

SECTION II
 PLUM BROOK ROCKET SYSTEMS DIVISION
 TEST OPERATIONS REPORT
 FOR THE MONTH OF
 JANUARY 1972

CENTAUR STANDARD SHROUD TESTS

B-3

YPQ4239

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.
<u>ITEMS COMPLETED</u>	
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.	
<u>ITEMS IN PROGRESS</u>	
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 initiator cylinder control systems in progress.	
Designing camera controls and indicator circuits.	

CHANGES: Schedule

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="263 314 511 408">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="462 414 722 510"><u>CENTAUR STANDARD</u> <u>SHROUD TESTS</u> (YPQ4239)</p> <p data-bbox="933 414 1274 478">LVD - J. C. HUMPHREY; RSD - W. E. KLEIN</p> <p data-bbox="795 542 917 574" style="text-align: center;"><u>SUMMARY</u></p> <p data-bbox="454 606 1282 670">The hydraulic proof test of the hydraulic system, cables and control system was completed January 27.</p> <p data-bbox="454 702 1250 904">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.</p> <p data-bbox="454 936 1291 1064">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.</p> <p data-bbox="779 1095 941 1127" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="454 1159 617 1191"><u>OPERATIONS</u></p> <p data-bbox="446 1223 1282 1617">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.</p> <p data-bbox="446 1649 1282 1819">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.</p> <p data-bbox="446 1851 1291 1915">The contract for the piping was awarded to Wrightco, Inc., Cleveland. But due to a protest by the next</p> <p data-bbox="633 1925 982 1968" style="text-align: center;">(Continued on Page 31)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="272 321 519 412">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="467 419 906 480"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="467 517 1250 676">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.</p> <p data-bbox="467 712 711 742"><u>INSTRUMENTATION</u></p> <p data-bbox="467 778 1263 904">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.</p> <p data-bbox="467 940 1295 1100">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.</p> <p data-bbox="467 1136 597 1166"><u>CONTROLS</u></p> <p data-bbox="467 1202 1339 1327">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.</p> <p data-bbox="467 1364 1356 1587">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.</p> <p data-bbox="467 1623 1351 1719">Some of the hardware for the Centaur pressurization system has been received. Camera control and indicator circuits are also being designed for later tests.</p>

SECTION II
 PLUM BROOK ROCKET SYSTEMS DIVISION
 TEST OPERATIONS REPORT
 FOR THE MONTH OF
 FEBRUARY 1972

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

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="318 336 568 431">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="516 406 938 470"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="873 502 1036 534" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="516 570 678 602"><u>OPERATIONS</u></p> <p data-bbox="516 634 1364 793">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.</p> <p data-bbox="516 832 1360 889">The shroud catchnet brake calibrations and check out were run at D-Site and 5 brakes are now calibrated.</p> <p data-bbox="516 927 1295 985">The electrical contract for the movie cameras is scheduled to be completed about March 1, 1972.</p> <p data-bbox="516 1023 1377 1283">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.</p> <p data-bbox="516 1321 1425 1481">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.</p> <p data-bbox="516 1513 760 1544"><u>INSTRUMENTATION</u></p> <p data-bbox="516 1576 1393 1736">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.</p> <p data-bbox="516 1774 1409 1970">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.</p> <p data-bbox="581 1974 930 2006" style="text-align: center;">(Continued on Page 35)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p>ROCKET DYNAMICS AND CONTROL FACILITY</p> <p><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p><u>CONTROLS</u></p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
HTF	<p>HYPERSONIC TUNNEL FACILITY</p> <p><u>HRE (GARRETT ENGINE)</u> (YOW4891) P&CD - E. A. LEZBERG; RSD - T. W. BRINK</p> <p><u>SUMMARY</u></p> <p>Headquarters and Langley representatives were at Plum Brook on February 24. Great emphasis was placed on the need to expedite the HRE test date. All possible avenues were explored. As a result, the critical path contracts - both GFE and actual construction - are being expedited by means of overtime premium pay. If present planned deliveries and contracts are maintained, a test run date of August 15 is now planned.</p> <p>Engine fuel system flow calibrations were performed and balancing orifices were made up. Final flow balancing will be completed in early March.</p> <p>(Continued on Page 37)</p>

SECTION II
 PLUM BROOK ROCKET SYSTEMS DIVISION
 TEST OPERATIONS REPORT
 FOR THE MONTH OF
 MARCH 1972

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p>ROCKET DYNAMICS AND CONTROL FACILITY</p> <p><u>CENTAUR STANDARD</u> <u>SHROUD TESTS</u> (YPQ4239)</p> <p>LVD - J. C. HUMPHREY; RSD - W. E. KLEIN</p> <p style="text-align: center;"><u>SUMMARY</u></p> <p>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.</p> <p>Preparations for the hinge test are progressing satisfactorily. An attempt to complete the hinge test on</p> <p style="text-align: center;">(Continued on Page 27)</p>

