

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

J-5

The fluorine material compatibility facility was operated from July 1, 1961 to March 2, 1962. Since this period of time the cell has been inactive. New tests are now being discussed between Lewis and Plum Brook engineers.

"J-5", The fluorine material compatibility facility, was in operation from the beginning of the Fiscal Year until March 2, 1962. It has been inactive during the remainder of the Fiscal Year, as new test programs are prepared.

January 23, 1963

PLUM BROOK STATION STATUS REPORT (continued)

"J-5" Fluorine Hydraulics Laboratory The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with a couple of cubic feet of fluorine with pressures up to 1500 psi

STATUS: No program exists and the facility has been idle for the past year.

February 28, 1963

ROCKET SYSTEMS "J-5" Fluorine Hydraulics Laboratory The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with a couple of cubic feet of fluorine with pressures up to 1500 psi.

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March 28, 1963

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STATUS: No program exists and the facility has been idle for the past year.

SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	May 1963	<u>J-5 Fluorine Hydraulics Laboratory</u> (I. A. Johnsen)	The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with 7 cubic feet of fluorine at pressures to 400 psi.
	STATUS: Note (A) : No definite run schedule has been established at the present time.		
The cell is being reactivated for material compatibility tests using liquid oxygen with varying quantities of liquid fluorine added. The tests are to study the effects of liquid fluorine and liquid oxygen mixtures on present day liquid oxygen propellant and engine system components. The J-5 test cell has been inspected for general operating conditions and pressure checked. Minor repairs have been made. Drawings are being updated and revisions made where necessary. Liquid oxygen flow checkouts will be made during the month of June.			
June 1963			
<u>J-5 FLUORINE- HYDRAULICS LABORATORY</u> (I. A. Johnsen)			The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi.
STATUS: The schematic flow diagram of the facility has been redrawn and revisions are being made as definite research requirements are specified. Actual design and buildup of the new components in the system are in the preliminary stages. The existing system has been functionally checked and the replacement of existing instrumentation has begun. A review is in process of the former system. This will determine the best method of operation of the cell for the present test requirements.			

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		<p>J-5 <u>FLUORINE-</u> <u>HYDRAULICS</u> <u>LABORATORY</u> (I. A. Johnsen) (ORO137)</p>	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi.</p> <p><u>NOTE</u> (A) : Based on present manpower available, this project is scheduled for its first test run the week of September 2.</p> <p><u>STATUS</u>: Items completed in July were the LN2 baths for the test section and the weigh tank, parking area for the LOX and LF2 trailers, the holders for the test samples and parts for the natural gas disposal system. Completed specifications and drawings on the burnoff tower and piping were put out for bid after a safety meeting on July 24. Valving in the test section is being installed as it becomes available from the shop. Items left to be completed are mounting of the weigh tank system, installation of the gas burnoff system, and installation of a heat exchanger for gaseous O₂F₂ testing. Laboratory scale tests using very small quantities of FLOX will be run near the test cell before the completion of J-5.</p>

August 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		J-5 <u>FLUORINE- HYDRAULICS LABORATORY</u> (I. A. Johnsen) (OR0137)	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi. The facility is presently being reworked to test FLOX and gaseous O₂F₂ as well as LF₂.</p> <p><u>STATUS:</u> Lack of manpower has delayed work in the cell considerably. Some welding and other fabrication work was sent to Lewis to expedite the cell buildup. Since J-3 and J-4 test cells are now operational, welders and electricians will be diverted to J-5 cell during the early part of September to complete that aspect of the modification. Problem areas exist in scheduling the necessary instrumentation technicians and mechanics into the test cell and still keeping data producing facilities in J area running.</p> <p><u>NOTE (A) :</u> Schedule has been changed to reflect delays in the cell buildup due to interference from the operating rigs (J-1, J-3, J-4).</p>

September 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	(Continued)	<u>J-5 FLUORINE-</u> <u>HYDRAULICS</u> <u>LABORATORY</u> (I. A. Johnsen) OR0137	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi. The facility is presently being reworked to test FLOX and gaseous O_2F_2 as well as LF_2.</p> <p><u>STATUS:</u> During the month, work on mechanical and electrical items progressed sufficiently so that pre-run test cell checkouts could be started. Items completed are: test section tubing, test section bath tubing, weigh tank tubing, weigh tank bath tubing, FLOX fill system, vent and waste disposal system, control tank wiring, test closet wiring, fill system wiring, weigh tank wiring, and electrical checkout of the overall system. The burnoff stand and the installation of burners, valves, orifices and tubing for the FLOX burnoff system were completed and an observation periscope installed in the control tank. Sample tests were run on the heat exchanger with a water bath evaporating liquid nitrogen. Results verified operational capability, thus, it will be used for gaseous O_2F_2 tests. A pressure check of the general system has been performed and repairs completed. LOX checkout runs will be made following the installation of control instruments. Further research instrumentation installation is required before beginning FLOX research runs.</p>

October 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		J-5 Fluorine-Hydraulics Laboratory (cont)	<p><u>STATUS:</u> During the first part of October, all mechanical and electrical items were completed and the test cell flow system was checked out with LO₂. On October 18, 1963, twenty-five test runs were completed on five test specimens at various FLOX concentrations and pressures from 25 PSIG to 400 PSIG. A sharp-edged Rulon "A" test specimen of an orifice configuration burned out at a FLOX mixture of 57% fluorine and a pressure of 400 PSIG.</p> <p>On October 25, 1963, five new test specimens of the same materials used in the previous tests were exposed to concentrations of FLOX from 50% to 100% fluorine, and pressures from 25 PSIG to 400 PSIG. Thirty test runs were completed without reactions.</p> <p>No difficulties were encountered in disposing of the FLOX mixture. On October 18, 1963, 62 pounds of FLOX were burned off and on October 25, 382 pounds were burned off.</p> <p>Prior to the next test runs, differential pressure transducers will be inserted across each orifice test specimen to determine the point at which the material starts reacting with the FLOX.</p>

