module and accumulators were installed at the inlet of each oxidizer valve. These bellows-type accumulators were charged with gaseous helium to 125 p.s.i.a., and two altitude tests were then conducted in which various engine pulsing combinations were utilized. The oxidizer supply manifold

pressure oscillations were damped from the usual ± 150 p.s.i. to ± 10 p.s.i. maximum, and the normal ± 150 p.s.i. valve inlet pressure oscillations were reduced to ± 20 p.s.i. maximum.

One additional test series is scheduled in which the accumulator bellows will be "stacked", or locked down, by applying 225 p.s.i.a. GH_e pressure, and the engines pulsed to determine the effect of a fixed volume at the valve inlets on these pressure oscillations.

II. SATURN V

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 subsystem 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 services as well as personnel access to the vehicle. The arm has capabilities to allow automatic reconnection in case of a mission hold or abort.

The special series of tests conducted for P&VE to determine the maximum lox line pressure that the carrier could have and still be retracted indicated that approximately 15 p.s.i.g. would stop a retraction. A special series of tests was conducted to determine the minimum pressure of hydraulic system that would give a satisfactory arm retraction under no wind and retarding wind conditions. These test results were transmitted to the cognizant design groups. The reliability tests were suspended during the above tests and are now being completed.

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.

The arm was re-activated to run a special series of tests for KSC to determine the minimum hydraulic system retraction pressure would give a satisfactory arm retraction under no wind and retarding wind conditions. After completion of these tests the arm was again placed in a standby condition.

c. S-II Intermediate (AA-04-02) - This inflight service arm provides air conditioning, electrical, pneumatic LH_2 and 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 have been completed and acceptance tests are now in process to verify the operation of the AA-04-02 arm to support vehicle launch. It is planned to retro-fit the lanyard system on AA-04-01 and AA-04-03.

System tests were conducted on the umbilical lanyard withdrawal system which revealed a problem of umbilical withdrawal cable damage. Also, the left leg of the umbilical impacted the arm structure. The problem of the umbilical leg impacting the arm structure (lox coupler static lanyard attach point) during simulated prelaunch conditions and reinstalling this structure for vehicle launch. The withdrawal cable damage problem was reduced with further modifications to the withdrawal system. The scheduled shipping date for the lanyard conversion modification in support of AS-502 took precedence over the complete resolution of these two problems.

The lanyard conversion kit for the S-II intermediate service arm was shipped September 15, 1967, to support AS-502 vehicle.

The modified lox line, reported in last month's progress report, has passed the cold-shock test, flex cycling tests, vibration tests, and burst test.

d. S-II Forward (AA-05-01) -

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.

The AA-05-01 arm was modified at MSFC by installing a lanyard withdrawal system to replace the dual cylinder withdrawal system used on AA-05-02 and AA-05-03. R&D testing on the lanyard withdrawal system has been completed. Acceptance testing of the lanyard withdrawal system and associated hardware is in progress. The tracking and oscillation tests are complete. The systems dry testing is approximately 60% complete.

The console #1 modification is completed to the latest changes.

A special series of tests were conducted for P&VE Lab on the S-II insulation vent spout lanyard pull-off system. These tests were successfully completed and the results transmitted to P&VE Lab. The arm is now being modified to accommodate the hardware for testing the spring-reel method of removing the vent spout covers. System test wet should begin during next report period.

e. S-IVB Aft (AA-06-01) - This inflight service arm provides LO_2 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.

The arm was installed on the tower simulator on March 8, 1967. Testing began on March 16, 1967, and continued until May 15, 1967, at which time the arm was removed from the test area and taken to the S-IC stand for a water flow test.

The arm was reinstalled in the test area on June 15, 1967, and testing was resumed. R&D testing on the lanyard system was completed on August 18, 1967, and the hardware necessary to convert AA-06-02 to the lanyard withdrawal system was then shipped to KSC.

A special series of tests was conducted for KSC to determine the minimum pressure in the hydraulic system that would give a satisfactory arm retraction under no wind and retarding wind conditions. These data were transmitted to KSC.

Acceptance testing in accordance with the SK75M24639 (Revision B) Test Criteria was begun on August 21, 1967. The systems test dry series of tests are scheduled to be completed by October 5, 1967. The start of full system tests with Cryogenic flow will be dependent upon the arrival of the LO_2 75M07823-9 propellant line.

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.