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.
<u>ITEMS COMPLETED</u>	
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.	
<u>ITEMS IN PROGRESS</u>	
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	<p data-bbox="269 331 511 426">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="456 436 860 495"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="456 531 1349 653">May 21 instead of June 15 is being made because of early delivery of the hardware. This <u>three week early hinge test date is dependent on many variables</u> but every effort will be made <u>to meet the new schedule.</u></p> <p data-bbox="456 722 1317 879">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.</p> <p data-bbox="781 915 943 947" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="451 982 1344 1877">The instrumented shroud half model was lifted into B-3 facility on March 3, 1972. The model catch 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 inadvertently 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.</p> <p data-bbox="532 1917 881 1948" style="text-align: center;">(Continued on Page 29)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="272 325 516 417">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="467 423 870 485"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="467 523 1360 746">The piping contractor, Wrightco, completed all work above level four on March 28, 1972, except the insulation of the 8" LH₂ 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.</p> <p data-bbox="467 785 1325 910">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.</p> <p data-bbox="467 949 1276 1010">The mechanics are installing purge lines and other equipment for the cryogenic unlatch tests.</p> <p data-bbox="467 1049 708 1076"><u>INSTRUMENTATION</u></p> <p data-bbox="467 1115 1325 1272">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.</p> <p data-bbox="467 1310 1325 1404">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.</p> <p data-bbox="467 1442 594 1470"><u>CONTROLS</u></p> <p data-bbox="467 1508 1308 1570">All camera controls and disk brake systems performed successfully during the model jettison test.</p> <p data-bbox="467 1608 1325 1700">A test to verify cable stretch and proof test remaining hardware required for the structural test is planned for the first week in April.</p> <p data-bbox="467 1738 1308 1864">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.</p> <p data-bbox="467 1902 1357 1964">All procurement for the Centaur vent system is complete and installation has been started in the Control Room.</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="270 348 518 442">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="452 442 716 540"><u>CENTAUR STANDARD SHROUD TESTS</u> (YPQ4239)</p> <p data-bbox="921 442 1268 506">LVD - J. C. HUMPHREY; RSD - W. E. KLEIN</p> <p data-bbox="812 570 928 604" style="text-align: center;"><u>SUMMARY</u></p> <p data-bbox="452 634 1334 804">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.</p> <p data-bbox="452 834 1341 995">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.</p> <p data-bbox="783 1025 948 1059" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="551 1089 1163 1123" style="text-align: center;"><u>CENTAUR STANDARD SHROUD TEST HARDWARE</u></p> <p data-bbox="452 1153 1390 1293">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.</p> <p data-bbox="452 1323 1394 1549">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.</p> <p data-bbox="452 1578 1361 1719">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.</p> <p data-bbox="452 1740 1361 1813">The Titan skirt was installed on the lower distribution cylinder in B-3 on April 17, 1972.</p> <p data-bbox="452 1834 1377 1910">Miscellaneous flight hardware has arrived throughout the month.</p> <p data-bbox="564 1932 915 1974" style="text-align: center;">(Continued on Page 25)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p>ROCKET DYNAMICS AND CONTROL FACILITY</p> <p><u>CENTAUR STANDARD SHROUD TESTS</u></p> <p><u>CONTROLS</u> (Continued)</p> <p>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.</p> <p>All valves for the LH₂ and LOX press-vent and outflow have been installed. The various delta-P and pressure protection systems are being installed on these valves.</p>
HTF	<p>HYPERSONIC TUNNEL FACILITY</p> <p><u>HRE (GARRETT ENGINE)</u> (YOD4891)</p> <p>P&CD - E. A. LEZBERG; RSD - T. W. BRINK</p> <p><u>SUMMARY</u></p> <p>Garrett personnel arrived at Plum Brook the week of April 24. Final engine preparations were completed and the engine moved from A-Site to HTF on April 26. The engine should be installed in the test chamber the week of May 1. Work is progressing satisfactorily on the facility hardware required for the HRE test program. The piping contract has been completed except for the insulation on top of the chamber.</p> <p><u>DISCUSSION</u></p> <p>The Wilkes piping contract inside the Test Chamber was completed on April 29, 1972. Outside the chamber the insulation contractors are still working on the chamber roof. When this last insulation is complete, final electrical hookup and check out of heater zone seven can be accomplished and the entire contractual package completed. This will be completed in early May with no further delay on NASA work in the test chamber.</p> <p>(Continued on Page 29)</p>

SECTION II

PLUM BROOK ROCKET SYSTEMS DIVISION

TEST OPERATIONS REPORT

FOR THE MONTH OF

MAY 1972

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-2	<p data-bbox="235 725 406 872">SPACECRAFT PROPULSION RESEARCH FACILITY</p> <p data-bbox="422 893 1315 978"><u>ADVANCED CENTAUR</u> LVD - S. V. SZABO; (YPQ4240) RSD - J. E. SHOLES</p> <p data-bbox="422 1021 1315 1106">Bid opening for the pump removal contract is scheduled for June 16, 1972.</p> <p data-bbox="422 1149 1315 1404">Analysis of the 11' valve material samples has shown a major failure of the basic structural material. It therefore appears that the 11' valve will be replaced using 304 stainless steel. A work order has been issued by the Rocket Systems Division to the Cleveland Facilities Engineering Division requesting redesign of the valve.</p> <p data-bbox="422 1447 1315 1532">No work was accomplished in B-2 related to the Centaur program.</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="235 329 479 425">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="414 425 673 521"><u>CENTAUR STANDARD SHROUD TESTS</u> (YPQ4239)</p> <p data-bbox="950 425 1291 489">LVD - J. C. HUMPHREY; RSD - W. E. KLEIN</p> <p data-bbox="787 563 901 591" style="text-align: center;"><u>SUMMARY</u></p> <p data-bbox="414 627 1258 819">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.</p> <p data-bbox="414 861 1226 989">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.</p> <p data-bbox="414 1021 1242 1117">The Test Readiness Review is well underway and the review should be completed during the first week of June.</p> <p data-bbox="755 1149 917 1176" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="495 1212 1193 1244" style="text-align: center;"><u>CENTAUR STANDARD SHROUD (CSS) TEST HARDWARE</u></p> <p data-bbox="414 1287 1323 1798">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.</p> <p data-bbox="414 1840 1307 1925">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</p> <p data-bbox="495 1968 836 2000" style="text-align: center;">Continued on Page 33)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="240 308 487 404">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="418 410 808 474"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="418 506 1282 666">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.</p> <p data-bbox="418 704 1315 995">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 instrumentation feedthrough connectors. LMSC personnel have also installed deflection potentiometers and strain-gages at B-3 in preparation for the hinge test.</p> <p data-bbox="418 1034 1234 1098">Hardware was installed on a rail car on May 26 for transport of the shroud between B-3 and SPF.</p> <p data-bbox="792 1129 925 1161" style="text-align: center;"><u>FACILITY</u></p> <p data-bbox="418 1193 1299 1389">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.</p> <p data-bbox="418 1427 1315 1549">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.</p> <p data-bbox="711 1587 1055 1619" style="text-align: center;"><u>TEST READINESS REVIEW</u></p> <p data-bbox="418 1651 1331 1815">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.</p> <p data-bbox="535 1917 889 1949" style="text-align: center;">(Continued on Page 35)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="240 363 480 459">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="415 495 816 559"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="415 627 659 655"><u>INSTRUMENTATION</u></p> <p data-bbox="415 689 1206 785">Hinge Test - hardware was connected to the site instrumentation system. Check out of the systems began.</p> <p data-bbox="415 819 1224 883">Centaur Standard Shroud - 90% of the thermocouples have been installed for the cryo-unlatch test.</p> <p data-bbox="415 917 1255 981">Centaur Vehicle Tank - All wiring information has been generated for internal vehicle instrumentation.</p> <p data-bbox="415 1015 1321 1304">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.</p> <p data-bbox="415 1342 553 1370"><u>CONTROLS</u></p> <p data-bbox="415 1404 1292 1630">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.</p>

