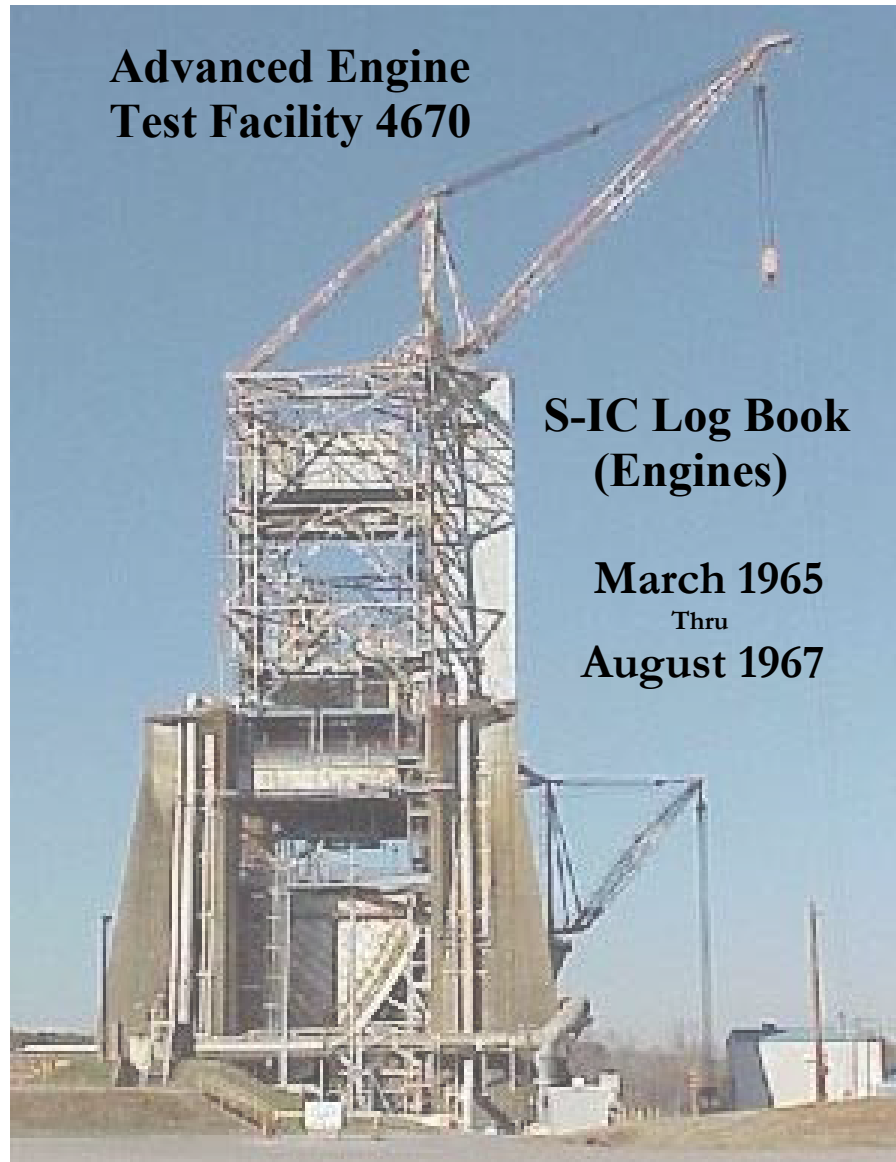


National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812



**GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MARSHALL SPACE FLIGHT CENTER, AL**

S-IC (ENGINES) LOG BOOK

March 11, 1965

Checked with Wallace on actuator inlet seals; he has them with 1/8" orifices - P/N 630313.

Talked with Ted LaMunyon on engine repairs. Suggested that purge lines be changed to eliminate interference with omega bans on turbine exhaust manifold.

March 12, 1965

Checked with Frank Hinkle on 3/8" Aeroquip disconnects to be used for chamber drains on S-IC-T. He has the disconnects, but adaptors were ordered to install them. Work order No. 489.

Sent Memo to ME Lab. on actuator lengths for S-IC-T. Memo #117-65. Also assigned actuators to engines.

Checked on stiff arms for engine F-2003, Position No. 5, they are located at S-IC Test Facility.

Engine actuator attach pins sent to LaMunyon. They did not have enough flat on one side - Ted will modify.

March 13, 1965 with Charles Davis of Quality

Discussion with Charles Davis of Quality. Stiff arm settings for center engine. He quoted nominal length of 57.938. $(59.870 + .228 - 2.160)$

March 15, 1965

Discussion with Carlton Smith finalized stiff arm lengths on Position No. 5 as engine log book setting -2.160"; therefore, stiff arms were sent to Engine Buildup Unit Bldg. 4705 to be set for Engine S/N F-2003 which

will be installed in center Position (No. 5) - Pitch 57.472
Yaw 57.663

Began installation of actuator attach bolts to stage. Nuts would not pickup more than one thread. The bolts were subjected to a dye check to clean up the thread. Bolt - 60B84003-1.

Sent work order to R-TEST-RT for fabrication of 1/16" orifices for installation of actuators. RT-487-65

Arranged with R-TEST-SPT for trial run at engine installation on Position No. 5 for Tuesday March 16, 1965.

Sent work order to R-TEST-RT for modification of engine actuator attach pins. COMPLETE.

March 16, 1965

John Collins (Boeing) checked center engine stiff arm with Mr. Linflow of Michoud; he quoted "E.O. No. 4 Drawing No. 60B19001-1 as stating 1400-1600 inch pounds". I supplied Mr. Clemmons with this information.

Installed stiff arms for center engine.

Installed engine S/N F-1002 in Engine Position No. 5. Attached gimbal block and installed stiff arm engine attach pins. Vertical installed worked good. Found that pump inlets will have to be aligned while installing engine.

Began installation of actuator attach pins to stage.

March 17, 1965

Installed Engine Position No. 5 PVC support brackets and removed PVC compressor device. Upon installation of support bracket LOX pump inlet pressure transducer flight type 0-500 p.s.i. was ruined. The rods through the LOX PVC flange were not long enough so bushings were fabricated installed to support them.

March 18, 1965

Actuator S/N 9 to be used on engine F-2005 was changed to S/N 10 due to excessive damage on 9; it will be rebuild by R-ASTR.

Checked on recirculation flange (hydraulic for stage) will receive Mon.

March 19, 1965

Attended S-IC-T planning meeting (Mr. D. chairman)

March 20, 1965

Checked with Frank Hinkle on 3 stage attach pins. Will receive Monday.

Checked engine service systems - all systems complete to Engine Position No. 3 on facility. They must be completed to all engines on the work platforms. Also drain hoses and drain manifolds must be made up. Hypergol purge lines must be made up.

March 22, 1965

Received gimbal block bolts from Herman Woods; also washers, and Hinkle will furnish nuts.

Picked up hot gas leak detector adaptors and hydraulic system leak check flange (recirculation).

Talked with Ace Perry to install brackets for backup redlines on LOX pump bearing jet pressure and LOX pump seal parameters.

March 23, 1965

Received hydraulic actuator inlet orifices with 1/16" orifice. Mr. Ball stored.

Received chamber drain adaptors for engine servicing. Checked with Hinkle on Aeroquip disconnects 3/8" to use for drains; he has them available.

Changed out one stage actuator attach pin because of galled nut.

March 24, 1965

Received bolts for LOX and fuel pump inlets.

LOX load test conducted. Loaded approximately 20%.

March 25, 1965

Removed PVC support brackets from Engine Positions No. 5 and No. 3.
Squab checked LOX PVC on Engine Position No. 5. Squab was good.

March 26, 1965

Removed PVC support brackets from Engine Positions No. 1, 2, and 4.
Also removed PVC flanges from Engine Positions No. 5, 3, 2, & 4.

Installed Engine Position No. 5 stiff arms to allow ME Lab to install
Heat shield panels.

Installed actuators # 17 and 20 in Engine Position No. 2. Sent actuators
23 and 24 back to ME Lab. to be set to F-2010 Log Book setting.

Mr. Branum was hurt on lift aloft at approximately 6:30 and was taken
to the base hospital. Slight bruise on left leg.

Meeting held with Dave Johnson, Aron Thomson, Pee Wee Holland and Tepool
on organization of engine work platform installation. Agreed to work to-
gether, and strive for compatible completion date.

March 27, 1965

Installed Engine S/N F-2007 in Engine Position No. 2, also installed
skirt S/N 8285562 on engine.

Installed actuator #10 and #17 in #1 and #2 sides of Position No. 1.

Began removing decking from rollout platform for plating which is uti-
lized in installation of engine access platforms.

Engine S/N F-2005 in Position No. 1 was installed with some slight load-
ing to the LOX PVC duct.

March 29, 1965

Installed skirt S/N 8285562 on Engine S/N F-2005, Position No.1. Thrust
chamber flange was bent. This problem was solved by re-bending it to its
original configuration.

Actuators S/N 21 and 22 were installed in Engine Position No. 3. Engine

S/N F-2008 and skirt S/N 8291921 were installed in Position No. 3.

Engine S/N F-2003 was installed in Position No. 5 - skirt S/N 8291922 was also installed.

Actuator S/N 23 and 24 were installed in Engine Position No. 4.

March 30, 1965

Installed engine S/N F-2010 in Engine Position No. 4. Installed skirt S/N 8291924. The LOX and fuel PVC lines had to be pulled down approximately 1-inch to the pump inlet.

Torqued stage actuator attach bolts to 1000 ft./lbs. and installed keys.

Torqued all LOX pump inlet at each position.

