SITE	LOCATION	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FACILITY	NERVA OT1016 (H. M. Henneberry)	On March 31, the planned "B-3" test program on the Mark IX turbopump was cancelled. On April 13, the decision was made to move the "B-1" Block II test program to "B-3". At "B-3" Facility a turbopump test program will be run on an alternating schedule with the systems tests. The research hardware will consist of an Aero-Jet Mark III, Mod 4 turbopump, a KIWI B1B reactor with dummy fuel cells, and several servo-control systems. Tasks for the next five months will include transfer of equipment from "B-1" to "B-3", upgrading of "B-3" Facility instrumentation, modification to the "B-1" steam system, and revisions to the "B-3" Facility piping and electrical system. Checkout runs with LN_2 are scheduled for October.

SECTION II

PLUM BROOK ROCKET SYSTEMS DIVISION

TEST OPERATIONS REPORT

FOR THE MONTH OF

MAY 1965

SITE	LOCATION	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA OT1016 (H.M. Henneberry) NERVA engine propellant feed system tests. The new steam regulating system was checked out during the week of May 17. The new reactor nozzle arrived at Plum Brook on May 21 and is currently being mounted. Transfer of the systems test equipment from "B-1" to "B-3" is nearly complete. Work is continuing on reactor carriage modifications, fabrication of the 54-inch nozzle adapter section, installation of servo-control valves, and hookup of new instrumentation equipment. The preliminary design of piping modifications for "B-3" systems tests has been completed. Liquid nitrogen checkout runs are scheduled for October.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC. NERVA / 0T1016 — NERVA engine propellant feed system tests. (H.M. Henneberry) The 54" adapter section and no-flow diffuser have been installed. Modification of the reactor carriage was completed. The reactor will be installed in "B-3" by July 2. The new thermocouple wires and instrumentation cabinets have been received and are being installed. Additional monitor instrumentation is being installed in the control room. Three of the Annin "Y" pattern servo-valves have been installed and are ready for checkout. Delivery of the Mark III, Mod. 4, turbo-pump is still scheduled for August 1, and checkout runs with liquid nitrogen are scheduled for October.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.

NERVA
OT 1016
(H. M. Henneberry)

NERVA engine propellant feed system tests.

The installation of the reactor and carriage has been completed. The piping to the nozzle is presently being installed. Pre-fabricated sections of the nozzle access platform have been delivered and are ready for installation.

A preliminary flow test was made on the altitude exhaust purge system with satisfactory results. Further testing will be performed when the steam system is returned to operation in August.

Installation of the new instrumentation cabinets is complete, and the new thermocouple wires have been pulled. Purchase Request for the addition to the forward instrument room still has to be processed.

Because the delivery of the Mark III, Modification 4 Turbopump has been extended to the latter part of August, Liquid Nitrogen checkout runs cannot be started until November.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.

NERVA
OT 1016 — NERVA engine propellant feed system tests.

(H. M. Henneberry)

The following work was accomplished during August:

(1) The nozzle access platform installation was completed.

(2) Temporary installation of some of the reactor piping was completed so that the guides and supports could be fabricated.

(3) Some of the movie and TV camera supports were designed, fabricated and installed.

(4) The signal conditioning equipment installation and checkout was 80% completed.

(5) A checkout of the exhaust purge system with the steam ejectors was completed on August 26. The O_2 concentration in the 54" duct was reduced to 0.5%.

(6) An initial checkout of the servo valves was completed.

Significant event schedules are:

(1) Installation of data transducers is scheduled to start September 1.

(2) The bid opening for the forward instrument room addition has been re-scheduled to September 10.

The following problems were encountered:

(1) On the August 26 test the steam pressure control system failed to regulate. There seems to be some problem with contamination of hydraulic fluid and resulting interference with servomotor operation. This problem is currently being investigated.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.

(2) The actuator on the four-inch servo vent valve developed a large internal leak. After a brief period of satisfactory operation a second actuator developed the same problem. The manufacturer has been contacted. The other actuators on the smaller Annin servo valves have operated satisfactorily to date.

(3) Leaks developed between the nozzle and Mylar seal adapter ring. Apparently they are located where "Devcon" has been used to seal instrumentation tube penetrations. These penetrations will be resealed.

The pacing item for Research Operations is the delivery of the Mark III, Modification 4 turbopump from Aerojet which has slipped to the latter part of September. However, an on schedule (September 15) delivery of research piping may still allow checkout runs with liquid nitrogen the first part of November. These checkout runs could be delayed if difficulties are encountered in sealing the nozzle leaks.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA OT 1016 (H. M. Henneberry) NERVA engine propellant feed system tests.

The installation of the pressure transducers, movie camera and TV camera on the reactor-nozzle assembly constituted the major mechanical effort this month. This work is scheduled for completion the week of October 4. The leak between the nozzle and the mylar seal adapter ring was effectively sealed using Devcon F-2. However, another problem has been encountered on the nozzle. The nine carbon steel AN fittings which are welded to the nozzle inlet manifold for use as pressure taps must be ground off and replaced with stainless steel fittings. This repair will be done with the nozzle in place.

The actuator manufacturer (Boonshaft and Fuchs) maintains that the internal leakage in the servo-valve actuators was caused by the adverse tolerance build-up and has agreed to repair any units found to be defective. Meanwhile frequency response tests have started on the two-inch tank pressurization servo and the four-inch pump load servo.

All but twenty-four channels of the signal conditioning equipment have been installed and checked out. The remaining twenty-four channels will be completed when equipment is delivered. Installation of the SEL subsystem has begun. Hook-up and checkout of transducers will start October 4. The contract for the addition to the forward instrument room will be awarded on October 1. The contract has a completion time of 75 days.

The problems which were encountered in the steam pressure control system were traced to calibration discrepancies which have been corrected. Checkout operation will be resumed the first week in October.

Delivery of the turbo-pump and most of its associated piping is scheduled for the week of October 4. Delivery of the liquid hydrogen level probe has slipped to October 11. The first liquid hydrogen run is still scheduled for mid-November.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.

NERVA
OT 1016
(H.M. Henneberry)

NERVA engine propellant feed system tests.

The Aerojet Mark III Turbopump was delivered the week of October 4, All of the valves and piping for the propellant flow system have been received. The turbopump has been installed and is being instrumented. The installation of the propellant piping is scheduled to be completed by November 6. The liquid hydrogen liquid level probe has been installed and the liquid hydrogen run tank is presently being pressure checked and inerted.

The repaired Boonshaft and Fuchs actuator for the tank vent servo valve is scheduled to be delivered to Plum Brook by November 1. However, the identical actuator on the pump load servo developed the same internal leakage and has been shipped to the manufacturer for repairs. Boonshaft has promised return delivery of this unit by

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.

NERVA

OT1016 (H.M. Henneberry) — NERVA engine propellant feed system tests.

The first liquid nitrogen checkout run was made on November 17. Major parameters were as follows:

a. Tank pressure of 5 psig.

b. Maximum liquid nitrogen flow rate of 34 pps.

c. Turbopump rpm of zero (as predicted).

d. Duration of flow through the reactor of 59 sec.

Automatic shutdown was initiated manually when the liquid interface had reached the desired position in the test configuration.

Major problems encountered were as follows:

a. Noise on instrumentation channels.

b. Liquid level probe failed after the run.

c. Ignition flares on the burn-off were extinguished by the flow of purge gas.

d. The tank shut-off valve failed to close during the shutdown sequence (apparently frozen).

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FACILITY (Continued)

Two types of errors showed up in the digital data tapes.

These were:

1. Random data word dropouts as evidenced by an error in the sync address of the next consecutive record following the dropout.

2. Two separate bursts, of approximately 2 seconds duration, of lateral, longitudinal and record length errors occurred during the data run. This happened without any other type of system error.

These two types of errors caused the automatic data retrieval program to halt upon recognizing the error conditions. No automatic or manual means was available for bypassing errors in the retrieval process.

The retrieval program has been provided with the capability of manual intervention in the event of error indications. No automatic bypass or error data is planned because of the difficulty of defining accurately the reason for the error indication. With the manual intervention capability, the programmer can decide what remedy to take upon defining the reason for the error indication. Therefore, given the same error indication, the capability now exists to retrieve the usable data.

The data acquisition group found that the first type of error, data work dropouts, was caused by random extra erroneous sync pulses being detected at the Central Recording System in data being received from the "B-3" Facility Subsystem. This was traced to the Facility Subsystem and cured by a design modification to the output data modulator input timing. The second type of error was the result of a bad section of magnetic tape. The tape appeared to have been folded over from the one edge. The tape handlers are being checked to see what may have caused this condition.

NOTE: Liquid Nitrogen Run No. 2 is scheduled for December 1, and Liquid Hydrogen Run No. 1 is scheduled for December 15.

SECTION II

PLUM BROOK ROCKET SYSTEMS DIVISION

TEST OPERATIONS REPORT

FOR THE MONTH OF

DECEMBER 1965

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA OT1016 (L. V. Humble) — NERVA engine propellant feed system tests. On December 7, Liquid Nitrogen Run No. 2 was made. The major parameters were as follows: (a) Tank pressure of 5 psig. (b) Maximum liquid nitrogen flow rate of 30 pps. (Continued on Page 26)

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC. (Continued)	

(c) Turbopump r.p.m. of zero.

(d) 65 second flow duration through the reactor.

Automatic shutdown was initiated manually when the liquid interface reached the desired position in the test configuration.

Major problems encountered were as follows:

(a) Central recording SEL Unit No. 2 did not operate properly. The run was recorded on SEL Unit No. 1.

(b) A bellows restraining mechanism failed, allowing the bellows to distort. In order to complete the run, the bellows was replaced with tubing.

On December 21, Liquid Hydrogen Run No. 1 was made. The major parameters were as follows:

(a) Tank pressure of 20 psig.

(b) Maximum liquid hydrogen flow rate of 13 pps.

(c) Turbopump r.p.m. of zero.

(d) 70 second flow duration through the reactor.

Automatic shutdown was initiated manually when the liquid interface reached the desired position in the test configuration. The only major problem encountered was in the central recording SEL system at "H" Building. The analog and digital indications of noise level did not agree. It was decided that the digital indication was correct. The system functioned properly in every other respect.

System chilldown tests with liquid hydrogen are scheduled for January 12 and 26.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	

NERVA

OT1016(L.V.Humble) — NERVA engine propellant feed system tests.

The second liquid hydrogen run which was scheduled for January 13, could not be made since the data from the first liquid hydrogen run (December 21, 1965) was not reduced until January 26. This data was needed before Run No. 2 could be made in order to check the program and data acquisition systems.

The long delay was reportedly caused by:

(1) A Lewis-Cleveland computer breakdown.

(2) "B-3" was the first facility to use 400 channels with variable multiplexing.

While the facility was in a standby condition, the following tasks were either accomplished or started:

(1) The re-heat system was cold flow tested with liquid nitrogen.

(2) Installation of new tank shutoff valve.

(3) Installation and checkout of mass flow meter.

(4) Installation and checkout of Fastex movie cameras.

(5) Installation of piping for turbopump test program.

(6) Checkout of turbine power control (scram) valve.

(7) Miscellaneous alterations to the instrumentation system.

(8) Installation of new ignition system for boilers.

(9) Checkout of steam pressure control system.

(10) Repair of mylar seal between nozzle and exhaust duct.

The above tasks are in addition to normal system checks and maintenance tasks.

NOTE: Liquid Hydrogen Runs 2 and 3 are currently scheduled for February 3 and 16.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROL FAC.	

NERVA
OT1016(L.V.Humble) — NERVA engine propellant feed system tests.

On February 3 and February 25, liquid hydrogen runs No. 2 and No. 3 were completed. Run No. 2 was a "wet" or pre-chilled pump test similar to Run No. 1, while Run No. 3 was a "dry" or unchilled pump test. Both tests were terminated in a normal manual mode when the system had reached the desired end conditions. The major parameters of the two tests were as follows:

		Run No. 2	Run No. 3
(a)	Liquid hydrogen tank pressure	10 psig	20 psig
(b)	Maximum liquid hydrogen flow	4 pps	12 pps
(c)	Turbopump rpm	0	0
(d)	Duration of flow	111 sec	95 sec

A summary of significant problem areas and comments concerning each test follows:

Run No. 2

(a) The liquid hydrogen mass flow meter did not function properly and no useful data was obtained from this device.

(b) The Fastax movie cameras were not used because they introduced noise on some of the instrumentation channels.

(c) Eight Rosemount temperature probes "opened" early in the test; therefore, no data was recorded from these probes.

Run No. 3

(a) Considerable effort had been expended to fix the liquid hydrogen mass flow meter since Run No. 2; however, several hours of work were required on the

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROL FAC.

NERVA (Continued)

run day to provide an acceptable signal. During the run, the device appeared to be working.

(b) The Fastax movie cameras were used for the first time in the belief that the problem of noise introduction had been solved. However, during the test, camera function generated sufficient noise to render unreadable pump speed and mass meter signals.

(c) The continuous liquid hydrogen level readout on the run tank malfunctioned during transfer to the facility. Point sensors and previous operating experience were used to approximate the liquid level in the run tank. No time or data were lost as a result of this problem.

The following problems were uncovered after the test, when research personnel started preliminary data evaluation.

(d) Thirty-two pressure transducers on the reactor were electrically calibrated (E.C.'d) 3% high. The problem has been traced to test conductor error in venting the system, thereby resulting in a "zero" when the actual system pressure in the exhaust duct was slightly negative rather than true atmospheric.

(e) FM recorder #401 failed to record and was traced to a loose wire on a relay. Fourteen channels of FM data were lost.

(f) The SEL subsystem did not sample each channel as programmed, but occasionally, in rather random fashion, sampled an incorrect channel. This problem, thought to be system noise at the time of the run, resulted in a scatter of random samples on several channels.

(g) The digital tape was found to have a lengthwise crease along one edge. The tape was played and checked at "H" Building after the run. Creasing may have occurred during rewind.

Most of the data on the digital tape is retrievable but would require a change in the computer program to

(Continued on Page 26)

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROL FAC.	

NERVA
OT1016(L.V.Humble) — NERVA engine propellant feed system tests.

Two test runs were completed during the month of March. The chilldown test run series was concluded with the completion of Test No. 4 on March 10. This test was a dry pump test similar to Test No. 3. The only exception was a variation in the run tank pressure. The test objective was to determine the system chilldown dynamics for a specific tank pressure. After the test objective had been accomplished, the new reheat system was tried. This system consists of a hot water to gaseous nitrogen heat exchanger where the heated nitrogen gas is used to warm-up the research hardware to ambient temperature; thereby making it possible to make at least two runs on the same run day, thus conserving manpower and money. The reheat system worked successfully on March 10, but a second run was not made because of an operational problem which now has been corrected.

On March 30, Test No. 5, the first of a series of three turbopump tests, was completed. These turbopump tests are intended to establish the lower end of the Aerojet Mark III pump performance map. This run was an unpowered (no turbine flow) test to obtain flow calibration data on the pump discharge valves and piping. Approximately 60 unique data conditions were established by automatic programming during the continuous 487-second run. The flow was ramped and stepped from 0 to 100% and back for run tank pressures of 10, 35, and 60 psig. The pump discharge was flashed to the burnoff at a maximum rate of 23.5 lb/sec. All of the test objectives were satisfied.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROL FAC.	
		NERVA XD1016 (L.V.Humble) — NERVA engine propellant feed system tests. On April 27, Test No. 6, the second of a series of three turbopump tests, was completed. The objective of these tests is to obtain low speed pump performance maps for the Aerojet Mark III turbopump. Turbopump speed lines of 1500, 3000 and 6000 rpm at propellant tank pressures of 35 and 50 psia were obtained during Test No. 6. Pump flow rate was ramped and held through seven steady state conditions at each turbopump speed and tank pressure. Forty-two steady state data conditions were obtained by automatic programming during the continuous 413 second run. The LH_2 being discharged from the pump was flashed to the burnoff at a maximum rate of 28 pps. The GH_2 railcar was used to supply turbine drive gas for this run. The car was charged to 2400 psig and the regulator was operated at pressures of 400 and 600 psig. The turbine drive gas was discharged through the exhaust duct and out the second stage steam ejector at a maximum flow rate of approximately 1 pps. This was the first time the GH_2 railcar had been used with GH_2 and it operated satisfactorily. All of the test objectives were satisfied.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.

NERVA
XD1016(L. V. Humble) — NERVA engine propellant feed system tests.

On May 19, Test No. 7, the third of a series of three turbopump tests was completed. The objective of this test was to obtain performance maps for the Aerojet Mark III Mod. 4 turbopump at speeds of 6000, 9000 and 11,000 rpm with propellant tank pressures of 35 and 50 psia. Pump flow rate was varied to obtain pump stall at each condition of speed and propellant tank pressure. Tank pressure, turbopump speed, and pump flow rate were varied through use of an automatic programmer. The test was programmed to run for 559 sec. However, 431 sec. into the run, automatic shutdown was manually initiated due to excessive turbopump vibration. The liquid hydrogen being discharged from the pump was flashed to the burn-off at a maximum rate of 35 pps. The gaseous hydrogen used to drive the turbine was discharged through the exhaust duct and out the second-stage steam ejector at a maximum rate of approximately 2 pps. The data indicates that turbopump speed, pressures and flow rates were oscillating at 12 cps and low amplitude during the run. The causes of these oscillations and the excessive turbopump vibration are still under investigation.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.

NERVA
XD1016 (L.V. Humble)

NERVA engine propellant feed system tests.

On June 9, an attempt was made to run Test No. 8. This test was to be a re-run of Test No. 7, in which excessive turbopump vibrations and oscillations in speed, flow and pressure were experienced. Modifications were made to the turbine power control valve servoamp and the regulated pressure feeding the control valve was changed. No. 8 test had to be aborted because of malfunctions in the run tank vent servo valve and in a helium purge regulator.

On June 14 Test No. 8 was made. Pump flow rate was varied to obtain pump stall at speeds of 6 000, 9 000 and 11 000 rpm. The tank pressures were 35 and 50 psia. A full duration test was completed. Oscillations were still present but of a lesser degree. The current feeling is that the oscillations are due to an excessive amount of internal leakage in the TPCV actuator which causes deadband in its response. There are no plans to repeat this test in the immediate future but a re-run may be accomplished later in the program. After Test No. 8, the hardware was modified for No. 9 and No. 10 chilldown tests.

On June 30, Tests No. 9 and No. 10 were completed. The objective of Test No. 9 was to obtain the chilldown characteristics of the system starting from a "dry" or unchilled condition, while Test No. 10 was from a "wet" or chilled condition. It took three hours for the reheat system to bring the reactor and nozzle to ambient conditions. No significant problems were encountered.

Test No. 11, a bootstrap test, is scheduled for July 20. Depending on the results from Test 11, Test 12 may also be run the same day.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA XD1016(L.V.Humble) — NERVA engine propellant feed system tests. During the month of July, the research piping and instrumentation were altered for the bootstrap test series. On July 26, the first of nine scheduled bootstrap tests was performed. This was a wet, or chilled, pump test. On the first attempt to run the test, the controls programmer failed to start and the test was aborted. The cause of the malfunction was found and corrected and the steam accumulators were recharged. After re-chilling the AeroJet MARK III pump, the liquid hydrogen tank pressure was ramped to 35 psia and the pump main discharge and turbine power control valves were opened simultaneously. Flow was maintained through the Kiwi "B-1" reactor for 23 seconds and reached a maximum level of 34 pps. Turbopump speed reached a maximum of 9,500 rpm. All of the research objectives were satisfied. The next two bootstrap tests are scheduled for August 24.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.

NERVA
PD1016(L.V.Humble) — NERVA engine propellant feed system tests.

The B-1 Boiler House was shut down for the first three weeks in August for the annual cleaning and State inspection of the boilers.

On August 25, the second in a series of nine System Bootstrap Start-Up tests was performed. This was a wet, or chilled, pump test in which the turbine power control valve was opened simultaneously with the pump main discharge valve. The primary test parameters were as follows:

Propellant tank pressure - 25 psia
Maximum turbopump r.p.m. - 8,600 r.p.m.
Maximum LH_2 flow rate - 30 pps (approx.)
Duration of LH_2 flow - 21 sec.

All test results seem to be satisfactory with the exception of a few transducers which were over-ranged during the test.

It had been planned to run a second test on August 25 on a back-to-back basis using the reactor re-heat system. However, the LH_2 mass flow meter was found to be inoperative during the first test. Since the second test was to be a dry pump test in which the data from the mass flow meter is essential, the second test was scrubbed.

The next test is presently scheduled to be run Sept. 14.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA XD1016(L.V.Humble) — NERVA engine propellant feed system tests. No research tests were scheduled for September. The reasons were: (1) An evaporation rate test was made on the 200,000 gallon liquid hydrogen storage vessel. The vessel could not be used for approximately two weeks. (2) Two new steam accumulators for the "B-2" Facility were installed. While they were being installed, the steam injector system could not be operated. Tests were made on one of the new six-inch regulators for the 5000 psig gaseous hydrogen railcars. The regulator was found to be leak-tight and regulated satisfactorily over a wide range of flow rates. The next two research tests will be back-to-back runs and are scheduled for October 5.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	

NERVA
XD1016(L.V.Humble) — NERVA engine propellant feed system tests.

Four bootstrap tests were performed during October; Tests Nos. 10 and 11 on October 5 and Tests Nos. 12 and 13 on October 12. The primary test parameters are tabulated as follows:

	Test 10 Wet Pump	Test 11 Dry Pump	Test 12 Dry Pump	Test 13 Wet Pump
LH_2 Tank Press(PSIA)	25	25	35	35
Max Turbopump RPM	9000	14100	8880	8400
Max LH_2 flow (PPS)	28	16.7	35	31.5
Duration LH_2 flow (sec)	22.8	41.4	47	22

All controlled parameters followed the planned test profile for this series. During Test No. 11 the turbopump did not bootstrap successfully. The turbopump accelerated but little or no head rise was generated across the pump. During Test No. 12 a different method was used to predict the time delay prior to opening the Turbine Power Control Valve and the turbopump bootstrapped successfully. During Tests Nos 12 and 13 some instrument channels were unusually noisy.