SECTION II

PLUM BROOK ROCKET SYSTEMS DIVISION

TEST OPERATIONS REPORT

FOR THE MONTH OF

JUNE 1972

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-2	<p data-bbox="253 706 418 836">SPACECRAFT PROPULSION RESEARCH FACILITY</p> <p data-bbox="444 840 711 902"><u>ADVANCED CENTAUR</u> (YPQ4240)</p> <p data-bbox="1029 840 1321 902">LVD - S. V. SZABO; RSD - J. E. SHOLES</p> <p data-bbox="444 968 1227 1129">The pump removal contract was awarded to William Ferrel, Inc. on June 23, for \$37,143.00 Work is expected to start by mid-July.</p> <p data-bbox="444 1198 1321 1293">No work was accomplished in B-2 related to the Centaur program.</p>

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.

(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

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.
<u>ITEMS COMPLETED</u>	
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.
<u>ITEMS IN PROGRESS</u>	
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	<p data-bbox="276 308 519 393">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="470 372 876 436"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="470 468 1234 595">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/TCP0-10 were completed.</p> <p data-bbox="470 627 1291 723">On June 21, 1972, tests 3c through 9c were successfully completed and on June 22, 1972, tests 10C through 16C were completed.</p> <p data-bbox="470 755 1323 1117">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.</p> <p data-bbox="470 1149 1274 1276">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.</p> <p data-bbox="706 1308 982 1351" style="text-align: center;"><u>CSS TEST HARDWARE</u></p> <p data-bbox="470 1372 1339 1606">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 LH₂ tank. The fitting of the insulation was completed on June 30. The LH₂ flight vent system, LH₂ fill and drain chute and a number of other tasks were worked on during this reporting period.</p> <p data-bbox="470 1638 1339 1798">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.</p> <p data-bbox="470 1830 1323 1904">GD/CA, LMSC and PB personnel provided support for the hinge tests conducted during June. Because of the</p> <p data-bbox="560 1915 917 1957" style="text-align: center;">(Continued on Page 37)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="289 285 532 378">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="467 385 870 449"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="467 480 1292 640">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.</p> <p data-bbox="467 676 1260 772">New, previously unplanned, work started by Rocket Systems Division engineers in this report period includes:</p> <ol data-bbox="467 804 1211 1134" style="list-style-type: none"> (1) Restraints for LH₂ vent nozzles; (2) Purge system for LH₂ vent disconnects; (3) Limit switch installation for the forward bearing reaction strut retraction signal; (4) Shroud quick vent; (5) LH₂ fill and drain chute purge system. <p data-bbox="467 1166 1341 1357">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.</p> <p data-bbox="467 1389 1341 1581">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.</p> <p data-bbox="467 1613 1032 1655"><u>INSTRUMENTATION</u> (Cryo-unlatch test)</p> <p data-bbox="467 1687 1260 1751">Thermocouple installation for the Centaur Standard Shroud is complete.</p> <p data-bbox="467 1772 1081 1793">Centaur Vehicle wiring is 50% complete.</p> <p data-bbox="529 1910 878 1942">(Continued on Page 39)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="322 314 569 410">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="503 414 905 474"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="503 506 872 538"><u>INSTRUMENTATION</u> (Cont)</p> <p data-bbox="503 580 1379 861">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.</p> <p data-bbox="503 900 636 932"><u>CONTROLS</u></p> <p data-bbox="503 963 1379 1287">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.</p> <p data-bbox="503 1315 1334 1410">The Hinge Test loading system is now being removed to facilitate the installation of equipment for the cryo-unlatch test.</p> <p data-bbox="503 1442 1351 1581">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.</p>