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J	<p>Novemeber 1963</p>	<p><u>J-5 FLUORINE-HYDRAULICS LABORATORY</u> OR0789 (I. A. Johnsen)</p>	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' dia. steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi. The facility is presently being re-worked to test FLOX and gaseous O₂F₂, as well as LF₂.</p> <p><u>STATUS:</u> Ninety-six test runs on three run days were accomplished during November. The runs were made at various flow rates, pressures, and FLOX concentrations. Reaction of a majority of the test specimens with FLOX was obtained. After the second run day, it was discovered that the flow system downstream of the specimens had become contaminated from the reaction of the specimens with the FLOX. It was decided to run the next series of tests without trying to remove the contaminants. At the end of the third run day, it was found that the tank and lines upstream of the specimens had also become contaminated. It was then decided to completely clean the facility tanks, lines, and valves, so the contamination would not have an influence on the results of the test program. The cleaning is expected to take one week to accomplish. Testing should resume in mid-December.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		<p>J-5 <u>FLUORINE-HYDRAULICS</u> <u>LABORATORY</u> ORO-789 (I. A. Johnsen)</p>	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi. The facility is presently being reworked to test FLOX and gaseous O_2F_2 as well as LF_2.</p> <p><u>STATUS:</u> Due to contamination buildup in the system, a complete cleaning and flushing was performed. Solvents used for this were: acetone, 30% nitric acid, deionized water, and acetone respectively. Following the cleaning, 79 runs were performed on December 10, 1963. New, high flow velocity tubular test pieces were used.</p> <p>During this set of tests, KEL-F 82 reacted at 60%, 400 PSIG, and 5#/sec. flow; Teflon FEP reacted at 70%, 400 PSIG, and 5#/sec. flow; and Rulon A reacted at 100%, 300 PSIG at 4#/sec. Teflon TFE and KEL-F 81-3 did not react.</p> <p>The system was refitted with new vent valves in the test closet and readied for the next set of tests. On December 18, 1963, 27 runs were performed. The tubular test specimens were again used.</p> <p>During this set of tests, KEL-F 82 reacted at 75%, 200 PSIG, at 3#/sec. flow; Teflon FEP reacted at 85%, 400 PSIG and 5#/sec. flow; Halon reacted under static conditions following run at 85%, 400 PSIG, at 5#/sec. flow; and nickel-filled Teflon reacted at 100%, 300 PSIG at 4#/sec. flow.</p> <p>Because of contamination from burnouts, the system is again undergoing a cleaning and flushing procedure. Also, due to faulty operation, all Hannifin Solenoids mounted in the test closet were replaced by Skinners for more positive actuation. The next anticipated run date will be in early January 1964.</p>

January 1964

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		J-5 HYDRAULICS LABORATORY OR0789 (D.S.Gabriel)	<p>The facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine, oxygen or mixtures of fluorine and oxygen are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>STATUS: From January 1, to January 16, the cell was readied for a run following a general flushing and cleaning of flow tanks. As a precaution to prevent valve hang-up, the Han-nifin solenoids were replaced with Skinners. The Skinners provide more positive action in the cold environment.</p> <p>On January 16, twenty-six runs were made during which Kynar, Kel-F 81A and Rulon A were burned out. On the 26th run, Rulon A burned out with additional reactions, causing extensive damage to the test cell. A complete survey revealed that it would take four to six weeks' work to rebuild the cell in a manner minimizing further delays from damage or contamination.</p> <p>Modifications and repairs include:</p> <ol style="list-style-type: none">1. Flanging of flow tanks and system valves for ease of removal and cleaning.2. Construction of a new test section bath.3. Replace the test closet with a containment system utilizing a jet engine transport pod.4. Replace, replumb and rewire all damaged equipment. <p>As of January 31, the following has been accomplished:</p> <ol style="list-style-type: none">1. One tank has been modified.2. Liquid nitrogen tank bath has been repaired.3. Test section bath has been constructed.4. Engine pod is ready for installation. <p>Testing is expected to resume in early March.</p> <p>NOTE (A): Test program has been delayed six weeks due to damages sustained in test cell explosion.</p> <p>continued on page 20</p>

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		<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OR0789 (D.S.Gabriel)</p>	<p>The facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>This report period has been spent rebuilding the test cell due to damage sustained in the run of January 16, 1964. As of February 29, the following repair and re-work has been accomplished:</p> <ol style="list-style-type: none"> (1) The second flow tank was flanged and valves rebuilt. Both tanks have been reinstalled. (2) The jet engine shipping container has been modified and installed. (3) The test section bath has been installed. (4) The test section and nineteen vent valves have been rebuilt. (5) All flow lines and operators on the flow tanks have been rebuilt. (6) Test section valves and operators have been installed. (7) A new burnoff system with surge tank was designed and installed. <p>Work to be accomplished before testing can proceed:</p> <ol style="list-style-type: none"> (1) Installation of LN₂ level switches. (2) Wiring valves and spark plugs for burnoff. (3) Installation and checkout of automatic flow controller. (4) Pressure check system to assure its pressure-tight capabilities. Stop all leaks. (5) Pickle the system with fluorine gas. (6) Perform the complete pre-run setup and checkout. <p>A test operation is tentatively scheduled for March 10 and 11.</p>

NOTE (A): The test date has been re-scheduled from March 1 to March 10. The site rebuilding will take longer than originally planned because some of the personnel that were scheduled to work at the site had to be reassigned to other test facilities.

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS LABORATORY</u> OV0789(D.S.Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>The rebuilding of the test cell continued during the first half of this report period. Between March 1 and March 12, the liquid nitrogen bath level switches were installed, burnoff tower wiring (valve spark plugs, and instruments) was completed, the system was pressure-checked, evacuated, and pickled with fluorine gas.</p> <p>On March 13, eight runs were made after complete pre-run setup and checkout was performed. Materials tested were Halon, Teflon FEP, KEL-F Amorphous, Kynar and Lucite. The Lucite reacted at 300 psi and 4 pound per second flow at 50% concentration. Additional reactions downstream blew out a section of 3/4" flow line, a 3/4" Annin 1600 series valve, and stressed a 3/4" Annin 3400 series flow control valve. Shrapnel did extensive damage to tubing, piping and electrical wiring near Tank #2. Repairs were begun immediately which included the following:</p> <ol style="list-style-type: none"> (1) Rebuilding fill valve, crossover valve, and damaged piping. (2) Building up a new flow control valve which had the flange blown off and a possible stressed body. (3) Installed a new bellows and spool piece on flow tank bath leading to Tank #2, and replaced the former 1/4" vent line with a 3/4" vent. (4) Tubed in new operator lines and 3/4" vent. (5) Rebuilt flow tank liquid nitrogen bath. (6) Removed, cleaned, and reinstalled Flow Tank #2. (7) Rewired all valves located near Tank #2.

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J	ROCKET SYSTEMS	<p>(8) Modified burner heads on tower.</p> <p>(9) Removed, cleaned, and reinstalled five downstream section valves.</p> <p>(10) Evacuated system after pressure check.</p> <p>(11) Pickled system and performed completed pre-run operation.</p>	<p>On March 30 and 31, forty-six runs were made with the following materials: Halon, Teflon, FEP, Kynar, Rulon and Viton A. Due to reactivity of Viton-A, the concentrations were begun at 50%. Burnouts occurred on all five specimens. System damage was slight, consisting of contaminated flow valves, flow lines and burned out burnoff heads.</p> <p>Burnoff improvements will be made before the next run scheduled on April 9 and 10. Equipment for gaseous FLOX runs will be installed and checked out by mid-April.</p>