Fabricated brackets for interface measurements of following parameters:

DA4000	1 thru 5	LOX Dome Purge
DA4008	1 thru 5	GG Fuel Purge
DA4009	1 thru 5	LOX Pump Seal Purge

March 31, 1965

Position No. 1 - Mounted brackets for DA4000, 4008, 4009, installed TVC supply to actuators and safetyed.

Position No. 2 - Installed interface brackets and installed tubing.

Connected actuator supply lines and safetyed.

No. 2 actuator had bad helicoil on supply side.

Position No. 3 - Same as 1 and 2 of Position No. 2.

Position No. 4 - Installed DA4000, 4008, 4009.

Installed hydraulic supply line to actuators.

Position No. 5 - Same as above. Also the engine work platforms were installed. Interference was noted on Positions No. 2 and No. 4.

April 1, 1965

Torqued gimbal bolts and installed gimbal boots on all positions.

Installed instrumentation which was available.

Rework work platforms to solve minor interference problems.

Began connecting E.A.P. supply flex lines.

April 2, 1965

Leak checked purge systems:

Leak on No. 1 MLV purge line position 5 - Engine F-2005 leak will be weld repaired.

Leak checked hydraulic system.

Small leak on instrumentation boss 2005.

Torqued and pin engine to actuator bolts to 25 ft./lbs.

Began installation of facility service tubing.

Ace Perry began installation of overboard drain lines and skirt torque checked.

Installed available instrumentation.

April 3, 1965

Completed torquing of LOX and fuel pump inlets.

Installed 0.040 orifices in hydraulic override engine Positions No. 2 and No. 4.

Skirt torquing and installation of overboard lines completed.

Dome bolts torqued and safetyed on all positions.

Continued installation of service tubing.

Conducted engine components test.

Purge system functional check.

April 5, 1965

Conducted components test.

Checked instrumentation following not installed - DA-1 1, 2, 3

DA-1B 1-5

DA-2A 1-4

DA-5D

1-5

DA-7F

1-5

DA-9

k, 2, 3.

Continued installation of engine service tubing.

Installed available instrumentation.

Installed Position No. 5 EAP manifold.

April 6, 1965

Repair Position No. 1 engine F-2005 L.D.P. line.

Hydraulic fuel and LOX leak checks conducted.

E.A.P. checkout not good - must rework.

Conducted blown LOX pump seal purge test.

Conducted components test and sequence.

Ace installed calorimeter bracket on Position No. 2, Engine F-2007.

Continued installation of service tubing.

April 7, 1965

Conducted four sequenct tests.

Completed installation of engine service tubing.

Checked out single engine service system.

Hypergol 190 reg. 150 c.c.p.

Fuel jacket 390 reg. 300 c.c.p.

LOX service 200 reg. 175 c.c.p.

Leak checked thrust chamber on Position No. 5, engine F-2003, also inspected injector everything good.

Ordered flex lines to complete engine service systems.

April 8, 1965

Tanked LOX and fuel pressurized for leak check - no leaks.

Flushed LOX dome engine Position No. 5, engine F-2003.

Safety wired.

Flak curtains completely installed about center engine.

Installed photocom water line to engine F-2003 Position No. 5.

Conducted X-20 minute countdown.

Conducted sequence test.

April 9, 1965

Conducted engine components and sequence.

Conducted Test S-IC-01, 1 cut it.

Conducted Test S-IC-02 cutoff by stage ignition limiter timer due to No. 1 main fuel valve open switch did not pickup.

Secured engines and retired.

Engine area purge line ruptured with emergency on, changed out a hard line. *APRIL 11, 1965 - Conducted Test S-IC-03.*

April 12, 1965

Began installation of preservative system.

Began connecting engine service systems to outboard engines.

Changed fuel pump balance cavity supply orifice on Position No. 3, engine F-2008.

Removed 0.430

Installed 0.410

Gerald Thomson began installation of additional drain manifolds.

Price Clanton began securing rolling platform at Position No. 3 to deck.

Began installation of photocon water lines to outboard engines.

Trichloroethylene flushed, water flushed, and leak checked position No. 5 engine F-2003.

Began installation of drain connections for outboard positions.

Removed DA-44, DA-3044, and R. B. in pump inlet from all outboard engines.

April 13, 1965

Continued installation of drain manifolds.

Changed out seal between engine control supply line and No. 2 H.P. duct on engine F-2003, Position No. 5.

Installed hypergol simulator on outboard engines.

Checked out hypergol simulator supply system, not adequate, changed to fuel system checkout.

Installed 2 additional chamber drain disconnects on all engines.

Removed actuator calibration rods.

Torque checked engine connections.

Completed modifications on normal engine area purge system.

Change high LOX dome purge reg. supply orifice to #50 drill.

Drilled and safety wired actuator locks.

Filled preservative oil tank 100 gall.

Completed installation of preservative oil system.

Drain trichloroethylene supply tank and repaired leaky flange - refilled with 1600 gal.

Sent prefill sample to P&VE Chem. Lab.

Completed installation of engine service system on engine access platforms.

Completed removal of all instrumentation not required for 5 engine firing.

Completed photocon water supply for DA7F engines 1-5.

Conducted first 2 five-engine sequence tests both were successful. Relay race was problem with control.

April 14, 1965

Conducted full engine components. Checkout valves were a little slow, some hanging up on Positions 2 and 3 hydraulic override.

Conducted 2 engine sequences and 1 complete engine and stage sequence. One sequence was cut off by hydraulic override. Engines 1, 3, & 5 shut down within 10 mils of fastest and slowest. Engines 2 and 4 shut down 70 and 90 mils later, respectively.

Conducted engine area purge checkout - OK.

Installed available instrumentation.

Safety wired engine instrumentation.

Hydraulic override valve was hanging up when in open position and energized to go closed. Requested control checkout voltage which seems to be low.

Installed additional flack curtains to protect outboard engines.

April 15, 1965

Completed mixing inert prefill in ground tank.

Conducted sequence and components.

Completed drain line installation on engine access platform.

Installed photocons and completed water system.

Installed 1-inch relief set at 105 p.s.i. in LOX pump seal purge line.

Leak checked LOX and fuel system.

Tanked fuel to 40% load capacity.

Check igniters and hypergols on hand - 94 igniters and 31 hypergols.

April 16, 1965

Conducted engine components 9:00 - one engine stop backup hung in open, it was cycled several times and returned to the closed run condition.

Dropped fuel to engines and leak checked engines and aft compartment. (9:30)

Tanked LOX and leak checked.

Installed additional flak curtains removed deck andlocked.

Conducted test S-1C-T-04. Programed cutoff.

Post-test inspection revealed slight fuel leak on engine F-2005 Position #1 in the area of the GG fuel purge check valve. LOX seal leaks on Positions 1 and 4.

Post-test inspection also revealed slight buckling of the No. _____ band on skirt S/N 8285560 on engine F-2005.

Considerable amount of trouble incurred when attempting to remove aft compartment access panels.

Three men were left to secure engines and GG ball valve heaters.

April 19, 1965

Trich flushed and leak checked all chambers. No leaks.

Preserved turbopumps engines 1-5.

Drain control system on engines and AMF hydraulic system.

Upon attempt to inspect main chambers, it was discovered that the pump on the Ballimore lift would not pump. Mr. Mace of R-TEST-SPT was notified.

Fill trich supply tank on south side.

April 20, 1965

Pressurized LOX tank to 30 p.s.i. to acquire reading on LOX pump seal leakage. Readings were acquired on all positions -data as follows:

Pos. 1	Eng. F-2005	4,925 scim
Pos. 2	Eng. F-2007	45-60 scim
Pos. 3	Eng. F-2008	500 scim
Pos. 4	Eng. F-2010	4,750 scim
Pos. 5	Eng. F-2003	35 scim

During the above mentioned check the pumps were rotated 360° in both directions.

Meeting held on above data decision to pull positions 1 & 4 for LOX pump seal change.

All instrumentation and control cables removed.

ME Lab began removal of dishpan curtains. ME also requested to remove manual actuator cover plates.

Removed hypergol simulators potitions 1 & 4.

Removed overboard drain lines and skirt bolts.

Removed DA-1, DA-5, DA-7 on all engines, gave to instrumentation for pressure calibration check.

April 21, 1965

Installed manual engine actuator on Position 1 and 4.

Changed out filters on AMF hydraulic system.

Disconnected all actuators on engines F-2005 and F-2010, Pos. 1&4.

Removed DA-3-1 and DA-4-1 - gave to instrumentation for pressure calibration check.

Began changing out thrust vector control system lines which were questionable to P&VE.

a. Position No. 1 Engine S/N F-2005

Out - Engine supply P/N 60B83002-5, S/N 0000002

In - Engine supply P/N 20M55050-1, S/N 13.25.

Out - #2 Actuator supply P/N 60B83002-3, S/N 0000006

In - #2 Actuator supply P/N 60B83002-3B, S/N 1000004

Out - #1 Actuator return P/N 60B83004-1, S/N 0000009

In - #1 Actuator return P/N 60B83004-1E, E/N 0000053

Out - Ground supply P/N 60B83004-2, S/N 0000003

In - Ground supply P/N 60B83004-3, S/N 0000011

b. Position #2 - Engine S/N F-2007

No changes made.

c. Position No. 3 Engine S/N F-2008

Out - Engine supply P/N 60B83002-5, S/N 0000014

In - Engine supply P/N 20M55050-1, S/N 13.32

d. Position No. 4 - Engine S/N F-2010

Out - Engine supply P/N 60B83002-5, S/N 1000005

In - Engine supply P/N 20M55050-1, S/N 13.27

April 22, 1965

Removed Engine S/N F-2010 and skirt, sent to R-TEST-SPT for LOX pump seal change out.