SECTION II
 PLUM BROOK ROCKET SYSTEMS DIVISION
 TEST OPERATIONS REPORT
 FOR THE MONTH OF
 JULY 1972

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.)- PROJECT ENGINEERS
B-2	<p data-bbox="287 689 452 812">SPACECRAFT PROPULSION RESEARCH FACILITY</p> <p data-bbox="482 817 746 876"><u>ADVANCED CENTAUR</u> (YOQ4240)</p> <p data-bbox="1037 812 1328 872">LVD - S. V. SZABO; RSD - J. E. SHOLES</p> <p data-bbox="482 910 1334 1200">On July 10, a pre-construction conference was held with William Ferrel, Inc., for the pump removal contract NAS3-16192-PB. At that time the shop drawings for the lifting structure were submitted for NASA approval. The revised drawing was approved on July 25, and the notice to proceed was given July 27. The equipment is expected to arrive the second week of August, with the actual pump disassembly expected to start August 14.</p> <p data-bbox="482 1234 1367 1489">On July 21, a meeting was held between Rocket System Division personnel and Facilities Engineering Division from Lewis-Cleveland. This meeting was called to discuss the structural problems involving the 11 foot valve. It was agreed that the Facilities Engineering group would pursue the procurement and installation of a new valve assembly, and that Plum Brook would pursue the removal of the existing valve.</p> <p data-bbox="482 1523 1367 1591">No work was accomplished in B-2 related to the Centaur program.</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="299 300 541 395">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="475 395 736 491"><u>CENTAUR STANDARD SHROUD TESTS</u> (YPQ4239)</p> <p data-bbox="1009 389 1351 453">LVD - J. C. HUMPHREY; RSD - W. E. KLEIN</p> <p data-bbox="865 523 979 551" style="text-align: center;"><u>SUMMARY</u></p> <p data-bbox="475 583 1334 715">Major equipment installations completed in July were stub adapter modifications, equipment module, truss adapter, payload model base, CSS aft skirt to conical boattail section.</p> <p data-bbox="475 746 1372 912">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.</p> <p data-bbox="475 944 1356 1076">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.</p> <p data-bbox="475 1108 1339 1240">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.</p> <p data-bbox="839 1268 1001 1295" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="480 1336 645 1364"><u>OPERATIONS</u></p> <p data-bbox="475 1395 1344 1719">Work efforts were concentrated on the Centaur tank during the month of July. The LH₂ 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 H₂ 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.</p> <p data-bbox="480 1751 1323 1783">Some of the major equipment installation dates were:</p> <p data-bbox="480 1815 1212 1879">July 17 - Finished stub adapter modifications July 18 - Installed equipment module</p> <p data-bbox="583 1910 935 1942" style="text-align: center;">(Continued on Page 33)</p>

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
	STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 Y004239

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
 <u>ITEMS COMPLETED</u>	
LH2 fill line, tubing runs, elec. & inst. lines in aft seal area & tank side were completed	Jul 24, 1972.
Facility H2 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.	
 <u>ITEMS IN PROGRESS</u>	
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 & ΔP 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	<p data-bbox="284 319 535 414">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="462 414 730 478"><u>CENTAUR STANDARD SHROUD TESTS</u></p> <p data-bbox="462 510 820 542"><u>OPERATIONS</u> (Continued)</p> <p data-bbox="462 574 1372 670">New, previously unplanned, work started by Rocket Systems Division at Plum Brook in this report period due to test requirement changes includes:</p> <ol data-bbox="462 702 1323 1074" style="list-style-type: none"> (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. <p data-bbox="462 1095 1323 1159">System check out and validation tests are expected to start around August 21, 1972.</p> <p data-bbox="462 1191 706 1223"><u>INSTRUMENTATION</u></p> <p data-bbox="462 1255 1323 1319">Centaur Vehicle wiring is complete. All strain gages are complete except for those on the F.B.R. struts.</p> <p data-bbox="462 1351 1356 1457">The thermocouple ovens have been received and are being checked in the standards and calibration lab. Facility thermocouple cables are 80% complete.</p> <p data-bbox="462 1489 1331 1521">Accelerometer installation and wiring is 40% complete.</p> <p data-bbox="462 1553 1356 1681">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.</p> <p data-bbox="462 1713 592 1744"><u>CONTROLS</u></p> <p data-bbox="462 1776 1364 1904">The work on the pressure vent and ΔP 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</p> <p data-bbox="568 1925 925 1968">(Continued on Page 37)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p>ROCKET DYNAMICS AND CONTROL FACILITY</p> <p><u>CENTAUR STANDARD SHROUD TESTS</u></p> <p><u>CONTROLS</u> (Continued)</p> <p>of the cryo-unlatch test has been received. Work is currently being done on the tank outflow and camera and facility read out systems.</p> <p>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.</p> <p>Cables for the structural test will be proof tested and checked for elongation at the contractor's plant early in August.</p>
HTF	<p>HYPERSONIC TUNNEL FACILITY</p> <p><u>HRE (GARRETT ENGINE)</u> (YOD4891)</p> <p>P&CD - E. A. LEZBERG; RSD - T. W. BRINK</p> <p><u>SUMMARY</u></p> <p>The Garrett Engine alignment and installation was completed in July with permanent dowelling of parts in place.</p> <p>Interference between some points of the water and fuel piping continue to plague these installations. This should be resolved in early August.</p> <p>Problems with leaking astrograb couplings prevented completion of the GH₂ system check out. These should be resolved by mid-August.</p> <p>Load cell thrust calibration is expected to start by August 14 with water and fuel flow calibrations following. These calibrations may be delayed because of manpower being needed by the CSS program at B-3 facility.</p> <p>(Continued on Page 39)</p>