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u></p> <p>OV0789(D.S.Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>On April 9 and 21, runs were made with liquid FLOX. All test specimens were burned out while making 24 runs on April 9, and 22 runs on April 21. In each instance, system damage incurred was minimal. On April 9, two burners were damaged during burnoff operations, and on April 21, one IRC was burned out on test section No. 5.</p> <p>On April 29, gaseous checkout runs were made to determine functional operation and control of the gaseous FLOX system using liquid oxygen. The results of the checkout test indicated further modifications were needed. Control valve relocation, the installation of a flow surge dampener, and a new operating procedure have been instituted and will be checked out with liquid oxygen on May 1. The first FLOX run is scheduled for May 5, using 1/4" tubular test pieces similar to those run in liquid FLOX.</p>

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789(D.S.Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>On May 1, a checkout of the system was made, using a new flow controller. After several check runs to set gains, successful automatic system control was achieved. Necessary system modifications included: Switching from downstream to upstream control, reduced Cv in the control valves, manual pressure control with the downstream valve, a surge chamber to damp out pulsations.</p> <p>On May 5, a series of 32 runs resulted in routine burnout of all five specimens in various concentrations of 300 psi gaseous FLOX at 70° F. Flow velocities ranged from 50#/sec. to choked flow through the 1/4" diameter specimen orifice.</p> <p>Installation of a larger surge chamber and line vent upstream of the condenser were indicated by run results; these were both installed for the May 19 run.</p> <p>On May 14, checkout runs were made to see if a pressure feedback controller could be used in the system. After repeated unsuccessful attempts, it was decided to use manual control as long as it was satisfactory and practical.</p> <p>On May 19, 15 runs similar to the May 5 runs were made, but in this case, three of the materials did not burn out. Minor system damage was done when line five, containing Viton A, reacted. Damage was limited to the burning of an Annin valve and several tubing lengths. Investigation of the system after clean-up revealed contamination in several lines and the dip tube on the receiver tank. These test run components will be disassembled and cleaned prior to the first of June tests.</p> <p>Gaseous FLOX runs will be made for approximately three months. After this, a high pressure (1500 PSIG) system will be installed so that both high pressure liquid and gas can be run. The high pressure flow tank has been delivered and it will be installed as soon as the low pressure runs are completed.</p>

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789(D.S.Gabricl)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>The June runs were a continuation of the series started in May. Gaseous FLOX at 70° F and 300 psi pressure was run through five 1/4" diameter tubular specimens each run day.</p> <p>On June 5, a series of eighteen runs resulted in the burnout of two specimens. Concentrations of 50 to 100% were run at flow velocities of 50 to 500 fps.</p> <p>On June 16, ten runs resulted in burnout of only one specimen. Concentrations were 80 and 100%, and flow velocities again ranged from 50 to 500 fps.</p> <p>On June 23, a decision was made to delay the planned high pressure tests in favor of spill tests. The spill tests will involve dumping approximately 15 pounds of FLOX on various test media. Reactivity and type of reaction are to be photographed. Necessary modifications to the test cell should be completed by the end of July. During build-up of the spill stand, gaseous runs will be continued.</p> <p>On June 30, eight runs resulted in burnout of two specimen. Concentrations of 80 and 100% were run at flow velocities of 50 to 500 fps.</p> <p>NOTE (A): The spill tests are tentatively scheduled for the last week in July, and one more gaseous FLOX run will be made prior to the spill tests.</p>

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789 (D.S.Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 PSI.</p> <p>On July 14, a series of ten runs resulted in burnout of four out of five test specimens. Gaseous flox at 70° F. and 300 PSI was run at flow velocities of from 50 to 500 FPS. The specimens were either 1/8" diameter X 1" tubular configurations or 0.2" diameter X 1/2" tubular configurations. Duration (30 minute) runs were made on the 1/8" specimens and normal 30 second runs were made on the other test pieces.</p> <p>Burnout of Leg 5, Viton A, caused sufficient damage to the test facility to make extensive rebuilding necessary in order to perform further flow tests. A decision was made to delay system repairs in order to make flox spill tests as soon as possible. The first spill test is scheduled for August 3. System repair will continue whenever possible while the spill tests are being conducted.</p>

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789 (D.S. Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 PSI.</p> <p>On August 3, 10, 17 and 25, spill tests were made with FLOX. These tests involved spilling from five to ten pounds of several liquid oxygen-fluorine mixtures onto various test media. The purpose of these tests was to determine the hypergolic reactivity of FLOX and to see how this reactivity affected dispersion of the toxic products. A total of 24 spills were made into the following media: Water, JP-4, sand, charcoal, limestone, asphalt, dirt, water-soaked sand, JP-4 soaked sand, coke, oil-soaked sand and concrete. Data was in the form of photographic and meteorological information. Several severe reactions caused minor equipment damage, but this did not interfere with normal run scheduling.</p> <p>Some progress was made in building up the high pressure flow system. The completion date for this rework has been rescheduled from September to October.</p>

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J	ROCKET SYS	J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789 (D.S.Gabriel)	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressures from 0-1500 PSIG, in both liquid and gaseous state. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>On September 1, 1964, two LOX spill tests were completed. The purpose of the tests was to determine the relative times between LOX and FLOX when spilled in JP-4 to simulate a launch pad accident. On the second test, a detonation on the spill pad occurred. The spill test equipment was damaged to some extent. Since the spill test data was complete, the damaged equipment was not rebuilt.</p> <p>Work began immediately on rebuilding the FLOX compatibility rig to resume liquid flow testing of non-metallic specimens at 1500 PSIG. Twenty-eight valves, two spool pieces, several special fittings, and all test section fittings and holders were hydrostatically tested to 2250 PSIG. The high pressure tank was installed and the valves mounted in place. A complete rewiring and retubing was done to accommodate the new system and repair usable parts of the original low pressure system.</p> <p>A LOX checkout run was made on September 28 to verify operation of the automatic controller on the liquid system and check all system functions. Minor repairs were made and following a complete system retorque, runs will begin in early October.</p>

