

STATUS REPORT OF "J" SITE FROM JULY 1, 1961 = JULY 1, 1962

J-1

The gaseous hydrogen-liquid oxygen rocket test engine has been in operation for the entire 1 year period. At the same time construction has been proceeding to support the second phase of work to be done in the J-1 test rig.

J-2

For the period July 1, 1961 to December 31, 1961, the cell was operational. The H_2-F_2 rocket system test program was completed on December 31, 1961. From December 31, 1961 to May 7, 1962 the cell was inactive. Construction began on May 8, 1962 on a new H_2-O_2 rocket system. Construction is continuing and should be complete by August 1, 1962.

MEMO to CS Moore, Subj: Info for Yearly exper fac oper rpt for PBS, 7-5-62

j. "J" Site - Rocket Test Area:

The operation of the various test stands making up the "J" site are listed below:

"J-1", The gaseous hydrogen - liquid oxygen rocket test engine has been in operation throughout the year. Work has now progressed to include the second phase of the test program.

"J-2", The rocket systems test stand ran from July 1, 1961 to December 31, 1961 with an H_2-F_2 rocket system test program and from December 31, 1961 to May 7, 1962 the cell was inactive. The remainder of the year has been spent in preparing for the new H_2-O_2 rocket system.

"J-2" Site	Liquid Hydrogen- Liquid Oxygen Throttling Tests	Throttling and combustion instability tests of a liquid-oxygen - liquid hydrogen pressure fed rocket system
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STATUS: The test rig was completely rebuilt during the early part of 1962, and has been in more or less continuous operation since. Propellant flows and chamber pressure are under closed loop automatic control and each firing covers a range of test conditions. This program has been well supported by Lewis Research Center with both hardware and people.

On the last run, the regeneratively cool combustion chamber split longitudinally two seconds after a successful ignition. The safety system detected the failure and the engine was automatically shut down with no damage to the cell. This chamber, of channel construction, had eleven minutes of accumulated running time before failure.

The failed combustion chamber is being replaced from spare hardware on hand and no lapse in schedule will occur

2/28/1963

PLUM BROOK ROCKET SYSTEMS FACILITIES STATUS REPORT			CONTINUED
SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	ROCKET SYSTEMS "J-2"	Liquid Hydrogen- Liquid Oxygen <u>Throttling Tests</u> (I.A. Johnsen)	Throttling and combustion instability tests of a liquid oxygen-liquid hydrogen pressure fed rocket system.
	STATUS: A total of nine data runs were made on one run day. Testing was terminated due to engine failure. New hardware has been installed and the program will continue with no major delay in schedule.		

3/28/1963

PLUM BROOK STATION ROCKET SYSTEMS FACILITY STATUS REPORT			CONTINUED
SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	J-2	Liquid Hydrogen - Liquid Oxygen <u>Throttling Tests</u> (I.A. Johnsen)	Throttling and combustion instability tests of a liquid oxygen-liquid hydrogen pressure fed rocket system. transfer theory into the region required for the design of nuclear rocket nozzles. Presently, solid copper heat sink engines are being used. Ultimately, the program will progress to a highly instrumented liquid hydrogen cooled chamber.
(CONTINUED)			
STATUS: J-2 Two run days produced a total of 13 research data runs. Minor engine failures were noted after the second series of runs. Engine repairs are being made, and the program will continue on schedule.			
		<u>M-1 Hydrogen-Oxy- gen Gas Generator</u> (I.A. Johnsen)	Investigation of the gas generator for the Aerojet M-1 rocket engine program.
STATUS: Plans are progressing for the gas generator tests as man-power time permits.			

SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 Liquid Hydrogen Liquid Oxygen <u>Throttling Tests</u> (I.A. Johnsen)	Throttling and combustion instability tests of a liquid oxygen-liquid hydrogen pressure fed rocket system.
STATUS: J-2 On April 10th one research data run was made of 25 seconds duration. During the 25 second period, both the engine and injector suffered burn out failures. Leaks in the engine had been repaired prior to this run with silver solder. This was the first firing after the engine had been repaired. It is believed that engine failure occurred first which resulted in the injector burn out. This was the last regenerative engine of its size available for test firing. A new engine of shorter length is being fabricated and is expected at Plum Brook for installation during the week of May 13th. Cell modifications now in progress include larger hydrogen and oxygen flow lines and valves, instrument changes, and engine exhaust system changes to accept the new engine. Test firings are planned for the last week of May.			
<u>M-1 Hydrogen-Oxygen Gas Generator</u> Investigation of the gas generator for the Aerojet M-1 rocket engine program. (I.A. Johnsen)			
STATUS: The ordering of vendor supplied hardware is 90% complete. Drawings for plumbing of flow lines and for locations of equipment and dewars are 50% complete. Tentative date for system check out should be late July.			

May 1963

PLUM BROOK ROCKET SYSTEMS DIVISION STATUS REPORT

CONTINUED

SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J		<u>J-2 Liquid Hydrogen</u> <u>Liquid Oxygen</u> <u>Throttling Tests</u> (I. A. Johnsen)	Throttling and combustion instability tests of a liquid oxygen-liquid hydrogen pressure fed rocket system.
	STATUS:	NOTE (A): The number of run days requested by research engineers has been increased from six to eight. NOTE (B): Anticipated start of research runs has been changed to compensate for delivery of component hardware.	
		The O ₂ and H ₂ flow system cell modifications have been completed. Provisions were made to install flush mounted pickups for investigation of feed line oscillations in the larger diameter flow lines. All components for the engine exhaust system modification are fabricated. Minor cell modifications will be completed when the new test engine is delivered to Plum Brook. Depending on the arrival of the test hardware, research runs are tentatively scheduled for the week of June 9, 1963. Approximately four run days will be required to complete the present program which will include two engine changes.	
		<u>M-1 Hydrogen-Oxygen Gas Generator</u> (I. A. Johnsen)	Investigation of the gas generator for the Aerojet M-1 rocket engine program.
	STATUS:	All major components required for the installation of gas generator system have been ordered. Installation will start prior to the completion of the current program in the test cell. The 175 cubic foot liquid hydrogen tank will be positioned during mid-June. Specifications for the removal of the present tanks, modification of the test cell and installation of the exhaust system are now being written for contract purposes.	

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June 1963

SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 <u>LIQUID HYDROGEN- LIQUID OXYGEN</u> Throttling Tests (I. A. Johnsen) OR 9045	Throttling and combustion instability tests of a liquid oxygen-liquid hydrogen pressure fed rocket system. <u>NOTE (A)</u>: Engine and injector failures during operational test firings have increased the time required to complete the test program. <u>STATUS</u>: The present tests will be completed with one more test day which should be the week of July 7, 1963. The test run of June 21 resulted in a burned out injector and a crack in an engine channel. The hardware has been returned to Lewis for repair and/or replacement. Flush mounted pressure pickups using a helium purge were incorporated in the flow system for the last run and the data is being analyzed. M-1 <u>HYDROGEN-OXYGEN GAS GENERATOR</u> (I. A. Johnsen) Investigation of the gas generator for the Aerojet M-1 rocket engine program. <u>NOTE (B)</u>: Equipment deliveries and installation work time estimates have been increased and this is reflected in a change of operation schedule from August 15 to the end of September. <u>STATUS</u>: Work has been completed on the pad for the hydrogen tank and the tank is to be placed in position and leveled on June 27. The drawings and specifications for contract purposes have been completed and the Purchase Request is being processed. Operations should begin the latter part of September.

July 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	<u>J-2 LIQUID HYDROGEN- LIQUID OXYGEN</u> Throttling Tests (I. A. Johnsen) OR9045	Throttling and combustion instability tests of a liquid oxygen-liquid hydrogen pressure fed rocket system.
		<u>STATUS:</u> On July 9, it was decided by Cleveland engineers that the J-2 cell would not be run so that more effort could be placed on the J-3 buildup. On July 17, this decision was reversed since existing equipment in J-2 was needed for the completion of both J-3 and J-5 test cells. Manpower was reassigned to the cell to prepare for a run. On July 26, four runs were completed successfully before the tests were terminated by engine failure. The cell is being dismantled for the M-1 program and will be reassembled when parts and manpower become available.	
		<u>M-1 HYDROGEN-OXYGEN GAS GENERATOR</u> (I. A. Johnsen) OR0152	Investigation of the gas generator for the Aerojet M-1 rocket engine program.
		<u>STATUS:</u> Items ordered for this program are in the process of being delivered. Drawings for moving the control consoles from the trailers to B-1 control addition are being prepared.	