SECTION II
 PLUM BROOK ROCKET SYSTEMS DIVISION
 TEST OPERATIONS REPORT
 FOR THE MONTH OF
 AUGUST 1972

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-2	<p data-bbox="240 697 407 825">SPACECRAFT PROPULSION RESEARCH FACILITY</p> <p data-bbox="451 832 711 889"><u>ADVANCED CENTAUR</u> (YOQ4240)</p> <p data-bbox="1015 832 1323 889">LVD - S. V. SZABO; RSD - J. E. SHOLES</p> <p data-bbox="451 927 1279 1215">The first week of August was spent constructing the lifting structure for the removal of the pump. The structure was load tested on August 9, and arrived at Plum Brook on August 11. Beginning August 14, the structure was erected, and the disassembly of the pump started. Parts were examined as they were removed and the disassembly will be completed by September 1. Damage was rather extensive, and seemed to be worse above the water line.</p> <p data-bbox="451 1253 1295 1442">LeRC's independent consultant was on site during the week of August 14. He inspected the pump installation and some of the damaged pump parts. His preliminary inspection report attributes the damage to cavitation caused by vortexing at the inlet which indicates that inlet modifications are required.</p> <p data-bbox="451 1481 1279 1640">The present plan is to inspect the removed parts more closely to determine which ones can be salvaged. A list of required new parts will be prepared. Further discussions will be held with the manufacturer to determine the cause of the failure.</p> <p data-bbox="451 1678 1198 1736">No work was accomplished in B-2 related to the Centaur program.</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="233 280 477 374">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="441 378 704 472"><u>CENTAUR STANDARD SHROUD TESTS</u> (YPO4239)</p> <p data-bbox="976 378 1312 438">LVD - J. C. HUMPHREY; RSD - W. E. KLEIN</p> <p data-bbox="782 476 896 506" style="text-align: center;"><u>SUMMARY</u></p> <p data-bbox="441 540 1234 736">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.</p> <p data-bbox="441 770 1243 829">All GD/CA tasks were completed and their personnel have returned to San Diego.</p> <p data-bbox="441 863 1230 957">The Test Readiness Review Panel and Area 20 Safety Committee have been reviewing the test procedures for the CSS.</p> <p data-bbox="441 991 1182 1051">Piping and movie camera check outs are nearly complete.</p> <p data-bbox="441 1085 1230 1221">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.</p> <p data-bbox="743 1255 909 1285" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="441 1319 600 1349"><u>OPERATIONS</u></p> <p data-bbox="441 1383 1260 1519">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.</p> <p data-bbox="441 1544 1273 1574">Some of the major equipment installation dates were:</p> <p data-bbox="441 1608 1260 1638">August 1 - Installed Centaur tank radiation shield.</p> <p data-bbox="441 1672 1273 1702">August 3 - Installed -Y section of CSS tank barrel.</p> <p data-bbox="441 1736 1273 1766">August 5 - Installed +Y section of CSS tank barrel.</p> <p data-bbox="441 1800 1000 1830">August 10 - Installed payload model.</p> <p data-bbox="506 1910 854 1940" style="text-align: center;">(Continued on Page 35)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="298 285 545 378">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="509 385 773 449"><u>CENTAUR STANDARD SHROUD TESTS</u></p> <p data-bbox="509 480 863 512"><u>OPERATIONS</u> (Continued)</p> <p data-bbox="509 544 1203 576">August 11 - Installed CSS payload cylinder.</p> <p data-bbox="509 608 1089 640">August 15 - Installed CSS nose cone.</p> <p data-bbox="509 672 1252 715">August 17 - 23 - Installed H₂ vent fin on CSS.</p> <p data-bbox="509 742 1333 870">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.</p> <p data-bbox="509 906 1365 1129">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.</p> <p data-bbox="509 1166 1365 1261">LMSC personnel were essentially done with their tasks on August 21 and therefore started to install NASA-furnished deflectometer instrumentation.</p> <p data-bbox="509 1295 1317 1519">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.</p> <p data-bbox="509 1555 1377 1810">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.</p> <p data-bbox="594 1923 948 1955">(Continued on Page 37)</p>

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	SPACECRAFT PROPULSION RESEARCH FACILITY	<p data-bbox="496 421 756 480"><u>CENTAUR STANDARD SHROUD TESTS</u></p> <p data-bbox="496 517 849 544"><u>OPERATIONS</u> (Continued)</p> <p data-bbox="496 580 1386 740">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.</p> <p data-bbox="496 776 1365 836">The first cryo-unlatch test is scheduled for September 20, 1972.</p> <p data-bbox="496 872 737 900"><u>INSTRUMENTATION</u></p> <p data-bbox="496 936 1386 995">Pressure, temperature, strain and acceleration measurement systems are complete except for final check out.</p> <p data-bbox="496 1032 1365 1091">Deflectometers and pyro system instrumentation is about 85% complete.</p> <p data-bbox="496 1127 1219 1155">"Flow Sheet" and digital format are complete.</p> <p data-bbox="496 1191 1386 1287">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.</p> <p data-bbox="496 1323 623 1351"><u>CONTROLS</u></p> <p data-bbox="496 1387 1365 1447">Check out of the valves for the pressure vent and fill systems is approximately 95% complete.</p> <p data-bbox="496 1483 1333 1542">Interfacing to the XDS910 computer control and abort system is 75% complete.</p> <p data-bbox="496 1578 1284 1638">Check out of the tank protection error monitor is complete and the system is operational.</p> <p data-bbox="496 1674 1386 1810">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.</p>

SECTION II

PLUM BROOK ROCKET SYSTEMS DIVISION

TEST OPERATIONS REPORT

FOR THE MONTH OF

SEPTEMBER 1972

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
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B-2	SPACECRAFT PROPULSION RESEARCH FACILITY
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ADVANCED CENTAUR
(Y0Q4240)

LVD - S. V. SZABO;
RSD - J. E. SHOLES

The removal and disassembly of the damaged water pump was completed on September 1. A final report was received from the independent consultant on September 18. No further progress was made due to test activities at the B-3 facility.