Systems test dry are in progress and should be completed by October 4, 1967. The LH_2 vent line problem (LH_2 vent line strikes the L/O 1206 platform during retraction) has not been resolved. During withdrawal from certain vehicle positions the vent line strikes an unpadded portion of the L/O 1128 bumper.

A special series of tests was conducted for KSC to determine the minimum pressure in the hydraulic system that would give a satisfactory arm retraction under no wind and retarding wind conditions. These data were transmitted to KSC.

Eight system tests were conducted to determine the strain imposed on the IU door frame by disconnecting the umbilical carrier.

Twenty-five tests were conducted to determine the effect of various sizes of orifices and lines in the ball-lock and primary withdrawal GN_2 systems. These tests should be completed by October 4, 1967.

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

Special tests were conducted to determine the minimum pressure required to retract the arm in 9.2 seconds with a retarding wind, and with no wind; and to determine the flow characteristics of the primary and secondary withdrawal system.

During the minimum pressure retraction tests, it was determined that a primary retraction pressure of 580 p.s.i.g. with no wind, and that a primary pressure of 725 p.s.i.g. with a retarding wind would retract the arm in the specified time of 9.2 seconds. These data were transmitted to KSC.

Withdrawal system (primary and secondary) flow tests were conducted to determine if the overall system was adequately designed to satisfy the air motor flow requirements. Testing and discussions with the air motor vendor indicates system is satisfactorily designed. System tests will be conducted to determine if a lower withdrawal pressure can be obtained, and still meet the withdrawal time of 1.25 to 1.50 seconds.

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.

The environmental chamber was removed on September 20, 1967, and shipped to KSC for modification. The test program will be resumed upon receipt of the modified chamber.

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

The DRRS is a system for the 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 structural assembly was received on September 21, 1967, and installed on September 25, 1967. Download tests were successfully completed on September 28, 1967.

Special tests were performed on the air motor hoists system in an effort to produce the alleged failure of the ML-1 hoists at KSC. The arm was raised and lowered several times with various exhaust restrictions on the air motor. No abnormal operation was observed. Inlet pressures were manually fluctuated. This action did not produce any erratic action of the motor. As the pressure was dropped to the brake engagement level the motor simply stopped.

Disassembly and further investigation was accomplished by R-QUAL, MSFC.

The currently scheduled delivery date of the control console from ME Lab is October 9, 1967, at which time testing will be resumed.

3. LC-39 Tail Service Masts (Set 1)

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.

Testing has been completed to test plan Section III.D. Special tests are in process to obtain data from the A/S 501 launch. They include minimum pressure tests, failure mode tests, and change proposal tests. The special tests are scheduled to be completed October 13, 1967.

The extension of the completion date is a result of unexpected facility problems during buildup and testing.

Upon completion of the special tests, the flight umbilicals will be installed and the remainder of the scheduled tests completed.

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 a test bed for development of the holddown arm secondary release system and protective hood (blast shield).

The protective hood system was installed on Holddown Arm 003 and testing was initiated when, on August 10, 1967, an AVO (HDA 865) requesting removal of the hood hydraulic/pneumatic assembly for shipment to the Martin-Denver Corporation, Denver, Colorado was received. A flash report was released documenting results of the limited testing accomplished prior to shipment of the hydraulic/pneumatic assembly to Denver. The hydraulic/pneumatic assembly was returned (contaminated) September 8, 1967, to R-TEST-CF. The assembly was cleaned by flushing with clean hydraulic fluid and reinstalled in the protective hood system. Further testing of the protective hood will be accomplished, and a flash report documented during the next reporting period.

At the request of KSC Design, R-ME has repaired the cracks in all arms in accordance with Document 76K02512, "Holddown Arm Repair Procedure for Launch Complex 39". Load testing of the repaired holddown arms, requested by KSC Design will be conducted after completion of the protective hood system tests.

5. Saturn V Lift-Off Switch Rack and Pinion Actuator

This program is being conducted for KSC to ensure that the lift-off switch equipped with a rack and pinion actuator, will function properly and to compare the rack and pinion operating characteristics with the rotary actuator arm operating characteristics.

Testing was completed 7-14-67 and the results indicate that rack and pinion actuator, with modifications, will provide a proper lift-off signal; however, the rack and pinion will apply more force to the vehicle heat shield than the rotary arm. A test report is being prepared. This item will no longer appear in this report.

6. Hydrogen Embrittlement Test

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

Buildup of this test is complete. The PAP was submitted August 31, 1967. The SOP has been submitted to Safety. Tail Service Mast priority has delayed testing. Checkout is now in process. Testing will 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.