On October 26, one of the new 6-inch 5000 PSIG gaseous hydrogen railcar regulators was tested. The regulator was found to be leak-tight and regulated satisfactorily over a wide range of flow rates. The addition of considerable accumulator capacity in the dome loading volume was found to have a very favorable effect in eliminating dome pressure variations. As a result, regulated pressure variations are also considerably reduced.

The next two research tests are scheduled for November 3.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FACILITY NERVA XD1016(L.V. Humble) — NERVA engine propellant feed system tests. Four bootstrap tests were performed during November: Tests Nos. 14 and 15 on November 9, and Tests Nos. 16 and 17 on November 22. The primary test parameters are tabulated as follows:

	Test #14 Dry Pump	Test #15 Wet Pump	Test #16 Wet Pump	Test #17 Dry Pump
LH_2 Tank Pressure(psia)	35	35	35	35
Max Turbopump (RPM)	8,100	8,600	5,500	9,600
Max LH_2 Flow (PPS)	34	32.5	30	15
Duration LH_2 Flow (sec)	54	15.3	31.4	32.5

All controlled parameters followed the planned test profile for this series.

The turbopump bootstrapped successfully on all tests except #17. This test was an attempt to shorten the required time delay on pump speed for dry pump startup by throttling the pump discharge flow. Both pump speed and head rise were erratic during this test. The final two research tests in this program are scheduled for Dec 14.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA XD1016(L.V.Humble) — NERVA engine propellant feed system tests. On December 14, two wet bootstrap tests were performed. The primary test parameters are tabulated as follows: LH_2 Tank Press (psia): Test #18 = 25, Test #19 = 25 Max Turbopump Speed (rpm): Test #18 = 5500, Test #19 = 8650 Max LH_2 Flow (PPS): Test #18 = 22, Test #19 = 29 Duration LH_2 Flow (sec): Test #18 = 37.9, Test #19 = 28.3 All controlled parameters followed the planned test profiles. The turbopump bootstrapped successfully during both tests. These two tests complete the scheduled program. With the completion of the test program, the worth of the reactor reheat system was evaluated. This reheat system shortened the program completion date by approximately three months and saved over $50,000 worth of propellants. The installed cost of the reheat system was about $3000. By using the reheat system, six tests were performed as back-to-back, or second, runs. Also, it was possible to complete another test run which would have normally required rescheduling to another test day. A pump cavitation program has been approved for B-3 Stand. Detailed test requirements, task assignments, and schedules have not been published. The month of January will probably be spent removing the existing research hardware and overhauling the facility subsystems.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA YPD2070(L.V.Humble) — NERVA engine propellant feed system tests. Most of the bootstrap test research piping and equipment has been disassembled. All of the research equipment except the KIWI reactor will be out of the test stand by February 15. Removal of the reactor will require opening the south roll-up door and use of the overhead crane. Present plans are to leave the reactor in place until May or June when weather conditions will be more favorable. We have started overhauling the facility subsystems. The maintenance and repair of the major subsystems should be completed by the end of February. The research equipment installation design for the pump cavitation program has begun. Most of the research test requirements should be defined by February 15.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA YPD2070 (L.V.Humble) — NERVA engine propellant feed system tests. The liquid hydrogen run tank heat leak and temperature profile have been investigated and a summary of proposed procedures has been sent to the research group. A test will be performed with liquid hydrogen in the tank to define temperature gradients during chilldown. A rake is presently being designed to measure liquid hydrogen temperatures throughout the tank. Design calculations for the vapor bulb system are nearly complete. A design review meeting will probably be held within the next two weeks.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA YPD2070 (L.V.Humble) — NERVA engine propellant feed system tests. A division level meeting was held on March 27 to resolve the final differences over the operating document. Following this meeting, the Cleveland and Plum Brook project engineers drafted a rewrite which should be ready for signatures the first week of April. Fabrication of the pump mount, turbine discharge lines, and tank temperature rake have begun. The pump inlet line is being designed and appears to be a critical lead time item. A design review meeting should be held within the next two weeks.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	

NERVA
YPD2070(L.V.Humble)

NERVA engine propellant feed system tests.

The design of the new piping for the pump cavitation program is nearing completion. The purchase request for the pump inlet line should be ready to go to Procurement by the second week in May.

The vapor bulb design proposal was reviewed and accepted by Lewis-Cleveland.

A sketch of the total pressure rake has been sent to United Sensor for their comments and cost estimate.

Twelve (12) new pressure transducers are being procured to complete the requirements of the program.

The temperature rake for the liquid hydrogen tank is scheduled to be delivered the first week of May. Feed-thru connectors are being tested. The liquid hydrogen temperature test will probably be conducted the latter part of May.

The scram actuator for the turbopump speed control valve is scheduled to be shipped May 12. The analog computer simulation of the turbopump is still under consideration.

The presure vent servo-controller has been modified with 0.1% input resistors to increase the accuracy of the pressure control system.

A procedure for removing the KIWI reactor and carriage has been written. All of the required equipment has been located and its condition checked.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	

NERVA
YPD2070(L.V.Humble) — NERVA engine propellant feed system tests.

The pump inlet line purchase request, with drawings and specifications, has been sent to Procurement.

The temperature rake for the liquid hydrogen tank has not arrived. However, the tank temperature test has been delayed because of the Rosemount calibration dip test. The tank temperature profile test is scheduled for July 1. The Plum Brook proposal for the liquid hydrogen temperature measuring system has been written and is being forwarded to Cleveland for approval.

The turbopump over-acceleration device is scheduled for delivery July 15. The speed control valve scram actuator which was scheduled to be shipped May 12 has not been delivered.

Fabrication of the vapor bulb and the turbine discharge lines is complete and the reactor, nozzle, and carriage have been removed from the test stand and placed in storage.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA YPD2070(L.V.Humble) — NERVA engine propellant feed system tests. Most of the month of June was spent in making calibration dip tests with Rosemount's temperature probes and in installing the liquid hydrogen tank temperature rake. The installation of the tank temperature rake will be completed early in July. A tank temperature test is scheduled for July 22. The new tank vent valves will be installed for this test. Bids for the pump inlet line were opened June 23. The contract will be awarded July 3. This appears to be the critical item on the schedule. Set-up of the analog simulation control system for the cavitation tests is scheduled to begin July 10. The redesign of the turbine speed control valve scram actuator has not been completed by the manufacturer. Alternate methods of speed control and fast shutdown are being investigated.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
B-3	NUCLEAR ROCKET DYNAMICS AND CONTROLS FAC.	NERVA YPD2070(L.V.Humble) — NERVA engine propellant feed system tests. The test program for "B-3" was cancelled on July 19, 1967. All purchase requests and work orders were reviewed and those no longer needed were cancelled. The pump inlet line contract, which was awarded on July 6, 1967, was cancelled. The liquid hydrogen recovery system will be completed "in-house" as time permits. The recovery system is a general facility upgrading which was not specifically for the cancelled research program. The tank temperature profile test was run on July 25 and 26. The data is now being reduced and no further testing will be done unless additional data is required. A report will be made on the results.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CENTAUR STANDARD SHROUD TESTS	B-3	YPQ4239
CONTRACT MODS AND FACILITY CHECK OUT COMPLETION	December 1971.
INSTALLATION AND SYSTEM CHECKOUT COMPLETION	July 1972.
CRYOGENIC TESTS SCHEDULED FOR	July thru October 1972.
STRUCTURE TEST SCHEDULED FOR.	November 1972.
Tank removed from shipping pallet.	
Bubble leak checked.	
Pressure decay test in progress.	
X-ray test scheduled for	Week of February 1, 71.
Leak check with spent vacuum shoe scheduled for . . .	Week of February 15.

CHANGES: (schedule changes since last report)

CHANGES: None.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS (YPQ4239) LVD - J. C. HUMPHREY; RSD - W. E. KLEIN

CENTAUR TANK #55-7562 STATUS

The 7562 tank was removed from the shipping pallet and put into rings on January 13 and 14, 1971. The tank was then bubble leak checked in areas which were inaccessible while the tank was in the shipping pallet. No further leaks were found. On January 19, 1971, the tank was prepared for a pressure decay test to try to determine the overall leak rate.

The blast shield was removed from the aft edge of the 412 ring on January 28, 1971. The aft edge of the 412 ring was then bubble leak checked. Several bubble leaks were found. This indicates that the gas is coming up under the 412 ring and finding the easiest paths out through both the forward and aft edges of the 412 ring.

The tank is to be X-rayed the first week in February. Depending on the results of the X-ray, the tank will then be leak checked with a special vacuum shoe on the inside of the LOX tank. This fixture will be used in conjunction with a mass spectrometer to try to isolate the leak. This work should take place starting the third week in February.

The pressure decay test is still in progress and the data are being examined. The results are inconclusive at this time.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CHANGES: (schedule changes since last report)	
CENTAUR STANDARD SHROUD TESTS	B-3	YPQ4239
CONTRACT MODS AND FACILITY CHECK OUT COMPLETION . . .	December 1971.
INSTALLATION AND SYSTEM CHECK OUT COMPLETION.	July 1972.
CRYOGENIC TESTS SCHEDULED FOR	July thru October 1972.
STRUCTURE TEST SCHEDULED FOR.	November 1972.
Tank being X-rayed and checked.	
Design of test stand modifications underway.	
Design reviews are scheduled for	End of March 1971.
Concept drawings for catchnet system are scheduled to be completed	March 22, 1971.
Meeting with LMSC is scheduled for	Week of March 22, 1971.
Pre-concepts on cameras and lights are scheduled to be completed.	March 22, 1971.
Structures contract is scheduled to start.	June 1, 1971.
Equipment removal contract write-up is in progress.	
CHANGES: None.	

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

BACKGROUND

This is the first complete progress report for the Centaur Standard Shroud (CSS) qualification tests to be run in the B 3 Test Stand. The B-3 tests are part of a series of tests to flight qualify the CSS.

The CSS is a concept where one shroud can be used to launch a variety of payloads using a Titan-Centaur combination. The first scheduled use of the CSS will be for the Viking probe in early 1975. The shroud has two hinged petals that are 14 feet in diameter and 56 feet high. Lockheed Missiles and Space Company (LMSC) has been awarded a contract to build six shrouds. The first of these will be used for a test shroud. There is no spare test shroud in the event the first one should be damaged.

The first series of tests will consist of three cryogenic separation tests. Each shroud half will separate approximately 9 degrees before hitting the catchnets. The Centaur 7562 tank will be used inside the shroud. The hydrogen tank will be filled with liquid hydrogen and the LOX tank will be filled with liquid nitrogen. The hydrogen tank will probably be partially drained before initiating the separation.

The second series of tests will consist of a number of structural tests. The exact number, load value, and nature of the tests are still under discussion. However, these loads will be applied to the CSS and Centaur tank to simulate aerodynamic loads on the CSS, interstage adapter, stub adapter, truss adapter, and the Viking transition adapter. The CSS will be taken to 125% of flight design loads.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

STATUS

During the first week in February, X-rays were taken on the 7562 tank. These X-rays showed that approximately 375 spot welds had stress corrosion cracks. Approximately 1/3 of these were relatively bad. There were also five stress corrosion cracks which appeared in the two seam welds.

During the last week of February, a structures engineer from General Dynamics/Convair was at Plum Brook to inspect the tank. Upon close internal inspection of the LOX tank,he found approximately 70 spot welds that showed signs of the stress corrosion inside the tank. Some of these had a corrosion product on the surface similar to that found on the terminal of a car battery.

Approximately 41 of the 70 were leak checked using a small vacuum shoe connected to a Veeco. Out of these, there were five probable leakers and five definite leakers.

This information, along with the X-rays and the visual observations of the GD/C engineer, has been returned to GD/C for a decision on the status of the 7562 tank.

The design of the test stand structure and floor modifications and the loading fixtures is being done by the LeRC-Cleveland design groups. Most of this design work is well underway, and final design reviews are scheduled for the end of March.

The design of the catchnet system is being done by the Plum Brook Engineering Division. The intent is to use as much equipment as possible from the Skylab tests at SPF. Concept drawings and sketches are now being prepared. These are to be completed by March 22, 1971. Meetings with LMSC personnel have been scheduled at Plum Brook and at Cleveland during the week of March 22, 1971. The catching system concept drawings will be reviewed with LMSC at that time.

(Continued on Page 37)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued) The design work for the high speed movie cameras and lighting is being done by the Plum Brook Engineering Division in conjunction with the Photo Lab at Cleveland. The preliminary concepts are in the process of being put on paper. Concept drawings will be available for review at the LMSC meetings. The gas and propellants system design is also being done by the Plum Brook Engineering Division. Concept design work has just started and conceptual drawings will be available for the LMSC meetings. Work is in progress to put out a contract to remove the run tank, existing platforms, and miscellaneous valves and piping. This contract must be completed by the end of May 1971 to meet the schedule. The structures contract is scheduled to start June 1, 1971. There have been several delays in putting out a change order to the original Lockheed contract. This change order is needed to obtain design information on the catch system, movie cameras, and the Cleveland structural work. We have been able to get some information from Lockheed to start design concepts, but there is now a need for specific information. When Plum Brook management agreed to support the B-3 CSS tests in July 1970, the Hypersonic Tunnel Facility project was supposedly cancelled. Shortly after the CSS project information started coming in, the HTF project was re-activated.Consequently, the Plum Brook Mechanical Engineering Branch had to complete the HTF work before starting the B-3 work. This puts their design effort approximately one to two months behind where it should have been by this time. Our time schedule is fairly tight. Any further delays in getting information from Lockheed could impact the schedule and ultimately, the flight schedule. Any further delays on the design effort or the awarding of contracts could have the same effect. At this point we do not know the status of the 7562 tank or what impact it could have on the schedule.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YPQ4239

CONTRACT MODS AND FACILITY CHECK OUT COMPLETION	December 1971.
INSTALLATION AND SYSTEM CHECK OUT COMPLETION.	July 1972.
CRYOGENIC TESTS SCHEDULED FOR	July thru October 1972.
STRUCTURE TEST SCHEDULED FOR	November 1972.
Bid opening for the removal of site run tank is scheduled for	April 20, 1971.
Design of test stand structure, floor modifications, and work platform is about complete.	
Ad Hoc Committee on structural change formed.	
Structural contract is scheduled to be awarded by. . .	June 1, 1971.
Design work is centering on the catchnet system, movable work platform and electrical work.	
Gas and propellant feed system design has started.	
Tests are being made to evaluate straingage signal monitoring networks.	
PR's for hydraulic loading cylinders and controllers have been submitted.	
Preliminary hydraulic flow and abort system schematics are completed.	
Design of the bulkhead and propellant tank protective system is 75% complete.	
Vent control system transducers were ordered.	

CHANGES: Schedules added.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The work on the CSS project is progressing satisfactorily. With the exception of the leaky Centaur tank all problem areas are being resolved as they arise. Drawings for a major contract to strengthen the B-3 structure are in final review with contract award scheduled for June 1, 1971.

DISCUSSION

OPERATIONS

A decision has not been reached on what should be done with the leaky 7562 Centaur tank. It does appear at this time, however, that if the 7562 tank is to be used, it will be necessary to put it back into F site for at least one more cold shock test.

The site showing for the equipment removal contract is scheduled for April 5, 1971. This contract will remove the existing run tank and platforms from the stand. The bid opening should take place approximately April 20. The contractor will have 45 days to complete his work.

The Cleveland Facility Engineering Division design work on the test stand structure and floor modifications and on some new work platforms is now almost complete. Work is now progressing on the specifications. An Ad Hoc Committee was formed to review the proposed structural changes. The first Ad Hoc Meeting was held on March 29, 1971. The problems associated with handling shroud related equipment with the present limited travel crane dictated the need for an additional crane in B-3. Therefore, it was decided to add a 5-ton auxiliary crane under the bridge of the 65-ton crane to give the desired additional coverage. The crane installation is being added to the structural contract. This contract is scheduled to be awarded by June 1, 1971.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

The Plum Brook Engineering Division has continued work on the mechanical design of the shroud catchnet system and the three movable work platforms and the electrical design for the movie cameras and lighting. Some problems have been encountered in finding lamps with sufficient power and the desired filament temperature that will still be usable in an explosion-proof fixture. Equipment has been ordered to run some checkout tests to verify the proper operating characteristics of the lamps under consideration. Design work has also started on the gas and propellant feed systems. Lines are being sized and valve lists prepared. It appears that some of the equipment can be reused with only minor modifications required. Design concept drawings on all of the above systems were presented for comments at a joint NASA-Lockheed meeting during the week of March 29, 1971.

INSTRUMENTATION

A series of tests has been initiated to evaluate the proposed strain gage signal conditioning networks.

Tests planned will include noise rejection, lead-wire effects, thermal compensation, stability and system compatibility. Results thus far appear highly promising.

CONTROLS

Purchase requests for the hydraulic loading cylinders and controllers have been submitted.

Preliminary hydraulic flow and abort system schematics have been generated.

Design of the bulkhead and propellant tanks protection system is 75% complete. Transducers for the vent control systems have been ordered.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CENTAUR STANDARD SHROUD TESTS	B-3	YPQ4239
CONTRACT MODS AND FACILITY CHECK OUT COMPLETION	December 1971.
INSTALLATION AND SYSTEM CHECK OUT COMPLETION.	July 1972.
CRYOGENIC TESTS SCHEDULED FOR	July thru October 1972
STRUCTURE TEST SCHEDULED FOR.	November 1972.
ITEMS COMPLETED	
Design of structure and floor modifications.	
Explosion-proof lighting fixtures received.	
Camera locations submitted to Lockheed.	
Flow schematic and valve list (gas and feed systems)	
Strain gage signal conditioning networks tested.	
B-1 LH_2 level probe removed.	
PR initiated for loading cylinder controllers.	
Protection circuit design work (vent and bulkhead)	
Ordered tank pressure transducers.	
Prototype hydraulic actuator tested.	
ITEMS IN PROGRESS	
Equipment removal contract	Start week of May 3, Complete week of June 17.
Design of shroud catchnet system, work platform.	
Design of cameras and lighting electrical.	
Design of gas and propellant feed systems.	
Specifications for ΔP transducers.	

CHANGES: Progress schedules added.

CHANGES: (schedule changes since last report)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS (YPQ4239) LVD - J. C. HUMPHREY; RSD - W. E. KLEIN

SUMMARY

The work on the CSS project is progressing reasonably well. A few tasks are slightly behind schedule (mostly due to late arrival of preliminary information to start design). However, this should not create any significant problems provided there are no further delays.

The problem of the corroded and leaking spotwelds on the 7562 Centaur tank is nearing resolution. The contractor will start removal of excess equipment from the test stand early in May. Design of the test stand structural modifications is nearing completion and has been reviewed by the Ad Hoc review committee.The catchnet system design is progressing and procurement of the structural test loading fixtures is in progress.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

DISCUSSION

There still has been no decision on what to do with the 7562 Centaur tank. The latest word is that the tank will be used as it is without any further testing. If this is done, the test pressures will be lowered slightly and the portion of the structural tests which would significantly load the lower portions of the Centaur tank will be eliminated.

The equipment removal contract was awarded April 23, 1971, to Mack Iron of Sandusky. The contractor has 10 days to start and 45 days to complete his work.

The Cleveland Facility Engineering Division design work on the test stand structural and floor modifications is virtually complete. The drawings have been completed and the specifications are in Procurement typing. The Ad Hoc Committee formed to review the design made some relatively minor recommendations which were incorporated into the design. The contract is still scheduled to be awarded June 1, 1971.

The Plum Brook Engineering Division has continued work on the mechanical design of the shroud catchnet system, the three movable work platforms and on the electrical design for the movie cameras and lighting. Full time effort must be given to these three tasks if the schedule is to be met.

Design effort on the catching system is now being coordinated with T. Porada of the Systems Analysis Office in the Launch Vehicles Division. Mr. Porada is developing an analog model of the shroud and catchnet system. This should aid the design effort considerably and give increased confidence in the final design.

The explosion-proof lighting fixture proposed for the camera lighting has arrived. We are still waiting for the desired lamp to run some time-temperature tests.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS & CONTROL FACILITY (Continued)

A new camera location list and some new camera mounting concepts were submitted by Lockheed at the NASA-Lockheed meetings which ended April 2, 1971. Work is now proceeding on locating the cameras based on this new information.

Design work on the gas and propellant feed systems has continued. The flow schematic and a valve list are now complete and have been given to the Plum Brook Engineering Division. They have now started preliminary design effort on the propellant feed systems and on all of the electrical control circuits.

INSTRUMENTATION

Preliminary tests were completed on the proposed strain gage signal conditioning networks. These tests look very good and the results appear to give a strain gage error of less than ± 10 in./in. strain.For the majority of the strain measurements this is equivalent to less than 1% error. Further testing with another specimen is planned.

The LH_2 level probes were pulled out of the boiler plate Centaur tank in B-1. We are planning to use the flight LH_2 probe in the 7562 tank. A shorter, more accurate probe will be used to cover the top portion of the LH_2 tank for the boil-off tests.

CONTROLS

A supply contract for the loading cylinder controllers has been awarded. A purchase request was initiated and the controllers should be ordered approximately the first of May.

An RFP for the loading cylinders has been prepared. This should leave Procurement approximately the first of May.

Design work on the vent systems and on the bulkhead and tank protection circuits has been completed. The tank pressure transducers and most of the other components in the ΔP circuits have been ordered. The specifications for the ΔP transducers are being written.

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A prototype hydraulic actuator, load cell, and simulated load has been set up and operated successfully with feedback control at the D Site controls lab.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CENTAUR STANDARD SHROUD TESTS B-3	YP04239
CONTRACT MODS AND FACILITY CHECK OUT COMPLETION . . .	December 1971.
INSTALLATION AND SYSTEM CHECK OUT COMPLETION.	July 1972.
CRYOGENIC TESTS SCHEDULED FOR	August 15 to Nov. 15,72
STRUCTURE TEST SCHEDULED FOR	Feb. 1 to June 1973.
ITEMS COMPLETED	
46,000 gallon tank removed.	
Explosion-proof fixture and lamp tested.	
Second series of strain gage evaluations.	
Digital volt meter repaired and installed.	
Wind direction analog servo-resolver circuitry devel.	
ITEMS IN PROGRESS	
Equipment removal contract	Completion week of Jun 1.
Shroud catchnet system and work platform design.	
180° shroud model design work started.	
High speed movie camera lighting and valve electrical control design.	
Preliminary sketches of propellant feed and vent sys.	First week of June comp.
Servo valves purchase request initiated.	