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J	ROCKET SYSTEMS	J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789 (D.S. Gabriel)	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressures from 0-1500 psig, in both liquid and gaseous state. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>Following the October 30 run, contaminated portions of the system were cleaned and rebuilt. In the interest of safety, all high-pressure valves were removed, checked, rebuilt, and reinstalled. The bellows seal helium supply system was also rebuilt. Preparations were made for the next run and test specimens installed.</p> <p>On November 20, fourteen runs with fluorine and FLOX (80% fluorine) were made. All test sections burned out at flow rates to 2.1#/sec. and pressures to 1100 psi. Little system damage occurred but the flow lines were contaminated. The contaminated lines are being cleaned and similar high-pressure liquid tests are scheduled for December 10.</p> <p>The high-pressure liquid testing is scheduled to be completed by early January. The cell will then be converted for high-pressure gaseous FLOX testing.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	J-5 <u>HYDRAULICS LABORATORY</u>	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressures from 0-1500 PSIG, in both liquid and gaseous state. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>During the first two weeks of December the following measures were taken to prevent premature test specimen burnouts:</p> <ol style="list-style-type: none"> (1) The 'J' Site Helium manifold was cycle flushed with tri-chloroethane through a five micron filter. (2) All the fluorine and helium equipment including the tanks, tubing, fittings, and valves were disassembled, cleaned and reinstalled using fluorine clean procedures. <p>On December 15, seven runs were made. Three test specimens experienced premature burnouts, one showed surface reaction from a previous run, one specimen cracked due to shock and could not be tested. Investigation showed particles in the helium system so the following steps were taken:</p> <ol style="list-style-type: none"> (1) A five micron filter and a cold trap were installed in the test section helium purge line. (2) The test specimens were cleaned, examined with a magnifying glass and the cleaning solvent evacuated from the pores of the specimens. (3) Specimen holders were cleaned and examined during specimen installation. (4) To check pickling effects, two of the specimens were not pickled. <p>On December 23, six tests were made on four specimens. All specimens burned out prematurely. A fifth specimen which was not tested was examined and found to have metallic particles on its surface.</p> <p>NOTE: Further helium purge system modifications and procedural changes will be made before the next checkout run which is scheduled for January 6.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> (OV0789) (D.S.Gabriel)</p>	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressure from 0-1500 psig, in both liquid and gaseous state. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>A run was made on December 23, to see if the premature burnouts experienced in November had been eliminated by system modification. Premature burnouts were still experienced and the following additional modifications were made:</p> <ol style="list-style-type: none"> (1) A separate high pressure helium source was installed. (2) A new dryer was added to the system. (3) A sintered bronze filter was added. (4) A filter was added to the test specimen purge line. (5) All upstream bellows were flushed with filtered solvent. (6) The cold trap was removed from the helium purge line. (7) The specimens were cleaned and surfaces evacuated to 30 microns. (8) The purge system and check valves were cleaned and inspected at the test site. (9) The entire flow system and high pressure helium system was dismantled and cleaned. (10) The system was pickled for fourteen hours and the specimens for thirty minutes. <p>The January 12 run had to be canceled when three test specimens cracked while being immersed in LN₂. The January 14 run was canceled because there was an indication that the F₂ tank had developed a high pressure leak. On January 19, 14 runs were made on Teflon specimens. One specimen ran to its expected burnout point while the other three burned out prematurely. The last specimen was inspected and metallic particles were found on its surface.</p>

Using laboratory filter equipment, extensive samples were again taken from every conceivable point in the helium and F₂ flow system. All helium components were disassembled and inspected. The worst item appeared to be the brass particles from a Grove regulator in the helium purge system.

The system will be reassembled using ultra clean methods and the Grove regulator will be replaced by an all aluminum

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> (OV0789) (D.S. Gabriel)</p>	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressure from 0-1500 psig, in both liquid and gaseous states. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>On February 2, 5, 12, and 19, FLOX research runs were successfully conducted. Premature burnouts were eliminated and all run days produced usable data.</p> <p>On February 2, six runs were accomplished and one high-flow burnout recorded before the facility was shut down due to inoperative valves.</p> <p>The specimens were replaced and heater wire was installed on the valve heads. The run was completed on February 5. Twenty-one runs, using various concentrations of FLOX, were made on February 5 and five specimen burnouts were recorded.</p> <p>On February 12, twenty runs were accomplished and five burnouts were recorded. 100% liquid fluorine and 70% FLOX were used during this run.</p> <p>On February 19, seventeen runs and five burnouts were recorded. 100% liquid fluorine, 70% FLOX and 60% FLOX were used during this run.</p> <p>The February 26 test run was cancelled due to adverse weather conditions causing electrical power failures. This run is rescheduled for the week of March 1, and will complete the current FLOX program.</p> <p>A short test program has been scheduled for the month of April to determine the cause of premature burnouts which occurred during the months of November and December 1964.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOF)	DESCRIPTION
J	ROCKET SYSTEMS	<p data-bbox="398 553 555 584">March 1965</p> <hr/> <p data-bbox="541 670 761 731">J-5 <u>HYDRUALICS</u> <u>LABORATORY</u></p> <p data-bbox="541 768 761 829">OV0789 (D.S. Gabriel)</p>	<p data-bbox="822 670 1488 962">This facility handles up to 175 pounds of FLOX in various concentrations at pressure from 0 - 1500 psig, in both liquid and gaseous states. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p data-bbox="541 993 1488 1116">On March 1, thirteen research runs were made on five test specimens. Although flow rates of 4 lb/sec and pressures of 1000 psi were reached, three of the burnouts were classed as premature, based on previous data.</p> <p data-bbox="541 1156 1488 1535">On March 19, a run was made to determine if metal particle contamination was the cause of premature burnouts. Five teflon test samples were prepared. Two were left uncontaminated. The other three samples were deliberately contaminated with brass filings, stainless steel filings, and a combination of brass and stainless steel, respectively. Only one premature burnout was encountered. The other burnouts occurred far beyond previous data in flow rate and concentration. It appears that metal particles have not been the cause of the consistent failures experienced during December 1964 and January 1965. Further metal contamination tests have been suspended.</p> <p data-bbox="541 1545 1488 1708">On March 30, the final research run was made, completing the Lewis Research Center program. In this test, the five specimens were burned out during 33 runs, with 70%, 75%, and 85% FLOX concentrations and 100% LF₂. The test cell will be deactivated and maintained on a standby basis.</p>

8-65

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
J	J-5 HYDRAULICS LAB	<u>HADLEY VALVE TESTS</u>		Valve tests with liquid fluorine. The Hadley valve assembly was tested to a limited extent this month. On August 11, the valve was cycled fifty-one times in liquid fluorine at 20 psi. In spite of the fact that considerable seal leakage was encountered, after testing no visible damage was evident. A decision to continue testing was agreed upon in spite of leakage in both the shaft seal and valve seal. Subsequent attempts to fluorine cycle the valve were unsuccessful. On August 19, termination of testing was necessitated when an IRC burst and burned following pressurization of the liquid fluorine in the valve assembly. On August 26, the test was terminated when Valve 199 on the fluorine trailer could not be opened because the stem had stripped from the valve yoke.

September 1965

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
J	J-5 HYDRAULICS LAB			<p data-bbox="427 322 1279 355"><u>HADLEY VALVE TESTS</u> Valve tests with liquid fluorine.</p> <p data-bbox="427 392 1330 553">On September 13, testing of the modified Hadley valve was completed. The valve was cycled 2400 times in liquid fluorine at pressures between 20 to 100 psi. The tests were terminated when the valve operator upper bearing seized.</p> <p data-bbox="427 590 1284 752">Several other deficiencies were encountered. Leakage on both the shaft and flow seals was excessive. The valve could not be opened if chilled down while closed or if a greater than 20 psid existed on the seal. It was also found that the seal had a slight score mark.</p>

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

J-5

The fluorine material compatibility facility was operated from July 1, 1961 to March 2, 1962. Since this period of time the cell has been inactive. New tests are now being discussed between Lewis and Plum Brook engineers.