Repaired rolling deck by removing brake assembly.

April 23, 1965

Removed Engine S/N F-2005 and skirt - sent to R-TEST-SPT.

Installed calibrate nozzles for purge flow test in Positions No. 1 and engine simulating orifice Pos. #4. LOX dome, nozzle #127, simulating orifice 0.434. LOX pump seal, nozzle #173, simulating orifice 0.084. GG fuel, nozzle #128, simulating orifice 0.290.

Installed DA-1, DA-5, DA-7, in positions 2, 3, and 5.

Removed and reinstalled DA-10-3 for instrumentation.

Began installation of stand talkers platform.

Changed out Greer compensator lines.

April 26, 1965

Completed installation of stand talkers platform.

Completed torque check on engine positions 2, 3, & 5.

Changed out seals on skirts for engines F-2005 and F-2010.

April 27, 1965

Removed fuel pump balance cavity reutrn line; Pos. #2 engine F-2007 to be hydrostated.

Picked up chamber entry lift from R-TEST-SPT and brought to test stand.

Installed stand talkers panel box on work deck.

Check out DA-7A and DA-14 on Position No. 5, Engine F-2003.

Identification numbers painted on Positions 2, 3, and 5, Engines F-2007, F-2008, and F-2003.

Installed new transducer in DA-10-3.

April 28, 1965

Installed Engine F-2005 in Position No. 1, also installed thrust chamber extension nozzle P/N 209210, S/N 8285560.

While at R-TEST-SPT the following component changes were made:

a. LOX pump seal assembly

Out - P/N NA5-260034-1A, S/N S001

In - P/N NA5-260034-1a, S/N S040

b. No. 1 actuator supply line

Out - P/N 60B83002-1, S/N 0000006

In - P/N 60B83002-1, S/N 1000009

Installed Engine F-2010 in Position No. 4, also installed thrust chamber extension nozzle P/N 209210, S/N 8291924.

While at R-TEST-SPT, the following component changes were made:

a. LOX pump seal assembly

Out- P/N NA5-260034-1A, S/N S053

In - P/N NA5-260034-1A, S/N S041

b. No. 1 actuator supply line

Out - P/N 60B83002-1, S/N 0000005

In - P/N 60B83002-1, S/N 1000005

Due to pre valve changes and fuel line removal and installation, the No. 1 fuel pump inlets required realigning before hookup could be accomplished.

April 29, 1965

Installed and connected actuators on Engines F-2005 and F-2010. Completed connecting hydraulic system to stage and actuators.

Torqued thrust chamber extension nozzles on engines F-2005 and F-2010.

Hydrostated the following fuel pump balance cavity return lines.

Engine F-2008 and reinstalled

Engine F-2007 and reinstalled

Engine F-2003 and reinstalled

Installed fuel pump balance cavity orifice in Position No. 3, engine F-2008, Out - RD251-4087-0410, In - RD251-4087-0390.

Torqued gimbal blocks on engines F-2005 and F-2010.

Drain reservoir and changed out hydraulic filters in Greer system.

Installed hand rails on north apron to rolling deck.

Torqued fuel pump inlets and LOX pump inlet on engine F-2005, safety wired LOX pump inlet.

Removed DA-1012-1 and gave to instrumentation for check. It was found to be faulty. Removed D-1012 from engine F-2009 at R-TEST-SPT and installed on engine F-2005.

April 30, 1965

Installed overboard drain lines on engine F-2005 and engine F-2010. Also completed engine area purge on skirts.

Sent LOX dome flush kit to Rocketdyne to be returned to Edwards Test Site.

Removed LOX pump seal purge line engine F-2010 and installed new line. The line was removed due to RP-1 spillage into it.

Out - P/N S/N

In - P/N 38253, S/N 038

Inspected main injectors on positions 1-5. Discrepancies noted as follows:

a. Position No. 1 engine F-2005, object which appeared to be weld chipped located in inner fuel ring. This object was removed with pliers.

Removed actuator locks on F-2005 and F-2010 - checked gimbal clearance. Torqued LOX and fuel pump inlets on F-2010, began engine torque check. Modified chamber entry lift to incorporate bleed valve.

Installed CA-2 and C-9 on all positions.

Installed TVC instrumentation on engine F-2005.

Four men utilized on hydraulic systems. AMF and Greer.

Hydrostated the following fuel pump cavity lines - Engine F-2005 and #1

and #2 returns.

May 1, 1965

Removed and hydrostated the following fuel pump balance cavity line (return).

Engine F-2010, also changed out orifice plate

Out - .844"

In - .844"

Fabricated DA-2010-1 thru 5 instrumentation brackets.

Changed out both seals on GG fuel purge check valve engine F-2005 Pos. #1.

Completed removal of photocon on DA-7F and moved to DA-15A on tap CF2c.

Leak checked hydraulic system - one leak on hydraulic skid, changed out O-ring on supply filter.

Began installation of actuator delta P brackets on Positions No. 2-4.

Checked out actuators on Positions No. 1 and No. 4 with ground electrical box. Noted that Position No. 1 pitch actuator S/N 17 was not smooth at null or while gimbaling.

Checked out checkout valve travel time, seemed to have rotated in approximately 3 to 4 seconds.

Checked calorimeters located on engines (9) thermocouple must be installed on Position #2, also new calorimeter must be installed and purge line connected.

Checked inert prefill tank must add or go to prestone for S-1C-05.

Installed DA-2010 on Position 3, 4, 5.

May 3, 1965

Installed DA-2010 positions 1 and 2, completed LOX pump inlet transducers.

Installed DA5004-1.

Completed torque check on engine F-2010 position #4.

Conducted engine purge checkout.

LOX Dome	Loader Outlet 1000	Reg. Outlet 990
LOX Seal	" 80	" 80
GG Fuel	" 200	" 180

Completed engine identification numbers positions No. 1 and 2.

Changed out O-ring on position No. 3 engine F-2008 GG fuel drain.

Drain inert fill tank and filled with ethylene glycol.

Leak checked complete fuel system at 15 p.s.i. - no leaks recorded.

Drop DA15-2 and DA15-3 igniter fuel pressure.

Installed actuator delta P brackets positions #2 & #4 Engine F-2007 and F-2010.

Changed out DA22-1.

Installed DA4000-1, DA4008-1, DA4009-1 at station 109 upon completion of purge checkout.

Conducted components and spanned main valves, signal problem on Pos. #5 engine F-2003 blockhouse corrected it.

Continued gimbal checkouts and calibrated instrumentation on act. pos.

Trich flushed the following domes: Engine F-2007 Pos. #2.

May 4, 1965

Removed A.P.M. filters from hydraulic return line and connected to skid.

Trich flushed LOX dome on engine F-2005 and F-2010.

Installed calorimeter at exit on position No. 2 Engine F-2007.

Taped chamber and exhaustorator joint on Pos. No. 3 Engine F-2008 and patched joint on all other positions.

Fabricated brackets and installed DA3A-1 - 5.

Installed calorimeter purge line in aft compartment on Pos. #2.

Reworked high LOX dome purge regulator loading system for faster response. Checked high LOX dome purge at 975 loader out and 970 reg. Outlet.

Obtain quality reading on inert prefill tank - 50.6% water, 0.1 sodium nitrite, 49.3% prestone.

Completed torque check on engine F-2005 Pos. #1.

Removed manual engine actuators and ME Lab. began installation of heat shield cover plates.

Completed installation of chamber exit spray nozzles on Pos. #4.

Conducted engine components and sequence test (2). Everything OK.

Continued gimbal system checkouts.

May 5, 1965

Removed the following GG fuel purge lines:

Engine F-2005 P/N 88254 S/N 16

Engine F-2007 P/N

Engine F-2008

Engine F-2010

Engine F-2003

Installed cover plate P/N 308240 on all engines. Lines were sent to Mr. Hinkle, R-TEST-SPT.

Changed out DA1012-1 two times because of transducer failure. Also changed out DA22-1 same reason.

Conducted full stage and engine components also conducted simulated firing.

Tanked fuel and leak checked without hydraulics

Filled hydraulic reservoir on A.M.F. through the engine control system. Drained down fuel below prevalues.

Conducted engine gimbal system checkout periodically.

May 6, 1965

Conducted high LOX dome purge test as follows main supply 1400 p.s.i.g.

Loader outlet 950 p.s.i.g.

Reg. outlet 940 p.s.i.g.

Engine positions 1-5 respectively 604, 625, 623, 613, 610.

Changed out G^u ball valve opening control line orifice seal plate because of leak.

Out RD251-4098-0079

In RD251-4098-0079

This change was made on Engine F-2008 Pos. #3.

Changed out leaking 3/8 buld head tee on fuel bubbling position #1.

Conducted normal pre-test procedures.

Conducted S-1C-05.

Post-test inspection revealed following:

- a. GG ball valve drain Pos. No. 1 engine F-2005
- b. Skirt hat band ripples pos. 4, 1, 3.
- c. Purge ring on Pos. 3 skirt exit flare pulled.

Post-test securing was completed per S.O.P.

May 17, 1965

Trich flushed chambers 1-5. Water flushed and leak checked - no leaks.

Preserved pumps 1-5.

Drained control systems and changed out filter bypass valve on hydraulic skid.

Repair GG ball valve drain pos. No. 1.

Secured engine work platform and rolling deck.

May 10, 1965

Installed manual engine act. pos. 2 & 3.

Inspected chambers and injectors 1, 2, 3, 4, 5.

Remove DA1, 5, 7 all positions for instrumentation check.

Began repair on lower level access doors.

Reworked chamber entry lift.

Removed DA3-2 DA10-2 BAD!

May 11, 1965

Removed flak curtains and related brackets.