SITE	RESEARCH LABORATORY INSTALLATIONS (FOR) DESCRIPTION
J	ROCKET SYSTEMS J-2 M-1 HYDROGEN- OXYGEN GAS GENERATOR OR0152(I. A. Johnsen) Investigation of the gas generator for the Aerojet M-1 rocket engine program. <u>STATUS:</u> Equipment for the program is in the process of being delivered. The contract for the test cell modification has not yet been released for bidding. Work has not begun on the dismantling of the test cell due to lack of manpower to start the work. Drawings related to the relocation of control functions from the trailers to the B-1 addition are in various stages of completion. <u>NOTE (A)</u> : Schedule has been changed to reflect deliveries of materials and anticipated cell buildup time.

September 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 M-1 HYDROGEN- OXYGEN GAS GENERATOR OR0152(I.A.Johnsen) <u>STATUS:</u> All hardware, except for some valves and the hydraulic pump system, has been received for the M-1 gas generator program. Delivery is expected on the valves by October 30th. The pump contract is now ready to be awarded. The bids for the cell modification have been received and are being reviewed. All equipment which is unnecessary for the new program has been removed from the test cell. Tentative instrumentation lists have been compiled and distributed to the groups concerned. The necessary funding for the move of control functions from J control trailers to B-1 control addition has been approved by Plum Brook Station and was sent on 9-23-63 to the Lewis Budget Office. The plans for the move are well underway and should progress rapidly when money is made available.	Investigation of the gas generator for the Aerojet M-1 rocket engine program.

October 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS		Investigation of the gas generator for the Aerojet M-1 rocket engine program.
		<u>J-2 M-1 HYDROGEN- OXYGEN GAS GENERATOR</u> OR0152 (I.A. Johnsen)	
		NOTE (A): Program has been cancelled.	

September 1964

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 <u>LIQUID HYDROGEN</u> <u>FACILITY</u> OR0137 (I.A.Johnsen) Rebuilding of the cell was accomplished this month in preparation for acceptance tests to be run on the five foot test tank for the Cryogenic Propellant Tank Laboratory. Modifications included: 1. Removal of old LOX tank and equipment. 2. Tubing in a new fill system including necessary purges and tank pressurization equipment. 3. Rebuilding of the vent system. 4. Installation of preliminary instrumentation. Final cell modifications will be possible when Contractor-furnished equipment and attendant instrumentation becomes available. A liquid nitrogen checkout, followed by a liquid hydrogen checkout, is planned for early October. First research runs are expected to commence sometime in December 1964. Additional checkout runs may be made prior to this date to validate instrumentation system operation.	This is a liquid hydrogen facility capable of handling 145 pounds of liquid hydrogen at 250 psi.

October 1964

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 <u>LIQUID HYDROGEN</u> <u>FACILITY</u> OR0137(I.A. Johnsen) On October 26, a successful liquid nitrogen checkout was made. Equipment was checked, boil-off and warm-up information was obtained. NOTE: The liquid nitrogen checkout was delayed due to the late delivery of the new burst discs, leaky regulators, and delays in the instrument installation. Preparations are now being made for a liquid hydrogen checkout run which is scheduled for mid-November. Instrumentation is being installed for the research runs which are scheduled for December.	This is a liquid hydrogen facility capable of handling 145 pounds of liquid hydrogen at 250 psi.

November 1964

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 <u>LIQUID HYDROGEN</u> <u>FACILITY</u> OR0137(I.A.Johnsen) During November, no work was accomplished in this area. A liquid hydrogen checkout is scheduled for December. The "K" Site five-foot tank is scheduled to be installed and tank testing started by the end of December.	This is a liquid hydrogen facility capable of handling 145 pounds of liquid hydrogen at 250 psi.

