

2/28/1963

PLUM BROOK ROCKET SYSTEMS FACILITIES STATUS REPORT

CONTINUED

SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	ROCKET SYSTEMS "J-4"	<u>Linde Tank</u> 51201 (Pinkel)	The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems. It was originally built to accommodate the old NACA high energy test vehicle.
<p>STATUS: At present, J-4 Test Cell is being put into running condition for expected boil-off tests on Linde applied super insulated test tank. Expected arrival date of test tank with insulation is March 4, 1963. It is anticipated that ground handling test runs will commence during the third or fourth weeks of March. This delay being caused by the different configuration of Linde Tank when compared to types of tanks for which the test cell was designed.</p>			
<p>March 28, 1963</p>			
<p>STATUS: <u>J-4 Tank Test Facility</u> <u>Linde Tank</u> The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems. It was originally built to accommodate the old NACA high energy test vehicle.</p>			
<p>Note (A) - The Linde insulated liquid hydrogen tank tests have been delayed. The tank arrived at Plum Brook with damaged insulation and was returned to Linde for repair. A delay of 3 to 4 weeks is expected. When the tank is returned</p>			
<p>J-4 the research engineers wish to install it in J-3. Operation-wise this installation will depend on the amount of facility modification that has been completed in preparation for the A. D. Little tests. Preparations are still being made to mount the Linde tank in J-4.</p>			
<p>Note (B) - If Project Management so desires, cold-shock test will be run on the A. D. Little tank in J-4.</p>			
<p>Note (C) - Combined propellant tanks, such as the "high energy test vehicle" tanks, will no longer be tested in J-4. Anticipated programs call for single, insulated, liquid hydrogen tanks. The facility will be modified accordingly.</p>			

SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	April 1963	<p>STATUS: J-4 <u>Tank Test Facility</u> <u>Linde Tank</u></p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems. It was originally built to accommodate the old NACA high energy test vehicle.</p> <p>Note (A) : Schedule was delayed because the Linde tank is presently being tested in J-3 facility, after these tests are completed it will be tested in J-4. Cold shock tests will not be conducted on the A. D. Little tank.</p> <p>The J-4 facility will be modified to accept the Linde insulated tank now under test in J-3. Testing in J-4 should begin in late May. Purpose of the test is to determine the effectiveness of the insulation under atmospheric conditions.</p>
	May 1963	<p><u>J-4 Tank Test Facility</u> <u>Linde Tank</u> (I. I. Pinkel)</p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems. It was originally built to accommodate the old NACA high energy test vehicle.</p> <p>STATUS: Modification of the test cell to accept the Linde super-insulated liquid hydrogen tank has been completed. During tests in J-3 test cell, a small leak developed in the insulation. Location of the leak has been determined and the research engineers will attempt to seal it. Instrumentation installation and checkout is progressing and tests are scheduled for the first half of the month of June. The objectives of the test are; (1) Measure liquid hydrogen boil-off rates under atmospheric conditions, and (2) Verify results obtained during initial tests in J-3 when the space chamber was at atmospheric pressure.</p>

SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	June 1963	<p>J-4 TANK TEST FACILITY <u>LINDE TANK</u> (I. I. Pinkel) 51210</p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems. It was originally built to accommodate the old NACA high energy test vehicle.</p> <p><u>STATUS:</u> Two research test runs were accomplished on the <i>Linde super-insulated liquid hydrogen tank. Both tests were made at atmospheric conditions around the tank and</i> less than 15 micron vacuum on the insulation. The first test lasted approximately forty hours. This test was unsuccessful due to leakage of the boil-off gas through a burst disc assembly. Repairs were made and the second test was run a week later. The second test was successful and lasted forty-eight hours. That data obtained from the second test is being analyzed by the research engineers. Further tests will be scheduled for the last two weeks of July.</p>
	July 1963	<p>J-4 TANK TEST FACILITY <u>LINDE TANK</u> (I. I. Pinkel) OV0698</p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems. It was originally built to accommodate the old NACA high energy test vehicle.</p> <p><u>STATUS:</u> On July 9, it was decided by Cleveland personnel that the test cell would be used for CENTAUR arc tank insulation studies. Plans were immediately formulated and actual modification started a week later. Since the CENTAUR arc tank will be installed in the J-4 cell before J-3, some manpower has been diverted from J-3 to assist in the J-4 modifications. It is anticipated that all modifications will be complete before the arrival of the CENTAUR arc tank.</p>