CHANGES: *Progress schedules added.*

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The problem of the corroded and leaking spotwelds on the 7562 Centaur tank has been resolved by imposing a 2/3 load restriction on the aft tank mounting ring.

The equipment removal contract is near completion and site showing for the structural contract has been held.

Design of the shroud catchnet system, propellant feed and vent systems is proceeding satisfactorily.

DISCUSSION

OPERATIONS

Launch Vehicles Division has received a memo from GD/C listing their recommendations for using the 7562 Centaur tank. We can use the tank providing we do not exceed two-thirds of the rated loads at the aft tank mounting ring (412 ring).

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

The equipment removal contract is in progress and the 46,000 gallon run tank has been removed. The contract should be completed during the first week in June.

The site showing for the structural contract was held May 25, 1971. The bid opening is scheduled for June 3,1971. The contract calls for completion by October 1, 1971.

Most of the loading fixtures will be made in Paducah, Kentucky, by the AEC. This was necessary to meet the dates required by the schedule.

The Plum Brook Engineering Division has continued the effort on the mechanical design of the shroud catchnet system and the three moveable work platforms. Work has been started on the 180° model of the shroud half. This model will be used to proof test the catcher system. Work has continued on the electrical control design for the high speed movie cameras, lighting, and valves. Full time effort must be given to these tasks if the schedule is to be met.

The explosion-proof fixture and lamp proposed for the camera lighting was tested. It was found that the glass was the hottest point of the fixture. The temperature reached 675°F in one hour and was leveling off. Since the allowable temperature per the electrical code is approximately 850°F and since plans call for operating these lights for only about 15 minutes, this fixture-lamp combination is considered satisfactory.

Preliminary sketches of the propellant feed and vent systems are now in progress and are to be submitted the first part of June for approval. Final drawings will follow.

INSTRUMENTATION

The second series of strain gage evaluations has beer completed. Although the data has not been completely evaluated, some salient details are

(Continued on Page 41)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued) available; the noise level realized with the chevron bridge circuitry, as read on the noise checker at "H" Building, is quite acceptable. The average peak-to-peak noise is one part in 500 on a 5 MV channel. The scatter between gages also appears to be low. The Digital Volt Meter for the 400 channel scanner has been repaired and installed, a few minor problems remain to be corrected. The analog servo-resolver circuitry necessary to display wind direction on the SEL has been developed and will be tested shortly. CONTROLS Delivery date for the loading cylinder controllers is June 30. Proposals in response to the RFP for the loading cylinders are due the 10th of June. A purchase request for the servo valves is now in the procurement cycle. A hydraulic loading system design review committee has met twice. No major exceptions to the present design were encountered. A final report is now being formulated by the committee.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YPQ4239

STATUS	SCHEDULE
HINGE SPRING RATE TEST	June 1972.
CRYO-UNLATCH TESTS	Sep to Nov 15, 1972.
STRUCTURAL TESTS	Feb to Jun 1973.
HINGE LOADING TESTS	Jan 1974.
ITEMS COMPLETED	
Structural contract awarded.	
50,000# load cells received.	
10,000# load cells ordered.	
Servo valve contract awarded.	
Some servo controllers were shipped.	
ITEMS IN PROGRESS	
180 degree shroud half model design.	
Propellant feed design.	
Vent system design.	
Electrical control design.	
Camera, lighting and valve electrical design.	
Load cells being calibrated.	
Hydraulic loading cylinder design.	

CHANGES: Schedules added.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The equipment removal contract has been completed and the structural contract was awarded to Sandusky Fabricating and Sales, Inc. for $99,950 and 120 days completion. This contract was negotiated for a reduction from 180 day completion to 120 day completion. This shortened completion date has returned the pressure to the Plum Brook Engineering Division for expeditious completion of the design work.

DISCUSSION

On June 2, the day before the structural contract bids were to be opened, the contract was extended from 120 day to 180 day completion time. This was done because several of the contractors receiving the IFB were stating they could not meet the 120 day completion time. This caused fears that there would be no response on the IFB or that the prices would be too high. As a result of the contract time extension, six bids were received. The contract was awarded to Sandusky Fabricating and Sales, Inc.,for $84,950. Subsequent to the award,a 120 day completion was negotiated for an increase of $15,000. and a $250. per day liquidated damages clause. This total contract price of $99,950 was less than the original government estimate and also less than the next bidder. Schedules are now being revised to show the extent of the impact of the contract modification.

The Plum Brook Engineering Division has continued their design efforts. The Mechanical Engineering Branch effort was devoted to the 180 degree shroud half model and the propellant feed and vent systems. Design work is almost complete on the shroud model and some of the work is now in drafting. The design and drafting on the vacuum jacketed portion of the liquid hydrogen supply line is virtually complete. Work is continuing on the rest of the propellant feed and vent systems. The Electrical Engineering Branch has continued work on the electrical control design, the high speed movie camera, lighting, and valves.

The equipment removal contract is now complete.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued) INSTRUMENTATION The 50,000# load cells have been received, and are now being calibrated at Lewis-Cleveland. The 10,000# load cells (new requirement) have been placed on order. A new specimen has been assembled for the strain gage accuracy test. The initial specimen experienced adhesive failure on some strain relief tabs. Since the system experienced a non-reproducible zero shift (approximately 5% F.S.), it was decided to duplicate the test with a new specimen. CONTROLS The HLA (Hydraulic Loading Actuators) control has been technically evaluated and a recommendation has been sent to procurement regarding award. The servo valve contract has been let. A portion of the servo controllers have been shipped, the rest are due shortly from the factory. Preliminary design work has begun on the hydraulic loading cylinger for the hinge test and the model unlatch jettison test. The ΔP error monitor chassis and front panel have been fabricated.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YPQ4239

HINGE SPRING RATE TEST	June 1972.
CRYO-UNLATCH TESTS	Sep to Nov 15, 1972.
STRUCTURAL TESTS	Feb to Jun 1973.
HINGE LOADING TESTS	Jan 1974.
ITEMS COMPLETED	
Shroud half model design	
Liquid hydrogen supply line design	
New and old valve control design	
Camera location drawings redone	
Shroud handling procedures	
Additional load cells ordered	
Controllers and servo valves received	
Load simulator for proof test ordered	
ITEMS IN PROGRESS	
Shroud catcher and model hinger being designed . . .	Aug 1 (completion date)
Camera and light control schematics	
Bulkhead ΔP error monitor wiring	10% complete
Failsafe manifolds, cylinders and controllers being ordered.	
Main load test design started.	

CHANGES: None

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS (YPQ4239) — LVD - J. C. HUMPHREY; RSD - W. E. KLEIN

SUMMARY

The shroud half model design is complete and has been sent to LVD for approval. Design and drafting of the shroud catcher and model hinge is nearly complete. Control circuit design is now in drafting. Camera and lighting locations have been sent to Lockheed for approval.

Shroud handling procedures and design concepts will be discussed with Lockheed the week of August 30 in Cleveland.

Failsafe manifolds, cylinders and controllers for the Hinge and Jettison tests have been ordered.

DISCUSSION

OPERATIONS

The Plum Brook Mechanical Engineering Branch completed their design effort on the shroud half model. The drawings have been sent to Launch Vehicles Division for their approval. Design and drafting is proceeding on the shroud catcher and model hinge. These drawings should be complete about August 1, 1971. The snubber system concepts are almost complete and should go to drafting about August 1, 1971. The drawing for the vacuum jacketed portion of the liquid hydrogen supply line has been approved and signed off. The drawing for the rest of the liquid hydrogen supply line is complete and check prints have been distributed for comments.

Lockheed is coming to Cleveland for a series of meetings during the week of August 30, 1971. All of the above information will be discussed with them at that time.

The Plum Brook Electrical Engineering Branch completed their design effort on 20 new valve control circuits. These circuits are now in drafting. Drawings have been marked up for minor changes to about 20 existing valve control circuits. A work order has been written to do this work in-house. The camera location drawings have been redone again and have been sent to Lockheed for approval. A drawing showing the location of the lighting was also sent. These two items have been a problem

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS

OPERATIONS (Continued)

area from the start and the locations must be settled now to meet the schedules. Work is progressing on the control schematics for the cameras and lights. Purchase requests have been written for most of the components for the camera and light control circuits.

Shroud handling procedures have been written and sent to Lockheed for comment. These procedures will be discussed the week of August 30. Work is progressing on the control panel layouts and the pneumatic system flow schematic.

INSTRUMENTATION

The 12 additional load cells have been ordered. This completes the known requirements.

Since the shroud is scheduled to be listed at SPF following the B-3 tests, several coordination meetings with SPF personnel have been held to insure the mutual use of all instrumentation. Further coordination requires sufficient information from Cleveland to resolve common measurements.

The second set of strain gage accuracy tests have not yet been made due to technician shortage. It is expected that these tests will be completed the first week in August.

CONTROLS

Wiring of the bulkhead delta-P error monitor is 10% complete.

The controllers and servo valves required for the main loading tests have been received. The PR and specifications for the failsafe manifolds, cylinders, and controllers required for the Hinge and Jettison tests have been written. The load simulator for the proof test has been ordered. Work has started on wiring prints and cable requirements for the main load tests. A work order to the shop for repair and checkout of the necessary servo valves for the Hinge tests is also in progress.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS	B-3	YPQ4239
HINGE SPRING RATE TEST		June 1972.
CRYO-UNLATCH TESTS		Sep to Nov 15, 1972.
STRUCTURAL TESTS		Feb to June 1973.
HINGE UNLOADING TESTS		Jan 1974.
ITEMS COMPLETED		
Control actuators & controllers ready for inspection.		
Prints for controls patchboard & interconnections.		
Hydraulics proof test equipment received.		
ITEMS IN PROGRESS		
Design of catchnet.		
Design of movable work platforms (info needed)		
Structural steel installation proceeding on schedule.		
Loading actuators, 1/2 model hydraulic loading actuator and failsafe manifold being procured.		
Fabrication of 7 hydraulic loading actuators scheduled to be completed		Week of Sep. 22.
Hinge test servo valves being checked.		
Structural test controllers being inspected.		
Patchboard and control interconnects started.		
Electrical design for cont. & actuators		95% complete.

CHANGES: None.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS (YPQ4239) — LVD - J. C. HUMPHREY; RSD - W. E. KLEIN

SUMMARY

Design effort is on schedule in all phases except the movable platforms, cameras and shroud pyrotechnics. The structural steel contractor is on schedule. The technique for welding of thermocouples to samples of the aluminum shroud has not been successful at this time. Lockheed is reviewing their techniques for necessary changes.

Control actuators and controllers for the structural test are ready for inspection. Electrical prints for

(Continued on Page 33)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

this installation are nearly complete. Purchase requests for the hinge test actuators and the 1/2 model loading actuator are in procurement.

DISCUSSION

OPERATIONS

A series of meetings with LeRC and Lockheed personnel started August 31 and will end September 2. No major changes resulted from the August 31 meeting on the catchnet mechanism being designed by Plum Brook Engineering Division.

Plum Brook Engineering Division is on schedule in all phases except the design effort on the movable work platforms. Information is still needed from Launch Vehicles Division on cameras and shroud pyrotechnics to finalize those phases of the design effort. This information must be forthcoming soon to remain on schedule.

Rocket Systems Division has to order the loading cables in September to remain on schedule. The design review of the gas and liquid flow schematic must be completed in September.

The structural steel contractor has been in the test stand since early August. His work is progressing satisfactorily, both in speed and in quality. Barring any major problem, this contract should be completed on or ahead of schedule.

INSTRUMENTATION

The second strain gage accuracy tests were delayed to the first week in September due to B-2 manpower priority. Construction of stain gage balance panels will begin after analysis of the test data.

Spot welding of the thermocouples to samples of the aluminum shroud by Lockheed at Plum Brook was unsuccessful. Lockheed is to review their techniques and supply detailed information.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued) CONTROLS The purchase requests for the hinge test hydraulic loading actuators, 1/2 model jettison hydraulic loading actuator, and failsafe manifolds are all currently in the procurement cycle. The seven hydraulic loading actuators for the structural test are scheduled for inspection at the contractor plant the week of September 22. Servo valves for the hinge tests are currently being checked at the valve shop. The controllers for the structural test are being inspected at the standards lab. Prints for the controls patchboard and controller interconnections are complete and work has been started. Electrical prints for the installation of the controllers and hydraulic loading actuators are 95% completed. Equipment required for the hydraulics proof test has been received. The purchase request for cables, turnbuckles and associated hardware is waiting final dimensions for cable lengths. These dimensions are due from Lewis-Cleveland in one week.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YPQ4239

STATUS	SCHEDULE
HINGE SPRING RATE TEST	May 1972.
CRYO-UNLATCH TESTS	Aug to Oct 15, 1972.
STRUCTURAL TESTS	Jan to May 1973.
HINGE UNLOADING TESTS	Jan 1974.
ITEMS COMPLETED Straingage accuracy tests. Hydraulic proof tests instruments and controls ordered.	
ITEMS IN PROGRESS CSS Catcher system design has to be changed. Work platforms, misc. steel work, loading cables, misc. hardware, piping install., shroud model, valve elec. components, camera controls & lights are being procured. Structural steel contractor proceeding. Controller and load system elect. work started. Radial proof tests cable design work started.	

CHANGES: Schedules changed.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS (YPQ4239) LVD - J. C. HUMPHREY; RSD - W. E. KLEIN

SUMMARY

Conceptual design of the CSS Catcher System is being changed. Lockheed's final shroud design dictates lower catcher requirements. When the new concepts are finalized, a new time schedule will be determined.

Several items are slipping behind schedule. All efforts are being taken to boost the manpower required to do the tasks.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

DISCUSSION

OPERATIONS

Major changes are being considered in the CSS catcher system designed by the Plum Brook Engineering Division. Design of the catcher system started before a design was finalized by Lockheed for the shroud. Therefore, the catcher requirements have been changed as the final design of the shroud evolved. Plum Brook now finds itself in the position of having a catcher system designed that is not totally compatible with the Lockheed designed shroud. Some parts of the system will have to be redesigned to keep the loads put into the shroud by the catcher system at a lower than anticipated level. When the new concepts are finalized and approved, a new time schedule will be determined. By the end of the first week in October, the overall impact on the schedule should be known.

Launch Vehicles Division still owes Plum Brook information on the camera locations between the shroud and Centaur tank and those on top of the tank. No design effort is being put into this area. This information is long past due and will now start impacting the schedule.

A number of PR's and contracts are now in various phases of the procurement cycle. These include such items as work platforms and miscellaneous steel work, loading cables and miscellaneous hardware, piping installation, shroud model, and electrical components for valve and camera controls and camera lights.

The structural steel contractor is progressing quite satisfactorily. It appears at this time that he will also receive a change to his contract to fabricate and install some additional miscellaneous items. Included will be the additional building structural steel changes needed to perform the hinge and vent fin tests.

Rocket Systems Division is behind schedule on the propellant and purge gas flow schematic and on the control panel layouts.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued) INSTRUMENTATION The straingage accuracy tests were completed. Purchase orders have been placed for power supplies, load cells, and special pressure transducers needed for the hydraulic proof tests. CONTROLS Electrical prints for the controllers and associated load control system have been finished and work has started on these items in B-Control. Sketches for the Failsafe System have been sent to engineering and some material has been placed on order. Most of the items required for the hydraulic proof test have been purchased or are in Outside Fabrication. Cables, turnbuckles, and wire are also in the procurement cycle. Design work has started on the remaining cable and hardware required by the radial proof tests.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CENTAUR STANDARD SHROUD TESTS	B-3	YPQ4239
HINGE SPRING RATE TEST	May 1972.
CRYO-UNLATCH TESTS	Aug to Oct 15, 1972.
STRUCTURAL TESTS	Jan to May 1973.
HINGE UNLOADING TESTS	Jan 1974.
ITEMS COMPLETED	
Structural steel contract completed.	
Old "B" control panel removed.	
Two of seven hydraulic loading cylinders were acceptance checked.	
ITEMS IN PROGRESS	
Installation of proof test hydraulic lines started. (Proof Test schl'd for . . .	December 1971.)
Preparing contract for installation of hydraulic proof test items.	
Conduit and wiring being installed.	
New catching system being designed.	
Piping design nearly completed.	
Proof test strain gage installation started.	
Proof test load cells being calibrated.	
Control room wiring	50% complete.
Failsafe circuits being designed.	
Hinge, vent fins and jettison cylinders bid opening.	November 2, 1971
Axial cables scheduled to be delivered	November 18, 1971
Adaptors, rods & proof test parts - bid opening . .	October 29, 1971
Lateral proof test cables scheduled to be delivered.	December 15, 1971
Pyro-system designs started.	

CHANGES: None

CHANGES: (schedule changes since last report)

B-3 ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The structural steel contract is complete. An installation contract for the loading fixtures, cylinders, etc. is being prepared. This contract may be the pacing item for the hydraulic proof test.

The new concept for the catching system is complete and final design has started. This design change may cause a two to four week delay in the schedule.

Both pyro-system designs have been started but information on the locations of the movie cameras inside the shroud is still needed from Launch Vehicles Division.

DISCUSSION

OPERATIONS

The structural steel contract has now been completed. Mechanics and electricians are now working in the test stand. The Mechanics are oiling the aft ring on the Centaur tank to inhibit further corrosion in the spot welds. Work has started on the hydraulic lines for the hydraulic proof test scheduled for December. Some of the equipment needed for the proof test is now arriving, but some is not scheduled for delivery until the first part of December. Late delivery of some of these items could delay the start of the hydraulic proof test.

The electricians are installing conduits and connecting wires that were removed for the structural steel contract. The old control panel and graphic panel in "B" control have been removed.

The installation of the loading fixtures, cylinders, etc. for the hydraulic proof test will be contracted and a purchase request is now being processed and

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued) specifications and assembly drawings are being completed. This contract could well become the pacing item for the proof test since we need approximately two weeks after the fixtures are stacked to install instrumentation and control wiring and to run check out tests. A list of jobs and the manhours needed to complete each job has been completed for the mechanics. There is a total of approximately 1800 manhours work remaining between now and the first of January. This list will now be transferred to a calendar schedule, based on equipment deliveries to determine weekly manhour requirements. The new concepts for the catching system are virtually complete and the final design effort has begun. The new design has no movable framework and the shroud will see significantly lower stress levels. The exact impact of the design change on the schedule is still not known, but may cause a two to four week delay in the schedule. The design effort and specifications are nearly complete for the piping contract. This contract should be ready to go out for bid in about two weeks. Plum Brook personnel will install the purge tubing for the tank and shroud. The gas and propellant control panel and the test stand wiring for the cryogenic systems have been included in this contract. Launch Vehicles Division still owes Plum Brook information on the locations of the movie cameras inside the shroud. Additional information was received on the pyrotechnic systems at the end of this month. Plum Brook now has sufficient information to design the electrical controls and safety interlocks for both pyro systems. (Continued on Page 39)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

INSTRUMENTATION

Strain gage installation for the hydraulic proof testing has started. The strain gage power supplies and the load cells have been received. The load cells are presently being calibrated.

CONTROLS

Approximately 50% of the control room wiring for the load control loops has been completed. The ΔP monitor is completed except for check out. The Engineering Division is still working on the failsafe circuits. Most of the mechanical and electrical hardware required has already been received. Two of the seven hydraulic loading cylinders have been acceptance checked with good results.

The following is the status of purchase requests currently in the procurement cycle:

(1) Hinge, vent fin, and jettison cylinders - Bid opening - 11-2-71.

(2) Axial cables - Delivery 11-18-71.

(3) Adaptors, rods and proof test parts - Bid opening - 10-29-71.

(4) Additional turnbuckles, etc. - Delivery 11-18-71.

(5) Lateral proof test cables - Delivery 12-15-71.

Hydraulic panels, cylinder and tubing installation are currently being laid out by operations. The valve shop has started locating parts.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
CENTAUR STANDARD SHROUD TESTS	B-3	YPQ4239

STATUS	SCHEDULE
HINGE SPRING RATE TEST	June 1 - 15, 1972.
CRYO-UNLATCH TESTS	Aug 15 - Nov 15, 1972.
STRUCTURAL TESTS	Feb - June, 1973.
HINGE UNLOADING TESTS	Jan 1974.
ITEMS COMPLETED	
Stokes vacuum pump checked out.	
Reinstalled conduit and wiring (removed for contractor)	
Mechanical piping and electrical contracts out for bid	Bid opening - 12-29-71
Strain gages installed on loading cylinders.	
The scanner and SEL have been repaired.	
All of the instrumentation components for the hydrogen proof test are on hand.	
Hinge, vent fin and jettison cylinders were ordered.	
ITEMS IN PROGRESS	
Accumulator panels, pipe lines, etc. for hydraulic proof test being installed	Jan 10, 1972
Design for catcher system nearly completed.	
Failsafe circuits and servo rake wiring being instld.	
Designing valve actuators & Centaur track protectors.	
PRE design started on model jettison "spring" and camera feedback circuits.	

CHANGES: (schedule changes since last report)

CHANGES: Schedules changed.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The stack-up contract for the hydraulic proof test will be awarded December 3. Work will start December 8 with a completion of 21 days required. Starting date for the hydraulic proof test is January 10 and is still valid at this time.

Site showing for the piping and electrical contract is December 15 with the bid opening scheduled for December 29. This contract must be completed by April 1 so the system validation tests can be started July 1.

Any further changes and/or additions to the requirements or test plan will probably impact the starting date for the cryogenic separation test program which is scheduled for August 15.

DISCUSSION

OPERATIONS

The contract for the "stack-up" of the equipment for the hydraulic proof test should be awarded about December 1, 1971 and the contractor is scheduled to start work the week of December 6, 1971. The last items needed for this contract are due December 17. The contractor has a required completion time of three weeks.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

(Continued)

The B-3 mechanics are installing accumulator panels, hydraulic lines, etc. for the hydraulic proof test. They have also checked out a Stokes vacuum pump for installation in the stand by the "stack-up" contractor.