Changed DA15 to DA55 on positions 1 and 5.

Completed modification on lower engine access platform trap doors.

Installed D1018, D1019 2, 3, 4

Installed DA1, 5, 7 Position #2

Removed actuator inlet orifices on Pos. 2 & 3.

Removed CA9-4 - Check revealed short.

Set gimbal protractors to 0 and removed locks on positions 2 and 3.

Fabricated instrumentation brackets for DA15.

Dye checked turbine exhaust manifold on positions 1 and 3. Pos. #3

revealed one crack at

Retubed engine area purge at chamber exit on Pos. #3.

Began engine torque check on pos. #4.

Completed actuator installations on Pos. 2 & 3.

May 12, 1965

Changed DA15 to DA55 on Position #4.

Installed all CA9 and CA2 positions 1-5.

Began installation of heat exchanger wraparounds.

Dye check turbine exhaust manifold Pos. 2 and 4.

Control checked for 28 V on all stop backups, good.

Removed manual engine actuators from engines.

Installed available hydraulic trans.

Fabricated heat exchanger coil leak check panel.

Leak checked hydraulics and checked actuator zero's on pos. 2 & 3.

Installed DA1, 5, 7 on all positions.

Checked turbine hanger bracket covers - results as follows:

Pos. #1, Eng. F-2005 No cracks

Pos. #2, Eng. F-2007 2 cracks

Pos. #3, Eng. F-2008 No cracks

Pos. #4, Eng. F-2010 4 cracks

Pos. #5, Eng. F-2003 2 cracks

Installed filter bypass valve on hydraulic skid.

Fabricated brackets and installed filter delta P gages on hydraulic skid and A.M.F. unit.

Changed out servo pressure gage on Greer unit.

Drained Greer reservoir below connection interface and connect supply and return lines to hydraulic system.

May 13, 1965

Modify engine access platforms for heat exchanger line clearance.

Continued installation of heat exchanger LOX and helium systems.

The following is list of major component:

	#1	#2	#3	#4	#5
LOX flowmeter	NA-1 $\frac{1}{2}$ -373	282	324	367	307
LOX check valve	3662577	3672869	3652926	3655022	3662578
LOX bypass	006 005A	005A	008 010	008	002
Helium bypass	004	018	011	008A	037

4 .150 orifices were installed in each LOX inlet

2 .400 orifices were installed in each helium inlet

1 .870 orifice was installed in each helium^{bypass} line

1 .200 orifice was installed in each LOX bypass

Removed Pos. #5 E.A.P. feed manifold for modification due to heat exchanger crossover line interference.

Check all overboard brackets for cracks.

Began drop of test on heat exchanger coils.

May 14, 1965

Continued drop off test on heat exchanger LOX and helium coils
Data as follows:

Pos. #1	Eng. F-2005	LOX coil 3"	H.E. coil $4\frac{1}{2}"$
Pos. #2	Eng. F-2007	" 2.5"	" $2\frac{1}{2}"$
Pos. #3	Eng. F-2008	" $4\frac{1}{2}"$	" 2"
Pos. #4	Eng. F-2010	" $3\frac{1}{2}"$	" $1\frac{1}{2}"$
Pos. #5	Eng. F-2003	" $2\frac{1}{2}"$	" 2"

Installed pressure switch on A.M.F. heat exchanger.

Changed out seals on flush bypass valve on Greer hydraulic unit.

Complete Greer hook up to main hydraulic system.

Continued installation of H.E. hardware.

May 15, 1965

Installed DA36, 37, 39 on all positions.

Began thrust chamber extension nozzle bracket support installation.

Began installation of helium and LOX H.E.

Thermocouple data as follows:

<u>Engines F-</u>	<u>2005</u>	<u>2007</u>	<u>2008</u>	<u>2010</u>	<u>2003</u>
He. out temp.	5636	5632	8943	8980	7031
GOX out temp.	5646	5642	8949	7382	7030
LOX in temp.	10055	7082	6872	8878	6848

Removed engine overboard drain lines for bracket modification.

Hydraulic checkouts with Greer system.

Control gimbal system checkouts and also clearance checks.

Conducted multi sequence test, finally 45 sec. test completed. Without gimbal program.

Installed DA10-3, DA3-2

May 16, 1965

Continued bracket support welding.

May 17, 1965

Continued modification of overboard drain line brackets. (Completed).

Re-installed overboard drain lines E.A.P. lines.

Removed and cleaned LOX inlet orifice on Pos. #1.

Removed inert prefill detector on all positions in preparation for modification.

Reinstalled E.A.P. manifold on Pos. #5.

Completed installation of helium and GOX system hardware.

Demonstrated gimbal system malfunctions on Pos. #4 and #3 to Mr. Howard.

Completed installation GOX and helium instrumentation.

Completed band modification on thrust chamber nozzles extensions as follows:

Eng. F-2005 Pos. #1, installed reinforcing band 347 cres. .125 x 1.75) at ref. 0° and 180°.

Eng. F-2007 Ref. 0°.

Eng. F-2010 Ref. 180°.

Welded reinforcements on inert prefill level detectors. Pos. #1-5.

Completed installation of hydraulic system instrumentation.

May 18, 1965

Completed LOX and fuel system leak checks - 2 fuzz leaks on DA3-4 and DA4-1.

Conducted components test, stop backup solenoid began leaking in the open position thru the overboard line.

Conducted 2 sequence tests - OK.

Calibrated thrust vector control system with osc. and control.

Conducted gimbal checkouts at $\frac{1}{2}$ c.p.s. and $\pm 2^\circ$ on pitch actuators, Pos. #1-4.

Ran step function $\pm 2^\circ$ on Pos. #1. Both actuators - Yaw & Pitch.

Ran osc. on Pos. #1 G.F.M. inlet and outlet to study pressure surges.

Installed DA36, DA37, DA38-5, also completed installation of DA1012's.
Reinstalled inert prefill detectors on Positions 1-5 and dye checked prefill detector welds.

Removed DA-2A-3A, 4, 6, 4008 on all positions.

Removed all bellows covers from heat exchanger and sent to warehouse.

Installed manual engine actuators on positions #4.

Installed lock on yaw actuator pos. 4 and removed actuator supply line and installed 1/16" orifice in actuator inlet. Open pre-filtration bypass valve.

Installed DA1015 and DA1017 Pos. 2, 3, & 4.

Filled preservative oil tank to overflow.

Leak checked LOX and helium systems to heat exchanger. Leaks as follows:

LOX inlet on heat exchanger Pos. 1 & 3.

LOX inlet temp. trans. Pos. 4.

Helium outlet pres. trans. Pos. 3.

Installed flex hoses to E.A.P. manifolds on Pos. 5.

May 19, 1965

Installed Pos. #1 DA1012-1, static G. F. M. delta P.

Cleaned tap DA-7-1 and DA-7A-1.

Filled 800 gal. of prefill in ground tank - Add 2.5 gal. of sodium nitrite and bubbled for 2½ hours.

Removed manual engine actuators and stored on intermediate level. Also installed manual engine actuator cover plates.

Fabricate and installed cover plates on flak curtain attach points.

Installed wrapping on Pos. 5 GOX line to protect from engine area purge line.

Deliver engine chamber access lift to Ball's shop for repair.

Completed installation of calorimeters on engines.

Changed out stop backup solenoid on Pos. #1, engine F-2005, valve was leaking in open position to overboard line.

Conducted LOX and helium heat exchanger leak check, leak on Pos. 3 LOX inlet.

Changed out seal and re-leak checked. OK.

Conducted full sequence with gimbal system active. OK.

Policed levels 10-11 & 12 for firing.

POOR D-- JOB!!!

May 20, 1965

Changed out DA1015 and 1017-1 to 0-1500 p.s.i. pickup.

Taped skirt hat bands on all positions top side.

Conducted engine components and engine sequence.

Fuel emergency dump line was damaged when a control man accidentally cycled the emergency dump valve.

Checked out gimbal system with control and osc.

Conducted Test S-IC-T-06 for scheduled duration.

Secured test facility.

May 21, 1965

Completed engine post-test servicing.

Installed keep-out signs on engine platforms.

Preserve turbopumps.

May 24, 1965

Inspected main chamber injector the following discrepancies were noted.

Pos. #5 Eng. F-2003 (see notebook for drawing) crack $\frac{1}{2}$ " vertical.

All others fine.

Removed main LOX valve position indicator and limit switch assembly from #2 MLV on Pos. #5, Eng. F-2003.

Out NA5-27336-1B, S/N 3123

In NA5-27336, S/N 3597

Installed manual engine actuators on Pos. #4.

Removed actuator P/N S/N 24

Installed actuator P/N S/N 25

Torqued stage attach pin and locked with key.

Installed actuator supply and return lines.

Removed the following instrumentation.

DA-1 1-5 DA2000A-1

DA-3 1-5 DA-1A-1

DA-7 1-5

Returned actuator 24 to R-ASTR.

Installed MV-74 in hydraulic acc. shutoff valve control.

Began engine torque check. Pos. 1- Pos. 5.

May 25, 1965

Removed DA2010-1 sent to instrumentation.

Removed gimbal filter manifold Pos. #1 eng. F-2005 -

Out P/N S/N

In P/N S/N

Tap pot housing on 3 Greer hydraulic pumps and installed drain line to waste sump.

Removed and reinstalled fuel pump inlet temps. Pos. 1 & 5.

Changed out DA39-3, DA7-3, DA39-1, DA39-5.

Installed thrust OK pressure switch bracket on Pos. #3, Engine F-2008.

Picked up Balleymore cham. lift and installed casters.

Completed installation of delta P brackets and removed locks on yaw actuator Pos. #4.

