SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK LAB		
		CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

Vacuum chamber fabrication, erection, and installation is now complete. Currently, the contractor is engaged in acceptance testing of the vacuum chamber as defined by the specifications.

A temporary storage area for Government-furnished equipment has been prepared. Purpose of the area is to control and facilitate handling of Government-furnished equipment prior to installation by the various contractors.

Status of the remaining construction is as follows:

(1) The Balfour roll-up door for equipment access into the building is now being fabricated. Delivery is expected by June 1.

(2) An engineering drafting service contract was awarded to expedite completion of electrical contract drawings for process control and data instrumentation. In support of this endeavor, an approved control panel layout was submitted.

(3) The general contract was revised because of excessively high bids received on the initial advertisement. Rebids are due May 7.

(4) Process piping and steam generating and distribution contracts are currently being advertised. Bids for these contracts are due on May 5.

(5) A contract for reactivation of the Ransom Road sewage lift station, which serviced the Cryogenic Propellant Tank Laboratory, has been prepared and approved. This contract will be advertised by May 8.

Facility checkouts are scheduled to start by mid-January 1965.

6-64

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK LAB		
		CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

Vacuum chamber leak rate testing was satisfactorily completed. Beginning with an initial chamber pressure of $8\frac{1}{2}$ microns PSIA, the leak rate averaged $\frac{1}{2}$ micron per hour over a 48 hour period. Pending the delivery of spare "O" rings, this contract will be closed.

Status of other contracts is as follows:

(1) The general contract was awarded to R. G. Beer, Inc. A pre-construction conference was held on May 25, and the contractor is now on the site.

(2) Electrical contract drawings were completed. This contract is now out for bids.

(3) The boiler plant contract was awarded to T. O. Murphy, Inc.

(4) Process piping contract bid opening was rescheduled from May 5 to June 3.

(5) The sewage lift station electrical power contract was partially completed. A sub-contractor for R. G. Beer, Inc. is also working at the lift station.

Government-furnished equipment for process piping has been partially delivered from Lewis Research Center storage and from outside suppliers. Cleaning requirements for process piping were submitted to interested parties for review and will be added to the piping contract.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK LAB		
		CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

Much of the activity for Power House No. 3 during June centered about completing designs and awarding contracts. As a result of this activity, contract status is as follows:

(1) Vacuum chamber contract - complete except for delivery of spare "O" Ring seals.

(2) General contract - the prime contractor (R. G. Beer) is on the job and an estimated 5% of the total work has been completed. The main effort has been in the demolition and excavation type jobs.

(3) Electrical (Instrumentation and Controls) - bids were opened on June 26. There was only one bidder (Valley Electric) and the quote was approximately $25,000 over a $175,000 estimate. This contract was written to allow the successful bidder 215 days to complete after the award of the contract.

(4) Electrical (Safety) - This job is still in the design stage at Lewis. Drawings and specifications are currently scheduled for completion September 1, 1964.

(5) Hydraulic actuator installation - A purchase request is being processed for this work.

(6) Process Piping - This contract was awarded to Elsberry on June 25. The pre-construction conference will be held on July 1, 1964 with completion of the job scheduled within 90 days.

(7) Five foot test tank - modification drawings for the existing tank were completed.

(8) Thirteen foot test tank - contract for the construction was awarded to Lockheed Aircraft.

(9) Liquid hydrogen fill and drain valve - this contract to be awarded July 1, probably to Kemp Aero Products.

NOTE Ⓐ : The facility checkout schedule was based on the Lewis PERT schedule dated June 3, 1964.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK LAB	CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

Early in the month, a construction PERT program was set up, which indicates a tentative completion of construction on March 1, 1965. The PERT chart was discussed with all contractors on the job in order to bring interface and procurement problems to light. A determined effort will be made to prevent schedule slippage, and to improve upon the schedule if at all possible.

Contract status at the close of the reporting period is as follows:

(1) Vacuum Chamber - complete except for delivery of spare "O" Ring seals.

(2) General Contract - the walls and roof of Building 905 (control room) as well as the foundation for the boiler house were poured. Plumbing and electrical work in Building 901 (test area) is well under way. This contract is estimated to be 10% complete.

(3) Process Piping - the vacuum pumps, one 36" valve, and one heat exchanger were set. The Government-furnished items for this contract are approximately 65% complete. Most of the required items should be on hand by September 1. This contract is estimated at less than 5% complete.

(4) Boiler House - steam lines have been laid between buildings 901 and 905.

(5) Roll-up Door - door installation is 95% complete, lacking only the installation of a sill plate angle.

(6) Electrical Safety - preliminary design is complete and a safety committee review was held on detector head locations and types. An A & E contract will be awarded to produce detail drawings and specifications by September 1.

(7) Electrical (Instrument and Controls) - Valley Electric, the successful bidder, was given notice to proceed on July 29. Contract completion is expected by March 1, 1965.

(8) Five Foot Test Tank - A review of completed drawings indicated a need for design changes. These changes are now being incorporated into the drawings.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK		
		(9)	LH_2 Fill and Drain Valve - A fabrication and installation contract was awarded to Cryovac. Four months are required to complete this contract.
		(10)	Hydraulic Actuator Installation - This contract is now being advertized with award scheduled for August 19. Unfortunately, this contract was written with a 60-day completion clause, but with an optional 90-day completion. If the successful bidder takes the extra 30-days, then final completion of the facility may be delayed beyond the March 1, 1965 schedule. In order to insure completion of this contract within the 60 days, additional funds will be required.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK LAB		
		CRYOGENIC PROPELLANT TANK OR0137 (I.A. Johnsen)	Cryogenic propellant pressurization and dynamics testing.

Excellent weather allowed the construction to progress rapidly during the past month, particularly with respect to masonry, demolition, and excavation type projects. Current status is as follows:

(1) General Contract: Concrete pads were poured for liquid nitrogen and liquid hydrogen stations. A new concrete floor was also poured in the control room and in the sump pit in Bldg 901, E & M Room area. Concrete block masonry is well underway in both structures, while plumbing and electrical work is estimated at 15% complete. The boiler house is being erected.

(2) Process Piping: All vacuum equipment, including diffusion pumps, is now in place with this system being approximately 50% complete. Progress on other systems, as follows: Gaseous nitrogen, gaseous hydrogen and helium systems - 20%; liquid nitrogen - 60%; steam and hydraulic - 30%; hydrogen burnoff - 10%. All Government furnished equipment is on hand except for approximately 1% still out on purchase.

(3) Boiler House: Boilers are expected on site about September 15.

(4) Electrical Safety: Final drawings and specifications are expected to be ready for bid by September 4.

(5) Electrical (Instruments & Controls): Government furnished equipment for this contract is nearly 75% on hand, although there is approximately another 18% still out on purchase. The 30 KC digital system (one of the critical path items on PERT) is due at Lewis on Sept. 1 for preliminary checkout.

(6) Five-Foot Test Tank: Design changes were made recently and are now being checked. Assuming a normal procurement cycle, this tank will probably not be available before April 1, 1965.

(7) Hydraulic Actuator Installation: This contract was awarded with a 90-day completion date. As mentioned in last month's report, there is a possibility that the 90 days may have an adverse effect on the facility completion date of March 1, 1965.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK LAB	CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

Construction on the site is, in general, progressing on schedule. There are, however, four areas which show little progress and may affect the construction schedule at a later date. These areas are:

1. The delivery of the boilers has been rescheduled from September 1 to October 15. Consequently, heating from the boiler plant will not be available until mid-November, and adverse weather could affect construction. The boiler house, electrical, plumbing, and main steam line are, however, 95% complete.

2. The electrical contractor for instrumentation and controls did not start his site installation work until September 25, although he was given notice to proceed prior to August 1. By his own work schedule, the Contractor is 7% behind schedule. The final checkout of the process piping and vacuum systems cannot be completed on schedule due to the lack of instrumentation and control wiring.

3. The 30 KC digital system is scheduled to be installed in "H" Building. This is on the critical path and its delivery to Plum Brook is already one week late.

Continued on Page 27

9-64

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK LAB		

4. An A.O.C. to clean bottles for gas storage is expected to be completed by October 13. Allowing ninety days delivery, a week in transit, and seven weeks total for mounting in racks, plus field installation, the bottle farms will not be operational until March 12, 1965. Work is currently in progress on piers and footings, which are scheduled to be completed by October 7.

The remaining work appears on schedule as follows:

5. General Contract: This contract is 50% complete. Structural work in Building #905 is 100% complete; block walls in Building #901 are 100% complete; plumbing, heating, and electrical in 901 and 905 are 43% complete; paving is 95% complete, and the 16" air duct has been installed.

6. Five-foot Test Tank: Specifications and design modifications will be complete by approximately October 5. Assuming a normal procurement cycle, it is estimated that the tank will not be completed before April 1, 1965. However, an estimated two week delay in the fabrication of the LH_2 vacuum-jacketed line will be required because of necessary repairs to a Government-furnished Annin valve.

7. Process Piping: Progress at the site is on schedule. Status of sub-systems is as follows:

	% Complete
Vacuum	85%
Gaseous Systems	80%
30" Vent Stack	100%
LN_2 Piping	90%
H_2 Burnoff	90%
Steam and Hydraulics	90%

8. Pedestal, Seal and Actuator: Fabrication is now on contract with delivery due November 27.

9. Electrical Safety System: Drawings and specifications are now being processed through Procurement.

10. Railroad: A purchase request for design and specifications was started through the procurement cycle. A completion date of April 1 was requested.

10-64

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
CPTL	CRYOGENIC PROPELLANT TANK LAB		
		7.	Designs and specifications were completed for the electrical safety contract, but the Purchase Request has not been approve. This is a critical path item, and a contract award should have been made October 9 to satisfy the construction PERT chart.
		8.	The railroad contract is out for bid and should be awarded in early December.
		9.	Designs and specifications for the five-foot test tank modifications were completed and are now in procurement. The tank cradle and shaker connection mechanism contract status is similar.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK LAB	CRYOGENIC PROPELLANT TANK OR0137(I.A. Johnsen)	Cryogenic propellant pressurization and dynamics testing.

The present estimated facility completion date is July 2, 1965. This is twelve weeks beyond the scheduled completion date of April 9. The $75,000 safety system, a critical path item, is twelve weeks behind schedule. Invitations for Bids for this work are scheduled to be opened December 31. The Invitation requests a 120 to 150-day contract completion time. If awarded for a 120-day completion, the facility completion date still would be eight weeks behind schedule. The safety system review and the required changes caused the twelve-week delay.

Status of other work appears as follows:

(1) The $193,000 instrumentation and control electrical contract is four weeks behind schedule and efforts are being made to bring it back on schedule.

(2) The gas storage bottle cleaning contract for various Plum Brook gas storage areas was awarded November 20. The first 144 bottles should be assigned to "K" Site to keep this item on schedule.

(3) Installation of the 30 KC digitizer system: The instrument cable bid opening date had to be extended several times because of no response, due to the short requested delivery time. The bid opening is scheduled for December 18. The Invitation for Bids for the cable installation has been held up until after the cable bid opening.

(4) The heating plant is 98% complete. The boilers were fired for the first time on November 30.

(5) The actuator vacuum seal failed in its initial operation tests, apparently due to a seizing between the seals and the actuator. The seal is currently under investigation by the responsible design group.

(6) The process piping contract is 80% complete, with the vacuum-jacketed liquid hydrogen line nearly ready for delivery. All three Government-furnished Annin valves for the liquid hydrogen system were found to be defective.

(Continued on Page 30)

11-64

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK LAB	(Continued)	
		(7)	The general construction contract is 90% complete. Remaining work is largely of an electrical nature.
		(8)	Bids for the railroad contract were opened November 24. The only bid received was greater than the Government estimate. The bid is being evaluated at the present time.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK LAB		
		CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

Status of construction on the various contracts is as follows:

(1) The R. G. Beer general construction contract is 99% complete.

(2) The instrument and control wiring contract is now estimated to be five weeks behind schedule. Valley Electric, the contractor, had assured the Government that their work force could be increased to fourteen men by December 21 in an attempt to put this contract back on schedule--to date this agreement has not been complied with, but our construction office states that the contractor has agreed to work extra time, if necessary, to meet the contract completion date of March 1.

(3) Bids for the electrical safety work were opened Dec. 31. The low bidder was Valley Electric with a bid of $78,600 and 150-day completion (June 17). This contractor is presently working at the site on the instrument and control contract (Item 2), which is five weeks behind schedule.

The design still has to be completed for a third electrical job which includes the installation of T.V., vacuum chamber gas analyzer and research data wiring for the inside of the vacuum chamber.

Since both of these electrical jobs are critical path items, the facility completion date will be determined by their completion.

(4) The Elsberry process piping contract is 90% complete. the vacuum-jacketed liquid hydrogen line was delivered and the installation will start the first week of January. Remaining work is primarily cleaning and testing.

(5) The railroad contract is currently in legal review. An amended SJO and purchase request were approved for the higher-than-expected bid. This contract should be awarded early in January.

(Continued on Page

12-64

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK LAB	(Continued)	

(6) The heating plant is in operation, although a few minor modifications are necessary.

(7) Hydraulic actuator seal and pedestal: The seizing failure reported from last month's test was apparently caused by an oversized shaft. The seal was changed to reduce interference, and testing is again underway. An alternate seal design is also under consideration.

(8) Miscellaneous:

(a) Delivery of the 30 KC digital system to Plum Brook was rescheduled to January 4, 1965.

(b) Bids for modification of the five-foot NOMAD test tanks were excessively high. Therefore, alternate "8-Ball" tanks were substituted. Bids for this work will be opened January 7, 1965, and it is expected that the job can be completed in sixty days.

(c) The thirteen-foot test tank which is being fabricated by Lockheed is approximately 40% complete.

(d) The vacuum system's 36" Edwards angle valves were removed to be nickel-plated. This was necessary because of extensive oxidation.

NOTE: A meeting was held on December 16 with responsible groups from Lewis and Plum Brook. The estimated first run date was slipped from April 15 to July 2, which was the estimated completion date given in last month's report.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK LAB	CRYOGENIC PROPELLANT TANK OR0137 (1.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

The present estimated facility completion date is August 20. This is three weeks beyond the scheduled completion date of July 30. Completion of "K" site construction continues to depend upon the completion of the critical path electrical contracts. The electrical safety contract was awarded January 15 to Valley Electric. It is estimated that the notice to proceed will be given by February 2, thereby making July 2 the contract completion date. The bids for this job were opened on December 31, 1964.

Valley Electric is currently working on an instrumentation and controls electrical contract. This contract is 70% complete and approximately ten weeks behind the contract schedule. Our construction office met with the contractor and the work force has been increased to eighteen. With this change, the contract should be completed by the first week of March, or one week beyond the contract completion date ~~of March~~ 1.

The design is nearly complete for the third electrical contract (for TV, the partial pressure analyzer, and additional research instrumentation), and this design is scheduled to be finished by February 12. This job is also a critical path item.

(Continued on Page 30

1-65

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK	(Continued)	

Status of other remaining contracts is as follows:

(1) The R. G. Beer general construction contract is 99% complete.

(2) The Elsberry process piping contract is 92% complete. The system cleaning and the required vacuum-jacketed liquid hydrogen line modifications remain to be completed.

(3) The Acme Construction railroad contract was awarded for $46,625 and the notice to proceed should be given by February 1, thereby making the contract completion date April 1.

(4) The "eight-ball" tank modification work should be awarded to Akron Steel Fabricators by February 4; thereby making the contract completion date June 2.

(5) Lockheed reports that the 13-foot test tank fabrication is on schedule and should be completed by May 3.

(6) The T. O. Murphy boiler contract was completed.

(7) The SEL digital equipment is now located in "H" Bldg. The contract for procuring the instrumentation cable for the cable run from "K" site control to "H" building was awarded to General Cable on January 15, with a contract completion date of May 15. Due to required design changes, the cable installation drawings and specifications were not completed this month.

(8) Handling equipment (monorail, hoist, etc.) is in preliminary design and is scheduled to be completed by February 15.

(9) The hydraulic actuator pedestal was delivered and the seal is currently undergoing tests. An alternate seal design is scheduled to be completed by February 12.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK LAB	CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

The present estimated facility completion date is August 20. The controls and instrumentation electrical contract (Valley Electric) is now 91% complete. While the current status is still behind schedule, an augmented work force has increased the work tempo sufficiently to enable a probable completion within two weeks of the scheduled date. Required field changes may extend this completion date. Valley Electric was given, on February 2, the notice to proceed on the electrical safety contract, thereby establishing the contract completion date of July 2.

Design and specifications for the third electrical contract (TV, tank instrumentation, etc.) have been completed. Assuming normal procurement, an award of contract can be expected about April 1, with a probable 90-day completion. The partial pressure analyzer, essential to the hydrogen test program, was deleted from the contract in order to avoid delay. Since the analyzer is a long lead item, and installation details have not yet been worked out, constant attention must be focused on this subject to avoid postponement of hydrogen tests.

Current developments on other contracts are as follows:

(1) Acme Construction was given notice to proceed with the railroad contract and construction is already well underway. The contract completion date is April 1.

(2) The support cradle for the 5-foot test tank is 35% complete and progressing on schedule.

(3) The liquid hydrogen fill and drain valve was received and will undergo acceptance tests in the near future.

(4) A contract for modification of the "eight ball" tank was awarded to Akron Steel Fabricators on February 4. The contract completion date is June 2.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK LAB	CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.

Contract status as of March 31 is as follows:

(1) General construction: Construction is complete except for minor cleanup items. A final contract inspection was made March 18.

(2) Process piping: The piping is complete except for

(a) Cleaning the liquid nitrogen system.

(b) Installation of identification tags on system components.

(c) Change order work connected with installation of stainless steel bellows in the vacuum system.

(3) Electrical (controls and instrumentation): Contract change orders and system testing remain to be done.

(4) Electrical (safety): The contract is approximately 5% complete.

(5) Instrumentation cable from "K" to "H": The cable is scheduled to be delivered April 2 and the installation contract bid opening date is April 16.

(6) Communications: The conduit installation purchase request is now in Procurement.

(7) Partial pressure analyzer: The specifications for procurement are scheduled to be completed by April 16.

(8) TV and tank instrumentation: The bid opening date for this contract is April 9.

A check of pressurization for Rooms 101 and 201 showed that these rooms are not adequately sealed to obtain 1/2" H_2O with the existing blower. Accordingly, specifications are being prepared to remedy this situation.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOF)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK LAB		A full complement of NASA mechanics have been assigned to the site; therefore, system and equipment checkouts and other necessary site work are in progress. Some of the jobs recently completed are included in the following list: (1) A preliminary check of the vacuum system. This checkout reemphasized the need for stainless steel bellows to replace the present rubber hoses. (2) Modification of the trailer stanchions on gas manifolds, disassembly, cleaning, and reassembly of the actuator seal and drive rod mechanism. (3) Modification of the cooling water system to increase flow rate to the CVC diffusion pumps. The process piping control system checkouts are scheduled to be started on April 9. The checkouts will include pressure, flow, and temperature controls, as well as heat exchanger performance. The first series of tests will be made utilizing ambient and chilled gaseous nitrogen.

SITE	LOCATION	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	CRYOGENIC PROPELLANT TANK OR0137 (I. A. Johnsen)	Cryogenic Propellant pressurization and dynamics testing.

Contract status as of the close of this reporting period is as follows:

(1) Electrical:

(a) Instrumentation and Controls - 99% complete.
(b) Safety-25% complete and on schedule.
(c) TV and Tank Instrumentation - Notice to proceed given to Valley Electric on April 26 - Completion is set for July 26.

(2) Process Piping:

Notice to proceed with piping for the 13-foot test package was given to Elsberry on April 23 with completion scheduled by July 3, 1965. Delivery of flexible metal connections for the vacuum system should complete the initial porcess piping contract by mid-May

(3) Partial Pressure Analyzer:

Specifications for this unit were completed and the Purchase Request is in Procurement.

(4) 13-Foot Test Tank:

This test tank failed during hydrostatic test at Lockheed's plant. Design changes are in progress for a second tank scheduled for November delivery.

(5) Ruckers Actuator Installation:

The Contractor is expected to complete this job by May 31.

(6) Fill and Drain Valves:

Valves were not acceptable due to erratic operation, and were returned to the vendor for modifications.

(7) Instrumentation Cable (901 to H):
Contract award is expected by May 13.

(Continued on Page 30)

SITE	LOCATION	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
K	CRYOGINIC PROPELLANT TANK SITE		

CRYOGENIC PROPELLANT TANK (Continued)

NASA work at the site continued at a satisfactory rate during the month of April, comprised primarily of the following tasks:

(1) Initial pressure and flow control tests were performed on the process piping system, making use of ambient temperature nitrogen gas. NASA design loaders for the pressure regulators exhibited erratic operation and will require some modification. Temperature control checkout was temporarily precluded because of a heat exchanger gas leak.

(2) The electrical operation of the valves was checked out.

(3) The process heat exchanger was repaired and hydrostatically checked.

(4) Prepared for the actuator installation by:

(a) removing window in Room 201 for equipment access;
(b) cleaning Government-furnished equipment;
(c) installing actuator pedestal on vacuum chamber.

(5) The hydraulic system was modified and the control acceptance tests on vacuum chamber door operating system was completed.

(6) The purge pressure indicator switches were assembled and calibrated.

(7) Valve operators were modified for the CVC 36" vacuum valves.

5-65

SITE	LOCATION	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	CRYOGENIC PROPELLANT TANK — Cryogenic propellant pressurization and dynamics testing. OR0137 (I.A. Johnsen) Status of major contracts at the end of May is as follows: (1) Electrical (Safety): 75% complete, and on schedule. (2) Electrical (TV & Tank Instrumentation): 15% complete. (3) Process Piping (13-ft. Tank): 25% complete.

SITE	LOCATION	RESEARCH INSTALLATION & DESCRIPTION
K		

(4) Conduits for Communication System:

The contractor was given notice to proceed on May 24, with completion scheduled for June 21.

(5) Partial pressure gas analyzer:

In procurement.

(6) Digitizer Cable Installation:

The contract was awarded to Valley Electric on May 26, with a 60-day completion .

(7) Liquid Hydrogen Fill and Drain Valves:

These valves have not yet fully passed Government acceptance tests. Actuator problems were apparently solved, although static seal leaks have developed.

(8) Ruckers Actuator Installation:

Completion of this contract is delayed due to difficulties encountered during checkout. Replacement of some items of equipment by Ruckers is necessary before a successful checkout can be achieved.

(9) Five-Foot Tank Modification:

Due to procurement difficulties encountered with the manhole flange and the instrumentation connectors, it is unlikely that the first tank will be received before July 1. Assuming four weeks for tank instrumentation at Lewis, plus two to three weeks for installation and checkout at Plum Brook, This will cause a two-week delay in the start of the test program.

(10) Vacuum System Modifications:

Flexible metal bellows are now on hand and installation is in progress. The vacuum system checkout is scheduled to be completed during June.

(Continued on Page 30)

5-65

SITE	LOCATION	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK (Continued)

Major non-contract items completed by Plum Brook personnel include the following:

(1) The liquid hydrogen system was cold-shocked.

(2) Electrical purge pressure switches were installed.

(3) Valve controller checkout for the process piping was completed, and it was determined that the heat exchanger (Taylor) controller must be modified.

(4) A static leak check was performed on the shaker seals.

(5) A dummy mass was installed and a drive linkage was connected to the Ruckers unit so that performance checkout tests could be made.

6-65

June 1965

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK — Cryogenic propellant pressurization and dynamics testing.

OR0137 (I.A.Johnsen)

Completion of the facility is now largely dependent upon electrical items. Current status is as follows:

(1) Electrical (Safety):

An estimated three-week-time extension will be required because of change orders plus late delivery of detection heads and diesel-generator equipment.

(2) Electrical (TV and Tank Instrumentation):

25% complete and behind schedule due to material procurement delays. Contract completion is expected July 26.

(3) Electrical (Cable Installation):

Material is arriving on site, although no actual progress is evident. The August 15th completion date is still probable.

(4) Electrical (Communications Conduit):

Complete except for delivery and installation of 17 utility boxes. The contract should be completed by July 8,

(6) Process Piping (13-ft. Tank):

This contract is 50% complete.

(7) Residual Gas Analyzer:

Bids for this equipment were opened June 25 with the contract award expected by July 7.

(8) 5-ft. Tank Modifications:

The "eight ball" tank was expected to be hydrostatic tested by the first week of July. Estimated delivery to Lewis Research Center for instrumentation is July 8.

6-65

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K		(9) LH_2 Fill and Drain Valves: These valves were returned to Kemp Aero Products for seal modifications. Additional Government testing is required before final acceptance. In the meantime, NASA personnel are extensively occupied with system checkouts and other non-contract type work. Among the more prominent items are the following: (1) Gas bottle storage racks were installed. (2) Completed vacuum checkouts on the manifold chamber, and the two CVC diffusion pumps. Checkout of the two Edwards pumps still remains. Highest vacuum obtained in the chamber up to this time is in the neighborhood of 5×10^{-5} torr. (3) Monitored Ruckers actuator installation and conducted initial checkouts. These checkouts indicated the need for replacement of certain faulty Ruckers components. Due to the long delivery cycle for these items, it is almost certain that final acceptance of the Ruckers unit will be delayed until August 30 or later.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			

CRYOGENIC PROPELLANT TANK
OR0137 (I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

At the present time, Valley Electric is working on four, simultaneous electrical contracts at "K" Site. Contracts and their status are:

(1) Electrical(Safety):

Original completion date was July 2, 1965. The contract is approximately 75% complete, with major delays being caused by change orders and late delivery of material. The contractor supplied diesel-generator has not been delivered.

(2) Monorail Hoist Installation:

Clean-up items remain on this contract, which was scheduled to be completed July 24.

7-65

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K		(3) TV and Tank Instrumentation: Practically no progress at all was made on this contract during the month of July. With a scheduled completion date of July 27 only 27% of the work has been accomplished. The reason for failure to meet the installation schedule was due to the late delivery of the contractor supplied material. (4) Cable Installation: Scheduled completion date is August 15, a date which must be met to satisfy the established test date. All materials are on hand and trenching was begun. However, the contract is behind schedule and only 10% complete. In summary, all four electrical contracts are behind schedule. From the standpoint of Operations Engineering, Valley Electric's work staff is undermanned for the tasks yet to be done. If the test date is to be met, the manpower problem will have to be remedied and material deliveries expedited. (5) Five-foot Test Tank: Welds did not pass X-ray inspection and structural warping is also evident. Therefore, weld repair and stress relieving will be required before cold shocking and hydrostatic tests. Latest delivery date is optimistically set for August 18. (6) LH_2 Fill and Drain Valves: These valves are still at the vendor's plant for necessary modifications. Kemp Aero Products apparently cannot or will not release a delivery date for return of the valves. (7) Residual Gas Analyzer: Contract for this equipment was awarded June 30 to Aerovac. Delivery is expected September 10.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	Completed work by Site personnel includes the following: (1) Vacuum system checkout to 2×10^{-5} torr completed. (2) Repaired roots blower vacuum pump. (3) Installed new seal in 30' vent stack. (4) Modified vent and pressurizing pass-through on vacuum chamber to eliminate conductive chilling of chamber walls. (5) Completed installation of Marotta loaders. (6) Modified gas manifolds.

8-65

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			
		CRYOGENIC PROPELLANT TANK OR0137(I.A. Johnsen)		Cryogenic propellant pressurization and dynamics testing.
		The electrical contracts should all be finished by September 15, however checkout time, plus the delay caused by the late delivery of the five-foot tank may prohibit any test run before October 15. Delays at this time can be attributed primarily to late deliveries on contractors' purchase orders, an undermanned contract work force, and fabricating problems with the five-foot diameter test tank.		
		Contract status is as follows:		
		(1) Monorail hoist installation -		
		Hoist is operational, but cleanup items remain.		
		(2) Electrical (Safety) -		
		Completion on September 15 is contingent upon the September 2 delivery of the leak detection separator tank and the emergency power transfer switch.		

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE

(3) Cable Installation:

Estimated completion date is September 6.

(4) Seals for Pressurized Rooms:

The contractor has completed 30% of the job and is now waiting for delivery of doors and frames. These items are being expedited.

(5) TV and Tank Instrumentation:

Completion of this contract is estimated for September 15, with the exception of TV units and related connectors. A control panel assembly for purge pressure indicators is also needed for which no delivery date is available.

(6) Five Foot Test Tank:

Results of weld X-Rays indicated tungsten inclusions but the welds were accepted. Instrumentation brackets will be mounted inside the tank, to be followed by cold shocking, hydrostatic testing and leak testing. Additional machining is also required on the tank-cradle mounting ring. Following delivery to Lewis-Cleveland the tank will be instrumented. Akron Steel Fabricators is currently estimating three weeks for the contract completion.

(7) LH_2 Fill and Drain Valves:

Acceptance tests are being conducted by Lewis-Cleveland.

(8) Residual Gas Analyzer:

The Government rejected Aero-Vac's original submittal. Amended submittals are currently due.

Major work items completed by site personnel include:

(1) An extended vacuum system pumpdown (two days) produced a vacuum of 2×10^{-6} torr.

SITE	SITE NAME RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE (2) Leak checked Bellofram dynamic seals, which showed 1.6×10^{-3} cc/sec leak. (3) Completed mechanical portion of GN_2 purge system. (4) Installed five foot tank cradle-suspension assembly. (5) Fabricated electrical and gas pass-thrus for fill and drain valve control.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK — Cryogenic propellant pressurization and dynamics testing.
OR0137 (I.A.Johnsen)

The site is now ready for research test equipment installation. Only clean-up items remain, and these are detailed as follows:

(1) Electrical (Safety) - This item is 95% complete with the major remaining item being checkout of the diesel generator emergency power supply and changeover switch.

(2) Cable Installation - This contract is complete except for final grading, NASA checkouts are now in process.

(3) TV and Tank Instrumentation - All field work is complete. Delivery of the TV units and three spare Deutsch connectors is scheduled for October.

(4) Seals for Pressurized Rooms - This contract is 30% complete and waiting for delivery of steel doors and door frames. Temporary seals were installed on the present doors, and a trial run produced a satisfactory 0.5" water pressue.

(5) Residual Gas Analyzer - The analyzer has been shipped and the installation contract will be awarded October 8 (this item is not mandatory for initial tests).

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	(6) Five Foot Test Tank - The tank is again being X-Rayed following liquid nitrogen cold shocking. Assuming that the X-Rays of the welds are satisfactory*, the tank will receive a hydrostatic test on October 8. Instrumentation will be installed at Lewis, with delivery to Plum Brook not expected prior to October 25. *NOTE: 10-8-65 - X-Rays showed cracks in the welds. (7) LH_2 Fill and Drain Valves - These valves were again returned to Kemp-Aero for modification due to continuing static seal leakage. The five-foot tank's fill and drain valve is required for the initial tank test. Major work items completed by site personnel during the past month include: (1) Installation of temporary seals in pressurized rooms and a successful checkout. (2) Installation of new temperature controller on the small heat exchanger. (3) Installation of temperature probes in diffusion pumps. (4) Completed Rucker hydraulic actuator installation and operational checkout. (5) Modified and checked out burnoff.

10-65

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			
		CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)		Cryogenic propellant pressurization and dynamics testing.
		All construction contracts that have not been completed at "K" Site are in the "clean up" stage and do not constitute test restraints. It is expected that final inspections will be conducted during November. Test restraints are now in effect because of the following two items: (1) The five-foot test tank welds have been plagued with cracks and tungsten inclusions. X-ray results of the latest weld repairs were due October 29. Following verification of good welds, the tank must be hydrostatically tested and instrumented prior to "K" Site installation. Estimated delivery date to Plum Brook is December 15.		

10-65

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	(2) The LH_2 fill and drain valves (emergency shutoffs) are due from Kemp-Aero on November 3. These valves have had a long history of static seal leakage, and have yet to complete final acceptance tests. Major work items completed by site personnel include the following: (1) Three gaseous helium and two gaseous hydrogen checkout runs were completed at process gas temperatures of -260°F. and +240°F. Flow temperature and pressure controllers operated satisfactorily as did the safety systems and miscellaneous support hardware. Problems uncovered point out the need for minor modifications to the heat exchanger gas-liquid separator tank, and the possible need for additional temperature stabilization venting in the pressurizing gas line. (2) New quick quench cooling was added to the two Edwards diffusion pumps. It is expected that this rapid pump cooling will hasten site shutdown by five hours. (3) Modification of the five-foot tank carriage suspension was completed. (4) Designed and built accumulator charging panel for the Rucker unit. (5) Repaired and realigned vacuum chamber door locks. (6) Installed oil fume eliminators on vacuum roughing pumps. (7) Investigated and proposed modifications to Building 905 heating system to reduce temperature fluctuations which tend to cause drift in the SEL data reduction system. A test will be performed in the near future to determine the full effect of temperature variation.

11-65

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			
		CRYOGENIC PROPELLANT TANK OR0137 (I.A. Johnsen)		Cryogenic propellant pressurization and dynamics testing.
		In preparation for forthcoming tests with liquid hydrogen a 100-gallon cylindrical tank was temporarily installed in the vacuum chamber, and expulsion tests were made using liquid nitrogen as the working fluid. This was a final operational check of all systems, excluding data requisition, so that the site is now proven ready for the test program. The five foot diameter tank is now in Lewis Lab for instrumentation. Delivery to Plum Brook is expected during the week of December 6, and every effort will be made to run a hydrogen test before the first of the year. Fill and drain valves from Kemp Aero Products are currently undergoing acceptance tests for the third time. (Continued on Page 29)		

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE (Continued)	As of the end of November, the vacuum chamber was pumped down to approximately 5 X 10^{-6} torr for vacuum instrumentation checks, including the partial pressure analyzer.
—	HYDROGEN HEAT TRANSFER FAC.	HYDROGEN ROCKET NOZZLE OR0137(N.D. Sanders) Experimental tests will be operated over chamber pressure ranges from 150 psi to 1200 psi and hot gases to 4200°R will be supplied from the pebble bed heater. Status of major contracts:

Item	Estimated Completion Date
1. Pebble bed heat exchanger It is 90% complete. The acceptance tests are now being made.	12-20-1965
2. High-pressure liquid hydrogen dewar It is 90% complete and the acceptance tests are scheduled to start 1-4-1966.	2-01-1966
3. Piping systems These systems are 92% complete and are presently being cleaned and tested.	1-01-1966
4. Electrical, controls and instrumentation These items are 90% complete.	2-01-1966
5. Electrical, Safety system	Completed
6. Electrical, Hydraulic pump	Completed

(Continued on Page 30)

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
OR0137 (I.A. Johnsen)

Cryogenic propellant pressurization and dynamics testing.

A liquid hydrogen expulsion test with the 5' tank was attempted on December 16. Equipment malfunctions, however, caused the test to be aborted, with the earliest possible test date now being mid-January.

One of the failures causing cancellation was the remote vacuum readout. Prior to the test run date, the only operable vacuum readout was the Aerovac partial pressure analyzer, which also serves as the hydrogen leak detector within the chamber. Investigation of the December 16 failure indicated an overloaded circuit. While the damaged components have been replaced, the basic cause of the failure is not yet totally resolved.

The second failure which contributed to the test cancellation was the extremely high leak rate of Valve 262 (Kemp Aero Products). An oxidizer shutoff valve from an RL-10 engine was selected as replacement, and suitable piping adapters are now being made.

Other "K" Site activities for the month of December included the following:

(1) The original thin flexure plates of the tank 4-point suspension system were replaced by one of bonded metal and rubber construction. Dynamic tests in the 0.5 to 2.0 cps range (empty tank) indicate that lateral motion problems and resonant frequencies were eliminated from the desired test frequency range.

(2) The 13-foot tank was received from Lockheed on December 28, and has been stored in Plum Brook Building 308.

(3) Two contractors are still active at "K" Site, working on the installation of doors in the pressurized room, and on the enlargement of vent holes in the main building floor.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			
		CRYOGENIC PROPELLANT TANK OR0137 (I.A. Johnsen)		Cryogenic propellant pressurization and dynamics testing.

Five-foot tank, liquid hydrogen expulsion tests #1 and #2 were completed in January. All expulsions were made by means of 500°R. gaseous hydrogen and the hemispherical injector.

On January 13, seven expulsions were made, primarily for the purpose of facility shakedown, including the data acquisition system. This test day indicated a need for minor changes in controls and instrumentation hardware, as well as in operational techniques. Digital data for this date will probably not be reduced.

On January 18, eight expulsions were completed. Data was successfully obtained for five expulsions, having periods of 133, 198, 274, 333, and 400 seconds. In addition to acquiring applicable research data, the second test verified a real need for the following changes or additions:

(1) Automatic liquid flow control.

(2) Automatic data orifice differential pressure range selection.

(3) An additional or improved method for liquid level sensing (5% ullage determination).

Site work accomplished during the month includes the following:

(1) Liquid flow control tests using liquid nitrogen and gaseous helium.

(2) The 156" tank spare parts, handling fixtures, etc., were inventoried.

(3) The heat exchanger condensate return was insulated.

(4) The steam-gas separator tank was modified for a combustible gas detection head.

(5) The five-foot tank liquid level sensors were rewired.

(6) The fill and drain valve #262 was removed and the replacement valve installed.

(7) The build-up and repair of vacuum instrumentation remote readout was completed.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
OR0137 (I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

Static expulsion tests on the five-foot tank with gaseous hydrogen and the hemispherical injector were completed during February.

On February 10, four 700°R expulsions were accomplished with periods of 557, 363, 272 and 151 seconds. In addition, two 2-minute pressure-hold tests were also made at 700°R.

On February 14, four 300°R expulsions were performed with periods of 418, 294, 209, and 144 seconds. One 2-minute pressure-hold test was made at 500°R and two pressure-hold tests were made at 300°R.

Pressurant for the next series of tests will be gaseous helium. An ullage gas sampling system is being installed for these tests. At the same time, the five-foot tank was returned to Lewis-Cleveland for the installation of a T.V. viewing port. Estimated date for the next test is March 23.

Site work accomplished during the month includes the following:

(1) The 5' tank was removed from the chamber.

(2) The gas sampling system installation was started.

(3) The Roots blower was removed and shipped to the factory for repairs.

(4) The replacement flow meter was installed.

(5) A Bendix optical liquid level sensor was installed.

(6) The actuator was removed for actuator seal modification.

(7) Temporary water lines were installed for diffusion pump baffle plates.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

<u>CRYOGENIC PROPELLANT TANK</u> Cryogenic propellant pressurization and dynamics testing.
OR0137(I.A.Johnsen)

Tests originally scheduled for March 23 have been rescheduled for April. Rescheduling was necessary due to malfunctions of the residual gas analyzer, the ullage gas sampling system, and the hydrogen tank television. Welding problems during modification of the 5-foot research tank also resulted in delays.

Efforts were primarily directed to site modification and buildup for gaseous helium tests; major work areas were as follows:

(1) The 5-foot tank was removed from the vacuum chamber for modifications and reinstalled following modifications.

(2) Installed television purge system.

(3) Cleaned vacuum chamber and foreline pump manifold.

(4) Fabricated and installed additional tank vent line.

(5) Installed vacuum instrumentation for local readout with nude gage.

(6) Installed 5-foot tank television following extensive leak repairs on housing.

(7) Fabricated residual gas analyzer calibration system.

(8) Fabricated, installed, and evaluated diffusion pump baffle plates.

(9) Completed vibration control panel modifications.

(10) Completed 90% of 13-foot tank instrument rake.

(11) Cleaned and rebuilt residual gas analyzer head.

(12) Initiated plans for 13-foot tank acceptance tests to be conducted at Plum Brook.

(13) Designed, fabricated, and installed ullage gas sampling probes and related instrument vacuum pump system.

Outside contract work:

(1) Replacement of wooden doors with metal doors - 50% complete.

(2) Relocation of fresh air intake was awarded on March 28 to Wilkes, Inc.

(3) Installation of additional explosion-proof lighting will be released for bids in April.

4-66

April 1966

SITE	SITE NAME	RESEARCH INSTALLATION & DESCIRPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
OR0137 (I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

Work efforts for the month of April were aimed primarily at troubleshooting the tank TV and the ullage gas sampling system. As a result, there were only two test days this month.

On April 27, four expulsions and one pressurization hold run were completed using 500°R helium pressurant gas and a test tank pressure of 35.6 psig. On April 29, helium was used for the pressurant gas but the testing had to be stopped when the helium manifold became plugged with desiccant from the dryer. The screen at the dryer inlet was in a position resembling a full-open butterfly valve. This problem is being investigated.

TV troubles during the month were traced to arcing in a vacuum exposed connector. The ullage sampling system has poor reliability, due primarily to signal drift, low sensitivity, and long time response of the partial pressure analyzer. In the near future, the analyzer will be replaced by a hot wire sensor.

A recent proposal eliminates the need for acceptance testing of the 13' tank, at least to the extent called out by the tank specification. As a substitute for the liquid nitrogen proof test to 260 psi, the tank will be installed in the vacuum chamber, filled with liquid hydrogen, and subjected to a pressure of only 50 psi.

Status of outside contracts is as follows:

(1) Steel door and painting - 60% complete. The major task remaining is the outside painting.

(2) Fresh air intake - material has been delivered.

(3) Additional explosion-proof lighting - bid opening is scheduled for May 19.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK Cryogenic propellant pressurization and dynamics testing.
OR0137 (I.A.Johnsen)

On May 18 and 20, tests were successfully completed with the 5-foot tank. Tests included seven expulsions and two pressure-hold runs with 35.6 psig helium at 300°R and 700°R. Due to TV failure, one run day had to be cancelled.

Tasks started or completed during May included:

(1) Cleaned desiccant from helium manifold, removed contaminated helium bottle farms and installed additional manifolding for temporary use of helium trailer tubers.

(2) Modification of the ullage sampling system is in progress. Delays were incurred due to oxidized filaments which precluded bench-testing and calibration of the new hot wire sensor.

(3) A fifth vent was installed in the pressurization line to facilitate pressurant gas temperature stabilization.

(4) The hydraulic actuator and vacuum seal pass-through was installed.

(5) The analyzer head was replaced with a new unit and the system was calibrated.

(6) The 5-foot tank catch basin for slosh tests was fabricated and the basin installation was started.

(7) The fabrication of vacuum baffle plates was completed and they are presently being installed.

(8) The 5-foot tank instrumentation was changed for the slosh tests.

(9) Liquid hydrogen mass flow meter design and engineering was completed.

(10) The vacuum chamber lights were installed for TV illumination.

(11) Completed two weeks of trouble-shooting and line checks on hydraulics actuator electronics.

Progress on outside contracts, as follows:

Outside painting: 75% complete
Air vent relocation: 80% complete

Bids for the additional explosion-proof lighting were opened May 19, and the contract award is expected by June 6.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK ORO137 (I. A. Johnsen) Cryogenic propellant pressurization and dynamics testing.

During the month of June data from eight slosh and fourteen pressure hold tests was recorded, using 300°R GH_2 and helium. All tests were performed with the 5 foot tank at the 28% ullage level. One three hour fill test was made to determine tank wall temperature gradients for application to the 13 foot tank analysis. It is expected that 5 foot tank testing will extend through August.

Additional tasks completed at the site include the following:

1. On June 6, lightning caused extensive damage to "K" Site electrical, instrumentation, controls and data acquisition systems. Approximately 8 days of repair and troubleshooting were required to correct the damage.

2. Completed installation of the five foot tank LH_2 catch basin (vacuum chamber protection).

3. Installed additional vacuum chamber pass-throughs for electrical connectors to accommodate slosh instrumentation - load cell, accelerometers, etc.

4. Completed diffusion pump baffle plate installation.

5. For improved temperature control, the Valve #256 vent line was increased to 1". In addition, gas mixing Valve #241 was relocated much nearer to the test tank.

6. Fabricated, installed and tested the spool piece necessary for five foot tank boiloff tests.

7. Completed calibration and installed GowMac hot wire sensor for ullage gas sampling.

8. Following repeated failure and troubleshooting of the COHU TV system, an alternate was prepared and installed.

9. Manufactured bakelite mounts for the thirteen foot tank rake thermopiles.

Continued on Page 28

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE (Continued)	
		10. Began installation of thirteen foot tank wall instrumentation. 11. Contract status: (a) Painting - Contract was completed. However coverage was poor and contract negotiations for additional work is being considered. (b) Fresh Air Inlet - Contract for the relocation was completed. (c) Explosion-Proof Lighting - Contract was completed.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			
		CRYOGENIC PROPELLANT TANK OR0137 (I.A.Johnsen)		Cryogenic propellant pressurization and dynamics testing.

On July 21 and 22, research data was recorded during 18 successful test runs. Tests were made with both gaseous helium and gaseous hydrogen at 300°R. Tank pressure at 50 psia was used for all these tests at either pressure-hold or pressure-slosh conditions. Likewise, all testing was performed with the five-foot tank at 55% ullage level.

Three previously scheduled test dates were cancelled due to either TV malfunctions and/or gas leaks through the five-foot tank instrumentation connectors. It is believed that the use of helium as a TV purge may have caused deterioration of the camera vidicon tube. The purge gas was subsequently changed to gaseous nitrogen. Several fixes were attempted for the leaking connector, but except for actual capping (and loss) of the connector, no suitable repair procedure has yet been found.

A thermal gradient test was performed on a 3/4" thick slab of 2219 aluminum. Data indicates that the maximum temperature gradient possible is 40°F. per inch. This value is significant for the forthcoming series of tests with the 13-foot tank.

Following the 13-foot tank acceptance tests, the five-foot tank will be reinstalled. The 9-foot "kick stage" tanks have tentatively been scheduled for March 1967 delivery. Test planning is proceeding, based upon that delivery date.

Procurement lead time for a new liquid hydrogen vent and manifold required to support the 13-foot diameter tank tests has been delayed. This delay apparently has resulted from questions concerning justification. If this item is not provided, expulsion flow rates required by research will have to be limited.

Since procurement has been delayed since June 21, and this is a key item for testing the 13-foot tank, the overall research program schedule must be readjusted to reflect this delay.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK	CRYOGENIC PROPELLANT TANK OR0137(I.A.Johnsen)		Cryogenic propellant pressurization and dynamics testing.

The 156-inch diameter spherical tank successfully passed the imposed acceptance tests on August 24. The tank was pressurized with helium to 160 psig, at four different levels of liquid hydrogen. We detected no leaks greater than $5 \times 10^{-4} \frac{\text{std. atm. cc}}{\text{sec.}}$, which was the minimum discernable leak rate possible with the facility system.

Following this test, the 5-foot heavy wall tank was reinstalled in the vacuum chamber, and preparations are progressing for a resumption of the test series interrupted for the acceptance test. The next scheduled test with the 5-foot tank will be at the 75% ullage level.

Leak checks on instrument connectors for the 13-foot tank indicate that about half of them have leak rates greater than specified by contract. Replacement connectors are being investigated by NASA, Lockheed, and Physical Sciences Corporation. An immediate design solution and procurement is required to meet the proposed test schedules.

The servo module for the Ruckers' hydraulic actuator was relocated to reduce overheating and consequent DC shift of the actuator.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
OR0137 (I.A. Johnsen)

Cryogenic propellant pressurization and dynamics testing.

On September 14, while filling the five foot heavy walled test tank with liquid hydrogen, an approximately 5 cc/sec gas leak developed inside the vacuum chamber. The test run was rescheduled to September 15 so the condition could be corrected.

On September 15, data was recorded during 18 successful passes. Tests were made using both gaseous helium and gaseous hydrogen at 300°R. All tests, both pressure-hold and pressure-slosh, were run with 75% ullage level and at a tank pressure of 50 psia. Two passes were made to checkout the controls for the next series of scheduled slosh-during-expulsion runs.

On September 20, sixteen slosh and expulsion runs were made. All tests were made with 300°R gaseous hydrogen.

On September 21, twenty slosh and expulsion runs were made. All of these tests were made with 300°R gaseous helium.

The runs scheduled for the last week of September were postponed because of wall temperature sensor problems and central recording system difficulties.

The status of the "K" Site test program is as follows:

(1) The 5-foot heavy wall tank program is nearly complete.

(2) The 5-foot thin wall tank is scheduled to be delivered to Cleveland by October 24. It will take approximately three weeks to instrument the tank before it can be delivered to Plum Brook. The test program could be completed in two to three weeks.

(3) The 7-foot tank is expected to be ready for testing by mid-February 1967.

(4) The 13-foot tank is ready for test. If it is decided that a splash pan is necessary, testing will be delayed until approximately March 1967.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK — Cryogenic propellant pressurization and dynamics testing.
OR0137 (I.A.Johnsen)

The test operations report on the thick-walled, 5-foot diameter tank is as follows:

On October 11, nine expulsion-slosh data runs with 300°R. helium were completed. These tests determined the effect of anti-slosh baffles on the mass ratio (w/gas--w/liquid).

On October 14, eight more data runs were completed. These tests were identical to the previous series except that the pressurant gas was changed from helium to hydrogen.

On October 20 and 26, gas injector evaluation tests were conducted. Radial and straight pipe injectors were tested.

Boiloff testing is scheduled for the first week in November. This will complete the test program.