The B-3 electricians have virtually completed reinstalling all of the conduit and wires that had to be removed for the structural steel contract. They are also working on various other jobs needed for the hydraulic proof test. The hydraulic proof tests are expected to start during the week of January 10, 1972.

The IFB for the mechanical piping and electrical contract has been mailed. The site showing is scheduled for December 15 and the bid opening will be December 29. The contract has to be completed by April 1, 1972 to be on schedule. We have requested the contactor to start the upper level work first. This will allow us to start stacking flight hardware after he is complete down to level four.

The design effort on the new light weight catcher systems has been nearly completed and parts are going out for fabrication. An analog computer run was made by Cleveland the last week in November. This information gave expected net forces more than double those which we had previously received. The exact impact on the schedule is still not known, but is expected to add one week on the completion of the catcher system proof tests.

The present schedule shows the preparations for the catcher system proof test starting about February 22, 1972. About the last week in November we were requested to simulate the shroud springs in the model actuator system. This was a change in concept and required the addition of a load cell in the actuator assembly. We presently feel this can be done without impacting the overall schedule.

The above problems are typical of several we have had with this and other systems. Design information we request from Cleveland is almost always later than the original request date and usually received at the last

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued) possible date to meet schedule. There have been several instances where the final information is significantly different than preliminary information received at an earlier date. The catcher system has probably been the worst example of this. In addition, the program objectives and effort required have multiplied over the original estimates based on information received more than a year ago. All of the above changes have been absorbed without changing the end date. The schedule is now so tight that no further schedule perturbations can be tolerated without changing the end date. INSTRUMENTATION The strain gage installation on the loading cylinders is complete. Connector locations on the Titan skirt have been established, and the strain gage installations are progressing. The scanner has been repaired and is now working. The SEL has been repaired and will be qualified the first week in December. All components required to support the hydraulic proof test are on hand. Heavy Facilities Service Division support is scheduled for the last two weeks in December. CONTROLS The hydraulic loading actuators have been checked out and are ready for shipment to B-3. Electrical is installing the failsafe circuits and servo valve wiring. The hinge, vent fin and jettison cylinders have been ordered. The lateral proof test cables are due December 15, 1971. Work has started designing valve actuators and tack protection systems for the Centaur tank. Preliminary design work has begun on the model jettison "spring" simulation and camera speed feedback circuits.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS (YPQ4239) LVD - J. C. HUMPHREY; RSD - W. E. KLEIN

SUMMARY

Preparations for the hydraulic proof test are progressing satisfactorily and the scheduled test dates between January 10 and 21, 1972 will be met. The 1/2 shroud model catch system test is scheduled for February 21, 1972 and all necessary equipment is on order.

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NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CHANGES: (schedule changes since last report)	
CENTAUR STANDARD SHROUD TESTS B-3	YPQ4239
HYDRAULIC PROOF TEST	Between Jan 10 & 21,72.
HINGE SPRING RATE TEST	June 1 - 15, 1972.
CRYO-UNLATCH TESTS	Aug 15 - Nov 15, 1972.
STRUCTURAL TESTS	Feb - June, 1973.
HINGE UNLOADING TESTS	Jan 1974.
ITEMS COMPLETED	
Stack-up contract completed.	
1/2 shroud model catch system parts are all ordered. Testing scheduled for	Feb 21, 1972.
Piping contract bids opened	Dec 29, 1971.
Structural test deflectometers were ordered.	
Hydraulic Proof Test control hardware installed.	
CF-16A installed.	
CF-16A-910 computer interface checked out.	
Hydraulic system cleaned and checked out.	
Run information, relay assignments, & programmer data finalized.	
Model jettison cylinder delivered.	
ITEMS IN PROGRESS	
Hydraulic proof test instrumentation 90% complete . .	Jan 9 completion.
Structural test instrumentation components being ord.	
Signal conditioning boxes in progress.	
Abort program being modified.	
Data cards being prepared.	
Disc brake test being designed.	
Actuators and tank pressurization equipment are being procured.	
Control check lists, flow sheets are	70% complete.

SITE	SITE NAME RESEARCH INSTALLATION &(TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

DISCUSSION

OPERATIONS

Installation is on schedule and the hydraulic proof test will be run between January 10 and 21, 1972. The stack-up contract is completed. Only a few minor problems in fitting up and checking out all of the hydraulic proof test equipment have been encountered. It now appears we should be finished taking data by January 21, 1972. Tear down of the equipment will start following the last test.

All equipment for the 1/2 shroud model catch system test is now on order. All scheduled deliveries support the existing schedule. We should be ready to start testing by February 21, 1972.

The bids for the piping contract were opened on December 29, 1971. Five bids were received. Four of these were at, or below, the Government estimate. The bids will be reviewed by the Legal Office at Cleveland before the contract is awarded. The contractor has 90 days to complete the contract and this will place the completion around April 1, 1972, thereby maintaining our schedule.

INSTRUMENTATION

The instrumentation for the hydraulic proof test is 90% complete. No problems are expected in supporting this test during the week of January 10, 1972.

The instrumentation requirements for the 1/2 model shroud catch system tests that are to follow the hydraulic proof tests have not been finalized yet.

The instrumentation for the structural tests has started. The deflectometers are on order. The orders for all components should be complete by the next report period. The assembly of the signal conditioning boxes has started.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	CONTROLS All hardware for the B-2 hydraulic proof test has been installed. The HTF sequence and abort program is being modified for B-3. The CF-16A has been installed and the CF-16A -910 computer interface has been checked out. The hydraulic system at B-3 has been cleaned and checked out. All run information, relay assignments, and programmer data has been finalized and data cards are being prepared. The model Jettison Cylinder has been received and will be checked out at "D" Site. The disc brake test is currently being designed by engineering. These tests will be conducted at "D" Site. Actuators and equipment for the Centaur tank pressurization are in Procurement. Check lists, recording flow sheets, and other proof test run requirements are approximately 70% complete.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
CENTAUR STANDARD SHROUD TESTS	B-3	YPQ4239

STATUS	SCHEDULE
SHROUD MODEL CATCH SYSTEM TEST	Feb 28, 1972
HINGE SPRING RATE TEST	Jun 1 - 15, 1972.
CRYO-UNLATCH TESTS	Aug 1 - Nov 1, 1972
STRUCTURAL TESTS	Jan 15 - May 1, 1973
HINGE LOADING TESTS.	Dec 1973.
ITEMS COMPLETED	
Hydraulic proof test completed	Jan 27, 1972.
Piping contract awarded, notice to proceed given . .	Jan 26, 1972.
Most of half model shroud catch system instrumentation delivered or on hand.	
Catchnet load cells fabricated.	
ITEMS IN PROGRESS	
Installing shroud model catch system.	
Shroud half model scheduled to be delivered	Feb 17, 1972.
Net catch system brakes being checked at D-Site.	
Negotiating with piping contractor (for April 1 comp)	
Evaluating cause of axial load cell sensitivity shift.	
Catchnet load cells gages being installed.	
Analog simulation for intiator cylinder control systems in progress.	
Designing camera controls and indicator circuits.	

CHANGES: Schedule

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The hydraulic proof test of the hydraulic system, cables and control system was completed January 27.

The shroud model catch system test scheduled for February 28 is dependent on delivery of the model shroud. The shroud fabrication contractor has material problems and welding certification problems. A possibility of one month delay in this test appears likely at this time.

The piping contract was awarded to Wrightco, Inc., with the 90 day completion date being April 25. Procurement and construction office efforts are being made to reduce the completion date to April 1.

DISCUSSION

OPERATIONS

Set up and check-out of the hydraulic proof test hardware was completed. The hydraulic proof test was started on January 14, 1972. The only major problem encountered during the test was the untwisting of two cables under load conditions, which started to unscrew the piston shaft from a part of the hydraulic cylinder body. The problem was resolved by adding swivels in all the cable stack-ups. The hydraulic proof test was completed per test plan on January 27, 1972. Norris Bros. will begin tear down of the stack-up on February 1, 1972.

Equipment is now being installed in B-3 for the shroud model catch system test scheduled for February 28, 1972. The shroud half model is scheduled to be completed and delivered at the site on February 17, 1972.

The contract for the piping was awarded to Wrightco, Inc., Cleveland. But due to a protest by the next

(Continued on Page 31)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (Continued)

lowest bidder, the notice to proceed was delayed to January 26, 1972. This extends the contract completion date to April 25, 1972. Negotiations with the contractor to complete the contract by April 1, 1972 are in progress.

INSTRUMENTATION

Instruments performed well on the Hydraulic Proof Test. However, the 50,000 pound axial load cell appeared to have a sensitivity shift during the test and is being evaluated.

Instruments for the half model shroud catch system are either on hand, or will be delivered in time to support the tests. The catch net load cells have been fabricated and sent to Lewis-Cleveland for gauge installation and calibration.

CONTROLS

The hard, soft, and super soft loads on the hydraulic proof test cages were completed the third week in January. All hardware, software, and interface equipment worked satisfactorily.

The disc brake test is being conducted at D-Site. The test is designed to determine brake settings required for stopping the half model shroud jettison. An analog simulation is currently being performed for the initiator cylinder control system. The initiator cylinder has been checked out at D-Site and meets performance specifications.

Some of the hardware for the Centaur pressurization system has been received. Camera control and indicator circuits are also being designed for later tests.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS (YPQ4239) LVD - J. C. HUMPHREY; RSD - W. E. KLEIN

SUMMARY

The shroud half model was completed on February 26. Instrumentation is being installed and the shroud will be erected in B-3 March 3, 1972. The shroud half model test is scheduled for March 9 and 10.

The piping contractor has reduced his completion date from April 25 to April 3 for increased compensation.

All attempts are being made to keep the program on schedule. Gordon MacKay has been named facility coordinator to expedite the program.

(Continued on Page 33)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CENTAUR STANDARD SHROUD TESTS B-3	YP04239
SHROUD HALF MODEL CATCH SYSTEM TEST	Mar 9 & 10, 1972.
HINGE SPRING RATE TEST.	Jun 1 - 15, 1972.
CRYO-UNLATCH TESTS.	Aug 1 - Nov 1, 1972.
STRUCTURAL TESTS.	Jan 15 - May 1, 1973
HINGE LOADING TESTS	Dec 1973.
ITEMS COMPLETED	
Fab of shroud half model completed	Feb 26, 1972.
Shroud half model instrumented.	
Piping contractor awarded change order to reduce installation time.	
14 valves located for electrical wiring.	
Hydraulic proof test equipment was removed	Feb 4, 1972
Brake calibrations and c/o were run at D-Site.	
Strain gage printed circuit cards were received.	
Strain gage & deflector measurements power supplies returned to factory.	
Layout of capacitance measuring electronics compltd.	
Half Model, Hydraulic Cylinder installed & c/o.	
Hinge test cylinder delivered.	
Facility coordinator assigned to project.	
ITEMS IN PROGRESS	
Piping installation, now scheduled to be completed .	Apr 3, 1972.
Movie cameras electrical contract is scheduled to be completed	Apr 1, 1972.
Making modifications on hydraulic circuitry.	
Planning stretch test on structural load cables.	
Making plans for spring rate simulating tests.	

CHANGES: (schedule changes since last report)

CHANGES: Catch system test schedule

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS (Continued)

DISCUSSION

OPERATIONS

The tear down of the hydraulic proof test stack-up was completed on February 4, 1972. The forward load application fixture, Centaur loading cylinder, and shroud loading cylinder were weighed and stored outdoors at B-3.

The shroud catchnet brake calibrations and check out were run at D-Site and 5 brakes are now calibrated.

The electrical contract for the movie cameras is scheduled to be completed about March 1, 1972.

The piping contractor, Wrightco, is now on the job and has agreed to reduce the completion time for the contract from April 25, 1972 to April 3, 1972 for an increase in price of $15,000. The piping contract called for wiring valves other than those installed by the piping contractor. Therefore, fourteen valves had to be placed at their permanent location ahead of schedule.

The shroud half model was completed by the contractor at SPF on February 26, 1972 and has been instrumented. The shroud half model and hardware will be installed in B-3 about March 2, 1972. The model catch system test is now rescheduled for March 9, 1972.

INSTRUMENTATION

All instrument installations on the shroud model were completed at the SPF Building. This will allow the shroud model to be erected at the B-3 test stand without delay for instrument installation. All material required for the instrumentation is on hand.

The printed circuit cards for the strain gage circuitry have been received. The power supplies for the strain and deflection measurements have been returned by the factory. Installation of these items will follow the shroud test. The capacitance measuring electronics layout is 100% complete.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (Continued)

CONTROLS

The hydraulic cylinder for the half model jettison test has been installed and checked out. Final modifications are being made to the circuitry before the half model shroud is placed on the cylinder.

A stretch test is being planned to check the stretch in the 66' structural load cables. Results from the test will determine whether different cables will be needed.

All of the cylinders required for the hinge test have been received. Plans are being made to run a simulated test for the spring rates expected. These tests will be performed at D-Site.

A preliminary check has been made of the start and Time Zero (To) signal for the cameras. The voltage feedback signals indicating film movement will be checked when the cameras are run.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

HINGE SPRING RATE TEST	May 21 (completion)
CRYO-UNLATCH TESTS	Aug 1 - Nov 1, 1972
STRUCTURAL TESTS	Jan 15 - May 1, 1973
HINGE LOADING TESTS	Dec 1973.
ITEMS COMPLETED	
Shroud half model tests completed	Mar 15, 1972.
Shroud removed from stand	Mar 24, 1972.
All piping work above level four except 8" vent insul.	
Contract awarded for installation of work platform.	
Contract awarded for installation misc. mech. tasks.	
Most of instrumentation parts for Hinge Test on hand.	
Procurement of vent system controls completed.	
ITEMS IN PROGRESS	
Piping contract estimated completion	April 19, 1972.
Installing purge lines and other equipment.	
Making instrumentation wiring modifications.	
Testing control system hinge test cylinders.	
Installing vent system control system in control room.	

CHANGES: Hinge spring rate test schedule (was June 15 now May 21).

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	**ROCKET DYNAMICS AND CONTROL FACILITY**

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The test program for the shroud half model was completed on March 15, 1972. The test data was satisfactory and the model was removed on March 24, 1972.

Preparations for the hinge test are progressing satisfactorily. An attempt to complete the hinge test on

(Continued on Page 27)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD
SHROUD TESTS (Continued)

May 21 instead of June 15 is being made because of early delivery of the hardware. This three week early hinge test date is dependent on many variables but every effort will be made to meet the new schedule.

The scheduled date of August 1 for the cryo-unlatch testing is firm. The cryogenic piping will be three weeks late but because of early delivery of the hardware and elimination of the mockup adapter, this time can probably be made up.

DISCUSSION

The instrumented shroud half model was lifted into B-3 facility on March 3, 1972. The model carch system test was started on March 9, 1972. Two preliminary tests were performed before the formal tests defined in the test plan were attempted. The two preliminary tests consisted of slowly swinging the shroud half model into the nets and the tests were successfully completed. After the two preliminary tests, two 25% energy level tests were run. On March 10, 1972 a 50% energy level test was run and everything performed as planned. Immediately after this run, two support columns on the shroud half model were broken when the model was inadvertantly brought from the tipped position to the upright position too fast. The columns were repaired on March 13, 1972, The test runs were completed on March 15, 1972. These tests consisted of one 50%, one 75% and three 110% energy level runs. All tests were completed satisfactorily. The following paragraph was taken from a Cleveland report on the results of the test: "Based upon the reasonable comparison between test data and analytical predictions and the structural margins predicted, it is felt that the current catcher system design will meet its objectives and no further testing of the cryo-unlatch catch system is required." The shroud half model was removed from B-3 on March 24, 1972 and stored at the siding near Loading Dock Road.

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SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CENTAUR STANDARD SHROUD TESTS (Continued)

The piping contractor, Wrightco, completed all work above level four on March 28, 1972, except the insulation of the 8" LH_2 vent line. Last month, Wrightco had agreed to reduce the contract completion date from April 25, 1972 to April 3, 1972. However, Wrightco now estimates the contract completion date to be April 19, 1972.

Norris Bros. was awarded the movable work platform installation contract plus miscellaneous mechanical tasks including cutting the 10'6" hole in Platform A. Norris Brothers completion date is April 12, 1972.

The mechanics are installing purge lines and other equipment for the cryogenic unlatch tests.

INSTRUMENTATION

Work has begun on wiring modifications to meet the accelerated hinge test schedule. Wiring tests and routing for the Titan Skirt, ISA, Conical Section, and Hinge Area have been completed and sent to Cleveland.

Most of the parts required to support the Hinge Test are on hand. The remaining items have promised deliveries which are adequate to support our schedules.

CONTROLS

All camera controls and disk brake systems performed successfully during the model jettison test.

A test to verify cable stretch and proof test remaining hardware required for the structural test is planned for the first week in April.

The twelve cylinders required for the hinge test are being tested at D Site. They are being tested under the same conditions as those required for the actual test.

All procurement for the Centaur vent system is complete and installation has been started in the Control Room.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The Centaur Standard Shroud arrived at Plum Brook on April 4, 1972. The boattail was instrumented and installed on the interstage adapter on April 27, 1972. The Titan skirt was installed in B-3 Facility on April 17, 1972.

The piping contract was completed on April 19, 1972. The movable work platforms are 95% complete. Mechanical, instrumentation, and control work is progressing satisfactorily on the hinge test and cryo-unlatch test work. The hinge test is scheduled for May 25, 1972.

DISCUSSION

CENTAUR STANDARD SHROUD TEST HARDWARE

On April 4, 1972, the Centaur Standard Shroud arrived at Plum Brook and is located at the Space Power Facility. Also the Lockheed crew arrived to install strain gauges on the shroud.

The interstage adapter (ISA), stub adapter and equipment module were delivered at Cleveland for strain gauge installation on April 12, 1972. The ISA, with the strain gauge installation completed, was delivered to Plum Brook from Cleveland, on April 25, 1972. The boattail has been instrumented by LMSC and was installed on the ISA at SPF on April 27.

The General Dynamics-Convair (GD/CA) crew arrived at Plum Brook on April 25, 1972 to work on GD/CA hardware. They started match drilling the aft seal plate to the 5D (7562) Centaur Vehicle.

The Titan skirt was installed on the lower distribution cylinder in B-3 on April 17, 1972.

Miscellaneous flight hardware has arrived throughout the month.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS CONTROLS (Continued) Information for the sequence and abort program for the hinge test is 90% complete. Most of the hardware required for the hinge test has been checked out at D Site. A pair of relief valves across the hydraulic cylinder for load protection has proved successful. Relief valves will be installed on all cylinders to be used during the hinge tests. All valves for the LH_2 and LOX press-vent and outflow have been installed. The various delta-P and pressure protection systems are being installed on these valves.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The Interstage Adapter Assembly(ISA) with attached boattail section of the CSS was installed in B-3. The Centaur tank was then assembled on the ISA. The hydraulic cylinders, load cells, and hinge test fixtures have been assembled and are being aligned. Hinge testing is scheduled to start June 5.

The stub adapter, equipment module, truss adapter and forward bearing reaction struts arrived from LeRC-Cleveland on May 31. Instrumentation will be installed on the equipment before moving into B-3.

The Test Readiness Review is well underway and the review should be completed during the first week of June.

DISCUSSION

CENTAUR STANDARD SHROUD (CSS) TEST HARDWARE

On May 8, 1972 the ISA, with the boattail attached to it, was transported to B-3 from SPF. The ISA was lifted into the facility, but the ISA and Titan Skirt did not align properly. Bolt holes had to be reamed out and the ISA and Titan Skirt were finally mated on May 13, 1972. During this installation it was noted that the ISA and boattail were rotated about 0.9° clockwise from the desired position in the facility. Because of this misalignment it was necessary to relocate the hydraulic cylinder pulloff pads in the facility for the hinge test. The Centaur tank was installed on the ISA in B-3 on May 25, 1972. The hinge test fixtures (5) and test hinge pins were proof tested at D Site on May 30, 1972. All systems were installed for the hinge test by May 31, 1972. Due to alignment problems the hinge tests have been rescheduled to start on June 5, 1972.

GD/CA personnel installed the ISA and Centaur tanks in B-3 with NASA assistance. They have been bolting other hardware to the flight equipment in preparation for the

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NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

HINGE SPRING RATE TEST SCHEDULED FOR	Jun 5, 1972
CRYO-UNLATCH TESTS	Aug 1 - Nov 1, 1972
STRUCTURAL TESTS	Jan 15 - May 1, 1973
HINGE LOADING TESTS	Dec 1973.
ITEMS COMPLETED	
ISA & boattail moved from SPF to B-3	May 8.
ISA & boattail installation completed on	May 13.
Payload cylinder assembled in handling fixture.	
Nose cone half sections were assembled.	
Forward & aft seal plates modified to accept instr.	
Deflection potentiometer & strain-gage installed.	
Rail car hardware installed	May 26.
Hydraulic cylinger pulloff pads relocated.	
Centaur tank installed	May 25.
Movable platform installation completed.	
Roll-up doors repaired.	
Roll-up doors electrical design of remote operator completed.	
Internal vehicle instr wiring info completed.	
Equip module area inst. detailed.	
Gas sampling problem resolved.	
1000 computer cards made for cryo-unlatch flow sheet.	
All control cylinders installed and checked out.	
CF-16 & 910 computer programs completed.	
All control check sheets are completed.	
ITEMS IN PROGRESS	
Installation of roll-up doors electrical equip to start	Early June.
Installation of cryo-unlatch test purge lines, etc., in progress.	
Test Readiness Review Panel review underway.	June 9 (comp date)
Hinge Test instrumentation connected - c/o underway.	
Cryo-unlatch test T/C 90% installed.	

CHANGES: Test Schedule

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (Continued)

hinge test and cryo-unlatch tests. The stub adapter equipment module, truss adapter and forward bearing reaction struts arrived at Plum Brook from Cleveland on May 31, 1972. This equipment will be instrumented before installation in B-3.