Installed pot on main LOX valve #2, Pos. #5, Eng. F-2003 (See No. 2 May 24, 1965).

Continued engine torque check.

Began installation of heat exchanger flight transducers.

May 26, 1965

Removed the following flight transducers (Engine F-2005)

Fuel pump inlet #2, out, S/N 2125, P/N NA5-27316-T2-1c

In S/N 1636

LOX Pump Bearing Jet, out, S/N 1685, P/N NA5-27316-T10-1c

In S/N 1682

Engine Control Return, out, S/N 1310, P/N NA5-27316-T5-1c

In S/N

Completed flight instrumentation on heat exchangers.

Installed DA1A-1.

Installed CA-2-1-5, CA-9-1-5, DA-2010-1.

Clean up shops on 10th level, 11th, and 12th south west tower.

Completed engine torque check on all positions.

Removed flight turbine outlet pressure sensing line and installed blind flange on engine F-2005 Pos. #1.

Retorqued end housing on hydraulic pump No. 2 A.M.F.

Installed DA-7-1, 2, 4, 5.

Leak checked thrust OK pressure switch assembly eng. F-2008.

Began fabrications of engine Position pots.

Replaced DA-3-5.

May 27, 1965

Installed DA39-2, 4.

Removed sequence valve end housing and checked GASKO seal on all eng. positions. No gasket discrepancies were noted.

Installed continuous GG LOX injector purge on eng. S/N F-2010 Pos. #4.

Out - Line Assy. Dome Purge #1 MLV P/N 408846; In Retro-fit Kit P/N 18-410061.

Leak checked GG LOX injector purge on Pos. #4.

Installed flex line on photocon water supply at dishpan Pos. 1-4.

Visual inspection of turbine exhaust manifold and overboard line brackets.

Pos. 1 omega band #3 bottom $\frac{1}{4}$ " crack.

Pos. 4 skirt band #2 vertical $\frac{1}{4}$ " crack.

Installed new Tygon drain tubing on Pos. #2.

May 29, 1965

Replumb photocon water supply to pickup GG Pc photocon.

Checked out #2 MLV position switch and pot on Pos. #5.

Installed suction system from hydraulic platform to engine platform.

Pulled all D-55-1-5.

Installed MV-74-VE on Pos. #3. In S/N 160, Out S/N 158.

Installed MV-74 in hydraulic accumulator shutoff valve control.

Leak checked hydraulic system.

Conducted engine components and sequence.

Preliminary TVC system checkout.

June 1, 1965

Installed DA-59-1-5 and DA-3A-1-5 on modified bracket.

Removed GG hot gas drain line on Pos. #5 & #3.

Conducted components and sequence test.

Calibrated TVC system on Pos. #1, 2, 3.

Changed out DA-13-2, DA-14-2.

Installed DA-200A-1.

Tanked up hydraulic reservoirs - AMF 325 gal., Greer 175 gal.

Replumbed accumulator shutoff valve control.

Changed out LOX bypass orifice on Pos. #1 & #2, Eng. S/N F-2005 and F-2007, respectively from .200 to .250.

June 2, 1965

All Greer hydraulic motors were greased by O.T.S.

Changed out MV-74-VE on Pos. #3. Out S/N 160, In S/N 158.

Changed because of faulty position switch.

Checked out accum. shutoff valve blockhouse control - OK.

Recalibrated Pos. #1 and calibrated Pos. #4. TVC system with control and osc.

Conducted full gimbal program with osc.

Installed engine level access steps from 12th level south side.

Removed DA-1B-1-5.

Installed DA-8A-1-5 and connected water.

Removed GG hot gas bleed lines on Pos. #1, 2, 4, eng. S/N F-2005, F-2007, F-2010, respectively.

Installed engine Pos. pots on Pos. #1 & #3, yaw and pitch plan.

Removed manual engine actuators from engine work level to storage.

June 3, 1965

Removed MV-74-VE on engine S/N F-2008, Out S/N 158, In S/N 310.

The stop backup valve leaked by during a sequence.

Installed engine pos. pots on Pos. #1 and #3 yaw and pitch plane.

Fabricated brackets for act. delta P DA1018-1-4 and DA1019-1-4.

Weld repaired the following:

Pos. #4 overboard brackets 2 places.

Pos. #1 omega band on exhausterator.

Installed CA-22-1-1-5.

Changed out DA-5004-1.

Completed all pos. GG hot gas drain deletions.

Installed manual engine actuator access covers.

Conducted engine sequence and checked out gimbal system.

Conducted fuel and LOX system leak check - no leaks.

Installed supply and return temp. transducers on Greer.

June 4, 1965

Conducted LOX and fuel system leak checks.

Conducted components test.

Calibrated TVC system throughout day.

Clean up 10 & 12 levels for test.

Conducted sequence test cutoff at 85 sec. Eng. 3 main level valve left open.

Changed out stop backup valve - Out P/N MV-74VE, S/N 158; In P/N MV-74VE , S/N 310.

Changed out Boeing flight act. delta P to static delta P 0-1000 p.s.i.

Stat DA-1018 -1, 2, 3, 4

DA-1019-1, 2, 3, 4

June 7, 1965

Changed out DA-22-1,3,4.

Installed Benton hand valves for DA-22 on Pos. 1, 2, 3, 4.

Leak checked CA-22 on LOX side.

Leak checked LOX outlet to heat exchanger on dome.

Calibrate eng. position pots on positions 1 and 3.

Conducted components.

Conducted 2 sequence test.

Continued TVC System checkout.

Tanked fuel above prevalues to 8070.

June 8, 1965

Conducted components and sequenct test.

Checked out gimbal system and calibrated with instrumentation and control.

Conducted pre-test S-1C-07 countdown.

During countdown all AC power.

Rolling deck bumped pos. 3 thrust chamber.

Conducted S-IC-T-07 - observer cutoff on fuel pump inlet pres. Pos. #5.
Post-test inspection revealed the following discrepancies.

Yaw actuator zero shift 5.1°.

Leak on Pos. #5 Eng. control supply line at #2 fuel H.P.D. Eng. S/N
F-2003.

Leak (hydraulic) on pitch act. return pres. line at weld to return line
flange.

The following lines were found to be deformed:

Pos. #1 Pitch return (bad).

Yaw return (slight).

Pos. #3 Pitch return (cracked) see above.

Yaw return (slight)

Pos. #4 Pitch return (slight).

Yaw return (bad).

Thrust chamber leak on Pos. #1 eng. F-2005 just below jacket (hot gas).

Thrust chamber tube leaks on eng. S/N F-2003 Pos. #5.

Zone 2, tube 95 $\frac{1}{4}$ " transverse crack

Zone 4, tube 123A seeper

Zone 4, tube 125A seeper

Performed post-firing securing.

Trich and water flushed thrust chamber.

Drained down control system.

June 9, 1965

Changed out yaw actuator Pos. #3 Eng. S/N F-2008, Out S/N 21, In S/N 19.

Changed out both seals on Eng. Pos. #5 Eng. S/N F-2003 control system
flight supply line - Out RD405332-19 at H.P.D.; In RD405332-19

Out RD406332-17 at 4-way; In RD-406332-17

Inspected main chamber injectors (FINE).

Repaired chamber tube leaks on Pos. #5 with R.T.V.

Changed out the following instrumentation transducers:

DA-2-2, 5, 1	DA-5-4, 5
DA-1-2, 5	CA-9-1, 2, 3, 4, 5
DA-13-2, 5	CA-2-1, 2, 3, 4, 5

Installed manual engine actuators on Pos. #1.

The following actuator return lines were changed out:

Pos. #1 Eng. S/N F-2005, #1 Yaw Out P/N 60B83004-1E, S/N 0000053
In P/N R-11423, S/N 0000001 - #2 Pitch Out P/N 60B83004-1#, S/N 0000020
In P/N R-11423, S/N 0000002

Pos. #2 Eng. S/N F-2007, #1 Pitch Out P/N 60B83004-1E, S/N 0000023
In P/N 60B83004-1E, S/N 0000060 - #2 Yaw Out P/N 60B83004-1E, S/N 0000025
In 60B83004-1E, S/N 0000065

Pos. #3 Eng. S/N F-2008, #1 Yaw Out P/N 60B83004-1E, S/N 0000049
In P/N R-11423, S/N 0000003 - #2 Pitch Out P/N 60B83004-1E, S/N 0000051
In P/N R-11423, S/N 0000004

Pos. #4 Eng. S/N F-2010, #1 Pitch Out P/N 60B83004-1E, S/N 0000042
In P/N 60B83004-1E, S/N 0000068 - No. 2 Yaw Out P/N 60B83004-1E, S/N 0000052
In P/N 60B83004-1E, S/N 0000064

June 10, 1965

Removed MOOG actuator S/N 17 from Eng. Pos. #1 pitch and installed hydraulic
research - Out P/N 50M35008, S/N 17 In P/N S/N 016

Removed and reinstalled DA-59-1-5.

Retubed DA-9-1 to eliminate heat problem on pickup.

Fabricated and installed brackets for eng. Pos. #2 & #4 stainless steel
products return lines.

Torque checked dome bolts on eng. Pos. #4, Eng. S/N F-2010 - OK.

Tighten hydraulic skid panel connections.

Conducted LOX and fuel system leak checks OK.

Visual leak check on turbine exhaust manifold looked good.

Removed manual engine actuators and installed access covers.

Installed the following instrumentation:

DA-5 -1, 4 DA-13-12, 3 DA-1015-4 DA-1019-3

Modify bracket for DA-1018-1 on pitch actuator delta P Pos. #1.

Conducted components and sequence test.