Six tests were conducted during September. These tests were made to study the effectiveness of perforated baffles to contain liquids in a low gravity field.

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.

Eleven tests (C-035-61 through 71) were conducted during this report period. Test 63 completed the 701 pound model weight series. Tests 64 through 71 were conducted with the 833 pound model weight. A data transmittal covering the 701 pound model weight series (C-035-39 through 63) is in work.

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.

105-inch Diameter Tank: A pin hole leak was found in the fill line and the tank was removed from the chamber for repairs. This tank should complete tests during the month of October 1967.

30-Inch Calorimeter: The calorimeter remains at M.E. Laboratory for repairs. No schedule is available on this item due to low priority.

D. Storable Propellant Space Engine Testing

This program was requested by R-P&VE-P to provide support for testing of advanced technology engines.

One 25-pound thrust monopropellant engine was received from Hamilton Standard on September 28 and is scheduled to be tested in the 3-foot diameter altitude cell during the month of October.

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 offshore sites.

Five tests (C-002-35C through 39C) were accomplished during this report period. Testing phase is now complete. Draft of Internal Note covering single and cluster engine test phases is scheduled for completion November 1, 1967.

F. 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.

No tests were conducted with the 30K thrust level engine during this reporting period. Approximately seven tests with an existing solid copper injector will be conducted when scheduling permits.

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 chamber 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 test is to measure the temperature at the combustion chamber wall, near the injector, so that the phase of the combustion products might be determined.

The tests conducted for this effort were discussed with P&VE and R-TEST-C representatives in May, and it was agreed that three to five additional tests would 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. The injector face has been received, but no testing will be performed until Test Position 115 becomes operational. It is estimated that testing will resume by November 1, 1967.

G. 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 program has been cancelled and a final memorandum report is in progress. The memorandum report will cover both the hubless inducer with impeller and the LH_2 high-speed inducer test phases. The memorandum report is to be transmitted in October 1967. This is the final monthly report for this project.

H. Acoustic Studies

Requestor: R-P&VE-SVR and 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-existant. 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 strapon 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).

During this reporting period, test stand modifications were completed and testing to determine cluster effects as a function of engine separation distance and cluster diameter (No. 7 above) was begun.

The single engine configuration base line tests have been completed, and a 4-engine cluster configuration test series will begin when scheduling permits.

I. 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.

Work on the Internal Note is continuing and completion is anticipated during October 1967.

This project will not be included in future monthly progress reports since it is complete.

J. 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 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 is being 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 was conducted using the Basic Saturn V Booster scale model and has established baseline data. Phase II tests will use the same scale model booster but with the uprated F-I engines. Phase III is utilizing the basic Saturn V scale model with 120-inch simulated solid motor strap-ons. Phase IV will use the basic Saturn V model with 156-inch simulated solid motor strap-ons. No tests were conducted during this report period.

It was reported in the previous progress report that tests with the solid "Strap-On" had been conducted. KSC reviewed the data and determined that a new deflector should be tested.

Testing will resume when a new deflector, designed by KSC, can be built. It is expected that this will be completed the first week of October and testing will immediately resume.

In this interim period provisions are being made to obtain data in the deflected exhaust stream as requested by KSC.

K. 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 progam

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.

No tests were conducted during this reporting period. A new tektite sample has been fabricated and a test on this sample will be conducted when scheduling permits.

L. Dynamics and Stability of Motions of a Cable-Connected Spinning Space Station

The purpose of this test program, requested by R-AERO-DD, is to determine the stability area of two bodies connected by a cable spinning in space.

A catapult system was designed and is being built by Test Laboratory. With this catapult system the model will be spun up to a pre-determined speed, and then shot into the air. Data will be recorded using 16 mm motion picture cameras. A net will be erected to catch the model.

There will be approximately 100 missions obtained in 10 test periods. The tests should start in mid-October.

IV. APOLLO APPLICATION

A. S-IVB Workshop

1. 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.

Testing is complete on the condensation model, with the results from P&VE's computer program being awaited before dismantling the model.

Assembly by M.E. Laboratory, of the 1/8 segment is approximately 90 percent complete. Testing is scheduled to start approximately one month from receipt of the segment from M.E. Laboratory.

2. Insulation Flammability Study

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

Two-mil, three-mil, and four-mil aluminum covered polyurethane insulation samples were tested in 11 tests conducted in the Redstone vacuum drying chamber during this reporting period. The one MSFC two-mil sample tested was 30 percent burned whereas two Douglas potassium silicate - zinc oxide coated two-mil samples did not burn.