There was no Centaur related work accomplished at B-2 during September.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="276 308 527 414">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="470 414 738 510"><u>CENTAUR STANDARD SHROUD TESTS</u> (YPO4239)</p> <p data-bbox="901 414 1250 478">LVD - J. C. HUMPHREY; RSD - W. E. KLEIN</p> <p data-bbox="803 542 933 585" style="text-align: center;"><u>SUMMARY</u></p> <p data-bbox="470 606 1347 744">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.</p> <p data-bbox="470 766 958 808">Some problem areas noted were:</p> <ol data-bbox="470 829 1364 1234" style="list-style-type: none"> (1) The teflon sleeve between the LH₂ 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 LH₂ in the fuel tank and the purge rate test series could not be run. <p data-bbox="820 1255 990 1298" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="462 1319 641 1361"><u>OPERATIONS</u></p> <p data-bbox="462 1383 1299 1596">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.</p> <ul data-bbox="544 1617 1307 1925" style="list-style-type: none"> 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 <p data-bbox="552 1925 909 1968" style="text-align: center;">(Continued on Page 31)</p>

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE
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CHANGES: (schedule changes since last report)

CENTAUR STANDARD SHROUD TESTS B-3 YP04239

<p>CRYO-UNLATCH TESTS</p> <p>STRUCTURAL TESTS SCHEDULED FOR</p> <p>HINGE LOADING TESTS</p>	<p>Sep thru Dec 1972</p> <p>Mar 1973 to Jun 20,73</p> <p>Jul 1974.</p>
<p><u>ITEMS COMPLETED</u></p> <p>Final facility & CSS preparation completed</p> <p>Shroud leak tests and repairs completed</p> <p>Combined system test completed</p> <p>Shroud leak tests and repairs completed</p> <p>Jettison test #1 complete</p> <p>Structural test team was established and meetings held with Titan Centaur Project Office.</p>	<p>Sep 1 thru Sep 15</p> <p>Sep 6 thru Sep 13</p> <p>Sep 18 thru Sep 20</p> <p>Sep 21 thru Sep 25</p> <p>Sep 26 thru Sep 27</p>

CHANGES: Schedule change.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="272 304 516 400">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="467 400 881 463"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="467 495 1271 697">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.</p> <p data-bbox="467 729 1271 985">The Combined Systems Test was conducted using LN₂ 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.</p> <p data-bbox="467 1017 1271 1176">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:</p> <ol data-bbox="475 1208 1255 1772" style="list-style-type: none"> <li data-bbox="475 1208 1255 1368">(1) The teflon sleeve between the LH₂ vent fin and facility vent cracked and leaked H₂. This will affect the boiloff test results since the H₂ leaked upstream of the vent line Venturi. <li data-bbox="475 1400 1255 1602">(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. <li data-bbox="475 1634 1255 1772">(3) The shroud could not be pressurized to the desired levels with LH₂ in the Centaur tank. The shroud leakage rate was more than the facility supply system could furnish. <p data-bbox="557 1825 898 1857">(Continued on Page 33)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="267 308 511 404">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="470 404 909 468"><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p data-bbox="470 500 1347 627">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.</p> <p data-bbox="479 670 722 702"><u>INSTRUMENTATION</u></p> <p data-bbox="470 734 1331 893">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.</p> <p data-bbox="470 925 1356 1223">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.</p> <p data-bbox="479 1255 609 1287"><u>CONTROLS</u></p> <p data-bbox="470 1319 1364 1585">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 LH₂ 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.</p> <p data-bbox="755 1606 1015 1638"><u>STRUCTURAL TESTS</u></p> <p data-bbox="479 1670 1307 1862">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.</p> <p data-bbox="592 1915 941 1947">(Continued on Page 35)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p>ROCKET DYNAMICS AND CONTROL FACILITY</p> <p><u>CENTAUR STANDARD SHROUD TESTS</u> (Continued)</p> <p>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.</p>
HTF	<p>HYPERSONIC TUNNEL FACILITY</p> <p><u>HRE (GARRETT ENGINE)</u> (YOD4891) P&CD - E. A. LEZBERG RSD - T. W. BRINK</p> <p><u>SUMMARY</u></p> <p>Engine cooling water lines were flushed out in preparation for the water calibration tests. The vacuum-GN₂ purge test was performed but will have to be repeated due to insufficient engine pressure stabilization times. Work progressed on several sub-systems in preparation for the first HRE test scheduled for the week of October 16. Several electrical tasks remain to be completed because all electricians were pressed into service at B-3 Facility.</p> <p>The Test Readiness Review is in progress and their report is expected early in October.</p> <p><u>DISCUSSION</u></p> <p><u>OPERATIONS</u></p> <p>Work continued on the load cell calibrations throughout the month. Repeated attempts were made to reduce the binding of the cowl to the engine inner body. The problem is slowly being resolved. As part of the calibration, repeated cooling water system flushings were performed on the engine supply and return piping, as well as the engine itself. The engine flush was completed on September 28. Each leg of the system has</p> <p>(Continued on Page 37)</p>