Leak checked hydraulic system.

Installed lock on pos. #2 yaw actuator, orificed the inlet and opened refiltration valve.

June 11, 1965

Checked off static measuring program S-1C-08.

Leak check fuel system.

Conducted components and sequence.

Conducted gimbal program checkout.

Recalibrated gimbal system.

Removed brackets from S.S.P. hydraulic return lines.

Conducted Test S-1C-08.

Performed post-firing securing procedures.

June 14, 1965

Trich and water flushed thrust chamber jackets.

Leak checked chambers.

Same leaks on Pos. #5 as S-1C-07.

Crack trans. tube 9B zone 3 Pos. #1.

Preserved turbopumps.

Preservative would not flow freely on engine Pos. #1 engine S/N F-2005. The preservative filter will be changed out.

Leak checked turbine exhaust manifolds:

Pos. #1: two cracks, Pos. #2 four cracks, Pos. #4 two cracks,
Pos. #5 three cracks.

Went to movie.

June 15, 1965

Changed out preservative filter on Eng. S/N F-2005 bearing coolant control valve.

In P/N NA5-28057, S/N 101

Out P/N NA5-28057, S/N None

Disconnected Pos. #1 and #2 crossover lines at interface.

Inspected injectors.

Cracks present in following compartments on Pos. #5, Eng. S/N F-2003 - 5, 9, 10, 12.

Turbine exhaust manifold cracks found on following positions 1, 2, 3, 4, 5.

Changed out flush bypass valve on Greer.

Drained down engine control system.

June 16, 1965

Completed engine torque check on Pos. #1, 2, 3, 4, 5.

Gave blood for Odom - all went home.

June 17, 1965

Removed DA-1019; DA1012-3, for checkout.

Began engine area purge tubing for F-1 Ts.

Began buildup of Mark II hydraulic unit for S-1 TS.

June 18, 1965

Weld repaired engine F-2005 and engine F-2003 thrust chamber tubes.

Continued fabrication of purge tubing.

Continued fabrication of Mark II.

June 19, 1965

Weld cocoon lugs on thrust chamber skirts.

Completed Mark II buildup and delivered to F-1 TS.

Completed purge for F-1 TS.

Mounted tubber on engine access platform for manual engine actuator installation.

Began fabrication of service turbine brackets.

Completed thrust chamber welding and turbine exhaust manifold cracks.

June 21, 1965

Removed engine area purge lines Pos. #3 and #5.

Removed GG LOX purge on Pos. #1 and installed continuous purge.

Began interface connects on crossover lines.

June 22, 1965

Completed interface connections on crossover lines.

Pull engine area purge lines for skirt band buckling fix on engines Pos. #1, 5, & 4.

Continue engine service tubing modification.

Fabricating manual engine actuator buggy.

Fabricate stairway form 12th level south to engine access platform.

Welded hat bands on skirt Pos. #1.

June 23, 1965

Completed stairway to 12th level south.

Installed oiler and air supply to engine access tugger.

Continued work on engine service tubing.

Continued work on manual engine actuator dolly.

June 24, 1965

Installed handrails from 12th level to intermediate platform north side.

Installed GG fuel drain adaptors on Eng. F-2005 and Eng. F-2007.

Relocated TV camera on Eng. F-2003 Pos. #5.

Installed 2 gages on hydraulic skid panel.

Continued work on service tubing.

Continued manual engine actuator dolly.

Began installation of retrofit kit on Pos. #5.

June 25, 1965 (Tom Shaner began writing)

Completed retrofit Mod.#R5266-14, kit No. 18-410059 on Eng. Pos. #5, S/N F-2003 as follows:

- a. Changed out wraparound line brackets.
- b. Changed GG water shield.
- c. Installed permanent insulation on turbine water shield.

Began retrofit kit No. 18-410059 on engine Pos. No. 3, S/N F-2008.

Completed change out on GG water shield.

Tape repaired turbopump hanger covers on Eng. Pos. #5, S/N F-2003, and Eng. Pos. #3 S/N F-2008.

Continued fabrication of manual engine actuator handling fixture.

Completed engine service turbine modifications.

Completed weld repair of thrust chamber hat bands on Pos. #1, 5, & 4

Reinstalled engine area purge tubing on Eng. Pos. #1.

Replaced 3/4" O.D. drain ground half on No. 2 side of Eng. Pos. #2.

Replaced thrust chamber jacket 3/8" purge O.D. ground half eng. Pos. #2.

Removed chamber entry rigs from beneath engines and secured on level 10.

Began engine insulation installation from throat down on Eng. Pos. #3 and #5.

June 26, 1965

Completed fabrication of manual engine actuator handling fixture and brackets.

Removed actuator return lines from Eng. Pos. #3, S/N F-2008 and delivered to Tepool at F-1 Test Stand.

Pitch - P/N Out R-11423, S/N out 0000004; Yaw - P/N Out R-11423, S/N Out 0000003.

Removed actuator return lines from Eng. Pos. # 2 & 4 and sent to Hinkle for X-ray. Eng. Pos. No. 2, S/N F-2007 - Pitch - P/N Out 60B83004-1E, S/N Out 0000060; Yaw - P/N Out 60B83004-1E, S/N Out 0000065.

Eng. Pos. No. 4, S/N F-2010 - Pitch - P/N Out 60B83004-1E, S/N Out 0000068 Yaw - P/N Out 60 B83004-1E, S/N Out 0000064.

Completed retrofit Mod. #RD266-14, kit No. 18-4100 on engine Pos. #3, S/N F-2008 as follows:

Changed out wraparound brackets.

Changed GG water shield.

Installed permanent insulation on turbine water shield.

Changed wraparound brackets and GG water shield on Eng. Pos. #1, S/N F-2005. Turbine water shield insulation would not fit due to misalignment of holes - will be returned to Rocketdyne.

Changed GG water shield on Eng. Pos. #4, S/N F-2010 and began installation of turbine water shield insulation.

Changed wraparound brackets on Eng. Pos. #2, S/N F-2007, and prepared yaw actuator for removal.

Continued cocoon insulation installation on Eng. Pos. #5.

Repaired photocon water supply on Eng. Pos. #2.

June 28, 1965

Completed installation of permanent insulation on Eng. Pos. #2, S/N F-2007.

Completed installation of permanent insulation on Eng. Pos. #4, S/N F-2010 except for 3 wraparound brackets and one section of turbine insulation.

Installed overboard (.150) and purge (.100) orifices in GG continuous purge on Eng. Pos. #1, S/N F-2005.

Inspected injector on Eng. Pos. #3, S/N F-2008 - OK.

Continued cocoon installation on Eng. Pos. #3 and #5.

Reinstalled engine area purge tubing on Eng. Pos. #4, S/N F-2010.

June 29, 1965

Injectors on Eng. Pos. #1, 2, & 4 were reinspected with results as follows:

Pos. #1, S/N F-2005

Bad - Comp. 10, .011" separation between the land and first LOX ring inside the outer circumferential baffle.

Pos. #2, S/N F-2007

Bad - Comp. 3, separation between the land and outside of outer circumferential baffle 5" lone.

Comp. 9, 10, 11, & 12, a separation between the land and outside the second LOX ring inside of the outer circumferential baffle.

Pos. #4, S/N F-2010

Bad - Comp. 7, a .020" separation between the outside of the outer circumferential baffle and the land.

A .006" separation between the rings and radial beffle between compartments 11 & 12, from the second to sixth rings from outside of inner circumferential baffle.

Tanked up both hydraulic reservoirs to full with RP-1 (Greer - 581 gal.; A.M.F. - 59 gal.)

Installed yaw manual engine actuator Eng. Pos. #2 and removed yaw actuator. Picked up actuator S/N 17 from ME Lab. Actuator set to 59.820 inches. Delivered actuator S/N ____ to ME Lab.

Removed two turbine hanger covers and two sections of turbine insulation each on Pos. 2 thru 5 for turbine hanger bracket inspection. No cracks were found.

Installed pitch actuator return line, P/N _____ S/N _____
on Pos. #2.

Installed yaw actuator return line, P/N _____ S/N _____
pm $\frac{1}{4}$ ps/ #4.

Plumbed pressure switch to $2\frac{1}{2}$ " water supply line on A.M.F. unit.

Filled the inert prefill tank with 50% ethylene glycol mixture. Trich tank was low and will be filled tomorrow.

Changed out seals on $\frac{1}{4}$ " Robbins on A.M.F. unit, pump No. 4.

Inspected injector on Pos. # 5, S/N F-2003 -

Bad - Comp. 7, a separation between land to fuel ring, ring 7, 5 doublets long between hypergol ports.

Comp. 8, a separation between land to fuel ring, ring 7, 5 doublets long between hypergol ports.

Comp. 9, 10, a separation between the fuel ring and the outer circumferential baffle 90° ^{in each comp.} ~~on each comp. $\frac{1}{2}$~~

Comp. 11 & 12, land to ring cracks intermittently.

Continued cocoon installation Pos. #3.

June 30, 1965

Installed pitch and yaw actuator return lines on Eng. Pos. #3, S/N F-2008:

Pitch - P/N in 60B83004-1F, S/N in - 0000063

Yaw - P/N in 60B83004-1F, S/N in -0000062.

Reinstalled permanent turbine cover insulation and hanger bracket covers on Eng. Pos. #2 & #5.

Reinstalled turbine hanger bracket covers on Eng. Pos. #3, S/N F-2008.

Installed manual engine actuators at Eng. Pos. #4.

Prepared Eng. Pos. #2, 4, & 5 as follows:

Eng. Pos. #2 - Removed bottom half of overboard drain lines. Disconnected wraparound lines and purge lines.