Testing will continue into next month.

W. L. Grafton

GEORGE C. MARSHALL SPACE FLIGHT CENTER
TEST LABORATORY
MONTHLY PROGRESS REPORT
TECHNICAL SUPPORT DIVISION
SEPTEMBER 1, 1967 through SEPTEMBER 30, 1967

I. SATURN IB

A. S-IB Stage Testing

Design was completed on a lox storage vent system modification at the STTE test position.

B. H-1 Engine

1. Supported static testing at the Power Plant Test Stand with high pressure industrial water and RP-1 fuel.

2. Continued miscellaneous shop support for S-IB Test Facility.

II. SATURN V

A. S-IVB J-2 Engine Testing

1. Design was completed on a GN_2 purge loop system for the J-2 engine thrust chamber at the S-IVB Test Stand.

2. Design was started on the protective covers for the LH_2 fill valves at the S-IVB Test Stand.

3. Design was started on extension of the emergency fire poles and adding a protective heat radiation shielding at the S-IVB Test Stand.

4. Supported testing of S-IVB Stage with high pressure gases, high pressure industrial water, and recharging of the gaseous hydrogen system.

5. Supported S-IVB Relief Valve Test at CTL Cell 104 with high pressure gases, LN_2, and industrial water pressure.

6. Continued shop support for S-IVB programs.

B. F-1 Engine Testing

1. A study was started to modify the thrust measuring system in the F-1 Engine Test Facility West Area to obtain better measuring accuracy. As a preliminary to the study a checkout of existing load cells and instrumentation was asked to be conducted. The checkout indicated that instrumentation wiring was the trouble area and therefore modification studies have been stopped until instrumentation corrections can be verified by static firing.

2. Supported testing at the West Area F-1 Engine Test Stand wigh high pressure gases and high pressure industrial water.

C. Component Testing - S-II Stage Aft Structural

1. Design was completed on the S-II stage aft structural test assembly including cryogenic piping, vents and high pressure gas systems, mechanical and hydraulic systems. Modifications are being conducted to completed designs as they are received from the Test Operations Office in their latest findings on test requirment refinements.

2. Fabrication on the S-II tower structure progressed to 45% completion.

D. GSE Testing

1. Design progressed to 85 percent completion on structural support for the S-IVB Aft Swing Arm Tip Assembly used in automatic reconnect of the umbilical system.

2. Design was completed on the modification to the S-II Forward Swing Arm Umbilical panel and Random Motion Simulator to test the pull out plugs on the S-II Stage insulation pruge system.

3. (S-IC Intertank) - Supported testing at the GSE Test Area with LN_2 and high pressure gases.

3. Fabricated duct for filter blower, 100% complete and continued shop support for miscellaneous machine work.

E. Transportation of Stages

1. The S-1C Forward Handling Ring Sub-assemblies for the second ring manufactured by Progressive Welders, Inc. has been received by MSFC. Completion is scheduled for October 15, 1967. The Handling Rings being manufactured by BECO are being fabricated. The assembly Jig fixture will not be installed in the BECO plant as originally reported last month but will be installed in bldg. 4650 instead.

2. A meeting with The Boeing Company is scheduled for October 5, 1967 to settle differences of opinion in the design of the handling rings for the S-IC Stage.

3. The modification to the Barge "Orion" by the Diamond Manufacturing Company in Savannah, Georgia was completed. A sea trial was immediately conducted from Savannah to Michoud. Minor trouble encountered was the diesel generator fan cooling system which was immediately remedied by General Motors who manufactured the motor-generator sets. The Barge "Orion" eventually arrived at the MSFC Docks for installation of a GN_2 pressurization system and S-IC, S-II vehicle tie-down equipment.

4. Design was started for a new S-IC forward preservation cover for use with the S-IC Steel Forward Handling Rings.

F. KSC Support

Maintained safety and pre-launch review supporting the 501 launch.

G. Saturn V Stage Dynamic Testing

Supported testing at the Saturn V Dynamic Test Stand with high pressure gases.

H. Vent Trap for Water Storage Reservoirs

Progressed to approximately 85% completion.

I. Zero Gravity Drop Tube Access Platforms

Modified the platforms at elevation 351.48 feet.

J. LOX Tank Lines

Welded fittings to LOX Tank Pressurizing Lines.

K. S-IC Handling Ring

Rework of the handling ring progressed to 95% completion.

L. Super-Insulation Facility

Build-up of super-insulation facility progressed to 70% completion.