The thin-walled, 5-foot tank testing is scheduled for December. Akron Steel Fabricators is expected to deliver the tank to Lewis-Cleveland by November 18. The tank will be instrumented at Cleveland, before delivery to Plum Brook.

Preliminary drawings on the suspension system for the 9-foot kick stage tank were completed and are being reviewed.

The estimated delivery of the vacuum chamber catch basin is February 15, 1967. Cleveland-Lewis will have the basic liner fabricated by an outside contractor. Liner installation, support hardware, and piping will be handled by Plum Brook. The railroad dewar vent system and the new gas manifold system designs were approved and purchase requests will be initiated in November. Railroad dewar blast wall construction is 50% complete and is scheduled to be finished by November 15. All of these items are required for the 13-foot tank tests.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			
		CRYOGENIC PROPELLANT TANK OR0137 (I.A. Johnsen)		Cryogenic propellant pressurization and dynamics testing.

On November 2, the 5-foot diameter thick-walled tank boil-off test was completed. During the $5\frac{1}{2}$ hr test, 29.5% of the liquid was evaporated. Data was recorded at each 0.25 of an inch decrease of liquid level. This test concluded the thick-walled tank program.

The delivery date of the five-foot diameter, thin-walled tank has been extended from November 18 to December 3. Testing is scheduled to start January 5.

Down time between tests is being utilized to complete the instrument connector test rig, ullage sampling system modification, chamber stack modifications, and the thirteen-foot tank systems.

Status of the splash pan and emergency drain for the thirteen-foot tank is as follows:

(1) Union Carbide Corporation, Nuclear Division, Paducah, Kentucky started fabrication of the pan on November 25.

(2) Emergency drain design is 75% complete; field work has been started.

Railroad dewar vent design is currently being reviewed to reduce contract installation cost. Installation of the railroad dewar blast wall was completed November 25.

The seven-foot diameter test tank is scheduled to be insulated during March. A clean room work area will be provided for this work in the compressor building, #5131.

12-66

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
OR0137 (I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

On December 6, the accuracy of the hot wire hydrogen liquid level sensors was investigated. Liquid levels were measured within ± .050 of an inch. The sensors will be installed in the 5' thin-walled tank at 5% and 95% ullage level. Testing is scheduled for January 17 and 18.

The railroad dewar burnoff design is complete. The design and purchase request for material have been submitted for approval. The burnoff will be fabricated and installed in-house.

The high-pressure gaseous hydrogen manifold will be installed by contract. The design is complete. Contract specifications will be completed by January 15.

Delivery of the splash pan from Union Carbide Corporation, Nuclear Division, Paducah, Kentucky, is expected by January 15. The splash pan emergency drain design is complete. Field installation and purchase of materials is in progress.

The 5' thin-walled tank instrumentation and volume calibration were completed. A portable cradle for handling the 5' thin-walled tank was fabricated.

Status of other site projects is as follows:

(1) 13' tank instrument rake - complete

(2) Stack modifications - 50% complete

(3) Residual gas analyzer vacuum isolation system - 90% complete

(4) Ullage sampling system - 50% complete

(5) Instrument connector test rig - 40% complete

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
YOR1573(I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

Twenty data runs were completed during January. Ten static expulsions were made with gaseous hydrogen and gaseous helium at 520°R. Ten shake expulsions were made with gaseous hydrogen and gaseous helium at 300°R. These tests completed the five-foot diameter chem milled tank program.

The 13-foot diameter tank test is tentative scheduled for March 29. Procurement of the railroad gas manifold, however, is three weeks behind schedule and will delay testing to late in April. Status of other jobs required for the 13-foot tank program is as follows:

(1) Splash pan was delivered to the site January 31. 70% of the materials are available. Installation will begin February 2.

(2) Emergency drain: Fabrication and delivery of parts is approximately 90% complete. Field work is 25% complete. Job completion is scheduled for March 1.

(3) Railroad liquid hydrogen dewar vent and manifold will be installed in-house. Procurement of the high pressure manifold and vent pipe has been initiated. The electrical design will be completed by February 9. Concrete piers for pipe supports have been poured. Estimated job completion date is March 20.

(4) The electrical changeover to the 13-foot tank pressurizing system is 90% complete. Piping changeover in the test cell will be started by February 1.

(5) Decision on the installation of a TV port in the 13-foot tank is required. Lead time to procure and fabricate facilities for cold shocking and pressure testing the tank is approximately 16 weeks. If the TV port is required, a decision to go ahead must be made soon or the research program will be delayed.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	CRYOGENIC PROPELLANT TANK YOR1573 (I.A.Johnsen)		Cryogenic propellant pressurization and dynamics testing.

Preparations for the 13' diameter tank tests have continued through February. Status of major tasks in process is as follows:

(1) The splash pan installation is complete. Quality of material received was good, except that minor metal removal was necessary on the flange of the door neck section.

(2) The emergency drain piping installation is 80% complete. All material, including the long-delayed plastic pipe, is now on hand.

(3) Vent installation for the railroad hydrogen dewar is approximately 60% complete. The electrical design is now complete. The originally scheduled March 20 completion date still remains in effect.

(4) Piping and related electrical changeover for the 13' tank pressurization system has fallen behind schedule. It is expected that additional manpower will remedy this problem area.

(5) Instrumentation of the 13' tank walls is underway, and will be complete by March 7. Internal instrumentation rakes have been fitted to the tank brackets. The thermopile modules, which are currently being installed, are on the critical path for testing of the 13' tank.

(6) No confirmation has yet been received on the installation of the 13' tank TV port. As a result, no facilities for window-proof testing are on order or in preparation.

First tests for the 13' tank are scheduled for April.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			
		CRYOGENIC PROPELLANT TANK YOR1573 (I.A.Johnsen)		Cryogenic propellant pressurization and dynamics testing.

The 13' diameter tank tests are scheduled for April 21 with operational checkout runs scheduled for April 18 and 19. Checkout runs will include a partial fill, pressurization, expulsion and sample data acquisition.

All mechanical type system modifications have been completed. Approximately 200 manhours of electrical work remains on these modifications. The major remaining task is the installation of internal tank instrumentation. Both the electrical and instrumentation work has been assigned extra manhours; neither job is expected to delay the test date.

Preliminary work on the 9' diameter oblate spheroid tank is as follows:

(1) Transportation dolly and work platform have been delivered to and inspected by Lewis-Cleveland.

(2) Chamber work platform fabrication was awarded and the contract completion date is May 20.

(3) Access ladder design is complete and being processed for final approval.

(4) Suspension system design is complete; specifications are being drafted for contractor bids (IFB).

(5) Delivery of the Lockheed tank is scheduled for mid-May. Final proof tests will begin April 18. A contract extension (139 days) has been given to Boeing and the tank delivery is expected in July.

The 7' tank modification contract has been signed with Lockheed; delivery is scheduled for May 1. Fabrication of a mobile work platform will be completed by April 7th; contractor is Sandusky Fabrication and Sales. Tools required for insulating the tank are being ordered by Lewis-Cleveland personnel.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			
		CRYOGENIC PROPELLANT TANK YOR1573(I.A.Johnsen)		Cryogenic propellant pressurization and dynamics testing.
		On April 28, an operations test with the 13-foot diameter tank test system was completed. Three Rosemont circuits appeared open, necessitating a modification of tank pass-through connectors. Additional time will also be required to finalize settings on the pressurant gas controllers. The first research data run with the 13-foot tank has been scheduled for May 11 and 12.		
		The high-pressure gas manifold contract is expected to be awarded by May 10. The completion of this manifold will enable railroad tubers to be used at "K" Site and significantly expedite the 13-foot tank tests.		
		Final assembly of the cryogenic-vacuum hardware evaluation rig will be completed by mid-May. Primary purpose of this test rig will be to evaluate leak rates and electrical characteristics of vacuum to liquid hydrogen instrument pass-throughs.		
		A semi-clean assembly room for insulating the 7- and 9-foot test tanks is in the initial planning stages. The room layout, size, and location have been finalized. Approximately 1600 square feet of floor space is required. The assembly room will be located in the Reactor Assembly, Test, and Storage (ATS) building.		

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE			

CRYOGENIC PROPELLANT TANK
YOR1573(I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

Four test days with the 13-foot tank at 50 psia were completed during May. Each test day consisted of two pressure ramp-hold tests and three expulsion runs. Test modes were as follows:

May 12 - GHe pressurant at 300°R
May 18 - GHe pressurant at 520°R
May 19 - GH_2 pressurant at 520°R
May 24 - GH_2 pressurant at 300°R

The ullage gas analyzer system design and installation were completed, and the system was used during the helium pressurant tests. For the month of June we have scheduled straight pipe injector and slosh tests.

The connector test rig installation is nearly 75% complete. One Physical Sciences pass-through connector is available for testing. In addition, a Plum Brook experimental model is also available. It is expected that these tests will begin in late June or early July.

On May 19, the Lockheed-built 9-foot oblate spheroid tank was received at Plum Brook. This tank was stored in the Reactor ATS Building. To facilitate later transfer to "K" Site, the tank was left in the shipping crate.

A semi-clean room assembly area for tank insulation work was designed. This design is being processed for final approval. Erection of the contractor-built module within the ATS Building is expected by July 1. Addition of electrical work and a blower system will complete the assembly by mid-July.

Preliminary shop work on piping and minor electrical field work was begun on the railroad high-pressure gas manifold. The contractor, Valley Electric, will begin the major field installation on June 12.

Bids for the new pressurant gas system relief vent are scheduled to be opened June 5.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
YOR1573(I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

Three tests were completed on the 13' tank during the month of June. A summary of runs is as follows:

June 9 - Straight pipe injector tests - 2 runs
June 16 - Pressure-effect tests @ 75 psia - 4 runs
June 27 - Pressure-effect tests @ 35 psia - 4 runs

Fabrication of module panels for the insulation assembly area was awarded to Fries Lumber, Huron, Ohio. The original all-wood modular design was modified to incorporate a fabric-reinforced, polyethylene roof. Polyethylene, .006" thick, was also added as a portion of one wall to make use of natural lighting. Erection of this "semi-clean" room in the ATS Building should be complete by July 14.

The railroad high-pressure manifold, contracted for by Valley Electric, is 75% complete. July 15 is the scheduled completion date. Use of this manifold will be required during the latter part of July to support 55% ullage tests on the 13' tank.

Low bid for the new pressurant gas system relief vent was approximately 50% above the Government estimate. Price negotiations are in progress.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
YOR1573(I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

On July 7, seven data runs at 28% ullage (13' dia. tank) with 300°R GHe were attempted. Three pressure-hold runs were acceptable. However, the four planned pressure-hold-slosh runs could not be accomplished due to severe tank depressurization effects during initial slosh conditions. Maximum tank pressure drop was 13 psi from the nominal 35 psig tank pressure.

On July 11, 17, and 24; checkout runs to measure, analyze, and modify the tank pressure control loop were conducted. System modifications were devised, as listed below, which limited the pressure drop to only 2 psi:

(1) Modified valve #253, which was not stroking properly;

(2) Increased control orifice diameter;

(3) Replaced control pressure transducers with others to improve frequency response;

(4) Reduced pressure control error signal;

(5) Changed pressure control valve trim from linear to percentage trim;

(6) Increased pressurant gas supply pressure to 450 psi;

(7) Modified controller electronic circuitry to reduce pressure oscillations caused by the increased system gain.

On July 25, four pressure-hold-slosh tests at 28% ullage were successfully run with 300°R GH_2. One GHe test run was also made. In addition, one trial run was conducted to verify the performance of the pressure control system at 55% ullage. The remaining tests at 28% ullage with 300°R GHe are scheduled for August 3.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE (Continued)	CRYOGENIC PROPELLANT TANK (Continued) Because of the time required to modify the pressure control system, the program did not proceed as planned for July. It is now planned to temporarily suspend the 13' diameter tank tests in order that contract obligations are satisfied with the Lockheed "kick stage" tank. Terms of the contract require acceptance testing to be performed by the end of August. Status of current "K" Site contracts is as follows: (1) The high pressure railroad manifold will be completed by August 15. (2) The pressurization gas vent and relief modification contract was awarded to Lieb-Jackson, Inc., of Columbus. Site work will begin August 7 with contract completion scheduled for September 21.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
YOR1573(I.A.Johnsen)

Cryogenic propellant pressurization and dynamics testing.

During August, five test days were accomplished with the 13' tank. A sixth run day was attempted, but overspeeding of the liquid hydrogen turbine flowmeter on the second data pass forced a cancellation. All test days were accomplished using either gaseous hydrogen or helium at 300°R. Tests ranged from pressure-hold types to slosh with expulsion. The flowmeter overspeed was caused by loss of the flowmeter feedback signal to the flow controller. This, in turn, actuated the flow control valves to the 100% open position, thus overspeeding the flowmeter. This test is rescheduled for September 8, which will complete the 13' tank program.

Insulation of the 7' Lockheed tank is approximately 30% complete. September 15 is the scheduled completion date, and the testing of this tank should begin in October.

Two contracts were completed during August. The heat exchanger relief valve system is complete and now in operation. In addition, the railroad gas manifold was completed and was used during the last four days of testing.

The next test series in the "K" Site program will be acceptance testing of the Lockheed 9' tank. This is basically a warm leak test. It is scheduled for September.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	CRYOGENIC PROPELLANT TANK YOR1573 (I.A.Johnsen)		Cryogenic propellant pressurization and dynamics testing.

Four tests were run on September 12 to complete the 13' diameter tank program. The tank was then sprayed with a strippable coating and stored for possible future programs.

A summary of 13' tank test modes and objectives included the following:

(1) GH_2 and GHe pressurant effects.

(2) Pressurant gas temperature effects at 300°R and 520°R.

(3) LH_2 outflow rates of 12.0, 8.08, 5.84, 4.82 and 4.0 lbs/sec.

(4) Pressure ramp rate of 30, 60 and 90 seconds.

(5) Ullage effects at 5%, 28%, 55% and 75% volumes.

(6) Slosh effects at stable planar, splash planar, and unstable liquid conditions.

(7) Antislosh baffle effects.

(8) Thirty and 300 second tank pressure hold effects.

(9) Straight pipe versus hemispherical injector effects.

(10) Tank pressure effects at 50 and 75 psia.

Acceptance leak tests for the Lockheed 9' tank are scheduled for October 10. This tank is now in place in the "K" Site vacuum chamber. The latest delivery estimate for the Boeing 9' tank is October 23. If the present delivery schedule is met, the Boeing tank will be acceptance tested before the 7' tank insulation tests.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	CRYOGENIC PROPELLANT TANK (Continued) Insulation and instrumentation of the 7' tank is virtually complete, except for the top and bottom hat sections. Status of the facility for insulation boil-off tests is as follows: (1) A new (more sensitive) tank pressure controller, sensors and valves have been installed. Wiring is now in progress. (2) Hardware for the constant temperature bath (used to provide a constant pressure reference for the tank pressure control transducer) is available and ready for installation. (3) Insulation substrate purge gas control selsyn motors, valves, and drive have been delivered. Installation is in progress. Five Hastings flowmeters (to be used for measuring purge flow) are on order. Delivery of these flowmeters is the most critical item for boil off tests. (4) Boil off gas measurement will be a two part system to accommodate the various flow rates associated with ground and space hold tests. Low flow will be measured by means of a standard gas meter already on hand. High flow rates will be measured either by an orifice plate or a turbine type meter. Connector test rig completion has been delayed because of 7' and 9' tank efforts. Work yet remaining includes the vent stack installation, wiring of the vent fan motor, and gas detector installation.

10-67

SITE	SITE NAME	RESEARCH INSTALLATION	& DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE		
		CRYOGENIC PROPELLANT TANK YOR1573(I.A.Johnsen)	Cryogenic propellant pressurization and dynamics testing.
		Current tasks are centered about acceptance leak testing of both the Lockheed and Boeing 9' oblate tanks. The Lockheed tank testing has been completed. Two test methods indicated a maximum leak rate of 2.2×10^{-4} atm. cc He/sec. This compares with a specified leak rate of 10^{-6} cc/sec. Pending a Cleveland research decision to accept or reject the tank, it was recrated and prepared for storage. The Boeing 9' tank was delivered to Plum Brook on October 25. The tank is being prepared for leak testing. These tests are planned for completion by November 10. The Lockheed 7' tank is in the final stages of insulation. Material has been cut for the upper and lower hat sections, and is ready for installation. Purge lines, valve operator line, and fill line adapters were fabricated and installed. Leak testing is in progress. The completely insulated tank is scheduled to be delivered to "K" Site by November 10. Test cell preparation for the 7' tank boil-off program is in progress. The tank pressure control system is 50% complete. Boil-off flow will be measured by a recently borrowed 23,000 CFH/hr gas meter. Procurement of Hastings flow meters for helium substrate purge measurements remains a critical item. First testing with the 7' tank should begin approximately December 1.	

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	CRYOGENIC PROPELLANT TANK YOR1573(I.A.Johnsen) (CRD - R.L.DeWitt; RSD - J.V.Gillette) Cryogenic propellant pressurization and dynamics testing. Contract acceptance leak tests were completed on the Boeing 9' diameter ablate tank. Leakage rate of the tank was less than the contract-specified 1.1×10^{-5}cc He/sec. Following completion of this test, the tank was sprayed with a strippable coating and stored in Building 9205. Test of the Lockheed 7' diameter tank is scheduled to begin the week of December 18. One problem area has been the tremendous amount of time needed to acquire the Hastings flow meters for insulation purge. As a result it has been necessary to provide an alternate measuring system. The 7' tank will be delivered to "K" Site and installed in the chamber on December 4. Checkouts have been planned to try to insure sufficient reliability of equipment to last through the boil-off test.

SITE	SITE NAME	RESEARCH INSTALLATION	& DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE		
		CRYOGENIC PROPELLANT TANK YOR1573 (CRD - R.L.DeWitt; RSD - J.V.Gillette)	Cryogenic propellant pressurization and dynamics testing.
		Insulation tests with the Lockheed 7' tank were rescheduled for January 8. The original schedule of December 18 did not materialize because of late delivery of the tank to the site due to insulation and weather problems. Lack of manpower during the holidays also made testing impractical.	
		In the meantime, systems checkouts are continuing. Particular attention has been placed upon the new tank pressure control device, which is the key to accurate data during the boil-off test.	
		Ground has been broken for installation of a new control cable between the test facility and "K" Control. Completion of the contract is expected by mid-March.	

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
YOR1573 (CRD - R.L.DeWitt; RSD - J.V.Gillette)

Cryogenic propellant pressurization and dynamics testing.

On January 16, evaluation of the Lockheed insulation system was started. The insulated 7-foot diameter tank consists of a helium purged sublayer of fiberglass, an "Aclar" membrane, and three multilayer blankets of aluminized mylar with dexiglass spacers. The test sequence started with a simulated ground-hold condition and continued into a simulated space condition. The ground-hold condition was produced by purging the test chamber with nitrogen at one atmosphere pressure, starting the helium flow to the insulation purge system and loading the tank with liquid hydrogen. After the ground-hold data was obtained, the test chamber was evacuated to 100 microns with the roughing pumps and then the four diffusion pumps were started. Testing proceeded well until the heaters on the two CVC diffusion pumps burned out. The heater failure was initially attributed to the high gaseous throughput which carried the diffusion pump oil into the forepump line. The large throughput was caused by helium used to purge the insulation, plus the sublimation of nitrogen which froze on various pipe surfaces during the ground-hold.

On January 23, the test sequence was reversed. The test chamber was evacuated using the two remaining Edwards diffusion pumps. No helium purge was used and the test tank was filled with liquid hydrogen. After obtaining the data at space conditions the vacuum system was valved off, the helium purges started and the test chamber was brought to atmospheric pressure by addition of nitrogen gas. A successful test resulted.

On January 30, another "space-to-launch" sequence was attempted. After 16 hours of pumping, one of the two remaining Edwards pumps overheated and was valved off. Fifteen hours later the last pump overheated and the test was terminated.

At this time it is believed that the January 30 failure of the Edwards pumps is not associated with the January 16 failure since the pumps were serviced failure of the Edwards pumps is not associated with the January 16 failure since the pumps were serviced after the January 16 run and ran satisfactorily on January 23. Extensive investigations are underway and are currently directed toward the possibility of diffusion pump oil contamination and the effects of the cold outdoor temperature environment during operation.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	

CRYOGENIC PROPELLANT TANK
YOR1573
(CRD - RL DeWitt;
RSD - JV Gillette)

Cryogenic propellant pressurization and dynamics testing.

No test operations were scheduled during February. Efforts, instead, were devoted to the repair and revision of the vacuum system. Some additional work was put into the modification of the connector test rig for a forthcoming "thermal link" test series.

At the time of the Edwards diffusion pump failures (see January 1968 report), it was planned to replace the heaters and continue immediately with the test program. Closer investigation revealed, however, that accomplishing other vacuum system changes at this time would be the best plan. Therefore, the following work program was initiated.

(1) Removed all four diffusion pumps--cleaned boiler and nozzle assemblies. Straightened and leak-checked the two CVC diffusion pump boiler bottoms.

(2) Cleaned forelines and roughing pumps.

(3) Installed LN_2 baffles between diffusion pumps and angle valves. Modified forelines and water piping as necessary.

(4) Installed thermocouples and an automatic shutdown system to prevent further pump heater burnouts. These thermocouples were placed on the CVC diffusion pump heaters and on the Edwards pump boiler bottoms.

We are still endeavoring to determine the cause of the Edwards pump failure. To prove or disprove the frozen oil theory, thermocouples were installed on the wall of one pump to determine the vertical thermal gradient.

A revised schedule of tests is in preparation. The next space-hold/ground-hold test with the 7' tank will begin March 12.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	
		CRYOGENIC PROPELLANT TANK YOR1573 (CRD - RL DeWitt; RSD - JV Gillette) Cryogenic propellant pressurization and dynamics testing. Test objectives were completed on Phase 1 of the three blanket insulation system for the 7' tank. Objectives included: (1) Verification of Lockheed test results. (2) Determination of insulation degradation resulting from cyclic tests. (3) Recording of transient data during pumpdown from atmospheric pressure to space hold conditions. These tests required two, 72 hour periods (March 12-15 and March 19-21). Four ground hold and two space hold boil off tests were completed. The next test series with the 7' tank is scheduled for April 23. In the interim the tank will be returned to the ATS Building, where the insulation (Continued on Page 26)

3-61

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE (Continued)	CRYOGENIC PROPELLANT TANK (Continued) will be stripped and then reinstalled. Purpose of the next test series will be to determine performance repeatability of the insulation system. The new installation will include changes necessary to support additional blankets for future tests. Recently modified vacuum equipment performed satisfactorily during March. However, during the March 12-15 test, one Edwards diffusion pump was shut down manually due to slowly increasing temperature. This was caused by a drop in oil level resulting from solidification of oil on the upper pump wall. Cell ambient temperature was higher during the March 19-21 period, and no problems were encountered. A closed loop glycol system to control the temperature of the diffusion pumps is being studied. Current cell activities are directed toward the completion of these items: (1) Reinsulation of the 7' tank. (2) Completion of the control cable installation contract. (3) Build-up for and conducting of the thermal link test program. (4) Vacuum chamber leak checks and repairs. In addition, diffusion pump baffles recently delivered by CVC and installed have improperly machined "O" ring grooves on the Edwards pump installation. A temporary fix was installed by Plum Brook for the March tests. CVC has been notified of the error, the ring grooves will be remachined, and reimbursement from CVC will be requested.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT TANK SITE	
		CRYOGENIC PROPELLANT TANK YOR1573 (CRD - RL DeWitt; RSD - JV Gillette & JE Cairelli) Cryogenic propellant pressurization and dynamics testing. Major effort during April was directed toward stripping insulation from the 7' tank. Because of instrumentation changes and damaged insulation components, the tests scheduled for the end of April were not accomplished. Repairs have been completed on insulation blankets and the aclar purge bag. The 7' tank was leak checked. Reinstallation of the insulation is now about 50% complete. The tank test program is scheduled to resume the latter part of May. The thermal link test facility with thermal links installed has been checked out with LN_2. Stabilization times for the links proved much longer than predicted. This made the 150 liter LH_2 supply too small. Minor modifications are now in progress to enable use of a standard roadable dewar. This test program is planned for completion prior to resuming the 7' tank boiloff tests.

May 1968

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE			
		CRYOGENIC PROPELLANT TANK YOR1573 (CRD - RL DeWitt; RSD - JV Gillette & JE Cairelli)		Cryogenic propellant pressurization and dynamics testing.

The thermal link test program was completed during May. Six thermal links of various materials and configurations were tested. Data from these tests will be used in forthcoming tests of the flat-plate calorimeter at "C" Site.

Reinsulation of the 7-foot Lockheed tank was completed. The tank was moved back to "K" Site and reinstalled in the vacuum chamber. While the tank was at the Assembly,Test, and Storage Building, the tank piping and instrumentation pass-throughs were leak checked and some instrumentation changes were made. As an aid in determining the LH_2 saturation point in boil-off tests, a small heat source was installed in the tank. The next boil-off test is scheduled for the week of June 3.

Downtime between insulation tests was used to conduct further system leak-checks on the 25-foot vacuum chamber. Several pass-throughs were modified as a result of these tests. Chamber pressures in the 10^{-6} Torr range have subsequently been achieved.

Preparations for methane (liq. CH_4) pressurization and expulsion tests with the 5-foot thick wall tank have been started. Delivery and storage arrangements for methane are complete and various components and materials are on order. Preliminary designs for the liquid sampling system and tank instrumentation are underway.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	**CRYOGENIC PROPELLANT RESEARCH SITE**			
		CRYOGENIC PROPELLANT TANK YOR1573 (CRD - RL DeWitt; RSD - JV Gillette & JE Cairelli)		Cryogenic propellant pressurization and dynamics testing.
		Two insulation boil-off tests were conducted with the Lockheed 7' tank during June. In all cases the working fluid was LH_2. The first test, June 4 through June 6, was an evaluation of the reinsulated tank. Since previous tests the tank had been stripped down to the Aclar substrate purge bag, repairs made, and the three multilayer blankets reinstalled. Following this test a fourth blanket was added to the tank. Some difficulties were encountered due to poor quality of the Lockheed-supplied blankets. A partial list of problems includes misaligned blanket support straps, buttons improperly located and ties not properly trimmed, and blankets cut oversize. A combination of reassigned hours and overtime enabled the job to be completed in two weeks. As a result it was possible to test the four blanket configuration June 26 through June 28. The next test is scheduled for July 22. This test will be with a five blanket, purged substrate insulation system.		

7-68

July 1968

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE			
		CRYOGENIC PROPELLANT TANK YOR1573 (CRD - RL DeWitt; RSD - JV Gillette)		Cryogenic propellant pressurization and dynamics testing.

The five-blanket, purged substrate insulation boil-off test was completed during the period July 15 through July 18. This was the sixth test in the Lockheed 7' tank series. The seventh and final test with a six-blanket (60 layer) insulation system is scheduled for the week of August 5.

To reduce insulation chilldown time during the five-blanket test, helium was admitted to raise vacuum chamber pressure to 12 microns. Chamber pressure was held constant for 2-1/2 hours after filling the LH_2 tank. Using this method the total test time was reduced approximately 10 hours. Even larger savings are expected for the six-blanket test.

Other activities include setting up for LH_2 cold wall sample tests in the "little rig". These samples are made from aluminum honeycomb cemented to an aluminum backing plate. Objectives of the test are to determine wall temperature gradients and to evaluate integrity of the adhesive bond with thermal cycling. Test results will be applied to the design of LH_2 cold walls for forthcoming shadow-shield tests.

Preparations for the liquid methane program are also underway. The Gow-Mac ullage sampling system has been calibrated for methane. The 5',thick-walled tank has been shipped to Cleveland for instrumentation. A contract was awarded for liquid sampling system solenoid valves. Delivery is expected September 30.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE	

CRYOGENIC PROPELLANT TANK
YOR1573
(CRD - RL DeWitt;
RSD - JV Gillette)

Cryogenic propellant pressurization and dynamics testing.

The seventh, and final, test in the Lockheed 7' tank series was performed during the period August 5 to August 7. This completes a long series of boil-off tests on the purged substrate, multi-layer insulation scheme.

As in the previous test, vacuum chamber pressure was raised (to 14 microns) for a period of four hours after filling the LH_2 tank. It is estimated that approximately 24 hours of chilldown time was saved during this six-blanket, 60 layer test.

On August 1, 8, and 27, tests were performed on cold wall material samples in the "little rig". These tests provided a total of five temperature cycles between 200°R and LH_2 temperature. The honeycomb fin temperature gradient was higher than expected. There was also evidence of bond deterioration between the fins and base plate in five of the six bonding agents tested.

Preparations continue for the liquid methane tests scheduled to begin in October. Diaphragms in the actuator shaft seal were replaced. Piping and wiring modifications are also in progress. Bottles for the liquid methane sampling system were due August 22. This material has not been received and the supplying vendor is now on strike.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE	

CRYOGENIC PROPELLANT TANK
YOR1573
(CRD - RL DeWitt;
RSD - JV Gillette)

Cryogenic propellant pressurization and dynamics testing.

Work continued in preparation for 5' tank methane tests during September. The vacuum chamber was checked for leaks and three major leaks were found in the TV case, the 36" chamber relief valve, and in the tubing for the LN_2 cooled baffle plates.

The Aerovac residual gas analyzer was calibrated using H_2 and CH_4.

The LCH_4 sampling system status is as follows:

1. Five bottles were made available to start bottle rack assemblies. The original order of 70 bottles which has been delayed due to a strike at the supplier's plant were received on September 30.

2. The electrical wiring for the liquid sampling system is complete outside the chamber. Remaining wiring will be completed after the test tank is installed in the chamber.

3. Sample system heaters were shipped September 22. The thermoswitches have been delayed due to lack of materials but should be delivered by October 4.

4. Solenoid valves were shipped on September 27, but have yet to be delivered.

(Continued on Page 30)

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	(Continued)	

CRYOGENIC PROPELLANT TANK (Continued)

5. Relief and check valve delivery is expected by October 14.

The AEC railroad car which will be used for GCH_4 supply was checked for alignment with "K" Site gas manifold. Adapter spool pieces are needed to connect the car. Grayloc flanges are being purchased to complete the installation.

The instrumentation on the 5' tank is slower than anticipated. The tank should be received at Plum Brook about October 10. Since at least two weeks of work remain to be done after the tank is received, the first Methane test will not be possible until late October.

Sample cold wall tests were continued on September 5, 6, 12, 17, 18, 25, and 26 in the "little LH_2 rig". To date, nine samples with epoxied bonding (aluminum honeycomb on aluminum backing) have been tested. Major conclusions from these tests are:

1. The high emissivity 3M black velvet paint does not crack or peel with repeated thermal cycling.

2. No degradation of the strength of the bond could be visually detected.

3. Some degree of deterioration of heat conduction was evident on all samples for at least the first cycle.

Three samples remain to be tested. They include aluminum honeycomb on stainless steel backing, an epoxy with aluminum filler, and a brazed sample.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE	

CRYOGENIC PROPELLANT TANK
YOR1573
(CRD - RL DeWitt;
RSD - JV Gillette)

Cryogenic propellant pressurization and dynamics testing.

Preparations for the methane pressurization and expulsion tests were continued during October.

The 5' diameter thick wall tank was delivered to "K" Site October 15. The tank was installed in the chamber, and the tank instrumentation sensors verified as to location and channel. Instrumentation, TV and mechanical connections to the tank are currently being finalized. Six thousand gallons of LCH_4 have been delivered to the site. The methane test program was program was presented to the Area 20 Safety Committee and approved.

Individual systems were checked out as follows:

1. Operated TV 24 hours in vacuum.
2. Changed actuator pass thru seal.
3. LCH_4 sampling system was 90% completed.
4. Set up gas detectors for methane.
5. Cleaned, serviced and checked the Visicorder and strip charts.
6. Made up new (more flexible) tank instrument cables.
7. Changed controls from the 13' to 5' piping system.
8. Installed and calibrated pressure transducers.
9. Rewired pressure controller, flow controller, and run sequence timer.
10. Checked out operation of hydraulic actuator.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	(Continued)	

CRYOGENIC PROPELLANT TANK (Continued)

The following work was performed in the ATS Building assembly area:

1. Removed and weighed three insulation blankets from the 7' tank;

2. Removed liquid level sensors for installation in the 5' tank.

Eight days of cold wall sample testing was completed in the "little rig". Test results indicate that the aluminum honeycomb on aluminum backing with Narmco 329 sheet adhesive is the more promising combination for the 13' cryoshroud panels. Two honeycomb samples remain to be tested. These tests have conflicted with on-site contractors and the methane test preparations.

A "K" site utilization meeting was held with research and operations personnel attending. Four test programs, LPG (3 parts); 4' shadow shield; 200 layer insulation; and the 9' shadow shield, were tentatively scheduled through the next 28 months. These programs are estimated to require 17 months of actual testing. Intervals between above tests will be scheduled for the three calorimeter programs. The overall programs appear optimistically tight; however, by utilizing off-site facilities at both Plum Brook and Lewis-Cleveland, buildup in the cell area can be reduced and more actual test time realized.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE	

CRYOGENIC PROPELLANT TANK
YOR1573
(CRD - RL DeWitt;
RSD - JV Gillette)

Cryogenic propellant pressurization and dynamics testing.

During November, three run days were scheduled for the liquid methane expulsion test series. The test hardware was the 5-foot, heavy-wall tank; using gaseous methane as the pressurant.

The first two run days were largely thwarted by a liquid leak at the dewar bayonet connection, leaks through an instrumentation connector in the test tank lid, and an inability to flow at the maximum required expulsion rate.

The leaks were repaired, the liquid discharge was switched to the large 4" line, and a third test was run on November 27. Five successful runs were made.

In addition to the methane tests, six Centaur tank instrumentation feed-thrus for B-2 were leak checked in the "little rig". Two LOX connectors were tested in LN_2 and four hydrogen connectors were tested in LH_2. A nominal 6×10^{-8} standard cubic centimeters of helium per second leak was measured on each of five connectors. Leak rate on the sixth connector was too high to measure. Apparently, there was insufficient bonding of the epoxy potting compound. Following repairs, a retest is scheduled for December 13.

-12-68

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE	

CRYOGENIC PROPELLANT TANK
YOR1573
(CRD - RL DeWitt;
RSD - JV Gillette)

Cryogenic propellant pressurization and dynamics testing.

Six test days were scheduled during December. Data taken were sufficient to complete the expulsion series using gaseous CH_4 as the pressurant. Both slosh and non-slosh runs were made. All tests were at the 5% ullage start and without tank baffles.

One run day was cancelled because of much greater than anticipated gas flow rates at the initiating of slosh. This effect was also observed in previous LH_2 tests, but was much more in evidence with methane. To combat the problem, an automatic linear ramp of slosh amplitude was instituted. In addition it was necessary to increase the supply of pressurant gas available.

The next test series is scheduled to begin during the week of January 6. This series will use helium as the pressurant gas. Repair of a GN_2 leak into the vacuum chamber and repair of the Ruckers hydraulic system must be completed prior to these tests. Also required is a new calibration of the Gow-Mac ullage gas analyzer.

The liquid methane sampling system has not yet been successfully demonstrated. Solenoid valves, essential to operation of the system, have been leaking both through the valve and through body seals into the vacuum chamber. An in-house designed and built valve has been checked out, and these valves will be installed for the next test series.

In addition to the methane tests, several liquid level point sensors for the Centaur LH_2 tank were calibrated in the "little rig". Calibration included voltage vs. current characteristics for the sensor, both in and out of liquid hydrogen.

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE			

CRYOGENIC PROPELLANT TANK

(CRD - RL DeWitt;
RSD - JV Gillette)

Cryogenic propellant pressurization and dynamics testing.

Nine liquid methane program test days were accomplished during January. All of the desired temperature and slosh data were recorded for the helium pressurant gas series at 5% ullage. Hydrogen gas pressurant tests are now about 35% complete. Several expulsions must be rerun due to a leak discovered at the pressurant gas data orifice.

Several problems have restricted test operations during the month.

1. The liquid sampling system did not obtain full operation. Several valve leak problems had to be solved. Because of the undersized vent line, only three of the five requested samples could be obtained. A larger vent is now being installed.

2. The hydraulic shaker has operated in an intermittent fashion. Evidence of poor workmanship by the vendor has been uncovered and repaired, but as of this writing, no significant trouble source has been pinpointed. Problems in this area have been serious.During one checkout, the hydraulic control was lost, and excessive "G" loads were placed into the test package. The instrumentation rake that is suspended in the 5' tank was damaged.

Tests scheduled for February include completion of the hydrogen and nitrogen pressurant expulsions. In addition 17 runs have been added to the methane gas pressurant program. This will add two weeks to the methane program.

Several project meetings have been held in support of future "K" Site programs. Piping schematics and detailed schedules are being compiled for each program.

The aluminum calorimeter was delivered to ATS Building from "J-3". The spiral wrap insulation is on hand. The tank has to be insulated before the April test runs, but it has been impossible to obtain personnel for the insulation application because of top priority work at B-2.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE	

CRYOGENIC PROPELLANT TANK (CRD - RL DeWitt; RSD - JV Gillette) — Cryogenic propellant pressurization and dynamics testing.

Nine test days were accomplished during the month of February. All of the pressurization-expulsion tests in the liquid methane program were completed at the 5% ullage level in the unbaffled 5' tank. These tests included the remaining GH_e pressurant runs, the modified GN_2 pressurant runs, and additional GCH_4 pressurant runs.

GN_2 tests with slosh and cold gas were eliminated from the program for the reason that warm GN_2 gas quantities for expulsion were significantly greater than for other propellant gases. Additional research data with GN_2 would not have provided useful information. Ten GCH_4 propellant runs were added to better define the large differences in pressurant quantities between static and slosh conditions.

At this time the vacuum chamber and test tank are open. Instrumentation is being relocated for 50% ullage level tests. The test program will resume on March 11. Based upon present plans, the low pressure methane program should be complete about the end of April 1969.

MULTILAYER INSULATION — Insulation tests using 30" calorimeters.

In the 30" calorimeter program, the original multilayer insulation has been stripped from both copper and aluminum 30" calorimeters. Preliminary checkout of the constant-tension mechanism is complete. And

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE	

CRYOGENIC PROPELLANT TANK (CRD - RL DeWitt; RSD - JV Gillette) — Cryogenic propellant pressurization and dynamics testing.

Instrumentation was relocated from the 5% to the 50% ullage level during the first week of March. This included an instrument modification to retain six liquid level sensors at the 5% ullage level. Testing was resumed on March 11 and completed on March 20. A total of six test days was required to finish the 50% ullage, 5' tank, and LCH_4 propellant expulsion tests. Tests included three pressurant gases (CH_4, GHe, and GH_2) at 400°R tank inlet temperatures.

Data was recorded for two phases of pressurization with the above gases and temperatures. The first, pressurant decay, was observed by expelling from 5% to 50% ullage and observing the decay during hold at 50% ullage for slosh and static conditions. The second, engine simulated restart, was accomplished by initiating the pressure ramp and expulsion from the 50% ullage level.

Of the original Phase I methane program, 12 passes remain. These will be slosh tests with tank baffles at 5% ullage. In addition, 11 more slosh tests were added to the methane program to determine the effect of varied amplitude and frequencies at 50% ullage with anti-slosh baffles. Estimated completion of Phase I, low pressure, methane program is still the end of April.

MULTILAYER INSULATION — Insulation tests using 30" calorimeters.

Application of the spiral wrap multilayer insulation on the 30" aluminum calorimeter is still in progress.

(Continued on Page 31)

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	(Continued)	

MULTILAYER INSULATION (Continued)

The first insulation attempt was scrubbed after applying sixty layers. The insulation had sagged, and slippage occurred between the layers. Both sag and slippage increased as successive layers of insulation were applied. The original sixty layers were removed and reapplication has started. Retaining lines secured longitudinally to the calorimeter and across every ten layers are being installed to reduce sag and slippage. In addition, the insulation is being applied with decreasing tension, as opposed to constant tension. This will maintain a constant torque in the calorimeter insulation system and eliminate excessive loading of the insulation as the number of layers are increased. Progress meetings are being held every Friday morning during the systems build-up for the calorimeter tests.

FUTURE PROGRAMS: MULTILAYER INSULATION; ADL SHADOW SHIELD; PENETRATION EFFECT; LIQ. CH_4 PHASES 2 & 3

No significant changes in the other programs are being reported. A project meeting was held for the ADL Shadow Shield program and the preliminary SRT Task Plan was reviewed. Fabrication of the 4' test tank cold guard modification is complete and the tank is now ready to be coated with aluminized mylar. These tests are tentatively scheduled for August 1, 1969, based on earliest possible hardware delivery.

The 13' cryoshroud checkprints are currently being reviewed. The design is considered complete, with only the final drawings and specification remaining.

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	CRYOGENIC PROPELLANT RESEARCH SITE	

CRYOGENIC PROPELLANT TANK
YOR2500
(CRD - RL DeWitt;
RSD - JV Gillette)

Cryogenic propellant pressurization and dynamics testing.

Twenty-eight passes were accomplished during five test days in April. These tests completed the 5' thick walled LCH_4 tank pressurization and expulsion program. These were slosh tests performed with anti-slosh baffles installed. Pressurant gases were helium and methane, each at tank inlet temperatures of 400°R and 650°R. Both partial and complete expulsions were made to observe pressurant decay and to simulate engine restart.

MULTILAYER INSULATION
YOR2023

Insulation tests using 30" calorimeters.

Current work efforts are being directed toward site buildup for the 30" aluminum calorimeter, continuous wrap insulation tests. The 5'-diameter methane tank and associated piping and valving have been removed. A new vent system with multiple flanges has been installed to accommodate the calorimeter, as well as future tests with cryogenic shrouds. Modified controls and new instrumentation systems are 75% completed. Piping and valve modifications are 30% complete. The major remaining work in the cell is electrical. Depending upon the availability of extra manhours for the electrical work, the calorimeter test program will begin on or about May 20.

Assembly of research hardware is progressing on schedule at the ATS Building. The calorimeter insulation, 160-layer continuous wrap, is complete. The revised insulation procedure significantly reduced insulation sag and slippage, to the satisfaction of both the research and operations engineers.

Remaining work at the ATS Building includes leak-checking and installation of the calorimeter manifold, heater installation on the shroud, and installation of instrumentation thermocouples. A limited amount of preassembly of the shroud and support hardware will be accomplished before shipping to "K" Site.

(Continued on Page 33)

SITE	SITE NAME	RESEARCH INSTALLATION & DESCRIPTION
K	(Continued)	
		FUTURE PROGRAMS: MULTILAYER INSULATION; ADL SHADOW SHIELD; PENETRATION EFFECT; LIQ. CH_4 PHASES II & III The 8' ADL cryoshroud is scheduled to be cold-shocked and leak-checked by High Vacuum Equipment Corporation during the week of May 5. A "K" Site operations engineer will be present to evaluate the test procedure and verify the results. An aluminized mylar coating is being applied, in-house, to the 4' test tank. The SRT Task Plan has been completed and distributed for final approval. Test hardware for Phases II and III of the high-pressure methane program is being made ready. A fabrication contract was awarded on April 25 for two high-pressure liquid methane tanks. The contract has a 60-to 90-day completion time. Outside-fabricated tank viewports are being experimentally evaluated in LeRC-Cleveland. A high-pressure, liquid methane valve is being evaluated at Plum Brook for vacuum service. Preliminary meetings have been held to discuss controls systems and to evaluate proposed test procedures.

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

MULTILAYER INSULATION (YOR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

Final site preparations and two days of pretest operations were completed with the 30-inch aluminum calorimeter, continuous wrap insulation system. These tests revealed additional minor work was required on the LH_2 fill valves, vacuum system and instrumentation. Research testing will be started on June 3 or 4.

The pretest checkouts on May 26 and 27 revealed a vacuum leak from the vacuum chamber TV purge. Ultimate chamber pressure was 3×10^{-7} torr after the purge line was isolated from the chamber. The heated shroud was operated at 83°F. Surface temperature gradients were less than 2°F as measured on six thermocouples, and oscillatory temperature drift appeared less than 1°F during a one hour period. Backpressure control of the guard and measure tanks was satisfactorily maintained at approximately 17 psia within ± .05 mm Hg and ± .0026 mm Hg, respectively. The measure tank boiloff rate during checkout appeared high. Subsequent check indicated the LH_2 fill line valves were not seating properly. New valve seats were installed, the valve operator stroke was adjusted, and the fill line was flushed to eliminate particles. Four liquid level sensors had been improperly terminated. They are now rewired to the proper indicator lights.

FUTURE PROGRAMS

8' ADL CRYOSHROUD (YOR3119) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

A field inspection of the 8' ADL cryoshroud was made in Boston, Mass. The main conclusion was that additional cold leak checking would be required at K Site when the cryoshroud is delivered. The shroud is expected to be delivered in June. Additional work on the shadow shield, including instrumentation, is required. Completion and delivery will depend on approval of additional contract funding.

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

FUTURE PROGRAMS (Cont.)

FLAT PLATE CALORIMETER (YOR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

All major hardware for the flat plate calorimeter is available from C-Site. The insulation shield configuration design has yet to be finalized. Shields will be fabricated and installed at the Reactor ATS Building. A meeting has been scheduled to review the program and determine shroud heater requirements. A revised test program outline was requested, and a preliminary test schedule will be developed.

LIQ. METHANE (YOR2500) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

No significant changes are reported for Phases II and III of the liquid methane program.

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

MULTILAYER INSULATION (YOR2023) — CRD - J. E. MALOY: RSD - N. L. SCHROEDER

Three boiloff tests were conducted with the spiral wrapped, 160 layer, insulated calorimeter. The lowest boiloff rate recorded was approximately 4.0 SCFH. The expected rate was approximately 1.2 SCFH based on similar insulation systems. Preliminary indications are that the overall thermal coefficient will be higher for this particular system. Future tests with 100, 60, and 20 layers, plus tests with various layer densities are expected to confirm these initial results. The next test with 100 layers is scheduled for July 14.

Following the first test, June 3 - 6, 8 thermocouples were installed to verify heat inputs through the piping and suspension hardware. The second test, June 16 - 18, duplicated the first boiloff test result, approximately 4.5 SCFH. The additional instrumentation indicated the temperature gradient through the piping and suspension could not account for this greater-than-expected boiloff. The third test, June 25 through June 30, was conducted with the outer insulation net retainer removed. The retainer tie supports may have caused thermal shorting by crushing the insulation as well as creating poor insulation venting characteristics. The final boiloff rate was approximately 4.0 SCFH.

(Continued on Page 33)

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

The spiral wrap insulation tests are requiring more time than originally anticipated. A minimum of two days of pumping at or below 5×10^{-6} Torr is required to assume the insulation is vented prior to filling the calorimeter with LH_2. Four to five days are required to attain and determine steady state conditions. After the test, two to three days warm up are required to prevent condensation on the insulation when the vacuum chamber door is opened. Configuration changes of the insulation will require approximately one week.

In addition to the above tests, the "Little LH_2 Rig" was operated one day to test an MB submersible pressure transducer for zero shift and sensitivity in LH_2. This work was done for the Plum Brook calibration lab.

FUTURE PROGRAMS

8' ADL CRYOSHROUD (YOR3119) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

The 8' cryoshroud was delivered to Plum Brook during June. Operational tests for cold leaks and chill down characteristics are tentatively planned for August 15 while the 30" aluminum calorimeter is being reinsulated. Delivery from ADL of the completed shadow shields, with instrumentation installed, will be approximately August 30. Additional LH_2 and LN_2 dewar pads are being designed. Additional piping and piping insulation has been ordered for LN_2 service to the vacuum chamber. Hardware for transporting and suspending the 4' tank and cryoshroud is approximately 50% complete.

FLAT PLATE CALORIMETER (YOR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

No significant changes to report.

LIQ. METHANE (YOR2500) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

A new delivery date of July 30 has been established for the two high pressure tanks. A redesign of the quartz ports was required. The visible flow section and strob light system will be tested at Lewis-Cleveland during July.

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

30" CYLINDRICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

During July both the 60 and 100 layer spiral wrapped, multilayer insulation tests were completed. Approximately one week was required for each test plus a week down time prior to each test for configuration changes, test cell preparation, and vacuum pump down. Preliminary test evaluation indicates that all the data recorded is satisfactory. At this point in the testing program there appears to be an optimum number of layers, 30 to 60, for which little or no additional thermal protection can be attained by increasing the number of insulation layers. Another test with 40 layers, therefore, has been added to the program. This portion of the program is now scheduled for completion by August 29.

FUTURE PROGRAMS

8' ADL CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

Operation tests of the shroud are now scheduled for September. Final delivery of the shroud fittings and flex lines was made in July. A meeting of Plum Brook and Lewis-Cleveland engineers is scheduled for August 1 to finalize the shroud test objectives and necessary support hardware.

A research test plan is currently being formulated for the actual shadow shield tests with the 4' tank mounted within the 8' cryoshroud. The tank has been covered with aluminize mylar. Work is progressing in other support areas such as additional dewar pads and the suspension system.