LMSC personnel have been working in both the B-3 and SPF areas, The payload cylinder section of the shroud was assembled in the handling fixtures in early May. The nose cone half sections were also assembled. The forward and aft seal plates were cut out and reinforced to accept instumentation feedthrough connectors. LMSC personnel have also installed deflection potentiometers and strain-gages at B-3 in preparation for the hinge test.

Hardware was installed on a rail car on May 26 for transport of the shroud between B-3 and SPF.

FACILITY

All movable platform work has been completed. The roll-up doors have been repaired and appear to be operating satisfactorily. The design of electrical equipment for remote operation of the doors has been completed. Installation of the electrical equipment will start in early June.

The B-3 mechanics have spent most of this report period preparing for the hinge test. However, purge lines and other installations are continuing for the cryo-unlatch test.

TEST READINESS REVIEW

The Test Readiness Review Panel was appointed and the review is well underway. Presentations were made to the panel and the panel has inspected the site and reviewed the installation. Present indications are that the review will be completed during the first week of June.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (Continued)

INSTRUMENTATION

Hinge Test - hardware was connected to the site instrumentation system. Check out of the systems began.

Centaur Standard Shroud - 90% of the thermocouples have been installed for the cryo-unlatch test.

Centaur Vehicle Tank - All wiring information has been generated for internal vehicle instrumentation.

General - Instrumentation in the Equipment Module area and Stub Adaptor area has been detailed. Information has been generated and released for installation of all thermocouples for the Stub Adaptor and Equipment Module. The gas sampling problem has been resolved. Installation of this equipment will begin after the Hinge Testing. 1000 computer cards for the cryo-unlatch flow sheet (based on preliminary information) have been made.

CONTROLS

All of the cylinders have been installed and checked out manually. The CF-16 and 910 computer programs are completed. The 910 data tapes are completed and are being checked out. Most of the recommendations of the Readiness Review Committee have been completed or are in progress. The check sheets for all systems are also completed.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The Hinge Load testing started on June 5, 1972 but due to relief valve and servo valve problems, the 25% tests were started again on June 21, 1972. On June 27, 1972, the final hinge tests 17.8L and 19.8L were completed. This test series completes the present CSS Hinge Loading test program. (Ultimate load tests are scheduled at the end of the entire CSS program.

The stub adapter was installed on the Centaur tank on June 13, 1972. The multilayer insulation blanket installation was completed on June 30. Tubing runs, radiation shield installation, and gas sample system installation was completed in June.

Because of the delay caused by stackup misalignment problems and the hinge test loading cylinder problems, the start of validation testing for the cryo-unlatch test is rescheduled for approximately August 15, 1972.

DISCUSSION

HINGE TESTS

On June 5, 1972, several 25% runs were made to exercise the loading systems with low abort limits before starting the official Centaur Standard Shroud Hinge Load Tests. While trying to put cylinder P-2 on line, the system aborted due to an amplifier failure. The amplifier called for a full load and before the system could abort, a load spike of 6700 pounds was seen. Although this caused no damage, it was apparent that the relief valves were not providing the desired protection. Tests were run at D-Site to try to lower the maximum peak load on an abort. As a result of the tests at D-Site, the reliefs were re-set to lower values, smaller Moog servovalves were installed and orifice plates were installed between the Moog and the cylinder.

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NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

HINGE SPRING RATE TEST	Completed June 27.
CRYO-UNLATCH TESTS TO START	Aug 15.
STRUCTURAL TESTS	Jan 15 - May 1, 1973.
HINGE LOADING TESTS	Dec 1973.
ITEMS COMPLETED	
Stub adapter installed on Centaur tank	Jun 13, 1972.
LH_2 tank insulation installed	Jun 30, 1972.
Shroud retrofit work completed	Jun 21, 1972.
Thermocouple installation completed.	
Instrumentation flow sheet completed.	
Hydraulic protection system redesign, reset & retested	Jun 20, 1972.
ITEMS IN PROGRESS	
LH_2 flight vent system.	
LH_2 fill and drain chute.	
Tubing runs.	
Radiation shield installation.	
Gas sample system installation.	
Design of restraints for LH_2 vent nozzles.	
LH_2 vent disconnect purge system design.	
Forward bearing reaction strut limit switch design.	
LH_2 fill and drain chute purge system design.	
Design of an access ladder.	
Tank instrumentation wiring	50% complete.
Instrumentation in strut adapter area & equip module	45% complete.
Gas sampling & accelerometer signal conditioning installation.	7-10-72 (compl. date)
Facility thermocouple cables.	45% complete.
Preparing wiring list for strain gage & deflectometer.	
Hinge test loading system being removed.	
Pressure vent, ΔP protection vent flow valve circuits are nearly complete.	

CHANGES: Test schedule

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS (Continued)

On June 20, 1972 the 25% runs were successfully completed. Also tests 1C and 2C of the Centaur Standard Hinge Load Tests per Test Requirements Document, LeRC/TCPO-10 were completed.

On June 21, 1972, tests 3c through 9c were successfully completed and on June 22, 1972, tests 10C through 16C were completed.

On June 23, 1972, test 18.8L was attempted but an abort occurred due to a mechanical stop assembly that had shifted approximately 3/16 inch. While verifying that the cylinder had hit the mechanical stop, it was found that the position indicators on all 12 cylinders had been set up for full cylinder stroke rather than the desired value. Therefore all of the cylinder position data for runs 1C-16C had the wrong scale factor. By adding the corrected scale factor to the data reduction program the test results were satisfactorily adjusted.

On June 26, 1972, test 18.8L was completed, and on June 27, 1972 the final tests 17.8L and 19.8L were successfully performed which completed the Centaur Standard Shroud Hinge Load Tests.

CSS TEST HARDWARE

NASA and GD/CA personnel installed the stub adapter on the Centaur tank on June 13, 1972. GD/CA immediately began laying the multilayer insulation blankets on the top of the LH_2 tank. The fitting of the insulation was completed on June 30. The LH_2 flight vent system, LH_2 fill and drain chute and a number of other tasks were worked on during this reporting period.

The LMSC special manufacturing crew arrived at Plum Brook on June 12 to perform retrofit operations on the shroud. This work was completed on June 21. The LMSC insulation crew arrived on June 26 and left on June 30 when their work was completed.

GD/CA, LMSC and PB personnel provided support for the hinge tests conducted during June. Because of the

(Continued on Page 37)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD
SHROUD TESTS (Continued)

delays encountered during the hinge tests certain jobs could not be started. However, tubing runs, radiation shield installation, gas sample system installation and some other work was started by the Plum Brook mechanics.

New, previously unplanned, work started by Rocket Systems Division engineers in this report period includes:

(1) Restraints for LH_2 vent nozzles;

(2) Purge system for LH_2 vent disconnects;

(3) Limit switch installation for the forward bearing reaction strut retraction signal;

(4) Shroud quick vent;

(5) LH_2 fill and drain chute purge system.

The Plum Brook Engineering Division was also requested to provide an access ladder to a door on the Titan skirt and a work platform to be attached to the payload model. All of the above work is a result of program changes and equipment problems not envisioned before June 1, 1972.

Because of the equipment misalignment problems encountered in May and the resultant need to reposition the hydraulic cylinders and the delays encountered during the hinge tests, the start of validation testing for the cryo-unlatch test has been rescheduled for approximately August 15, 1972.

INSTRUMENTATION (Cryo-unlatch test)

Thermocouple installation for the Centaur Standard Shroud is complete.

Centaur Vehicle wiring is 50% complete.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD
SHROUD TESTS (Continued)

INSTRUMENTATION (Cont)

The preliminary flow sheet is complete. Instrumentation in the equipment module and stub adaptor areas is 45% complete. Installation of gas sampling and accelerometer signal conditioning will be completed the week of July 10, 1972. Facility thermocouple cables are 45% complete. Thermocouple ovens due June 15, 1972 and cable due August 1, 1972 are pacing items. Detailed wiring lists for strain gages and deflectometers are being prepared.

CONTROLS

On the 25% hinge test check out run an operation amplifier failure caused a load spike that was higher than anticipated. An investigation of this spike showed it to be a characteristic of the hydraulic relief valve, the servo valve size and the hydraulic cylinder size. In order to eliminate the possibility of another load spike the hydraulic protection systems were resized, reset and retested at D-Site. After the systems changes were installed, the Hinge Tests were successfully completed.

The Hinge Test loading system is now being removed to facilitate the installation of equipment for the cryo-unlatch test.

Requirements for the abort and sequence of the cryo-unlatch test have not been finalized. The pressure-vent, ΔP protection, and outflow valve circuits are nearly complete.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YPQ4239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

Major equipment installations completed in July were stub adapter modifications, equipment module, truss adapter, payload model base, CSS aft skirt to conical boattail section.

Delay in equipment module installation was caused by the requirement to seal up a number of holes in the stub adapter. This requirement was a result of a GD/CA study made on venting characteristics of the CSS during flight.

Some delay was caused by LeRC/TCPO decision to use 2 rather than 6 forward bearing reaction struts. This necessitated relocating a movie camera and a rework of the forward seal warming purge ring.

The system check out and validation tests are planned for August 21. This date is a tight requirement and any further requirement changes will possibly delay this start.

DISCUSSION

OPERATIONS

Work efforts were concentrated on the Centaur tank during the month of July. The LH_2 fill line, tubing runs, electrical and instrument lines, etc., in the aft seal area and up the side of the tank were completed by July 24. The 60-foot long facility H_2 vent was put in place during the week of July 25. It did not fit properly and had to be modified. Preliminary modifications were completed on July 31. The hinge test equipment was removed on July 18 thru 21 after LMSC found the hinge test data acceptable.

Some of the major equipment installation dates were:

July 17 - Finished stub adapter modifications
July 18 - Installed equipment module

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NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YOQ4239

SYSTEM VALIDATION TESTS SCHEDULED TO START	Aug 21, 1972.
CRYO-UNLATCH TESTS TO START	Sep, 1972.
STRUCTURAL TESTS	Mar 1973 thru June 1973
HINGE LOADING TESTS	Mar 1974
ITEMS COMPLETED	
LH_2 fill line, tubing runs, elec. & inst. lines in aft seal area & tank side were completed	Jul 24, 1972.
Facility H_2 vent preliminary mods completed	Jul 31, 1972.
Hinge test equipment removed.	
Stub adapter modification completed	Jul 17, 1972.
Equipment module installed	Jul 18, 1972.
Truss adapter installed	July 19 - 20, 1972.
Payload model base installed	Jul 21, 1972.
CSS Aft skirt installed	Jul 24, 1972.
CSS Aft skirt bolt-up to conical boattail section. .	Jul 27, 1972.
Reworked forward seal warming purge ring & gas deflector curtain.	
One movie camera had to be relocated.	
Insulation taping redone.	
21 gussets on CSS seal area were modified.	
Most of the cryo-unlatch test control sequence and abort info was received.	
Vehicle instrumentation wiring is completed.	
Most of the strain gages are completed (the F.B.R. strut gages are not completed)	
Thermocouple ovens were delivered.	
Modification of SEL sub-system completed.	
ITEMS IN PROGRESS	
The following previously unplanned work was started:	
Seal vent holes in stub adapter & equip module.	
Equip. module quick vent valve	
Purges, lights, brackets for relocated movie camera.	
Modify camera purge system.	
Modify forward seal warning purge ring.	
Preparing for shroud installation.	
Tank pressure-vent & $\triangle P$ protection systems	80% complete.
Tank outflow, camera & facility control readout systems are being installed.	
Thermocouple ovens are being checked out.	
Thermocouple cables are	80% complete.
Accelerometer installation & wiring are	40% complete.

CHANGES: Test Schedule

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS

OPERATIONS (Continued)

July 19-20 - Installed truss adapter
July 21 - Installed payload model base
July 24 - Installed CSS aft skirt
July 27 - Finished bolt-up of CSS aft skirt to conical boattail section

The equipment module installation was delayed from July 12 to July 18 due to a new requirement to seal up a number of holes in the stub adapter and equipment module. The requirement was a result of a study GD/CA made on the venting characteristics of the CSS during flight. Also as a result of a GD/CA thermal study the camera purge system inside the CSS had to be modified.

A decision was made by LeRC/TCPO to use 2 rather than 6 forward bearing reaction struts for the first cryo-unlatch test. This necessitated relocating one movie camera and a rework of the forward seal warming purge ring and gas deflection curtain.

LeRC/TCPO was not satisfied with the CSS insulation taping work performed by LMSC. The work had to be redone by LMSC. The drawings available to the LMSC people at Plum Brook apparently were not very specific on what was to be accomplished and what the desired results were to be. LMSC also had to modify, by grinding, approximately 21 gussets on the CSS in the forward seal area. The gussets and surrounding structure would not allow the forward seal release cable to release properly.

There are now five GD/CA people at Plum Brook. Two additional technicians arrived in early July to assist the two technicians and one engineer previously assigned to Plum Brook. GD/CA has been working on a number of tasks associated with their equipment.

(Continued on Page 35)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS

OPERATIONS (Continued)

New,previously unplanned, work started by Rocket Systems Division at Plum Brook in this report period due to test requirement changes includes:

(1) Seal up vent holes in stub adapter and equipment module.

(2) Equipment module quick vent valve.

(3) Relocate movie camera and associated brackets, purges, lights, etc.

(4) Modify camera purge system.

(5) Modify forward seal warming purge ring.

System check out and validation tests are expected to start around August 21, 1972.

INSTRUMENTATION

Centaur Vehicle wiring is complete. All strain gages are complete except for those on the F.B.R. struts.

The thermocouple ovens have been received and are being checked in the standards and calibration lab. Facility thermocouple cables are 80% complete.

Accelerometer installation and wiring is 40% complete.

Modification on the 400 channels of the SEL subsystem to improve stability under conditions of high humidity is complete. Re-qualification of the subsystem will be done during the second week of August.

CONTROLS

The work on the pressure vent and $\triangle P$ protection systems on the Centaur tank are approximately 80% complete. A complete system check out will then be performed. Most of the information required for the sequence and abort

(Continued on Page 37)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS CONTROLS (Continued) of the cryo-unlatch test has been received. Work is currently being done on the tank outflow and camera and facility read out systems. A new hydraulic relief valve and an evaluation of its effectiveness will be made at D-Site for use on both the structural and ultimate hinge tests. The hinge loading fixtures will also be structurally tested for the ultimate hinge test. Cables for the structural test will be proof tested and checked for elongation at the contractor's plant early in August.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CENTAUR STANDARD SHROUD TESTS (YP04239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

During the month of August the following major equipment was installed: Centaur tank radiation shield, -Y section of CSS tank barrel, +Y section of CSS tank barrel, payload model, CSS payload cylinder, CSS nose cone and hydrogen vent fin on the CSS.

All GD/CA tasks were completed and their personnel have returned to San Diego.

The Test Readines Review Panel and Area 20 Safety Committee have been reviewing the test procedures for the CSS.

Piping and movie camera check outs are nearly complete.

The first cryo-unlatch test is scheduled for the week of September 18. This date is tight and all systems check outs have to be nearly trouble free to meet this date.

DISCUSSION

OPERATIONS

Work efforts were concentrated on installing the Centaur Standard Shroud during the month of August. Individual systems check outs were begun on August 21 and were still underway at the end of August.

Some of the major equipment installation dates were:

August 1 - Installed Centaur tank radiation shield.

August 3 - Installed -Y section of CSS tank barrel.

August 5 - Installed +Y section of CSS tank barrel.

August 10 - Installed payload model.

(Continued on Page 35)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

SYSTEM VALIDATION TESTS STARTED	Aug 21, 1972.
CRYO-UNLATCH TESTS TO START	Sep 20, 1972
STRUCTURAL TESTS.	Apr 1973 thru June 73.
HINGE LOADING TESTS	Jul 1974.
ITEMS COMPLETED	
Centaur tank radiation shield installed.	
-Y section of CSS tank barrel installed.	
+Y section of CSS tank barrel installed.	
Payload model installed.	
CSS payload cylinder installed.	
CSS nose cone and hydrogen vent fin on CSS installed.	
GD/CA tasks completed.	
21 gussets modified on CSS forward seal.	
Additional 4 FBRs installed by GD/CA personnel.	
Check out of piping system installation.	
Valve electrical & pneumatic check out.	
Movie camera feedback signals, electrical operation, and calibration carried out.	
Completed flow sheet and digital format.	
Tank protection error monitor check out.	
Cables for structural tests inspected and delivered.	
ITEMS IN PROGRESS	
Test procedures for CSS being reviewed by TRR Panel and Area 20 SC.	
Individual system check outs underway.	
LMSC installing deflectometer instrumentation.	
Comments being compiled by TCPO on all meetings, critiques, etc.	
Deflectometers and pyrosystem instrumentation	85% complete.
Valve check out for pressure vent and fill sys . . .	95% complete.
XDS910 computer control and abort system	75% complete.

CHANGES: Test Schedule

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS OPERATIONS (Continued) August 11 - Installed CSS payload cylinder. August 15 - Installed CSS nose cone. August 17 - 23 - Installed H_2 vent fin on CSS. LMSC had to further modify the 21 gussets on the CSS in the forward seal area. The initial modification made in July was not adequate. The new modification was accomplished from August 7 to 9. On August 22 the LeRC/TCPO made the decision to use six forward bearing reaction struts for the first cryo-unlatch test. This was a reversal of a decision made in July to only use two FBRs. GD/CA personnel installed the addition 4 FBRs. All GD/CA tasks were completed by August 25 and all GD/CA personnel left Plum Brook for San Diego. LMSC personnel were essentially done with their tasks on August 21 and therefore started to install NASA-furnished deflectometer instrumentation. The upper east roll door jammed in its guide rails on August 16. During repair efforts on August 28, the door fell in its guide rails. Apparently the door had become detached from the roller while attempts were made to unjam it. The problem is under investigation and no scheduled impact is expected. RSD members have been meeting with the Area 20 Safety Committee and the Test Readiness Review Panel as various B-3 systems are reviewed and approvals given to proceed with the first cryo-unlatch test. Also, personnel from GD/CA, LMSC and the LeRC/TCPO have been critiquing the installation at B-3 during most of August. All comments are being compiled by LeRC/TCPO and will be acted on in early September. (Continued on Page 37)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	SPACECRAFT PROPULSION RESEARCH FACILITY	CENTAUR STANDARD SHROUD TESTS OPERATIONS (Continued) Piping system installation check out, valve electrical and pneumatic check out and movie camera feedback signals, electrical operation and calibration were carried out from August 21 to August 31. No insurmountable difficulties were encountered. The first cryo-unlatch test is scheduled for September 20, 1972. INSTRUMENTATION Pressure, temperature, strain and acceleration measurement systems are complete except for final check out. Deflectometers and pyrosystem instrumentation is about 85% complete. "Flow Sheet" and digital format are complete. The major remaining workloads are: (1) total system check out; (2) wiring and check out of digital displays, and (3) pyro and gap detector instrumentation debugging. CONTROLS Check out of the valves for the pressure vent and fill systems is approximately 95% complete. Interfacing to the XDS910 computer control and abort system is 75% complete. Check out of the tank protection error monitor is complete and the system is operational. The cables for the structural test have been inspected at the contractor's plant for stretch under design load. All cables were within specification and have been delivered.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YP04239)

LVD - J. C. HUMPHREY;
RSD - W. E. KLEIN

SUMMARY

The combined systems test was performed on September 18 through 20, 1972. Countdown for the first Jettison Test was started on September 26 and the shroud was successfully jettisoned on September 28 at 11:57 p.m.

Some problem areas noted were:

(1) The teflon sleeve between the LH_2 vent fin and the facility vent was cracked and allowed hydrogen leakage upstream of the vent line Venturi.

(2) The shroud super-zip ordnance containment tube ruptured in several places. Although this created no problem in B-3 during the test, this could be a problem in flight.

(3) The shroud could not be pressurized to the desired pressure level with LH_2 in the fuel tank and the purge rate test series could not be run.

DISCUSSION

OPERATIONS

The first half of September was spent in final preparations of the facility and the Centaur Standard Shroud (CSS) for the testing phase of the program. The Combined Systems Test and first Jettison Test were conducted in the last two weeks of September. Some of the significant events are listed below.

Sept. 1-15: Final facility & CSS preparation.

Sept. 6-13: Shroud leak tests and repairs.

Sept. 18-20: Combined Systems Test.

Sept. 21-25: Shroud leak tests and repairs.

Sept. 26-29: Jettison Test #1

(Continued on Page 31)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CHANGES: (schedule changes since last report)	
CENTAUR STANDARD SHROUD TESTS B-3	YP04239
CRYO-UNLATCH TESTS	Sep thru Dec 1972
STRUCTURAL TESTS SCHEDULED FOR	Mar 1973 to Jun 20,73
HINGE LOADING TESTS	Jul 1974.
ITEMS COMPLETED	
Final facility & CSS preparation completed	Sep 1 thru Sep 15
Shroud leak tests and repairs completed	Sep 6 thru Sep 13
Combined system test completed	Sep 18 thru Sep 20
Shroud leak tests and repairs completed	Sep 21 thru Sep 25
Jettison test #1 complete	Sep 26 thru Sep 27
Structural test team was established and meetings held with Titan Centaur Project Office.	
CHANGES: Schedule change.	

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS (Continued)

An attempt was made to pressurize the shroud from September 6 thru 13. Leaks were encountered and repairs had to be made. This led to a series of leak tests and repair periods until the minimum design pressure and flow rate for the pressurizing gas was reached.

The Combined Systems Test was conducted using LN_2 in both Centaur tanks. All systems functioned properly. However, a frost buildup occurred on the outside of the CSS around the aft seal area. This raised concern about the insulation installation. Insulation modifications were made on September 22 and 23 following the Combined Systems Test.

The countdown for the first jettison test started on September 25. The test was successfully performed on September 28 when shroud separation occurred at approximately 11:57 p.m. Some problem areas noted during the test were:

(1) The teflon sleeve between the LH_2 vent fin and facility vent cracked and leaked H_2. This will affect the boiloff test results since the H_2 leaked upstream of the vent line Venturi.

(2) The shroud super-zip ordnance containment tube ruptured in three places during the test. This caused no problem at B-3, but could be a significant problem in flight if the escaping gases and rubber shrapnel impinged on the payload.

(3) The shroud could not be pressurized to the desired levels with LH_2 in the Centaur tank. The shroud leakage rate was more than the facility supply system could furnish.