M. Vacuum Chamber

Fabrication continued on the 36' x 48' vacuum chamber for familarization effort.

N. Gaseous Hydrogen Vessels

Continued fabrication of gaseous hydrogen pressure vessels. Blocks are 30% complete, specimens are 70%.

O. Access Platforms

Fabricated removable top and access platform on vertical tank at Cell 112.

P. Accoustical Test Facility

1. Booster scale model is 95% complete.

2. Complex umbilical tower is 100% complete.

3. Launcher is 75% complete.

4. Deflector is 35% complete.

5. Piping is 50% complete.

Q. S-II Section Test Assembly

1. Continuing fabrication on forward load assembly progressed to approximately 90% complete.

2. Fabrication on high pressure GH_2 storage system progressed to approximately 30% complete, material is 98% complete.

3. The firex system fabrication progressed to approximately 10% complete.

4. BECO fabrication of the specimen support system is approximately 40% complete.

5. Fabrication on the access tower removable platform is 80% complete.

6. Modification on the umbilical panel is 90% complete.

7. The in-board loading assembly fabrication progressed to approximately 45% complete. (Fabrication by BECO proceeding on schedule of 11-17-67).

8. Fabrication on the aft lox bulkhead loading ring progressed to approximately 35% complete.

III. SUPPORTING RESEARCH AND TECHNOLOGY

A. LH_2 Mass Flow Calibration Facility

Design was stopped on the LH_2 Mass Flow Calibration Facility pending clarification of the project.

B. High Altitude Engine Test Facility

Design was completed on the mounting of a C-1 engine in the High Altitude Engine Test Facility.

C. High Pressure Engine Combustion Facility - Position 300

Design continued on the high pressure, high flow LH_2

System to be installed at test position 300.

D. High Altitude Instrumentation Research & Development

1. Design progressed to 70% completion on an Ion Gage Calibration System for use in the Instrumentation Development Building.

2. Design was completed on an air blower and flexible air duct to cool the Vibration Shaker in The Instrumentation Development Building.

E. Jet Impingement on Water

Supported testing at building 4750 with LOX and RP-1 fuel.

F. Insulation Position Testing

1. Supported test at building 4748, Cell "C", with high pressure gases, LN_2, and LH_2.

2. Supported test at building 4749, Cell "B", with pressure gases, LN_2, and LH_2.

G. Tektite Studies

Supported testing at Cell 105, building 4583, with gaseous hydrogen, other high pressure gases, and industrial water pressure.

H. Acoustic Studies

Supported testing at Cell 116, Acoustic Model Test Facility, with RP-1 fuel, high pressure gases, and industrial water pressure.

I. Super Insulation Testing

Supported test at Old Dynamic Test Stand with LN_2 and high pressure gases.

J. Helium Liquefication Testing

Supported test at building 4650, Helium Liquefication Test, with LN_2 and high pressure gases.

K. Propellant Support to Other Offices and Labs by Semi-Trailer

LN_2	LH_2
4619 - P&VE	BECO - P&VE
4628 - P&VE	4628 - P&VE
4732 - AERO	4624 - P&VE
4705 - ME	
4476 - ASTR	
4702 - ME	
4331 - ASTR	
4481 - ASTR	

L. High Pressure Gas Support to Other Labs by Semi-Trailer

GHe	GN_2	Air
4476 - ASTR	TMC - Chem. Cleaners	4708 - QUAL
4619 - P&VE	4708 - QUAL	MSI Cleaners
4622 - P&VE	4732 - AERO	
4708 - QUAL	4619 - P&VE	
4620 - P&VE		
4614 - P&VE		

IV. SYSTEM BUILD UP AND MODIFICATION

A. Helium System

The "K"-bottle filling system for pressurizing helium cylinders with MSFC Spec. 364A helium was fabricated, cleaned, and purged. The first order of "K" bottles was filled during the month.

B. Air Compressor Station

Work has continued on the problems experienced with the Norwalk compressors.

C. Hydrogen Systems

1. The technical evaluation of the proposals for the GH_2 gage procurement is being held until the submittals have been completed; the required drawings were not submitted with the original packages.

2. A procurement request was submitted for the purchase of a 10,000 psig liquid hydrogen pump.

3. A cost estimate was prepared for running boil-off tests on seven Air Products Company 13,000 gallon liquid hydrogen semi-trailers being procured by Logistics. As a result of this estimate being considerably lower than that submitted by Air Products, preparations are now under way for running the first test which is expected to be during the last of October. Prior to the first A.P.C.I. test, a run will be made with one of the existing MSFC semi-trailers.