SECTION II

PLUM BROOK ROCKET SYSTEMS DIVISION

TEST OPERATIONS REPORT

FOR THE MONTH OF

NOVEMBER 1972

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-2	<p data-bbox="261 672 423 795">SPACECRAFT PROPULSION RESEARCH FACILITY</p> <p data-bbox="453 804 716 863"><u>ADVANCED CENTAUR</u> (YOQ4240)</p> <p data-bbox="922 804 1211 863">LVD - S. V. SZABO; RSD - J. E. SHOLES</p> <p data-bbox="760 902 893 932"><u>FACILITY</u></p> <p data-bbox="453 966 1276 1123">Magnaflux and X-Ray inspection of the pump shafts has been completed. No defects have been detected. Negotiations between Peerless Pump and NASA continue, with another meeting scheduled for December 11.</p> <p data-bbox="453 1161 1321 1289">The 11' valve was removed from the spray chamber. The valve material shows numerous stress corrosion cracks. A replacement valve is being ordered with delivery and installation scheduled for March 1, 1973.</p> <p data-bbox="727 1327 971 1357"><u>CENTAUR PROGRAM</u></p> <p data-bbox="453 1391 1321 1583">A contract for X-ray and dye penetrant inspection of the "battle-ship" tank welds was awarded. This activity will take place at B-1 Test Stand in December. Reactivation of the B-1 Test Stand has started on a "manpower available" basis. B-3 has priority on the manpower.</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="233 268 477 363">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="428 368 688 463"><u>CENTAUR STANDARD SHROUD TESTS</u> (YPO4239)</p> <p data-bbox="764 497 881 529" style="text-align: center;"><u>SUMMARY</u></p> <p data-bbox="428 563 1304 625">Cryogenic Unlatch Test No. 2 was accomplished the week of November 6 with separation on November 8.</p> <p data-bbox="423 661 1284 757">Work is proceeding on preparations for Cryogenic Unlatch Test No. 3. The following series of tests will lead up to the No. 3 separation:</p> <ol data-bbox="431 793 1284 1017" style="list-style-type: none"> (1) Ambient Seal Releaser Test. (2) LN₂/LN₂ Tanking, Heat Transfer, and Seal Release Test. (3) LH₂/LN₂ Tanking, Heat Transfer, and Seal Release Test. <p data-bbox="423 1055 1313 1151">The Ambient Seal Releaser Test is planned for the week of December 18 if all contractor modifications are complete by December 11.</p> <p data-bbox="423 1187 1297 1312">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.</p> <p data-bbox="423 1349 781 1381"><u>CRYOGENIC UNLATCH TEST</u></p> <p data-bbox="1019 1349 1297 1410" style="text-align: right;">LVD - S. V. SZABO RSD - W. E. KLEIN</p> <p data-bbox="760 1444 925 1476" style="text-align: center;"><u>DISCUSSION</u></p> <p data-bbox="423 1510 586 1542"><u>OPERATIONS</u></p> <p data-bbox="423 1576 1297 1768">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:</p> <ol data-bbox="423 1804 1292 1836" style="list-style-type: none"> (1) November 1 - 4: Shroud leak checks and repairs <p data-bbox="521 1906 870 1938" style="text-align: center;">(Continued on Page 31)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="240 287 483 378">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="435 385 792 449"><u>CRYOGENIC UNLATCH TEST</u> (continued)</p> <p data-bbox="435 480 1292 512">(2) November 6 - 9: Cryogenic Separation Test No. 2</p> <p data-bbox="435 544 1003 576">(3) November 10-15: Remove shroud</p> <p data-bbox="435 608 1292 640">(4) November 16-30: Shroud refurbishment activities</p> <p data-bbox="435 676 1325 868">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.</p> <p data-bbox="435 906 1325 1034">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:</p> <p data-bbox="435 1066 1357 1619"> (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. </p> <p data-bbox="435 1651 1357 1874">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.</p> <p data-bbox="561 1906 911 1938">(Continued on Page 33)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="235 276 487 372">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="430 372 787 436"><u>CRYOGENIC UNLATCH TEST</u> (continued)</p> <p data-bbox="430 478 673 510"><u>INSTRUMENTATION</u></p> <p data-bbox="430 542 1307 798">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.</p> <p data-bbox="430 840 1226 904">Assuming minimal further instrumentation changes, no schedule delays are anticipated.</p> <p data-bbox="430 936 560 968"><u>CONTROLS</u></p> <p data-bbox="430 1000 1258 1127">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.</p> <p data-bbox="430 1159 1339 1330">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.</p> <p data-bbox="430 1361 673 1393"><u>STRUCTURAL TEST</u></p> <p data-bbox="990 1361 1323 1415">LVD - J. C. HUMPHREY RSD - L. C. GENTILE</p> <p data-bbox="730 1457 901 1489"><u>DISCUSSION</u></p> <p data-bbox="430 1521 592 1553"><u>OPERATIONS</u></p> <p data-bbox="430 1585 1088 1617"><u>General Site and Equipment Modifications:</u></p> <p data-bbox="430 1649 1307 1787">Drawings for the Centaur LH₂ 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.</p> <p data-bbox="527 1883 876 1915">(Continued on Page 35)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="228 272 472 363">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="423 370 667 431"><u>STRUCTURAL TEST</u> (continued)</p> <p data-bbox="423 470 951 497"><u>Structural Test Work in Progress:</u></p> <p data-bbox="423 534 1292 757">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.</p> <p data-bbox="423 795 643 823"><u>Vent Fin Test:</u></p> <p data-bbox="423 859 1243 921">Installation drawings were completed. Parts are on order.</p> <p data-bbox="423 959 821 987"><u>Hydraulic Loading System:</u></p> <p data-bbox="423 1023 1300 1085">The desired method of loading the shroud was presented by TCPO. It was previewed and agreed to by Plum Brook.</p> <p data-bbox="423 1123 643 1151"><u>Strain Gauges:</u></p> <p data-bbox="423 1187 1292 1312">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.</p> <p data-bbox="423 1351 659 1378"><u>Deflectometers:</u></p> <p data-bbox="423 1415 1276 1572">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.</p> <p data-bbox="423 1610 764 1638"><u>Data Recording System:</u></p> <p data-bbox="423 1674 1235 1800">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.</p> <p data-bbox="464 1896 813 1923">(Continued on Page 37)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p>ROCKET DYNAMICS AND CONTROL FACILITY</p> <p><u>STRUCTURAL TEST</u> (continued)</p> <p><u>Visual Displays:</u></p> <p>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.</p> <p><u>CONTROLS</u></p> <p>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.</p> <p>D-Site testing has begun on putting orifices in the failsafe manifolds to increase the unloading time in an abort condition.</p> <p>Design of the shear loading control panel and associated analog computer ramp generating system is now in progress.</p>
HTF	<p>HYPERSONIC TUNNEL FACILITY</p> <p><u>HRE (GARRETT ENGINE)</u> (YOD4891)</p> <p>P&CD - E. A. LEZBERG; RSD - T. W. BRINK</p> <p><u>SUMMARY</u></p> <p>Eight run starts were attempted with only one start accomplishing successful tunnel and engine inlet start conditions.</p> <p>The next test is scheduled for December 7 and several variables will be explored among which are variations in wedge nozzle pressure, stroking the engine inlet, and waiting a longer period for the chamber pressure to pump down before opening the engine inlet. If an engine inlet start is accomplished, an engine firing is planned with hydrogen.</p>