(Continued on Page 33)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CENTAUR STANDARD SHROUD TESTS (Continued)

Test data will be reduced and be available the first week in October. Shroud removal will start on October 2. The second jettison test is scheduled for early November.

INSTRUMENTATION

Final instrumentation set up was completed and the Cryo-Unlatch Test was performed successfully. The instrumentation workload consisted of a total system check out, completion of the digital displays, last minute changes, and minor corrections before the run.

Preliminary plans are being made for instrumentation of the Structural Test. The strain gage wiring scheme to enable selection of required gages for each test is being formulated. Deflectometer relocation strategy between various tests is being studied. Assignments have been made for ordering of additional connectors, deflectometers, wire, etc. Finalized plans will be put on drawings and sketches when the final TRO is released October 11.

CONTROLS

The XDS910 computer control and abort system performed properly during the Cryo-Unlatch Test. All other control systems basically performed satisfactorily with some problems occurring in the LH_2 vent system. These include solenoid valve HC228 which tends to stick in the energized position and the loss of a total pressure transducer signal. These are action items to be corrected prior to the next test.

STRUCTURAL TESTS

A structural test team has been established. L. Gentile was assigned as the Rocket Systems Division subproject engineer to handle this phase of the program. A series of meetings were held with Titan Centaur Project Office (TCPO) personnel to define final requirements for the test program.

(Continued on Page 35)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS (Continued) A new type of relief valve is to be evaluated at D-Site. This hydraulic relief valve is to be used in the Structural, Vent Fin, and Hinge Ultimate Load Tests. In addition, the hinge fixtures required for the Ultimate Load Test will be proof loaded at D-Site. These jobs should be completed during October and November.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS

B-3 ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YP04239)

SUMMARY

Cryogenic Unlatch Test No. 2 was accomplished the week of November 6 with separation on November 8.

Work is proceeding on preparations for Cryogenic Unlatch Test No. 3. The following series of tests will lead up to the No. 3 separation:

(1) Ambient Seal Releaser Test.

(2) LN_2/LN_2 Tanking, Heat Transfer, and Seal Release Test.

(3) LH_2/LN_2 Tanking, Heat Transfer, and Seal Release Test.

The Ambient Seal Releaser Test is planned for the week of December 18 if all contractor modifications are complete by December 11.

Structural Test definition and requirement discussions between Rocket Systems Division and TCPO continued throughout the month. Agreement was reached in the major areas under consideration.

CRYOGENIC UNLATCH TEST

LVD - S. V. SZABO
RSD - W. E. KLEIN

DISCUSSION

OPERATIONS

The first week in November was spent conducting shroud leak checks and in preparing for Cryogenic Separation Test No. 2. The test run was conducted during the second week and the rest of the month was spent on refurbishment activities. Some of the significant events are listed below:

(1) November 1 - 4: Shroud leak checks and repairs

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NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

CRYO-UNLATCH TESTS	Sep thru Feb 7.
STRUCTURAL TESTS SCHEDULED FOR	Apr 1973 to June 30, 73
HINGE LOADING TESTS	Jul 1974.
CRYO-UNLATCH TEST	
ITEMS COMPLETED	
Cryogenic Unlatch Test #3 completed	Nov 8.
Other shroud items completed:	
Leak checks and repairs	Nov 1 thru 4.
Remove shroud	Nov 10 thru 15.
Started refurbishment	Nov 16.
Information on Test #3 instrumentation changes, etc., received.	
ITEMS IN PROGRESS	
Preparing for Cryo-Unlatch Test #3.	
Structural test definition and requirements discussion	
Sequence changes being made in computer controls.	
Installing additional TV cameras.	
STRUCTURAL TESTS	
ITEMS COMPLETED	
Loading ring drilled.	
Load strap support system designed & parts ordered.	
Vent Fin Test installation drawings complete; parts ordered.	
Method of loading shroud presented & agreed to.	
Strain Gauge plan completed.	
Deflectometers installation plan finalized. PR written; one contract awarded.	
New external adjustable reliefs were checked out at D-Site.	
ITEMS IN PROGRESS	
LH_2 tank vent and fill lines drawings are being made.	
Fabricating loading fixture counter balance system.	
Laser system being activated.	
Setting up hydraulic system.	
Instrumentation requirements document is being prepared & is scheduled to be ready	Jan 15, 1973.
Failsafe manifold orifices are being tests at D-Site.	
Designing shear loading contract panel & computer ramp generating system.	

CHANGES: Schedule changes.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CRYOGENIC UNLATCH TEST
(continued)

(2) November 6 - 9: Cryogenic Separation Test No. 2

(3) November 10-15: Remove shroud

(4) November 16-30: Shroud refurbishment activities

Shroud leak tests were performed on November 2 and 3, 1972. The leaks found during these two tests were corrected. Overall, the shroud had fewer leaks than were found before the first test. Therefore, we were able to maintain higher pressures for any particular flow rate.

Countdown operations began on November 6, 1972 and the separation test was performed on November 8, 1972. The following significant problems were encountered during the separation:

(1) The forward seal did not separate from the shroud and was ripped during jettison.

(2) Both shroud halves hit the collision detectors on the payload model during separation. This was probably caused by the forward seal failing to separate properly.

(3) The shroud heat transfer rate was still much higher than anticipated.

(4) The super-zip tube ruptured in several places when the secondary cord system was fired.

(5) Three internal movie cameras failed to operate. This was probably caused by improper film gate adjustment.

Each of these problems has been resolved and, where possible, corrections are in process. The next separation test had tentatively been scheduled for either the week of January 15, 1973 or the week of January 22, 1973. However, word was received that changes were being considered in the shroud insulation system. Therefore, the next test date is uncertain at this time.

(Continued on Page 33)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CRYOGENIC UNLATCH TEST
(continued)

INSTRUMENTATION

Instrumentation additions, changes and deletions for Jettison Test #3 now total about 150 measurements. The major portion of these changes are thermocouples. Two additional thermocouple reference ovens have been added. These changes require rewiring and repatching as well as the complete revision of flow sheets, digital and FM formays, check sheets and pattern tape.

Assuming minimal further instrumentation changes, no schedule delays are anticipated.

CONTROLS

Sequence changes are being made to incorporate the firing of the forward seal explosive bolts from the SDS 910 computer. A bolt breakwire system is also being added to the abort monitor.

The installation of four additional TV camera systems is proceeding satisfactorily. One camera is now installed in the boattail and the three new cameras are due for delivery on December 11. The wiring and monitor installation for the three new cameras is complete.

STRUCTURAL TEST — LVD - J. C. HUMPHREY
RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

General Site and Equipment Modifications:

Drawings for the Centaur LH_2 tank vent and fill lines are being prepared. A shroud loading fixture counter balance system is being fabricated. Mounting pads are being welded on the Centaur load cylinder, etc.

(Continued on Page 35)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	STRUCTURAL TEST (continued) Structural Test Work in Progress: Some preliminary tasks are being accomplished at the site between shroud testing. The laser system is being activated to determine building movement under wind loads. The hydraulic system is being set up for some preliminary testing. The shroud loading ring was drilled and a shear load strap support system was designed and parts ordered. Vent Fin Test: Installation drawings were completed. Parts are on order. Hydraulic Loading System: The desired method of loading the shroud was presented by TCPO. It was previewed and agreed to by Plum Brook. Strain Gauges: A plan was prepared which coordinates the installation of the strain gauges with test stand schedule requirements. The installation will permit the selection of the appropriate gauges for each test. Deflectometers: The location and mounting methods have been finalized to the extent that purchase orders could be written. One contract has been awarded. A second purchase order is being prepared to take care of additional deflectometer requirements. Data Recording System: A sampling rate of 5 samples per second per channel was agreed upon. The instrumentation requirements document is being prepared and is scheduled to be ready on January 15, 1973. (Continued on Page 37)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

HRE (GARRETT ENGINE) HTF YOD4981

HRE TESTING SCHEDULE	Nov 1972 thru Jun 1973.
NEXT TEST SCHEDULED FOR	Dec 7, 1972.
ITEMS COMPLETED	
Eight run starts made.	
Five obtained run pressure.	
One accomplished tunnel & engine start conditions.	
Safety review made on GN_2 heater system	Nov 21, 1972.
Corrected data recording system electrical noise prob.	
Engine cavity purge profile check out completed.	
Central system ready for fuel run.	
Engine ignitors & two fuel control loops have been C/O.	
ITEMS IN PROGRESS	
Downstream jet pump nozzle being fabricated;	
scheduled delivery	Jan 5, 1973.
Preparing for next run.	

CHANGES: None.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY STRUCTURAL TEST (continued) Visual Displays: Basic test monitoring information will be selected from the digital data system and displayed on CRT units. Cameras, TV and two x-y plotters will also be utilized. Some of the data will be computerized, to detect deviation from preselected values. CONTROLS The check out of the new externally adjustable reliefs at D-Site has been completed. Data shows that the new units nearly eliminate pressure rise due to a sudden hard over condition. A method has been developed to set the desired relief pressure without using a load cell for reference. D-Site testing has begun on putting orifices in the failsafe manifolds to increase the unloading time in an abort condition. Design of the shear loading control panel and associated analog computer ramp generating system is now in progress.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (YP04239)

CRYOGENIC UNLATCH TEST — TCPO - S. V. SZABO; RSD - W. E. KLEIN

DISCUSSION

OPERATIONS

The first two weeks of December were spent in preparation for a series of tests to be conducted in late December, January and February.

A factory representative was at Plum Brook on December 6 - 8 to inspect the Millikin cameras that failed to operate properly during Cryo-Unlatch Test No. 2. Clutch and gate adjustments were made to all cameras. The cameras were loaded with film and run after being cold soaked at 15°F for approximately 18 hours. The cameras operated properly.

The major events of the month were:

(1) Dec. 1: The Titan Centaur Project Office decided to modify the CSS insulation system.

(Continued on Page 29)

12-72.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-2	SPACECRAFT PROPULSION RESEARCH FACILITY	AIR FORCE PROGRAM (Y0S5056) — RSD - R. DEZELICK Plum Brook and Air Force personnel met at Plum Brook on December 12 to discuss the use of the B-2 Facility for a small solid rocket propellant motor program. Requirements were defined and work orders initiated to the Plum Brook Engineering Division to start design modifications to the vacuum chamber. Schedules were not defined.
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS (YP04239) CRYOGENIC UNLATCH TEST — TCPO - S. V. SZABO; RSD - W. E. KLEIN DISCUSSION OPERATIONS The first two weeks of December were spent in preparation for a series of tests to be conducted in late December, January and February. A factory representative was at Plum Brook on December 6 - 8 to inspect the Millikin cameras that failed to operate properly during Cryo-Unlatch Test No. 2. Clutch and gate adjustments were made to all cameras. The cameras were loaded with film and run after being cold soaked at 15°F for approximately 18 hours. The cameras operated properly. The major events of the month were: (1) Dec. 1: The Titan Centaur Project Office decided to modify the CSS insulation system. (Continued on Page 29)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

CRYO-UNLATCH TESTS	Jan thru Feb 1973.
LN_2/LN_2 SEAL RELEASE TEST	Jan 9 - Jan 10.
LN_2/LH_2 SEAL RELEASE TEST	Jan 24 - Jan 25.
CRYOGENIC UNLATCH TEST	Feb 7 - Feb 8.
STRUCTURAL TESTS SCHEDULED FOR	Apr 73 - Jun 30, 1973
ENGINEERING EVALUATION TEST	Feb 15, 74 - Jul, 1974
CRYO-UNLATCH TEST	
ITEMS COMPLETED	
Camera inspected by factory representative	Dec 6 - Dec 8.
Clutch & gate adjustments made and checked out.	
CSS insulation modifications decided	Dec 1.
Insulation system changed & T/C added	Dec 4 - Dec 9.
Shroud moved from SPF and installed	Dec 11 - Dec 13.
Facility equipment installed to shroud and tank . . .	Dec 14 - Dec 18.
Ambient seal release test performed	Dec 19.
Shroud rain leak test performed	Dec 20.
Sequence & abort program updated.	
Seal bolt separation central recording set up.	
Test #3 patchboards, flowsheets, digital FM formats, check sheets & digital pattern tapes were completed.	
ITEMS IN PROGRESS	
Preparing for Jan 9-10 LN_2/LN_2 seal release test.	
STRUCTURAL TEST	
ITEMS COMPLETED	
Detailed 3 month test schedules completed.	
Drawing for LH_2 vent line mods completed.	
Loading fixture counter balance was delivered.	
Building movement readings were obtained.	
Actuators reinstalled and checked out.	
Hydraulic loading panel design completed.	
ITEMS IN PROGRESS	
Loading panels being fabricated.	
Working at D-Site to reduce Failsafe unloading rates.	
Making pressure, deflectometer & accelerator transducer changes.	
Started work on LH_2 vent line.	
Drawing of LH_2 fill line scheduled to be complete . .	Week of Jan 9.
Structural test work in progress.	

CHANGES: Schedules

SITE	SITE NAME	RESEARCH INSTALLATION &(TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CRYOGENIC UNLATCH TEST (Continued)

(2) Dec. 4-9: Made changes to insulation system and installed additional thermocouples.

(3) Dec. 11-13: Moved shroud from SPF and installed it in B-3.

(4) Dec. 14-18: Installed facility equipment to shroud and Centaur tank.

(5) Dec. 19: Performed ambient seal release test.

(6) Dec. 20: Performed shroud rain leak test.

The shroud was moved from SPF and installed in B-3 on a three-shift basis. Inclement weather (rain and high winds) caused a 17 hour delay in the operation. During the ambient seal release test, the release mechanism detonators fired prematurely due to a wiring mistake in the firing circuit that was not detected during pre-run check out. Movie camera pictures of the seal releasing were lost due to the premature firing. However, visual observation after the test indicated that the seal separated properly. The seal was repositioned immediately after the test so the shroud rain test could be conducted on December 20. The rain test indicated the shroud leaks and further study is necessary to "fix" the problem.

The schedule for completing the cryogenic unlatch portion of the program is:

(1) Jan 9&10: LN_2/LN_2 Tanking, Heat Transfer, and Seal Release Test.

(2) Jan 24&25: LN_2/LH_2 Tanking, Heat Transfer, and Seal Release Test.

(3) Feb 7&8: Cryogenic Unlatch Test No. 3.

INSTRUMENTATION

Patchboards, flowsheets, digital and FM formats, check sheets and digital pattern tape are now complete for Jettison Test No. 3.

(Continued on Page 31)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CRYOGENIC UNLATCH TEST (Continued)

INSTRUMENTATION (Cont)

The major remaining workload consists of pressure, deflectometer and acceleration transducer changes and system check out. Minor strain gauge repairs and additions are also required.

No schedule delays are anticipated.

CONTROLS

The sequence and abort program was updated for the seal pyro installation. Provisions for recording real time seal bolt separation have also been provided.

STRUCTURAL TEST — TCPO - J. C. HUMPHREY; RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

Detailed test schedules were developed for the next three month period. Items that can be accomplished while the cryo-unlatch tests are in progress were identified.

The drawing for the LH_2 tank vent line modification has been completed, and preliminary work has been started. The LH_2 tank fill line drawing should be completed during the week of January 9.

The Centaur loading fixture counter balance structure has been received at Plum Brook.

Some structural test work is in progress. Building movement readings were obtained with the laser beam. Relative movement between the base load distribution cylinder and the 147 foot level of the tower appeared minimal. Basic testing of the hydraulic system is in progress. Leak checks were made and the cylinders were stroked manually. Mounting brackets for the deflectometers are being fabricated.

(Continued on Page 33)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD TESTS (YP04239) CRYOGENIC UNLATCH TEST TCPO - S. V. SZABO; RSD - W. E. KLEIN

DISCUSSION

OPERATIONS

A series of tests were made in January to demonstrate the reliability of the new forward seal release mechanism and establish the effectiveness of the modified CSS insulation system.

(Continued on Page 19)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

FORWARD SEAL AND INSULATION TESTS	Jan thru Feb 1973.
CRYO-UNLATCH TEST #3	Feb 7 - Feb 8
STRUCTURAL TESTS SCHEDULED FOR	Apr - Jun 30, 1973.
ENGINEERING EVALUATION TEST	Feb 15 - Jul 1974.
CRYO-UNLATCH TEST	
ITEMS COMPLETED	
Shroud Leak Tests	Jan 3 & 5
LN_2/LN_2 Tanking, Heat Transfer, Seal Release and Rain Tests	Jan 8 - 11.
Shroud Leak Test and Rain Test	Jan 18.
LN_2/LH_2 Tanking, Heat Transfer, Seal Release and Rain Tests	Jan 22 - 24.
Bending Mode Test	Jan 26.
Results of tests showed new forward seal release functioned properly.	
Instrument & recording changes accomplished.	
Major tasks for Cryo-Unlatch Test #3 complete.	
Vent System modified to add payload purge, and vent valves to error monitoring system.	
ITEMS IN PROGRESS	
LMSC modifying shrouds to eliminate water leaks.	
Results of CSS Bending Mode Test being analyzed.	
STRUCTURAL TEST	
ITEMS COMPLETED	
Shroud counter balance support system assmbld & loaded.	
Centaur stretch system assmbld & checked.	
Pad eyes welded on test tower & proof loaded.	
Test requirements document reviewed & approved.	
Visual display requirements clarified & techniques developed.	
LH_2 fill line drawing completed.	
Strain gauge channel connector wiring designation sheets completed.	
Deflectometer transducers received.	
Balance panel circuit revised for new deflectometers.	
Test control requirements reviewed.	
ITEMS IN PROGRESS	
Fabrication of components for fill & vent line mods.	
Circuit mods are	20% complete.
Cable additions for strain gauges are	60% complete.
Calibration rig work is	70% complete.
Structural flow sheet work initiated.	
Computer programming, TV, controls & sequencing, control panel mods, and alarm display work started.	

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CRYOGENIC UNLATCH TEST (Continued)

The major events of the month were:

(1) Jan 3&5 - Shroud Leak Tests

(2) Jan 8-11 - LN_2/LN_2 Tanking; Heat Transfer, Seal Release, and Rain Tests.

(3) Jan 18 - Shroud Leak Test and Rain Test

(4) Jan 22-24- LN_2/LH_2 Tanking; Heat Transfer, Seal Release and Rain Tests.

(5) Jan 26 - CSS Bending Mode Test

(6) Jan 29-31- Preparations for Cryogenic Unlatch Test #3 (scheduled for Feb 7).

Results of the tests showed that the new forward seal release mechanism functioned properly. The modified CSS insulation system reduced the heat transfer rate through the shroud by a factor of 2, to approximately 100,000 BTU/HOUR. This lower heat transfer rate is within the flight vehicle design limits. The need for better sealing of joints during the manufacturing process, became apparent during the simulated rain tests. Steps are being taken by LMSC to modify the shrouds during manufacture to eliminate water leaks due to rain.

The CSS Bending Mode Test was conducted to determine the first cantilever bending mode and natural frequency of the shroud. A 2000 pound horizontal load was applied at the nose cone of the CSS. The load was released instantaneously and the shroud characteristics measured by accelerometers and deflectometers. The results of test are now being analyzed.

Cryogenic Unlatch Test #3 is scheduled for February 7, 1973.

(Continued on Page 21)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

CRYOGENIC UNLATCH TEST (Continued)

INSTRUMENTATION

All requested instrument and recording changes were accomplished on schedule. Instrumentation and data recording support was provided for the Tanking and Seal Separation Tests. No major problems or errors were evident.

The major tasks required for Cryo-Unlatch #3 are complete. The remaining workload consists of a very thorough system check out and set up, plus probable changes in requirements.

CONTROLS

LN_2/LN_2 and LH_2/LN_2 seal release tests were implemented and completed successfully. Abort and sequence requirements for Cryo-Unlatch Test #3 have been met.

Vent system was modified to add payload purge and vent valves to the error monitoring system.

STRUCTURAL TEST — TCPO - J. C. HUMPHREY; RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

Preparations continued for the CSS Structural Tests.

The shroud counter balance support system was assembled and proof loaded.

The Centaur stretch system was assembled and checked.

Pad eyes were welded on the test tower and proof loaded.

The test requirements document was reviewed and approved.

Visual display requirements have been clarified. Mutually agreeable techniques have been developed.

(Continued on Page 23)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

STRUCTURAL TEST (Continued)

The Centaur LH_2 fill line drawing was completed. Off-Site fabrication of the components required for the fill and vent line modification is in progress.

INSTRUMENTATION

All connector wiring designation sheets for the additional 252 strain gauge channels have been completed.

Approximately 20% of circuit modifications and 60% of cable additions for strain gauges have been completed.

All new deflectometer transducers have been received from the manufacturer. About 70% of the work on the calibration rig has been completed. The balance panel circuit has been revised to accommodate the new deflectometers. New deflectometer balance panel boards are presently being fabricated.

Work has been initiated on the structural flow sheets.