Disconnected pitch actuator supply and return lines. Disconnected PVC's except for 4 bolts each. Disconnected actuators from engines.

Eng. Pos. #4 & 5 - Removed bottom half of overboard drain lines. Disconnected wraparound lines and purge lines. Disconnected skirt extensions except for 8 bolts.

July 1, 1965

Pulled engine Pos. #4, 5, & 2 and sent to Ball's shop for injector replacement.

Covered nozzle extension on Engine Pos. #5 to protect insulation from rain.

Began prep. on engine Pos. #1 for removal as follows:

Removed LOX PVC bolts except 4,

Removed nozzle extension bolts except 8.

Removed overboard drain lines and engine area purge lines.

Took Ham to hospital.

Completed installation of all manual engine actuators at Eng. Pos. #1, 2, & 4.

July 2, 1965

(Written by Tepool)

Completed prep. on Eng. Pos. #1, S/N F-2005 for engine removal.

Removed engine S/N F-2005 and delivered to engine prep shop for injector replacement.

July 6, 1965

(Written by Shaner)

Installed Eng. Pos. #2 pitch actuator, S/N 23.

Installed Eng. Pos. #2, S/N F-2010 as follows:

Installed gimbal block bolts.

Installed new LOX pump inlet seal and attached LOX PVC with bolts.

Attached fuel PVC's with bolts.

Installed skirt.

Installed Eng. Pos. #2 yaw actuator, S/N 25.

Installed Eng. Pos. #4 pitch actuator, S/N 18 and yaw actuator, S/N 17.

Removed actuators from Pos. #4 for installation at Pos. #2.

July 8, 1965

Installed pitch actuator return line, P/N 60B83004-1F, S/N 0000066 and yaw actuator return line, P/N 60B83004-1F, S/N 0000064 on Eng. Pos. #2, S/N F-2010.

Torqued gimbal block bolts to 600 ft.-lbs. on Eng. Pos. #2, S/N F-2010.

Torqued and safety wired LOX and fuel PVC's to pump inlets on Eng. Pos. #2, S/N F-2010. (LOX - 450 in-lbs., fuel - 200 in-lbs.).

Torqued nozzle extension bolts on Eng. Pos. #2, S/N F-2010 to 120 in-lbs.

Connected actuator supply lines and wraparound lines on Eng. Pos. #2, S/N F-2010.

Installed overboard drain lines and engine area purge lines on Eng. Pos. #2, S/N F-2010.

Two men supported cocoon installation on Eng. Pos. #3, S/N F-2008.

ME Lab connected flame curtain to dishpan on Eng. Pos. #2, S/N F-2010.

Installed Eng. Pos. #1, S/N F-2005 as follows:

Installed gimbal block bolts and attached manual engine actuators.

Installed LOX and fuel PVC to pump inlet bolts. (New LOX pump inlet seal used)..

Installed nozzle extension and bolts.

July 9, 1965

Continued hookup of Eng. Pos. #1, S/N F-2005 as follows:

Torqued gimbal block bolts to 600 ft-lbs.

Torqued LOX pump inlet bolts to 450 in-lbs.

Torqued fuel pump inlet bolts to 200 in-lbs.

Installed overboard drain lines.

Installed engine area purge lines.

Connected and torqued wraparound lines.

Hooked up pitch and yaw actuators to outriggers and connected actuator supply and return lines.

Torqued nozzle extension bolts to 120-in-lbs.

Installed Q.D. drains on Eng. Pos. #1 and #2.

Reinstalled turbine water shield permanent insulation and turbine hanger bracket covers on Eng. Pos. #3, S/N F-2008.

Two men worked on cocoon installation, Eng. Pos. #3.

Installed new gasket seal on nozzle extension of Eng. S/N F-2003.

July 19, 1965

Installed Eng. Pos. #5, S/N F-2003 as follows:

Installed gimbal block bolts and connected stiff arm struts.

Installed new LOX pump seal and LOX pump inlet bolts.

Installed fuel pump inlet bolts.

Installed nozzle extension and bolts.

Installed overboard drain lines and engine area purge lines.

Installed Eng. Pos. #4, S/N F-2007 same as Pos. #5.

Injectors were replaced in Eng. Pos. #1, 2, 4, & 5 as follows:

<u>Eng. S/N</u>	<u>P/N Out</u>	<u>S/N Out</u>	<u>P/N In</u>	<u>S/N In</u>
F-2003	208081	4068183	2090241	4074921
F-2005	208081	7031300	209241	4068946
F-2007	208081	7076087	209241	4074922
F-2010	208081	4068305	209241	4068840

While at Engine Prep shop, Eng. S/N F-2003 turbopump on LOX side was disassembled and cleaned down to the main LOX seal. LOX seal was leak checked at 25 scim.

July 10, 1965

Continued engine installation as follows:

Torqued and safety wired LOX pump inlet and fuel pump inlet bolts, Pos. #4 & 5.

Torqued gimbal block bolts and nozzle extension bolts, Pos. #4 & 5.

Installed pitch actuator supply line, Pos. #4.

Connected pitch and yaw actuators, Pos. #4.

Connected wraparound lines and engine area purge supply lines, Pos. #4.

Pos. #5.

Connected wraparound lines ~~XX~~

Reinstalled turbine hanger covers and turbine permanent insulation Pos. #4.

Installed GG fuel injector purge wraparound line Pos. #3 for cocoon purge supply.

Installed continuous GG LOX injector purge, Pos. #3.

Continued cocoon installation, Pos. #3.

July 12, 1965

Reinstalled yaw actuator return line, P/N 60B83004-1E, S/N 0000065 Pos. #4.

Realigned pitch actuator supply line, Pos. #1 were found slightly buckled.

Connected engine area purge supply lines on Pos. #1 and #2.

Disconnected heat exchanger helium and LOX inlet and outlet lines and installed test plates for coil drop off test, Pos. #3, #5.

Began fabrication and installation of GG LOX injector continuous purge, Pos. 4 & 5.

Installed gimbal block bolts, Pos. #1, #2.

Reinstalled permanent insulation on turbine and turbine hanger covers, Pos. #2.

Removed gimbal actuator locks, Pos. #1.

Connected LOX dome outlet to heat exchanger flange, Pos. #1 and #2.

Removed the following instrumentation from Pos. #3 because of cocoon interferences: DA3A-3, DA14A-3, DA33-3.

Exchanged the following instrumentation between Pos. #2 and #4:

DA1018	DA22	DA39
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DA1019	DA10
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Installed hypergol simulator, Pos. #2.

July 13, 1965

Completed installation of GG continuous LOX injector purge, Pos. #4 and Pos. #5. Installation of continuous purge is now complete at all engine positions.

Installed LOX dome and GG LOX injector flush unit, Pos. #5.

Welded in plates to cover gaps on engine access platforms at Pos. #2 and #4.

Installed fuel pump balance cavity supply line orifices, Pos. #2 and #3.

S/N 2010 - .350" dia., S/N 2008 - .360" dia.

Completed heat exchanger coil "drop-off" tests, Pos. #1 and #5:

Pos. #1 S/N F-2005 - LOX 3.0 in. water; He 3.5 in. water

Pos. #5 S/N F-2003 - LOX 3.5 in. water; He 4.0 in. water

Disconnected LOX and helium inlet and outlet flanges, Pos. #1 and #2. for H.E. coul drop-off test.

Exchanged the following instrumentation between Pos. #2 and #4:

DA1018, DA9, DA2, DA3A, DA59, DA1019, DA37, DA12A, DA8, DA1015, DA22, DA11, DA13A, DA1, DA1012, DA10, DA36, DA5, DA33, DA7A, DA39, DA14, DA13, DA14A, DA12.

This completes instrumentation changeout, Pos. #2 and #4.

Reinstalled CA1A-4, Pos. #4.

Reinstalled DA3A-3, Pos. #3.

July 14, 1965

Hooked up H.E. inlet and outlet flanges after could "drop-off" test, Pos. #5. The old seals were reinstalled.

Installed hypergol simulator, Pos. #1 and #5.

Performed LOX dome and GG LOX injector flush, Pos. #5. Removed flush unit and reinstalled dome plugs, GG LOX check valve and GG continuous LOX purge line.

Installed LOX dome flush unit, Pos. #1, performed LOX dome and GG LOX injector flush, Pos. #1, removed flush unit and reinstalled dome plugs, GG LOX check valve and GG continuous LOX purge line.

Performed H.E. could "drop-off" test, Pos. #2, #3, and #4:
Pos. #2, S/N F-2010 - LOX coil - 2 in water; He coil - 2 in. water
Pos. #3, S/N F-2008 * 5.5 in. water 3.0 in. water; Pos. #4 S/N F-2007
4.0 in. water, 2.5 in. water.

Installed new H.E. LOX inlet seal, Pos. #3, P/N 404673-27-F, installed old seals at GOX outlet, He inlet, He outlet, and hooked up all four H.E. flanges.

Installed new H.E. LOX inlet, He outlet, LOX outlet seals, old He inlet seal, Pos. #2 and hooked up all four H.E. flanges. LOX inlet P/N 404673-27-F, He outlet P/N 306261-3, LOX outlet P/N 306261-5.

* Seal bleed leak at 1/8" boss.

Installed LOX dome flush unit, Pos. #4, performed LOX dome and GG LOX injector flush, removed flush unit, reinstalled dome plugs, GG LOX check valve and GG continuous LOX purge.

Installed hypergol simulator, Pos. #2, #3, #4.

Gerald Thompson reinstalled chamber exit spray lines and braces removed for engine removal.

Installed LOX dome flush unit, Pos. #2, performed LOX dome and GG LOX injector flush, removed flush unit, reinstalled dome plugs, GG LOX check valve and GG continuous LOX purge.