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

FLAT PLATE CALORIMETER (YPR2023) — CRD - J. E. MALOY; NSD - N. L. SCHROEDER

Penetration effects testing with the flat plate calorimeter have been moved up in the "K" Site test schedule to approximately October 15. At least five configurations will be included They are:

(1) Smooth insulation with no penetrations

(2) Hat section

(3) Fiberglas buffer zone

(4) Staggered (or interleaved)

(5) At least one isotherm attachment

Project meeting will be held each Friday morning. An updated test plan and instrumentation requirements have been completed. Insulation and instrumentation work will begin in the ATS Building during the first week of August.

LIQUID METHANE (YPR2500) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

Fabrication of the high pressure tanks has been delayed an additional four weeks to August 30. Original fabrication time estimates by the contractor were considerably unrealistic. Other work in process includes the following:

(1) Mass flow meters delivered and will be water calibrated

(2) New seals for the view port assembly have been ordered

(3) Transparent test section has been fabricated

(4) Photographic support hardware has been ordered

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

30" CYL. CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

During August two data runs at 40 and 20 layers of insulation were completed. These concluded the 40-layer-per-inch density phase of testing. The calorimeter will be removed to make room for the 8' cryoshroud.

8' DIA. ADL CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

Preparations are now underway for the acceptance test of the 8' ADL Cryoshroud. The following tasks were completed during August:

(1) The shroud baffles were installed;

(2) All shroud tubing was flushed and mass spectrometer leak-checked;

(3) The vacuum chamber penetrations for the shroud vents were fabricated;

(4) The vent control valves were built-up and are ready for installation;

(5) Fill and vent piping adaptors were fabricated;

(6) Conoseal gaskets were ordered. One spare set of seals was acquired from ADL.

(Continued on Page 29)

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

8' DIA. ADL CRYOSHROUD (Continued)

Acceptance testing is scheduled to begin the week of September 22.

Delivery of the 4' dia. tank is scheduled for late October. Testing of the Shadow Shield Systems is tentatively scheduled to begin in late December.

FLAT PLATE CALORIMETER (YPR2023) — CRD - J. E. MALOY; NSD - N. L. SCHROEDER

Work was begun in preparation for insulating the Flat Plate Calorimeter. The following work was accomplished during August.

(1) A template was built for cutting out the 58" dia. insulation blankets and locating thermocouples;

(2) The shroud water system was removed from "J" Site;

(3) Thermocouple dynamic reference junctions were fabricated;

(4) Construction of a new calorimeter support ring has been started;

(5) The 2" O.D. Test Penetration is being fabricated;

(6) An insulation support structure is being designed to cover the piping at the bottom of the calorimeter.

LIQUID METHANE (YPR2500) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

Due to the addition of SEMI System tests, Methane Phase II and III testing has been rescheduled to start early in June 1970.

An attempt was made to water calibrate the mass flow meters. During the calibration, bearing problems developed and the calibrations could not be made. The meters are presently being rebuilt.

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

Sept 1969

K — CRYOGENIC PROPELLANT RESEARCH SITE

30" CYL. CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

Work accomplished in preparation of installing the Flat Plate Calorimeter in "K" Site during the past month is as follows:

(1) Thermocouples have been installed at all necessary locations on the calorimeter, support cone, fill and vent lines and environmental shroud.

(2) The first insulation system consisting of 20 layers of aluminized mylar with silk netting spacer material has been fabricated and installed, complete with necessary instrumentation.

(3) The environmental shroud has been installed on the calorimeter.

(4) All of the necessary hardware for supporting the calorimeter in the vacuum chamber has been received.

(5) The control panels and variacs for the calorimeter warm-up heaters are being installed.

(6) All of the components for the environmental shroud heating system are on hand and ready for installation.

It is expected that the complete system will be ready for testing by the middle of October.

8' DIA. ADL CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

On September 22 and 23 the 8' ADL Cryoshroud was leak checked in the "K" Site vacuum chamber. With 40 psig He pressure in the shroud tubing, the overall warm He leakage rate was 2.1×10^{-3} std cc/sec. After filling the shroud with LH_2 and maintaining a 20 psig line pressure the overall H_2 leak rate measured over $1\frac{1}{2}$ hours was 1.48×10^{-3} scc/sec. After the leak test and cold shock, the shroud was inspected. Several welds were cracked. All of the tubes appeared to be sound, however one of the tack welds holding the tubing to the #2 baffle was separated. Remaining weld cracks were in areas where reinforcing angles and channels were fastened to the skin with both tack welds and bolts. These welds do not appear to have significant structural value to the shroud. If repaired, they would probably fail on subsequent cooldowns.

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

During the checkout a leak was discovered in one of the diffusion pumps. The pump was valved off throughout the test. Subsequent leak checking revealed a leak in LN_2 baffle above the diffusion pump. The baffle will be removed for repairs before installing the flat plate calorimeter for the next series of tests.

Delivery of the 4' dia. tank is still scheduled for late October. Testing of the Shadow Shield System is expected to begin in late December.

LIQUID METHANE (YPR2500) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

The "see through" flow section was cold shocked in LN_2 and hydrostatic tested. The section failed at 500 psi. Maximum test pressure was to have been 1000 psi. The flow section is being redesigned.

One of the LCH_4 shut off valves for use inside the vacuum chamber was tested with LN_2 in the "D" Site vacuum chamber. The pneumatic operator was cycled with no significant leakage at a chamber pressure of 2×10^{-6} torr. However, the valve would not shut tight when it was cold. The valve is presently in the valve shop for repair.

SEMI SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - N. L. SCHROEDER

Description: Self Evacuating Multilayer Insulation on a 30' dia. cylindrical LH_2 tank, mounted inside the 8' dia. shroud. Shroud is to be water heated to 70°F.

A meeting was held September 17 between Lewis-Cleveland and Plum Brook personnel to discuss hardware and facility requirements and for a preliminary review of the task plan. Linde is supplying the tank and insulation. Delivery is expected early in February. Design has been started by Lewis-Cleveland on the tank fill tube and instrumentation.

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

PENETRATION EFFECT (YPR2023) — CRD - W. R. JOHNSON; RSD - N. L. SCHROEDER

Installation of the flat plate calorimeter in the "K" Site vacuum chamber was completed.

All necessary piping was installed and leak-checked. Also completed was the installation and checkout of the environmental shroud heating system and the calorimeter tank warm-up heater control system.

Instrumentation terminations between the test article and the site were completed and functional tests were performed.

The wiring for the edge guard heaters was completed between the test cell and the control room. But several control panel components were not received from the manufacturer. Delivery is expected in early November.

During the checkout of the calorimeter tank warm-up heaters, power to the 4000 watt outer cold guard heater was accidentally left on overnight. This resulted in the calorimeter surface heating up to about 385°F, and a slight discoloration of the silk netting spacer material between the first few layers of aluminized mylar insulation blanket resulted. It was decided to replace this blanket, and work is presently underway to accomplish this task.

It is expected that the first test will be performed during the first week of November.

SHADOW SHIELD TESTS (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

The 8' cryoshroud was moved from "K" Site to the ATS Building where it was disassembled for repairs.

The work was done by a service man from High Vacuum Equipment Corp. Work was confined to the top and bottom covers, and consisted of grinding the cracked welds, installing additional screw fasteners, and repainting the high emissivity surface. The 4' tank,

(Continued on Page 33)

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

SHADOW SHIELD TESTS (Continued)

shadow shields, and all related hardware were received from ADL, which completed this contract.

Buildup of the test package at the ATS Building will begin early in November. The assembly should be ready for moving to "K" Site sometime in December.

A penetration for the third LH_2 supply, inside the vacuum chamber, was installed. The LH_2 piping, two more chamber penetrations, and two LN_2 supply lines will be installed during downtime between tests with the flat plate calorimeter.

Insulation for the 8' shroud has been designed and is being procured.

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

The two high pressure stainless steel tanks were received at Plum Brook. Plans are being made to provide a work area where the tanks can be assembled with their suspension system and interconnecting piping can be fabricated.

13-FT. CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

A 4' x 4' cryoshroud wall sample is being tested with LN_2 at "K" Site. The tests are temperature cycles in air between ambient outside temperature and LN_2 temperature. The purpose of testing is to observe the performance of the glue joint between the honeycomb face material and the aluminum sheet backing.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

Linde design of the test tank has been completed and fabrication begun. Delivery of the complete package is still expected in early February.

Lewis-Cleveland design has been completed and fabrication begun on the tank fill tube and instrumentation.

(Continued on Page 35)

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

FACILITY ITEM

Repair of Vacuum System LN_2 Baffle: Close inspection of the leaking LN_2 baffle revealed a crack in the copper tubing, which is coiled around the baffle. The crack appeared to be caused by metal fatigue in the area where the LN_2 feedline joined the baffle coil. The feedlines were not made to allow for thermal contraction.

To avoid a recurring problem with thermal cycling, the inner baffle assembly was rotated with respect to the outer shell to provide a 90° bend in the feedlines. This should greatly reduce any stresses caused by thermal cycling.

Since there are four LN_2 baffles in the vacuum system, and all have similar construction, the probabilities are high that the remaining baffles will also develop leaks.

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

PENETRATION EFFECT (YPR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

Two full scale tests were performed on the Flat Plate Calorimeter during the first and third weeks of November. The insulation system for both tests consisted of 20 shields of aluminized mylar with two layers of silk net spacer material between each shield. All control and instrumentation systems functioned normally but preliminary data indicate that the LH_2 boil-off rate in the measure tank is considerably higher than predicted. An investigation is presently under way to uncover any possible heat leaks that would have this effect on the boil-off rate.

SHADOW SHIELD TESTS (YPR3119) — CRD - R. E. DEWITT; RSD - J. E. CAIRELLI

Additional work was accomplished during November in preparation for the shadow shield tests at K Site. A project meeting was held on November 14 to review the work assignments and man-hours required to assemble and install the shadow shield test package in K Site. As a result of this meeting, a work schedule was prepared and distributed to those involved.

The inner high emissivity surface on the 8' cryoshroud cylindrical section was cleaned and repainted. This was due to poor vendor quality control. A contract to fabricate insulation for the outside of the 8' cryoshroud has not yet been awarded due to lack of bidders. Part of this work may have to be done in-house. Work was started on developing a technique for installing aluminized-mylar radiation shields inside the shadow shield support struts.

Paint used to produce the high emissivity surface on the shadow shield support struts appears to have excessive outgassing properties under vacuum and 700°R operating conditions. The struts will be baked in an evacuated container to remove the volatiles. Work has begun at Lewis to assemble the bake-out container.

(Continued on Page 29)

NARRATIVES ON ADJOINING PAGE

K SITE

TASK J.O.	PROGRAM	STATUS	SCHEDULE
YPR2500	LIQUID METHANE	. . . . . Project being reevaluated.	

CHANGES: Schedule deleted.
(Since last report)

TASK J.O.	PROGRAM	STATUS	SCHEDULE
YPR3119	SHADOW SHIELD TESTS (13' Cryoshroud)	. . . . . First sample test terminated.	

CHANGES: None
(Since last report)

TASK J.O.	PROGRAM	STATUS	SCHEDULE
YPR1327	SEMI-SYSTEM	. . . . . Delivery of tank heads delayed. Most of Lewis-Cleveland fabricated equipment was completed.	1st Test, Week Feb. 23, 1970 - Delivery, early Feb. 1970.

CHANGES: None
(Since last report)

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

SHADOW SHIELD TESTS (Continued)

Vacuum jacketed piping for the third LH_2 supply inside the vacuum chamber was fabricated in the Plum Brook weld shop, and it is now being installed. Work should be completed the first week in December.

Buildup of the test package at the ATS building is expected to be completed by late December.

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

The methane program is being reevaluated. All test buildup has been stopped.

13-FT. CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

The LN_2 temperature cycle tests on a 4' X 4' sample of coldwall were terminated after 49 cycles. Inspection of the sample after testing showed:

(1) The weld joints between "D" tubes and plate showed no signs of deterioration.

(2) The glue bond between plate and honeycomb had serious crazing.

Attempts are being made to speed the contractor in perfecting the glue bonding technique and delivery of a new sample.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

Delivery of the hemispherical tank heads to Linde has been delayed because of the G.E. strike. Therefore, delivery of the test package to Lewis-Cleveland will be delayed. A revised schedule is not yet available.

All Lewis-Celveland fabricated equipment is complete, except for the guard tank purge bag.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	
		PENETRATION EFFECT (YPR2023) — CRD - W. R. JOHNSON; RSD - N. L. SCHROEDER The investigation into the problem of high LH_2 boil-off from the measure tank of the flat plate calorimeter continued through the past month. The shroud was changed from the normal water heated test configuration to a LH_2 cooled system to completely cold guard the measure tank. This system was tested with a resultant LH_2 boil-off of 22 SCFH instead of the expected zero boil-off. To verify that there were no gas leaks into the system, the measure tank was allowed to boil dry. (Continued on Page 29)

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

PENETRATION EFFECT (Continued)

The boil-off dropped to zero as expected. A second test was performed with all instrumentation cable, power cables, and any other heat path into the system disconnected. Very little change was noted.

Design and construction of the calorimeter are presently being investigated to see if there are problems in these areas to explain the high boil-off rate.

SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCKL; RSD - J. E. CAIRELLI

Additional work on the flat plate calorimeter and heavy year-end leave have delayed buildup of the shadow shield package. It is now planned to complete this assembly in the ATS building in early February.

The 7' tank was removed from the ATS building and placed in storage. The tank transport vehicle remains in the clean room, however. It will be used to support the shadow shield hardware during assembly and to transport the test package to "K" Site.

For the 8' cryoshroud, baffles are being modified to correct for excessive warpage which occurred during fabrication. This work is being done by contract with completion scheduled for early January. A contract was also let for the fabrication of an insulation system for the outside of the 8' shroud. Delivery is expected late in January.

Vacuum jacketed piping for the third LH_2 supply line inside the chamber was installed, cold-shocked, and proof tested. Shop fabrication of the new LN_2 supply piping into the vacuum chamber was also completed. Installation is planned for January.

Requirements for an additional and flowing LH_2 guard on the fill and vent lines to both measure and guard tanks were defined. Design work was begun on this

(Continued on Page 31)

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

SHADOW SHIELD TESTS (Continued)

item as well as for the tank internal instrumentation rake.

Miscellaneous work completed includes a vacuum bakeout of the shadow shield struts, a water volume calibration of the 4' tank and the development of a method for installing radiation shields inside the shadow shield support struts.

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

A methane task plan was formulated and approved at the CRD section level. It is now awaiting branch level approval.

13-FT. CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

Contractor has been working to perfect the honeycomb bonding techniques. A cold wall sample is expected to be delivered to Lewis-Cleveland in January. Thermal cycle tests will then be performed at "K" Site to check bond performance.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

The hemispherical tank heads were delivered to Linde. Delivery of the completed test package to Lewis-Cleveland is expected March 2, 1970.

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

PENETRATION EFFECT (YPR2023) — CRD - W. R. JOHNSON; RSD - N. L. SCHROEDER

One test was performed on the flat plate calorimeter during the month of January. The high boil-off rate of LH_2 in the measure tank continued to be a problem. However, a significant drop to 7.5 SCFH from a previous rate of 22.0 SCFH was observed after the installation of LH_2 cold guards in the measure tank fill and vent lines. This confirmed the suspicion that convection of GH_2 in these lines was the cause of the high boil-off rate.

The calorimeter was removed from the test chamber. A modification of the measure tank fill and vent system will be required to eliminate the gas convection problem.

The 30-inch diameter cylindrical calorimeter with a 20 layer spiral wrapped insulation system in presently being installed at "K" Site. Testing of the 30-inch calorimeter is expected to start the second week of February.

SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

Work accomplished in support of the shadow shield task is as follows:

(1) Instrumentation rake is complete and has been received at Plum Brook.

(2) The secondary cold guard is complete and will be installed by the end of February.

(3) The installation of the internal radiation shields in the shadow shield support struts has been completed.

(4) Thermocouple installation on the outside surface of the support struts is in progress and should be completed by the end of February.

(5) The 4' ADL calorimeter has been cleaned since the water volume calibration.

(Continued on Page 29)

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

SHADOW SHIELD TESTS (Continued)

(6) Two vacuum chamber LN_2 supply lines were installed, cold-shocked and proof tested.

(7) The task of covering the outside surface of the 8' cryoshroud with aluminized mylar is in progress.

Also the modification of the baffles is almost complete with delivery expected by the second week of February.

It is expected that the shadow shield test package will be complete by the second week of March.

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

The test plan formulated and approved at the CRD section level is still awaiting action at the CRD branch level.

13-FT. CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

Another cold wall sample has been completed by the contractor and will be sent to Plum Brook the first week of February. This sample will then be tested at "K" Site to check honeycomb bond performance.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

The delivery of the tank heads to Linde as reported last month was in error. Labor problems have prevented the fabrication of the tank heads. The expected delivery date of the test package to LeRC has slipped to May 4, 1970.

Feb. 1970

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

PENETRATION EFFECT (30" CYL. CALORIMETER) (YPR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

One test was performed during the month of February. This test was a repeat of the final test of the previous series which ended in August of 1969. Results were almost identical and showed no serious degradation of the insulation during the six month storage period. This 20 layer test also served as a base line condition for the next tests which will be performed with 15, 10 and 5 layers of insulation. The next test will probably be delayed until the last week of March due to a shortage of manpower caused by "B-2" operations.

SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

During the cleaning of the ADL 4' calorimeter following the water volume calibration, a leak was discovered in the brazed joint where the stainless support neck enters the copper tank. Preliminary attempts to rebraze only the leaking area failed so the whole joint was rebrazed. The calorimeter was leak checked and cold shocked with LN_2. The final leak check is in progress at this time.

The straightened baffles for the 8' cryoshroud were delivered during the month of February.

All other work on the shadow shield hardware has almost come to a complete halt due to lack of manpower.

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

The test plan has been approved at all levels and work will start on this program in the near future.

13-FT. CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

The second cold wall sample shipped to LeRC-Cleveland by the contractor was unsatisfactory and returned without testing. A meeting with the contractor will be setup to discuss the latest problems.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

No change in delivery date for tank heads or schedule.

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

PENETRATION EFFECT (30" CYL. CALORIMETER) (YPR2023) — CRD - J. E. MALOY; RSD - N. L. SCHROEDER

Three tests were performed on the 30" aluminum, cylindrical calorimeter during the month of March. The test configuration consisted of the aluminized mylar/silk net system with 15, 10 and 5 layers of insulation. Preliminary tests results indicated that system performance was better than predicted for the lower number of radiation shields.

One more test on the calorimeter will be performed with all of the radiation shields removed. The calorimeter will then be sent to the ATS Building where a new 160 layer spiral wrap insulation system will be installed for testing at a later date.

SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

During March the test package buildup work continued at the ATS Building. The 8' cryoshroud cylindrical section was covered with aluminized mylar. Stiffener rings were added to the shroud baffles, and baffles were sandblasted to remove damaged paint. All shroud Rosemount temperature sensors were installed. Lead wires remain to be installed.

Weld work to install a flowing cold guard on the guard tank was completed and cold shocked. Guard tank Rosemount temperature sensors were installed except for lead wires.

The mass spectrometer leak check of the rebrazed neck joint showed no significant leak after cold shocking with LN_2. Aluminized mylar coating damaged during the neck joint repair was replaced. The 30 layer insulation blankets were cut out, fitted to the measure tank and thermocouples were installed. Insulation work will be completed the first week in April. The shadow shield support strut instrumentation was completed, and a new work stand, for handling the shadow shield test package, was fabricated on contract and delivered to Plum Brook.

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

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

The purchase request for LCH_4 sampling system valves was approved and is now in Procurement.

13-FT. CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

A third cold wall sample was received from the contractor. A series of over 70 thermal cycles with LN_2 resulted in no detectable damage to the sample.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

The Semi-System test plan has been written and is being circulated through CRD for approval.

The tank heads were received by Linde and tank fabrication is in progress. The completed assembly is expected to be delivered to Lewis-Cleveland the first week in May.

The He purge bag for the guard tank is presently being fabricated in Cleveland.

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

PENETRATION EFFECT (30" CYL. CALORIMETER) (YPR2023)

CRD - J. E. MALOY;
RSD - N. L. SCHROEDER

The final test of the series on the 30" dia. aluminum cylindrical calorimeter was completed during the month of April. The calorimeter was removed from the chamber. It is awaiting shipment to the ATS Building, where a new insulation system will be installed on the calorimeter as soon as manpower becomes available.

The new insulation system will consist of 160 layers of aluminized mylar shields with "Tissueglass" instead of silk netting spacer material. The insulation will be applied in a continuous spiral wrap using the constant tension device at a layer density of 40 layers per inch.

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

SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

Test package buildup continued at the ATS Building. The 30 layer insulation blanket for Test #2 was completed using the test tank as a template. Thermocouples were installed as required on the blanket. The next step was to mate the guard tank and measure tank and place then in the new work stand. The strut support ring, struts, and payload simulator were then installed on the measure tank.

Instrumentation work completed included the installation of all Rosemount temperature sensor lead wires on the test tank, guard tank and on the 8' dia. cryo-shroud. Instrument rakes were also installed in both tanks.

During the continuity check of the strut thermocouples, after assembly of the tank, several couples were found to be open or shorted. The payload and all the struts were removed. Repairs were made to the strut wiring. Then the struts and payload were reinstalled. At this same time it was also decided to paint the payload emitting - surface black to produce a high emissivity.

Several relatively major facility modifications were also completed in April.

Two new LN_2 supply lines into the chamber were completed, and a new N_2 roof vent was installed. The 7000 gal. LN_2 dewar from "J" site was moved to "K". New penetration and vent lines for the flowing LH_2 cold guard were also installed.

It is expected that the test package will be moved to "K" site during the first week in May. The anticipated starting date for the first series of Shadow Shield tests is June 1.

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

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

The bid opening for LCH_4 sampling valves will be May 1.

13-FT CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI

Construction of the 13' Cryoshroud has begun.The work accomplished by the contractor to date is as follows:

(1) Bonding of honeycomb to the sides, bottom and top panels is completed.

(2) All components have received two coats of of the required three coats of paint.

(3) Assembly of the side panels to the top and bottom manifold rings is complete.

(4) Leak checking is partially complete. All leaks found have been repaired.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

All performance tests, including leak test,pressure test and vibration test have been completed on the test tank by Linde. The Semi-System package is due to be shipped from Linde May 11.

Due to delays in the Shadow Shield test program, the Semi-System hardware will have to be stored for at least a month before it can be tested. Therefore, preparations are underway to provide a CO_2 purged cover bag for the Semi-System to prevent insulation deterioration during storage. Four (4) 50 lb. bottles of high purity CO_2 are on hand for this purpose.

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

PENETRATION EFFECT (30" CYL. CALORIMETER) (YPR2023) — CRD - J. J. MALOY; RSD - N. L. SCHROEDER

The installation of the new 160 layer insulation system on the 30" aluminum calorimeter has been postponed due to the full test schedule at "K" site. It is expected that six to nine months will elapse before the test can be re-scheduled.The insulation work will be performed immediately preceding the new test date.

This program will be dropped from the monthly status report until work is resumed.

SHADOW SHIELD TESTS (YPR3119) — CRD - R. V. STOCHL; RSD - J. E. CAIRELLI

All test package buildup work at the ATS Building was completed. The test tanks and 8' cryoshroud were moved to "K" Site.

The test tanks were then assembled to the cryoshroud. But before moving the test assembly into the chamber, all tubing connections were leak checked. Leaks were found in the welds which join the Marman flanges to the guard tank tubes. After much difficulty, the leaks were repaired using silver solder.

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

SHADOW SHIELD TESTS (CONT)

At that time the test assembly was moved into the chamber. Plumbing, instrument and electrical connections were made to the test package. Heater power supplies and temperature controls for the payload simulator were also installed.

For control of the experiment and its environment, cryoshroud controls were built and installed. In addition a new boiloff valve was installed parallel to the measure tank boiloff valve to increase the boiloff control flow range.

The research people have requested a change in the measure tank fill line piping. This change consists of installing a liquid shutoff valve inside the chamber close to the test tank and installing a vent line and valve in the liquid fill line. The purpose of the change is to provide a means for prechilling the liquid fill line before topping off the measure tank.

The anticipated starting date for the first series of shadow shield tests is now June 15.

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

Bids were opened May 1 for LCH_4 sampling valves. G. W. Dahl Co., Inc. was the low bidder.

One prototype 2-way valve has been received and is being acceptance tested. If the tests prove the valve to be satisfactory, the contract will be awarded for (6) 2-way and (6) 3-way valves.

(Continued of Page 35)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	
		13-FT CRYOSHROUD (YPR3119) — CRD - R. L. DEWITT; RSD - J. E. CAIRELLI The 13' cryoshroud is completely fabricated. Preliminary leak checking is complete. Final acceptance testing at the contractor's plant will be done the first week in June. The expected delivery date for the 13' shroud is June 15.
		SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI The completed Semi-System test package was delivered to the ATS Building. It will be stored in the ATS Building until the first series of Shadow Shield tests is complete.

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

SHADOW SHIELD TESTS (YPR3119) — CRD - R. V. STOCHL; RSD - J. E. CAIRELLI

The measure tank fill line modifications were completed and the cryoshroud insulation installed.

Two system checkout runs using LH_2 were performed during June.

The first checkout run was made on June 19. Several hydrogen leaks developed while chilling the 8' cryoshroud and the test tanks causing the vacuum to decay. The run was aborted to determine the cause of the leaks.

Inspection of the SSP tube fittings used to connect LH_2 lines inside the chamber showed signs of leaks when tested with helium in LN_2. The tube fittings were modified to accept copper nose cones of the type used on AN fittings. The modified fittings proved to be leak-free in LN_2.

The second checkout run was started on June 23. The cryoshroud was chilled with LH_2 and the temperature controlled between 40° and 50°R. LH_2 required for a 16-hour period of no heat load shroud operation was 800 gallons. The individual shroud temperature controls work well but interact when operated at the same time. LH_2 flow capacity should be increased.

An H_2 leak developed when the measure tank was filled with LH_2. Also the test tank LH_2 shut off valves 248 and 262 showed signs of the leakage from the operators.

With the payload heaters turned off, the measure tank boil-off reached 23 SCF/hr. after only two hours from fill.

(Continued on Page 35)

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

SHADOW SHIELD TESTS (Continued)

The payload heaters were turned on to check the payload temperature control. At 600°R payload temperature the heaters separated from the payload.

Although the payload did not reach the 700°R operating temperature, the measure tank boiloff far exceeded the 120 SCF/hr. anticipated boiloff. The test was terminated to inspect the test package.

Inspection showed the heaters separated from the payload. A check of the measure tank surface showed no serious degradation of the aluminized mylar emissivity. The degradation was not sufficient to account for the high boiloff observed during the test.

A series of tests will be made to determine a suitable method for reattaching the payload heaters. Repairs will be attempted without removing the test package from the chamber.

The next anticipated run date is July 13.

LIQUID METHANE (YPR2500) — CRD - T. O. MCINTIRE; RSD - J. E. CAIRELLI

The prototype 2-way valve was tested and appeared to have minor problems which should be readily corrected. The contract was therefore awarded to G. W. Dahl for the 12 sampling valves. Delivery should be by late September 1970.

Due to the heavy schedule of test work in the "K" Site chamber, it is unlikely that this project can be worked before calendar year 1972. Therefore, this job will be dropped from the report until such time as manpower and test time become available.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (YPR3762) — RSD - J. V. GILLETTE The 13' cryoshroud and handling cart were delivered to Plum Brook for storage prior to RPM testing. The heat sealed plastic covering blew off while enroute from Massachusetts. As a result the special high emissivity surfaces were degraded due to an accumulation of dirt, road dust, and bugs. In some areas the high emissivity black paint had been scraped during handling. The entire honeycomb and baffle surfaces will have to be cleaned and spot painted prior to testing in the vacuum chamber. The shroud did not appear to have any structural damage during shipment. Both the shroud and the handling cart are being stored in Building #9205. A protective plastic cover will be placed over the shroud to reduce further accumulation of dirt and dust. SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI The Semi-System test package has been bagged and is being purged with a small continuous flow of CO_2. Purging is necessary to prevent contamination of the CO_2 in the insulation panels. The purge will continue until the semi-system package is installed in "K" Site.

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

SHADOW SHIELD TESTS (YPR3119) — CRD - R. V. STOCHL; RSD - J. E. CAIRELLI

Following the June 23 run attempt, the shadow shield test package was opened to reinstall the heaters on the payload. Both adhesive and mechanical clamps were used to hold the heaters. The original adhesive selected by ADL was used but with the addition of a primer coating recommended by the adhesive manufacturer. Eight additional thermocouples were installed between the heater blankets and payload.

The tank surface emissivity was checked using a portable comparator. The mylar covering on the upper half of the measure tank appeared excessively deteriorated. It was therefore replaced. Two minor leaks were found and repaired in the measure tank piping.

Shadow shield testing was resumed on July 20, 1970. Prior to flowing LH_2 into the system, the payload heaters were turned on. The heater power supplies operated only at full power and would not regulate. Testing was delayed until the following day to allow time to repair the power supplies.

On the following day, July 21, 1970, the cryoshroud and test tanks were filled with LH_2. The measure tank was filled first. Chamber pressure before filling the measure tank was 2×10^{-6} torr. After filling, the chamber pressure was up to 5×10^{-5} torr, (Approximately 13 atm. cc/sec. leak). With the guard tank cold but not filled, the chamber pressure increased to 2×10^{-4} torr, (Approximately 52 atm. cc/sec. leak). With the guard tank filled to the top, the chamber pressure exceeded 1.5×10^{-3} torr. The payload heaters were operated continuously during the run to maintain the payload temperature at approximately 530° R. Almost full power was required to maintain temperature. The large LH_2 leak prevented obtaining reliable research data. However, LH_2 runs were made on July 22 and 23 to accomplish the following:

(1) To improve shroud temperature controls under operating conditions.

(Continued on Page

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	(Continued) (2) To improve the payload temperature controls under operating conditions. (3) To determine source area of LH_2 leaks. (4) To determine effectiveness of LH_2 shutoff valves inside the chamber. Following test runs, the LH_2 piping was again checked for leaks. Two small leaks were found in the modified SSP tube fitting, and a larger leak was found in the measure tank LH_2 shutoff valve flange seal. All SSP fittings were replaced with AN type tube fittings. The Raco flange seal was replaced with a Creavey seal. The three instrument feed thrus used on the test tank were removed and leak checked in LN_2. The feed thrus from the top of the cold guard tank were tight while warm, but leaked excessively when chilled in LN_2. The other two connectors had less than 10^{-5} atm. cc/sec. leak both warm and cold. Preparations are now underway to make a LH_2 cold shock and vacuum leak check the first week in August. If the test is successful, the test package will be completely assembled and boil-off testing resumed during the week of August 10, 1970. <u>RESEARCH PROPULSION MODULE</u> (YPR3762) RSD - J. V. GILLETTE Repairing, cleaning, and repainting of the 13' cryo-shroud surfaces were negotiated with the contractor, Tenvac. Tenvac agreed to recondition the surfaces and has completed spot replacement of damaged honeycomb. Final cleaning and painting will be accomplished when the modified, conical shroud bottom is delivered in September. Design and procurement of the shroud heater system (blanket heaters, DC power supplies, and temperature controllers) are currently in progress. An equipment search is being conducted in Cleveland and Plum Brook to locate existing power supplies and controllers. Due to the lack of a formally published Test Plan (reference LHB 8220.2) and module design, some areas of the test facility build up are not adequately defined. Specifically, the assembly-clean room requirements and some piping requirements are lacking.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	
		SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI
		The Semi-System test package has been bagged and is being purged with a small continuous flow of CO_2. Purging is necessary to prevent contamination of the CO_2 in the insulation panels. The purge will continue until the semi-system package is installed in "K" Site.

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

SHADOW SHIELD TESTS (YPR3119) — CRD - R. V. STOCHL; RSD - J. E. CAIRELLI

The LN_2 cold shock and vacuum leak check of the test assembly was completed during the first week of August. The system was able to maintain a chamber pressure of 4.8×10^{-5} Torr with both the measure tank and cold guards filled with LH_2. Final assembly of the completed test package was then completed in preparation for the first series of tests.

The first test configuration for the base line test consisted of the complete test package assembly (measure tank, cold guards, payload simulator, and support struts) enclosed in the 8' diameter cryo-shroud but without any shadow shields installed. During the period of August 13 through August 21, Phase I tests (utilizing LH_2 in both the test package and the cryo-shroud) were completed. Steady state data consisting of support strut temperature profiles and measure tank boil-off rate were recorded with the payload simulator at LH_2 temperature, 530°R and 700°R.

After allowing the test package to warm up and making some minor plumbing changes outside of the vacuum chamber, Phase II of the test was completed during the period of August 24 through August 27. Phase II tests utilized LN_2 in the measure tank and cold guard and LH_2 in the cryo-shroud. Steady state data was recorded for payload simulator temperatures of 530°R and 700°R.

Preparations for removal of the test package from the chamber are in progress. After removal from the site, the tank will be sent to the ATS clean room where build-up for the next test series will be performed.

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

RESEARCH PROPULSION MODULE (YPR3762) — RSD - J. V. GILLETTE

An evaluation of instrument lead wire for RPM thermal studies will be conducted during September in the "K" site "little rig". The design and build up have been completed for the test fixture and necessary instrumentation.The test objective is to evaluate the noise level associated with small lead wires on platinum resistor temperature probes. The smaller wire (.003, .005, or .010 as opposed to 24 AGW)is preferred to reduce heat leaks in the forthcoming RPM tests.

A presentation of the clean room-assembly area requirements was made at Plum Brook by the research personnel. Specifications included humidity, temperature, and cleanliness levels plus an estimate of required floor space. A study has been initiated through the Engineering Division to determine where this assembly area can be located to meet the necessary clean room standards.

The design was completed for the 13' shroud warm-up system, and the power supplies, heater pads, and instrument amplifiers were placed on order. The original intended supplier for heater pads may not be able to meet electrical resistance specifications. This is not expected to be a problem, however, as other supply sources are available.

An engineering study of the requirements for cryogenic flow measurements in five locations was completed. Venturi tubes will be used for the module fill and expulsion flow measurements on both tanks. Flow measurements required for the initial 13" shroud tests will be made with a turbine type meter.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

Installation of the Semi-System test package into the "K" Site vacuum chamber will begin as soon as the shadow shield test package removal is completed.It is expected that installation will be completed during the month of September and that testing will begin early in October.

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

SHADOW SHIELD TESTS (YPR3119) — CRD - R. V. STOCHL; RSD - J. E. CAIRELLI

Following the first series of shadow shield tests, a leak check of the 4" diameter ADL tank showed excessive leakage in the area of union between the stainless steel neck and the copper tank wall. Close visual inspection of the joint showed a large void under part of the braze fillet. The tank was sent to Cleveland for repair. The stainless steel neck has been cut off at the copper sleeve on the tank wall. A copper ring will be furnace brazed to the stainless steel neck. Then the copper ring will be welded to the copper tank sleeve. The tank will then be LN_2 cold shocked and leak tested at Lewis-Cleveland.

While at Lewis-Cleveland the tank will also be fitted with mounting pads to locate the strut support ring.The tank should return to Plum Brook the first week in October.

RESEARCH PROPULSION MODULE (YPR4173) — RSD - J. V. GILLETTE

Boeing Aircraft Company is currently fabricating the 15 layer insulation blankets. The blankets are comprised of alternate layers of aluminized mylar and silk netting. Three sets of two blankets each have been contracted for these tanks;no spare blankets were ordered. Representatives from Plum Brook and Cleveland were present to inspect the initial forming operations. Due to forming problems which required development of new techniques, the work appears 2 - 3 weeks behind schedule.

Noise level tests on .003", .005", and .010" diameter instrument lead wires were completed in September. Initial data evaluation indicates that no increase in noise level was discernible with the smaller wire. Temperature readings in LH_2 did not appear to be in error. Following data playback and close evaluation of the data, a test report will be distributed.

(Continued on Page 35)

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

RESEARCH PROPULSION MODULE (Continued)

The 13-foot shroud honeycomb surfaces have been completely repaired and repainted by the contractor, TENVAC. The shroud and all associated pieces have been bagged and sealed from environmental dust and dirt deposits during storage.

Fabrication of the conical shroud bottom has been delayed due to forming problems. TENVAC is in the process of developing new rolling procedures; delivery date has been tentatively set for the latter part of November.

The shroud heater system instrument amplifiers have been delivered. The order for heater pads has been placed, and delivery is expected on schedule. The system power supplies are currently out for bid; specifications were written to include standard commercial units.

Thirteen-foot shroud/shadow shield test details are still being finalized. The shadow shield thermal tests will be accomplished with the shroud checkout test. A series of preliminary material tests have been initiated. These tests are to determine stretch properties of the X-850 membrane material plus the adhesive qualities of the tape and glue at cryogenic temperatures.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

The Semi-System test package is being installed in the "K" Site vacuum chamber. Installation will be completed the first week in October and testing will begin the second week in October.

OTHER WORK

The new LH_2 piping to the R.R.dewars is being installed and should be completed the first week in October.

The contractor is on the job constructing the flood control system for "K" Control Building.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY (Continued)	Plum Brook Rocket System Division has recently spent a considerable effort in closely planning the use of manpower to support the active test sites. Successful use of this planning depends upon timely completion of scheduled tasks. And only four weeks after the approval of the plan, HTF has apparently already slipped three weeks due to contract implementation considerably different from that information which was fed into the plan. Repairs to the 30" steam line are still not completed. The original hydro test indicated a leak in one of the bellows joints. A patch for this bellows was ordered, received, and welded into place. However, refilling the pipe with water revealed another leak on a girth weld of the same bellows joint. Steam ejector checks are planned for the last three weeks of November following repairs now in progress. Plum Brook has recommended the purchase of a new bellows joint as a safer approach than the questionable repair of the existing bellows. The oxygen piping contract was awarded to Mechanical Fabricators, Inc. The completion is scheduled to be 30 days following the delivery of the last of six oxygen bottles. These are still scheduled for delivery January 14, 1971, from Riley Stoker Company.
K	CRYOGENIC PROPELLANT RESEARCH SITE	<u>SHADOW SHIELD TESTS</u> (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI Repair work at Cleveland was completed on the 4' diameter ADL tank. The tank was returned to Plum Brook. It was then LN_2 cold shocked and mass spectrometer leak checked. No leaks were found. Work is under way to build up the test configuration for the second series of shadow shield tests. The present schedule shows the shadow shield tests resuming in mid-January 1971.

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

RESEARCH PROPULSION MODULE RSD - J. V. GILLETTE (YPR4173)

Fabrication of the insulation blankets is behind schedule. The contractor, Boeing Aircraft Company, has requested a six week delivery extension from mid-November to January 1, 1971. The primary problem is in the thermal vacuum forming of the X-850 cover material. This is a reinforced aluminized mylar which exhibits "spring-back" in the die instead of retaining the form of the die.

Preliminary 13' cryoshroud test build up was started during the last week of October. The shroud was moved from storage to "K" site where the round head honeycomb retaining screws were replaced with counter sunk flat head screws. This modification was required for installation of the heater pads. A series of cryogenic tests were conducted on the D. C. 93-046 adhesive and primer to assure adequate adhesion of heater pads at LH_2 temperatures.

The shroud heater system components are all on hand except for the power supplies and additional heater pads. Bid opening for the power supplies is scheduled for November 6. The additional heater pads are required due to modifications of the layout configuration. The additional pads for one baffle and the new conical shroud bottom will be ordered during the first week of November.

The modified conical shroud bottom delivery may be again rescheduled beyond November 30. The shroud bottom and a cryoshroud vacuum tank are both being fabricated by TENVAC. The contractor may require additional time to deliver the conical bottom if it becomes necessary to expedite the cryoshroud vacuum tank for early RPM component testing at RETF.

Other RPM activities include:

(1) Safety approval of fire resistant fabric enclosure for a clean room assembly area at K site.

(Continued on Page 31)

K SITE

SEMI-SYSTEM YPR1327

	STATUS	SCHEDULE
K	First test completed and tank was shipped to Goddard.	
	Tank is scheduled to be returned	November 16, 1970.
	LN_2 piping to railroad dewars completed.	

CHANGES: Schedule change.
(Since last report)

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

RESEARCH PROPULSION MODULE (Continued)

(2) Completed the design and initiated installation of 4" LH_2 vacuum jacketed supply line in the vacuum chamber.

(3) Completed the changeover from a 4" inlet to a 1-1/2" inlet LH_2 line on the 13'cryoshroud.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

The first test on the Semi-System was completed. The boiloff rate appeared to reach a steady state value of 43 SCFH (approximately 43 BTU/hr heat leak).

Inspection of the Semi-System test package showed the following degradation of the insulation:

(1) (2) external thermocouples had lifted from the surface.

(2) The bottom insulation panels separated from the tank fasteners.

(3) The glued seams between insulation panels separated in some areas.

The above mentioned items were repaired at K site. The tank was then shipped to Goddard for vibration testing. The tank is due to return to K site on November 16 for the second and final test now scheduled for late November.

OTHER WORK

The new LH_2 piping to the R.R. dewars has been completed.

The "K" Control Building flood control system contract is approximately 90% completed. Job is presently waiting for Government approval of plans for steps over the dike. All work should be completed during November.

Poles have been set and all new fixtures installed for the additional exterior lighting for "K" site. The contractor is held up for delivery of underground cable. This contract should be completed during November.

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

SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

Build up work on the test configuration for the second series of shadow shield tests is continuing at the ATS Building. This work is expected to be completed in time for installation into "K" Site the second week of December. Testing will resume in mid-January.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

Heater pads were installed on the 13' cryoshroud walls, top, and two baffles during November. Over 260 individual heater pads were required. Additional heaters for the shroud bottom and the third baffle plate are currently in Procurement.

Electrical terminations for the shroud wall heater were completed. Approximately 25% of the top terminations were completed. Thermocouples for the temperature control were installed, as well as over one half of the shroud Rosemount instrumentation. Work on the shroud was stopped as scheduled on November 23 to prepare for the second series testing of the Semi-System.

Bids were opened for the power supplies for shroud heater control system during November. Delivery is scheduled for mid-December.

The preliminary design and assembly procedure is complete for the 10' shadow shield. Shadow shield parts are scheduled for delivery from Cleveland during December. An estimated 160 man hours will be required for the assembly which is scheduled for completion in December, pending the availability of manpower.

Preliminary design for the ATS clean room modification is completed. Modifications include an air lock entry, equipment access door, temperature and humidity control, and air distribution and filter system. Final drafting and purchase of materials will be initiated in December.

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

RESEARCH PROPULSION MODULE (Continued)

The primary area of concern at "K" Site is an adequate supply of manpower. Thermocouple shop hours applied to the ADL Shadow Shield buildup in the ATS Building were less than requested. This resulted in a later-than-scheduled completion, which is very close to impacting the overall RPM schedule.

In addition, manhours requested for the application of heater strips to the cryoshroud was underestimated. This will require some further manpower expenditure between now and the cryoshroud test date to catch up.

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

Vibration testing at Goddard on the Semi-System package was completed. The tank was returned to Plum Brook November 18.

Inspection of the test package showed damage to several of the insulation panels. Damage was apparently due to overpressure in the space behind the panels. The panels still look to be structurally and thermally sound.

In order to avoid repair of the insulation panels, the entire package will be enclosed in a plastic bag and purged with CO_2.

The Semi-System test package is presently being installed at "K" Site with testing expected to begin December 7.

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

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

The RPM build up and test schedule has been modified to reflect the new hydrogen tank delivery of May 1. The chemically milled gore panels are requiring more set up time than was originally estimated by the manufacturer.

All hardware for the RPM, prototype 10' shadow shield has been delivered from LeRC-Cleveland. Assembly will start by the 1st of the year in ATS. Completion is scheduled no later than February 1. However, this date is dependent on the available manpower. Thermocouple shop personnel have been in short supply the past several months.

Manufacture of the 13' cryoshroud conical bottom has not been completed. A heater control circuit will be designed for the original flat bottom and additional heater strips will be purchased to avoid test delays if the conical bottom is not delivered as scheduled.

Boeing Aircraft Co., has completed and shipped the LH_2 tank insulation system. Delivery is expected by January 7.Purchase requests for instrumentation and controls connectors and pins were written for current and future RPM requirements.

The H-F module electrical wiring design is approximately 50% complete. Design of the supporting "K" site electrical wiring is in the preliminary stages. Purchase of electrical hardware will be initiated during January. The H-F module instrument wiring harness design was completed. The harness layout is designed to mate with present and new facility cables.

SITE	SITE NAME	RESEARCH INSTALLATION * (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	

SEMI-SYSTEM (YPR1327) — CRD - J. R. FADDOUL; RSD - J. E. CAIRELLI

On December 7 we began the second SEMI-system test. For this test the entire test package was enclosed in a plastic bag and purged with CO_2. The test was terminated on the following day with a steady state boiloff rate of 1630 SCFH. This was approximately four times the expected value.

The high boiloff rate was caused by poor vacuum in the insulation panels. The lowest pressure recorded in the panels during the run was 25μ Hg.

To bring the boiloff rate to acceptable levels the purge bag was removed and the insulation panel port covers removed. This permitted the panels to be evacuated to the vacuum chamber pressure.

On December 14 the test was re-run. Steady state boiloff for this test was 38 SCFH.

The SEMI-System tank has been removed from "K" Site and sent to LeRC-Cleveland. The insulation panels will be removed there and inspected.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

A series of 0-9000 RPM spin up tests of the first pressure measuring system have been successfully run on the SE-13 Cold Spin Test Rig. The tests were made to compile data to assess the repeatability, accuracy, and reliability of the system. The test data will be reduced to tabulations and plots of comparable speed points of the spin up and spin down excursions. Preliminary examination of the data shows the system is repeatable, accurate, and reliable and

(Continued on Page 43)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY	HRE (GARRETT ENGINE) (Continued) The high pressure water system was worked on by the pipe shop, and some prefabrication work has begun. Final tie-ins cannot be done until the Hot Train components are in place. The job is approximately 10% complete. The high pressure GN_2 tie-in to the diluent injection flange, and film cooling flange were begun. Again, final tie-in cannot be done until the hot train is in place.The job is approximately 20% complete. Assembly of the hot train will begin as soon as the bakeout test is complete. At this time, it appears that this will be during the weeks of March 8 to March 26, 1971 dependent upon availability of manpower. Note that repairs to the damaged power ports will delay the entire HTF schedule from four to six weeks.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

LH_2 TANK TEST PROGRAM SCHEDULED TO START	June 1971.
10' diameter prototype shadow shield is 75% complete.	
Radiation Shield completed.	
Hold down tabs needed to finish second shield.	
Semi-clean assembly area modifications progressing.	
Air Conditioning unit bids open.	
Air Conditioning installation purchase request scheduled for . . .	Early February.
Construction modifications purchase requests being processed.	
Roll-up door contracts scheduled to be awarded . . .	February 5.
13' cryoshroud bottom was delivered.	
Conical bottom delivery scheduled for	February 26.
LH_2 tank cold guard design review scheduled to be completed by	February 5.
Design, fab. and installation PR for K Site semi-clean assembly area is in process.	
H-F module electrical desing is completed.	
Electrical and instrument interface (module and facility) in process.	
Cold guard instrument connectors are being tested.	

CHANGES: Schedules added.

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

SHADOW SHIELD TESTS (Continued)

A second test with the insulation removed and the test tank filled with LN_2 was started on January 26 and is now in progress. Results of this test are not yet available. The test will be completed the first week of February.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

The prototype 10' diameter shadow shield is about 75% complete. One radiation shield is complete and the second shield requires hold down tabs. To finish the prototype, the radiation shields must be stretched, assembled, marked for instrumentation, disassembled, instrumented and reassembled.

Purchases for the semi-clean insulation assembly area modifications are well underway. Bids for the air conditioning blower unit and cooling units have been received and are being evaluated. Purchase request for the air conditioning installation will be written in early February. The construction modification purchase requests are being processed. An award of contract for the roll up door will be made by February 5.

The 13' cryoshroud bottom has been delivered. A Contract extension has been granted to TENVAC to complete the conical bottom by the end of February. Heater pads are available for installation on the flat bottom and one remaining baffle plate. Additional heater pads are being ordered for the conical bottom.

The LH_2 tank cold guard design is ready for final review which will be accomplished by February 5th.

A purchase request for the design, fabrication and installation of the K site fabric enclosed semi-clean assembly area has been written and is in process.

(Continued on Page 39)

NARRATIVES ON ADJOINING PAGE

PROJECT TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Cold Spin testing scheduled for . . . . . . Advanced system drawings modified and released for manufacture.	January 2, 1971 to April 26, 1971.

CHANGES: Schedule added.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (continued)

The H-F module electrical wiring design is complete and ready for final review. Design of the electrical and instrument interface between the module and facility is in process.

Instrument connectors to be used on the cold guards are being tested in the K Site "little rig". These tests are to determine e.m.f. levels between pins due to thermocouple effects when the connector approaches LH_2 temperatures. Acceptability of a standard off the shelf connector may reduce costs as well as save time by eliminating the need for long lead custom manufactured connectors.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

The Cold Spin Test Rig data taken last month was shown to be inconclusive because of the pressure polarity reversals and overranging. Plans are being made to change some ranges and re-route some of the pressure connections. Testing is expected to continue throughout the month of February.