(September 13, 1963)

SITE	RESEARCH LABORATORY INSTALLATIONS (FOR)	DESCRIPTION
J	<p>J-4 <u>TANK TEST FACILITY</u> <u>LINDE TANK</u> (I. I. Pinkel) OV0698</p> <p><u>STATUS:</u> Three tests were made during this report period. On August 13, a programmed test on #1 CENTAUR tank was run. The tank was filled with LH₂ and boiloff data was recorded. The liquid level sensors did not function correctly. Inspection of the tank after test shutdown revealed that an insulation panel had separated from the tank skin during the test. Research personnel decided to continue the test program in J-3 utilizing #1 Centaur tank. A programmed test on #2 Centaur tank was run in J-4 on August 24. The tank was filled with LH₂ and boiloff data was recorded. Attempts by the United Controls liquid level sensor representative to adjust sensors were to no avail and the sensors did not function. Inspection of the tank after boiloff was completed revealed that approximately 2/3 of the insulation had separated from the tank skin during the program. The #2 tank was again tested on August 28 to verify boiloff results obtained in the test of August 24th.</p> <p><u>NOTE (A)</u> : Centaur arc tank insulation program has been extended until October 1st.</p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems.</p>

SITE	LABORATORY RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	<p>September 1963</p> <p>J-4 <u>TANK TEST FACILITY</u> <u>LINDE TANK</u> (I. I. Pinkel) OV0698</p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems.</p> <p><u>STATUS:</u> Two tests were made during this report period. On Sept. 9, a programmed test on #3 CENTAUR tank was run using LH₂ as the cryogenic liquid. Boiloff data was satisfactorily recorded for research purposes. The "United Controls" point level sensors functioned correctly on this test. Inspection of the tank after shutdown revealed a small area where trapped air had broken the insulation to tank bond. Goodyear personnel repaired the failure and #3 CENTAUR tank was then mounted in J-3 facility. On September 28, the initial test on #4 CENTAUR tank was run, using LH₂ as the cryogenic liquid. Boiloff data was satisfactorily recorded for research purposes. The #4 CENTAUR tank, wound with Mylar and fiberglass, provided the same results as previous tests. The insulation to tank bond failed on #4 CENTAUR tank.</p>
	<p>October 1963</p> <p>J-4 <u>TANK TEST FACILITY</u> <u>LINDE TANK</u> (I. I. Pinkel) (I. A. Johnsen) OFO 567</p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems.</p> <p><u>STATUS:</u> On October 4, this facility was used to test a new 10,000 gallon liquid hydrogen dewar to see if the dewar met specifications. The test lasted about five days, and it was found that about $1\frac{1}{4}$ times more hydrogen boiled off than was specified.</p> <p>On October 21, 1963, the Centaur Arc Tank #4 was tested using liquid hydrogen as in previous tests. The purpose of this test was to evaluate the performance of the tank's insulation after a simulated flight test in J-3 facility.</p> <p>During the test, a silver solder joint in the vent line cracked which caused the boil-off data obtained from the gas meter to be incorrect. However, the elapsed time boil-off of the liquid was comparable to previous test, so the test results were acceptable.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	November 1963	<p>J-4 <u>TANK TEST FAC.</u> OG0851 (I.I.Pinkel)</p> <p><u>STATUS:</u> During this report period, no work was accomplished in this facility. The test requirements for the next test program have not been received.</p> <p><u>NOTE</u> (A) : Two previous programs were cancelled and the CENTAUR jettison insulation test added.</p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems.</p>
	December 1963	<p>J-4 <u>TANK TEST FAC.</u> OG0-851 (I.I.Pinkel)</p> <p><u>STATUS:</u> Since the test program for CENTAUR jettison insulation has not been received, no work could be accomplished during December.</p>	<p>The facility is a semi-enclosed vertical stand originally built to study cryogenic propellant loading and insulation problems.</p>