CONTROLS

The control requirements for the B-3 Structural Tests have been reviewed. Work in various areas such as computer programming, TV, control and sequencing, control panel modification and alarm display has been started. There is still work to determine the final orifice size for the hydraulic failsafes pending outcome of D-Site Tests. All major purchase items have been received or a satisfactory promise date has been obtained.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS (YP04239) CRYOGENIC UNLATCH TEST — TCPO - S. V. SZABO; RSD - W. E. KLEIN DISCUSSION OPERATIONS "In a split second during the quiet evening hours last Wednesday, two latches unfastened, hinges rotated, and a 6500 pound aluminum cover on a rocket broke loose at Plum Brook Station". Lewis News 2-23-73 (Continued on Page 23)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

STRUCTURAL TESTS SCHEDULED FOR	Apr - Jun 1973.
CRT STRESS-STRAIN READOUT TEST	Mar 21, 1973.
50% LOAD VALIDATION TEST	Apr 2, 1973.
STRUCTURAL TEST #3 (FIRST STR. TEST)	Apr 9, 1973.
ENGINEERING EVALUATION TEST	Feb 15 - Jun 30, 1974.
ITEMS COMPLETED	
Cryo-Unlatch Test #3 completed	Feb 7, 1973.
Shroud removed and sent to SPF	Feb 9 - Feb 12.
Shroud structural strengthen mods complete.	
Strain Gages installed	Feb 12 - Feb 26.
LN_2 Fill Line installed	Feb 22.
Centaur tank loading cylinder installed	Feb 23.
New tank stretch system	Feb 23.
CSS Aft skirt section installed	Feb 27.
Decision to have a LN_2 boil-off test following Test #7L.	
Preliminary flow and digital format sheets for tests 3, 4, & 7 completed.	
Alarm hardware C/O completed.	
ITEMS IN PROGRESS	
Strain gage check out	80% complete.
Deflectometer balance panel card work	80% complete.
Strain Gage facility cable work	60% complete.
Deflectometer facility cable work	40% complete.
Additions & Mods to thermocouples	70% complete.
Coding of program changes	50% complete.
TR48 interface design work	50% complete.
TR48 installation work	20% complete.
Testing Datametrics Unit.	
CSS structural test preparations continuing.	
Fabricating & Installing deflectometer brackets & other test hardware.	
Working on facility shutdown plans for Station Standby Status.	
Changes to sequence, abort and alarm system program are scheduled to be completed	Mar 21, 1973.
Modifying failsafe manifolds for axial cylinders.	
All purchases of major control items are scheduled to be delivered	Mar 5, 1973.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CRYOGENIC UNLATCH TEST (Continued)

Cryogenic Unlatch Test #3 was successfully performed on February 7, 1973 at 9:20 P.M. All data has been reviewed and no anomalies have been found. Therefore no further cryogenic unlatch tests are scheduled.

The +Y half of the shroud was removed from B-3 on February 9, 1973 and sent to SPF for refurbishment. The -Y half of the shroud was removed on February 12.

No further status reports will be prepared relative to cryogenic unlatch tests.

INSTRUMENTATION

Instrumentation and data recording support was provided for Cryo-Unlatch Test #3. The only problems consisted of the Datametrics Pressure Transducer and the F.B.R. stain gages. The Datametrics unit is now being tested in the Standards Lab. A simulation of cryogenic conditions on the F.B.R. stain gage wiring showed that the zero drift problem was likely in the gage installation. Cleveland is planning further tests of the F.B.R. strain gages.

STRUCTURAL TEST — TCPO - J. C. HUMPHREY; RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

Preparations continued for the CSS Structural Test Program during this report period. Test stand work primarily involved the fabrication and installation of deflectometer mounting brackets and other test related hardware. A six man NASA team from Cleveland and a six man LMSC team installed strain gages on the shroud on a two shift,ten hour/day, six day/week basis. An LMSC manufacturing team made modifications to structurally strengthen the shroud for the upcoming tests. A total of six additional LMSC and nine additional GDC men have been at Plum Brook to assist in shroud preparations for the structural tests.

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SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

STRUCTURAL TEST (Continued)

The major events of this month were:

Feb. 12-26: Installed strain gages and made manufacturing modifications on the shroud at Space Power Facility.

Feb. 22 : LN_2 fill line installed on Centaur LH_2 tank.

Feb. 23 : Installed Centaur tank loading cylinder and new tank stretch system in B-3.

Feb. 27 : Installed CSS aft skirt section on conical boattail at B-3 Facility.

TCPO decided to perform an LN_2 boiloff test following Structural Test #7L. This constitutes an additional test requirement. The formal paperwork (EWO) for the test arrived at Plum Brook on February 23, 1973. Some purge systems will have to be reinstalled for which plans had not previously been made. The primary problem posed by the new request involves the cable routing inside the shroud for the additional thermocouple recording requirements. It is hoped that the additional work can be accomplished without a schedule slip.

The test schedule is:

Mar. 21: CRT Sress-Strain Readout Test

Apr. 2: 50% Load Validation Test

Week of
Apr. 9: Structural Test #3 (first of the series of seven structural tests).

Plans are being formulated for shutdown of the facility after completion of the final engineering evaluation test program.

INSTRUMENTATION

All strain gage installation work has been completed.

(Continued on Page 27)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

STRUCTURAL TEST (Continued)

Eighty percent of strain gage check out by RSD personnel has been completed.

Eighty percent of the deflectometer balance panel card work has been completed.

About sixty percent of facility cable work for strain gages has been completed.

About forty percent of facility cable work for deflectometers has been completed.

Preliminary flow and digital format sheets for tests 3, 4 and 7 have been produced.

Seventy percent of work on thermocouple additions - modifications has been done.

CONTROLS

Sequence, abort and alarm system program changes are proceeding on schedule for a completion date of March 21. The coding of the program changes is 50% complete. There will be no CF-16 aborts, eliminating the requirements for changeable limits.

The design of the TR-48 interface for the Structural Tests is 50% complete and the installation is 20% complete. The check out of the alarm hardware is complete.

The failsafe manifolds for the axial cylinders are being modified with orifices so that the cylinder fails at a controlled rate. The last major purchase items required are due on March 5, 1973.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD (CSS) TESTS (YP04239) STRUCTURAL TEST — TCPO - J. C. HUMPHREY; RSD - L. C. GENTILE DISCUSSION OPERATIONS Preparations continued for the CSS Structural Test Program during this report period. Test stand work primarily involved the installation of the CSS and related facility hardware. Fabrication and installation of deflectometer mounting brackets continued through most of March. (Continued on Page 29)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE
CENTAUR STANDARD SHROUD TESTS	B-3	YP04239
STRUCTURAL TESTS SCHEDULED FOR	Apr - Jun 1973.
25% CHECK OUT & 50% LOAD VALIDATION TEST	April 9, 1973.
STRUCTURAL TEST #3L.	April 16, 1973.
ENGINEERING EVALUATION TEST	Feb 15 - Jun 30, 1974.
ITEMS COMPLETED	
Fabricated deflectometer mounting brackets.	
Installed shroud -Y and +Y tank sections	March 3, 1973.
Removed tank section AGE gear	March 5, 1973.
Installed Centaur Load cylinder	March 5, 1973.
Installed Payload Section	March 6, 1973.
Installed Nose Cone	March 7, 1973.
Installed Loading Fixtures	March 10, 1973.
Installed deflectometer brackets on shroud	March 13-23, 1973.
Installed counterbalance beam	March 14, 1973.
Installed deflectometers	March 19-28, 1973.
Installed & checked out deflectometers wiring to B-3 patchboard.	
All other instrumentation checked out.	
Site and control room patchboards have been patched.	
Installed all control hardware for initial tests.	
Completed software programs for sequence, abort, and alarm.	
Data needed for first structural test was received.	
Vent fin test control hardware was received.	
ITEMS IN PROGRESS	
Structural test program preparations progressing.	
Installing shroud & related facility hardware.	
Installing final mechanical hookup of deflectometers	
Checking out instrumentation through SEL data sys.	
Checking out control system and software programs.	
Checking control hardware for vent fin tests.	

CHANGES: Test schedule changes.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

STRUCTURAL TEST (Continued)

The major events of this month were:

Mar. 3 -Installed CSS -Y and +Y tank sections in B-3.

Mar. 5 -Removed tank section AGE gear and installed Centaur load cylinder.

Mar. 6 -Installed CSS payload section.

Mar. 7 -Installed CSS nose cone.

Mar. 10 -Installed shroud loading fixures.

Mar. 14 -Installed counterbalance beam below crane rails.

Mar. 13-23-Installed deflectometer brackets on shroud.

Mar. 19-20-Installed deflectometers.

Mar. 28 -Started final mechanical hookup of deflectometers to the shroud.

Numerous problems developed during the installation of the deflectomers. Many had to be relocated due to interferences with building beams, hand rails, and Centaur vehicle attachments. Difficulties in equipment installation and check out plus the addition of another check out test at reduced loads will cause a one to two week delay in the schedule.

The current test schedule is:

Week of April 9 - 25% check out and 50% load validation test.

Week of April 16- Structural Test #3L.

INSTRUMENTATION

During the month of March the following was accomplished:

All deflectometer wiring has been completed and checked through to the B-3 patchboard.

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SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

INSTRUMENTATION (Continued)

All strain gages for the current run have been patched through the transfer box and checked through to the patchboard.

All other instrumentation associated with Runs 3 and 4 has been checked out in a similar manner.

Both site and control room patchboards have been patched. At present final check out through the SEL data system is being accomplished.

Instrumentation should be ready for the first structural pre-test on week of April 9, 1973.

CONTROLS

All controls hardware required for the initial structural tests has been installed and is currently being checked out. The necessary software programs for sequence, abort and alarm have been completed and are in the check out phase. The sequence, abort, and alarm data has been obtained from Lewis-Cleveland and is being implemented for the first series of structural tests.

All purchased hardware required for the vent fin tests has been received and is being checked at D-Site. Plans are being made to proof test all parts involved in loading apparatus for all structural tests.

Safety Committee and Readiness Review Committee recommendations are also currently being implemented.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS (YOQ4239)

STRUCTURAL TEST

TCPO - J. C. HUMPHREY;
RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

Check out runs and the first structural test were accomplished in this reporting period. Except for minor problems in a few areas, all tests operations went well. Significant events of the month are noted below:

April 1-7: Finish defelctometer hookups.

April 9-10: Pre-run countdown operations.

April 11: 25% Load Test and 27% Abort Test successfully accomplished.

April 13: 50% Load Test successfully accomplished.

April 16-20: Modifications to facility & research hardware resulting from 50% Load Test.

(Continued on Page 19)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS	B-3	Y0Q4239
STRUCTURAL TESTS SCHEDULED FOR		Apr - Jun 1973.
CHECK OUT RUNS AND FIRST STRUCTURAL TEST COMPLETED.		
STRUCTURAL TEST #4L SCHEDULED FOR		May 2, 1973.
STRUCTURAL TEST #5L SCHEDULED FOR		May 16, 1973.
ENGINEERING EVALUATION TESTS		Feb 15 - Jun 30, 1974.
ITEMS COMPLETED		
Deflectometer hookups completed		April 7.
Pre-run countdown operations completed		April 9 - 10.
25% load test and 27% abort test completed		April 11.
50% load test completed.		April 13.
Facility and research hardware mods(after 50% load test). . .		April 16 - 20.
Pre-run countdown operations		April 23 - 24.
Structural Test #3L completed		April 25.
Set up instrumentation for 252 strain gages, 90 deflectometers, 5 temperatures, and 15 pressures.		
Recalibrated, corrected or repaired 30 strain gages and 8 deflectometers.		
Cleared instrument ground loops.		
Added fuses and comparator circuit to strain gage power supply.		
Capacitors added to strain gage power supplies.		
45 flow sheets and check sheets were made.		
Corrections and mods were made to control system.		
Facility control amplifier channel was changed.		
Modified data marker (generated during load ramps).		
ITEMS IN PROGRESS		
Preparing for Structural Test #4L scheduled for . .		May 2, 1973.

CHANGES: Added next run schedule dates.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

STRUCTURAL TEST (Continued)

April 23-24: Pre-run countdown operations.

April 25: Structural Test #3L successfully accomplished.

April 26-30: Preparation for Test #4L.

The combined CSS and facility hardware deflected about 50% more than anticipated under shear loading during the 25% and 50% Load Tests. Approximately 18% of this is attributed to the CSS and the remainder to the facility mounting hardware. Therefore, for Test #3L it was necessary to preload the CSS in shear to assure sufficient hydraulic cylinder actuator stroke to get the maximum shear load of 36,800 pounds. It may be necessary to preload the CSS for the remainder of the Structural Tests.

Test #4L is scheduled for May 2 and Test #5L for May 16. An attempt will be made to accelerate the test schedule in order to deliver the CSS to SPF by July 1, 1973.

INSTRUMENTATION

During the month of April, B-3 instrumentation supported three successful test runs. These were 3L - 25%, 3L- 50% and 3L - 100%.

In preparation for these tests the following instrumentation was set up.

252 strain gages
90 deflectometers
5 temperatures
15 pressures

During the month, about 30 strain gages and 8 deflectometers were corrected, recalibrated, or repaired.

The instrument ground loops at B-3 test were cleared.

Fuses and a comparator circuit were added to the strain gage power supplies as a safety measure.

Capacitors were added to the strain gage power supplies to eliminate noise.

(Continued on Page 21)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

STRUCTURAL TEST

INSTRUMENTATION (Continued)

Approximately 45 flowsheets and check sheets were produced.

CONTROLS

Some minor corrections and modifications were made to the control system during the 25% check out and 50% load validation tests. The faulty amplifier channel that caused two error aborts has been completely changed. A drift free set point at 100% load has been provided for the axial loads. The data marker that is generated during load ramps was modified to provide a 1 second pulse for each 2% of load change for use in data acquisition.

During Structural Test #3L, all control systems basically performed satisfactorily. The one abort that occurred was caused by noise spikes on the "B" bridge of the North load cell. In ramping to 100% of shear load, the sum of "A" and the sum of "B" signals disagreed by 800 pounds. These problems are being investigated.

5-23

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS (Y0Q4239)

STRUCTURAL TEST

TCPO - J. C. HUMPHREY
RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

All work this month was directed to the preparation for, and conducting of, structural test runs. Significant events of the month are noted below:

May 2: Structural Test #4L successfully accomplished.

May 3-10: Preparation for Test #2L-1: Moved shear strap, relocated deflectometer and activated a new set of stain gages.

May 11: Structural tests #2L-1 & 2L-1A successfully accomplished.

May 12-17: Preparations for Test #1L-1.

May 18-19: Structural tests #1L-1 & 1L-2 & shroud leak test successfully accomplished.

May 21-22: Preparations for Test #2L-2.

May 23: Structural test #2L-2 (vent fin test) sucessfully accomplished.

(Continued on Page 21)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS	B-3	Y00423

STRUCTURAL TESTS SCHEDULED FOR	Apr - June 1973.
TEST 1L3 SCHEDULED FOR	June 4, 1973.
TESTS 7L-1 & 7L-2 SCHEDULED FOR	Week of June 11, 19
TESTS 5L-1, 5L-2, 5L-3, & 5L-4 SCHEDULED FOR	Week of June 26.
ENGINEERING EVALUATION TESTS	Feb 15 - June 30, 19
ITEMS COMPLETED	
Structural Test #4L completed	May 2, 1973.
Structural Test #1L-1 & #1L-2 completed	May 18 - 19, 1973.
Shroud Leak Rate Test completed	May 18 - 19, 1973.
Structural Test #2L-2, Vent Fin Test, completed . . .	May 23, 1973.
Operations preparations completed for special forward seal test #1L-3	May 24 - 31, 1973.
Operations preparations completed for Cryogenic Structural Test #7L-1 & 7L-2	May 24 - 31, 1973.
Two new tests added to program.	
Test #1L-3 instrumentation flowsheets and formats completed.	
ITEMS IN PROGRESS	
Work is progressing for Test Series 7 and 5.	
Control changes being made for 1L-3 structural test.	

CHANGES: Run Schedules Added.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

STRUCTURAL TEST (Continued)

May 24-31: Preparation for special forward seal test #1L-3 and cryogenic structural test #7L-1 and #7L-2.

The results of Test Nos. 3L, 4L, and 2L-1 and 2L-1A all verified that the CSS test hardware deflects approximately 50% greater than anticipated under shear load. This test result necessitated investigation of loads on the Centaur tanks, available motion of the vent fin disconnect, available clearance between the CSS and payload, design of the forward seal and design of the FBR struts. As a result of the investigations, the FBR struts were installed for Test #1L-1. The objective was to determine a combined stiffness factor for the shroud, FBR struts and Centaur tank. The information was needed for the redesign of the FBR strut spring mechanism and caused an additional special test to be added to the test program. The FBR struts were removed after Test #1L-1 and Test #1L-2 was run.

During Run #1L-2 the shroud was to be pressurized to approximately 3 psig to test the forward seal and its retention device. The seal "popped" off the retaining ring at about 2 psig. None of the seal equipment was damaged. The fact that the seal "popped" at a lower pressure than expected is of concern and another special test #1L-3 has been scheduled to further define the problem area.

Between Test #1L-1 and 1L-2 on May 18, a CSS leak test was performed to determine if the shroud tank section had additional leakage from that observed on April 6, 1973 before the structural tests began. Additional leaks could be caused because of flexing the shroud during the structural tests from April 6 to May 18. However, there was no significant change in shroud leakage.

The current schedule is as follows:

Test 1L-3: June 4

Test 7L-1 & 7L-2: Tentatively scheduled for week of June 11.

(Continued on Page 23)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	

STRUCTURAL TEST (Continued)

Test 5L-1, 5L-2, 5L-3, 5L-4: Tentatively scheduled for week of June 26.

Test 5L-3 and 5L-4 are new tests added to the program as a result of the FBR redesign. Shroud removal from B-3 will start immediately after the 5L series of structural tests are completed.

INSTRUMENTATION

During the month of May instrumentation and data support was provided for the test runs. There were no major problems. Noise levels on the data are very low. Last minute changes have been incorporated without errors.

Flowsheets and formats are ready for special test #1L-3. Data coordination and pattern tape generation has been accomplished on an emergency basis, by telephone, with Cleveland.

Work has also been progressing on Test Series 7 and 5.

CONTROLS

The 1L, 2L and 4L series structural tests have been performed sucessfully. Changes are now being made for the final 1L-3 structural test scheduled for the first week of June.

The 7L cryogenic structural test series will involve an extensive sequence and abort program. The 7L test includes the firing of pyros, movie cameras, tank protection system, and structural loading. Information is now being obtained from Lewis-Cleveland regarding this run.

The follow-up 5L test after 7L will be similar to the present tests and will not involve any extensive control system changes.

SECTION II

PLUM BROOK ROCKET SYSTEMS DIVISION

TEST OPERATIONS REPORT

FOR THE MONTH OF

JUNE 1973

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY	CENTAUR STANDARD SHROUD (CSS) TESTS (Y0Q4239) STRUCTURAL TEST TCPO - J. C. HUMPHREY; RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

All work this month was directed to the preparation for, and conducting of, structural test runs. Significant events of the month are noted below:

(Continued on Page 17)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

AIR FORCE PROJECT (EXO-PEG TESTS) B-2 YGP32

NEXT RUN SCHEDULED FOR.	August 1973
Aerospace Corporation working on instrumentation for Phase II testing.	

CHANGES: Run schedule changed from July to August.

CENTAUR STANDARD SHROUD TESTS B-3 YOQ42

SEAL TEST SCHEDULED FOR	Jul 2, 1973.
ENGINEERING EVALUATION TESTS SCHEDULED FOR	Apr 15 - Oct 15, 197
ITEMS COMPLETED	
Structural test #IL3 completed	June 4, 1973.
Prepared for 7L series of tests	June 5-13, 1973.
Completed Boiloff Test & 7L Series of tests	June 14-15, 1973.
Modified aft seal plate.	June 16-22, 1973.
Installed new forward seal	June 16-22, 1973.
Prepared for 5L & 6L test series	June 16-22, 1973.
Completed 6L series and 5L-2 tests	June 28, 1973.
Forward seal redesigned, fabricated & installed.	
ITEMS IN PROGRESS	
Preparing for July 2 test series.	
Control equipment being reviewed to determine necessary repairs.	

CHANGES: Engineering Evaluation Tests schedule.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

STRUCTURAL TEST (Continued)

June 4: Test IL-3 (forward seal pressure test) completed. Seal popped off at 2.1 psig.

June 5-13: Preparations for test series 7L.

June 14-15: Successfully completed the following tests:
#7L-1 - Launch transient loading
#7L-2 - Limit load on FBR system
#7L-3 - FMR separation
#7L-4 - Payload Branch Spring Rate without FBRs.
- Boiloff Test

June 16-22: Modified aft seal plate. Installed new forward seal. Preparations for 5L & 6L test series.

June 28: Successfully completed the following tests:
#6L-1 - Limit loads on FBR and ISA Pressure and load test on forward seal.
#6L-2 - FBR Separation
#6L-3 - FSR Release
#5L-2 - Limit Tension Load.

The forward seal "popped off" the CSS retainer during Test IL-3 on June 4. The seal is required to withstand 3.0 psig and it failed at 2.1 psig. This second failure (first failure was on May 18 during test IL-2) necessitated a redesign of a portion of the forward seal by GDC.

The boiloff test results on June 14 were nearly identical to those obtained earlier this year. This indicated that the insulation had not degraded due to handling and being exposed to atmospheric conditions for long time periods.

It was decided to structurally modify the CSS aft seal plate to enable it to better withstand the 3 psig pressure it would be subjected to during the forward seal tests. This modification was made by LMSC personnel. During this same time period GDC personnel installed the redesigned forward seal. The larger retaining bead on the seal caused clearance problems on other CSS components. The FBR retract springs had to be relocated and structural gussets on the CSS forward seal plate had to be ground out to provide adequate clearance.

(Continued on Page 19)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

STRUCTURAL TEST (Continued)

The redesigned seal withstood a 3 psig pressure check on June 28 and the test will be repeated on July 2.

The July 2 series of tests will complete this portion of the B-3 test program. Shroud removal activities will start on July 5, and should be completed by July 20.

INSTRUMENTATION

During this month the instrument section prepared for and supported the following cryogenic structural tests:

7L-1, 2, 3	6-14-73 - 6-15-73
6L-1, 2, 3, 5L-2	6-28-73

On Test 7L approximately 400 channels of digital and 65 channels of analog information were recorded.

On Test 6L and 5L approximately 200 channels of digital and 57 channels of analog information were recorded.

All tests were covered by the real time data display and plotting system at B-Control.

At present, instrumentation is planning the orderly removal of instrumentation from the test hardware prior to its shipment to SPF for the Heated Jettison Tests.

CONTROLS

The current structural test series in B-3 has been successfully completed. A review of all equipment used is being made to determine what repairs are necessary,and steps to facilitate the repairs will be taken.

All structural test equipment will be inventoried, identified and stored. Equipment will be built up as far as possible to existing Engineering Evaluation Test configuration requirements.

Design, purchase and testing of additional Engineering Evaluation Test items will be started within the next month.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TAS
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

AIR FORCE PROJECT (EXO-PEG TESTS)	B-2 (NARRATIVE ON PAGE 5)	YGP
NEXT RUN SCHEDULED FOR		January 1974.
Aerospace Corporation procuring and modifying instrumentation for Phase II.		
Facility Prepared PR and specs for pump shaft inspection.		