The advanced rotating 72 channel temperature and pressure measuring system drawings have been modified to include the changes expressed in the comments made by involved personnel from the Air Breathing Engine Division and the I & C Division. The drawings have subsequently been released for manufacture.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119
TESTS ARE IN PROGRESS Two tests completed in February. Next test scheduled for		March 8, 1971.

CHANGES: Schedule added.

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

SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

During February two shadow shield tests were completed. Both were made with LH_2 in the cryoshroud, LN_2 in the test tanks and with two shadow shields installed.

In order to maintain a constant tank pressure at steady state conditions, heat was added to the measure tank. This was done by means of light bulbs mounted inside the measure tank.

For the first test, shadow shields were equally spaced between the tank and payload. With the payload temperature maintained at 530°R, the heat energy required to maintain steady state conditions was .872 watts. For a payload temperature of 700°R the power requirement dropped to .843 watts.

The second test was made with the shadow shields moved close to the payload. The spacing between payload and measure tank remained the same as for the earlier test. The payload temperature was held at 700°R. Steady state heater power was .63 watts.

Hydrogen leakage from the dewar 8" bayonet connections has been a problem during long duration tests. Midway through the first test, a rubber O-ring seal in the LH_2 railroad dewar 8" bayonet was replaced with a spring loaded teflon (Creavey) seal. No leakage has developed since.

The shadow shield test package was due to be removed from K site and modified for the final test configuration. But an additional run has been requested using the present configuration but with strut insert modifications. The next shadow shield test is scheduled for March 8. Following this, the shadow shield test will be removed and the 13' cryoshroud test installed in the chamber.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

13' CRYOSHROUD TEST SCHEDULED TO START	April 12, 1971.
LH_2 TANK TEST PROGRAM SCHEDULED TO START	June 1971.
Cryoshroud instrumentation and assembly scheduled to be completed.	Week of March 18.
ATS building semi-clean assembly area proceeding as scheduled.	
Air conditioning and blower order let.	
Air lock construction completed.	
Roll up door ordered.	
Fabrication of 13' cryoshroud is scheduled to be completed	March 16, 1971.
LH_2 tank cold guard is in drafting.	
PR for (K) semi-clean area was approved.	
Low cost instrument connectors were tested at K site "Little Rig".	

CHANGES: Schedules added.

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

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

The 13' cryoshroud tests have been tentatively rescheduled to begin the week of April 12. Rescheduling was required because of a two week extension of the ADL 8' cryoshroud research program for an additional test.

The 13' cryoshroud test includes one prototype 10' shadow shield and the payload simulator. Instrumentation and assembly of the shadow shield will be complete by the middle of March. Some delay was encountered with the shield instrumentation in developing satisfactory strain gage application techniques. The payload simulator has been completed at Lewis and is ready for delivery to Plum Brook. Six Rosemount temperature transducers must be installed prior to installing the payload simulator. The cryoshroud is ready to install, except for completion of the heater terminations on the shroud bottom.

Modifications to the ATS building semi-clean insulation assembly area are progressing on schedule. A contract for purchase of the air conditioning and blower units has been let. Installation of the units is on a separate purchase request currently in procurement. Construction of the air-lock personnel entry is complete. The new roll up door has been ordered and will be installed in-house.

The 13' cryoshroud conical bottom is reportedly in final stages of fabrication. All sheet metal forming is complete. All but the lower cooling tubes have been welded in place, and approximately 75% of the honeycomb installed. Shipment from the contractor's TENVAC plant is expected on the 16th of March.

A design review of the LH_2 tank cold guard has been completed with respect to materials, fabrication, and thermal characteristics. The cold guard design is currently in drafting.

(Continued on Page 45)

NARRATIVES ON ADJOINING PAGE

PROJECT TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

First pressure measuring system cold spin test stopped for another project. Slip ring needs repair will be shipped to manufacturer. Design of the 5 range pressure transducer is complete and fabrication should be completed by	April 30, 1971.

CHANGES: Run schedule changed.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (Continued) The purchase request for the design, fabrication, and installation of the K site fabric enclosed semi-clean assembly area has been approved. Request for bids will be made early in March. Tests were conducted on low cost instrument connectors with the K site "little rig". The test results were inconclusive due to emf levels observed between various pins. These emf levels were not present on previous tests with the 8' cryoshroud. Further testing will be made on the 8' cryoshroud. Reviews may also be conducted in the "little rig".

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

The first pressure measuring system has been removed from the Cold Spin Test Rig and will be re-installed at a later date. The rig is being used for another project. During this "off the rig" period, the first pressure measuring system will be refitted with different range pressure transducers. The slip ring will again be exchanged back to the original reworked one. Four channels of the replacement slip ring appear to have broken or poor contacts to the lead wires that connect the rotor contact discs to the terminal block. Since the ring is still under warranty, it will be shipped back to the manufacturer for repair.

All phases of the procurement of items for the advanced rotating 72 channel temperature and pressure measuring system are on schedule. The Engineering design work for the 5 range pressure transducers has been completed. Datametrics is now waiting for delivery of the materials and parts needed to build the first unit. The target completion date of April 30, 1971 looks good at this time.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119

FINAL TEST OF THE SECOND SERIES COMPLETED (March 12)	
SHADOW SHIELD UNDERGOING CONFIGURATION CHANGES.	
NEXT SERIES OF TESTS TO BEGIN	Week of June 1, 1971.

CHANGES: Schedule added.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY (Continued) CONTROLS The steam regulating system operated satisfactorily during ejector check out. Maximum run time before loss of 200 psig controlled pressure was 275 sec. The events recorder-controller trip system to monitor the HRE engine water pressures has been checked out. The programmer block skip and reader advance modifications are complete and checked out. The facility flow computer is due at Plum Brook the early part of April. The abort program for the CF-16 computer has been compiled and is approximately 50% checked out.
K	CRYOGENIC PROPELLANT RESEARCH SITE SUMMARY The K site test program is proceeding on schedule. The first of two series of ADL shadow shield tests is complete. The 13' cryoshroud for the RPM program is being installed. It is likely that GDC difficulties with the RPM LH_2 tank fabrication will cause major changes in future schedules. SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL ; RSD - J. E. CAIRELLI The final test of the second series of ADL shadow shield tests was completed on March 12. This test (#4A) was added to the original test plan. The purpose of this test was to obtain more information on the effect of the shield mounting method on the shield temperatures. The ADL shadow shield test package has been removed from K site and is presently at the ATS building undergoing configuration changes for the final series of ADL tests. This series of tests is expected to begin the first of June.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

13' CRYOSHROUD TEST SCHEDULED TO START	April 12, 1971.
LH_2 TANK TEST PROGRAM SCHEDULED TO START	October 1971..
Shroud tests are scheduled to start	Week of April 12, 1971.
Site changeover and build-up is approximately 1/3 comp.	
13' cryoshroud was delivered.	
Heater strips are being wired.	
Conical bottom for part 2 tests was delivered.	
Fabric enclosure sent out for bid.	
Air conditioning system is being designed.	
LH_2 tank delivery is scheduled for.	August 13, 1971.
13' shroud, 10' shield and payload simulator have been instrumented.	
Cabling and balance panels were modified for stain gages.	
Connector data is being obtained to justify "off-the shelf" type connectors.	
Logic design for B-Control data link was completed.	
50% of the software completed for tabular data in engineering units to the terminal.	
Subassembly wiring for the four heater control systems completed.	
Control room, test cell, and 3 payload simulator cont. systems wiring is completed.	
Wiring of the new temperature control valve is scheduled to be completed	Week of April 5, 1971.
Vacuum chamber wiring will be completed two weeks after shroud is installed.	

CHANGES: Schedule changes

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

As of March 18, all of the K site effort has been directed to build-up for the 13' cryoshroud tests, first test in the RPM program. Site changeover and build-up is approximately 1/3 complete. Currently the major stack-up (hardware assembled and hanging from the crane hook before lowering into the cryoshroud) consists of the index rails, the shroud top, the payload simulator with support ring, and two baffles. Hardware yet to be assembled on the stack-up includes the shadow shield assembly plus the 3rd baffle plate.

The 13' cryoshroud was delivered to K site on schedule and the previously installed heater strips are in final stages of being wired. Some difficulties have been encountered in this first time assembly due to necessary hardware modifications, field matching and fitting of parts and handling problems due to the size and weight of the pieces being assembled in a minimum size work area. The sequence of remaining major events is to complete the stack-up with all instrument and control wire runs, install the stack-up in the shroud, install the closed circuit TV, and install the total shroud test package in the vacuum chamber. The shroud tests are anticipated to begin the week of April 12.

The 13' cryoshroud conical bottom was delivered from TENVAC during March. The conical bottom will not be used until Part 2 of the RPM test program. Heaters and instrumentation will be installed during late May and the first part of June.

Bid requests for the K site fabric enclosure were sent out about March 15, with a 30-day response period. Air conditioning equipment for this assembly area is now in engineering design.

A major schedule change appears imminent in the K site - RPM test program. The LH_2 tank delivery is expected to slip approximately 15 weeks beyond the

(Continued on Page 49)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (Continued)

May 1 scheduled delivery. The delay is being caused by tank material which exhibits grain structure,plus a mismatch between tank hemispheres beyond acceptable tolerances. The tank contractor is GDC. A new test schedule is being formulated which may fill in available site time with the vertical calorimeter, technology test program.

INSTRUMENTATION

The 13' shroud, 10' shield, and payload simulator, have been instrumented. The site cabling and balance panels have been modified for stain gages. Additional connector data was taken during the ADL Tank test. Based on the data, commercial, off-the shelf type connectors may be purchased for the RPM project. However, one more test will be conducted in the "Little Rig" to support this decision. The logic design for the data link from the B-Control computer complex to the K site terminal was completed. 50% of the software job to provide tabular data in engineering units to the terminal was completed.

CONTROLS

All 13' cryoshroud subassembly wiring for the four heater control systems has been completed. The control room/test cell wiring and the three payload simulator control systems wiring is complete with only the vacuum chamber wiring remaining unfinished.

The wiring of the new payload temperature control valve is nearly complete and will be finished during the first week of April.All vacuum chamber wiring should be complete two weeks after the shroud is hung in chamber.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Delivery of the prototype 5 range pressure transducer is scheduled for	April 30, 1971.
The 10 channel pressure and 62 channel temperature measuring system, bid opening is scheduled for . . .	April 12, 1971

CHANGES: Schedules added.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

The procurement of items for the advanced rotating 10 channel pressure and 62 channel temperature measuring system is on schedule with no foreseen problems. The bid opening for the system package is April 12, 1971. Delivery of the prototype five range rotatable pressure transducer for spin testing is scheduled for April 30, 1971. The first model rotatable 10 channel pressure measuring system is now off the ERB SE-13 Cold Spin Rig for installation of different range transducers and the replacement of the defective slip ring assembly. It will be returned to the rig upon the completion of other turbine blade tests now in progress.

The first model rotating 10 channel pressure measuring system will again be installed in the cold spin rig with major modifications in the pressure tubing runs from the blade to the pressure measuring system. The testing will be confined to the effects of radial tubing runs to the circumference of the rotating disc. The original test turbine blade will not be used because an unpredictable aerodynamic structural interference is created when the rotating test blade passes the structural members of the test rig. Testing will concentrate on verifying the correction calculations required to compensate for the effects of air centrifuging in the radial pressure tubing runs, and will also provide additional operating experience for the overall pressure measuring system. The previous data taken is not too reliable because of poor internal wiring contacts within the slip ring and the turbulence problem.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119

ATS BUILD-UP OF TEST CONFIGURATION #5	
Scheduled completion by	Mid May.

CHANGES: Schedule change

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

SUMMARY

The ADL shadow shield rebuild is being completed with some shield and thermocouple changes.

Past test results have indicated that there is little or no gain to be achieved by applying more than 30-50 layers of multilayer insulation. This is a most significant departure from the results predicted by theory. To date, all efforts to reconcile the difference have been to no avail. Therefore, a new experimental installation will be fabricated and tested. During May the vertical calorimeter will be spiral wrapped with 160 layers of insulation and the testing will be fitted into the schedule starting in September. After each heat-leak test, layers will be removed and the test rerun.

Testing of the 13' cryoshroud, payload simulator and 10' shadow shield have been delayed. The delay was caused by poor workmanship on the shroud by TENVAC. Over 500 NASA manhours were expended to correct the problems. Similar poor workmanship has been found on the payload simulator heater assembly.

The environmental enclosure is being readvertised because the one responsible bid was $36,000 as compared with the Government estimate of $20,000.

ADL SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL ; RSD - J. E. CAIRELLI

Build up of the test configuration (#5) is presently under way at the ATS Building. The work load has increased from that originally anticipated for two reasons:

(1) The two original shadow shields had become deteriorated and are being replaced by new shields. These new shields had not been instrumented (17 thermocouples on each).

(2) Additional thermocouples are being installed on three support struts.

Work at the ATS Building is now expected to be complete by mid-May.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023
TESTING TO BEGIN		September 1971.

CHANGES: None.

RESEARCH PROPULSION MODULE	K SITE	YPR4173
13' CRYOSHROUD TEST SCHEDULED TO START		May 3, 1971.
LH_2 TANK TEST PROGRAM SCHEDULED TO START		October 1971.
ITEMS COMPLETED		
Shroud assembly installed.		
Conceptual air conditioning design completed.		
RPM insulation blankets delivered.		
LN_2 expulsion line contract awarded		May 1971.
Connector data affirmed.		
13' shroud, 10' shield and payload simulator placed in vacuum chamber.		
Control wiring for cryoshroud completed.		
New payload temperature control valve checked out.		
TV camera installed and checked out.		
ITEMS IN PROGRESS		
Service line seals being leak checked.		
Aluminized mylar radiation curtains being installed.		
Enclosure being relined.		
4" LH_2 line into vacuum chamber		May 1971.
Instrumentation data link.		

CHANGES: Schedules added.

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

VERTICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - J. E. CAIRELLI

A delay in the RPM program because of late hydrogen tank delivery has simulated renewed interest in basic multilayer insulation studies. A series of tests using spiral wrap insulation on the vertical calorimeter is now being planned. Testing is expected to begin early in September.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

Testing of the 13' cryoshroud, payload simulator, and 10' shadow shield assembly has been delayed approximately 4 weeks. Test rescheduling was required due to extended leak repairs and lengthy leak checks on the shroud. Approximately 20 helium leaks in the 10^{-6} to 10^{-4} std cc/sec range were found in the shroud "D" tube welds and in the flex hose brazed ends. In addition, the contractor supplied hoses and shroud service lines required cleaning to remove scale and brazing flux. Approximately 500 unscheduled manhours have been required due to the contractor's (TENVAC) shoddy workmanship and inept leak check methods. At the time of this writing the shroud assembly is in the chamber complete with operable closed circuit T.V. Service line seals are being leak checked. The aluminized mylar radiation curtains are being installed. Tests are currently rescheduled to begin during the first week of May.

Only one bid was received for the K site fabric enclosure although 43 potential bidders were included in the advertisement. The bid of $36,600 was not within available funds. The job will be sent out by May 7, for readvertisement. The "small business" clause will be omitted from the new IFB.

The K Site air-conditioning system conceptual design is complete. Final design and layout detail is in progress. Some Plum Brook surplus equipment will be utilized, such as a 25-ton air-conditioning condensing unit, switch gear panel,

(Continued on Page 49)

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

and a temperature monitor and control unit. Use of this surplus equipment represents approximately a $2,500 cost saving.

Final shipment of the RPM insulation blankets was received from Boeing Aircraft. The surface emissivity of the blankets was inspected, and the blankets stored on tank contoured forms.

Other facility work in process includes fabrication and installation of a new 4" LH_2 line into the vacuum chamber.This item is being worked in-house, and will be accomplished during May. A contract for an LN_2 expulsion line has been awarded. This, too, is planned for installation during May.

INSTRUMENTATION

The "Little Rig" was operated to affirm previous connector data. The positive results obtained allowed us to purchase off-the-shelf commercial connectors for future tests.

The 13' shroud with the 10' shield and payload simulator was placed in the environmental chamber. The mating of the test package to the site instrument cabling was routine.

Fabrication of the K Data Link is nearly complete. Checkout of the B-Control end has begun. A number of general software routines for the terminal have been completed.

CONTROLS

The vacuum chamber wiring for the 13' cryoshroud is complete. The four heater control systems for the shroud have been operationally checked out with satisfactory results.

The final electrical checkout of the payload simulator heaters revealed multi-resistance paths to ground. It was found that two heaters had low resistance shorts and that the remaining ten heaters measured from 20K to 500K ohms to ground.

(Continued on Page 51)

NARRATIVES ON ADJOINING PAGE

PROJECT TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

SE-13 TEST SCHEDULE	Month of May.
Slip ring and bearings replaced. New pressure transducers installed. Manifolds installed.	
10 Channel pressure measuring system reinstalled in SE-13 spin rig.	
Fabrication of advanced model scheduled to be completed by	May 31, 1971.

CHANGES: Schedule added.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (Continued) It was decided to disconnect the shorted heaters and attempt to run the payload simulator with the remaining heaters. It is hoped that the heaters will not deteriorate any further during the runs. The quality of workmanship on the payload simulator as received at Plum Brook was very poor. The new payload temperature control valve has been satisfactorily checked out. The TV camera to be used for viewing the shadow shield was installed in the shroud and checked out locally. Cleveland research personnel observed these tests and were satisfied that the system would meet their requirements.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The first model of the 10 channel rotating pressure measuring system has been refurbished and returned to the ERB SE-13 Cold Spin Rig for further testing and application experience.

Construction of the mechanical components for the advanced model (Mod II) is underway by contract and is scheduled for completion by June 14, 1971. This unit will have 10 pressure channels each having 5 continuously scanned ranges and 62 temperature channels. Delivery of the first 5 range pressure transducer is expected by the end of May, 1971.

DISCUSSION

The first model rotating 10 channel pressure measuring system has been reinstalled on the ERB SE-13 Cold Spin Test Rig. The changes made in the pressure measuring system are: the replacement of the slip ring assembly, the replacement of the

(Continued on Page 53)

SPECIAL RESEARCH PROJECT

(Continued)

dual row ball bearings, and the installation of five new pressure transducers and five original pressure transducers. One side of each of the 10 differential pressure transducers is manifolded to a common line that routes back through the slip ring assembly to an atmospheric opening at the center rear of the pressure measuring system. With this tubing configuration, all the pressure transducers can be calibrated from 0-10 psig at the same time. All transducers will be electrically spanned to produce the same output at 10 psig. Testing will be made throughout the month of May 1971.

STANDARDS AND CALIBRATION LABORATORY — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Work hours on completed jobs
SPF	33 hours
B-2	103 hours
HTF	34 hours
K	17 hours
Reactor	14 hours

The work backlog is 850 hours.

INSTRUMENTATION DATA COMPUTER — RSD - J. L. HARROLD

The Rocket Systems Division ADP Acquisition Plan has been revised to reflect the purchase of two systems, one each for Edwards FRC and Rocket Systems, in order to save money for NASA. The revised plan has been forwarded to NASA Headquarters and revised purchase requirements have been forwarded to procurement.

Design was begun on the installation requirements for the RSD Data Computer. Design of hardware interfaces and some software requirements has begun. These will be itemized upon completion of individual items.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119
TEST SCHEDULE.		June to September 15.
ATS TEST PACKAGE BUILDUP COMPLETED.		

CHANGES: Schedule added.

48

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	SUMMARY The installation of the ADL shadow shield test in the K Site Vacuum Chamber will be complete in about three weeks. The 13' cryoshroud, payload simulator, and 10' shadow shield assembly for the RPM program successfully completed all test objectives during testing from May 11 through May 15.
		ADL SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI OPERATIONS All ATS Building work for the ADL test package buildup has been completed. The test package has been moved to K Site where it will be mated with the 8' diameter cryoshroud and installed in the K site vacuum chamber. Testing is expected to begin June 21. (Continued on Page 51)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023

TEST PACKAGE MOVED TO ATS BUILDING.	
Heater layout and heater purchase request in process	Complete week of June 1.

CHANGES: Completion date added.

RESEARCH PROPULSION MODULE	K SITE	YPR4173

LH_2 TANK TEST PROGRAM SCHEDULED TO START	October to March 1972.
13' CRYOSHROUD, 10' SHADOW SHIELD, LH_2 TANK, AND SUPPORT STRUTS	May to July 1972.
H-F SYSTEM	July 15 to Dec. 1972.
FLOX SYSTEM	Feb 1973 to March 1974.
Systems performance check out mods.	May 11 thru May 15.
Fabric enclosure being readvertised	
Site airconditioning design completed and in Procurement.	
LN_2 fill and expulsion line being installed	mid-June completion.
$4''^2 LH_2$ line being installed	July 1 complete.

CHANGES: Schedules added.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	ADL SHADOW SHIELD TESTS (Continued) CONTROLS Minor control system changes were made for the 13' cryoshroud check-out tests. No problems are anticipated in converting back to the original configuration.
		VERTICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - J. E. CAIRELLI OPERATIONS The vertical calorimeter and related hardware have been moved from storage to the ATS Building. We are presently making preparations to install the multilayer insulation. CONTROLS A closed loop heater system is planned for the vertical calorimeter body to facilitate tank warm up. A four circuit shroud warm up control system is planned utilized the 8' cryoshroud from ADL. Heater layout will be completed and heaters ordered the first week in June.
		RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE OPERATIONS The 13' cryoshroud, payload simulator, and 10' shadow shield assembly was tested May 11 through May 15. As a systems performance checkout test, all objectives were satisfactorily accomplished for the shroud and shadow shield. The payload simulator failed structurally and will require a new design. The shadow shield exhibited no detrimental characteristics. Areas of prime concern were thermally induced deformation of the support ring and excessive wrinkling of the 10' diameter reflective surfaces. The overall system leak rate was 0.18 std cc GN_2/sec with the system operating cold and at 20.3 psid LH_2. Minimal steady state LH_2 consumption was recorded at 111 (Continued on Page 53)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (Continued)

gph with the payload simulator cold at 45°R, and 165 gph with the simulator at 490°R. Three heater strips on the cryoshroud bottom loosened during the test. One heater control power supply malfunctioned during the test.

To-do items resulting from the test include:

(1) Redesign and build a new payload simulator. The new unit will consist of a single aluminum plate with LH_2 coolant "D" tubes, and heater strips mounted between the "D" tubes.

(2) Replace several conoseal flanges on the cryoshroud.

(3) Repair one known leak in the shroud top, and recheck the entire shroud system for leaks.

(4) Replace heater strips on shroud bottom.

(5) Repair heater control power supply.

The cryoshroud conical bottom will be leak checked and heater strips applied as soon as manpower is available. The conical bottom is not required until Part II testing in 1972.

The K site air-conditioning system design was completed in May and is currently in procurement. As written, the job calls for one general contractor to supply equipment and do the installation.

Other facility RPM work now in progress includes installation of the LN_2 fill and expulsion line and and the new 4" LH_2 line. The LN_2 piping is on an outside contract; completion is estimated by mid-June. The LN_2 line is being done in-house and may be completed by July 1.

(Continued on Page 55)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (Continued)

INSTRUMENTATION

The check-out test of the 13' shroud with the 10' shield and payload simulator was completed. One surface sensor failed during the test due to the failure of the adhesive used on the payload simulator heaters.

CONTROLS

The five LH_2 temperature control loops on the 13' cryoshroud performed well during shroud check-out tests. Temperature deviations were approximately $\pm 2^{o}F$.

The heaters on the payload simulator separated from the plate during shroud tests. The heaters have a thin layer of silicone rubber which is easily rubbed off and provides a very poor bonding surface. A new heater design is being planned using a series of small heaters between the "D" tubes on the top of the simulator.

Only one of the four cryoshroud heater circuits was put into automatic operations and it performed satisfactorily. The check-out tests were terminated before the other circuits warmed to the full setpoint temperature.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM — YPY2752

System installed and test run (SE-13 Cold Spin Test Rig)	
Next run scheduled for	Early June.
Delivery of five range pressure transducer scheduled for	June 15, 1971.

CHANGES: Schedule change.

STANDARDS AND CALIBRATION LABORATORY

302 hours of work completed. 1020 hours of backlog. 38 out of 53 (B-2) transducers failed acceptance test.	

CHANGES: None.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

Cold Spin Rig testing was again started (ERB SE-13) but was less than successful. During the first run, the pressure tubing connecting the transducers pulled loose from the rotor disc and was sheared off by a structural member. The pressure measuring unit was not damaged and performed satisfactorily prior to the tubing failure. The failure has postponed further testing until early June.

Delivery of the first 5 range pressure transducer for use in the advanced model (Mod 11)pressure measuring system will be delayed approximately 15 days.Receipt of this transducer is now expected by June 15, 1971.

DISCUSSION

The first model rotating 10 channel pressure measuring system was reinstalled on the SE-13 Cold Spin Test Rig. The excessive vibration problem, that appeared during the previous installation, was essentially eliminated by dynamically balancing both the pressure measuring system and the spin rig disc. After a brief running period, during which the pressure measuring system worked well, some of the hold down straps that bonded the pressure measuring tubes to the face of the spin rig disc became detached. This allowed the tubing group to respond to the high G forces and bow out far enough for a rig structual member to chop them off. The tubing will be replaced and strapped down by a stronger method. Testing is expected to be continued early in June, 1971.

STANDARDS AND CALIBRATION LABORATORY

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	186 hours
K	24 hours
HTF	44 hours
SPF	48 hours

(Continued on Page 59)

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER

Procurement of RSD computer approved by Headquarters. Purchase Request for floor mods initiated. K Site Data Link proceeding. SEL data acquisition system transmission line change checked out. SEL to XDS 9300 data link preliminary design completed. Long lead items ordered. Detail design begun.	

CHANGES:

STANDARDS AND CALIBRATION
LABORATORY (Continued)

Thirty-eight of fifty-three cryogenic transducers for B-2 failed acceptance tests and were returned to the vendor. The first two repaired units will be retested in early June. Total backlog is 1020 hours.

INSTRUMENTATION DATA COMPUTER — RSD - J. L. HARROLD

Verbal approval to proceed with the RSD Computer procurement was received from NASA Headquarters. An RFP is being prepared for procuring an XDS9300 and related hardware. We must now obtain GSA approval to permit Lewis Procurement to send the RFP's out to the bidders.

The purchase request for installation of a raised floor for the computer site was initiated and is in the approval cycle.

Fabrication and check out of the K Site Data Link is proceeding. The K Site fabrication is complete. A few changes remain before check out can begin. B-Control check out will be completed after the K Site work is finished.

Check-out of the tranmission line change to the SEL Data Acquisition System is complete.

Preliminary design of the SEL to XDS 9300 data link is complete. Long lead time parts have been ordered and detail design has begun.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119

TEST SCHEDULE	June to Sep 15
Testing resumed	June 22.
LH_2 phase completed	June 26.
LN_2 testing scheduled to be completed	July 2.
Check out of 8' shroud and ADL tank completed.	

CHANGES: Schedule added.

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

SUMMARY

LH_2 testing of the #6 shadow shield configuration was completed on June 26 after four days of tests. However, some data discrepancies occurred. With a payload temperature of 530°R the heatleak was about three times greater than for a payload temperature of 700°E! Preliminary indications are that the discrepancy may be due to the fact that the environmental test pressure was about $1\frac{1}{2}$ decades higher for the 530° payload test.

The assembly enclosure, platform, and air-conditioning contracts have been awarded with completion of all items expected by October 11.

Vertical Calorimeter buildup has been slow due to vacations and thermocouple work at other sites.

ADL SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

OPERATIONS

Installation of the #6 shadow shield test configuration into the K site vacuum chamber was completed during June. Testing was resumed on June 22. The LH_2 phase of this series of tests was completed June 26, 1971. The test was conducted at 530°R and 700°R payload temperatures. Steady state heat flux at 530°R payload temperature was 1/5 BTU/Hr. At 700°R payload temperature the boiloff was 0.5 BTU/Hr. The heat flux at 530°R was much higher than expected and may have been caused by the relatively high shroud internal pressure of $\approx 1 \times 10^{-5}$ torr. Shroud pressure with the payload at 700°R was $\approx 5 \times 10^{-7}$ torr.

Testing with LN_2 in the test tanks is presently under way. This phase should be complete July 2, 1971.

INSTRUMENTATION AND CONTROLS

The check out of instrumentation on the 8 foot shroud and ADL tank was completed (193 channels on SEL).

A lightning strike caused several controller cards and Preston amplifiers to go bad but all systems were corrected in time to complete the run of June 22. All cards will be repaired in-house.

(Continued on Page 47)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023
TEST SCHEDULE.		Nov thru Dec 1971.
50% of calorimeter thermocouples were fabricated. Heater layout completed. Heaters ordered.		

CHANGES: Schedule added.

RESEARCH PROPULSION MODULE	K SITE	YPR4173
TESTING SCHEDULE		Nov 1971; Jan 1971 thru Jan 1973.
ITEMS COMPLETED		
Fabric enclosure awarded		June 28.
Air conditioning contract awarded.		
One quadrant of the 13' cryoshroud bottle was leak ck'd.		
New payload simulator design completed and units ordered.		
ITEMS IN PROGRESS		
Fabric enclosure installation schedule		July 29 to Sep 27.
Vacuum chamber platform installation schedule . . .		July 12 to Aug 26.
Air conditioning installation schedule		July 12 to Oct 11.
LN_2 and LH_2 piping installation completion estimate . .		End of July.
LH_2 and two oxidizer tanks scheduled to be delivered. .		August.

CHANGES: Schedule changed.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEATCH SITE	

VERTICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - J. E. CAIRELLI

OPERATIONS

Work on the vertical calorimeter has been held up due to lack of manpower. The only work accomplished during June was to fabricate approximately half the thermocouples required to instrument the calorimeter.

CONTROLS

The layout of the heaters on the entire cryoshroud is complete and all the necessary units are on order. No new expenditures except for the heaters are expected. Existing equipment will be utilized for all vertical calorimeter tests. Heater gluing will be done at Plum Brook.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

OPERATIONS

The K site fabric enclosure for the clean room assembly area was awarded to R. L. Kuss and Company on June 28. The notice to proceed will be given following approval of shop drawings. On-site work is expected to begin by July 29 with the job completed by September 27.

The vacuum chamber external platform contract was delayed an additional week due to the current shadow shield tests. The new start date is July 12. Work is to be completed in 45 days.

The air conditioning contract for the K site assembly area has been awarded. Work at the site will begin July 12. This is a 90 day contract, which requires completion no later than October 11.

The above three contracts conflict with the present K site test schedule. The shadow shield and the vertical calorimeter programs are currently being reevaluated for a new test schedule.

(Continued on Page 49)

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

RESEARCH PROPULSION MODULE (Continued)

The installation of the LN_2 and LH_2 lines was not completed because of the extended shadow shield testing in June. Completion of both jobs is anticipated by the end of July.

One quadrant of the 13' cryoshroud conical bottom was leak checked. The room temperature leak rate exceeded full scale, 10^{-5} std cc He/sec., on the Veeco leak detector.

The hydrogen tank and the two oxidizer tanks are expected to be delivered in August. A request will be submitted to extend the 30 day contractural requirement for warm He acceptance leak checks of the tanks. The three tanks together will probably require 60 calendar days to test.

CONTROLS

A new payload simulator heater design is complete and all units are on order. Individual units will be glued to approximately the same area as before but on the opposite face of the simulator between the 'D' tubes. All gluing will be done at Plum Brook. One power supply failed during the initial 13' cryoshroud check out, but it has since been repaired. Since the unit was in warranty, there was no cost to the Government.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

SE-13 Spin Rig being reworked.	
Advanced model system package	Delivered.
5 range pressure transducer scheduled delivery . . .	July 15, 1971.

CHANGES: Schedule change.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

During the ERB SE-13 Cold Spin Rig shutdown period while new pressure tubes were being installed, an investigation was made to determine the cause of electrical zero shift in some of the pressure transducer channels after each spin up run. This problem was found to be caused by excessive clamping pressure on the case of the pressure transducers. Corrective measures are now being taken to eliminate the problem.

The advanced model (Mod 11) pressure measuring system package has been delivered on time. Delivery of the first 5 range pressure transducer for use in the system has again been delayed. It is expected to be delivered by July 15, 1971.

DISCUSSION

The electrical zero shift problem with the first model rotating 10 channel pressure measuring system was found to be caused by a design error in the transducer holders. The pressure transducer holder cavity depth was too shallow and caused the pressure transducer case to be compressed when bolted in the system. The compression force varied as a function of temperature and was caused by differences in thermal coefficient of expansion. During each spin up test the heat generated by the mercury slip ring assembly was directed toward the transducer holders by the slip ring fan. The cold spin rig rotation is opposite that of the J-75 engine for which the fan exhaust direction was designed. Prior to the installation of the pressure measuring system on the SE-13 rig, the system was tested with the correct rotation and the temperature problem went unnoticed.

NARRATIVES ON ADJOINING PAGE

PROJECT

STATUS

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LABORATORY

308 hours of work completed.

38 of B-2 transducers being reworked by manufacturer.

11 of HTF tranducers were returned to manufacturer.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER

Proceeding with procurement of Data Computer.

Award made for installation of raised floor for computer site.

"K" Site end of Data Link being checked out.

CHANGES: None.

STANDARDS AND
CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	132 hours
HTF	158 hours
K	10 hours
Reactor	8 hours

The 36 cryogenic pressure transducers for B-2 have not been returned by the manufacturer. Two transducers were rechecked after testing by MB; however, the same problems existed. Eleven of 50 transducers for HTF failed acceptance tests and were returned to MB. Tests failed were primarily thermal sensitivity, thermal zero, and thermal hysteresis.

INSTRUMENTATION DATA COMPUTER — RSD - J. L. HARROLD

All approvals were received to proceed with procurement of the Data Computer. The RFP was sent out and has been returned. Negotiations have been held and a contract is imminent at this point.

Bids were received for installation of a raised floor for the computer site and an award has been made.

Checkout of the K site end of the K Data Link has begun.

Radio Frequency Interference problems were encountered on the transmission line change to the SEL Data Acquisition System. The complete status of this task as reported last month is withdrawn until the RFP problem is cleared.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY	HRE (GARRETT ENGINE) CONTROLS mode of the diluent GN_2 valve is automatically switched from weight flow control to 2 psig purge pressure control. Careful timing of the switching points is required to prevent a mode transfer while the set point is too high as occurred during the subject run. To prevent a recurrence of this problem, mode transfer will be initiated when the heater pressure reaches 4.5 psig rather than 7 psig. The set point will be ramped to the purge level in 30 microseconds rather than 1.6 second. Using these conditions a successful run was achieved. A review of the data indicates that these settings will be satisfactory for all run conditions. The XDS-CF-16 and SDS-910 computers performed very successfully in sequencing and aborting the calibration runs. Minor changes in the program are required to completely mask out a data channel and for changing limits. Card reader problems and run schedules prevented making the changes during July. A problem with the alternating data channel checker hardware was found and a modified circuit is now being fabricated.
K	CRYOGENIC PROPELLANT RESEARCH SITE	SUMMARY LN_2 testing of the #6 shadow shield test configuration was completed on July 2. LH_2 repeat testing showed a higher heat flux than the June testing due to a higher shroud pressure. The contractors working on the enclosure, platforms, and air conditioning are progressing satisfactorily toward a completion by October 1. Testing was completed in the little rig for the pressure transducer to be used for POGO in B-2. This transducer is a PCB Piezotronics model 112M06. The transducer was calibrated with GHe at room, at LN_2, and at LH_2 temperatures. Test results show it to be very good at the low (Continued on Page 45)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119
TESTING TO RESUME		First week of Sep.
ITEMS COMPLETED		
LN_2 test of #6 shadow shield		Jul 2.
LH_2 test of #6 shadow shield		Jul 6 to 13.
Null test at two shroud pressure levels & LH_2 temp.		
ADL test package reworked and moved to ATS Bldg.		
All facility transducers were removed.		
ITEMS IN PROGRESS		
ADL test package being changed to #1 test config.		
Cleaning and recalibrating facility tranducers.		

CHANGES: None.

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

SUMMARY (Continued)

temperatures, changing less than one percent in sensitivity from that measured at room ambient down to 20°K.

ADL SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

OPERATIONS

The LN_2 phase of testing with the #6 shadow shield test configuration was completed July 2, 1971. Testing was conducted at 530°R and 700°R payload temperatures. The steady state heat flux was - 1.87 BTU/hr. at 530°R payload temperature and at 700°R payload temperature was - 1.71 BTU/hr.

Between July 6, 1971 and July 13 another test was made with LH_2. Repeat of the 530°R payload test resulted in a steady state heat flux of 2.3 BTU/hr. at a shroud vacuum of $\sim 4.4 \times 10^{-5}$ Torr. This heat flux was higher than that measured during the original 530°R run made in June. Shroud pressure for this test was higher than that of the June test.

A null test, with the payload near LH_2 temperature, was also performed at two shroud pressure levels. At approximately 4.4×10^{-6} Torr shroud pressure the heat flux was .63 BTU/hr. At approximately 1×10^{-4} Torr the heat flux rose of 1.7 BTU/hr.

The ADL test package has been removed from K site and moved to the ATS Building. There it is being changed back to the #1 test configuration.

While at the ATS Building the cold guard tank will also be checked for leaks, which appeared during the last series of runs. If possible, the leaks will be repaired.

The test package is expected to be returned to K site by mid-August.

Testing will then resume the first week in September.

(Continued on Page 47)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023

TEST SCHEDULE	Nov thru Dec 1971.
All thermocouples fabricated. Tube flattening method developed for vacuum sensing between insulation layers.	

CHANGES: None

RESEARCH PROPULSION MODULE	K SITE	YPR4173

TESTING SCHEDULE	Nov 1971; Jan 1972 thru Jan 1973
<u>ITEMS COMPLETED</u>	
Two tank lid instrument pass-throughs cold leak checked	
New LN_2 line installed	
<u>ITEMS IN PROGRESS</u>	
Fabric enclosure area assembly	Sep 24 (completion)
Vacuum chamber external platforms installation . .	Sep 24 (completion)
Air conditioning installation in the assy area . .	Sep 24 (completion)
Leak checking 13' shroud	
8' cryoshroud heater strips installation	
13' cryoshroud flat bottom heater strip installation	
LH_2 line installation	80% complete

CHANGES: Schedule changes

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	ADL SHADOW SHIELD TESTS (Continued) INSTRUMENTATION Test #6 for the shadow shield program ended July 12 after three weeks of testing. Three days were spent on the evaluation of a high-frequency-response cryogenic transducer to be used for the Centaur POGO tests at B-2. All facility transducers were removed for cleaning and recalibration. CONTROLS The ADL shadow shield was successfully tested at 530°R and 700°R. No serious problems were encountered with any systems during these tests.
		VERTICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - J. E. CAIRELLI OPERATIONS Work on the vertical calorimeter has been progressing very slowly due to lack of manpower. However, all thermocouples for the calorimeter have been fabricated. Also a method has been worked out to flatten 3/8" O.D. thin walled tube to be used for remote sensing of the vacuum between insulation layers.
		RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE OPERATIONS Three outside contractors are currently working at K site RPM tasks. Jobs being done under these contracts include the assembly area fabric enclosure, the vacuum chamber external platforms, and the assembly area air conditioning. All three contracts are scheduled for completion by the third week of September. No major tests are scheduled during this time. Primary efforts will be directed toward leak checking the 13' cryoshroud and installing heater strips on the 8' cryoshroud and the 13' cryoshroud flat bottom. (Continued on Page 49)

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

RESEARCH PROPULSION MODULE

OPERATIONS (Continued)

Two tank lid instrument connector pass throughs were cold leak checked in the "little rig". The first connector was leak checked after 12 thermal cycles with LH_2. The leak rates for both connectors were less than 10^{-8} std cc GH_2/sec. Including spares, there are ten connectors total. The remaining eight will be cold leak checked without thermal cycling. Based on relative leak rates the connector will be rated for selective application as lid connectors, bulkhead connectors, and spares.

Installation of the new LN_2 line is complete. The in-house installation of the LH_2 line is 80% complete.

The vehicle equipment bay piping requirements were reviewed by research and operations personnel. As a result, configuration changes are in process which will significantly reduce the facility GHe piping requirements for the K site tests.

Work on the 13' cryoshroud conical bottom was stopped pending further negotiations with the fabricator, TENVAC. Negotiations are in process for a refund because of the shroud work not meeting specifications and a possible rework of the conical bottom by TENVAC.

Initial shipments of miscellaneous vehicle hardware have been received at Plum Brook. Storage will be accomplished in the ATS Building assembly area prior to cleaning and installation.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

ZERO SHIFT problem corrected.	
5-range pressure transducer delivery date	August 30, 1971.

CHANGES: Schedule change.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

The pressure transducer electrical zero shift problem in the first rotating pressure measuring system has been solved. Several ERB SE-13 Cold Spin Rig runs were made during this month with satisfactory data showing the problem has been corrected.

Delivery of the first 5 range pressure transducer for use in the advanced model (Mod 11) pressure measuring system is still being delayed due to a range sensitivity shift problem.

DISCUSSION

The electrical zero shift problem with the first model rotating 10 channel pressure measuring system has been corrected by placing shims under each of the ten pie shaped transducer holders. This fix prevents the temperature dependent expansion forces from compressing the cases of the pressure transducers. The SE-13 Cold Spin Test Rig will be set up to test the accuracy of measuring cooling air mass flow through hollow turbine blades.

The range sensitivity shift problem with the advanced system 5 range pressure transducer has caused at least one month delay in delivery of the transducer. Datametrics seems to be unable to solve the problem that apparently cropped up after the transducer's electrical circuit boards were conformal coated with epoxy. The coating is needed to anchor the electrical components to the circuit board so as to prevent failures due to the high G forces produced by rotation.

NARRATIVES ON ADJOINING PAGE

PROJECT TASK NO.

STATUS

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LABORATORY

528 hours of work completed.

Transducer manufacturer has 36 of B-2 transducers.

3 transducers are scheduled to be reworked by 8-2-71.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER

Negotiations for the computer contract are complete.

Computer floor being installed.

K Site End of Data Link being checked out - 95% complete.

Design in progress on Data Link between SEL and XDS 9300.

CHANGES: None.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	171 hours
HTF	177 hours
SPF	185 hours
Reactor	16 hours
B-3	20 hours
H-Bldg	59 hours

The 36 cryogenic pressure transducers for B-2 have not been returned by the manufacturer. Three transducers have been completely disassmbled and rebuilt by MB. These transducers will be tested the week of August 2. If they pass acceptance tests, then the remaining 33 transducers will be rebuilt and delivered the first week in September.

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

Negotiations for the computer contract are complete. Procurement is waiting on pricing background information. The contract is written and is awaiting procurement approval, based on receipt of background prices, before signing can take place.

The contract for the computer floor in B-Control Building was awarded and installation has begun.

Detail design has begun on the data link between the SEL data acquisition systems and the XDS 9300 Data Computer.

Checkout of the K Site End of the K Data Link is 95% complete. It remains to tie the B-Control End and K Site End together and exercise the link with a computer. This will begin as soon as a computer (XDS CF16A) is available.

The RFI problem on the transmission line modification to the SEL Data Acqusition System remains to be cured. No work was attempted because the systems were in continual use.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY	(Continued) (5) Preliminary calculations and design work were done for the total temperature probes on the hot GH_2 weight flow measurement system. (6) All thermocouples on the Garrett HRE Engine were resistance checked for integrity. These readings also begin a history for the maintenance of the thermocouple systems on the engine. CONTROLS For the oxygen run in September, the control system will be operated in the final configuration that will be used for engine testing. Two Rosemount probes and and signal conditioning equipment are being added to measure the gas temperature at the diluent N_2 and diluent O_2 orifices. These temperatures will be used in the weight flow calculation that produces setpoint signals for the diluent N_2 and diluent O_2 control loops. The purge control loop will be modified to prevent a possible overpressure while on purge control. The program for the CF-16 abort system has been modified to completely mask out any data channel not required. The alternate channel electronics has also been modified. The final check out of the CF-16 program changes and alternate channel electronics cannot be completed until the completion of the current B-2 runs. The SDS-910 computer sequence and abort program has also been modified to facilitate changing abort limits between runs.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119

TESTING TO RESUME	Late September.
ITEMS COMPLETED	
ADL shadow shield moved to "K" Site.	
Cold guard tank leak checked.	
Heaters glued on cryoshroud top and bottom sections.	
ITEMS IN PROGRESS	
ADL package being installed.	
Cleaning and recalibrating facility transducers.	
Gluing heaters on barrel section	50% complete.

CHANGES: Schedule.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	(Continued)

The eight "POGO" transducers for B-2 were acceptance tested and calibrated in the "Little Rig".

RPM tank delivery from GD/C has been further delayed due to leaks. Earliest hydrogen tank delivery is now late September.

ADL SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

OPERATIONS

Assembly of the ADL #1 test configuration was terminated at the ATS Building. On July 30 the test package was moved to K site for completion. The work at the ATS Building was delayed due to lack of manpower.

The cold guard tank was leak checked. The only leaks found were in one of the electrical connectors and one flange seal. Both the connector and seal were replaced, which has seemingly eliminated the leaks.

Installation of the ADL package is presently underway at K Site. Testing is expected to begin the week of September 27.

INSTRUMENTATION

The 4' ADL tank has been returned to the site to repeat test #1 and is presently being checked out.

CONTROLS

The gluing of heaters on the cryoshroud top and bottom sections is complete, and the barrel section is approximately one-half complete. The remaining gluing and wiring will be completed after the final ADL testing in September.

(Continued on Page 45)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023
TEST SCHEDULE		Nov thru Dec 1971.
Parts being fabricated to adapt new cold guard to the 8' Shroud.		

CHANGES: None

RESEARCH PROPULSION MODULE	K SITE	YPR4173
TESTING SCHEDULE		November 1971; Jan 1972 thru Jan 1973.
ITEMS COMPLETED		
Vacuum chamber external platform installation.		
Hydrogen tank instrument rake cleaned; LH_2 line installation.		
13' cryoshroud flat bottom heater strips installed.		
Payload simulator reworked.		
4" LH_2 line to chamber completed.		
B-2 "POGO" system tested and calibrated.		
ITEMS IN PROGRESS		
Fabric enclosure assembly area.		
Air conditioning installation for the assy area.		30% (Oct 10 completion)
High pressure He line installation		25% complete.
Oxidizer tank leak check		Sep 3 (completion)
Hydrogen tank delivery		Last week September.
Facility transducers being installed.		
Tank fill and expulsion 'Venturi Tubes' being reworked.		

CHANGES: Schedules added.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	(Continued)

VERTICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - J. E. CAIRELLI

OPERATIONS

Due to lack of manpower, essentially no work was accomplished on the vertical calorimeter during August. In order to avoid delay in the K site schedule, the ATS Building work on the Vertical Calorimeter must be completed by the first week in October. This will require support from the thermocouple shop and K site mechanical personnel.

Design of a new cold guard to adapt the vertical calorimeter to the 8' shroud has been finalized, and parts are being fabricated.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

OPERATIONS

RPM tank delivery from GD/C has been further delayed due to leaks in the oxidizer tank. The present anticipated GD/C schedule is to complete the oxidizer tank leak check by September 3. This will be followed by the hydrogen tank leak check. Earliest possible hydrogen tank delivery is now estimated for the last week of September.

The payload simulator was dismantled, cleaned and polished by an outside contractor. New mounting brackets are being added in the Lewis-Cleveland shops. Heater strip installation and instrumentation will be completed by Plum Brook for the January tests.

No leak checking was accomplished on the 13' cryo-shroud walls due to lack of manpower. The shroud bottom was leak checked and two more leaks were found. Additional leak checking on the flat bottom will be required after repairs. Regluing of heater strips on the flat bottom was completed. Negotiations to rework the conical bottom by the contractor, TENVAC, have not materialized.

(Continued on Page 47)

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

RESEARCH PROPULSION MODULE (Continued)

Other RPM work completed by Plum Brook included cleaning the hydrogen tank instrument rake. The rake is now ready for final assembly and instrumentation. The tank fill and expulsion venturi tubes are being reworked for K site installation. Lead-in piping and transducer tubing are being added. The high pressure helium line installation is approximately 25% complete. And the 4" vacuum jacketed LH_2 supply line to the chamber was completed.

Installation of the K site fabric enclosure is proceeding on schedule. Iron work is about 50% completed. An additional zippered opening was added to the contract. This contractor will be delayed at least three days while the ADL test package is assembled in the vacuum chamber.

The fabric enclosure air pressurization and refrigeration system installation contract is 30% complete. All materials have been received except the air handler and expansion coil assembly. Contract completion is expected by October 10.

The new air-conditioning system in the ATS Building assembly area malfunctioned. The trouble was traced to a defective solenoid valve. A new valve is on order, and the system will be back on-line by September 10. In addition, a new drain line was installed to prevent condensate run-off into the assembly area.

INSTRUMENTATION

The facility transducers are being installed after cleaning and recalibration. Five are being replaced due to the higher standards placed on transducers since they were initially installed.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

5-range pressure transducer received. SE-13 test rig being modified.	