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J	January 1964	<p>J-4 TANK TEST FAC. The facility is a semi-enclosed vertical OG0851 (I.I.Pinkel) stand originally built to study cryogenic propellant loading and insulation prob- lems.</p> <p>STATUS: A test program has not been received for the Cen- taur jettisonable insulation tests.</p> <p>NOTE (A) : Latest information now indicates that testing will not begin until the first week of April.</p>	
	February 1964	<p>J-4 <u>TANK TEST</u> A facility to study LH₂ tank <u>FACILITY</u> insulation. OG0851 (I.I.Pinkel)</p> <p>The detailed test program has not been received for the Centaur jettisonable insulation tests.</p> <p>NOTE (A) : Test program has been extended through September.</p>	
	March 1964	<p>J-4 <u>TANK TEST</u> A facility to study liquid hydrogen <u>FACILITY</u> tank insulation. OG0851 (I.I.Pinkel)</p> <p>Contact was made with the Cleveland engineer responsible for the jettisonable insulation tests. The program was discussed in general terms, but as yet no definite program requirements have been established. Lewis personnel will contact Plum Brook operation engineers when the facility build-up and instrumentation requirements have been finalized. No work was accomplished on this project.</p>	

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J	ROCKET SYSTEMS	J-4 <u>TANK TEST FACILITY</u>	<p>A facility to study liquid hydrogen tank insulation.</p> <p>A new vacuum-jacketed liquid hydrogen transfer line was installed in the cell during April. Lewis Research engineers associated with the Centaur jettisonable insulation test program are expected to provide information about the program on May 4.</p> <p>New plans call for the installation and testing of a liquid hydrogen tank insulated by Arthur D. Little in the facility. The A. D. Little tank is to arrive at Plum Brook in early May. Personnel are not available to be permanently assigned to the A. D. Little test program at this time; therefore, this program will be undertaken when and if the manpower becomes available from other test cells.</p> <p>NOTE (A) : A. D. Little tank tests have been added to the "J-4" schedule.</p> <p>NOTE (B) : Centaur jettisonable insulation tests have been tentatively postponed until July.</p>

May 1964

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-4 <u>TANK TEST FACILITY</u>	<p>A facility to study liquid hydrogen tank insulation.</p> <p>Due to the concentration on "J-3" test cell, the work on "J-4" test cell was not started until the latter part of May. This facility is now being readied to perform an insulation integrity and a heat flux test on the Arthur D. Little tank.</p> <p>The jobs that have been completed for the A. D. Little tests are:</p> <ol style="list-style-type: none">1. The liquid hydrogen transfer line was insulated.2. The facility piping was cold-shocked and pressure checked.3. The tank was installed.4. Existing instrumentation has been checked and re-calibrated.5. A liquid nitrogen spray bar, for cooling the exterior of the tank has been designed and is being built. <p>It is expected that the first test will begin June 8.</p> <p>Work on the Centaur jettisonable insulation test was started this month:</p> <ol style="list-style-type: none">1. The necessary vacuum pumps have been located.2. A firing circuit is now being designed.