December 1964

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 <u>LIQUID HYDROGEN</u> <u>FACILITY</u> OR0137(I.A.Johnsen) Preparations were made for the LH₂ check-out. The test capsule is now scheduled to be delivered January 11. Final mechanical, electrical and instrumentation work cannot be completed until the test capsule has been installed.	This is a liquid hydrogen facility capable of handling 145 pounds of liquid hydrogen at 250 PSI.

January 1965

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 <u>LIQUID HYDROGEN FACILITY</u> OR0137(I.A.Johnsen)	This is a liquid hydrogen facility capable of handling 145 pounds of liquid hydrogen at 250 psi. During January, one liquid hydrogen tests was made on the "K" Site research tank bottom package. On January 12, the package was installed. Necessary piping and electrical work were completed by the 19th and a one hour warm helium check indicated that the seal configuration met the warm requirements. Its leak rate was approximately 5×10^{-9} cm³/sec., at a seal differential pressure of 175 psi. On January 21, a liquid hydrogen run was made. No leak larger than 1×10^{-6} cm³/sec. was recorded. Greater mass spectrometer sensitivity could not be achieved because of an internal electrical drift. An attempt to obtain higher sensitivity by using helium was not successful. Due to possible external leakage sources, the recorded leaks could not be definitely traced to the internal seals. Modifications to the leak detector and piping systems were made to eliminate the high background readings and to increase the leak sensitivity of the mass spectrometer. NOTE: The run scheduled for January 28 had to be canceled because of a vacuum pump failure and the non-availability of liquid hydrogen. The next test is scheduled for the first week of February.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS		<u>J-2 LIQUID HYDROGEN FACILITY</u> OR0137(I.A.Johnsen) This is a liquid hydrogen facility capable of handling 145 pounds of liquid hydrogen at 250 psi. On February 2, a liquid hydrogen test was made on the "K" Site tank bottom feed-through package. Hydrogen sensitivity of 5×10^{-8} cm²/sec was possible during this test, due to the successful modifications of the test cell and the mass spectrometer. Shortly after initiating transfer, a cold gas leak in excess of 3×10^{-6} cm³/sec was recorded at a 40 psig pressure, but after the tank bottom was covered with liquid, the leak decreased. Shortly after pressurizing the tank to 175 psia, a leak of 5.6×10^{-6} cm³/sec developed. This leak "cleaned up" and subsequently reappeared when the tank was vented and then repressurized. An attempt to heat cycle the package was unsuccessful due to the inability of the mass spectrometer to pump down the cold chamber to a stable pressure. On February 4, the warm package was pressurized with helium to 175 psia. A sniffer probe with a maximum sensitivity of 1.5×10^{-7} cm³/sec was used to detect any leakage source. Negative results were obtained on all welds and outer seals, but both inner conoseal rings showed leaks of approximately 1.5×10^{-4} cm³/sec. The package was then disassembled for shipment back to the contractor. The bolt torques were checked and were found to be from 70% to 80% below pre-run values. This check was made after several heat cycles had taken place. An instrumented test section with a modified bolting arrangement is due early in March. Twenty days have been allocated for testing this package.

March 1965

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-2 <u>LIQUID HYDROGEN</u> <u>FACILITY</u> OR0137(I.A.Johnsen) The instrumented test package was received on March 9 at Plum Brook. A warm helium check on March 12 indicated that a leak in excess of 10^{-4} cm³/sec. was present. On March 13, the package was dismantled and tested with a portable probe. No leaks greater than allowed by the specifications were found on the conoseals or on fourteen of the fifteen instrument connectors. One feed-through connector was found to have a faulty weld with a leak in excess of 10^{-5} cm³/sec. The package was returned to the contractor in California for repair. Repairs cannot be made until a new feed-through connector is available. Since the lead time will be approximately 10 days, the capsule will not be available for testing at Plum Brook until approximately April 10.	This is a liquid hydrogen facility capable of handling 145 pounds of liquid hydrogen at 250 psi.