CHANGES: Schedule

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	(Continued)

MISCELLANEOUS K SITE ITEMS

OPERATIONS

The contract work to install platforms on both sides of the K site chamber and in the south bay area has been completed. The north burnoff support system was straightened. Cables were added between supports to prevent movement of the supports. This work was accomplished by contract.

INSTRUMENTATION (YPQ4240)

Eight PCB Piezotronics pressure transducers for the B-2 "POGO" program were tested and calibrated in LH_2. This work was done in the "Little Rig". There was no interference with the contract work being done at K site.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The first rotating pressure measuring system will be used to check out the accuracy of measuring cooling air mass flow through hollow turbine blades. The SE-13 Cold Spin Test Rig is presently being modified to make this test.

The first 5 range pressure transducer for use in the advanced model (Mod 11) pressure measuring system has been delivered to Plum Brook Station.

DISCUSSION

The advanced pressure measuring system 5 range pressure transducer was finally delivered after being overdue for nearly four months. It is presently scheduled to be acceptance tested in the Plum Brook Calibration Lab. A static calibration will be made to insure the transducer's compliance with the purchase order specifications. Subsequent to successful static

(Continued on Page 51)

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LABORATORY

276 hours of work completed. Transducer manufacturer has 36 of B-2 transducers and is rebuilding - scheduled completion . . . . . Two MB transducer were retested.	Sep 10, 1971.

CHANGES: Schedule added.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (Continued)

test results, the transducer will be spin tested. The transducer will be mated with the I&C Division developed digital data system where the required 10K HZ carrier signal and DC voltages are supplied via the system's rotary transformer type signal transfer device.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	152 hours
HTF	24 hours
K	80 hours
SPF	16 hours
Reactor	4 hours

MB Transducer Contract Status

Two cryogenic transducers were re-tested during August. From the results of these tests it appears that MB has located the area of failure. MB is now rebuilding all of the transducers returned. We should start receiving the first of these during the second week of September.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER

Awarded contract for XDS9300 Computer. . (90 day del) .	August 10, 1971
Computer floor installed.	
Check out of K Site End of Data Link complete.	
Integrated check out (B-Control and K)	90% complete.
Design and fabrication in progress on Data Link between SEL and XDS 9300.	
Interconnect junction box design for XDS 9300	50% complete.
CF 16 software routines being debugged.	

CHANGES: None.

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

The computer contract was awarded to Xerox Data Systems on August 10, 1971. The contract provides for delivery of the XDS 9300 within 90 days from that date.

The installation of the computer floor is complete. Temporary AC power remains to be installed prior to the arrival of the XDS 9300. Permanent power and air conditioning will not be available until after the computer is installed.

Detail design of the data link between the SEL data acquisition systems and the XDS 9300 Data Computer is 85% complete and fabrication has begun. A manual control and display panel remains to be designed.

Detail design for an interconnect Junction Box for the XDS 9300 is 50% complete.

Check out of the K Site End of the K Data Link is complete. The B-Control End and the K Site End have been linked together over 5000 feet of coax. The integrated check out is 90% complete. CF16 software routines are now being debugged to provide K site input/output from the data computer.

The RFI problem on the SEL Data Acquisition System transmission line modification has been cured. The problem was, in fact, not RFI, but digital leakage resulting from an incorrect disable voltage.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY (Continued)

to determine the cause for the insulation failures at the top of the nitrogen heater.

CONTROLS

Valves for the gas sampling system have been installed and wired. The shutdown circuit has been modified to eliminate the possibility of a shutdown without the illumination of an annunciator window. The diluent N_2 control valve will be operated in the flow control mode only. For the Mach 6 runs with oxygen the two psi purge will be supplied through the film cooling flange.

The CF-16 abort program has been reworked to simplify changes and the alternate channel electronics have been reinstalled. Check out cannot be made until the lightning repair damage to the CRS memory interface is completed.

Preliminary examination of the previous calibration run data has caused the Rocket Systems Division to strongly suspect an inherent instability in the flow through the nitrogen heater core. Indication of a one hertz oscillation in certain heater pressures are indicated. The source is suspected to be the very small pressure drop across the heater core and the high heating rate for the gas passing through the core. The seriousness of such an instability has yet to be determined. To date, adverse effects have not been detected in the tunnel flow stream, however some of the heater insulation problem may be related to the flow instability.

The data are being more fully analyzed and additional instrumentation will be installed for the upcoming run.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119
TESTING SCHEDULED TO RESUME		Week of October 4, 71.
ITEMS COMPLETED ADL#1 configuration installed.		
ITEMS IN PROGRESS Heater installation on the 8' dia cryoshroud. Contract work continuing.		

CHANGES: Schedule

VERTICAL CALORIMETER	K SITE	YPR4173
TEST SCHEDULE		Nov - Dec 1971.
ITEMS COMPLETED Tank surfaces cleaned and foam ends trimmed. Sensing tubes formed. Guard tank heating and control thermocouples instl. Calorimeter practice work completed. Control systems finalized.		
ITEMS IN PROGRESS Buildup scheduled to be completed		Week of October 25, 71
Thermocouples being installed.		

CHANGES: None

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	ADL SHADOW SHIELD TESTS (YPR3119) — CRD - R. J. STOCHL; RSD - J. E. CAIRELLI

OPERATIONS

Installation of the ADL #1 configuration in the K Site chamber is complete. The resumption of testing has been rescheduled to the week of October 4. This was done for the following reasons:

(1) Lack of manpower due to leave and reassignments to assist at B-2 and HTF and vertical calorimeter buildup at the ATS Building;

(2) To allow contract work to continue uninterrupted on the fabric enclosure;

(3) To complete installation of heaters on the 8' diameter cryoshroud.

INSTRUMENTATION

Instrumentation was completed and tested for support of the October testing.

CONTROLS

Check out for the ADL run in early October was completed this month. No problems were encountered.

VERTICAL CALORIMETER (YPR4173) — CRD - J. E. MALOY; RSD - J. V. GILLETTE

OPERATIONS

Due to limited manpower, only the following vertical calorimeter work was accomplished during September:

(1) The tank surface was cleaned and foam ends trimmed to uniform diameters.

(2) The between wrap, vacuum sensing tubes were formed and their mounting holes and attachments provided.

(3) The guard tank heating and control thermocouples were installed.

(Continued on Page 49)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173
TESTING SCHEDULE		Jan 1972 thru Jan 1973
CRYOTESTS SCHEDULED FOR		Early December
INSULATED LH_2 TANK TESTS SCHEDULED TO BEGIN . . .		March 15, 1972.
ITEMS COMPLETED		
8 Physical Science connectors were tested.		
1 Inconel glass connector tested.		
Oxidizer tank delivered.		
ITEMS IN PROGRESS		
LH_2 tank scheduled to be shipped		October 15, 1971
LH_2 tank being leak tested.		
Fabric enclosure		70% complete
Enclosure air handler delivery		November 1, 1971
Enclosure air handler installation estimated . . .		November 15, 1971

CHANGES: Schedules

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

VERTICAL CALORIMETER (Continued)

(4) The practice wrap of the calorimeter to establish proper tension to achieve 50 layers per inch, was completed.

Wrapping of the actual insulation to be tested will begin the first week of October. The Vertical Calorimeter buildup at the ATS Building is expected to be finished by the last week in October and testing will begin at K Site in late November.

INSTRUMENTATION

Thermocouples for monitoring the insulation thermal profile are being installed at the ATS Building.

CONTROLS

The two guard tank warm up control loops were finalized and all equipment is on hand. It has been decided to make both systems closed loop.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

OPERATIONS

The RPM test schedule was revised to reflect slippage caused by late delivery of the LH_2 tank. The LH_2 tank cryotests are scheduled for early December; the insulated LH_2 tank tests are scheduled to begin March 15.

The oxidizer tank was delivered last month from GDC and stored in Building 9215. The LH_2 tank is not expected to be shipped before October 15. Currently the hydrogen tank is being leak tested by GDC.

The K Site assembly area fabric enclosure is 70% complete and the fabric rollup door is installed. A stop order was given to the contractor to permit testing of the ADL #1 configuration. The contractor will not return to finish the installation until October 18. The air handler for the enclosure pressurization and air-conditioning will not be delivered until November 1. Approximately two additional weeks will be required for installation.

NARRATIVES ON ADJOINING PAGE

PROJECT TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Acceptance test delayed until repairs are made on Cal Lab pressure standard. SE-13 spin rig being modified.	

CHANGES: None.

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

RESEARCH PROPULSION MODULE (Continued)

Eight Physical Science connectors have been cold leak tested in the "little rig". Measured leak rates have not exceeded 10^{-8} std cc He/sec. The last connector leak tested was also checked for thermally induced emf's between pins. Some low level "noise" was observed during the transient cool down period; however, no significant emf's were indicated. A full report of the induced emf's is in process.

All the RPM vehicle wire leads have now been assigned connector pin numbers. Completion of this task allows 19 individual cable runs to be fabricated in LeRC-C leaving only seven cables to be fabricated at Plum Brook during the vehicle assembly.

INSTRUMENTATION

Connector wire designations have been made. One of the inconel-glass connectors was tested for thermal voltaic characteristics during the hydrogen proof testing cycle.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The static acceptance test of the first five range pressure transducer for use in the advanced model (Mod II) pressure measuring system has been delayed due to repairs being made on the Calibration Lab's pressure standard.

The SE-13 cold spinning that is being used to test the first pressure measuring system has been shutdown for modifications needed for the upcoming turbine blade cooling air flow tests. The first rotating pressure measuring system will be used to make these tests.

DISCUSSION

A careful examination of the advanced pressure measuring system five range pressure transducer has

(Continued on Page 53)

NARRATIVES ON ADJOINING PAGE

PROJECT TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LABORATORY

229 Manhours of work completed. 1020 hours of backlog. 12, B-2 transducers returned from the manufacturer.	

CHANGES: None.

INSTRUMENTATION DATA COMPUTER

ITEMS COMPLETED K Data Link hardware checked out. PR for keyboard CRT units initiated. Houston Instruments digital plotter received. CF-16A digital controller received.	
ITEMS IN PROGRESS	
Data acquisition system to XDS 9300 data link logic fabrication	30% complete.
Data acquisition system panel design	60% complete.
Design of interface between CF/6A's and XDS9300 . .	20% complete.

CHANGES: None.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (Continued)

led to some doubt as to its ability to withstand the high G forces encountered at 9000 RPM rotational speeds. A cord wood construction technique was used to mount the electronic components on a printed circuit board. This assembly technique does not give the longer length components very much physical support. Datametrics is presently evaluating the possibility of completely encapsulating the interior of the package so as to provide the necessary physical support for the components. Encapsulation does not allow easy repair of a defective unit.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	103 hours
K	41 hours
HTF	24 hours
SPF	48 hours
Reactor	24 hours
Total	1020 hours

Twelve of the defective MB cryogenic transducers for B-2 have been returned from the manufacturer. They are presently being cleaned before evaluation.

INSTRUMENTATION DATA COMPUTER — RSD - J. L. HARROLD

Check out of the K Data Link hardware is complete. Software generation for CF16A operation of the link is proceeding as time permits.

A purchase request for three Keyboard CRT units was initiated.

(Continued on Page 55)

INSTRUMENTATION DATA
COMPUTER (Continued)

The Houston Instruments digital plotter has been received.

One CF-16A digital controller was received along with an I/O teletype and miscellaneous I/O circuit boards. Included is the plotter coupler board to be used to operate the Houston Instrument plotter.

Detail design of the data acquisition system to XDS 9300 data link logic is complete. Fabrication is about 30% complete. This does not include the associated manual control and display panel. The panel design is 60% complete.

No further work has been accomplished on the interconnect junction box for the XDS 9300. The design remains 50% complete.

Detail design has begun and is about 20% complete for the interface between the two CF/6A's and the XDS 9300.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

SHADOW SHIELD TESTS	K SITE	YPR3119
ITEMS COMPLETED (YPR3119) Shadow Shield testing completed . . . . . . Ionization gauge test made. Four control system power supplies sent out for repair		(Oct 6 - 13, 1971)

CHANGES: Schedule.

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

SUMMARY

The ADL Shadow Shield configuration #1 testing was completed between October 6 and October 13. This testing completes this program and the hardware will be placed in storage.

The vertical calorimeter has been wrapped with 160 layers of multilayer insulation. Thermocouples and vacuum sensing tubes were installed during wrapping. Testing is scheduled for late November.

The "K" Site fabric enclosure and air conditioning package is behind schedule with completion expected in late November.

The RPM hydrogen tank arrived at Plum Brook on October 29, approximately 10 months late. Acceptance testing of the LH_2 tank and the FLOX tank will begin in November.

ADL SHADOW SHIELD TESTS (YPR3119)

CRD - R. J. STOCHL;
RSD - J. E. CAIRELLI

OPERATIONS

A repeat of the ADL Shadow Shield configuration #1 test was completed between October 6 and October 13. This marks the end of YPR3119 shadow shield testing at "K" Site.

All testing was performed with LH_2 in the test tanks and in the cryoshroud. Data was obtained at 530° and 700°R payload temperatures. For the null test the payload was chilled to near LH_2 temperature. The null test was performed at five different levels of shroud vacuum.

Boiloff measurements for the 530° and 700°R payload temperatures were in the range of predicted values. But the boiloff rates for the null tests were higher than predictions for the indicated shroud vacuum. The boiloff did agree with the predictions if the shroud pressure was actually close to the indicated chamber pressure.

(Continued on Page 49)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR4173

FIRST TEST SCHEDULED FOR	Late November.
ITEMS COMPLETED	
Calorimeter insulation completed.	
Thermocouple installation completed.	
ITEMS IN PROGRESS	
Calorimeter being instrumented.	
Support adaptor and fill lines being installed.	
Cryoshroud heater wiring underway. Scheduled comp . .	November 5, 1971.

CHANGES: None.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	

ADL SHADOW SHIELD TESTS (Continued)

In preparation for the upcoming vertical calorimeter tests, an addition test was attempted during the shadow shield test program. This additional test was to determine the effect of adding a long, thin tube to the mouth of the G.E. ionization gauge of the type used at "K" Site. The vertical calorimeter will use this same arrangement to measure vacuum between layers of insulation.

Two identical G.E. ionization gauges were used. One was attached to a long thin tube. The other had no tube. Both were mounted inside the 8' shroud with their open ends close together. The outputs of both gauges were observed during evacuation of the chamber. Unfortunately the referenced gauge, without the tube extension, became inoperable after a short period of operation, before filling the test tanks. All shroud vacuum measurements taken after that time were made with the modified vacuum gauge.

CONTROLS

A total of four power supplies from the payload and shroud control systems were sent back to the factory for repair or modification. The problems arose during the Shadow Shield testing in October, but did not delay the test. The power supplies will be required for RPM testing.

VERTICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - J. V. GILLETTE

During October the 30" vertical calorimeter was wrapped with 160 layers of multilayer insulation. Insulation thermocouples and four vacuum sensing tubes were installed during wrapping. The calorimeter is presently being fitted with the remaining instrumentation, support adaptor and fill lines.

The test package will be sent to "K" Site the first week in November. Testing is expected to begin late in November. However it may be rescheduled to allow LH_2 testing of the RPM hydrogen tank.

(Continued on Page 51)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173
TESTING SCHEDULE		Jan 1972 thru Jan 1973
CRYOTESTS SCHEDULED FOR		Early December.
INSULATED LH_2 TANK TESTS SCHEDULED TO BEGIN		March 15, 1972.
ITEMS COMPLETED		
A/C and air pressurization hardware delivered.		
Hydrogen tank delivered		October 29, 1971.
LH_2 and FLOX tank brackets installed.		
Two physical science armatures cold leak tested.		
LH_2 tank rake assembly completed.		
ITEMS IN PROGRESS		
Installation of fabric enclosure in progress - estimated completion .		Late November.

CHANGES: None.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	VERTICAL CALORIMETER (Continued) INSTRUMENTATION Installation of thermocouples in the insulation is complete. CONTROLS The top and the barrel of the 8' cryoshroud heater wiring were completed this month. Only the bottom remains to be wired and this work will be completed in the first week of November.
		RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE OPERATIONS The "K" Site assembly area fabric enclosure will not be completed until late November. In addition to the government Stop Order to permit the final shadow shield test, additional time was lost because zippers on the roll up door were installed incorrectly. The door has been returned to the contractor's plant where new zippers will be installed. All hardware for the air-conditioning and air pressurization system is on hand. The air system installation will be completed by mid-November. The RPM hydrogen tank arrived from GDC on October 29, approximately three weeks later than scheduled. Uncarting and preparations for the warm leak acceptance tests and bracket addition for the LH_2 and FLOX tanks have been installed. Testing will begin about November 10, 1971. The last two Physical Science connectors (10 total) were cold leak tested. As with the previous eight connectors the measured leak rates did not exceed 10^{-8} std cc He/sec. A test report of the connector cold leak tests will be distributed. The payload simulator is scheduled to be shipped to Plum Brook for installation of the heater strips. Installation of hardware mounting blocks and thermal shorting pads is being completed in LeRC-C. (Continued on Page 53)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

5 range pressure transducer static acceptance test completed.	

CHANGES: None.

STANDARDS AND CALIBRATION LABORATORY

351 manhours of work completed. 1165 hours of backlog. Factory repaired B-2 transducers, 3 out of 5 failed tests.	

CHANGES: None

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (Continued) INSTRUMENTATION The rake assembly for the LH_2 tank has been completed.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — V. S. PETERSON

SUMMARY

The static acceptance test of the first five range pressure transducer for use in the advanced model (Mod II) pressure measuring system has been completed. It does not meet specifications for linearity at 40°F.

DISCUSSION

The Plum Brook standards laboratory has completed a thorough static evaluation of the first test model of the 5-range pressure transducer intended to be used in the advanced 10 channel pressure and 62 channel temperature measuring system. C.G.S. Datametrics, the transducer manufacturer, did not include in their report a 40°F linearity test. The linearity deviation at 40°F exceeds our specification by 100%. Discussion with Datametrics in the following month will bring a satisfactory solution to this problem.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	123 hours
HTF	18 hours
K	14 hours
SPF	53 hours
Reactor	17 hours
LeRC-C Acceptance Test of rotating transducer	38 hours
Direct run support-B-2	88 hours
Total	351

(Continued on Page 55)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER

ITEMS COMPLETED Familiarization training for CF16A completed. ITEMS IN PROGRESS Refurbishment of XDS progressing. Software for K Site functional demonstration data link Data computer interfaces progressing.	80% complete.

CHANGES: None.

STANDARDS AND
CALIBRATION LAB (Continued)

The B-2 cryogenic transducers repaired at the factory are being retested. Three out of five again failed acceptance tests. Tests on additional transducers are now in progress.

Total Calibration Laboratory Backlog - 1165 hours.

INSTRUMENTATION DATA
COMPUTER

J. L. HARROLD

The invoice for the Edwards FRC XDS9300 was received and paid, realizing an additional 3% discount for prompt payment.

The Plum Brook XDS9300 is presently in the check out phase of the refurbishment cycle at XDS. XDS installation personnel visited Plum Brook to discuss and plan for installation in December 1971 or January 1972.

The CF16A familiarization training was accomplished in October.

The progress on the numerous interfaces related to the data computer is given in tabular form below. The figures are percent complete.

Description	Chassis		Panel	
	Design	Fab.	Design	Fab.
SEL to XDS9300	100%	60%	90%	0%
XDS9300 Junction Box	80%	0%	N/R	N/R
2 CF16A Interconnect Boxes	100%	0%	0%	0%
2 CF16A to XDS9300	40%	0%	0%	0%

N/R = Not Required

Other required interfaces will be added to the table in the future as they are begun.

Functional demonstration software for the "K" Site data link is 80% complete. This software provides the functional subroutines necessary for inclusion in operating programs to be generated later.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY	(Continued) The SDS910/CF-16 sequence and abort program performed successfully during the H_2 and O_2 runs. The intermittent CRS memory flag generation and 910 interface problems which occurred prior to these runs have been corrected.

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

VERTICAL CALORIMETER (Continued)

The work completed at K Site includes the following:

At K Site the shroud lid and support structure were assembled and hung on the site crane. The test package was then mated to the shroud lid. The support tube thermocouple rake was installed, and X-Ray radiographs were taken of the insulation.

But at this point mechanical work is held up in order to complete assembly of the thermocouple pins into connectors and installation of the vacuum gauges and their cables on the test package.

It is estimated that three to four weeks delay to the calorimeter test program has resulted from the delay in instrumentation.

INSTRUMENTATION

The connections to the calorimeter have been completed, allowing the site mechanics to proceed with the installation of the calorimeter in the chamber. Additional wiring has been provided for the extra Hasting flow meters.

The data link conversion program for K Site is approximately 85% complete.

CONTROLS

Heater wiring on the 8' cryoshroud and all interconnecting wiring was completed in November. The remaining wiring from the shroud to the chamber pass-through will be completed within 2 to 3 days time after the calorimeter/shroud package is hung in the chamber. Existing heater control circuits will be used for both shroud and tank warmup temperature control.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

TESTING SCHEDULE	Jan 1972 thru Jan 1974
<u>ITEMS COMPLETED</u> Fabric enclosure completed. ATS Clean Room cleaned. LH_2 and LF_2 tanks warm leak checked. Tank support brackets were installed. LH_2 tank installed in support ring. Tank structure damage repaired. <u>ITEMS IN PROGRESS</u> Hardware and LH_2 tank internal instrumentation are being installed for cold leak test. LF_2 tank being crated for storage.	

CHANGES: None.

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

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

OPERATIONS

The K Site assembly area fabric enclosure is complete. Air conditioning system flow rate was established as satisfying the contract specifications. The enclosure will be acceptance tested in December by establishing a 0.1" H_2O pressure differential between the inside and outside of the enclosure. The maximum allowable air flow required to pressurize is 2000 CFM.

In preparation for RPM assembly and insulation work all non-essential equipment was removed from the ATS Building clean room and the area was extensively cleaned. Clean room procedure will be established and adhered to in this area throughout the RPM project.

Both the LH_2 and LF_2 tanks were successfully warm leak tested for contract acceptance. Total measured leaks were 1.4×10^{-7} scc GHe/sec for the LH_2 tank and 4.4×10^{-8} scc GHe/sec on the LF_2 tank. Support brackets for both tanks were located and welded on the mid and aft vehicle structures.

While the tank was installed in the midstructure, the LH_2 tank flight weight struts were installed, adjusted, and safety wire locked. Presently the LH_2 tank is installed in the tank support ring with brass struts. Hardware addition and internal instrumentation for the LH_2 tank cold leak test is in progress. The LF_2 tank is bieng recrated and will be placed in storage until needed.

Damage to both the mid and aft structure has occurred during shipping. In both cases the damage was repaired or considered minor. Additional lift points and protective crating will be used to prevent other damage during future transport between Lewis-Cleveland and Plum Brook.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
	STATUS	

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Pressure transducer failed to meet static specifications. Negotiations are in progress to resolve this problem.

STANDARDS AND CALIBRATION LABORATORY

298 manhours of work completed.

1416 hours of backlog. (251)manhours increase from last report.)

Three out of ten Tabor H_2O_2 transducers were rejected.

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

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

V. S. PETERSON

SUMMARY

The absence of CGS Datametrics management and engineering project personnel from their plant at the same time has delayed a firm decision as to what action they will take in solving the 5-range rotatable pressure transducer problem.

DISCUSSION

As reported last month, the 5-range rotatable pressure transducer failed to meet static specifications when tested at the Plum Brook Station Standards Lab. Furthermore the transducer's electronic circuit layout with respect to component mounting appears to be faulty and its chances of surviving the 9000 RPM developed "G" forces are very slim. We feel that a redesign of the electronic circuit board is mandatory and the major costs for the rework must be borne by CGS Datametrics. Negotiations will be continued to bring a satisfactory solution to both the static specification and the hostile high G problems.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	133 hours
B-3	6 hours
HTF	49 hours
K	50 hours
SPF	28 hours
LeRC-C Rotatable Pressure Transducer	32 hours
	298 hours

Time has not permitted the testing of additional MB cryogenic transducers. The factory believes it has solved the drift problem. Three out of ten Tabor H_2O_2 transducers were rejected because their builtin reference failed.

Total backlog - 1416 hours.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER

ITEMS COMPLETED Inspected XDS 9300 in California. Computer installation requirements agreed upon.	
ITEMS IN PROGRESS XDS 9300 being refurbished. Scheduled completion . . .	First of December
Electrical and air-conditioning installation bid opening	December 3
The chassis and panels for numerous computer interfaces are being worked on.	

CHANGES: None

INSTRUMENTATION DATA COMPUTER

J. L. HARROLD

An inspection of the Plum Brook XDS9300 was made at the XDS refurbishment center in California. Refurbishment is expected to be complete the first week in December. Shipping will proceed shortly thereafter with delivery expected by the end of December.

A second visit was made to Plum Brook by the XDS installation representative. Final installation requirements were agreed upon by XDS and NASA.

Bids for electrical and air conditioning installation requirements for the computer facility are due December 3, 1971. It is not expected that the electrical and air conditioning installation will be complete until the first week of February 1972. It has been decided to delay installation of the XDS9300 to prevent interference with the facility contracts, even though the XDS 9300 will be delivered earlier.

The progress on the numerous interfaces related to the data computer is given below in tabular form. The figures are percent complete.

Description	Chassis		Panel	
	Design	Fab.	Design	Fab.
SEL to XDS9300	100%	70%	100%	0%
XDS9300 to Junction Box	100%	5%	N/R	N/R
2-CF16A Intercon. Boxes	100%	20%	10%	0%
2-CF16A to XDS9300	90%	0%	5%	0%
* HTF Heater Link	20%	0%	0%	0%

N/R = Not Required

* The HTF Heater Link design was begun early, pending approval of the requirement. It must be implemented in a very short time to realize its full effectiveness. The requirement is in addition to the RSD Computer Plan, but will be implemented at the same time.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY	INSTRUMENTATION (Continued) Design of the hot GH_2 fuel total temperature probe is 100% complete. Purchase requests for materials are in Procurement. Data amplifier outputs (64) are being wired into the scanner patchboard. The wiring is approximately 50% complete. The preliminary design to automate the GN_2 heater was presented and reviewed. The design should be finalized in early January. Flow sheets for the HRE engine program were begun. CONTROLS For the Mach 7 run on December 2 with diluent N_2 in the O_2 system, the controls transducer for heater pressure was moved from the annulus back to the heater inlet. This essentially eliminated the heater pressure oscillations (13 H_z) that were present on the previous run. The GH_2 fuel metering Venturi water and air calibrations are complete. The GH_2 fuel control valve check out at the valve shop is complete. The five control valves are at the site ready for contractor installation.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023
ESTIMATED START OF NEXT TEST		Week of Jan 10, 1972
ITEMS COMPLETED		
Installation completed		
"Bake-Out" of test package completed		December 15-16, 1971.
First test		December 17 to 29, 71.
Null test completed		December 23, 1971.
ITEMS IN PROGRESS		
Removing section of $1\frac{1}{2}$" vacuum-jacketed transfer line for repairs - estimated completion		January 10, 1972.

CHANGES: Schedules

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

SUMMARY (Continued)

Hardware installation on the RPM LH_2 tank was delayed due to misalignment of vent line, fill line, and mixer motor nozzle as received from LeRC-C. These items were returned for rework.

The ATS Building clean room assembly area has been cleaned and is now ready for work requiring clean room procedures.

VERTICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - J. E. CAIRELLI

During December the installation of the 30" diameter vertical calorimeter into the K Site vacuum chamber was completed.

On December 15, "Bake Out" of the test package was initiated. During this time the newly installed shroud heaters were used to warm the test package from room temperature to 130°F. On the following day the vacuum chamber was evacuated and the "Bake Out" continued overnight.

On December 17, the first test of the 160 layer insulation series was started. This test was performed with LH_2 in the test tanks and in the shroud. This test was intended to be a "null test" with the boiloff expected to approach zero. On December 23 the "null test" was completed after zero boiloff was recorded by making use of the measure tank fill line cold guard.

Upon completion of the "null test" the shroud was heated to 530°R. To speed up the temperature stabilization of the insulation, the vacuum chamber pressure was raised to approximately 1×10^{-3} Torr by admitting Helium. When the temperatures reached a level near the expected value, the chamber was again evacuated to approximately 1×10^{-5} Torr. The time saved by adding Helium is estimated to be approximately 90 hours. Boiloff measured at steady state with the 530°R shroud was 6.5 SCFH.

On December 29, while attempting to refill the cold guard tanks, a liquid hydrogen leak developed in one section of

(Continued on Page 43)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

TEST SCHEDULE	Jan 1972 thru Jan 1974
<u>ITEMS COMPLETED</u> Mixer motor nozzle redesign and mods completed. All LH_2 tank hardware on hand. Liquid methane tank delivered and stored. ATS clean room area ready. Fiberglass forms for LH_2 tank delivered. Vehicle mid and aft structure returned to Cleveland. Equipment bay parts were received. Payload simulator heaters checked out & delivered to site. Equipment box and LH_2 switchplate heater control system was redesigned.	

CHANGES: None.

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

VERTICAL CALORIMETER (Continued)

the $1\frac{1}{2}$ inch vacuum jacketed transfer line. Testing was terminated on December 30. Examination of the line showed that the leak was in the inner pipe. The section of line is being removed for repair. Further testing with 160 layers of insulation will not resume until the line repairs are complete, perhaps as soon as the week of January 10, 1972.

INSTRUMENTATION

Instrumentation was completed in support of the run date. All measurements appeared satisfactory.

CONTROLS

The shroud top, side, and bottom heater control systems worked correctly after installation in the chamber. The guard tank upper heater had an 800 ohm short to ground and the bottom guard heater was satisfactory. Since the tank insulation was wrapped over the heaters, it was impossible to correct the short. The D.C. voltage supply to the heaters is floating so the single short to ground caused no operating difficulty, but the short should be corrected at the first opportunity. Both guard tank heater control systems worked correctly after installation in the chamber.

No control problems were experienced during the December calorimeter run.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

OPERATIONS

Hardware addition to the LH_2 tank was not started in December due to unexpected modifications required on the vent line, fill line, and the mixer motor nozzle. Both the vent and the fill lines required additional shop work before they could be installed. The cause for the errors in line dimensions is not presently understood since both lines were previously matched

(Continued on Page 45)

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

RESEARCH PROPULSION MODULE (Continued)

to the vehicle mockup in Lewis-Cleveland. A design review of the mixer motor nozzle revealed that maximum flow would only produce marginal LH_2 circulation. The resulting nozzle redesign and modification is now completed. The hardware modification delayed assembly by approximately two weeks. All tank hardware for the LH_2 tank cryotest is now on hand. Assembly will begin the first week of January.

The liquid methane tank was delivered in December and stored in Building #9215. Warm leak acceptance tests must be completed by February 1 to meet control requirements.

The ATS Building clean room assembly area is now ready for work requiring clean room procedures. Scaffolding, for work around the tank, has been cleaned. The only remaining preparation is the acquisition and cleaning of hand tools.

Fiberglass forms for insulating the vent line, fill line, and strut penetrations were delivered and checked for proper lay-up on the LH_2 tank.

The vehicle mis and aft structures were returned to Cleveland for cleaning, instrumenting and painting.

All parts for the equipment bay assembly were delivered to Plum Brook for cleaning,and assembly is scheduled to begin January 10 in the Plum Brook white room.

INSTRUMENTATION

Research Propulsion Module instrumentation requirements for LH_2 cryogenic leak tests have been reviewed. No major problems are apparent at this time.

CONTROLS

All heaters for the payload simulator have been checked out before gluing. The heaters and layout have been delivered to the site mechanics to be glued at the first opportunity.

A redesign of the equipment bay box and LN_2 switchplate heater control systems was necessary due to new heat transfer studies. This redesign is complete and will cause no problems or delay.

NARRATIVES ON ADJOINING PAGE

PROJECT	TASK NO.
STATUS	

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM	YPY2752
The five range pressure transducer returned to manufacturer for rework.	

STANDARDS AND CALIBRATION LABORATORY
232 manhours of work completed. 1258 hours of backlog. New shipment of MB Transducers are being tested.

RESEARCH	& (TASK NO.) - PROJECT ENGINEERS

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The CGS Datametrics model 1089 five range rotatable pressure transducer has been returned to the manufacturer. The circuit mounting problem will be corrected and the turn around time for this work is estimated to be one month.

DISCUSSION

As a result of discussions between the primary parties concerned (Plum Brook, LeRC-C Air Breathing Engines, and Datametrics), the model 1089 transducer will be reworked rather than redesigned. The rework approach was chosen as the best means to speed up the completion of the advanced rotating model 10 channel pressure and 62 channel temperature measuring system.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	39 hours
B-3	22 hours
HTF	82 hours
K	39 hours
SPF	50 hours
	232 hours
Total Backlog	1258 hours

A new shipment of MB transducers, both standard and cryogenic type, are being tested. The acceptance rate appears to be increasing. The judgement is based on a relatively small sample.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER B CONTROL

ITEMS COMPLETED	
Electrical and A/C Contracts award XDS 9300 was shipped from California Design of chassis (2-CF16A to XDS9300) completed.	
ITEMS IN PROGRESS	
Electrical and A/C installation expected completion. . Work on chassis and panels for numerous computer interfaces is proceeding.	Week of Feb 1, 1972.

CHANGES: Schedule added.

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

Electrical and air conditioning installation contracts were awarded and work began early in December. Completion is expected by the first week of February.

The XDS 9300 was shipped the last day of December from California. Arrival is expected at Plum Brook during the second week of January.

The progress on the numerous interfaces related to the data computer is given below in tabular form. The figures are percent complete.

Description	Chassis		Panel	
	Design	Fab.	Design	Fab.
SEL to XDS9300	100%	95%	100%	10%
XDS9300 Junction Box	100%	75%	N/R	N/R
2-CF16A Intercon. Box	100%	80%	20%	0%
2-CF16A to XDS9300	100%	0%	5%	0%
HTF Heater Link	30%	30%	5%	0%

N/R = Not Required

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR202

RESUME TESTING	mid-March.
<u>ITEMS COMPLETED</u> First part of Calorimeter tests completed. 158 measurements were performed satisfactorily. $1\frac{1}{2}$" vacuum-jacketed transfer line repaired and instld. <u>ITEMS IN PROGRESS</u> Installing RPM LH_2 tank for cryotesting.	

CHANGES: Schedule.

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

SUMMARY

Repairs to the hydrogen line were completed. The results of vertical calorimeter testing this month definitely points out the need for a cold guard around the center support tube before any further testing is conducted. The vertical calorimeter will be removed and necessary support tube modifications made to maintain a constant 37°R under all test conditions.

The RPM LH_2 tank is expected to be complete and ready for transport from ATS Building to K-Site by February 7. The cold leak test, I-1B, will commence around the end of February.

VERTICAL CALORIMETER (YPR2023)

CRD - J. E. MALOY;
RSD - J. E. CAIRELLI

DISCUSSION

OPERATIONS

The 1½" vacuum-jacketed transfer line, which failed during operation in December was repaired and reinstalled.

Following shutdown on December 29, the vacuum chamber was partially pressurized with GN_2 to 1M Hg. and maintained at that level until January 10, when the chamber was again evacuated to $\sim 5 \times 10^{-6}$ torr.

Testing with 160 layers of insulation was resumed on January 13. The first half of this test was with 530°R shroud temperature. It was intended to make a comparison with the 530°R shroud test performed in December. The December run differed in that the insulation had been exposed to helium at 1M Hg. pressure prior to testing. The steady state boiloff was 7.05 SCFH, which was identical to the December run. A difference in boiloff would have indicated the presence of gas trapped between the layers of insulation.

The second half of testing was performed with the cryoshroud temperature maintained at 140°R with LN_2. Chamber pressure was raised to approximately 1×10^{-3}

(Continued on Page 39)

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

VERTICAL CALORIMETER

OPERATIONS (Continued)

torr by introducing helium, then recirculated to stabilize insulation temperatures. An estimated three days of testing were thus eliminated. Steady state boiloff was 0.8 SCFH.

In order to determine the effect of the tank support temperature a heater, located at the top of the support tube, was energized at 7.8 watts of power. The resultant steady state boiloff was 2.85 SCFH, proving that the calibration tank is not thermally isolated from the support tube.

It was subsequently decided that further vertical calorimeter testing would be curtailed until the support tube is modified to maintain a constant 37°R under all test conditions.

Preparations are presently underway to install the RPM LH_2 tank in the K-Site chamber for cryotesting. While the RPM tests are in progress, the vertical calorimeter will be disassembled and modified. Vertical calorimeter testing is expected to resume in mid-March.

INSTRUMENTATION

The 158 measurements performed satisfactorily.

CONTROLS

Run support was provided during the month of January. All control systems performed satisfactorily.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

LH_2 TANK COLD LEAK TEST SCHEDULED FOR	End of February.
ITEMS COMPLETED Trial spin up of mixer motor completed. Installed instrument rake, mixer motor & hatch. Valves and tubing fitted and cleaned. 24 strut end fittings were removed, cleaned & reinstalled. Constructed mobile power supply & water cooling system for brazing machine. Liquid methane tank warm leak test completed. Liquid methane tank crated and put in storage. External platinum resistance thermo. pos. located. LH2 rake mounted and checked out.	
ITEMS IN PROGRESS Brazing sample joints with induction brazing machine. Work on the LH_2 tank is continuing and scheduled to be completed	February 7, 1972.
New interconnect instrumentation cable being instld.	

CHANGES: Schedule

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

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

Work completed on the LH_2 tank during January included:

(1) Trial spin-up of mixer motor.

(2) Installation of instrument rake, mixer motor and tank hatch.

(3) Fitting and cleaning of valves and tubing to be mounted on LH_2 tank.

(4) Removal, cleaning and reinstallation of 24 strut, monoball end fittings.

Practice braze joints with the Aeroquip induction brazing machine are currently being made. Before brazing could begin a mobile power supply was constructed to provide 150 Amp, 220 vac, single phase power. A new cooling water supply was also installed.

The LH_2 tank is expected to be complete and ready for transport to K-Site by February 7, 1972. The tank cold leak test, I-1B, will be delayed approximately one week to the end of February due to the unscheduled removal of the vertical calorimeter from the vacuum chamber.

The liquid methane tank was successfully warm leak tested for contract acceptance. Measured leak rates were 3.97×10^{-8} scc GHe/sec on the hatch and 6.80×10^{-9} scc GHe/sec on the bottom penetration. Total maximum allowable leak was 1×10^{-6} sec GHe/sec. The tank has been recrated and stored in Building #9215.

Assembly of the equipment bay hardware has not been started. This was due, in part, to receipt of tubing which did not meet diameter tolerances. In addition, other jobs with higher priority were being completed by the shop personnel.

(Continued on Page 43)

NARRATIVES ON ADJOINING PAGE

SPECIAL RESEARCH PROJECT TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Agreement made on 5-range pressure transducer rework.	
Rework scheduled to be completed by	early February, 1972.

CHANGES: None.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (Continued) INSTRUMENTATION The LH_2 tank instrumentation rake was mounted and checked. Positions were located for the external platinum resistance thermometers on the LH_2 tank. Interconnect cable requirements were determined and construction was started.

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

SPECIAL RESEARCH PROJECT
RSD - V. S. PETERSON

SUMMARY

The CGS Datametrics model 1089 five-range rotatable pressure transducer rework negotiations have led to an interim fix that will allow us to proceed with the spin testing of this transducer. The rework is now expected to be completed early in February 1972.

DISCUSSION

The rework agreement with the contractor covers the removal of a quantity of soft silastic potting material that covers a group of electronic components that were added for temperature compensation. There is a real risk that the removal process may damage some components and they may have to be replaced. After the successful completion of the removal of the silastic material and replacement of damaged parts, the interior of the transducer case will be completely filled with a hard and clear potting compound. This potting process will provide the physical support for the circuit components that are now poorly mounted on the circuit board in a vertical cord wood fashion. The original intent was to use a conformal coating of plastic over low profile components to secure them to the board whereby defective components could be replaced. Datametrics did not follow the philosophy and built the first unit without consulting with NASA. Complete encapsulation negates the repair concept and essentially makes the transducer a throw away item if it becomes defective. A complete repackaging design will be necessary to restore the repairability concept. It is uncertain at this time whether the redesign costs are warranted.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LABORATORY

453 manhours of work completed.

1189 hours of backlog.

INSTRUMENTATION DATA COMPUTER B CONTROL

ITEMS COMPLETED	
XDS9300 was received.	
Installed and checked out XDS CF16A digital controller with mini-Rads.	
Disc operating system was written (so that the mini-Rads would be used)	
ITEMS IN PROGRESS	
Electrical and air conditioning installation contracts expected completion	early February.
Work on chassis and panels proceeding.	
Software systems are being formulated	
Platinum resistance thermometer thermocouples and Z-table generation is	90% complete.
Plot routines.	90% complete.
Floating point math routines	90% complete.

CHANGES: None.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	74 hours
B-3	87 hours
HTF	73 hours
K	149 hours
SPF	70 hours
	453 hours
Total Backlog	1189 hours

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

The XDS9300 was received and will be installed during February.

Electrical and air conditioning installation contracts are proceeding towards an early February completion.

The XDS CF16A Digital Controller equipment was installed with their Mini RAD's and checked out.

The progress on the numerous interfaces related to the data computer is given below in tabular form. The figures are percent complete:

Description	Chassis		Panel	
	Design	Fab.	Design	Fab.
SEL to XDS9300	100%	100%	100%	50%
XDS9300 Junction Box	100%	100%	N/R	N/R
2-CF16A Intercon. Box	100%	100%	50%	10%
2-CF16A-XDS9300	100%	70%	5%	0%
HTF Heater Link	50%	30%	5%	0%
DC Power Distr.	100%	70%	100%	100%

N/R = Not Required

Check out of the various interfaces will begin in February.

INSTRUMENTATION DATA
COMPUTER SOFTWARE SYSTEMS

RSD - I. KRAMARCHUK

Software systems are being formulated and implemented for the CF16 mini-computers. The same software is applicable to the mini, alone, and to the combined mini - XDS9300 computer complex. The immediate objective is to give the K-Site RPM project on-line data from the mini-computer.

(1) Thermocouple and Z-Table (for platinum resistance thermometers) generation is 90% complete.

(2) Plot routines and floating point math routines are 90% complete.

(3) A Disc Operating System was written so that the mini Rads would be usable. XDS has practically no software available for the Rads, as yet.

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

SUMMARY

The necessary parts of the vertical calorimeter have been sent to Lewis-Cleveland for modification and installation of an additional cold guard. Testing is expected to resume in April.

The RPM LH_2 tank assembly was moved to K-Site and is now in the vacuum chamber. Final installation is about 50% complete. Testing will start around the middle of March.

The 13' cryoshroud is at B-2 Site for leak checking and mating with the conical bottom.

(Continued on Page 43)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023

TECHNOLOGY TESTS	Apr 3 to Jun 5, 1972.
ITEMS COMPLETED Calorimeter removed from Site. Test Package disassembled. Center support tube assembly and calorimeter tanks sent to Cleveland for modification.	
ITEMS IN PROGRESS Modification of center support tubes and calibration tank	Mar 3 (est'd comp date)

CHANGES: Schedule added.

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

VERTICAL CALORIMETER (YPR2023) — CRD - J. E. MALOY; RSD - J. E. CAIRELLI

DISCUSSION

OPERATIONS

During February the Vertical Calorimeter was removed from the K-Site vacuum chamber. The test package was disassembled and the center support tube was removed from the vertical calorimeter (this was done without disturbing the 160 layers of insulation).

The center support tube, mounting flange, and all hardware which attached directly to the mounting flange and calorimeter tanks were sent to Lewis-Cleveland for modification. Modifications also include shortening of the measure tank fill line dip tube and the addition of Rosemount temperature sensors.

All Lewis-Cleveland modifications are expected to complete by March 3.

The assembly of the vertical calorimeter test package will not actively begin until the present RPM LH_2 tank test is completed.

Vertical calorimeter testing is expected to resume the first week in April.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

During February the LH_2 tank assembly was completed for the tank cryo-leak test. Work included final fitting of all tank valve and tubing runs and induction brazing all tube fittings. Following assembly, all fittings were carefully mass-spec'd for zero detectable leakage. The multilayer insulation purge system and insulation support studs were included in the tank assembly. The tank was transported to K-Site and is currently

(Continued on Page 45)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173
LH_2 CRYO TESTS		thru Mar 27, 1972.
LH_2 TANK TESTS		Jun 26 to Aug 6, 1972.
F_2 TANK TESTS		Aug 14 to Sep 25, 1972.
LH_2 TANK WITH SHADOW SHIELD TEST		Oct to Feb, 1973.
LH_2 & LF_2 SYSTEM TESTS		Apr to Sep 1973.
ITEMS COMPLETED		
Cryo leak test, LH_2 tank assembly completed.		
LH_2 tank installed in vacuum chamber.		
13' shroud move to B-2.		
LH_2 tank cryo test, test plan finalized.		
Safety permit test details presented & approved.		
Layout approved for control panel modifications.		
(ATS) Assembly Area cleaned & ready for insulation work.		
Equipment bay system completed and cleaned.		
Conducted a 4-day test of the "little rig".		
Events recorder added to facility.		
4 power supplies returned and checked out.		
ITEMS IN PROGRESS		
Piping from LH_2 tank to facility piping		50% complete.
Instrumentation & electrical work underway.		
New flanges are being installed on 13' shroud		
Payload simulator heater installation		50% complete.
Solenoid mounting panel installation		75% complete.
Drawings in process for control panel mods.		
Equipment bay system being leak checked.		
Electrical termination boxes & conduit runs started.		
Instrumentation for March tests is		80% complete.

CHANGES: Schedules added.

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

RESEARCH PROPULSION MODULE (Continued)

in the vacuum chamber. Tank to facility piping is approximately 50% complete. The instrumentation and electrical work is well underway to meet an anticipated test the week of March 13, 1972.

The 13' shroud was moved to B-2 where new flanges will be installed and the entire shroud warm leak checked.

The test plan for the LH_2 tank cryo-test was finalized and Test Plan Supplement #4 was approved. In support of latest work estimates the overall K-Site and ATS schedule was revised for the RPM program.

Other RPM work activities included:

(1) Payload Simulator: heater installation 50% complete.

(2) Safety Permit: Test details presented and procedures approved.

(3) Solenoid mounting panel: Installation 75% complete.

(4) Control Panel modifications: layout approved and drawings in process.

(5) Insulation panels: Assembly Area (ATS Bldg) cleaned and ready for insulation work. All hardware (forms, special tools, etc.) were delivered to the assembly area.

(6) Equipment Bay: System is completely assembled, cleaned and being leak checked.

(7) Electrical: Termination boxes and conduit runs have been started for June Tests I-2 & 3.

A four day test was conducted in the "little rig". The test objective was to determine temperature effects on ionization gage vacuum pressure readings. Simultaneous readings for both a "warm" gage and a "cold" gage were recorded between 10^{-3} and 10^{-8} Torr. Preliminary

(Continued on Page 47)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

5 range rotatable pressure transducer repaired and returned.

Transducer is undergoing static specification compliance tests.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROHECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	

RESEARCH PROPULSION MODULE (Continued)

data indicated that temperature effects were of little or no significance in the temperature range tested. Both operation and research test reports will be written.

INSTRUMENTATION

Instrumentation for the March tests is 80% complete. Work consisted of tank instrumentation installation, and site wiring changes. An events recorder has been added to the facility, and it has been decided to use a multipoint recorder to monitor liquid levels.

CONTROLS

The four power supplies which were sent back to the factory for repair have been returned and checked out. All power supplies to be used with the various heater control systems are now operational.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The rework on the CGS Datametrics Model 1089 five range rotatable pressure transducer has been completed. The transducer is now at Plum Brook and is being tested for contract static specification compliance by the Standards Laboratory.

DISCUSSION

A visual inspection of the reworked transducer revealed that Datametrics did, as instructed, remove the silastic potting material and completely filled the transducer interior with hard transparent potting compound. Early data taken shows the transducer's static performance has shifted in values from the original data. Both zero and full scale outputs have been affected by the potting material. Further testing will continue to determine the performance of the transducer.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LABORATORY

237 manhours of work completed.

1300 manhours of backlog.

INSTRUMENTATION DATA COMPUTER B CONTROL

ITEMS COMPLETED XDS9300 installed. Design of 2-CF16A to XDS9300 interface completed. Design of 2-CF16A interconnect box completed. Fabrication of DC Power distributable chassis compltd. Design of HTF heater link chassis completed. Design of 9300 line receiver chassis completed. Design of 9300 I/O cables completed. ITEMS IN PROGRESS XDS9300 check out nearing completion. Contractual XDS standard software yet to be received. Electrical & AC installation . . . . . . Work on chassis and panels proceeding.	95% complete.

CHANGES: None.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	70 hours
B-3	33 hours
HTF	66 hours
K	20 hours
SPF	36 hours
Reactor	12 hours
	237 hours
Total Backlog	1300 hours

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

The XDS 9300 has been installed and check out is nearing completion. The XDS standard software requested in the contract has not been received. Action is proceeding to obtain the software before completion of check out.

Electrical and air conditioning installations are 95% complete.

The progress on the numerous interfaces related to the data computer is given below in tabular form. The figures are percent complete.