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J	ROCKET SYSTEMS	<p>J-4 TANK TEST FACILITY OG0851 (I.I.Pinkel)</p> <p>From June 9 through June 11, five tests were performed on an Arthur D. Little urathane foam insulated cryogenic tank. The objective of these tests was to determine the heat flux value of the insulation and to investigate the foam integrity under cryogenic conditions. The test summary is as follows:</p> <table border="1"> <thead> <tr> <th data-bbox="518 690 594 721"><u>Date</u></th> <th data-bbox="650 690 718 721"><u>Test</u></th> <th data-bbox="997 690 1108 721"><u>Results</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="518 752 619 782">June 9</td> <td data-bbox="650 752 883 782">LN₂ Boil-off #1</td> <td data-bbox="997 752 1425 782">Heat Flux = 96.8 BTU/hr ft²</td> </tr> <tr> <td data-bbox="518 813 619 844">June 9</td> <td data-bbox="650 813 883 844">LN₂ Boil-off #2</td> <td data-bbox="997 813 1425 844">Heat Flux = 96.3 BTU/hr ft²</td> </tr> <tr> <td data-bbox="518 874 619 905">June 10</td> <td data-bbox="650 874 921 905">LH₂ Boil-off #1&2</td> <td data-bbox="997 874 1425 905">Heat Flux = 93.0 BTU/hr ft²</td> </tr> <tr> <td data-bbox="518 936 619 966">June 11</td> <td data-bbox="650 936 933 1007">LN₂ in tank, spray foam with LN₂</td> <td data-bbox="997 936 1372 1007">Alumaseal bag blistered. Foam integrity - good.</td> </tr> <tr> <td data-bbox="518 1038 619 1069">June 11</td> <td data-bbox="650 1038 933 1109">LN₂ in tank, spray foam with LN₂</td> <td data-bbox="997 1038 1331 1109">Air pockets under bag Foam integrity - good</td> </tr> </tbody> </table> <p>All test objectives were met and the tank returned to Arthur D. Little.</p> <p>Effort for the balance of the month was directed toward preparation for the Centaur Jettisonable Insulation Tests. The vacuum system was installed and the detonator circuit completed.</p> <p>A LN₂ checkout of the system was completed on June 27, 1964.</p> <p>The first of the Centaur series tests will be made on July 1, 1964.</p>	<u>Date</u>	<u>Test</u>	<u>Results</u>	June 9	LN ₂ Boil-off #1	Heat Flux = 96.8 BTU/hr ft ²	June 9	LN ₂ Boil-off #2	Heat Flux = 96.3 BTU/hr ft ²	June 10	LH ₂ Boil-off #1&2	Heat Flux = 93.0 BTU/hr ft ²	June 11	LN ₂ in tank, spray foam with LN ₂	Alumaseal bag blistered. Foam integrity - good.	June 11	LN ₂ in tank, spray foam with LN ₂	Air pockets under bag Foam integrity - good	
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J	ROCKET SYSTEMS	<p>J-4 <u>TANK TEST FACILITY</u></p> <p>QG0851 (I.I.Pinkel & S.S.Manson) OR0399 (I.A.Johnsen)</p>	<p>A facility to study liquid hydrogen tank insulation.</p> <p>On July 1, the first of a series of Centaur jettisonable insulation tests was performed. The primary purpose of these tests is to investigate methods of jettisoning the insulation from a liquid hydrogen-filled Centaur arc tank. This first test proved to be unsuccessful, although the detonators on both sides of the tank were exploded. The detonation did not propagate along the explosive cutting charges as planned. It is thought that the cold temperatures affected the performance of the detonators and that nicks on the ends of the cutting charges kept the detonation from propagating.</p> <p>On July 20, another test was performed on the same tank. This time, the detonators were mounted away from the tank wall and the ends of the cutting charges were known to be free of nicks. The detonation propagated along the full length of the cutting charges, but a combination of frost and a few uncut strands of the fiberglass cinch wrap prevented the insulation from falling off the tank.</p> <p>The Centaur tank has been returned to Goodyear to be reinsulated and is expected back about September 1 for further testing.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J-1	ROCKET SYSTEMS	<p>August 1964</p> <p>J-4 <u>TANK TEST FACILITY</u> OG0851 (I. I. Pinkel & - S. S. Manson) OR0399 (I. A. Johnsen)</p> <p>The Arthur D. Little, Inc. calorimeter tests were cancelled, so no manpower was expended in this stand during August.</p> <p>The second Centaur arc tank test is now scheduled to start the end of September.</p> <p>September 1964</p> <p>J-4 <u>TANK TEST FACILITY</u> OG0851 (I. I. Pinkel & S. S. Manson) OR0399 (I. A. Johnsen)</p> <p>No manpower was expended in this facility during the month of September. Work will resume upon the arrival of the second Centaur arc tank. The tank is scheduled to arrive at Plum Brook about the middle of October.</p> <p>October 1964</p> <p>J-4 <u>TANK TEST FACILITY</u> OG0851 (I. I. Pinkel & S. S. Manson) OR0399 (I. A. Johnsen)</p> <p>No manpower was expended in this facility during the month of October. Work will resume about the middle of December after the second Centaur tank is delivered.</p>	<p>A facility to study liquid hydrogen tank insulation.</p> <p>A facility to study liquid hydrogen tank insulation.</p> <p>A facility to study liquid hydrogen tank insulation.</p>

November 1964

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-4 <u>TANK TEST FACILITY</u>	A facility to study liquid hydrogen tank insulation. No manpower was expended in this facility during the month of November. The test program scheduled for 'J-4' has been cancelled and there are no immediate tests planned for this facility.