"J-5", The fluorine material compatibility facility, was in operation from the beginning of the Fiscal Year until March 2, 1962. It has been inactive during the remainder of the Fiscal Year, as new test programs are prepared.

January 23, 1963

PLUM BROOK STATION STATUS REPORT (continued)

"J-5" Fluorine Hydraulics Laboratory The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with a couple of cubic feet of fluorine with pressures up to 1500 psi

STATUS: No program exists and the facility has been idle for the past year.

February 28, 1963

ROCKET SYSTEMS "J-5" Fluorine Hydraulics Laboratory The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with a couple of cubic feet of fluorine with pressures up to 1500 psi.

STATUS: No program exists and the facility has been idle for the past year.

March 28, 1963

J-5 Fluorine Hydraulics Laboratory The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with a couple of cubic feet of fluorine with pressures up to 1500 psi.

STATUS: No program exists and the facility has been idle for the past year.

SITE	LABORATORY	RESEARCH INSTALLATION (FOR)	DESCRIPTION
J	May 1963	<u>J-5 Fluorine Hydraulics Laboratory</u> (I. A. Johnsen)	The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with 7 cubic feet of fluorine at pressures to 400 psi.
	STATUS:	Note (A) : No definite run schedule has been established at the present time. The cell is being reactivated for material compatibility tests using liquid oxygen with varying quantities of liquid fluorine added. The tests are to study the effects of liquid fluorine and liquid oxygen mixtures on present day liquid oxygen propellant and engine system components. The J-5 test cell has been inspected for general operating conditions and pressure checked. Minor repairs have been made. Drawings are being updated and revisions made where necessary. Liquid oxygen flow checkouts will be made during the month of June.	
	June 1963	<u>J-5 FLUORINE- HYDRAULICS LABORATORY</u> (I. A. Johnsen)	The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi.
			STATUS: The schematic flow diagram of the facility has been redrawn and revisions are being made as definite research requirements are specified. Actual design and buildup of the new components in the system are in the preliminary stages. The existing system has been functionally checked and the replacement of existing instrumentation has begun. A review is in process of the former system. This will determine the best method of operation of the cell for the present test requirements.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		<p>J-5 <u>FLUORINE-</u> <u>HYDRAULICS</u> <u>LABORATORY</u> (I. A. Johnsen) (ORO137)</p>	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi.</p> <p><u>NOTE</u> (A) : Based on present manpower available, this project is scheduled for its first test run the week of September 2.</p> <p><u>STATUS</u>: Items completed in July were the LN2 baths for the test section and the weigh tank, parking area for the LOX and LF2 trailers, the holders for the test samples and parts for the natural gas disposal system. Completed specifications and drawings on the burnoff tower and piping were put out for bid after a safety meeting on July 24. Valving in the test section is being installed as it becomes available from the shop. Items left to be completed are mounting of the weigh tank system, installation of the gas burnoff system, and installation of a heat exchanger for gaseous O₂F₂ testing. Laboratory scale tests using very small quantities of FLOX will be run near the test cell before the completion of J-5.</p>

August 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		J-5 <u>FLUORINE- HYDRAULICS LABORATORY</u> (I. A. Johnsen) (OR0137)	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi. The facility is presently being reworked to test FLOX and gaseous O₂F₂ as well as LF₂.</p> <p><u>STATUS:</u> Lack of manpower has delayed work in the cell considerably. Some welding and other fabrication work was sent to Lewis to expedite the cell buildup. Since J-3 and J-4 test cells are now operational, welders and electricians will be diverted to J-5 cell during the early part of September to complete that aspect of the modification. Problem areas exist in scheduling the necessary instrumentation technicians and mechanics into the test cell and still keeping data producing facilities in J area running.</p> <p><u>NOTE (A) :</u> Schedule has been changed to reflect delays in the cell buildup due to interference from the operating rigs (J-1, J-3, J-4).</p>

September 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	(Continued)	<u>J-5 FLUORINE-</u> <u>HYDRAULICS</u> <u>LABORATORY</u> (I. A. Johnsen) OR0137	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi. The facility is presently being reworked to test FLOX and gaseous O_2F_2 as well as LF_2.</p> <p><u>STATUS:</u> During the month, work on mechanical and electrical items progressed sufficiently so that pre-run test cell checkouts could be started. Items completed are: test section tubing, test section bath tubing, weigh tank tubing, weigh tank bath tubing, FLOX fill system, vent and waste disposal system, control tank wiring, test closet wiring, fill system wiring, weigh tank wiring, and electrical checkout of the overall system. The burnoff stand and the installation of burners, valves, orifices and tubing for the FLOX burnoff system were completed and an observation periscope installed in the control tank. Sample tests were run on the heat exchanger with a water bath evaporating liquid nitrogen. Results verified operational capability, thus, it will be used for gaseous O_2F_2 tests. A pressure check of the general system has been performed and repairs completed. LOX checkout runs will be made following the installation of control instruments. Further research instrumentation installation is required before beginning FLOX research runs.</p>

October 1963

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		J-5 Fluorine-Hydraulics Laboratory (cont)	<p><u>STATUS:</u> During the first part of October, all mechanical and electrical items were completed and the test cell flow system was checked out with LO₂. On October 18, 1963, twenty-five test runs were completed on five test specimens at various FLOX concentrations and pressures from 25 PSIG to 400 PSIG. A sharp-edged Rulon "A" test specimen of an orifice configuration burned out at a FLOX mixture of 57% fluorine and a pressure of 400 PSIG.</p> <p>On October 25, 1963, five new test specimens of the same materials used in the previous tests were exposed to concentrations of FLOX from 50% to 100% fluorine, and pressures from 25 PSIG to 400 PSIG. Thirty test runs were completed without reactions.</p> <p>No difficulties were encountered in disposing of the FLOX mixture. On October 18, 1963, 62 pounds of FLOX were burned off and on October 25, 382 pounds were burned off.</p> <p>Prior to the next test runs, differential pressure transducers will be inserted across each orifice test specimen to determine the point at which the material starts reacting with the FLOX.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	<p>Novemeber 1963</p>	<p><u>J-5 FLUORINE-HYDRAULICS LABORATORY</u> OR0789 (I. A. Johnsen)</p>	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' dia. steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi. The facility is presently being re-worked to test FLOX and gaseous O₂F₂, as well as LF₂.</p> <p><u>STATUS:</u> Ninety-six test runs on three run days were accomplished during November. The runs were made at various flow rates, pressures, and FLOX concentrations. Reaction of a majority of the test specimens with FLOX was obtained. After the second run day, it was discovered that the flow system downstream of the specimens had become contaminated from the reaction of the specimens with the FLOX. It was decided to run the next series of tests without trying to remove the contaminants. At the end of the third run day, it was found that the tank and lines upstream of the specimens had also become contaminated. It was then decided to completely clean the facility tanks, lines, and valves, so the contamination would not have an influence on the results of the test program. The cleaning is expected to take one week to accomplish. Testing should resume in mid-December.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		<p>J-5 <u>FLUORINE-HYDRAULICS</u> <u>LABORATORY</u> ORO-789 (I. A. Johnsen)</p>	<p>The facility consists of a high pressure liquid fluorine system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine is passed through it. The system is capable of working with seven cubic feet of fluorine at pressures to 400 psi. The facility is presently being reworked to test FLOX and gaseous O_2F_2 as well as LF_2.</p> <p><u>STATUS:</u> Due to contamination buildup in the system, a complete cleaning and flushing was performed. Solvents used for this were: acetone, 30% nitric acid, deionized water, and acetone respectively. Following the cleaning, 79 runs were performed on December 10, 1963. New, high flow velocity tubular test pieces were used.</p> <p>During this set of tests, KEL-F 82 reacted at 60%, 400 PSIG, and 5#/sec. flow; Teflon FEP reacted at 70%, 400 PSIG, and 5#/sec. flow; and Rulon A reacted at 100%, 300 PSIG at 4#/sec. Teflon TFE and KEL-F 81-3 did not react.</p> <p>The system was refitted with new vent valves in the test closet and readied for the next set of tests. On December 18, 1963, 27 runs were performed. The tubular test specimens were again used.</p> <p>During this set of tests, KEL-F 82 reacted at 75%, 200 PSIG, at 3#/sec. flow; Teflon FEP reacted at 85%, 400 PSIG and 5#/sec. flow; Halon reacted under static conditions following run at 85%, 400 PSIG, at 5#/sec. flow; and nickel-filled Teflon reacted at 100%, 300 PSIG at 4#/sec. flow.</p> <p>Because of contamination from burnouts, the system is again undergoing a cleaning and flushing procedure. Also, due to faulty operation, all Hannifin Solenoids mounted in the test closet were replaced by Skinners for more positive actuation. The next anticipated run date will be in early January 1964.</p>