Description	Chassis		Panel		
	Design	Fab.	Design	Fab.	Check Out
SEL to XDS9300	100%	100%	100%	70%	0%
XDS9300 Junc Box	100%	100%	N/R	N/R	0%
2-CF16A Inter Bx	100%	100%	100%	30%	0%
2-CF16A-XDS9300	100%	100%	100%	20%	0%
DC Pwr Distrb	100%	100%	100%	100%	0%
HTF Heater Link	100%	50%	60%	10%	0%
9300 Line Recvr Chassis	100%	0%	N/R	N/R	0%
9300 I/O Cables	100%	0%	N/R	N/R	0%
HTF Htr Link Cab	10%	10%	N/R	N/R	0%

N/R = Not Required.

Check out has been delayed because of HTF Heater Link Design. Check out is beginning the first week of March.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SOFTWARE

ITEMS COMPLETED	
'K' program coding completed.	
CF-16 mini-RADS - program coding completed.	
CF-16 mini-plot routines and floating point match routines completed.	
ITEMS IN PROGRESS	
'HTF' heating control and monitoring system flow diagram	70% complete.
'HTF' heating control and monitoring system program coding	5% complete.
'K' data flow diagram	95% complete.
'K' data reporting system check out	60% complete.
CF-16 mini-RADS flow diagram	95% complete.
CF-16 mini-RADS check out	80% complete.
Platinum and thermocouple table generator	95% complete.

CHANGES: None.

INSTRUMENTATION DATA
COMPUTER SOFTWARE SYSTEMS

RSD - I. KRAMARCHUK

(1) HTF Heater Control and Monitoring System:

Flow Diagram	70% complete
Program Coding	5% complete
Check out	0% complete

(2) K-Site Data Reporting System:

Flow Diagram	95% complete
Program Coding	100% complete
Check out	60% complete

(3) General Disc Software for the CF-16 Mini-RADs:

Flow Diagram	95% complete
Program Coding	100% complete
Check out	80% complete

(4) Platinum and thermocouple table generation is 95% complete.

(5) The plot routines and the floating point math routines for the CF-16 computer are essentially complete.

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

SUMMARY

The modified center support tube assembly for the vertical calorimeter was delivered to K-Site on March 10. Assembly is nearly complete and testing will resume as soon as the RPM LH_2 tank test is complete. This is expected sometime in April.

The RPM LH_2 tank assembly leak test started on March 20. Excessive leakage required the chamber to be opened and leaks in the pressurization line repaired. The warm leak test was repeated on March 30 and will continue into the cold portion in April. Problems have plagued the mixer motor inside the tank and it is probable that the motor will not run at LH_2 temperatures.

The 13' shroud is being leak tested in B-2 and is progressing satisfactorily. The conical bottom leak test showed a very poor piece of hardware. The project group in Cleveland will make a decision to repair or replace with an outside contract.

(Continued on Page 37)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
VERTICAL CALORIMETER	K SITE	YPR2023

STATUS	SCHEDULE
TESTING SCHEDULED TO RESUME	Third week of April.
TECHNOLOGY TESTS	Apr to Jun 5, 1972.
<u>ITEMS COMPLETED</u>	
Center support tube modified, installed, tested and delivered	March 10, 1972.
Center tube instrumentation installed.	
Multi-layer insulation made for top & bottom of tanks	
Initiated procurement of insulation removal fixture.	
Additional temperature sensors installed.	
All power supplies reinstalled.	
<u>ITEMS IN PROGRESS</u>	
Control system	90% complete.
Assembly & installation work proceeding.	

CHANGES: (schedule changes since last report)

CHANGES:

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

VERTICAL CALORIMETER (YPR2023)

CRD - J. E. MALOY;
RSD - J. E. CAIRELLI

DISCUSSION

OPERATIONS

Modifications to the center support tube were completed during the first week of March by Lewis-Cleveland shops. Following assembly of the center support tube to the upper mounting flange and related parts, it was then cold-shocked and mass spectrometer leak checked at the South 40 test area. The support tube assembly was delivered to K-Site on March 10.

Plum Brook personnel then installed all instrumentation on the center support tube. The Measure Tank dip tube was shortened, instrumentation relocated, and multi-layer insulation blankets were made to cover the top and bottom of the calorimeter tanks.

Procurement and fabrication was initiated for parts necessary to construct a fixture to unwrap and save MIL material from the vertical calorimeter. This fixture will allow removal of insulation with minimal effort as different layer testing is required. The first test starts with 160 layers and the layers decrease with successive testing.

Vertical calorimeter testing is expected to resume the third week of April. This is subject to change depending upon the results of the RPM hydrogen tank testing.

INSTRUMENTATION

Additional Rosemount temperature sensors were installed to meet additional requirements of the next test series.

CONTROLS

All of the power supplies for the Vertical Calorimeter have been reinstalled and hooked up to the loads. The work required for the Vertical Calorimeter control system is approximately 90% complete.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173
LH_2 CRYO TESTS		thru Apr 3, 1972.
LH_2 TANK TESTS		Jun 26 to Aug 6, 1972.
F_2 TANK TESTS		Aug 14 to Sep 25, 1972.
LH_2 TANK WITH SHADOW SHIELD TEST		Oct to Feb 1973.
LH_2 & LF_2 SYSTEM TESTS		Apr to Sep 1973.
ITEMS COMPLETED		
LH_2 tank assembled and ready for testing.		
Cold leak tests conducted		Mar 22, 1972.
Pressurization line leaks repaired.		
Changed electrical pass-through connector.		
Changed transducers.		
Completed LH_2 warm leak test		Mar 30, 1972.
Instrumentation requirements completed for second series of tests.		
ITEMS IN PROGRESS		
Pumping down for second cold leak test		Apr 3 est'd compl date.
Installing heater strip to payload insulator		80% complete.
Fabricating tank vent & propellant line insulation covers		90% complete.
Fabricating lid and bottom insulation covers.		
Assembling floating temperature plate.		
Instrumenting tank struts.		

CHANGES: Cryo test schedule.

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

RESEARCH PROPULSION MODULE (YPR4173)

CRD - R. L. DEWITT;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

The LH_2 tank assembly (tank, valving, and tubing runs) leak test, RPM test I-1b, was started on March 20. A facility leak delayed actual testing one day. On March 21 a warm leak test was conducted with the tank at 60 psia and 5×10^{-6} Torr chamber pressure. A maximum leak of 2 to 6×10^{-3} std cc GHe/sec was measured on the tank and pressurization line. Selective leak rate measurements of tank and service lines at various pressures indicated this was primarily due to the pressurization line.

On March 22, cold leak tests were conducted and the motor spinup was attempted. Cold leak rates were essemtially the same as with the system warm. The mixer motor spinup was not accomplished due to a shorted connector.

The vacuum chamber was opened, leaks in the pressurization line were repaired, a tank lid electrical passthrough and connector were changed, and the Venturi 25 psia transducer was changed to a 50 psia transducer. On March 30, the warm leak test was repeated. The tank warm leak rate was measured at 3×10^{-4} std cc GHe/sec. No leak was detected in the pressurization line.

Due to an apparent high outgassing background in the chamber the system was pumped out over the weekend. A cold leak test will be made April 3 and the mixer motor spinup attempted once more. Assuming the tank system leak rate does not substantially increase, and a successful mixer motor spinup is accomplished, the tank will be ready for installing the insulation by April 10.

(Continued on Page 41)

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

RESEARCH PROPULSION MODULE (Continued)

Warm leak tests on the 13' shroud were started in March at the B-2 Facility. The conical bottom leaks are numerous. Many are too large to measure with a standard Veeco Mass Spectrometer. A decision will be made in the near future as to whether the conical bottom is to be repaired or replaced with a new conical bottom. Further "mass specing" has been directed to the shroud vertical walls. Maximum single allowable leaks have been set at 1×10^{-7} std cc GHe/sec. The overall allowable leak rate is not to exceed 1×10^{-5} std cc GHe/sec.

Heater strip addition to the payload insulator is 80% complete. The remainder of this job is primarily electrical terminations. Insulation covers for the LH_2 tank vent and propellant lines are 90% complete. Forms for the tank lid and bottom insulation covers are in process. Assembly of the "floating temperature" plate has been started in the "white" room.

INSTRUMENTATION

Instrumentation requirements for the second series of tests have been received. The tank struts are currently being instrumented by the thermocouple shop.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

5 range rotatable pressure transducer is being installed in Spin Test Rig.	

CHANGES: None.

NO ITEMIZED DATA SUMMARY FOR STANDARDS AND CALIBRATION LAB - See Page 43

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

The Datametrics Model 1089 five range rotatable pressure transducer is presently being installed in the I&C Division's Shaft Data Systems Spin Rig. The rotational performance will be checked out over a speed range covering zero to 9000 RPM. Upon successful performance, the speed tests will then be extended to cover the speed range of 9000-18000 RPM needed for future programs.

DISCUSSION

The transcuers zero and full scale outputs (static calibration) for each of the five pressure ranges have a slightly greater spread than is desirable. In order to speed up the advanced system program, it has been decided to proceed into the spinning evaluation. Present plans are to use a computer for engine test data gathering and computations. Since there will be so many correction factors, such as air centrifuging and air temperature, the zero and span corrections for each range will not appreciably add to the computer work load.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-2	99 hours
B-3	40 hours
B-3	48 hours (direct support)
K	33 hours
HTF	67 hours
SPF	58 hours
Reactor	1 hour
	346 hours
Total Backlog	1400 hours

NO ITEMIZED DATA SUMMARY FOR INSTRUMENTATION DATA COMPUTER - See Page 45

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

The XDS 9300 hardware is functioning properly, with one exception. The proper hardware for simultaneous access to three separate memories was not supplied. A proposal is expected soon for completion of this requirement. Library software has been partially received and rendered operational. Acceptance of the system will be made when the library software is complete and the simultaneous memory access proposal is received, evaluated and negotiated.

Fabrication of the data computer interfaces has stalled in order to concentrate sufficient effort to rendering the HTF Heater Link operational as well as other site requirements. The HTF Heater Link digital hardware phase is nearing completion and will allow the software phase to soon proceed unimpeded.

The raw data input from the SEL data acquisition systems to one CF16A digital controller is operational. The K Data Link is operational through the same CF16A. This means that software for temporary service for K Site can proceed unimpeded.

The progress of the numerous interfaces related to the data computer and HTF Heater Link is given below in tabular form.

Description	Chassis		Panel		
	Design	Fab.	Design	Fab.	Check Out
SEL to XDS 9300	100%	100%	100%	70%	20%
XDS 9300 Junction Box	100%	100%	N/R	N/R	0%
2-CF16A Intercon Box	100%	100%	100%	30%	70%
2-CF16A - XDS 9300	100%	100%	100%	20%	0%
DC Power Distribution	100%	100%	100%	100%	100%
9300 Line Recvr Chas	100%	0%	N/R	N/R	0%
9300 I/O Cables	100%	30%	N/R	N/R	0%
HTF Heater Link	100%	100%	100%	100%	50%
HTF Heater Link Cabs	100%	60%	N/R	N/R	50%

N/R = Not Required.

NO ITEMIZED DATA SUMMARY FOR INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS -

See Page 47

INSTRUMENTATION DATA
COMPUTER SOFTWARE SYSTEMS

RSD - I. KRAMARCHUK

(1) HTF Heater Control and Monitoring System:

Flow Diagram	80% complete
Program Coding	70% complete
Check Out	20% complete

(2) K-Site Data Reporting System:

Flow Diagram	95% complete
Program Coding	100% complete
Check Out	65% complete

(3) General Disc Software for the CF-16 Mini-RADS:

Flow Diagram	95% complete
Program Coding	100% complete
Check Out	80% complete

(4) Platinum and Thermocouple table generation is essentially complete.

(5) Check out of the 9300 software furnished by XDS has begun.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023
TESTING SCHEDULED TO RESUME		Week of May 1, 1972.
TECHNOLOGY TESTS		Apr to Jun 5, 1972.
ITEMS COMPLETED Vertical Calorimeter center support tube installed. Kinney vacuum pumps removed and sent to LeRC-C. Three insulation blankets were fabricated. Additional temperature sensors installed.		
ITEMS IN PROGRESS Kinney vacuum pumps being rebuilt and reinstalled scheduled for		May 15, 1972.

CHANGES: Start of testing schedule changed.

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

SUMMARY

The Vertical Calorimeter has been reassembled and mounted inside the 8' cryoshroud and installed in the chamber. Testing is scheduled for the first week in May.

On April 3, 1972, the RPM LH_2 tank was filled a second time with LH_2 and test 1-lb was completed.

New requirements for an ultimate operating vacuum of 5×10^{-7} Torr require the chamber to be cleaned and polished. A contract will be written for this task. A reduction of chamber pressure from 1×10^{-7} Torr to 1×10^{-6} Torr results in an increase of unwanted heat from 0.05 BTU/hr. to 0.9 BTU/hr. from gaseous conduction. The total heat leak into the test package is 0.3 BTU/hr. assuming that gaseous conduction is not a contributing path of heat addition.

VERTICAL CALORIMETER (YPR2023)

CRD - J. E. MALOY;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

The Vertical Calorimeter center support tube modification was installed with no apparent problems. The calorimeter test assembly was installed in the chamber, and testing will begin the first week of May. Some delay in the test buildup was encountered when the KT-500 Kinney vacuum pump failed. The pump was removed and shipped to Lewis-Cleveland to be rebuilt. Parts are being delivered from the manufacturer, and the pump will be reinstalled by May 15. Vacuum chamber pump down for the Vertical Calorimeter tests will be attempted by using the two smaller (KT-250) pumps.

INSTRUMENTATION

Additional temperature sensors were installed to meet the new requirements in support of the test scheduled for early May.

(Continued on Page 35)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE K SITE YPR4173

LH_2 TANK TESTS	Jul 31 to Sep 11, 1972.
F_2 TANK TESTS	Sep 18 to Oct 30, 1972.
LH_2 TANK WITH SHADOW SHIELD TEST	Nov 1972 to Mar 1973.
LH_2 & LF_2 SYSTEM TESTS	May to Oct 1973.
ITEMS COMPLETED	
LH_2 tank cold leak test completed and moved to ATS.	
(ATS) tank support delivered and assembled.	
Tank upper coolie hat fitted, and upper & lower units insulated.	
Tank strut monoball end fittings were cleaned.	
Payload simulator heater strip installation is compltd	
Floating temperature plate assy completed & C/O.	
4 T/C reference junctions returned for Mfg.	
Instrumentation review meeting held	Apr 21, 1972.
Payload simulator wiring design completed.	
ITEMS IN PROGRESS	
An LH_2 mixer motor is being tested.	
LH_2 tank is being insulated.	
Working on PR for chamber cleaning & wall polishing contract.	
Re-evaluating splash pan requirements.	
Proceeding on 13' cryoshroud "mass specing" at B-2.	
13' cryoshroud flanges are being replaced.	
New conical bottom being manufactured.	
Mixer motor power supply being checked.	
Payload simulator wiring sch'd to be comp by	May 31, 1972.

CHANGES: Test schedule extended five weeks.

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

VERTICAL CALORIMETER (Continued)

CONTROLS

Systems worked satisfactorily during prerun check out for the May 1 run.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

RPM Test 1-1b, LH_2 tank cold leak test, was completed in April. Due to the chamber high background gas, a definite leak rate could not be measured. The tank leak rate, however, is not greater than $1x10^{-3}$ std cc GH_2/sec while cold and at 60 psid. This leak rate is acceptable for future testing with a $5x10^{-7}$ Torr chamber pressure. The second attempted mixer motor spin-up was still not successful in LH_2. The power supply is being checked. A similar motor is being tested at Lewis-Cleveland to determine why the LH_2 tank mixer motor will not run. Following test 1-1b, the tank was removed from the facility and transported to the ATS Building. Insulation is being applied for the forthcoming TPM tests 1-2a and 2b, near earth and thermal null tests respectively.

Because of the new ultimate operating chamber pressure requirement, $5x10^{-7}$ Torr, work is being initiated to improve the present ultimate chamber pressure. A purchase request for a chamber cleaning and wall polishing contract will be written. One potential contractor has indicated this will be a 4 to 5 week task. The RPM test program will be rescheduled accordingly. The diffusion pump cooling water will be temperature conditioned to improve pump operation within any temperature environment. Unused cables and tubes inside the chamber will be removed. Seals and wall pass-thrus will be extensively leak checked. The splash pan requirements are being evaluated. The pan surface accounts for approximately one-third of the outgassing area. In addition,

(Continued on Page 37)

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

RESEARCH PROPULSION MODULE (Continued)

cleaning between the pan and chamber wall cannot be accomplished within vacuum cleanlines requirements. Acceptable leak rates on the 13' cryoshroud have been redefined.

Work on the 13' cryoshroud "mass specing" has progressed well at B-2. The first "once around" leak measurements were completed for each section. This included all tubes and most individual welds. The total leak rate is 3.67×10^{-5} std cc He/sec. Six welds have been selected for rewelding. These repairs should reduce the total leak rate to 2.2×10^{-6} std cc He/sec. All the shroud flanges are being replaced to eliminate the poor quality and improperly installed flanges supplied by the manufacturer. A new shroud concial bottom has been designed by Lewis-Cleveland. It is presently being manufactured by outside contractors. The new conical bottom will not be required until Part II testing.

Work in the ATS Building assembly area is proceeding on schedule. The tank support "A" frame was delivered and assembled. The tank upper coolie hat was fitted, and insulation blankets for both upper and lower coolie hats were completed. The tank strut monoball end fittings were cleaned and are ready for assembly. Heater strip installation was completed on the payload simulator. Electrical terminations and instrumentation remain to be done. In addition to the RPM work, three insulation blankets were fabricated for the Vertical Calorimeter.

The floating temperature plate assembly has been completed and leak checked in the "white" room.

INSTRUMENTATION

The mixer motor 3-phase power supply is being checked in the Standards Lab before its return to Cleveland. LH_2 tests on another mixer motor will then be run in Cleveland to determine motor starting characteristics in LH_2.

(Continued on Page 39)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		

CHANGES: (schedule changes since last report)

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM	YPY2752
5-range rotatable pressure transducer successfully tested over 0-9000 RPM range.	

CHANGES: None.

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

RESEARCH PROPULSION MODULE

INSTRUMENTATION (Continued)

The four thermocouple reference junctions have been returned from Dynascience and will be acceptance tested in May.

A meeting with R. Dewitt and P. Wanhanien was held on April 21 to review in detail the instrumentation requirements for tests 2a and 2b.

CONTROLS

The payload simulator wiring print is complete and has been given to the electricians. Wiring should be completed by the end of May.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The Datametrics Model 1089 five-range rotatable pressure transducer was successfully operated over a speed range of 0-9000 RPM. Further testing over a speed range of 9000-18000 RPM has been temporarily delayed due to a malfunction in the I&C Division's Shaft Data Spin Rig.

DISCUSSION

The successful transducer tests covering the speed range of 0-9000 RPM meets the requirements originally specified for the present Air Breathing Engine Division needs. Future turbine research will require spinning pressure transducer measurements covering a speed range of 0-18000 RPM. The model 1089 has a good chance to meet the performance capability for the extended speed requirement. A decision will be made during the early part of May 1972 to determine the location of the future spin testing as well as the specific pressure requirement needs for the Air Breathing Engine Turbine Research.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LAB

367 hours completed.

1075 hours of backlog.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER

Heater Link digital hardware is essentially complete.
Check out of analog multiplexer system has started.
Interfaces related to the data computer are progressing in fabrication and check out.

CHANGES: None.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	156 hours
HTF	149 hours
K	28 hours
SPF	27 hours
Reactor	7 hours
	367 hours
Total Backlog	1075 hours

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

The XDS 9300 has not been accepted because of small outstanding hardware and software requirements, as mentioned last month. The software requirement has been partially completed. A proposal has been submitted to Procurement to pay 95% of the system price. The remaining 5% is to be withheld until the outstanding items are complete. In return for 95%, we shall be permitted to use and interface with the system.

The HTF Heater Link digital hardware is essentially complete. Check out of the analog multiplexor system is currently beginning. It has been held up for delivery of a power supply.

The progress of numerous interfaces related to the data computer and the HTF Heater Link is given below in tabular form:

Description	Chassis		Panel		
	Design	Fab.	Design	Fab.	Check Out
SEL to XDS 9300	100%	100%	100%	90%	30%
XDS 9300 Junc Box	100%	100%	N/R	N/R	0%
2-CF16A Intercon Box	100%	100%	100%	100%	70%
2-CF16A - XDS 9300	100%	100%	100%	50%	0%
DC Power Distribution	100%	100%	100%	100%	100%
2-CF16A - TEC CRT	100%	0%	N/R	N/R	0%
9300 Line Rec Chassis	100%	100%	N/R	N/R	0%
9300 I/O Cables	100%	80%	N/R	N/R	0%
HTF Heater Link	100%	100%	100%	100%	90%
HTF Heater Link Cabs	100%	100%	N/R	N/R	90%

N/R = Not Required.

INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS

(See write up - Page 43)

INSTRUMENTATION DATA
COMPUTER SOFTWARE SYSTEMS

RSD - I. KRAMARCHUK

(1) HTF Heater Control and Monitoring System:

Hardware check out program	80% complete
Flow Diagram	80% complete
Program Coding	80% complete
Check out	20% complete

(2) K-Site Data Reporting System:

Flow Diagram	95% complete
Program Coding	100% complete
Check out	65% complete

(3) General Disc Software for the CF-16 Mini-RADS:

Flow Diagram	95% complete
Program Coding	100% complete
Check out	80% complete

(4) Data Display System Software (CF-16):

Flow Diagram	60% complete
Program Coding	30% complete
Check out	20% complete

(5) Check out and familiarization with the XDS-furnished software was accomplished with 15% of one man's time. This involved running the software, and communication with the XDS 9300 software expert in California to overcome various problems.

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

SUMMARY

Two tests were completed with the vertical calorimeter 160 layer insulation system. Next test will be with the 100 layer system.

The RPM payload simulator work is in progress in the ATS Building.

Centaur Standard Shroud work in B-3 and site work at the Hypersonic Test Facility has taken manpower from K-site. This is on a minimum basis but does affect the K-site test program to varying degrees.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023

TESTING SCHEDULED TO RESUME	June 19, 1972
<u>ITEMS COMPLETED</u> Two tests conducted with 160 layer insulation system. Null test conducted with all systems filled with LH_2. Warm test conducted with shroud at 530°R.	

CHANGES: None.

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

VERTICAL CALORIMETER (YPR2023)

CRD - J. E. MALOY;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

Two tests were completed with the vertical calorimeter 160 layer continuous wrap insulation system. The null test was conducted with all systems (measure tank, guard tanks, and shroud) filled with LH_2. Steady state boil-off was approximately 0.1 SCFH. The warm test, shroud at 530°R, yielded a steady state boil-off of 0.8 SCFH. Both boil-off rates were commensurate with the theoretical heat leak rates. The insulation temperature gradient was more characteristic of a conductive heat transfer profile rather than the predicted radiation heat transfer profile. It is possible that the insulation may have slipped and thermally shorted to an end cold guard. During the next unwrapping the insulation will be inspected for slippage. The "H" Building central recorder malfunctioned and no data was recorded during the night of May 22. Fortunately the test package was still cooling down and no steady data was lost.

Further vertical calorimeter testing has been temporarily suspended because all site personnel were reassigned to other facilities. Because of these delays the vertical calorimeter test schedule will require modification. As of this writing, the 160 layer tests with 140°R surrounds temperature have already been deleted from the program. The next calorimeter test will be with the 100 layer system. The earliest possible date to resume testing is June 19.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173
LH_2 TANK TESTS		Jul 31 to Sep 11, 1972.
F_2 TANK TESTS		Sep 18 to Oct 30, 1972.
LH_2 TANK WITH SHADOW SHIELD TEST		Nov 72 to Mar 73.
LH_2 & LF_2 SYSTEM TESTS		May to Oct 1973.
ITEMS COMPLETED Vehicle forward, aft & midstructures were completed. (painted and instrumented) Spare mixer motor was run at 61°R. Step-down transformers were installed. Revised instrumentation requirements were received. Cable fabrication & instrumentation installation drawings received. Drift problem in thermocouple reference junction has been corrected.		
ITEMS IN PROGRESS Payload simulator being assembled. Thermocouple reference junctions being calibrated.		

CHANGES: None.

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

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

The payload simulator work is in progress at the ATS Building on an "as available" basis of manpower. Heater electrical terminations and instrumentation remain to be done. As a result of the manpower shortage, virtually all other field work has stopped on the 13' shroud leak checking and welding and the tank insulation buildup.

The vehicle forward, aft and midstructures were completed (painted and instrumented) in Lewis-Cleveland and are ready for shipment to Plum Brook. All the major hardware required to complete the RPM program will be on hand when these structures arrive at Plum Brook.

INSTRUMENTATION

The spare RPM mixer motor was run in Cleveland at a temperature of 61°R. Overload was encountered at 36 volts and 0.52 Amps. Step-down transformers were installed which allowed overload at 44 volts and 0.625 Amps. Therefore, the K-site motor should run if there are no mechanical problems.

Revised instrumentation requirements were received and are being incorporated in an RPM 1-2a & b flow sheet and digital format.

All necessary drawings have been received for cable fabrication and instrumentation installation.

The drift problem in the Chromel Constantan Thermocouple Reference Junction (CR/CN TCRJs) has been corrected by Dynascience. The TCRJs are currently being calibrated.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

5-range rotatable pressure transducer test over the 9000-18000 RPM range has been delayed. The pressure measuring system to be returned . . . . . New type pressure transducer and slip ring will be installed.	early June.

CHANGES: Schedule delayed.

STANDARDS AND CALIBRATION LAB

187 hours completed. 1042 hours of backlog.

CHANGES: None.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

The 9000-18000 RPM test program for the Datametrics Model 1089 five-range rotatable pressure transducer has been delayed due to personnel changes in the I&C Division. A decision will be made early in June that will establish the direction and goals relative to the pressure measurement needs for the Air Breathing Engine Division turbine development programs.

DISCUSSION

During the early part of June, the original ten-channel rotating pressure measuring system will be returned to Plum Brook. New type 49-NC pressure transducers and a new style slip ring will be installed. The slip ring has a larger diameter hole through its rotor for easier routing of thermocouple extension wires through the package. This will require some mechanical modifications to the package structure. The advanced ten-channel pressure and sixty-two channel temperature rotating measuring system with the type 1089 pressure transducers will be evaluated for use in the new higher RPM research programs.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	56 hours
HTF	20 hours
K	42 hours
SPF	41 hours
Reactor	12 hours
Direct Labor support for B-3	16 hours
	187 hours
Total Backlog	1042 hours

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER

XDS9300 not accepted because of hardware discrepancies.
XDS9300 software requirement completed.

Proposal for simultaneous access to XDS9300 received from Xerox - not acceptable - Work will be accomplished by NASA.

Interfaces related to the data computer are progressing in fabrication and check out.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS

(See write up - Page 49)

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

The XDS9300 has not been accepted because of small outstanding hardware discrepancies. These are waiting for parts at the present time.

The XDS9300 software requirement has been completed.

The proposal for simultaneous access to the XDS9300 memories was received from Xerox and is unacceptable. NASA personnel will accomplish the job as time permits with considerable savings of money.

The progress of numerous interfaces related to the data computer and the HTF Heater Link is given below in tabular form:

Description	Chassis		Panel		
	Design	Fab.	Design	Fab.	Check Out
SEL to XDS9300	100%	100%	100%	100%	60%
XDS9300 Junction Box	100%	100%	N/R	N/R	0%
2-CF16A Intercon Box	100%	100%	100%	100%	80%
2-CF16A-XDS9300 I/F	100%	100%	100%	100%	10%
DC Power Distribution	100%	100%	100%	100%	100%
2-CF16A-TEC CRT	100%	50%	N/R	N/R	0%
9300 Line Rec Chassis	100%	100%	N/R	N/R	0%
9300 I/O Cables	100%	100%	N/R	N/R	0%
CF16A Interrupt Timer	100%	100%	N/R	N/R	100%
HTF Heater Link	100%	100%	100%	100%	95%
HTF Heater Link Cabs.	100%	100%	N/R	N/R	95%

N/R = NOT REQUIRED.

INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS

RSD - I. KRAMACHUK

(1) HTF Heater Control and Monitoring System:

Hardware check out program	95% complete
Flow Diagram	85% complete
Program Coding	85% complete
Check out	50% complete
Multiplexer check out software	40% complete

(Continued on Page 51)

INSTRUMENTATION DATA
COMPUTER SOFTWARE SYSTEMS (Continued)

(2) K-Site Data Reporting System:

Essentially completed basic display and conversion programs. Refinements will be made upon receiving specific research requirements.

(3) General Disc Software for the CF-16 Mini-Rads:

No change from last month.

(4) Data Display System Software (CF16):

No change from last month.

(5) Received LeRC-C thermocouple conversion routine based on National Bureau of Standards research. Applicability to our on-line XDS9300 computer has not been determined.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023
TEST SCHEDULE		To end Sep 1972.
TESTING SCHEDULED TO RESUME		July 1, 1972
160 layer insulation test completed in 7 days.		
60 layers of insulation and 8 thermocouples removed.		
100 layer warm test will begin		July 1, 1972

CHANGES: Test schedule.

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

SUMMARY

The 160 layer insulation test on the Vertical Calorimeter was started on June 19, 1972 and was completed seven days later. Final boil-off was approximately 1.15 SCFH of GH_2.

The system was warmed up and the insulation was unwrapped to 100 layers. The 100 layer test program is scheduled to start approximately July 1, 1972.

The RPM buildup continued in the ATS Building on insulation blankets and wiring of the payload simulator. The LH_2 tank lower hat blanket is 70% complete and the valve cover blanket was started. Insulation work is the critical path item as all RPM components are now at Plum Brook.

A purchase request for cleaning and polishing the vacuum chamber walls has been written and is in the procurement cycle.

VERTICAL CALORIMETER (YPR2023)

CRD - J. E. MALOY;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

On June 19 the Vertical Calorimeter with 160 layers insulation and a 530°R surrounds temperature was started. This was a rerun on the 160 layer warm system to verify the "fix" required due to slippage of insulation layers. The slippage had caused the outer layer to thermally short, which reduced the effective heat leak into the measure tank. A thermal barrier of 1/4" foam sheet and aluminized mylar was placed over the exposed insulation ends. The test required 7 days continuous running and was terminated when the insulation temperature profile and the tank boil-off appeared to reach steady state. Final boil-off was approximately 1.15 SCFH of GH_2.

Following the 160 layer test the system was warmed up, the vacuum broken and the insulation unwrapping process was completed. The 100 layer insulation warm test will begin on approximately July 1.

(Continued on Page 49)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173
LH_2 TANK TESTS		Oct 16 - Nov 15, 1972
LF_2 TANK TESTS		Jan 1973 - Feb 1973
LH_2 TANK WITH SHADOW SHIELD TEST		Feb 1973 - Jun 1973
LH_2 & LF_2 SYSTEM TESTS		Sep 1973 - Feb 1974
ITEMS COMPLETED		
Payload simulator heater wiring & terminations complete.		
6 Rosemounts located and installed.		
Cleaning & polishing RFP for chamber walls completed and PR in Procurement.		
Vehicle forward, aft and mid structures were delivered.		
Preliminary inst. flow sheet & digital format complete.		
ITEMS IN PROGRESS		
Fabricating special insulation blankets & wiring for payload simulator.		
LH_2 tank lower blanket		70% completed.
Valve cover blanket started.		
Rosemount & T/C terminations.		
CR/CN TCRJ's calibration is		90% completed.

CHANGES: Test Schedule

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPULSION RESEARCH SITE VERTICAL CALORIMETER (Continued) INSTRUMENTATION (1) Eight thermocouples were removed with the insulation removal. (2) No other changes in existing instrumentation.

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

Work continued in the ATS Building on the make up of special insulation blankets and wiring of the payload simulator. The LH_2 tank lower hat blanket is 70% complete and fabrication of the valve cover blanket was started. The payload simulator heater wiring and terminations were completed. The six Rosemounts were located and installed on the simulator. Rosemount and thermocouple terminations are all that remain to be done on the simulator. Insulation work appears to be the critical path item in the RPM build-up.

An RFP has been written for cleaning and polishing the vacuum chamber walls. The purchase request is currently in procurement. A 30-day advertisement for bids will be required due to the estimated cost of $15,000.00.

No additional welding was accomplished on the 13' cryo-shroud. Welding is expected to resume by the end of July.

The vehicle forward, aft, and mid structures were delivered to Plum Brook as scheduled. Delivery of all major RPM components to Plum Brook is now complete.

INSTRUMENTATION

(1) A preliminary flow sheet and digital format was completed and sent to LeRC-Cleveland.

(Continued on Page 51)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

The 10-channel rotating pressure measuring system was returned to PBS.

Mechanical design changes will be made to accommodate new components.

CHANGES: None

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPULSION RESEARCH SITE RESEARCH PROPULSION MODULE (Continued) INSTRUMENTATION (Cont) (2) Rosemount instrumentation was completed on the payload simulator. (3) Calibration of the CR/CN TCRJ's is 90% complete.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

The original ten-channel rotating pressure measuring system has been returned to Plum Brook. The system package will undergo some mechanical design changes that will accommodate new components purchased by the Lewis-Cleveland Air Breathing Engine Division.

DISCUSSION

Modifications to the original system are now being made to include a new style 13-channel mercury slip ring, a printed circuit type slip ring terminal block, and modified Langley type 49NC variable reluctance pressure transducers. The pressure transducers have larger diameter O-ring seals that are intended to place the sealing compression forces at a transducer case position that is less sensitive to internal compressive loads. The slip ring terminal block is larger in diameter and will enable easy replacement of the pressure transducers when range changes are required.

The original pressure measuring system will be used for all of the J-75 engine tests.

The advanced system with its 5-range scanning Datametrics pressure transducers and 72-channel shaft data system will be evaluated for the new 0-18,000 RPM turbine research programs.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LAB

400 hours completed.

1210 hours of backlog.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER

XDS9300 not accepted because of hardware discrepancies.

The remaining interfaces related to the data computer and the HTF Heater Link are being checked out.

CHANGES: None

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	47 hours
HTF	10 hours
HTF Direct Labor Support	153 hours
K	4 hours
B-2 (accept test transducers)	77 hours
H-Bldg	22 hours
H-Bldg Cal Lab Equip	83 hours
SPF	10 hours
Reactor	4 hours
	400 hours
Total Backlog	1210 hours

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

The XDS9300 remains not accepted because of remaining small hardware discrepancies. These are waiting for parts and XDS manpower.

The progress of numerous interfaces related to the data computer and the HTF Heater Link is given below in tabular form. Items that showed complete last month have been deleted.

	Chassis		Panel		
Description	Design	Fab.	Design	Fab.	Check Out
SEL to XDS9300	100%	100%	100%	100%	60%
XDS9300 Junction Box	100%	100%	N/R	N/R	20%
2-CF16A Intercon Box	100%	100%	100%	100%	90%
2-CF16A-XDS9300 I/F	100%	100%	100%	100%	70%
2-CF16A-TEC CRT	100%	100%	N/R	N/R	50%
9300 Line Rec Chassis	100%	100%	N/R	N/R	20%
9300 I/O Cables	100%	100%	N/R	N/R	25%
HTF Heater Link	100%	100%	100%	100%	100%
HTF Heater Link Cabs	100%	100%	N/R	N/R	100%

N/R = Not Required

(Continued on Page 55)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS

HTF Heater Control and monitoring system progressing.

K-Site data reporting system used on B-3 run.

"Quick Load" for SEL data tapes is being converted to XDS 9300.

CHANGES: None.

INSTRUMENTATION DATA
COMPUTER SOFTWARE SYSTEMS

RSD - I. KRAMARCHUK

Reassignments because of priority site workloads and cutback in personnel have necessitated reorganization of full- and part-time personnel available for this task, and a redefinition of priorities in this area. Low priority items that showed no progress last month will be dropped until progress can be reported.

Progress this month has been minimal because of familiarization time and lack of manpower.

(1) HTF Heater Control and Monitoring System:

Description	% Complete
Hardware check-out program	98
Flow Diagram	85
Program Coding	90
Check-Out	80
Multiplexer check-out software	85

(2) K-Site Data Reporting System:

This capability was used successfully for the B-3 tests in its present form. This item will not be reported again until further progress is made.

(3) Data Display System Software (CF16A)

This work has been taken over by another person and familiarization and organization is the only progress.

(4) Quick Look for SEL Data Tapes:

A summer student is in the process of converting an existing program for the XDS910 to be used on the XDS9300. The conversion is 30% complete in its existing form. Improvements will be made when the existing form is working.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YPR2023
TEST SCHEDULE		To end Sep 1972.
40 LAYER TESTING SCHEDULED TO START		Aug 9, 1972.
100 & 60 layer insulation tests completed in 24 test days.		
ITEMS COMPLETED DURING TESTING PERIOD System was leak checked. Repaired cold guard fill line leak.		
ITEMS IN PROGRESS Unwrapping calorimeter for 40 layer tests.		

CHANGES: None.

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

SUMMARY

All of the 100 and 60 layer insulation tests on the Vertical Calorimeter were completed during July.

The boil-off for the 100 layer 530°R surrounds temperature test was 2.1 SCFH. The boil-off for the 60 layer, 530°R surrounds test was 2.0 SCFH and 0.40 SCFH for the 140°R surrounds temperature.

The Calorimeter is being unwrapped for the 40 layer tests in August.

On the Research Propulsion Module progress has been slow due to lack of manpower. The upper and lower "coolie hats" have been completed and a sample meteoroid shield panel was fitted to the tank mockup. The design of a water cooling system for the diffusion pumps is complete.

VERTICAL CALORIMETER (YPR2023)

CRD - J. E. MALOY;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

All of the 100 layer and 60 layer insulation tests were completed during July. They required a total 24 test days. Preliminary control room data of insulation temperature gradients and corresponding boil-off rates indicated these tests were successful.

The boil-off for the 100 layer 530°R surrounds temperature test was 2.1 SCFH. This was larger than predicted, but was attributed to an unusually high vacuum pressure of 3×10^{-5} Torr.

During the unwrapping operation for the 60 layer tests the system was leak checked. A vacuum leak in the cold guard fill line was located and subsequently repaired. The vacuum for the remainder of tests was 2×10^{-6} Torr in the chamber and approximately 5×10^{-7} Torr inside the cold shroud. Hydrogen boil-off for the 60 layer, 530°R surrounds temperature test was 2.0 SCFM and 0.40 SCFM with the 140°R surrounds temperature.

(Continued on Page 45)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

LH_2 TANK TESTS	Oct 16 - Nov 15, 1972.
LF_2 TANK TESTS	Jan 1973 - Feb 1973.
LH_2 TANK WITH SHADOW SHIELD TEST	Feb 1973 - Jun 1973.
LH_2 & LF_2 SYSTEM TESTS	Sep 1973 - Feb 1974

ITEMS COMPLETED

Upper and lower coolie hats were installed.
Tank equator valve box side insulation panels and one of two top blankets were completed.
Sample meteriod shield panel was fitted to the tank mockup.
Diffusion pump bubble cooling system designed.
Two amplifiers ordered for L&N strip chart recorder.

ITEMS IN PROGRESS

Support strut cover templates are being made.
Vacuum chamber cleaning & polishing PR in proc. cycle.
SJO for diffusion pump controlled-temp. cooling sys. in process.

CHANGES: None.

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

VERTICAL CALORIMETER (Continued)

Currently, the vertical calorimeter is being unwrapped for the 40 layer tests, which include surrounds temperatures of 37°R, 140°R, and 530°R. Tests are scheduled to start August 9, 1972.

INSTRUMENTATION

Instrumentation was set up and monitored for run support. All systems functioned properly.

CONTROLS

During both 100 and 60 layer insulation tests, repeated calibration shifts occurred on the guard transducer. Both runs were completed and all other control systems functioned satisfactorily. The guard transducer is scheduled to be checked and calibrated the first week in August. This should cause no program delay.

RESEARCH PROPULSION MODULE (YPR4173)

CRD - R. L. DEWITT;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

Of the 320 manhours scheduled for insulation build up during July, only 180 manhours were actually available. The upper and lower "coolie hats" were completed, including the final trim and installation of the Velcro hook and pile. Side insulation panels and one of two top blankets were completed for the tank equator valve box. A sample meteoroid shield panel was fitted to the tank mockup and marked for velcro fastener locations. Mockup work on templates for the support strut covers was started.

The purchase request for cleaning and polishing the vacuum chamber walls is still in the procurement cycle. The estimated issuance date is August 21, pending approval from Headquarters.

(Continued on Page 47)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Datametrics Advanced System Pressure Transducer Spin Tests are scheduled to be completed in	August 1972.
ITEMS COMPLETED Modified rear bearing slip ring shaft coupler and accessory drive. Slip ring stator clamps fabricated. Printed Circuit type slip ring wire terminal mounting ring fabricated.	
ITEMS IN PROGRESS Assembling 10-channel rotating pressure measuring sys.	

CHANGES: Spin Test schedule

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE RESEARCH PROPULSION MODULE OPERATIONS (Continued) The design for a controlled-temperature water-cooling-system for the diffusion pumps is complete, and an SJO is in process. Installation is estimated to begin October 1, 1972. INSTRUMENTATION No instrumentation work was accomplished on the RPM project due to B-3 manpower priority. Two spare amplifiers were ordered for the L&N strip chart recorders.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The original ten channel rotating pressure measuring system is now in the process of being rebuilt. All of the new components required for this task are now on hand, including those fabricated by the Plum Brook machine shop. The system assembly will be completed by mid-August 1972.

DISCUSSION

The last of the components needed to start the process of assembly have been fabricated. They include the modified rear ball bearing slip ring shaft coupler and accessory drive, a new slip ring stator clamp, and a mounting ring for a printed circuit type slip ring wire terminal disc.

The Datametrics model 1089 advanced system pressure transducer spin tests are expected to be completed during August 1972. The spin tests will complete the model 1089 performance data up to and including 18,000 RPM as a requirement for the advanced turbine development programs. Firm requirements for the 18,000 RPM rotating pressure measuring system have not yet been negotiated with the Air Breathing Engines Division.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LAB

512 hours completed.

1172 hours of backlog.

CHANGES: None

INSTRUMENTATION DATA COMPUTER HARDWARE SYSTEMS

XDS9300 not accepted because of hardware discrepancies.

The remaining interfaces related to the data computer and the HTF Heater Link are being checked out.

CHANGES: None

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	185 hours
B-3 Direct Support	22 hours
HTF	112 hours
K	15 hours
SPF	19 hours
PBRF	2 hours
H-Bldg	17 hours
Standards Lab Equipment	140 hours
	512 hours
Total Backlog	1172 hours

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

The XDS 9300 remains not accepted. XDS service to eliminate the remaining discrepancies stopped on July 17, 1972. A formal letter of rejection was sent to Xerox on July 20, 1972. A letter dated July 20, 1972 was received from Xerox demanding payment. A contract meeting is scheduled for August 2, 1972 to resolve the problem of discrepancies and payment. Meanwhile the XDS 9300 has been inoperative from July 15, 1972.

The progress of numerous interfaces related to the data computer is given below in tabular form. The HTF Heater Link hardware has been deleted since it was complete last month. Progress on interfaces to the XDS 9300 was stalled because of the XDS 9300 being inoperative.

	Chassis		Panel		
Description	Design	Fab.	Design	Fab.	Check Out
SEL to XDS9300	100%	100%	100%	100%	60%
XDS9300 Junction Box	100%	100%	N/R	N/R	20%
2-CF16A Intercon Box	100%	100%	100%	100%	100%
2-CF16A-XDS9300 I/F	100%	100%	100%	100%	70%
2-CF16A-TEC CRT	100%	100%	N/R	N/R	100%
9300 Line Rec Chassis	100%	100%	N/R	N/R	20%
9300 I/O Cables	100%	100%	N/R	N/R	25%

N/R = Not Required

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS

HTF Heater Control and monitoring system progressing . . . . . 95% complete.

Data Display System temporary display capability routine.
Flow diagrams, programs and check outs are in progress.
"Quick Look" for SEL data tapes.
Conversion for XDS 910 to XDS 9300 completed.
CF16A debug utility program modified.

CHANGES: None.

INSTRUMENTATION DATA
COMPUTER (Continued)

SOFTWARE

(1) HTF Heater Control and Monitoring System:

The initial use of this automatic system is planned for the week of August 7, 1972. The software for the initial application is 95% complete.

(2) Data Display System (CF-16A):

This requirement is being implemented in a manner to provide a temporary capability without the XDS9300. Minimal rework will be required to provide the operational capability using the XDS9300. This will provide a run capability while the total system is being developed.

Temporary Display Capability

Routines	Flow Diag.	Prog.	C/O
Pattern/Request Table Sv	90%	90%	80%
Eng Unit Data Image Gen	10%	10%	10%
Raw Data Accum & Convert	5%	0%	0%
Main Eng Unit Data Display Program	20%	20%	0%

(3) Quick Look for SEL Data Tapes:

The necessary conversions from XDS910 to XDS9300 are 100% complete. The program in its converted form remains to be checked out. The check out has been delayed because the XDS9300 has been inoperative.

(4) CF-16A Debug Utility Program:

This program was modified to allow Input and Output for the CRT Displays. This allows immediate response as compared to using the teletype for I/O.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YOR2023

TEST SCHEDULE COMPLETE	Aug 1972.
40-layer insulation tests completed. Vertical Calorimeter to be removed and stored at PBS. Three tests required 17 days. Data recorded each hour and vacuum chamber pressure maintained at 2×10^{-6} Torr.	

CHANGES: Tests completed.

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

SUMMARY

The Vertical Calorimeter test program is completed. The 40-layer insulation tests were the last of this series.

Only 36 manhours were available for assembly work in the ATS Building, for the RPM program.

A new schedule has been made showing Tests I-2 & 3 starting in January. In order to meet this schedule, 800-900 manhours have to be worked between September 10 and December 10 preparing the RPM assembly in the ATS Building. Any deletion of manpower by the B-3 CSS program and the HTF-HRE program will impact this schedule.

VERTICAL CALORIMETER (YOR2023)

CRD - J. E. MALOY;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

The Vertical Calorimeter, 40-layer insulation tests were completed in August. The 40-layer system was tested with three different surrounds temperatures of 40°R, 140°R and 530°R. These tests complete the vertical calorimeter spiral wrap insulation research program. As currently scheduled the vertical calorometer will be removed from the K-Site vacuum chamber and stored at Plum Brook.

The three calorimeter tests required a total of 17 consecutive test days. Data were automatically recorded each hour, except for brief down times to change equipment. Data acquisition was also off for four evenings and part of one weekend to avoid lightning damage from impending thunderstorms. Vacuum chamber pressure was maintained at 2×10^{-6} Torr. With cryopumping, the pressure inside the shroud varied from 5×10^{-8} to 1×10^{-7} Torr. Approximate steady state hydrogen boil off for the 40°R, 140°R and 530°R tests was respectively 0.3 SCFH, 0.6 SCFH and 3.0 SCFH.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YOR4173

TESTS I-2 & 3	Jan & Feb 1973.
TESTS I-4, 5, 6, 7, & 8	Apr 1973 - Aug 1973.
TESTS II-1 thru 8	Nov 1973 - Apr 1974.
ITEMS COMPLETED	
Splash pan modification design completed.	
Cooling water system diffusion pump design complete.	
ITEMS IN PROGRESS	
Meteoroid shield estimated completion	Sep 28, 1972.
Bids due for vacuum chamber cleaning	Oct 2, 1972.
Electrical design drawings	75% complete.
13' cryoshroud flange installation	60% complete.
Conical shroud bottom to be assembled by contractor. Contract in procurement process.	
Thermocouple requirements given to T/C shop.	
Cable buildup & instr. requirements given to FSD.	

CHANGES:

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

VERTICAL CALORIMETER (Continued)

INSTRUMENTATION

Run support was provided for the first half of August.

RESEARCH PROPULSION MODULE (YOR4173)

CRD - R. L. DEWITT;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

Because of the calorimeter tests and lack of manpower, no RPM tasks were completed during August in the test cell, and only 36 manhours were available in the assembly area for insulation work. An estimates 800 manhours will be required to complete the tank insulation assembly.

Other RPM tasks currently in progress are as follows:

(1) Meteoroid shield is on an outside fabrication contract; estimated completion is September 28.

(2) Splash pan modification design is complete.

(3) The new diffusion pump cooling water system design is complete and a purchase request for installation is in procurement.

(4) The vacuum chamber cleaning contract is currently being advertised. Bids are due in by October 2, 72.

(5) The electrical design drawings are 75% complete.

(6) The 13' cryoshroud new flange installation is 60% complete. This job is being done on a "manpower as available" basis. The new conical shroud bottom will be assembled by an outside contractor. The contract is presently in the procurement process.

INSTRUMENTATION

Cable buildup and instrumentation requirements were given to FSD for the next phase of work to be completed. Also thermocouple requirements were given to the shop.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

FINAL SPIN UP TESTS	Sep 1972.
ITEMS COMPLETED Pressure transducer system reassembled with larger hollow slipring shaft.	
ITEMS IN PROGRESS Pressure transducers being installed in pie-shaped holders	Complete early Sep.