April 1965

SITE	LOCATION	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J-2	LIQUID HYDROGEN TEST STAND	<u>"K" SITE TANK TESTS</u> OR0137(I.A.Johnsen)	Tests are to be run on a instrumented tank bottom for a 13-foot diameter test tank. Failure of the "K" Site, 13-foot diameter, tank during hydrostatic testing at the contractor's plant delayed shipment of the test fixture until April 28. Therefore, J-2 hydrogen testing will not be possible until early May. On April 12, a leak test was made on NASA serrations. The test fixture utilized a 2-inch 150 psi stainless steel blind flange. The "standard" four concentric serrations were sealed with a Schedule 80 dead soft aluminum gasket. The serrations had a 8.3×10^{-7} cm³/sec chilldown (cold gas) leak rate; once liquid hydrogen covered the flange, no leak larger than 5×10^{-8} cm³/sec. was detected (maximum mass spectrometer sensitivity 5×10^{-8} cm³/sec.). The test was run for 26 minutes at 175 psid and for 44 minutes at 265 psid.

SITE	LOCATION	RESEARCH INSTALLATION	& DESCRIPTION
J	J-2 LIQUID HYDROGEN TEST STAND	<u>"K" SITE TANK TESTS</u> OR0137 (I.A. Johnsen)	Tests are to be run on an instrumented tank bottom for a 13-foot diameter test tank. Several warm helium checks of the "K" Site test fixture were made in early May. Leak indications were sometimes evident, but no definite source could be located. An attempt was made on May 11 to test the package in liquid hydrogen. Shortly after chilldown, the mass spectrometer indicated full scale reading. The test was terminated when the capsule vacuum rose significantly. The cono-seal gaskets were replaced when leakage was detected at the inner seal tap. Further testing with a special probe, after an extended period of pressurization, revealed that five instrument connectors were leaking beyond specification limits. One leak was in excess of 3×10^{-5} cm³/sec. The package is being shipped back to Lockheed for repair, or redesign and rework.

June 1965

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
J	ROCKET SYSTEM TEST SITES J-2 LIQUID HYDROGEN TEST STAND <u>"K" SITE TANK TESTS</u> OR0137(I.A.Johnsen) Tests are to be run on an instrumented tank bottom for a 13-foot diameter test tank. The cell has been put in a "standby" condition, since the contractor's redesigned package is not expected for some time. Related torque relaxation and cryogenic sealing tests are presently being conducted and are showing promising results.

July 1965

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
J	J-2 LIQUID HYDROGEN TEST STAND	<u>"K" SITE TANK TESTS</u> OR0137 (I.A.Johnsen)		Tests are to be run on an instrumented tank bottom for a 13-foot diameter test tank. No manpower was expended in the facility during this report period. Cryogenic sealing and bolt relaxation tests were continued as part of another related exper- iment. The Lockheed Modified Test Capsule is scheduled to be delivered to Plum Brook in November.

August 1965

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
J	J-3 VACUUM ENVIRONMENT TANK	<u>TANK INSULATION TESTS</u> PG0852 (S.S.Manson)		Various liquid hydrogen tanks will be tested under a vacuum environment. The effectiveness of various types of insulation will be studied. It is expected that at least two months will be required before the calorimeter is insulated and delivered to Plum Brook. Tests continued this month on an absolute backpressure device. The Cartesian diver manostat was found to be capable of maintaining a constant backpressure of 0.5 mm for extended periods.

January 1966

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
J	ROCKET SYSTEMS TEST SITES J-2	<u>"K" SITE TANK TEST</u> OR0137(I.A. Johnsen)		Tests are being conducted on the instrumented tank flange for the "K" Site 13-foot diameter test tank. The K-Site instrumentation lid was returned to Plum Brook on January 10, for acceptance testing. This lid had been at Lockheed for repairs and testing since May 1965. Preliminary warm checks with gaseous helium indicated leakage in two of the 15 connectors. Replacement of the connectors was done at Plum Brook by Lockheed personnel. One of the connectors had to be replaced twice because of excessive leakage. Following repairs, the lid was leak checked in a warm condition and all connectors appeared good. The lid was then cold shocked with liquid nitrogen and another connector failed. The lid has been returned to Lockheed for further re-design and/or repair.