January 1964

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J		J-5 HYDRAULICS LABORATORY OR0789 (D.S.Gabriel)	<p>The facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine, oxygen or mixtures of fluorine and oxygen are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>STATUS: From January 1, to January 16, the cell was readied for a run following a general flushing and cleaning of flow tanks. As a precaution to prevent valve hang-up, the Han-nifin solenoids were replaced with Skinners. The Skinners provide more positive action in the cold environment.</p> <p>On January 16, twenty-six runs were made during which Kynar, Kel-F 81A and Rulon A were burned out. On the 26th run, Rulon A burned out with additional reactions, causing extensive damage to the test cell. A complete survey revealed that it would take four to six weeks' work to rebuild the cell in a manner minimizing further delays from damage or contamination.</p> <p>Modifications and repairs include:</p> <ol style="list-style-type: none">1. Flanging of flow tanks and system valves for ease of removal and cleaning.2. Construction of a new test section bath.3. Replace the test closet with a containment system utilizing a jet engine transport pod.4. Replace, replumb and rewire all damaged equipment. <p>As of January 31, the following has been accomplished:</p> <ol style="list-style-type: none">1. One tank has been modified.2. Liquid nitrogen tank bath has been repaired.3. Test section bath has been constructed.4. Engine pod is ready for installation. <p>Testing is expected to resume in early March.</p> <p>NOTE (A): Test program has been delayed six weeks due to damages sustained in test cell explosion.</p> <p>continued on page 20</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
		<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OR0789 (D.S.Gabriel)</p>	<p>The facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>This report period has been spent rebuilding the test cell due to damage sustained in the run of January 16, 1964. As of February 29, the following repair and re-work has been accomplished:</p> <ol style="list-style-type: none"> (1) The second flow tank was flanged and valves rebuilt. Both tanks have been reinstalled. (2) The jet engine shipping container has been modified and installed. (3) The test section bath has been installed. (4) The test section and nineteen vent valves have been rebuilt. (5) All flow lines and operators on the flow tanks have been rebuilt. (6) Test section valves and operators have been installed. (7) A new burnoff system with surge tank was designed and installed. <p>Work to be accomplished before testing can proceed:</p> <ol style="list-style-type: none"> (1) Installation of LN₂ level switches. (2) Wiring valves and spark plugs for burnoff. (3) Installation and checkout of automatic flow controller. (4) Pressure check system to assure its pressure-tight capabilities. Stop all leaks. (5) Pickle the system with fluorine gas. (6) Perform the complete pre-run setup and checkout. <p>A test operation is tentatively scheduled for March 10 and 11.</p>

NOTE (A): The test date has been re-scheduled from March 1 to March 10. The site rebuilding will take longer than originally planned because some of the personnel that were scheduled to work at the site had to be reassigned to other test facilities.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS LABORATORY</u> OV0789(D.S.Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>The rebuilding of the test cell continued during the first half of this report period. Between March 1 and March 12, the liquid nitrogen bath level switches were installed, burnoff tower wiring (valve spark plugs, and instruments) was completed, the system was pressure-checked, evacuated, and pickled with fluorine gas.</p> <p>On March 13, eight runs were made after complete pre-run setup and checkout was performed. Materials tested were Halon, Teflon FEP, KEL-F Amorphous, Kynar and Lucite. The Lucite reacted at 300 psi and 4 pound per second flow at 50% concentration. Additional reactions downstream blew out a section of 3/4" flow line, a 3/4" Annin 1600 series valve, and stressed a 3/4" Annin 3400 series flow control valve. Shrapnel did extensive damage to tubing, piping and electrical wiring near Tank #2. Repairs were begun immediately which included the following:</p> <ol style="list-style-type: none"> (1) Rebuilding fill valve, crossover valve, and damaged piping. (2) Building up a new flow control valve which had the flange blown off and a possible stressed body. (3) Installed a new bellows and spool piece on flow tank bath leading to Tank #2, and replaced the former 1/4" vent line with a 3/4" vent. (4) Tubed in new operator lines and 3/4" vent. (5) Rebuilt flow tank liquid nitrogen bath. (6) Removed, cleaned, and reinstalled Flow Tank #2. (7) Rewired all valves located near Tank #2.