CHANGES: Schedule

STANDARDS AND CALIBRATION LAB

585 manhours completed.

1329 manhours of backlog.

CHANGES:

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

The original ten-channel rotating pressure transducer system has been reassembled with the larger hollow slipring shaft. The installation of ten pressure transducers in the pie-shaped holders will be completed early in September 1972. Shortly thereafter the system will be returned to LeRC-Cleveland for dynamic balancing and then reinstallation in the ERB SE-13 cell.

DISCUSSION

The installation of the ten pressure transducers requires the careful removal of some plastic encapsulant that seals the transducer electrical lead wires. In the condition as received from the manufacturer, the transducers cannot be inserted into the pie-shaped holders because of the plastic interference.

The Datametrics model 1089 advanced system pressure transducer is now expected to undergo the final spin up tests to 18000 RPM during the second week in September 1972.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	343 manhours
B-3 Direct Labor	215 manhours
H-Bldg Cal Lab Equipment	27 manhours
Total	585 manhours
Total Backlog	1329 manhours

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER HARDWARE SYSTEMS

XDS 9300 has been accepted, all discrepancies corrected.

Significant progress made on interfaces to XDS 9300.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS

HTF Heater Control & Monitoring System	97% complete.
Pattern/Request Table service, data image gen., raw data accum. & convert, and data display in progress.	
DEL Data Tapes quick look check out	60% complete.

CHANGES: None

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

The XDS 9300 has been accepted and full payment has been made to Xerox. A contract meeting was held August 2, 1972 to resolve the problems of discrepancies and payment. The following week Xerox repaired all the discrepancies. The system is now performing satisfactorily.

Significant progress has been made on the interfaces to the XDS 9300 since acceptance. Progress is shown in tabular form. Since check out was the only task incomplete last month, only check out progress will be reported here.

Description	Check Out
SEL to XDS 9300	90%
XDS 9300 Junction Box	80%
2 - CF16A - XDS 9300 I/F	100%
9300 Line Receiver Chassis	90%
9300 I/O Cables	80%

The tasks that showed complete last month are not shown here.

SOFTWARE

(1) HTF Heater Control and Monitoring System:

The software for the initial application is 97% complete. It remains to be updated, reassembled and checked. The system has been operated on line during August (See HTF Status).

(2) Data Display System (CF16A):

Temporary Display Capability

Routines	Flow Diag	Prog	C/O
Pattern/Request Table Service	90%	90%	90%
Engineering Unit Data Image Gen.	50%	50%	50%
Raw Data Accum & Convert	50%	50%	5%
Main Eng. Unit Data Display Prog.	75%	75%	0%

(3) Quick Look for SEL Data Tapes:

The check out is 60% complete.

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

SUMMARY

The Vertical Calorimeter is being disassembled for inspection and storage. Bids are due to be opened on October 5 for cleaning and polishing of the vacuum chamber.

All RSD engineering manpower has been detailed for 90 days starting September 25 to B-3 Facility for the Centaur Standard Shroud Program. A minimum amount of work on the RPM buildup can be continued in the ATS Building with coverage by CRD engineers.

(Continued on Page 41)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

VERTICAL CALORIMETER	K SITE	YOR2023

Calorimeter being disassembled. RSD Engineers detailed to B-3 Centaur Standard Shroud Program.	

CHANGES: None.

RESEARCH PROPULSION MODULE	K SITE	YOR4173

TESTS I-2 & 3	Apr - Jun 1973
TESTS I-4, 5, 6, 7, & 8	Aug 1973 - Dec 1973
TESTS II-1 thru 8	Mar 1974 - Aug 1974
RSD Engineering detailed to B-3 Centaur Standard Shroud Program.	
Cooling pumps controlled tank water system contract was awarded.	Sep 21, 1972.
13' cryoshroud repairs are in progress.	

CHANGES: Schedule changes.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECY ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	

VERTICAL CALORIMETER (YOR2023) — CRD - J. E. MALOY; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

As manpower permits the calorimeter is being disassembled for inspection and storage. No further tests are planned for this experiment. This report section will be terminated.

RESEARCH PROPULSION MODULE (YOR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

Insulation technicians were once again assigned to the ATS Building in mid-September. On September 25 all engineering personnel were removed from K-Site and were transferred to B-3 Facility to work on the CSS Program. Any engineering coverage for insulation work will be provided by Cleveland engineers from the Chemical Rockets Division.

In the meantime, bids will be opened on October 5 for cleaning and polishing of the vacuum chamber walls. An attempt to eliminate the emergency drain pan for the duration of the RPM Program was not approved by the Area Safety Committee. A supplementary contract is now in Procurement to modify (reduce in size) the drain pan to more accurately reflect the needs of the RPM tankage.

A contract to install a controlled temperature water system for the cooling pumps was awarded September 29. This new system will permit the use of better pump fluid for improved vacuum levels. Repairs to the 13' cryoshroud are still in progress.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Unit refurbished with new transducers.

New shaft installed.

System returned to LeRC-Cleveland.

CHANGES: None.

STANDARDS AND CALIBRATION LAB

477 manhours completed.

1471 manhours of backlog.

CHANGES: None.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

The original ten channel rotating pressure transducer system has been returned to LeRC-Cleveland after being refurbished with ten new style pressure transducers and a slip ring assembly having a larger diameter hollow shaft.

DISCUSSION

The larger diameter hollow ship ring shaft will allow heavier gauge or more pairs of thermocouple extension wires to be routed through the pressure measuring system to the rear mounted shaft data temperature measuring system.

The Datametrics model 1089 advanced system pressure transducer 18000 RPM spin tests have been delayed by problems with the I&C Division's spin test rig.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on completed jobs
B-3	172 manhours
B-3 Direct Labor	277 manhours
HTF	14 manhours
SPF	14 manhours
	477 manhours
Total Backlog	1471 manhours

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER HARDWARE SYSTEMS

Significant progress made on interfaces to XDS 9300.

The remaining four tasks are 80 to 95% complete.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS

HTF Heater Control & Monitoring System	97% complete.
Pattern/Request Table service, data image gen., raw data accum. & convert, and data display in progress.	
SEL Data Tapes quick look check out	75% complete.

CHANGES: Percentage complete.

INSTRUMENTATION DATA
COMPUTER

RSD - J. L. HARROLD

HARDWARE

Progress made on the interfaces to the XDS 9300 through the month of September is shown in the following table:

Description	Check Out
SEL to XDS 9300	95%
XDS 9300 Junction Box	80%
9300 Line Receiver Chassis	95%
9300 I/O Cables	85%

The tasks that showed completed last month are not shown here.

SOFTWARE

(1) HTF Heater Control and Monitoring System:

Same status as last month, due to B-3 work load.

(2) Data Display System (CF16A):

Temporary Display Capability

Routines	Flow Diag	Prog	C/O
Pattern/Request Table Service	100%	95%	95%
Engineering Unit Data Image Gen.	80%	55%	50%
Raw Data Accum. & Convert	95%	95%	95%
Main Eng. Unit Data Display Prog.	90%	75%	0%

(3) Quick Look for SEL Data Tapes:

The check out is 75% complete.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YOR4173

TESTS I-2 & 3	Apr - Jun 1973.
TESTS I-4, 5, 6, 7, & 8	Aug 1973 - Dec 1973.
TESTS II-1 thru 8	Mar 1974 - Aug 1974.
Cleaning and polishing vacuum chamber est'd complete .	Dec 15, 1972
Insulating & assembling LH_2 tank	70% complete.
Refurbishing 13' shroud.	

CHANGES: Schedule change.

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

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

SUMMARY

The cleaning and polishing contract for the vaccum chamber has been extended to include additional grinding on deeply pitted areas. Completion date is December 15.

Insulation and assembly of the LH_2 tank is 70% complete and about 250 manhours of work remain to be done.

Operations engineering manpower has been returned to the site and work is progressing towards a March test date.

DISCUSSION

OPERATIONS

The vacuum chamber cleaning and polishing contract has been extended by approximately 100 manhours. The contract extension was required to provide additional grinding on some deeply pitted surface areas. The anticipated contract completion is now December 15.

Refurbishment of the 13' shroud is still in progress on an "as available" manpower basis. At this time, one flange remains to be changed. One leak has been located and required repair welding. A final overall warm leak check is required. The new conical bottom will not be available until approximately January 15.

Insulation and assembly of the LH_2 tank is approximately 70% complete with an estimated 250 manhours remaining. All gore sections have been located and installed on the tank. The fill and vent line covers and the valve box insulation are finished. The fill line elbow cover is the only speciality piece not completed. One of the last tasks to be completed will be the transfer of the LH_2 tank from its present "A" frame support to the vehicle structure. The transfer must be accomplished outside the clean room due to insufficient floor space. In order to minimize contamination from humidity and airborne dust particles the transfer will be done during an off-shift period.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Original system modified and being used in SE-13.

CHANGES: None.

STANDARDS AND CALIBRATION LAB

471 manhours completed.

1374 manhours of backlog.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

The original ten channel rotating pressure transducer system is now being used for tests in the ERB-SE13 spin rig. It has been modified to incorporate four pressure channels and three thermocouple channels.

DISCUSSION

The ERB SE-13 tests are being made to confirm the mathematical formulas derived by the I&C Division that predict the effects of centrifugal force and temperatures on rotating pressure lines routed between the turbine blade and the pressure transducer.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	112 hours
HTF	43 hours
K	31 hours
SPF	84 hours
Cal Lab Equip Cal.	173 hours
B-3 Direct Labor	28 hours
	471 hours
Total backlog	1374 manhours

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER HARDWARE SYSTEMS

A combination interface was begun to provide three major and two minor hardware interfaces.

Printer/time code/thumbwheel switch interface - logic chassis & control panel requirements have been designed and are 10% fabricated.

INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS

HTF Heater Control & Monitoring System tested and ready for operation. Engr Unit data image gen in process. Main engr unit data display prog. in process. "X-Y" composite CRT display in process. Raw data accum. & convert . . . . . . 9300-CF16A Able Assembler was completed. K-Link engr unit display program was completed.	95% complete.

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

A combination interface was begun to provide three major and two minor hardware interfaces.

(1) Major interfaces

a. Provision to allow 9300 and dual CF16A access to a remote Versatec Printer/Plotter.

b. Provision to allow the 9300 and dual CF16A to read Binary or BCD time code from the SEL Remote Time System.

c. Provision to allow the dual CF16A to read remote thumbwheel switches.

(2) Minor interfaces

a. Six sense switches for each of the dual CF16As.

b. Provision to allow the Controls' CF16A to read Binary or BCD Time Code. The logic control is not included.

The Printer/Time Code/Thumbwheel Switch interface includes both logic chasses and control panel requirements. The design is 100% complete and fabrication is 10% complete.

No progress was attempted on the 9300 simultaneous memory access compatibility problem reported last month.

SOFTWARE

(1) HTF Heater Control and Monitoring System was tested on line successfully during the month. Software is considered satisfactory for unmanned operation.

(Continued on Page 49)

INSTRUMENTATION DATA
COMPUTER

SOFTWARE (Continued)

(2) Data Display System (CF16A)

Temporary Display Capability

Routines	Flow Diag.	Prog.	C/O
Pattern/Request Table Serv	Reported 100% last month		
Engr Unit Data Image Gen	90%	78%	78%
Raw Data Accum & Convert	96%	96%	96%
Main Eng Unit Data Disp Prog	95%	95%	95%
X-Y Composite CRT Display	5%	5%	0%

(3) 9300-CF16A Able Assembler

This item is 100% complete.

(4) The K-Link Engineering Unit Display Program is 100% checked out.

12-72

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

RESEARCH PROPULSION MODULE (YPR4173)

CRD - R. L. DEWITT;
RSD - J. V. GILLETTE

DISCUSSION

Cleaning and polishing of the 25' diameter vacuum chamber is complete. The splash pan was reduced in size; a modified lip was installed, and the splash pan reinstalled in the chamber. The four 36" diffusion pumps were drained, cleaned and recharged with Convalex #10 fluid. A warm chamber pumpdown will be conducted the week of January 8, 1973 to evaluate the effect of the system modifications and to determine overall, bare chamber performance. Following the warm vacuum test the 13' cryoshroud will be installed and the performance evaluated for the cold chamber and the leak rate will be determined for the modified cryoshroud.

(Continued on Page 37)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM

YPY2752

Preliminary evaluation made of test data.

Side-mounted air blast cooling system to be modified to more efficiently dissipate heat.

CHANGES: None

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (Continued) Other facility preparation for RPM tests included the installation of a 56 pair thermocuple cable. LH_2 cold guard leak checking is 90% complete and a thermal coating was applied to the floating temperature plate. Assembly of the fixed temperature plate was completed. Installation of electronics in the control room was started. Ninety percent of the facility electrical prints are complete. They were reviewed and are ready for final signatures. Tank insulation is proceeding nearly on schedule. All the gore sections, the bottom coolie hat, and the fill and vent/pressurization insulation covers were completed. The meteoroid shield was started, and the first instrument and electrical cables were run to the valve box.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The original ten channel rotating pressure transducer system with its new style slip ring and 49 NC pressure transducers has exhibited satisfactory performance in measuring cooling air flow rates through a rotating hollow turbine blade with internal cooling passages.

DISCUSSION

Preliminary evaluation of test data obtained from the ERB-SE-13 flow instrumented hollow turbine blade and rotating pressure measuring system configuration has shown it to yield one-half the overall error than all previous methods used. The slip ring temperature rose to an undesirable level at speeds near 9000 RPM. The side-mounted air blast cooling system for the slip ring will be modified to include heat transfer fins to more efficiently dissipate the heat.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LAB

386 manhours completed.

1432 manhours of backlog.

INSTRUMENTATION DATA COMPUTER HARDWARE SYSTEMS

Printer/Time Code/Thumbwheel switch interface fabrication is	90% complete.
Versatec printer/plotter was delivered.	
Installed error checking and display for the 2CF16A direct access interface.	
INSTRUMENTATION DATA COMPUTER SOFTWARE SYSTEMS	
Engineering Unit Data Image Gen. Progress	80%
Check Out	78%
Raw Data Accum & Convert check out.	96%
Main Eng Unit Data Display Program was completed.	
X-Y composite CRT display flow diagram	5%
program	5%
Pre-planning proceeding on Centaur Shroud Structural Test.	

CHANGES: None.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	178 hours
HTF	74 hours
SPF	61 hours
H-Bldg	73 hours
	386 hours
Total Backlog	1432 hours

INSTRUMENTATION DATA COMPUTER — RSD - J. L. HARROLD

HARDWARE

The Printer/Time Code/Thumbwheel Switch interface fabrication is 90% complete. The Versatec printer/plotter was received.

The 9300 simultaneous memory access compatibility problem reported in November was remedied. Now the 9300 program, RAD direct access, 2 SEL data acquisition system direct access, and 2 CF16A direct access to the 9300 memories can operate simultaneously without error. Error checking and display were installed for the 2 CF16A direct access interface.

SOFTWARE

(1) HTF Heater Control and Monitoring System - Time did not permit any further progress on this item. It remains satisfactory for unmanned operation.

(2) Data Display System (CF16A)

Temporary Display Capability

Further progress will be minimal on this temporary capability to allow full effort on providing display of data for the Centaur Shroud Structural Tests. The temporary capability is usable in its present form.

(Continued on Page 41)

INSTRUMENTATION DATA
COMPUTER (Continued)

SOFTWARE (Cont)

Routines	Flow Diag.	Prog.	C/O
Engr Unit Data Image Gen.	100%	80%	78%
Raw Data Accum & Convert	100%	100%	96%
Main Eng Unit Data Disp Prog	100%	100%	100%
X-Y Composite CRT Display	5%	5%	0%

(3) Centaur Shroud Structural Tests

Some preliminary planning is the only progress to report. The project includes:

Extensive conversion to engineering units by 9300.

X-Y composite data display on CRT.

Display of engineering unit data on CRTs.

Plotting of X-Y engineering unit data.

Recall of X-Y engineering unit data for plotting.

The total 9300-dual CF16A system must be used for this capability.

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

RESEARCH PROPULSION MODULE (YPR4173)

CRD - R. L. DEWITT;
RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

The primary work effort was in the ATS building clean room to prepare the RPM vehicle for shipment to K-Site. The vehicle structure was shipped to the reactor ATS building and uncrated. The fuel tank insulation was completed, and the tank was mounted in the structure. All instrumentation on the tank, tank support struts, and vehicle structure was completed. Seventeen braze joints were required to complete tubing runs on the tank and in the equipment bay. The payload simulator was moved into ATS clean room, the aft surface was cleaned, and 75 pre-test emissivity readings recorded.

(Continued on Page 29)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173
TESTS I-2 & 3		Apr - Jun 1973.
TESTS I-4, 5, 6, 7 & 8		Aug 1973 - Dec 1973.
ITEMS COMPLETED		
Vehicle structure shipped to ATS Bldg & uncrated.		
Fuel tank insulation completed & tank mounted.		
Instrumentation on tank, support struts & structure completed.		
Payload simulator moved, aft surface cleaned & 75 pre-test emissivity readings recorded.		
Vacuum chamber warm pump down accomplished in K-Site.		
Leaks found and repaired.		
K-Site assy area washed down and painted.		
Assy Area clean room standards established.		
13' cryoshroud cleaned and placed in assy area.		
Mods to stationary LN_2 Dewar completed.		
Thermocouple cable&oven install, mixer motor panel, shroud sensor check out, LH_2 tank, insulation, struts, and struture sensors & wiring C/O complete.		
LH2 cold guard leak checks & mods completed.		
ITEMS IN PROGRESS		
Process piping mods started.		
Controls work is approximately		33% complete.
Instrumentation work has been started.		
Test package sensor installation is approx.		90% complete.
Fitting shroud top & baffle sect to vert barrel sect.		

CHANGES: None

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY	HRE (GARRETT ENGINE) (Continued) to conclude that it is not necessary to pump down the transducers every run day, however, it is still necessary to blow the moisture out of the engine lines. The thrust stand has been recalibrated since all interferences have been removed from the HRE engine. There now appears to be good agreement between the calibration and thrust stand load cells. CONTROLS All the controllers at HTF have been modified with test jacks for use in pre-run check out. The diluent GN_2 control loop is being modified for fine control temperature correction. The amount of correction will be $\pm 200^{o}R$. Check out of the control loop will be in February. The next HTF run will be with injectors 1A and 1B.
K	CRYOGENIC PROPELLANT RESEARCH SITE	RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE DISCUSSION OPERATIONS The primary work effort was in the ATS building clean room to prepare the RPM vehicle for shipment to K-Site. The vehicle structure was shipped to the reactor ATS building and uncrated. The fuel tank insulation was completed, and the tank was mounted in the structure. All instrumentation on the tank, tank support struts, and vehicle structure was completed. Seventeen braze joints were required to complete tubing runs on the tank and in the equipment bay. The payload simulator was moved into ATS clean room, the aft surface was cleaned, and 75 pre-test emissivity readings recorded. (Continued on Page 29)

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

RESEARCH PROPULSION MODULE (Continued)

In K-Site, the vacuum chamber warm pump down was accomplished during January. The ultimate pressure for the bare chamber was 2×10^{-6} Torr. Three leaks were found in the diffusion pump baffles and one leak in the emergency drain valve flapper seal. The leaks have been repaired and an additional warm pump down is anticipated to determine the bare chamber ultimate vacuum level. The cold pump down which was originally planned will not be done due to insufficient time before the scheduled test date of March 1, 1973.

The K-Site assembly area was washed down and the floor was painted. Clean room standards are now in effect. The 13' cryoshroud was cleaned and is currently in the assembly area. The shroud top and baffle sections are being fitted to the vertical barrel section. Status of other site work is as follows:

(1) Completed modification of stationary LN_2 dewar vent.

(2) Started process piping modifications.

(3) Controls work (cable runs, terminations, controller installation, etc.) is approximately one-third complete.

(4) Leak checks and modifications to the LH_2 cold guard are complete and the guard is ready to insulate.

(5) Instrumentation work (panel build-up, wiring, etc.) in the control room has been started.

INSTRUMENTATION

Total test package sensor installation and wiring is approximately 90% complete.

Interconnect cables from test package to chamber wall have not been started.

(Continued on Page 31)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Intensive effort to be made to produce 20,000 RPM ten-channel rotary pressure measuring system.

LeRC developed shaft data sys to be included if time and space permit.

CHANGES: None

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

RESEARCH PROPULSION MODULE

INSTRUMENTATION (Continued)

Other completed items are:

(1) Thermocouple cable installation from wall to Instrument Room.

(2) Thermocouple oven installation.

(3) Mixer motor panel.

(4) Shroud sensor check out.

(5) LH_2 tank, insulation, struts, and structure sensors and wiring checked to connectors on Hat Box.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

An intensive effort will be made during the early part of this year to produce a 20,000 RPM ten channel rotary pressure measuring system. It will be made available for the LeRC Advanced Turbine Research programs.

DISCUSSION

Experience and technology gained during the development of the original ten channel 9,000 RPM rotary pressure measuring system will be used to shorten the time to build the advanced system. It is the intention to design the advance system around presently available pressure transducers. If time and space permit, the LeRC developed shaft data system will be included to allow both temperature and pressure measurements to be processed by the system.

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LAB

244 manhours completed.

1672 manhours of backlog.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER SYSTEMS

HARDWARE SYSTEM Printer/Time Code/Thumbwheel switch interface fab completed. Check out is . . . . . . Paper Tape Equipment ordered for CF16A. Further planned interfaces cancelled. SOFTWARE SYSTEM Final program changes completed, program reassembled, and check out is proceeding for HTF Heater C&M Sys. Work begun on requirements for CSS Tests.	90% complete.

CHANGES: None.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	31 hours
HTF	23 hours
K	16 hours
H-Bldg	59 hours
Special Project (for V. Peterson)	23 hours
Direct Labor B-3 and K-Site	92 hours
	244 hours
Total backlog	1672 hours

INSTRUMENTATION DATA COMPUTER — RSD - J. L. HARROLD

HARDWARE

Fabrication of the Printer/Time Code/Thumbwheel Switch Interface was completed. Check out is 90% complete. Additions were necessary to allow printing under interrupt control.

Paper Tape Equipment for the CF16A Input/Output has been ordered.

Work on the further planned interfaces have been cancelled because of Station phase out.

SOFTWARE

(1) HTF Heater Control and Monitoring System:

The final program changes, replacing temporary patches, have been made. The program has been reassembled and check out is proceeding.

(2) Centaur Shroud Structural Tests:

Work has begun on this software requirement. The requirement includes the general planned concept for displaying and plotting converted test data. An added special for the structures

(Continued on Page 35)

INSTRUMENTATION DATA
COMPUTER

SOFTWARE (Continued)

test includes display, storage, and plotting composite X-Y data.

The total system requires new programs for the 9300, the "A" CF16A and the "B" CF16A.

a. The 9300 program requirements include:

Initialization of Multiplexer Pattern Information.

Data Accumulation for Conversion; On Line, Playback and Data Recording.

Data Conversion; Multiplexer Pattern Data and Specials.

b. The "A" CF16A Program requirements include:

Data Storage of X-Y information for recall.

Plotting of X-Y information on recall.

Pattern initialization.

c. The "B" CF16A program requirements include:

Pattern initialization.

Normal CRT display servicing (2 CRTs).

X-Y composite CRT display servicing (1 CRT).

Output printing of CRT images.

Time insertion in CRT image.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

TESTS I-2 & 3	Apr - Jun 1973.
FIRST RUN	Week of Mar 26, 1973.
TESTS I-4, 5, 6, 7 & 8	Aug 1973 - Dec 1973.
ITEMS COMPLETED	
Vehicle forward section assembly completed.	
Heaters & Equip Bay insulation installed.	
Cold guard duct insulated.	
Tubing runs (floating temp plate & valve box).	
Equip Bay & Payload simulator partially installed on vehicle.	
Vehicle delivered to K-Site.	
Baffles fitted to 13' cryoshroud.	
Cryoshroud cover plate fabricated and installed.	
Installed electrical penetrations in chamber walls.	
Electrical cable runs from chamber installed.	
Control room graphic flow panel completed.	
Valve operator relay & fuse cabinet installed.	
Valve cycle counter installed and wiried.	
Auto-sequence panel fabricated.	
New area warning system installed.	
Clean room cleaned.	
Clean room parts inventoried.	
SEL validation checked.	
Design of LH_2 tank testing controls completed.	
Control hardware installed.	
ITEMS IN PROGRESS	
Test Package sensor installation	95% complete.
Test Package interconnect cables	70% complete.
Control wiring	75% complete.
Installing Equipment Bay.	
Installing Payload simulator.	
Installing tubing and piping runs.	
Installing valves.	
Time delay relay delivery scheduled for	Mar 15, 1973.
Installing Data Link scanner system.	
Instrumentation, controls & facility mechanical work scheduled to be completed by	Week of Mar 19.
Preparing shutdown plans for Station Standby Status.	

CHANGES: Next run schedule.

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

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

Assembly of the vehicle forward section for Phase 1 testing was completed in February. This included installation of heaters and insulation on the equipment bay, and insulating the cold guard duct. Tubing runs were completed from the floating temperature plate to the valve box. The equipment bay and payload simulator were partially installed on the vehicle structure. The assembled vehicle was shipped to K-Site under a dry nitrogen covering. Final installation of the equipment bay, payload simulator and related tubing runs on the vehicle are currently in process.

In the facility, work continued on a limited manpower basis. Baffles were fitted to the 13' cryoshroud, and cover plate fabricated and installed around the top of the cryoshroud barrel section. The cryoshroud top and baffles were hung from the facility hook in preparation for delivery of the vehicle. An electrical penetration was installed in the vacuum chamber wall. Tubing and piping runs and valve installation are still in progress.

Electrical work at the site has progressed as follows:

(1) Completed all cable runs from the vacuum chamber.

(2) Completed control room graphic flow panel.

(3) Installed new valve operator relay and fuse cabinet.

(4) Valve cycle counter installed and wired.

(5) Fabricated auto-sequence panel. Delivery of the time delay relay will not be until March 15.

(6) Completed the new area warning system installation. It is ready for check out.

(Continued on Page 35)

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

RESEARCH PROPULSION MODULE (Continued)

Work in the ATS Building will now continue on a build up of the two shadow shields. The clean room was cleaned, fabrication equipment brought in, parts inventoried, etc.

The SEL validation check was completed and the results are being reviewed. The Data Link scanner system will require one week to install, plus check out time. Other work areas, such as instrumentation, controls, and facility mechanical work are approximately 2-3 weeks from completion plus check out time. The first test run is currently planned for the last week of March, pending the availability of manpower.

Plans are being prepared for an orderly shutdown of the facility after completion of the currently scheduled test program.

INSTRUMENTATION

Test package sensor installation and wiring is approximately 95% complete.

The interconnect cables from test package to chamber wall are approximately 70% complete.

Remaining instrumentation installation and check out is awaiting installation of the test package in the chamber.

CONTROLS

All final controls design work and prints are completed for the LH_2 tank testing.

Installation of hardware in complete and the wiring is 75% finished. Systems check out should begin the second week in March.

NARRATIVES ON ADJOINING PAGE

PROJECT	TASK NO.
STATUS	

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM	YPY2752
Checking suitable commercial pressure transducers. New type of signal transfer devices being studied.	

STANDARDS AND CALIBRATION LAB
399 man hours of work completed. 1651 manhours of backlog.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

A conceptual design is presently underway that will lead to the construction of a 23,000 RPM multichannel temperature and pressure measuring system. The pressure system must accommodate static pressures in the order of 600 PSI.

DISCUSSION

A cursory examination of commercial pressure transducer types suitable for the high speed requirement is now underway. The multichannel capacitance type pressure transducer that failed during spin tests at LeRC-Cleveland will not be a candidate for this system in view of the short time schedule that will not allow another try. A study of new type signal transfer devices is also being made at this time.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	163 hours
HTF	33 hours
K	45 hours
SPF	18 hours
H-Bldg	31 hours
K-Site & B-3 Direct Labor	109 hours
	399 hours
Total Backlog	1651 hours

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SYSTEMS

HARDWARE SYSTEM	
Printer/Time Code/Thumbwheel Switch interface check out completed.	
Constructing remote control switch panels.	
Installing remote data viewing console cabines.	
SOFTWARE SYSTEMS	
HTF Heater control & monitoring system C/O complete.	
9300 Program	
Initialization of multiplexer pattern info	70% complete.
On-Line Data accumulation.	20% complete.
Data recording	10% complete.
Playback accumulation	5% complete.
Data conversion/multiplexer/Specials	20% complete.
"A" CF16A Program	
X-Y information plotting for recall	10% complete.
"B" CF16A Program	
Pattern initialization	40% complete.
Normal CRT display servicing	15% complete.
X-Y composite CRT display servicing	5% complete.
Output printing of CRT images	90% complete.
Time insertion in CRT images	90% complete.
Revisions of Temporary Display Program for HTF . . .	90% complete.

CHANGES: None.

INSTRUMENTATION
DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

Check out of the Printer/Time Code/Thumbwheel Switch Interface is 100% complete and operational under interrupt control.

Switch panels are being constructed for remote control of the CF16A programs.

The console cabinets for remote data viewing are being installed. This item will provide a CRT viewing station for converted test data remote from the computer area and convenient to other data sources.

SOFTWARE

(1) HTF Heater Control and Monitoring System:

Check out is complete for this item and the system is operational.

(2) Centaur Shroud Structural Tests:

(a) 9300 program requirements:

Initialization of Multiplexer Pattern Information, 70% complete.

On Line Data Accumulation, 20% complete.

Data Recording, 10% complete.

Playback Accumulation, 5% complete.

Data Conversion; Multiplexer Pattern Data and Specials, 20% complete.

(b) "A" CF16A Program:

Data storage of X-Y information for recall, 0% complete.

Plotting of X-Y information for recall, 10% complete.

INSTRUMENTATION DATA COMPUTER (Continued)

(c) "B" CF16A Program:

Pattern initialization, 40% complete.

Normal CRT display servicing (2 CRTs), 15% complete.

X-Y composite CRT display servicing (1 CRT), 5% complete.

Output printing of CRT images, 90% complete.

Time insertion in CRT images, 90% complete.

(3) Temporary Display Program:

Revisions were necessary to allow the programs' use for HTF. Revisions are 90% complete.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

RESEARCH PROPULSION MODULE	K SITE	YPR4173

TESTS I-2 & 3	Apr - Jun 1973.
FIRST RUN	Week of April 23, 1973.
TESTS I-4, 5, 6, 7, & 8	Aug - Dec 1973.
ITEMS COMPLETED	
Payload simulator mated to forward structure.	
Installed tubing runs from equip bay to temp plate to vehicle.	
Attached cryoshroud lid to vehicle & installed in cryoshroud.	
Cold guard mounted on cryoshroud.	
Duct fitted from cold guard to vehicle.	
Completed most of tubing runs from vehicle to cold guard.	
Installed equipment bay cold guard.	
Installed mylar tape to upper ring of forward struct.	
Installed thermocouples to upper ring of for. struct.	
Installed wiring for remote operated valves.	
Installed & checked out data link system.	
Checked out safety system.	
Received auto sequence panel time delay relay.	
Fitted shadow shield alum rings to transfer rings.	
Cleaned aluminum ring for assy of shields.	
Cut & glued sheets of X-850.	
Four sheets ready for final trimming, stitching, & fitting to aluminum rings.	
Cut tabs for joining X-850 sheets.	
Installed interconnect instrument cable for vehicle to equipment bay.	
Installed test package sensor.	
Installed pressure transducers.	
Moved digital data link to K-Control.	
Installed control wiring for Baratrons & equip bay heater.	
ITEMS IN PROGRESS	
Installing piping from chamber wall to test package. .	10% complete.
Installing control wiring & checking out compl sys . .	95% complete April 13 comp date.
Installing interconnect instrument cable from test package to wall	90% complete.

CHANGES: First run schedule.

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

RESEARCH PROPULSION MODULE (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

The payload simulator was mated to the vehicle forward structure in the K-Site clean room. Tubing runs were completed for the equipment bay and the floating temperature plate to the vehicle. The cryoshroud lid with the necessary baffle for Phase I testing was attached to the vehicle and the assembly was then installed in the cryoshroud. The cold guard was mounted on the cryoshroud and the duct fitted from the cold guard to the vehicle. Most of the tubing runs from the vehicle to the cold guard were completed.

The entire assembly was installed in the vacuum chamber and piping from the chamber wall to the package is approximately 10% complete.

Insulation of the equipment bay and cold guard was completed. The duct insulation will be permanently installed upon completion of the tubing runs from the vehicle to the cold guard. Mylar tape was attached to the upper ring of the forward structure and five thermocouples were attached to the ring for temperature data.

Electrical work at the site has progressed as follows:

(1) Remote operated valves have been connected to accommodate Phase I testing.

(2) The Data Link system has been installed and checked out.

(3) The Safety system is being checked out.

(4) The time delay relay for the auto-sequence panel has not been delivered.

At the ATS Building the aluminum rings for the shadow shields were fitted to the transport rings with minor modifications. The aluminum rings were cleaned and readied for assembly of the shields. Sheets of X-850

(Continued on Page 41)

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

RESEARCH PROPULSION MODULE (Continued)

were cut and glued. Four sheets are now available for final trimming, stretching and fitting onto the aluminum rings. The tabs necessary for joining two X850 sheets around the shadow shield ring were cut.

INSTRUMENTATION

(1) Interconnect cables from the test package to the wall are 90% complete.

(2) Five additional thermocouples were installed.

(3) Test package sensor (thermocouples and platinum resistance thermometers) is completed.

(4) Check out through the data system has not been started.

(5) Pressure transducers have not been installed.

(6) The Digital Data Link was moved to "K" Control.

CONTROLS

Wiring is approximately 95% complete and check out of some systemshas been started with completion expected by the second week in April. New wiring for the Baratrons and equipment bay heater was completed in March.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YPY2752

Evaluating new types of pressure transducers.

STANDARDS AND CALIBRATION LAB

574 manhours of work completed.

1526 manhours of backlog.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

Two new types of pressure transducers that look like they might satisfy the electrical and reliability requirements of this program are being studied for the best mechanical mounting technique in this 23,000 RPM system. Two of each type will be purchased for evaluation.

DISCUSSION

As a means of keeping this program within the bounds of allowable time, transducer evaluation will be concentrated on one or two types that we feel will work in this high speed application. The design for a test rig to spin test the tranducers will be started shortly.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time spent on completed jobs
B-3	235 hours
HTF	85 hours
K	4 hours
SPF	29 hours
H-Bldg	80 hours
Direct Labor B-3	141 hours
	574 hours
Total Backlog	1526 hours

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SYSTEMS

HARDWARE SYSTEM	
Installed & checked out CF16As & remote control switch panels.	
Completed remote data viewing console.	
CF16As high speed paper tape punch is operational.	
Fabricating an audio/visual alert unit.	
SOFTWARE SYSTEM	
Centaur Shroud Strutural Tests	
9300 Program	
Completed initialization of multiplexer pattern info.	
Completed on line data accumulation.	
Data recording system	90% complete.
Playback accumulation	30% complete.
CF16A Program	
Data storage of X-Y info for recall	85% complete.
Plotting of X-Y info for recall	85% complete.
Pattern initialization	90% complete.
Normal CRT display servicing	90% complete.
X-Y component CRT disply servicing	90% complete.
Completed output printing of CRT images.	
Completed line insertion in CRT images.	
Initial version of structural tests software is operational.	
Correcting and making improvements.	
Completed temporary display program for HTF,	

CHANGES: None.

INSTRUMENTATION
DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

Switch panels for remote control of the CF16A programs have been installed, checked out and are operational.

The remote data viewing console has been completed.

The high speed paper tape punch is now operational for the CF16As. The paper tape reader has not arrived.

An audio/visual unit is being fabricated to alert when significant errors or a computer failure has occurred in the hardware structure.

SOFTWARE

(1) Centaur Shroud Structural Tests:

(a) 9300 program requirements:

Initialization of Multiplexer Pattern Information, 100% complete.

On Line Data Accumulation, 100% complete.

Data Recording, 90% complete.

Playback Accumulation, 30% complete.

(b) "A" CF16A Program:

Data storage of X-Y information for recall, 85% complete.

Plotting of X-Y information for recall, 85% complete.

(c) "B" CF16A Program:

Pattern initialization, 90% complete.

Normal CRT display servicing (2 CRTs), 90% complete.

X-Y Composite CRT display servicing (1 CRT), 90% complete.

(Continued on Page 47)

INSTRUMENTATION
DATA COMPUTER (Continued)

Output printing of CRT images, 100% complete.

Time insertion in CRT images, 100% complete.

The initial version of the software for the structural tests is basically operational. Minor deficiencies remain to be corrected and operating improvements are being implemented.

(2) Temporary Display Program:

Revisions required for HTF use are 100% complete.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CRYOGENIC PROPELLANT STORAGE PROGRAM K YOR4173

TESTS I-2 & 3	Apr - Jun 1973.
FIRST RUN	Week of May 7.
TESTS I-4, 5, 6, 7, & 8	Aug - Dec 1973.
ITEMS COMPLETED	
Installed additional scaffolding in Test Chamber.	
Cold shocked and leak checked spool pieces.	
Installed tank cold guard radiation duct.	
Taped over several openings in Payload Simulator.	
Installed cable cope tray.	
Installed all pressure transducers.	
Installed all temperature sensors.	
Wrapped instrumentation cables with mylar tape.	
Completed facility check sheets.	
Safety Committee approved Phase I Testing.	
Completed 4, ten foot diameter alum. mylar shadow shield sheets.	
Prestretched four more shadow shield sheets.	
Installed control wiring in test chamber.	
Installed baffle heater control system.	
ITEMS IN PROGRESS	
Installing tubing and piping in chamber	90% complete.
Fabricating and assembling shadow shields, scheduled completion	June 1.
Checking out instrumentation to instrument room.	
Making control room instrument check.	
Checking data system noise.	
Installing and checking out data link program.	
Installing transducer on inside of tank.	
Installing control wiring (when personnel are avail.)	
Checking out control system (when personnel are available).	

CHANGES: First run schedule changed from April 23 to week of May 7.

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

Work has progressed at the facility on an "as available" manpower basis; consequently, the work slipped approximately one week during April. The primary manpower shortage is with site technicians, and, to a lesser extent, with service support groups. As of this writing, progress with controls systems is practically at a standstill with no foreseeable change.

Work completed in April was primarily inside the vacuum chamber. Additional scaffolding was added in the chamber. All the remaining spool pieces were cold shocked and leak tested. Ninety percent of the tubing and piping runs were completed in the chamber. The Tank-cold guard radiation duct was insulated. Several openings in the payload simulator were taped over. The cable cope tray was installed. All pressure transducers and temperature sensors were installed. The instrumentation cables were wrapped with mylar tape. Facility check sheets for the C.P.S.P. Tests are complete, and safety committee approval has been obtained for all of Phase I testing.

In the ATS Building assembly area the four, ten foot diameter, aluminzed mylar shadow shield sheets were completed, including all trimming, and the tabs glued in place. The tabs (144 total) will also be sewn to assure a secure installation. The four sheets were also prestretched. Prior to assembling the shadow shields for transport to K-Site, the sheet seams must be taped and 30 thermocouples fabricated and installed on the sheets. Strut openings must also be cut in the four sheets. To complete the rims for final assembly, a high emissivity coating will be applied, and the rims matched to the handling rings. The two shadow shields are scheduled for completion by June 1. A spare sheet will be fabricated if there is sufficient time before the ATS Building is closed.

(Continued on Page 29)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YOY2752

Mechanical design on the ten channel pressure,and 62 channel temperature,test rig has been started.	
Spin rig test site tentatively selected.	
Signal transfer device was received.	
Two new type pressure transducers were received.	
Design progressing on data system	Complete May.

CHANGES: None

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

INSTRUMENTATION

Work remaining before test:

(1) Instrumentation check out to instrument room.

(2) Control room instrument check out meters, strip charts, etc.

(3) Noise checks through data system.

(4) Data Link program and check out.

(5) Complete transducer installation outside tank.

CONTROLS

During this report period, time was devoted to chamber wiring and providing a baffle heater control system which is a new requirement. Installation, wiring, and check out of all systems should be completed early in May.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The mechanical design has been started for a ten channel pressure and 62 channel temperature test rig to be located at Plum Brook. It will be first used to test and evaluate pressure transducer performance over speed ranges up to 23,000 RPM. This test rig will be universal in nature in that it will have the capability for both the transducer tests and the final design complete system package tests.

DISCUSSION

A test site at Plum Brook has been tentatively selected for the spin rig installation. A signal transfer device and two new type pressure transducers for test evaluation have been received. Because of the large number of analog

(Continued on Page 31)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.
STATUS		

STANDARDS AND CALIBRATION LAB

513 hours of work completed.

1612 hours of backlog.

INSTRUMENT DATA COMPUTER ITEMIZED DATA ON PAGE 33

SPECIAL RESEARCH PROJECT (Continued)

signals to be handled by the system, a rotating data processing system somewhat like the LeRC-Cleveland designed Shaft Data System will be made part of the final rotating package. The design for the data system will be completed during the month of May 1973. Components for a bread board check out circuit will be ordered shortly thereafter.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
B-3	200 hours
HTF	27 hours
K	14 hours
SPF	17 hours
H-Bldg	46 hours
Direct Labor K-Site	193 hours
Direct Labor B-3 Site	16 hours
	513 hours
Total Backlog	1612 hours

INSTRUMENTATION DATA COMPUTER — RSD - J. L. HARROLD

HARDWARE

The high speed paper tape reader arrived and is operational.

The audio/visual unit, to alert when significant errors or a computer failure has occurred, has been installed and is operational.

The K-Site console was moved to K-Site control room. The Data Link remains to be adjusted for proper operation.

(Continued on Page 33)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SYSTEMS

HARDWARE SYSTEM	
Received and installed high speed paper tape reader.	
Installed audio/visual unit.	
K-Site console moved to K-Site control room.	
SOFTWARE SYSTEM	
B-3 Shroud tests software are operational.	
Expanded requirements and improvements continues.	
9300 program requirements	
Data recording	90% complete.
Playback Accumulation	30% complete.
Operational improvements	20% complete.
"A" CF16A Program requirements	
Data Storage and X-Y info for recall	90% complete.
Plotting of X-Y info for recall	90% complete.
Operational improvements	20% complete.
"B" CF16A Program requirements	
Pattern initialization	100% complete.
CRT display servicing.	95% complete.
X-Y composite CRT display servicing	95% complete.
Revising temporary display program.	
Revising "K" Data Link Program.	

INSTRUMENTATION DATA COMPUTER (Continued)

SOFTWARE

(1) Centaur Shroud Structural Tests:

All parts of this requirement have been operational for B-3 Tests. However, expanded operating requirements and basic improvements necessitate updated versions. This work continues on all phases and is reflected by small changes in the percent complete figures compared to last month. Items with 100% figures from last month are deleted for this report:

(a) 9300 program requirements:

Data Recording, 90% complete.
Playback Accumulation, 30% complete.
Operational improvements, 20% complete.

(b) "A" CF16A Program:

Data storage of X-Y information for recall, 90% complete.

Plotting of X-Y information for recall, 90% complete.

Operational improvements, 20% complete.

(c) "B" CF16A Program:

Pattern initialization, 100% complete.

Normal CRT display servicing (2 CRTs), 95% complete.

X-Y composite CRT display servicing (1 CRT), 95% complete.

(2) Temporary Display Program:

Further revisions are necessary for ease of operation and loading. These revisions will continue as time permits.

(3) K Data Link Program:

Revisions are being made to incorporate the K-Site operating requirements.

5-73

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

A warm, system leak check was performed on the CPSP test hardware during May. The original schedule called for the first leak check under hard vacuum only after all work inside the chamber was finished. The warm system leak check, however, was performed when instrument technicians were not available to complete work inside the chamber. The diffusion pumps were operated for approximately 5 days to obtain an ultimate pressure of $9X10^{-6}$ Torr with the vehicle fuel tank, tubing runs, equipment bay, payload simulator, cryoshroud, and the cold guard evacuated. The previous bare chamber ultimate pressure was $2X10^{-6}$ Torr. All the chamber wall electrical and mechanical ports were mass speced. The conclusion was that the hardware was outgassing and/or evacuation of system virtual leaks is extremely slow and will require extensive pumping prior to future tests. Results of the leak test on vacuum pumpdown are as follows:

(1) There was no apparent back streaming of diffusion pump oil.

(2) A cold guard leak greater than 0.10 std cc GHe/sec was traced to a faulty Conoseal gasket.

(Continued on Page 31)

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

(3) The fuel tank leak rate was measured at $5X10^{-4}$ std cc GHe/sec which is the same as measured during the tank acceptance test approximately one year previous.

(4) A high current flow noted in the fuel tank pressurization solenoid valve and subsequently traced to a partially shorted wire.

(5) The equipment bay has an immeasurably large leak. The exact location has not yet been determined, and a repair could required considerable time. An alternative, since the equipment bay hardware is not operated during the boil off tests, is to evacuate all the equipment bay tubing runs.

(6) Wiring was replaced on one diffusion pump heater.

All mechanical work is complete inside the vacuum chamber except for hanging cryoshroud mylar curtains and a final chamber clean up. With a normal complement of mechanics and technicians, testing could be started in 1 to 2 weeks.

Shadow shield build up in the ATS Building clean room is complete. Before mounting the shields in the handling fixture for delivery to K-Site, four additional thermocouples are to be mounted.

INSTRUMENTATION

(1) Four damaged Rosemounts were replaced.

(2) Cable for additional thermocouples was fabricated.

(3) Solenoid valves were checked out.

Work remaining before test:

(1) Instrumentation check out to instrument room.

(2) Control room instrument check out meters, strip charts, etc.

(3) Noise checks through data system.

(Continued on Page 33)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK I

STATUS

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YOY27!

Review meeting held May 30, 1973.
Slip ring ordered and received.
New pressure transducer ordered and received.
Design completed for 72-channel multiplexer and demultiplexer.
Design started on 12-channel rotatable pressure transducer container.

CHANGES: None.

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

(4) Data Link program and check out.

CONTROLS

All heater wiring in the vacuum chamber was completed and checked out in May. Control room wiring for all the control systems was also completed. A closed loop check out for heater controls and the boil off system should be completed by the second week in June. All auxiliary control systems will be checked out by the first week in June.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

On the morning of May 30, 1973, all groups concerned with the advanced turbine research project met at LeRC-Cleveland to discuss the present status and set guides for the future course of the 23,000 RPM pressure and temperature measuring system development. At this time it was agreed by all that only after June 30, 1973 could we implement a meaningful work schedule.

DISCUSSION

The following development program elements have been completed:

(1) Selection and procurement of a 23,000 RPM slip ring. It is capable of 40,000 RPM operation and has been received at Plum Brook.

(2) Selection of one or two types of pressure transducers that could operate at 23,000 RPM. A Setra System capacitance type has been purchased and received at Plum Brook. Another type will be ordered for evaluation.

(Continued on Page 35)

NARRATIVES ON ADJOINING PAGE

PROJECT

STATUS

CHANGES: (schedule changes since last report)

STANDARDS AND CALIBRATION LAB

474 manhours of work completed.

1535 manhours of backlog.

SPECIAL RESEARCH PROJECT (Continued)

(3) A paper design for a 72 channel MOSFET multiplexer and demultiplexer has been completed. This is a simplified version of the first stage of the LeRC-Cleveland developed shaft data system. It will mate with the slip ring signal transfer method.

(4) A 12 channel rotatable pressure transducer container has been partially designed.

The following development program elements are yet to be completed:

(1) Completion of the rotatable pressure transducer housing for transducer evaluation as well as a part of the complete system.

(2) The design and fabrication of a 23,000 RPM spin test rig for component evaluation and the final system tests.

(3) The design and fabrication of the complete system.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
B-3	99 hours
HTF	46 hours
K	11 hours
SPF	67 hours
B-2	17 hours
H-Bldg	42 hours
Direct Labor	
K-Site	112 hours
B-3 Site	32 hours
B-2 Site	48 hours
	474 hours
Total Backlog	1535 hours

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SYSTEMS

SOFTWARE	
Expanded requirements and improvements continue for Centaur Shroud Structural Test.	
9300 operational inprovements	40% complete.
"A" CF16A Programs	
Completed Data storage of X-Y info recall.	
Completed X-Y recall plotting.	
"B" CF16A Programs	
Completed X-Y composite CRT display servicing.	
Normal CRT display servicing	98% complete.
Making revisions to K Data Link.	

CHANGES: None

SOFTWARE

(1) Centaur Shroud Structural Tests:

All parts of this requirement have been operational for B-3 Tests. However, expanded operating requirements and basic improvements necessitate updated versions. This work continues on all phases and is refleted by small changes in the percent complete figures compared to last month. Items with 100% figures from last month are deleted for this report:

(a) 9300 program requirements:

Data Recording, 90% complete.
Playback Accumulation, 30% complete.
Operational improvements, 40% complete.

(b) "A" CF16A Program:

Data storage of X-Y information for recall, 100% complete.

Plotting of X-Y information for recall, 100% complete.