SECTION II
PLUM BROOK ROCKET SYSTEMS DIVISION
TEST OPERATIONS REPORT
FOR THE MONTH OF
DECEMBER 1972

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
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B-3

ROCKET DYNAMICS
AND CONTROL
FACILITY

CENTAUR STANDARD
SHROUD TESTS
(YPO4239)

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)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="289 321 535 417">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="500 449 1049 485"><u>CRYOGENIC UNLATCH TEST</u> (Continued)</p> <p data-bbox="505 517 1419 580">(2) Dec. 4-9: Made changes to insulation system and installed additional thermocouples.</p> <p data-bbox="505 612 1357 676">(3) Dec. 11-13: Moved shroud from SPF and installed it in B-3.</p> <p data-bbox="505 708 1406 772">(4) Dec. 14-18: Installed facility equipment to shroud and Centaur tank.</p> <p data-bbox="505 804 1370 846">(5) Dec. 19: Performed ambient seal release test.</p> <p data-bbox="505 878 1305 910">(6) Dec. 20: Performed shroud rain leak test.</p> <p data-bbox="500 942 1373 1400">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.</p> <p data-bbox="500 1432 1373 1495">The schedule for completing the cryogenic unlatch portion of the program is:</p> <p data-bbox="505 1527 1325 1591">(1) Jan 9&10: LN₂/LN₂ Tanking, Heat Transfer, and Seal Release Test.</p> <p data-bbox="505 1623 1325 1687">(2) Jan 24&25: LN₂/LH₂ Tanking, Heat Transfer, and Seal Release Test.</p> <p data-bbox="505 1719 1224 1761">(3) Feb 7&8: Cryogenic Unlatch Test No. 3.</p> <p data-bbox="500 1793 740 1825"><u>INSTRUMENTATION</u></p> <p data-bbox="500 1857 1373 1953">Patchboards, flowsheets, digital and FM formats, check sheets and digital pattern tape are now complete for Jettison Test No. 3.</p> <p data-bbox="581 1953 932 1985">(Continued on Page 31)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p data-bbox="280 314 524 406">ROCKET DYNAMICS AND CONTROL FACILITY</p> <p data-bbox="492 410 1036 442"><u>CRYOGENIC UNLATCH TEST</u> (Continued)</p> <p data-bbox="492 474 846 506"><u>INSTRUMENTATION</u> (Cont)</p> <p data-bbox="492 538 1295 666">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.</p> <p data-bbox="492 704 1052 736">No schedule delays are anticipated.</p> <p data-bbox="492 768 621 800"><u>CONTROLS</u></p> <p data-bbox="492 836 1357 927">The sequence and abort program was updated for the seal pyro installation. Provisions for recording real time seal bolt separation have also been provided.</p> <p data-bbox="492 995 735 1027"><u>STRUCTURAL TEST</u></p> <p data-bbox="922 995 1276 1059">TCPO - J. C. HUMPHREY; RSD - L. C. GENTILE</p> <p data-bbox="776 1091 943 1123"><u>DISCUSSION</u></p> <p data-bbox="492 1155 654 1187"><u>OPERATIONS</u></p> <p data-bbox="492 1219 1312 1347">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.</p> <p data-bbox="492 1385 1312 1513">The drawing for the LH₂ tank vent line modification has been completed, and preliminary work has been started. The LH₂ tank fill line drawing should be completed during the week of January 9.</p> <p data-bbox="492 1551 1341 1615">The Centaur loading fixture counter balance structure has been received at Plum Brook.</p> <p data-bbox="492 1653 1373 1908">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.</p> <p data-bbox="581 1921 935 1953">(Continued on Page 33)</p>

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
B-3	<p>ROCKET DYNAMICS AND CONTROL FACILITY</p> <p><u>STRUCTURAL TEST</u> (Continued)</p> <p><u>CONTROLS</u></p> <p>The axial and shroud shear hydraulic loading actuators and hydraulic tubing have been reinstalled. The actuators have been checked out in position control and plans are being made to check out the systems on load control. The hydraulic loading panel has been designed and is in fabrication. Work is in progress at D-Site to reduce the Failsafe unloading rates.</p>
HTF	<p>HYPERSONIC TUNNEL FACILITY</p> <p><u>HRE (GARRETT ENGINE)</u> (YOD4891)</p> <p>P&CD - E. A. LEZBERG; RSD - T. W. BRINK</p> <p><u>DISCUSSION</u></p> <p><u>OPERATIONS</u></p> <p>The facility was set up for a hot firing including hydrogen, oxygen and nitrogen systems on December 7. Freezing problems with valves and one water pipe delayed the test to December 8. During pre-run set-up on December 8, leakage past the radiation shutter O-ring was noted. Inspection showed galled metal on the shutter slide near the bottom in addition to leakage at the top. The decision was to run using the TV monitor to determine excessive leakage during the run at 3800°F on the GN₂ heater.</p> <p>The test was aborted manually before the steady state pressure was reached. Disassembly revealed approximately 6" of the O-ring was missing from the shutter valve near the top. Also, severe metal galling was noted at the sides and bottom of the shutter.</p> <p>Due to repair time required, it was decided to postpone further tests until January 17, 1973. Thus; additional engine checks can be made; the engine purge system can be converted to CO₂ and the new Jet Pump system can be installed to help the tunnel starting problem.</p> <p>(Continued on Page 35)</p>