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	<p>(8) Modified burner heads on tower.</p> <p>(9) Removed, cleaned, and reinstalled five downstream section valves.</p> <p>(10) Evacuated system after pressure check.</p> <p>(11) Pickled system and performed completed pre-run operation.</p>	<p>On March 30 and 31, forty-six runs were made with the following materials: Halon, Teflon, FEP, Kynar, Rulon and Viton A. Due to reactivity of Viton-A, the concentrations were begun at 50%. Burnouts occurred on all five specimens. System damage was slight, consisting of contaminated flow valves, flow lines and burned out burnoff heads.</p> <p>Burnoff improvements will be made before the next run scheduled on April 9 and 10. Equipment for gaseous FLOX runs will be installed and checked out by mid-April.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u></p> <p>OV0789(D.S.Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>On April 9 and 21, runs were made with liquid FLOX. All test specimens were burned out while making 24 runs on April 9, and 22 runs on April 21. In each instance, system damage incurred was minimal. On April 9, two burners were damaged during burnoff operations, and on April 21, one IRC was burned out on test section No. 5.</p> <p>On April 29, gaseous checkout runs were made to determine functional operation and control of the gaseous FLOX system using liquid oxygen. The results of the checkout test indicated further modifications were needed. Control valve relocation, the installation of a flow surge dampener, and a new operating procedure have been instituted and will be checked out with liquid oxygen on May 1. The first FLOX run is scheduled for May 5, using 1/4" tubular test pieces similar to those run in liquid FLOX.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789(D.S.Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>On May 1, a checkout of the system was made, using a new flow controller. After several check runs to set gains, successful automatic system control was achieved. Necessary system modifications included: Switching from downstream to upstream control, reduced Cv in the control valves, manual pressure control with the downstream valve, a surge chamber to damp out pulsations.</p> <p>On May 5, a series of 32 runs resulted in routine burnout of all five specimens in various concentrations of 300 psi gaseous FLOX at 70° F. Flow velocities ranged from 50#/sec. to choked flow through the 1/4" diameter specimen orifice.</p> <p>Installation of a larger surge chamber and line vent upstream of the condenser were indicated by run results; these were both installed for the May 19 run.</p> <p>On May 14, checkout runs were made to see if a pressure feedback controller could be used in the system. After repeated unsuccessful attempts, it was decided to use manual control as long as it was satisfactory and practical.</p> <p>On May 19, 15 runs similar to the May 5 runs were made, but in this case, three of the materials did not burn out. Minor system damage was done when line five, containing Viton A, reacted. Damage was limited to the burning of an Annin valve and several tubing lengths. Investigation of the system after clean-up revealed contamination in several lines and the dip tube on the receiver tank. These test run components will be disassembled and cleaned prior to the first of June tests.</p> <p>Gaseous FLOX runs will be made for approximately three months. After this, a high pressure (1500 PSIG) system will be installed so that both high pressure liquid and gas can be run. The high pressure flow tank has been delivered and it will be installed as soon as the low pressure runs are completed.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOR)	DESCRIPTION
J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789(D.S.Gabricl)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 psi.</p> <p>The June runs were a continuation of the series started in May. Gaseous FLOX at 70° F and 300 psi pressure was run through five 1/4" diameter tubular specimens each run day.</p> <p>On June 5, a series of eighteen runs resulted in the burnout of two specimens. Concentrations of 50 to 100% were run at flow velocities of 50 to 500 fps.</p> <p>On June 16, ten runs resulted in burnout of only one specimen. Concentrations were 80 and 100%, and flow velocities again ranged from 50 to 500 fps.</p> <p>On June 23, a decision was made to delay the planned high pressure tests in favor of spill tests. The spill tests will involve dumping approximately 15 pounds of FLOX on various test media. Reactivity and type of reaction are to be photographed. Necessary modifications to the test cell should be completed by the end of July. During build-up of the spill stand, gaseous runs will be continued.</p> <p>On June 30, eight runs resulted in burnout of two specimen. Concentrations of 80 and 100% were run at flow velocities of 50 to 500 fps.</p> <p>NOTE (A): The spill tests are tentatively scheduled for the last week in July, and one more gaseous FLOX run will be made prior to the spill tests.</p>

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789 (D.S.Gabriel)</p>	<p>This facility consists of a high pressure fluorine-oxygen system installed in a 38' diameter steel containment vessel. A test section is installed between a supply and receiver tank, and fluorine, oxygen, or mixtures of fluorine and oxygen, are passed through it. The system is capable of working with seven cubic feet of liquid at pressures to 400 PSI.</p> <p>On July 14, a series of ten runs resulted in burnout of four out of five test specimens. Gaseous flox at 70° F. and 300 PSI was run at flow velocities of from 50 to 500 FPS. The specimens were either 1/8" diameter X 1" tubular configurations or 0.2" diameter X 1/2" tubular configurations. Duration (30 minute) runs were made on the 1/8" specimens and normal 30 second runs were made on the other test pieces.</p> <p>Burnout of Leg 5, Viton A, caused sufficient damage to the test facility to make extensive rebuilding necessary in order to perform further flow tests. A decision was made to delay system repairs in order to make flox spill tests as soon as possible. The first spill test is scheduled for August 3. System repair will continue whenever possible while the spill tests are being conducted.</p>

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J	ROCKET SYS	J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789 (D.S.Gabriel)	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressures from 0-1500 PSIG, in both liquid and gaseous state. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>On September 1, 1964, two LOX spill tests were completed. The purpose of the tests was to determine the relative times between LOX and FLOX when spilled in JP-4 to simulate a launch pad accident. On the second test, a detonation on the spill pad occurred. The spill test equipment was damaged to some extent. Since the spill test data was complete, the damaged equipment was not rebuilt.</p> <p>Work began immediately on rebuilding the FLOX compatibility rig to resume liquid flow testing of non-metallic specimens at 1500 PSIG. Twenty-eight valves, two spool pieces, several special fittings, and all test section fittings and holders were hydrostatically tested to 2250 PSIG. The high pressure tank was installed and the valves mounted in place. A complete rewiring and retubing was done to accommodate the new system and repair usable parts of the original low pressure system.</p> <p>A LOX checkout run was made on September 28 to verify operation of the automatic controller on the liquid system and check all system functions. Minor repairs were made and following a complete system retorque, runs will begin in early October.</p>

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J	ROCKET SYSTEMS	J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> OV0789 (D.S. Gabriel)	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressures from 0-1500 psig, in both liquid and gaseous state. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>Following the October 30 run, contaminated portions of the system were cleaned and rebuilt. In the interest of safety, all high-pressure valves were removed, checked, rebuilt, and reinstalled. The bellows seal helium supply system was also rebuilt. Preparations were made for the next run and test specimens installed.</p> <p>On November 20, fourteen runs with fluorine and FLOX (80% fluorine) were made. All test sections burned out at flow rates to 2.1#/sec. and pressures to 1100 psi. Little system damage occurred but the flow lines were contaminated. The contaminated lines are being cleaned and similar high-pressure liquid tests are scheduled for December 10.</p> <p>The high-pressure liquid testing is scheduled to be completed by early January. The cell will then be converted for high-pressure gaseous FLOX testing.</p>