CHANGES: Run Schedule

CENTAUR STANDARD SHROUD TESTS	B-3	YO(
ENGINEERING EVALUATION TESTS SCHEDULED FOR		Apr 15 thru Oct 1!
ITEMS COMPLETED		
Structural test program completed		July 2, 1973.
CSS & related equipment was removed & sent to SPF . .		July 3 to 16, 197
Centaur removed and stored in shipping pallet in Bldg. No. 5131		July 13, 1973.
Cleaned up test site and inventoried equipment.		
Meetings held to review requirements for EET		July 31, 1973.
PR initiated for EET control items.		
Site personnel reassigned to HTF and K-Site		
ITEMS IN PROGRESS		
Repairing RT-20 analog computer power supply.		
Repairing digital run clock.		
Repairing vent system transducer power supply.		

CHANGES: None

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS (YOQ4239)

STRUCTURAL TEST

TCPO - J. C. HUMPHREY;
RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

The CSS Structural Test program was completed on July 2. The CSS and related Centaur equipment was removed from the test stand and sent to Space Power Facility for the heated jettison test program. The Centaur tank was put in the shipping pallet and is in storage in Building No. 5131. Significant events of the month are noted below:

July 2: Successfully completed the following tests:
#5L-1 - Pressure and load test on forward seal at ambient conditions,
#5L-3 - Forward seal release test at ambient conditions.

July 3-7: Removed deflectometers, counterbalance beam, forward load application fixture and south door beams.

July 9: Removed CSS nose cone, shroud, payload cylinder, and Centaur load cylinder.

July 10-11: Removed truss adapter and CSS tank cylinder.

July 12-13: Removed Centaur radiation shield stub adapter, fill lines, and CSS boattail skirt.

July 13: Removed Centaur from B-3 and stored in shipping pallet.

July 16: Removed Centaur ISA and CSS boattail. Derection complete.

The last half of the month was spent in cleaning up and inventorying equipment. Site personnel were reassigned to the Hypersonic Tunnel Facility to aid in the heater rebuild

(Continued on Page 9)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD TESTS (Continued)

operation and to K-Site. A minimum crew will be maintained at B-3 to cover preliminary work for the CSS Engineering Evaluation Tests.

A meeting was held with TCPO on July 31 to review requirements for the CSS Engineering Evaluation Tests. These tests will be conducted in B-3 when the heated jettision tests are completed at SPF.

INSTRUMENTATION

The final Cryo-Structural Tests were performed on July 1 and July 2.

Between July 3 and July 16 instruments supported the CSS and associated parts disassembly. This included the following:

(1) Removal of all thermocouples, pressure and RTS instrumentation from hardware.

(2) Removal of all internal and external cables from test hardware. In some cases cables were completely removed, in others, the cables were coiled back in Titan Skirt area.

(3) Depending upon future use requirements, all strain gage instrumentation was removed, cut back or tied down.

For the balance of the month the following was done:

(1) Removal of all deflectometers to calibration laboratory.

(2) Pull back and tie down all facility deflectometer cables.

(3) Documentation and repair of about 80% of instrument cables.

(4) Removal of about 50% of facility pressure transducers.

(Continued on Page 11)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD TESTS (Continued) CONTROLS Purchase requests have been initiated for the long lead time hardware for the engineering evaluation test. Current structural test hardware has been removed and stored to the extent required to facilitate removal of the CSS. Repair work is in progress on the following control room equipment: (1) RT-20 analog computer power supply, (2) Test conductor's digital run clock, and (3) Centaur vent system transducer power supply.

SECTION II

PLUM BROOK ROCKET SYSTEMS DIVISION

TEST OPERATIONS REPORT

FOR THE MONTH OF

AUGUST 1973

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS (YOQ4239)

ENGINEERING EVALUATION TESTS — TCPO - J. C. HUMPHREY; RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

Two meetings have been held with TCPO to discuss the CSS Engineering Evaluation Test Program. A minimum test plan has been proposed. Initially two dynamic bending mode tests would be made; one with, and one without, the FBRs installed. Two static structural tests would follow. The first would have cryogenics in the Centaur and the second would be made at ambient conditions.

(Continued on Page 7)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	T
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

AIR FORCE PROJECT (EXO-PEG TESTS) B-2 (NARRATIVE ON PAGE 5)

NEXT RUN SCHEDULED FOR	January 1974.
Aerospace Corporation procuring and modifying instrumentation for Phase II.	
Facility Held site inspection for pump shaft inspection work.	

CHANGES: None.

CENTAUR STANDARD SHROUD TESTS B-3

ENGINEERING EVALUATION TESTS SCHEDULED FOR	Apr thru May 31,
ITEMS COMPLETED Two meetings held with TCPO on test program. Preliminary tasks have been defined. Record copies of flow sheets and digital formats assigned and filed. Removed all pressure transducers and sent to Cal Lab. Work order written for load cell calibration. Initiated tasks to update all instrumentation blueprints.	
ITEMS IN PROGRESS Instrument cables being documented and repaired. Initiated design on test rig for deflectometers. Design and procurement of major contract items progressing	90% complete.

CHANGES: Schedule Change.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

ENGINEERING EVALUATION TESTS (Continued)

Tentative test schedules have been prepared. To meet schedule dates, test requirements should be relatively firm by the 15 of October 1973. This will allow enough time to order or fabricate test equipment and purchase any additional instrumentation if required.

A number of tasks preliminary to the EET have been defined and are being accomplished when manpower is available. They include:

(1) Raising the Titan Skirt and drilling additional mounting holes in the lower distribution chamber.

(2) Cleaning and oiling the Centaur Tank Section.

(3) Removing transducers, etc., for recalibration.

(4) Removal and repair of facility hardware where required.

INSTRUMENTATION

The following tasks were completed during August:

(1) All record copies of flow sheets and digital formats have been assembled and filed.

(2) All facility pressure transducers have been removed and sent to the calibration laboratory.

(3) Work orders have been written and all load cells are presently being shipped to Lewis-Cleveland for calibration.

(4) The task of updating all facility instrumentation blueprints has been initiated.

(5) Work on the documentation and repair of instrument cables is continuing.

(6) Per EET test requirements, work was initiated on the design of a test rig for deflectometers.

(Continued on Page 9)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CONTROLS As a result of a test review committee meeting, several EET tests have been eliminated or modified. Design and procurement of all major control items needed as of the present test configuration is 90% complete. The build up and testing of any new equipment should start within a month.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

AIR FORCE PROJECT (EXO-PEG TESTS)	B-2 (NARRATIVE ON PAGE 3)	YGP32
NEXT RUN SCHEDULED FOR		January 1974.
Facility Processing purchase requests for water pump parts. Contract awarded to inspect and replace drive shaft coupling bolts for three pumps.		

CHANGES: None.

CENTAUR STANDARD SHROUD TESTS	B-3	YOQ42
ENGINEERING EVALUATION TESTS SCHEDULED FOR		Apr thru May 31, 1971
ITEMS COMPLETED Design of Twang Tests loading systems completed. Method of shroud shear loading was modified. All LVDTs were delivered. O-Rings for the hydraulic failsafe were delivered.		
ITEMS IN PROGRESS Planning sessions on EETs. Proceeding with procurement of hardware. Working on request to have an absolute reference system to check shroud alignment between tests. Refurbishing the ladder instrument cabling. Updating instrumentation blueprints. Proceeding on tests to check deflectometers. Calibrating load cells and pressure transducers.		

CHANGES: None

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS (Y0Q4239)

ENGINEERING EVALUATION TESTS — TCPO - J. G. MCARDLE; RSD - L. C. GENTILE

SUMMARY

Planning sessions for the Engineering Evaluation Tests are continuing. Hardware is being bought as test requirements are firmed up. No problem areas have been uncovered at this time.

DISCUSSION

OPERATIONS

The weekly meetings with TCPO are continuing. The basic test plan as outlined in the previous report appears to be relatively firm. A number of items have been discussed in detail and clarified. Some of the major items are:

(1) A loading system for the twang tests has been designed. Pyrotechnic cable cutters will be used to release the shroud after it has been pulled over and parts are being ordered.

(2) The shroud shear loading has been modified to permit required deflections without a pre-load. Longer stroke cylinders will be used and attached to the shroud, through a cable system. The bell crank was eliminated.

(3) An absolute reference system has been requested to check shroud alignment between tests. If feasible, deflectometers will be used to obtain the measurements.

There has been little activity at the site over the past month.

The support contract with Lockheed to cover the EET program was reviewed.

(Continued on Page 7)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY CENTAUR STANDARD SHROUD (Continued) INSTRUMENTATION Work involving the refurbishment of ladder instrument cabling is continuing. Facility blueprint update work is continuing. A test involving the repeatibility of deflectometer measurements was initiated. Work on the calibration of both load cells and pressure transducers is continuing. CONTROLS Procurement of items for the EET tests is 95% complete. All LVDTs, including those for the 20 inch stroke cylinders, have been delivered. The O-rings for the hydraulic failsafes have also been received.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMIC$ AND CONTROL FACILITY CENTAUR STANDARD SHROUD (CSS) TESTS (YOQ4239) TCPO - L. G. MCARDLE; ENGINEERING EVALUATIONS TESTS RSD - L. C. GENTILE DISCUSSION OPERATIONS Weekly meetings with Titan Centaur Project Office were continued. The main body of the "Test Requirements Document" for the Engineering Evaluation Tests" was reviewed. A number of discrepancies were noted and correction will be made. The Instrumentation Section of the TRD is now being compiled. (Continued on Page 7)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK I
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS	B-3	YOQ423
ENGINEERING EVALUATION TESTS SCHEDULED FOR		Apr thru May 31, 1974

ITEMS COMPLETED

Titan-Centaur Project Office weekly meeting.
Reviewed "Test Requirements Document" report.
TRD instrumentation section was completed.
Cable cutting devices ordered.
Shroud alignment deflectometers tests completed.
Painted test fixtures.
Modified Centaur stand by pressurization system.

ITEMS IN PROGRESS

Assembling deflectometers frequency reference check wiring.
Calibrating pressure tranducers and load cells.
Assembling 20" hydraulic actuators.

CHANGES: None.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

ENGINEERING EVALUATION TESTS (Continued)

A firm order has been placed for the cable cutting devices, required for the Twang Tests. In general, most equipment for the EET Program is on order or at Plum Brook.

The deflectometer frequency response check out rig is being assembled.

The test to determine the feasibility of using deflectometers to check shroud alignment between tests has been completed. The method appears to be satisfactory.

Some of the test fixtures required for the EET have been repainted and a protective coating has been applied over the flanges. The Centaur standby pressurization system has been modified and reworked.

INSTRUMENTATION

Work continued on the calibration of pressure transducers and load cells.

The deflectometer stability tests were completed at B-3 Test Stand.

CONTROLS

The 20-inch hydraulic actuators required for the EET Tests are currently being assembled. All major control hardware has been received. Testing of the completed hydraulic actuator will be done at "D" Site. Proof testing of all structural hardware will then be done in B-3.

11-73

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS (YOQ4239)

TCPO - L. G. MCARDLE;
RSD - L. C. GENTILE

ENGINEERING EVALUATIONS TESTS

DISCUSSION

OPERATIONS

Weekly meetings with Titan Centaur Project Office were continued.

The instrumentation section of the "Test Requirements Document" was reviewed. A final instrumentation list will be issued after firm deflectometer requirements are established and deflectometer frequency response characteristics have been determined.

Accomplishment responsibility for various items on the test scheduled was also reviewed.

There has been minimum activity at the site and on existing work orders.

(Continued on Page 7)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS	B-3	YOQ42:

ENGINEERING EVALUATION TESTS SCHEDULED FOR	Apr thru May 31, 197
ITEMS COMPLETED	
Titan-Centaur Project Office weekly meetings.	
Reviewed Instr. Section of "Test Requirements Doc."	
Reviewed various items accomplishment responsibility.	
Calibrated load cells in the 20K# and 60K# range.	
Set up deflectometer frequency response rig.	
ITEMS IN PROGRESS	
Deflectometer and strain gage layout engineering work.	
Assembling 20" hydraulic actuators	60% complete.

CHANGES: None

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

ENGINEERING EVALUATION TESTS (Continued)

INSTRUMENTATION

All load cells in the 20K# and 60K# range have been calibrated and returned from LeRC-Cleveland.

Engineering work with TCPO was begun on deflectometer and strain gage layout for EET.

The deflectometer frequency response rig has been set up at H-Building. Tests are to begin shortly.

CONTROLS

The 20 inch hyrdaulic actuators required for the EET Tests are approximately 60% assembled in the valve shop. Testing of the completed hydraulic actuators will be accomplished at D-Site. Proof tests on all new structural hardware will then be done in B-3.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS (YOQ4239)

ENGINEERING EVALUATION TESTS

TCPO - R. W. HEATH;
RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

Because of the absence of many personnel during the holiday season the regular weekly meetings with the Titan-Centaur Project Office were not held. There was also minimum activity at the site and on existing work orders.

Tests were run to determine the affect of five feet of cable on the frequency response of a three inch deflectometer with a stroke of $\pm$ 1/4 inch. With two intermediate-point restraints, frequency response and zero shift were within two percent of that of the deflectometer alone. Further testing will be done on the specific deflectometers that will be used for the "Twang" tests on the Centaur Shroud. Accelerometers are also being calibrated for use in the "Twang" tests.

SITE	SITE NAME- RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTRDL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS
(YOQ4239)

ENGINEERING EVALUATION TESTS

TCPO - R. W. HEATH;
RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

Installation of the hard points, required for support of the hydraulic shear load cylinders, has been completed. Proof tests of the system are now in progress.

Four meetings were held with the TCPD project group to review the "Test Requirements Document". Detailed test load levels were defined and instrumentation, control and visual display requirements were reviewed.

Additional tests were conducted on the "Twang Test" deflectometers to determine the effect of extending string length.

Tests have been started to qualify the new hardware cylinders purchased for the engineering evaluation test series.

(Continued on Page 5)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 Y0Q4239

ENGINEERING EVALUATION TESTS SCHEDULED FOR	Apr thru May 31, 1974.
ITEMS COMPLETED	
Installed hard points for load cylinders.	
Four meetings with TCPO project group.	
Review test requirements.	
Defined test load levels.	
Reviewed instruments, controls, and Visual Display requirements.	
Ran tests on "Twang" deflectometers.	
Completed proposal to modify error monitor.	
Tested a Houston deflectometer.	
Received all pressure transducers.	
ITEMS IN PROGRESS	
Qualifying new hydraulic cylinders.	
Checking loading actuators.	
Working on abort and alarm requirements.	
Sequencing, control & abort electrical interfacing is	90% complete.
Working on T.R.D. Estimated completion	February.
Liquid level system is	90% complete.

CHANGES: None

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY (Continued)

ENGINEERING EVALUATION TESTS (Continued)

INSTRUMENTATION

Engineering work with TCPO on the T.R.D. for the Engineering Evaluation Tests is in progress. A final version of the T.R.D. is expected in February.

At the request of TCPO a Houston deflectometer test was performed. The requirement was generated as a result of the SPF testing. The test proved that a three inch deflectometer, set to one-half inch, with a restricted five foot cable extension, would operate properly to ten hertz.

The calibration of all accelerometers for the E.E. "Twang Test" has been successfully completed.

All required pressure transducers for E.E. tests have been delivered to B-3 Test Stand.

Frequency response tests on Houston deflectometers without extension cables, have been completed. Deflectometers, in the range between three and eighteen inches, were tested. All deflectometers tested operated properly below four hertz.

Work on the B-3 liquid level system is ninety percent complete.

CONTROLS

The "Twang Test" hydraulic load actuator has been installed and the facility hard points are being proof tested. The shear and payload hydraulic loading actuators are currently being checked out at D-Site. The new shear loading hardware and hard point will be proof tested about mid-month. The payload hydraulic loading actuator and its associated hard point will also be proof tested at this time.

The proposal for modification of the Centaur Tank Protection error monitor for the CSS dynamic response test is complete. This proposal will be presented to TCPO on February 5 for their concurrence. Abort and alarm requirements will also be finalized on this date. Sequencing, control, and abort electrical interfacing is 90% complete.

SITE	SITE NAME RESEARCH INSTALLATION &(TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS

ENGINEERING EVALUATION TESTS — TCPO - R. W. HEATH; RSD - L. C. GENTILE

DISCUSSION

OPERATIONS

The new hydraulic cylinders have been tested and qualified for use. Proof testing of the recently installed pull points has been completed.

The Titan skirt was releveled on the lower distribution cylinder. Stack up of the Centaur components has started. The interstage adapter is in the process of being installed.

Site work on instrumentation, purge lines, etc., is in progress.

The "Test Requirements Document" has been distributed.

(Continued on Page 5)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS	B-3	Y0Q4239
ENGINEERING EVALUATION TESTS SCHEDULED FOR		Apr thru May 31, 1974.
ITEMS COMPLETED		
Hydraulic cylinders tested and qualifed for use.		
Titan skirt releveled on lower distribution cylinder.		
Test Reqmts Document distributed.		
Calibration work for accelerometers for EET completed.		
Wire run and connectors associated with test hdwe strain gage instrumentation engineering layout work completed.		
Extended length deflectometer test rig complete.		
20" hydraulic loading actuators installed & checked.		
Proof tests completed.		
ITEMS IN PROGRESS		
Stack up of Centaur components has started.		
Interstage adapter being installed.		
Work on instrumentation, purge lines in progress.		
Strain gage and Centaur instrumentation cable work in progress.		
Installation of facility transducers in progress.		
Strain gage instrumentation of test hardware in progress.		
System check of axial hydraulic loading actuators . .		early March.

CHANGES: None

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

ENGINEERING EVALUATION TESTS (Continued)

INSTRUMENTATION

The calibration work for accelerometers for EET has been completed.

Cable work for strain gage and Centaur instrumentation at B-3 Test Stand is in progress.

Work on installation of facility transducers is in progress at B-3 Test Stand.

Engineering layout work for wire runs and connectors associated with test hardware strain gage instrumentation has been completed.

Work on strain gage instrumentation of test hardware at Space Power Facility is in progress.

The extended length deflectometer test rig is now complete. Tests on deflectometers with extension cables are to begin shortly.

CONTROLS

The new 20 inch hydraulic loading actuators have been installed and checked out in B-3. The proof tests required for the Twang Test, Shear, and Payload have been successfully completed. The axial hydraulic loading actuators will be reassembled with loading hardware and a system check will be made in early March.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD
SHROUD (CSS) TESTS

ENGINEERING EVALUATION TESTS - TCPO - R. W. HEATH;
(YGP3211) RSD - L. C. GENTILE

SCHEDULE - APRIL-MAY 1974

The stack up for the Centaur Standard Shroud "Twang Tests" has been completed.

All major components are in place. Cameras, instrumentation, etc., are being installed. Controls checks are in progress.

The first test is scheduled for the first week in April.

This initial series of tests will provide dynamic data, to verify the CSS Dynamic Model at loads above 25% limit. Tests will be conducted with and without the forward bearing reaction struts installed.

The cryogenic structural test is scheduled for early May with the non-cryogenic structural test to follow shortly thereafter.

INSTRUMENTATION

(1) Work involving the dynamic testing of deflectometers for EET has been completed.

(2) All accelerometers have been physically mounted on test hardware for EE twang test.

(3) All cable work associated with FBR strain gages has been completed.

(4) All deflectometers have been mounted and electrically checked out for EE twang test.

(5) Other instrumentation including pressures, load cells, thermocouples and platinum temperature sensors have been installed and checked out for EE twang test.

(6) Run boards have been patched in preparation for EE twang test.

CONTROLS

The changeover from HTF to B-3 was accomplished on March 30, 1974. Validation for the "Twang Tests" is scheduled for April 1, 1974. The tank pressure safety system has been modified and checked out for the "Twang Test". All hardpoints and related hardware have been proof tested for all remaining tests.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD SHROUD (CSS) TESTS

ENGINEERING EVALUATION TESTS (YGP3211) — TCPO - R. W. HEATH; RSD - L. C. GENTILE

SCHEDULE - APRIL-MAY 1974

The "Twang Test" series was completed on April 8 and 9. The data appeared to correlate with the Centaur Standard Shroud Dynamic computer model.

Stack-up for the "Structural" Test series has been essentially completed. The final test series is scheduled for the first two weeks of May.

INSTRUMENTATION

The Engineering Evaluation Twang Tests were successfully completed the week of April 8.

Preparations were made for Engineering Evaluation Tests 7E and 3E. This included:

(1) Installation and check out of ≈40 deflectometers.

(2) Final hook-up and check out of ≈ 60 strain gages.

(3) Pressure, temperature, load cell and liquid level set-up.

(4) Patching of boards at B-2 test stand and B-Control Building.

(5) End-to-end checks of all instrumentation channels.

CONTROLS

All support systems for the "Twang Tests" performed properly and were completed the second week of April.

The systems at B-Control were again changed from HTF to the B-3 configuration and preparations are now underway for the structural tests. The tank pressure safety system which was modified for the "Twang Tests" has been returned to its normal configuration.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	ROCKET DYNAMICS AND CONTROL FACILITY

CENTAUR STANDARD
SHROUD (CSS) TESTS

ENGINEERING EVALUATION TESTS (YGP3211) — TCPO - R. W. HEATH; RSD - L. C. GENTILE

SCHEDULE - COMPLETE MAY 1974

The "Engineering Evaluation Test" series has been completed.

Cryogenic test 7E was conducted on May 10, after two preliminary checkout exercises at reduced loads. Test 3E was made on May 15.

All test objectives were obtained and the strength envelope of the shroud was defined. Since the shroud was basically undamaged following the tests, it was decided to remove it and associated Titan/Centaur components from the B-3 tower.

Shroud components will be repackaged and stored in their original shipping containers at Plum Brook Station.

The stub adapter and equipment module will be returned to Lewis-Cleveland for additional testing.

The remaining hardware will be scrapped, recycled or stored at Plum Brook Station.

INSTRUMENTATION AND CONTROLS

Both the 7E and 3E structural tests were successfully completed. All control equipment performed satisfactory. All mechanical control equipment will be placed in storage. The electrical equipment will be left intact.