4. Work has begun on relocation of the hydrogen recharger facility from Test Stand 500 to the S-IVB Recharger Area.

D. West Area High Pressure Industrial Water System

Work has continued on the painting of the diesel exhaust stacks.

V. OTHER PROGRAMS

A. Apollo Telescope Mount

1. Design was completed on a 15 degree segment of the ATM Solar Panel to be mounted in The High Vacuum Facility for testing.

2. Design continued on the ATM Environmental Capsule and Transporter. Information on the capsule and transporter instrumentation requirements was received from R-ASTR and P&VE. Design effort slowed pending clarification of configuration changed on ATM.

B. Lunar Drill Project

1. A design review on one prime contractor (Northrup) designed "Drill String Drive Assembly" and on a "Slave Valve

Hammer Assembly."

2. Fabrication on nitrogen compressor lunar drill concept 1 is complete.

C. Nuclear Ground Test Module

The road survey from the West Coast to the Nuclear Test Site in Navada was suspended for the present due to shortage of funds. The survey will continue as soon as funds become available.

D. Neutral Bouyancy Facility

Fabrication on the Neutral Bouyancy Facility at M&ME is 15% complete.

E. Multiple Docking Assembly

Efforts are being made to secure MDA transportation requirements. As soon as information becomes available design of transportation equipment will begin.

F. Others

1. Design was completed on the removal and reinstallation of two high pressure gas bottles from the vicinity of building 4666 to the gas storage battery at 4751.

2. Design progressed to 50% completion on a weather hood ventilation system for room No. 5 of building 4746.

W E Marsalis

William E. Marsalis

GEORGE C. MARSHALL SPACE FLIGHT CENTER
TEST LABORATORY
MONTHLY PROGRESS REPORT
ADVANCED FACILITIES PLANNING OFFICE
SEPTEMBER 1, 1967, through SEPTEMBER 30, 1967

I. FACILITIES

A. R&A Projects

1. Additions to Cryogenic Storage - Project 7072 - Beneficial occupancy was obtained for the LH_2 Control Building, LH_2 Tanks and GH_2 bottles. Construction was completed for underground conduits, potable water line, also concrete pipe piers and trench. The project is approximately 95% complete.

2. S-II Structural Test Pad - Project 7076 - Open pipe trench #1 and open cable trench #1 were completed and excavation started for open pipe trench #2. Construction was started on underground conduits and the terminal building. The project is approximately 60% complete.

3. S-II Aft Section Test Assembly - Special requirements for the off-stand firex system and placement welding of pipe sections was continued. Concrete piping and valve installation was completed for 2 firex stations and construction of the remaining firex pits was started. Construction of cable tray supports was also started. The project is approximately 20% complete.

4. Construction is underway on the following projects:

a.	Project 7008 - Additional LOX Storage for All Test Positions, Building 4583	94% complete
b.	Project 7009 - Firex System Addition, Test Stand 115	94% complete
c.	Project 7013 - Elevator for Test Stand 500	40% complete
d.	Project 7021 - GH_2 Transmission System	98% complete
e.	Project 7023 - GN_2 Pipeline System	70% complete
f.	Project 7031 - Modifications to Provide LH_2 Service, TS 300	90% complete
g.	Project 6742 - GN_2 Connector Line	50% complete
h.	Project 7058 - Extension of Steam Line to S-IV B Test Stand	75% complete

i. Project 7066 - Timber Clearing, West Area
FY 67 Landscaping, Part II — 95% complete

j. Project for Landscaping Dodd Road, FY 67 — 5% complete

k. Improvements in Vicinity of Bldg. 4650 — 100% complete

l. Project for Fire Detection System - Contractor is preparing shop drawings and purchasing hardware. Construction has not been started.

B. Environmental Test Complex

A contract, for further studies of requirements and justifications, has been negotiated with the Bechtel Corp., San Francisco, California. Notice to proceed is expected to be given the week of October 9, 1967. Completion of all work on the contract is expected to take approximately fourteen weeks.

C. Propulsion Systems Test Facility

Design criteria for modification of STTE have been completed. A work order was given to R-TEST-BD to proceed with the design for the modification of the east side of the tower. Drawings for a PER have been initiated.

D. Nuclear Ground Test Module

The present budget status has eliminated all work on adaption of S-IC Test Stand for Ground Test Module. There will be no further reports on this project.

J. B. Carrington

Karl L. Heimburg

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