Operatioal improvements, 50% complete.

(c) "B" CF16A Program:

Normal CRT display servicing (2 CRTs), 98% complete.

X-Y composite CRT display servicing (1 CRT), 100% complete.

(2) Temporary Display Program:

Further revisions are necessary for ease of operation and loading. These revisions will continue as time permits.

(Continued on Page 39)

INSTRUMENTATION DATA COMPUTER (Continued)

(3) K Data Link Program:

Revisions are being made to incorporate the K-Site operating requirements.

(4) HTF Data Requirements:

Plans are being made to provide quick look plotted and graphic calculated data.

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE DISCUSSION OPERATIONS During June the primary work efforts were concentrated toward completing the instrumentation and controls systems and accomplishing a satisfactory warm leak check. Both the instrumentation and control systems are three to four days from completion plus check out. Continued system leak checking revealed an equipment bay pressurization valve was leaking. The leak was repaired by installing a (Continued on Page 25)

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

OPERATIONS (Continued)

new operator-stem and seal assembly. The subsequent 10 day pumpdown revealed yet another 10^{-3} std cc GHE/sec leak in the cold guard fill line. The leak was traced to a faulty conoseal gasket. This was the second fill line gasket which failed to seat; consequently, the three remaining gaskets were replaced in that line.

Between chamber pumpdowns the cryoshroud mylar curtains were installed and the final chamber clean up was accomplished. As of this writing the third chamber pumpdown is in process.

The two shadow shield assemblies are now complete including all instrumentation. They are supported in special handling fixtures, covered with plastic bags and purged.

INSTRUMENTATION

Work remaining before test:

(1) Instrumentation check out to instrument room - 20% complete.

(2) Control room instrument check out - meters, strip charts, etc. - 80% complete.

(3) Data Link Program and check out - 50% complete.

CONTROLS

All control systems wiring is complete with the exception of the lightning protection circuitry now being added to the heater control system. Off-line check out and set up of control systems is now 95% complete. The cryoshroud vent and fill valves are operational and ready for the cold leak tests scheduled for the first week of July.

NARRATIVES ON ADJOINING PAGE

PROJECT TASK I

STATUS

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YOY27

Design delayed due to staff changes and vacation schedules.

Design of pressure transducer housing will begin again on July 26.

STANDARDS AND CALIBRATION LAB

357 manhours of work completed.

1488 manhours of backlog.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

Plum Brook staff changes and vacation schedules have delayed the special research project progress. Full project effort will begin again on or about July 26, 1973.

DISCUSSION

The task and schedule outlined in last month's report will start after July 26, 1973 with an increased effort to make up lost time. The key item of this project is the 23,000 RPM testing of the pressure transducers. Maximum effort will be concentrated on the completion of the design for the pressure transducer housing which will serve for both the testing phase and the final package.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
B-3	78 hours
HTF	23 hours
K	17 hours
SPF	20 hours
H-Bldg	48 hours
Direct Labor	
K-Site	88 hours
B-3 Site	83 hours
	357 hours
Total Backlog	1488 hours

NARRATIVES ON ADJOINING PAGE

PROJECT	TASK
STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SYSTEMS

SOFTWARE	
9300 program requirements	
Data recording	95% complete.
Playback accumulation	40% complete.
Operational improvements	40% complete.
"A" CF16A program	100% complete.
"B" CF16A program	100% complete.
Making revisions to K-data link program.	
Revisions to HTF Quick Look data	50% complete.

CHANGES: None

INSTRUMENTATION
DATA COMPUTER

RSD - J. L. HARROLD

SOFTWARE

(1) Centaur Shroud Structural Tests:

All parts of this requirement are operational. Testing at B-3 will be complete very early in July. Items with 100% figures from last month are deleted for this report:

(a) 9300 program requirements:

Data Recording, 95% complete.
Playback Accumulation, 40% complete.
Operational improvements, 40% complete.

(b) "A" CF16A Program - 100% complete.

(c) "B" CF16A Program - 100% complete.

(2) K-Data Link Program:

Revisions are being made to incorporate the K-Site operating requirements.

(3) HTF Data Requirements:

The requirements for quick look data have been received from the research engineers. Program modifications are 50% complete.

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

As of this writing seven test days have been completed in the near earth configuration C.P.S.P. Test 1-2a and it is scheduled for completion August 1 or 2. A null test, 1-2b; a deep space test, 1-3a; and a second near earth test, 1-3b, are scheduled for August through September 3.

The final chamber pump down was initiated on July 9, 2 weeks prior to filling the tanks with LH_2. Evacuation of the tank insulation appeared to slow the vacuum chamber pump down. Final chamber pressure was $5X10^{-6}$ Torr. After filling the tanks and during subsequent testing, the pressure has held between $1x10^{-6}$ and $2X10^{-6}$ Torr.

(Continued on Page 17)

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

Shortly after loading the tanks, an erratic output was noted in the fuel tank pressure control system. This was traced to 50 mm pressure pulses in the pressure sensing line. A surge tank, which appeared to eliminate the pulses, was installed in the sensing line, however the reason for the pulses has not yet been determined. Additional instrumentation is being installed to verify the tank pressure and to further determine the cause of the pressure pulses.

In addition to test set up and actual test operations, the GN_2 electrical purge system was modified and new personnel at K-Site spent time training and familiarizing themselves with the K-Site systems.

INSTRUMENTATION

(1) One cryogenic pressure transducer inside the vacuum chamber was lost due to lightning. Since this measurement was not vital to the test, no attempt was made to replace the transducer.

(2) One Rosemount temperature sensor was lost on the tank during filling of the tank with LH_2.

(3) Two transducers were replaced after the test program was started to provide better range coverage.

No other significant instrumentation problems have been encountered to this date.

Run support is being given on a regular time and reassigned hours basis for daytime data acquisition. Data acquisition is on an automatic basis for after hours with Facilities Service Division personnel on call in the event of thunderstorm activity which could damage data acquisition equipment.

CONTROLS

Final check of all control systems was completed and no operational problems were found. Heater systems have been lightning protected to guard against controller and power failures. Sense line oscillations on tank pressure control were damped with a large surge tank to achieve satisfactory control, but the basic problem still remains. Steps are being taken to eliminate the problem.

NARRATIVES ON ADJOINING PAGE

PROJECT	TAS
STATUS	

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM	YO'
Ordered second type pressure transducer. Designing housings for two types of pressure transducers.	

STANDARDS AND CALIBRATION LAB
382 manhours of work completed. 1758 manhours of backlog.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

Full project effort has been resumed on July 30, 1973. A second type pressure transducer that may be suitable for the 23,000 RPM system has been ordered for test and evaluation.

DISCUSSION

The design for two types of pressure transducer rotatable housings is now underway. The pressure transducers that have been selected as best candidates for this program are manufactured by Setra Systems, Inc., and National Semiconductors. The latter device has been ordered and features a rectangular silicon wafer pressure sensing diaphragm with a four element strain sensing bridge formed by integrated circuit techniques. It also features an I.C. junction transistor located at the diaphragm center that can be used for precise temperature indication on control of the diaphragm temperature for improved accuracy.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
B-3	63 hours
SPF	23 hours
HTF	61 hours
K	51 hours
H-Bldg	24 hours
Direct Support K	160 hours
Total	382 hours
Total Backlog	1758 hours

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TAS
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER SYSTEMS

HARDWARE	
Designed and installed a repeater for K-Data Link	
Designed and installed a controllable counter.	
SOFTWARE	
K-Data Link program completed.	
9300 Program requirements:	
Playback Accumulation	50% complete.
Operational improvements	70% complete.
Special equation requirements	60% complete.
"A" CF16A Program:	
Modifying plotting program	60% complete.
"B" CF16A Program:	
Modifying triple CRT display program	60% complete.

CHANGES: None.

INSTRUMENTATION
DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

A repeater to demodulate and remodulate the K-Data Link signal between B-Control and K-Site was designed and installed in H-Building. The repeater restores signal strength over the long distance and provides reliable detection adjustment margins.

A controllable elapsed milliseconds counter was designed and installed in the computer interfaces. The counter can be controlled and read by the XDS9300 for use with the HTF test plots.

SOFTWARE

(1) Centaur Shroud Structural Tests:

These tests were completed during July. The incomplete items of XDS9300 data recording, playback accumulation and operational improvements will be developed primarily for the HTF tests in the near future. Any further progress for Centaur Shroud tests will be delayed until the Engineering Evaluation Test requirements are defined.

(2) K-Data Link Program:

This program is now operational with only minor improvements required as problems occur.

(3) HTF Data Requirements:

Revisions to the programs used for the Centaur Shroud Structural Tests are being made.

(a) 9300 program requirements:

Data Recording, 95% complete.
Playback Accumulation, 50% complete.
Operational improvements, 70% complete.
Special equation requirements, 60% complete.

(b) "A" CF16A Program - The plotting program is being modified to allow special plots and profiles. The modifications are 60% complete.

(c) "B" CF16A Program - The triple CRT display program is being modified to provide a visual profile of pressures on one CRT. The modification is 60% complete.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CRYOGENIC PROPELLANT STORAGE PROGRAM	K	YOR4

TESTS I-2 & 3 to RESUME	Sep 12, 1973.
TESTS I-4, 5, 6, 7, & 8	Nov-Mar 15, 1974.
<u>ITEMS COMPLETED</u> Removed top cooling lines. Installed insulation between baffle and payload simulator. Added one Rosemount sensor to insulator gap. Verified mixer motor operation. Replaced a chamber transducer. Lightning protected circuits moved to equipment instrumentation interconnection. Changed tank boil-off valve trim.	
<u>ITEMS IN PROGRESS</u> Preparing for Test 1-2b scheduled for	Sep 12, 1973.

CHANGES: Run schedule changed.

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - J. V. GILLETTE

DISCUSSION

OPERATIONS

The null test, 1-2b, was not performed as scheduled during August due to vacuum leaks and a operational error which damaged three vacuum diffusion pumps. The initial vacuum chamber pump down for Test 1-2b is now scheduled for September 12.

The first run attempt during the first week in August was unsuccessful due to hydrogen leaks in the cryoshroud top. The leaks were traced to three 45° mitered joints in the aluminum "D" tubing. Since the cryoshroud top has a history of developing new leaks it was assumed that the welded joints are fatiguing due to thermally induced stresses. There are twenty such joints in the cryoshroud top, and extensive down time would be required to modify the top. Since the cryoshroud baffle and the vehicle payload simulator are coplanar, sufficient cooling may be possible via the baffle and simulator without flowing LH_2 on top. Therefore, the top cooling lines have been disconnected and the spaces between the cryoshroud walls and the baffle and between the baffle and the payload simulator have been covered with multilayer insulation to prevent incident thermal radiation from reaching the vehicle.

The second run was aborted due to a cold leak in the fuel tank fill line. This leak was traced to a pressure transducer fitting that had been installed after the last test.

The third run attempt on August 30 failed because of overheating and subsequent damage to three diffusion pumps. The damage was confined to the loss of lead fillets around the cooling water coils. The overheating was caused by not establishing proper cooling water flows when the pumps were initially started.

INSTRUMENTATION

(1) Two shroud insulation Rosemounts and one Rosemount on the tank lid failed after cooldown on August 24.

(Continued on Page 15)

NARRATIVES ON ADJOINING PAGE

PROJECT	TA!
STATUS	

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM	YOY
Proceeding on design for 23,000 RPM system package.	

CHANGES: None

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

These sensors cannot be replaced without removing insulation.

(2) One Rosemount was added to measure insulator gap temperature.

(3) Mixer motor was verified running at ambient temperature. It was also started during tank fill with LH_2. All motor performance data appeared normal.

(4) A transducer inside the chamber that had failed earlier due to lightning was replaced.

CONTROLS

Several equipment failures were recorded due to lightning even though the landlines were protected. The lightning protection circuits were moved to the equipment interconnection so that they protect the cell wiring. Also, the measure tank boiloff valve trim was changed to permit higher accuracy control at low boiloff flow.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

A 23,000 RPM system package design is nearly complete. This package will contain ten National Semiconductors integrated circuit type pressure transducer mounted with critical elements close to the package spin axis.

DISCUSSION

Because of the extreme G forces developed at 23,000 RPM, this package design locates each pressure transducer close to the spin axis in an axial stack up

(Continued on Page 17)

NARRATIVES ON ADJOINING PAGE

PROJECT	TASK
STATUS	

STANDARDS AND CALIBRATION LAB

317 manhours of work completed.

1651 manhours of backlog.

SPECIAL RESEARCH PROJECT (Continued)

configuration. Each of the ten pressure transducers will be mounted in an easily removable "hockey puck" shaped container. A split type transducer containment structure allows easy replacement. The package design follows the previously described guidelines wherein the transducer spin test package configuration will be the best design suitable for inclusion as one section of the final ten channel pressure and 62 channel temperature measurement system.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
HTF	191 hours
K	33 hours
B-3	2 hours
SPF	45 hours
K-Site Direct Support	46 hours
	317 hours
Total Backlog	1651 hours

INSTRUMENTATION DATA COMPUTER — RSD - J. L. HARROLD

HARDWARE

No hardware additions or modifications were made this month.

SOFTWARE

(1) K-Data Line Program:

Improvements were completed and this program is now fully operational.

(Continued on Page 19)

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TA

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER

SOFTWARE	
K-Data Program fully operational.	
9300 Program Requirements (HTF)	
On line accumulation & data recording	95% complete.
Playback accumulation	70% complete.
Operational improvements	85% complete.
Special equation requirements	90% complete.
"A" CF16A Program (HTF)	
Plotting program modifications	90% complete.
New plotting program	20% complete.
"B" CF16A Program (HTF)	
Triple CRT display modifications	95% complete.
Vertical roll style formats for tabular data . . .	15% complete.

CHANGES: None.

INSTRUMENTATION DATA COMPUTER (Continued)

SOFTWARE (Continued)

(2) HTF Data Requirements:

(a) 9300 Program requirements:

On Line Accumulation and Data Recording, 95% complete.
Playback Accumulation, 70% complete.
Operational improvements, 85% complete.
Special equation requirements, 90% complete.

(b) "A" CF16A Program:

Plotting program modifications for use with the Versatec printer/plotter, 90% complete.

New plotting program for use with the Houston Instruments Digital Plotter, 20% complete.

(c) "B" CF16A Program:

The modification to the triple CRT display program to provide a visual profile of pressures on one CRT is 95% complete.

Work has begun to provide a vertical roll style format of tabular data and is 15% complete.

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - N. L. SCHROEDER

SUMMARY

The Null Test, I-2B and the Deep Space Hold Test, I-3a were completed after repairs on the damaged vacuum diffusion pumps had been accomplished. The Near Earth Test, I-3b, is in progress with completion expected by October 6. Installation of the shadow shields, required for all remaining tests, will begin about October 9 with completion expected about mid-November.

DISCUSSION

OPERATIONS

Repairs to the cooling coils on the three damaged vacuum diffusion pumps was completed on September 8.

(Continued on Page 13)

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

A function check of the complete vacuum system was then performed to verify proper operation.

The Null Test, I-2b was started on September 14 with filling of the LH_2 tank, in the chamber. Flow of LH_2 to the 13' cryoshroud was started on September 15. Steady state conditions were reached on September 21 with a final boil-off rate of 0.095 SCFH.

Changeover to the Deep Space Hold Test configuration, Test I-3a, was accomplished September 23 by cutting off LH_2 flow to the payload simulator and warming it up. Steady State Point 1 was reached September 26 with a boil-off rate of 3.35 SCFH at a chamber pressure of 2.1 x 10^{-6} Torr and a cryoshroud pressure of 1.0 x 10^{-5} Torr.

Deep Space Hold Steady State Point 2 was reached September 28 with a boil-off rate of 4.70 SCFH after increasing shroud pressure to 4.9 x 10^{-5} Torr by turning off two diffusion pumps and bleeding Helium into the chamber through a calibrated orifice.

Deep Space Hold Steady State Point 3 was reached September 30. Completion of this test is expected by October 6 after which the site will be down for approximately 6 weeks for a test configuration change.

INSTRUMENTATION

Run support was provided for completion of Tests 2b, 3a, and 3b.

(1) Mixer motor operated satisfactorily in LH_2 during Test 2b.

(2) One pressure transducer used only for providing meter readout failed.

(3) Interstitial Pressure Baratron will be tested in calibration laboratory to determine accuracy at 10^{-6} Torr line pressure.

(Continued on Page 15)

NARRATIVES ON ADJOINING PAGE

PROJECT	TASK
STATUS	

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM — YOY275

Design for 23,000 RPM system package scheduled to be completed week of Oct.

CHANGES: None

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE	CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued) CONTROLS The rewiring of the lightning protection circuits appears to be satisfactory. Several lightning storms have caused no damage since the rewiring. The heater control systems have performed well under all run conditions.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The fabrication drawings for the 23,000 RPM spin test rig will be completed during the first week of October 1973. The rig will be used to evaluate the performance of any pressure transducer selected for use in the ten channel system.

DISCUSSION

The spin test rig will be driven at speeds ranging from zero to 23,000 RPM by a small General Electric air turbine. The turbine will be slightly modified to allow insertion of a small diameter tube that will pass through the center of the turbine shaft. Pressurization of the test transducer will be made via this tube be an ultra-miniature rotary seal comprised of a non-rotating hyper-dermic needle pierced through the axial center of a soft rubber-like rotating seal contained at the exhaust end of the drive turbine assembly. This technique should provide a 23,000 RPM rotary air union that is not commercially available.

The anticipated outside shop fabrication time for the spin rig components should be about one month. We can then expect to spin test the selected pressure trans-ducers during the later part of November 1973.

NARRATIVES ON ADJOINING PAGE

PROJECT	TASK N
STATUS	

STANDARDS AND CALIBRATION LAB

495 manhours of work completed.

1451 manhours of backlog.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
SPF	68 hours
B-3	96 hours
K	29 hours
HTF	73 hours
H Bldg	213 hours
Direct Support	16 hours
Total	495 hours
Total Backlog	1451 hours

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

No tasks to report.

SOFTWARE

(1) HTF Data Requirements:

(a) 9300 Program Requirements:

On Line Accumulation, Data Recording, Playback Accumulation and Special Equation requirements are all operational. A tabulation printout of selected parameters has been provided for playback and is also operational.

Program improvements are necessary to increase the output rate of playback since output is rather slow in its present form. These improvements are 30% complete.

(b) "A" CF16A Program:

Plotting program modifications for use with the Versatec printer/plotter are complete.

A plotting program for use with the Houston Instruments Digital Plotter is operational.

(Continued on Page 19)

NARRATIVES ON ADJOINING PAGE

PROJECT SITE TASK N

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER

SOFTWARE	
K-Data Program fully operational.	
9300 Program Requirements (HTF)	
On line accumulation & data recording	100% complete.
Playback accumulation	100% complete.
Operational improvements	100% complete.
Special equation requirements	100% complete.
Program improvements	30% complete.
"A" CF16A Program (HTF)	
Plotting program modifications	100% complete.
New plotting program	100% complete.
"B" CF16A Program (HTF)	
Triple CRT display modifications	100% complete.
Vertical roll style formats for tabular data . . .	40% complete.

CHANGES: None.

INSTRUMENTATION DATA
COMPUTER (Continued)

The size of alpha/numeric characters must be increased for Datafax transmission to Langley.

(c) "B" CF16A Program:

The provision for a visual profile of pressures on one CRT is operational.

Work on a vertical roll style format of tabular data is 40% complete.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

CRYOGENIC PROPELLANT STORAGE PROGRAM	K	YOR4
TESTS I-4, 5, 6, 7 & 8 run schedule		Nov-Mar 15, 1974.
ITEMS COMPLETED		
Removed Deep Space Test.		
Installed Near Earth Test - I-3b		
Completed Near Earth Test (I-3b)		Oct. 3, 1974.
Removed test hardware from chamber.		
Tank removed from shroud and disconnected from payload simulator.		
Replaced wiring on LH_2 pressurization valve.		
Disconnected and labeled (I-3b) instrument cables.		
ITEMS IN PROGRESS		
Installing shadow shield.		
Reparing leaks in the cryoshroud top section.		
Making test article configuration changes		Est'd comp 11-28-73
Testing interstitial pressure Baratron.		
Repairing equipment damaged during lightning storm .		Est'd comp 11-30-73.

CHANGES: None

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173)

CRD - R. L. DEWITT;
RSD - N. L. SCHROEDER

SUMMARY

The final test of the Group I test series, Near Earth Test I-3b, has been successfully completed. The test hardware has been removed from the chamber and work is in progress on the shadow shield installation for the Group II test configuration.

DISCUSSION

OPERATIONS

Changeover from the Deep Space Test configuration to the Near Earth Test, I-3b, was accomplished by cutting off the flow of LH_2 to the cryoshroud and electrically heating it to a temperature of 530°R. Steady state conditions were reached on October 3 with a boil-off rate of 82.0 SCFH at a chamber pressure of 2.5×10^{-6} Torr and a shroud pressure of 1.1×10^{-5} Torr.

The complete test assembly consisting of the cryoshroud, insulated LH_2 tank in its structure, payload simulator, and cold guard tank, were removed from the chamber as a unit. The tank, in its support structure, was then removed from the shroud and disconnected from the payload simulator in preparation for the installation of shadow shields and additional instrumentation required for the remaining tests.

A malfunction of the LH_2 pressurization valve, HCV-2511C which was noticed during the draining of the LH_2 tank at the completion of the test, was traced to a short in the wiring in the tank valve box under the insulation. The wiring was replaced and an operation check of the valve performed.

Work is also in progress to repair leaks in the "D" tubing 45° mitered joints of the cryoshroud top section which had developed during a previous run attempt.

The test article configuration change is on schedule with completion expected by the last week of November.

(Continued on Page 19)

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

INSTRUMENTATION

Instrumentation cables were disconnected and labeled after completion of Test I-3b.

Calibration laboratory tests of the Interstitial Pressure Baratron are in progress.

All reference ovens are scheduled for on site calibration checks during week of October 29, 1973.

Instrumentation changes for next series of tests have not been received.

CONTROLS

Due to a late season lightning storm, all eight programmable power supplies suffered some damage. One supply was damaged seriously. In addition to these failures, some of the lightning protection circuitry was also damaged. All failures occurred at the site leaving the control room undamaged.

Repairs have been initiated on all damaged equipment and replacement parts have been ordered where necessary. All repairs should be complete by the end of November. No cause could be found that would justify the damage to the protective circuitry since it had protected the equipment during several previous lightning storms. The equipment failure occurred after the data taking and during warmup. No damage to the test hardware was observed as a result of the power supply failure.

NARRATIVES ON ADJOINING PAGE

PROJECT	TASK
STATUS	

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM — YOY27

Completed 23,000 RPM spin test rig drawings.

Proceeding on the contracting of spin rig fabrication.

G. E. Air Turbine delivered to PB Machine Shop.

Received 40 lead 16-channel multiplexer integrated circuits.

CHANGES: None.

STANDARDS AND CALIBRATION LAB

499 manhours of work completed.

1300 manhours of backlog.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The fabrication drawings for the 23,000 RPM spin test rig have been completed. The procurement process is now underway wherein an outside fabrication shop will receive a contract to build the rig components.

DISCUSSION

The General Electric air turbine is now in the Plum Brook Machine Shop where an attempt to drill a 1/8" hole through the axial center of the turbine shaft will be made. The success of this operation will depend upon the type of shaft metal as well as its hardness. An arc discharge method may be needed to bore the hole.

The 40 lead dual in line package 16-channel random/sequential access multiplexer integrated circuits have been received at Plum Brook. They will be used to breadboard a 72-channel analog multiplexer and de-multiplexer as one method to be evaluated for routing the 72-channels through a rotating signal transfer device.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
HTF	202 hours
K	5 hours
B-3	22 hours
SPF	38 hours
H & Cal Lab	103 hours
Rotary X-ducer Project	32 hours
Direct Support K-Site	97 hours
Total	499 hours
Total Backlog	1300 hours

NARRATIVES ON ADJOINING PAGE

PROJECT

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

INSTRUMENTATION DATA COMPUTER

SOFTWARE	
9300 Program Requirements (HTF) Program to increase output rate	90% complete.
"A" CF16A Program (HTF) Completed program to use Houston Plotter.	
"B" CF16A Program (HTF) Vertical roll style formats for tabular data	75% complete.
Planning program for "F" Site requirement for visual engineering units display.	

CHANGES: None.

INSTRUMENTATION
DATA COMPUTER

RSD - J. L. HARROLD

HARDWARE

No tasks to report.

SOFTWARE

(1) HTF Data Requirements:

(a) 9300 Program Requirements:

Program improvements to increase output rate of playback are 90% complete. Minor changes are continually being made to meet unique equation requests.

(b) "A" CF16A Program:

Operation programs are in use with the increased size of alpha/numeric characters on the Houston Instruments Plotter. Milliseconds are being added to the plot heading times.

(c) "B" CF16A Program:

Work on a vertical roll style format of tabular data is 70% complete.

(2) "F" Site:

Special requirements for visual engineering units for this requirement are minimal and are in the planning stage.

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

CRYOGENIC PROPELLANT STORAGE PROGRAM	K	YOR41
TESTS I-4, 5, 6, 7, & 8 RUN SCHEDULE		Jan-Apr 15, 1974

ITEMS COMPLETED

Repairs and leak tests to cryoshroud top completed.
Performed complete leak test of vacuum chamber.
Repaired facility valve leaks.
Resolved instrumentation problems.
Installed additional instrumentation.
Built transducer test manifold.
Tests completed on Interstitial Pressure Baratron.
Calibrated all temperature reference ovens.
Received power supply capacitors.

ITEMS IN PROGRESS

Investigating over-pressure vent system leak.
Calibrating Baratron diff. pressure transducer.
Installing sensors and terminating cabling.
Evaluating data for Interstitial Pressure Baratron tests.

CHANGES: Schedule Change.

SITE	SITE NAME RESEARCH INSTALLATION & TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - N. L. SCHROEDER

SUMMARY

Changeover to the new test configuration is in progress. Repairs are being made to facility hardware following a post test chamber leak check. Instrumentation changes have been resolved and a new interstitial pressure measurement system is being developed.

DISCUSSION

OPERATIONS

Repairs to the cryoshroud top have been completed, the unit cold shocked with LN_2 and a mass spec leak test performed. During the modification of the test hardware, a complete post test leak check of the vacuum chamber was performed. Several internal leaks were detected in facility valves to the chamber and were repaired. A significant external leak in the chamber over-pressure vent system was also detected. This problem is currently under investigation.

Preliminary data from the Group I test series indicated several discrepancies in the existing instrumentation and the need for additional instruments at various locations in the insulation blankets and on the support structure. All of these problems have been resolved and the additional instrumentation installed.

Insulation blanket interstitial pressure measurements continue to be a problem. No meaningful results were obtained during the last tests. A test manifold has been built and is presently being utilized to calibrate and verify the performance of the Baratron differential pressure transducer under high vacuum conditions. Two additional Baratron units will then be installed inside the chamber to measure shroud and interstitial pressures.

The installation of the shadow shields and complete reassembly of the test hardware has been delayed until the chamber leaks have been repaired and manpower is available. It is expected that the facility will be ready to resume research testing in early January.

(Continued on Page 17)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM	YOY2
Fabricating 23,000 RPM Spin Test Rig	50% complete Sched comp date - Ja
Received second type pressure transducer.	

CHANGES: None

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

INSTRUMENTATION

Instrumentation changes and additions were received November 1, 1973. Sensor installation and cable terminations for the new instrumentation is approximately complete.

Calibration laboratory tests of the Interstitial Pressure Baratron have been run. The data is being evaluated.

All temperature reference ovens have been calibrated.

CONTROLS

No controls work was accomplished at K-Site this month. Power supply capacitors were received at the end of the month and repair will begin in December.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) — RSD - V. S. PETERSON

SUMMARY

The 23,000 RPM spin test rig fabrication was not given to an outside shop and is now approximately 50% completed by the Plum Brook machine shop. They predict a completion date early in January 1974.

DISCUSSION

We have received a second type pressure transducer for evaluation in the spin test rig. The pressure transducers are Kulite Semiconductor model VQS-500-100 and they cover the range of +100 psi to -30 psi. If this transducer is chosen for the final system design, care must be exercised in routing the system pressure lines to the transducer so that the high side of the pair always reached the + pressure input part of the transducers.

NARRATIVES ON ADJOINING PAGE

PROJECT	TASK
STATUS	

STANDARDS AND CALIBRATION LAB

491 manhours of work completed.

1244 manhours of backlog.

INSTRUMENTATION DATA COMPUTER

9300 Program Requirements (HTF)

Completed program to increase output rate.

"B" CF16A Program (HTF)

Completed vertical roll style formats for tabular data.

CHANGES: None.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
HTF	228 hours
SPF	72 hours
B-2	32 hours
B-3	10 hours
F	16 hours
K	98 hours
H	15 hours
Direct Support K-Site	20 hours
	491 hours
Total Backlog	1244 hours

INSTRUMENTATION DATA COMPUTER

RSD - J. L. HARROLD

The incomplete tasks reported last month are now operational except for minor site oriented specifics. With the cancellation of further significant plans in this area because of Station standby plans and the completion of the present tasks, it seems appropriate to declare the system operational in the present status. Any further reporting will be done with the particular site using the system.

The effort in this area will focus on documentation and supporting operational use for the sites.

12-73

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173)

CRD - R. L. DEWITT;
RSD - N. L. SCHROEDER

SUMMARY

Assembly of the test hardware to the new test configuration is in progress. Repairs to facility hardware have been completed. Interstitial pressure measurement system problems have not as yet been resolved.

DISCUSSION

OPERATIONS

The leak check of the vacuum chamber has been completed with repairs being made to correct all significant leaks that were detected.

(Continued on Page 11)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TA
STATUS		SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM	YO
Fabricating 23,000 RPM Spin Test Rig	85% complete.
Assembly of rig scheduled to be completed	Jan 11, 1974.

CHANGES: None

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

CRYOGENIC PROPELLANT STORAGE PROGRAM

OPERATIONS (Continued)

Assembly of the test hardware is in progress. The shadow shields have been installed in their proper location but final adjustments and tensioning are yet to be accomplished. The payload simulator, cryo-shroud top and radiation baffles have also been mated to the main structure.

Check out of the interstitial pressure transducers to be used in the next test have been inconclusive. Accurate readings in the 10^{-5} to 10^{-6} Torr range were not obtained with the present test set-up. An attempt will be made to simulate actual test conditions by installing the transducers in the "D" site vacuum chamber. Necessary work to accomplish this task in in progress.

It is expected that the facility will be ready to resume research testing by the end of January.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

SUMMARY

The Plum Brook machine shop has estimated the fabrication of the components for the 23,000 RPM pressure transducer spin test rig to be 85% complete. Assembly of the rig is expected to begin during the first and second week of January 1974.

DISCUSSION

Room 104 in D-Site test building has been tentatively selected for the spin test rig installation and operation. This room is in an unoccupied rear area of D-Site. The test rig can be remotely operated from a control station at the northwest corner of the building test area. Room 104 can be viewed through a window in the test area. The Area 2C Safety Committee will be requested to approve this location and test program.

NARRATIVES ON ADJOINING PAGE

PROJECT	STATUS
STANDARDS AND CALIBRATION LAB	249 manhours of work completed. 1231 manhours of backlog.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
HTF	24 manhours
SPF	66 manhours
B-2	31 manhours
B-3	8 manhours
K	89 manhours
H	31 manhours
Total	249
Total Backlog	1231 manhours

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173)

CRD - R. L. DEWITT;
RSD - N. L. SCHROEDER

SUMMARY

Changeover to the new test configuration is almost complete. The test assembly has been installed in the vacuum chamber and final connections are in progress. The interstitial pressure measuring system has been checked out and is also being installed.

(Continued on Page 15)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

CRYOGENIC PROPELLANT STORAGE PROGRAM K YOR4173

TESTS I-4, 5, 6, 7, 8 RUN SCHEDULE	Jan-Apr 15, 1974.
ITEMS COMPLETED	
Test assembly installed.	
Checked out interstitial pressure measuring system.	
Alignment and tensioning of shadow shields.	
Replaced radiation baffle conoseal flanges.	
Radiation baffles positioned.	
Baratron unit mounted in insulated box.	
Connected all instrumentation wiring to test vehicle.	
Completed all repairs on heater control system power supplies.	
ITEMS IN PROGRESS	
Making final connections to test assembly.	
Installing interstitial pressure measuring system.	
Leak checking all service lines.	
Preparing for next test run	Est. Compl. Feb. 15.
Hooking up shroud heater control system.	
Resurrecting hybrid computer for flow rate readout.	

CHANGES: None.

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

CRYOGENIC PROPELLANT STORAGE PROGRAM

DISCUSSION

OPERATIONS

Final alignment and tensioning of the shadow shields and positioning of the radiation baffles has been completed. This task was delayed when it was discovered that the conoseal flanges on the baffles had not been replaced along with those on the cryoshroud and were defective. These flanges were replaced and the baffles leak checked. The vehicle was then installed in the cryoshroud and the complete assembly placed in the chamber. Connection and leak checking of all service lines inside the chamber is presently under way.

Checkout and calibration of the interstitial pressure Baratron Unit under simulated operating conditions in the vacuum chamber at "D" site has been completed. The unit was subjected to several vacuum cycles with the new sense lines installed and it was determined that reliable results could be obtained at pressures down to 10^{-5} Torr. The Baratron Unit has been mounted in a special insulated box and will be installed inside the cryoshroud to keep the sensing lines as short as possible.

It is expected that all facility checkouts will be completed by February 15, 1974 and full scale testing will resume at that time.

INSTRUMENTATION

Calibration of the Interstitial Pressure Baratron was completed in the "D" site vacuum chamber. The transducer with its associated temperature control and temperature monitoring components is being installed at "K" site for the 1-4 series of tests.

All instrumentation wiring was completed to connectors on the test vehicle.

(Continued on Page 17)

NARRATIVES ON ADJOINING PAGE

PROJECT	SITE	TASK NO.

STATUS	SCHEDULE

CHANGES: (schedule changes since last report)

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM YOY2752

Machining last test-rig item. Developed optical speed measurement system.	

CHANGES: None

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

CRYOGENIC PROPELLANT STORAGE PROGRAM

CONTROLS

Final repair of all power supplies for the heater control system on the shroud was completed this month. Almost all units have been returned to their racks and rewired to the appropriate system. Hookup to shroud load will be completed by the second week in February. Work has begun on resurrecting the hybrid computer for the large gas meter flow rate readout.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YOY2752)

RSD - V. S. PETERSON

SUMMARY

Rocket Systems Division support personnel covering the control and operations portions of the 23,00D RPM spin test rig are now in the process of preparing the site location and installation of the pressure transducer test rig at "D" site. The National Semiconductor IC pressure transducer will be the first type to be evaluated during February 1974.

DISCUSSION

The spin test rig's last item to be completed by the Plum Brook machine shop is a hypodermic needle type rotary pressure feed that will supply selectable pressure to the test transducer over a speed range of 0 - 23,000 RPM. The speed of the rig will be measured by an optical technique that uses a short wave length ultraviolet light source and an ultraviolet sensitive photo resistor sensor to produce a constant amplitude-six pulse per revolution speed signal. Dual sensors will be used, one for control (over speed shut down) and one for continuous speed measurement. The ultraviolet sensing technique will provide ideal speed signals free of the interference problems caused by room lighting and the speed variable signal amplitudes encountered with conventional magnets sensing techniques.

NARRATIVES ON ADJOINING PAGE

PROJECT TASK NO.

STATUS

STANDARDS AND CALIBRATION LAB

394 manhours of work completed.

1181 manhours of backlog.

STANDARDS AND
CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
HTF	122 manhours
SPF	102 manhours
B-2	23 manhours
B-3	63 manhours
H	48 manhours
K	36 manhours
Total	394
Total Backlog	1181 manhours

SITE	SITE NAME RESEARCH INSTALLATION &(TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - N. L. SCHROEDER OPERATIONS Installation of the vehicle in the vacuum chamber is complete. All piping and tube runs have been installed and a complete function and leak check performed. Final connection and check out of all instrumentation and controls cables and hardware has also been accomplished. Preparations for installation of the vehicle cold guard duct covering and the hanging of the aluminized mylar radiation shield on the outside of the cryoshroud are in progress. This task will complete the pre-test operations. (Continued on Page 15)

a selected number of abort channels will be tied in early in March. The circuit operation will be verified, and remaining channels wired in as time permits.

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

The assembly of the interstitial pressure Baratron box has been completed and the unit installed inside the cryoshroud. Preliminary readings observed during the ambient systems checks with the vacuum chamber pumped down to the 10^{-5} Torr range indicate that the unit and all associated hardware is operating properly.

Several days delay in the mass spec leak check of the vehicle in the chamber was experienced due to a loss of facility cooling water pressure and subsequent damage to one diffusion pump. The pump was repaired and additional protective thermocouples installed which sense cooling water outlet temperature in addition to the existing heater and oil temperatures.

Preparations for the shadow shield portion of the test series are almost complete. It is expected that testing will begin during the first week of March and continue through the first week of April.

INSTRUMENTATION

Interstitial Pressure Baratron was installed and checked.

Thermocouples on Baratron box were installed.

Thermocouple reference ovens were recalibrated.

Strip chart recorders in control room were calibrated.

All instrumentation work inside test chamber has been completed.

CONTROLS

Chamber wiring was completed and all heater circuits checked out satisfactory. Some minor controller repair is needed but this work should be completed by the first week in March. All other control systems are ready for the run.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YOY2752)

RSD - V. S. PETERSON

DISCUSSION

The 23,000 RPM spin test rig fabrication was completed this month by the Plum Brook Machine Shop. It was then transferred to LeRC-Cleveland for balancing. The ball bearings in the General Electric air turbine drive for the rig were found to be defective. A minor change in the method used to retain one of the spin rig's ball bearings was recommended.

The spin test rig was returned to Plum Brook for the bearing replacement and bearing retention changes. It will then be returned to Lewis-Cleveland for balancing during the latter part of March 1974. Preparation of "D" Site for the installation of the spin rig is now in progress.

STANDARDS AND CALIBRATION LAB

RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
HTF	89 manhours
K	45 manhours
B-3	80 manhours
SPF	39 manhours
H Building	20 manhours
Total	273 manhours
Direct Support K Site	48 manhours
Total Backlog	1205 manhours

3-74

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173)

CRD - R. L. DEWITT;
RSD - N. L. SCHROEDER

SCHEDULE - THROUGH MAY 1974

SCHEDULE CHANGE - THE RUN SCHEDULE HAS BEEN EXTENDED TO THE END OF MAY. THIS WAS NECESSARY DUE TO THE PROBLEMS IN EARLY MARCH IN GETTING THE SITE ON LINE

SUMMARY

Experimental testing was resumed during this reporting period. A Near Earth Test was completed and the Null Test is in progress.

DISCUSSION

OPERATIONS

Mass spec leak checking of the test hardware while maintaining a vacuum in the chamber was completed during the first week of March. Final preparations were completed and the chamber pumped down to the low 10^{-6} Torr range for test.

During pre-run operational checks of all systems, a short in the shroud closed loop heater circuit caused damage to three D.C. power supplies. Investigation indicated the problem was inside the chamber which required breaking the vacuum for access. Repairs to the wiring and power supplies were accomplished and test preparations resumed after a delay of about one week.

The test was started on March 15 with the filling of the measure tank and cold guard with LH_2. Steady state Near Earth data was taken on March 18 and 19. Boil-off from the tank was approximately 85 SCFH and agrees closely with the two previous Near Earth tests.

(Continued on Page 7)

SITE	SITE NAME RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
K	CRYOGENIC PROPELLANT RESEARCH SITE (Continued)

OPERATIONS (Continued)

On March 22 an attempt was made to cool down the cryoshroud in preparation for the Null Test. A ruptured weld in the top baffle of the cryoshroud caused termination of the test. Inspection of the baffle revealed that the faulty weld could not be reached without disassembly of the shroud. It was determined that the loss of this baffle would not seriously affect test results and it was taken out of the cryoshroud LH_2 flow circuit.

The chamber was pumped down and a cold gas leak check on the cryoshroud and another mass spec leak check of the chamber was performed before resuming research testing. The cryoshroud was filled on March 30 and the measure tank and cold guard on March 31 for the Null portion of the test program.

INSTRUMENTATION

Run support was provided for test series 1-4C and beginning 1-4A. No significant instrumentation problems have been encountered. The K Data Link has not been reliable because of lightning damage and electrical transients. The thermocouple reference ovens were checked for calibration stability. All were still within specifications.

CONTROLS

Finished power supply repair and completed total heater system check out. Two hydraulic actuators on boil off valves were found to have end seal leaks. These were repaired and the boil off system check out was completed.

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752) RSD - V. S. PETERSON

SUMMARY

The 23,000 RPM pressure transducer test rig has undergone the ball bearing retention modifications that were recommended by the LeRC - Cleveland balancing group. New ball bearings for the G.E. system drive turbine have been ordered.

DISCUSSION

As soon as the drive turbine is equipped with the new bearings, the spin rig will be assembled and delivered to the LeRC-Cleveland balancing group. The preparation of Plum Brook D Site for the installation of the spin test rig is proceeding slowly. The running of the rig and generation of spin performance data for the pressure transducers will be late in May 1974 or early June 1974.

STANDARDS AND CALIBRATION LAB RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
B-3	157 hours
K	53 hours
HTF	43 hours
H Building	29 hours
Direct Support	
K-Site	96 hours
B-3 Site	12 hours
	39D hours
Total Backlog	990 hours

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - N. L. SCHROEDER

SCHEDULE - THROUGH MAY 1974

SUMMARY

Experimental testing continued during this reporting period. Three Null tests and three deep space tests were successfully completed and a Near Earth test series is in progress.

DISCUSSION

OPERATIONS

Full scale testing of the complete research vehicle with shadow shields continued during this reporting period.

(Continued on Page 7)

SITE	SITE NAME	RESEARCH INSTALLATION & (TASK NO.) - PROJECT ENGINEERS
HTF	HYPERSONIC TUNNEL FACILITY	

HRE (GARRETT ENGINE) (Continued)

4-23-74 Reading 99
4-23-74 Reading 100
4-23-74 Reading 101
4-23-74 Reading 102
4-24-74 Reading 103
4-24-74 Reading 104
4-24-74 Reading 105

Reading 97 was the exhaust gas analysis run. Gas analyzer data was lost - the gas sampling probes collected large quantities of water and plugged the metering orifice to the gas analyzer.

CONTROLS

During the month of April, the final Mach 5 tests were completed. Run set up and run support were provided. Minor problems were encountered with the facility flow computer and the XDS 910 peripherals but were corrected without delaying the run schedule.

K CRYOGENIC PROPELLANT RESEARCH SITE

CRYOGENIC PROPELLANT STORAGE PROGRAM (YPR4173) — CRD - R. L. DEWITT; RSD - N. L. SCHROEDER

SCHEDULE - THROUGH MAY 1974

SUMMARY

Experimental testing continued during this reporting period. Three Null tests and three deep space tests were successfully completed and a Near Earth test series is in progress.

DISCUSSION

OPERATIONS

Full scale testing of the complete research vehicle with shadow shields continued during this reporting period.

(Continued on Page 7)

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

The Null Test under ultimate vacuum conditions was completed on April 5, 1974 with a steady state LH_2 boil off rate of 0.2358 SCFH at a cryoshroud pressure of 1.1×10^{-6} Torr. The second test of this series was accomplished by raising the shroud pressure with a helium bleed to an intermediate level of 1.0×10^{-5} Torr. A steady state boil-off rate of 0.2459 SCFH was recorded on April 8, 1974. The last Null Test point at the highest shroud pressure of 7.0×10^{-5} Torr resulted in a steady state boil-off rate of 0.3818 SCFH on April 9, 1974.

The helium bleed to the chamber and LH_2 flow to the payload simulator was stopped in preparation for the Deep Space Tests. During the warm-up of the payload simulator, the heater power supply failed. Repairs were accomplished and testing continued. The Deep Space Test at an ultimate shroud pressure of 2.1×10^{-6} Torr resulted in a steady state LH_2 boiloff of 0.344 SCFH on April 16, 1974. The intermediate pressure test was accomplished by again utilizing a helium bleed to raise shroud pressure to 1.2×10^{-5} Torr. A steady state boiloff rate of 0.494 was recorded on April 17, 1974. The final test at a higher shroud pressure of 7.6×10^{-5} Torr on April 19, 1974 resulted in a steady state LH_2 boiloff rate of 1.66 SCFH.

Several times during the test series, erratic tank pressure and boiloff rates indicated a possible leak in the measure tank vent system. A back-up burst disc was installed down stream of the existing facility relief system to verify zero leakage and a re-run of the ultimate pressure Null Test performed. Results of this test were almost identical to the previous test and it was concluded that the problem was not an internal leak which would have affected the boiloff data for several previous tests.

(Continued on Page 8)

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

A shortage in the supply of liquid hydrogen made it necessary to stop the Null and Deep Space portions of the test series and go into Near Earth Testing with a warm shroud until LH_2 was again available. During this warm-up cycle of the payload simulator, a malfunction in the heater circuit caused an over-temperature condition. This resulted in the apparent failure of an LH_2 cooling tube joint and subsequent rise in chamber pressure to the 10^{-3} Torr range. This cooling loop was isolated and chamber pressure returned to the 10^{-7} Torr range. This problem had little impact on the test program as cooling of the payload is only necessary for Null Tests and that portion of the program has been successfully completed.

A delay of about five days was experienced due to trouble shooting and repair of the shroud and payload simulator heater power supplies and circuits. This problem was finally resolved and full scale Near Earth testing resumed on April 30, 1974.

INSTRUMENTATION

Run support was provided for test series 1-4a and 1-4b. The K-Data Link continued to be unreliable in operation. After an analysis by the digital computer people responsible, it was determined that the system could not be repaired until K-Site was off-line. However, a restart capability was added to the software which has improved the operation somewhat.

An air conditioner failure for the instrument room caused some temporary instrument drift primarily in the interstitial pressure baratron and in the thermocouple reference junctions. The air conditioner was repaired and the thermocouple reference ovens were checked for drift and correction factors determined for those out of specifications.

The interstitial pressure boratron later failed when a leak developed in the payload simulator.

(Continued on Page 9)

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

CRYOGENIC PROPELLANT STORAGE PROGRAM (Continued)

CONTROLS

Run support is being provided on a continuous basis for the Null, Deep Space, and Near Earth tests. The boiloff control systems and the shroud LH_2 control systems are functioning satisfactorily. However, the shroud and payload simulator heater power supplies and associated circuits have again experienced damage due to electrical transients. The lighting protection circuitry has been removed since it is apparent that the existing configuration is not providing any protection, and only adds to the work load of trouble shooting and replacing component parts.

STANDARDS AND CALIBRATION LAB — RSD - D. H. WEIKLE

A summary of work completed this month is as follows:

Site	Time Spent on Completed Jobs
HTF	60 hours
B-2	120 hours
K	24 hours
B-3	53 hours
SPF	43 hours
F	4 hours
Rotating Transducer Project	56 hours
K-Site direct labor	20 hours
	380 man hours

SPECIAL RESEARCH PROJECT

TEN CHANNEL ROTARY PRESSURE MEASURING SYSTEM (YPY2752)

RSD - V. S. PETERSON

The Station Director has decided that the work associated with placing D-Site into standby condition cannot be further delayed. Therefore, testing at D-Site cannot be accomplished.

Problems have been encountered in replacing deflective bearings in the turbine drive and in the balancing of the test hardware. Effort to assemble the test rig on its independent mounting plate will continue on a manpower availability basis. Every effort will be made to end up with a completely assembled rig that can be run in Cleveland or at one of the active Plum Brook shop areas. Of course, any Plum Brook testing will be very minimal to verify that the test transducers are satisfactory for high rotational speeds.

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

CRYOGENIC PROPELLANT STORAGE PROGRAM — CRD - R. L. DEWITT; RSD - N. L. SCHROEDER

SCHEDULE - COMPLETE JUNE 1974

SUMMARY

Experimental testing was concluded during this reporting period. Preparations are underway to place the facility in a standby condition.

DISCUSSION

OPERATIONS

Full scale testing of the complete test vehicle with shadow shields continued into the month of May. Several re-runs of earlier Deep Space Tests were performed to verify repeatability of previous recorded data. Results were almost identical to previous tests and proved the integrity of earlier test results.

The final test of the 1-4 series was completed on May 15, 1974. Post test operations were completed on May 17, 1974 and preparations for placing the test facility in standby condition were started the week of May 20, 1974.

INSTRUMENTATION

Run support was provided for completion of test series 1-4.

The shroud ion gage system was removed for calibration.

The interstitial baratron was removed for repair.

A list of work to be accomplished before the next test series was given to the research engineer.

CONTROLS

All control systems performed satisfactorily during the final K Sites in May. All systems were left intact and in an operational status.

STANDARDS AND
CALIBRATION LAB

RSD - D. H. WEIKLE

Specific site manpower expenditure records were not kept during this reporting period. Site test runs were supported as needed. The pressure transducer inventory record brought up to date to show status of transducers returned from test sites. A suggested standby condition for the standards lab was submitted to the Instrument and Controls Branch Chief.