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J	ROCKET SYSTEMS	J-5 <u>HYDRAULICS LABORATORY</u>	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressures from 0-1500 PSIG, in both liquid and gaseous state. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>During the first two weeks of December the following measures were taken to prevent premature test specimen burnouts:</p> <ol style="list-style-type: none"> (1) The 'J' Site Helium manifold was cycle flushed with tri-chloroethane through a five micron filter. (2) All the fluorine and helium equipment including the tanks, tubing, fittings, and valves were disassembled, cleaned and reinstalled using fluorine clean procedures. <p>On December 15, seven runs were made. Three test specimens experienced premature burnouts, one showed surface reaction from a previous run, one specimen cracked due to shock and could not be tested. Investigation showed particles in the helium system so the following steps were taken:</p> <ol style="list-style-type: none"> (1) A five micron filter and a cold trap were installed in the test section helium purge line. (2) The test specimens were cleaned, examined with a magnifying glass and the cleaning solvent evacuated from the pores of the specimens. (3) Specimen holders were cleaned and examined during specimen installation. (4) To check pickling effects, two of the specimens were not pickled. <p>On December 23, six tests were made on four specimens. All specimens burned out prematurely. A fifth specimen which was not tested was examined and found to have metallic particles on its surface.</p> <p>NOTE: Further helium purge system modifications and procedural changes will be made before the next checkout run which is scheduled for January 6.</p>

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u> (OV0789) (D.S.Gabriel)</p>	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressure from 0-1500 psig, in both liquid and gaseous state. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>A run was made on December 23, to see if the premature burnouts experienced in November had been eliminated by system modification. Premature burnouts were still experienced and the following additional modifications were made:</p> <ol style="list-style-type: none"> (1) A separate high pressure helium source was installed. (2) A new dryer was added to the system. (3) A sintered bronze filter was added. (4) A filter was added to the test specimen purge line. (5) All upstream bellows were flushed with filtered solvent. (6) The cold trap was removed from the helium purge line. (7) The specimens were cleaned and surfaces evacuated to 30 microns. (8) The purge system and check valves were cleaned and inspected at the test site. (9) The entire flow system and high pressure helium system was dismantled and cleaned. (10) The system was pickled for fourteen hours and the specimens for thirty minutes. <p>The January 12 run had to be canceled when three test specimens cracked while being immersed in LN₂. The January 14 run was canceled because there was an indication that the F₂ tank had developed a high pressure leak. On January 19, 14 runs were made on Teflon specimens. One specimen ran to its expected burnout point while the other three burned out prematurely. The last specimen was inspected and metallic particles were found on its surface.</p>

Using laboratory filter equipment, extensive samples were again taken from every conceivable point in the helium and F₂ flow system. All helium components were disassembled and inspected. The worst item appeared to be the brass particles from a Grove regulator in the helium purge system.

The system will be reassembled using ultra clean methods and the Grove regulator will be replaced by an all aluminum

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J	ROCKET SYSTEMS	<p>J-5 <u>HYDRAULICS</u> <u>LABORATORY</u></p> <p>(OV0789) (D.S. Gabriel)</p>	<p>This facility handles up to 175 pounds of FLOX in various concentrations at pressure from 0-1500 psig, in both liquid and gaseous states. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p>On February 2, 5, 12, and 19, FLOX research runs were successfully conducted. Premature burnouts were eliminated and all run days produced usable data.</p> <p>On February 2, six runs were accomplished and one high-flow burnout recorded before the facility was shut down due to inoperative valves.</p> <p>The specimens were replaced and heater wire was installed on the valve heads. The run was completed on February 5. Twenty-one runs, using various concentrations of FLOX, were made on February 5 and five specimen burnouts were recorded.</p> <p>On February 12, twenty runs were accomplished and five burnouts were recorded. 100% liquid fluorine and 70% FLOX were used during this run.</p> <p>On February 19, seventeen runs and five burnouts were recorded. 100% liquid fluorine, 70% FLOX and 60% FLOX were used during this run.</p> <p>The February 26 test run was cancelled due to adverse weather conditions causing electrical power failures. This run is rescheduled for the week of March 1, and will complete the current FLOX program.</p> <p>A short test program has been scheduled for the month of April to determine the cause of premature burnouts which occurred during the months of November and December 1964.</p>

SITE	LABORATORY	RESEARCH INSTALLATIONS (FOF)	DESCRIPTION
J	ROCKET SYSTEMS	<p data-bbox="398 553 555 584">March 1965</p> <hr/> <p data-bbox="541 670 761 731">J-5 <u>HYDRUALICS</u> <u>LABORATORY</u></p> <p data-bbox="541 768 761 829">OV0789 (D.S. Gabriel)</p>	<p data-bbox="822 670 1488 962">This facility handles up to 175 pounds of FLOX in various concentrations at pressure from 0 - 1500 psig, in both liquid and gaseous states. Specimens are tested under flow conditions for capabilities to withstand high fluorine concentrations, high flow velocities. The system also has an attached spill unit capable of spill testing with up to 30 pounds of FLOX.</p> <p data-bbox="541 993 1488 1116">On March 1, thirteen research runs were made on five test specimens. Although flow rates of 4 lb/sec and pressures of 1000 psi were reached, three of the burnouts were classed as premature, based on previous data.</p> <p data-bbox="541 1156 1488 1535">On March 19, a run was made to determine if metal particle contamination was the cause of premature burnouts. Five teflon test samples were prepared. Two were left uncontaminated. The other three samples were deliberately contaminated with brass filings, stainless steel filings, and a combination of brass and stainless steel, respectively. Only one premature burnout was encountered. The other burnouts occurred far beyond previous data in flow rate and concentration. It appears that metal particles have not been the cause of the consistent failures experienced during December 1964 and January 1965. Further metal contamination tests have been suspended.</p> <p data-bbox="541 1545 1488 1708">On March 30, the final research run was made, completing the Lewis Research Center program. In this test, the five specimens were burned out during 33 runs, with 70%, 75%, and 85% FLOX concentrations and 100% LF₂. The test cell will be deactivated and maintained on a standby basis.</p>

8-65

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
J	J-5 HYDRAULICS LAB	<u>HADLEY VALVE TESTS</u>		Valve tests with liquid fluorine. The Hadley valve assembly was tested to a limited extent this month. On August 11, the valve was cycled fifty-one times in liquid fluorine at 20 psi. In spite of the fact that considerable seal leakage was encountered, after testing no visible damage was evident. A decision to continue testing was agreed upon in spite of leakage in both the shaft seal and valve seal. Subsequent attempts to fluorine cycle the valve were unsuccessful. On August 19, termination of testing was necessitated when an IRC burst and burned following pressurization of the liquid fluorine in the valve assembly. On August 26, the test was terminated when Valve 199 on the fluorine trailer could not be opened because the stem had stripped from the valve yoke.

September 1965

SITE	SITE NAME	RESEARCH INSTALLATION	&	DESCRIPTION
J	J-5 HYDRAULICS LAB			<p data-bbox="427 322 1279 355"><u>HADLEY VALVE TESTS</u> Valve tests with liquid fluorine.</p> <p data-bbox="427 392 1330 553">On September 13, testing of the modified Hadley valve was completed. The valve was cycled 2400 times in liquid fluorine at pressures between 20 to 100 psi. The tests were terminated when the valve operator upper bearing seized.</p> <p data-bbox="427 590 1284 752">Several other deficiencies were encountered. Leakage on both the shaft and flow seals was excessive. The valve could not be opened if chilled down while closed or if a greater than 20 psid existed on the seal. It was also found that the seal had a slight score mark.</p>