Performed LOX purge systems leak check, all positions. A weld crack was found at Pos. #4, S/N F-2007 on the No. 1 side LOX dome purge supply line just upstream of the No. 1 MLV. Crack must be weld repaired.

Reconnected LOX dome outlet flange to H.E. LOX supply, Pos. #1, 2, 3, 4, and 5. Leak checked flanges with high LOX dome purge on. OK.

Connected all H.E. flanges using old seals, Pos. #1 and 4.

Reinstalled DA3A-3, DA14A-3, DA33, Pos. #3.

Relocated DA3A, DA14A, DA33, Pos. #5.

July 15, 1965

Installed gimbal block boots, Pos. #1 and 5.

Fabricated and installed 0.200-inch orifices (2) in cocoon purge supply line, Pos. #3 and 5.

Changed out pitch actuator return line, Pos. #4, S/N F-2007:

Out - P/N 60B84003-1F, S/N 0000060; In - P/N 60B83004-1F, S/N 0000069.

Removed No. 1 LOX dome purge supply line from Pos. #4, S/N F-2007, and sent to Test Support Shop, Joe Mullins, for weld repair.

Installed GG fuel injector purge wraparound line for cocoon purge supply, Pos. #5, S/N F-2003.

Removed gimbal actuator locks, Pos. #2.

Torqued and safety wired He inlet and outlet, LOX inlet and GOX outlet flanges, Pos. #1 thru 5.

Added base plates to 4 engine access ladders.

Reinstalled 46.1 LOX dome purge supply line, Pos. #4, after weld repair.

Changed out pitch actuator return line, Pos. #3, S/N F-2008:

Out: P/N 60B83004-1F, S/N 0000063

In: P/N 60B83004-1F, S/N 0000075

Installed DA1A-4.

Re-ran calorimeter purge line, Pos. #2, S/N F-2010.

Removed pitch and yaw manual engine actuators from Pos. #1, 2, and 4 and lowered to rolling deck.

Completed installation of all cocoon bracketry and thrust chamber panels, Pos. #3 and 5.

July 16, 1965

Reinstalled DA1019-1, Pos. #1.

Reinstalled DA-1012-3, Pos. #3.

Completed reinstallation of turbine permanent insulation, Pos. #4.

Reinstalled CA1A-2, Pos. #2.

Removed manual engine actuator handling rig from engine platforms and secured on rolling deck.

Attempted to bring up hydraulics; after all 3 Greer main pumps were on and pressure at 500 p.s.i.g., main pump No. 2 shorted out in the pump J-box.

Activated and checked out cocoon purge, Pos. #3 and 5. Hand reg. set at 200 p.s.i.g. and stage Pos. 5 valve cycled.

Replumbed photocon water supply, Pos. #2 and 4.

Reinstalled 0.200-inch orifice in cocoon purge supply line, Pos. #5.

July 17, 1965

Performed heat exchanger LOX and helium lines leak check, all engine positions. LOX lines - 400 psig, helium lines - 200 ps.i.g. The following leaks were found:

- a. Position #1 - A small leak at the helium outlet seal leak detect boss. No action taken.
- b. Position #2 - Flange leakage at the LOX inlet and outlet flanges. Seals were replaced.
- c. Position #5 - Flange leakage at the GOX outlet flange. Seal replaced.
- d. Positions #3 and 5 - A small leak at the helium outlet seal leak detect boss, Pos. #3, LOX outlet seal leak detect boss, Pos. #5.
- e. Position #1 and 2 - Small fuzz leaks at GOX and helium outlet flanges at station 109. No action taken.

Attempted to bring up Greer hydraulic unit. No press. control - 750 max.

Performed hydraulic system components test. Used a temp. cluge for crossover valves.

Started A.M.F. unit and performed complete hydraulic system engine control system, thrust vector control system, flush bleed, and leak check. Internal leak found in hyd. skid valve. panel gage. Replaced faulty gage.

Performed engine sequence test. Attempted complete stage sequence test. Unsuccessful due to faulty operation of pressure switches in LOX and fuel tank.

Performed complete leak check on LOX and fuel systems on engines.

Continued cocoon installation pos. #3 and 5.

July 19, 1965

Performed a partial components and sequence test.

Developed a leak across the stem seal on the Greer supply cross over valve. Removed the position switch and actuator and replaced the stem seal. Reassembled the valve assembly.

Installed manual engine actuator bracket covers, Pos. #1, 2, 3, & 4.

Fabricated a new position switch actuator adaptor for Greer supply crossover valve.

Two men supported the cocoon installation, Pos. #3 and 5.

July 20, 1965

Fabricated and installed new handrails along south and west sides of rolling deck.

Removed DA1018-3 because of actuator insulation interference.

Installed a base plate on engine access ladder.

Attempted 4 sequence tests. Two were successful.

GG ball valve position switch, Pos. #1, S/N F-2005, was replaced by Ball's shop. The switch actuator rod was frozen and had broken loose from the ball valve linkage.

Extended and retracted pitch and yaw actuators at all engine positions to checkout gimbal equipment.

Removed manual engine actuator bracket cover plates at two positions.

Installed manual engine actuators, Pos. #3.

Drained hydraulic control system.

Installed the following transducers:

DA1A-3, DA12-5, DA7-3, DA14-2, DA1A-1

July 21, 1965

Installed new pressure switch in heat exchanger water supply line, A.M.F. hydraulic unit. Switch set at 10 p.s.i.g.

Installed 0-100 p.s.i.g. gage in heat exchanger water supply line, A.M.F. unit.

Connected manual engine actuators, Pos. #3. This required removal of cocoon bracket around turbopump.

Disconnected pitch and yaw supply and return ducts, pitch and yaw actuators, Pos. #3.

Installed new actuator engine connect pins and actuator bellows, pitch and yaw, Pos. #3.

Reconnected pitch and yaw actuators, supply and return ducts, Pos. #3.

Painted new handrails on rolling deck.

Modified engine access stairway to level 12 and added back plate to stairway.

Reinstalled CA10-3.

July 22, 1965

Brought up hydraulics 8:30 a.m. Attempted Greer unit operation. Still no pressure control.

Brought up A.M.F. hydraulic unit, main No. 1, and repeated hydraulic system leak check. A.M.F. H.E. water pressure switch functioned satisfactorily.

Performed 3 complete sequence tests. GG ball valve cycled freely. Switch travel rod moved freely also. Switch assembly was reassembled and reinstalled on GG ball valve. Operation OK.

Calibrated pitch and yaw actuators, Pos. #2 and 4.

Yaw actuator, Pos. #1, S/N 10 M00G, went hard over 5.2° extend with no servo current input (plug disconnected).

Reinstalled DA1018-3 and DA1019-3.

Supported cocoon installation with two men, Pos. #5.

Fabricated brackets for and installed CA5049-2 and CA5051-2. Plumbed

calorimeter purge lines to both pickups, Pos. #2.

Reinstalled DA9-1 and DA1A-5 and DA1A-2.

July 23, 1965

Brought up Greer hydraulic unit and began trouble-shooting pressure control problem. Main line temp. rapidly increases and pumps go to full volume. Suspect backflow through flush bypass valve.

Brought up A.M.F. hydraulic unit and cycled yaw actuator, Pos. #1 for Bill Howard. Also cycled yaw actuator, Pos. #4 for Boeing people to observe actuator return line movement.

Worked on cocoon installation, Pos. #3 and 5.

Performed cocoon purge checkout with recorders on; results as follows:

	<u>Loader Out</u>	<u>DA4026-3</u>	<u>CA4012-3</u>	<u>T set</u>
Pos. 3 Only	160 p.s.i.g.	129 p.s.i.g.	150° F	230° F
Pos. #3 and 5	160 p.s.i.g.	125 p.s.i.g.	150° F	230° F

Rigged up hoist and pulleys.

Drained down Greer hydraulic unit and began removal of flush bypass valve.

Picked up new actuator from Cold Cal and delivered to ME Lab for length setting.

Picked up actuator from ME Lab and brought to test stand.

Welded bracket for pitot tube on nozzle extension, Pos. #5, S/N F-2003.

Reinstalled DA2010-5.

July 24, 1965

Drained down engine hydraulic control system for actuator removal.

Removed manual engine actuators from Pos. #3 and installed at Pos. #1.

Removed yaw actuator, Pos. #1; and reinstalled new yaw actuator. Pin and nut were galled during removal and were replaced: Out - P/N 50M35008, S/N M00G 10; In - P/N 50M35008, S/N M00G 13.

Removed flush bypass from Greer hydraulic unit and installed Grayloc GR25 blind flanges at connections.

Plumbed drain line from Greer waste catch tank.

Plumbed drain line and valve from boost pump 2nd stage fitter.

Installed fuel pump inlet gimbal boots at Pos. #3, S/N F-2008. Interference problem between No. 1 pump inlet and instrumentation cable. Top of boot cannot be secured. Could not install Pos. #5 boots because of cocoon install would have to be removed.

Installed two turbine exhaust igniter adapters, P/N 209221 on Pos. #1, S/N F-2005.

July 26, 1965

Brought up hydraulics, A.M.F. unit and performed engine components test and three complete stage sequence tests.

Picked up "systems valves not OK". light on A.M.F. control panel.

Investigation revealed a broken position switch adapter in the A.M.F. supply valve.

Removed M00G actuator, S/N 10, and delivered to R-ASTR-NFS, C. Cornelius. Tanked up fuel (RP-1) in the hydraulic units, 800 gal. in Greer, topped off with 60 gal. in the A.M.F. unit.

Repaired switch adapter in the A.M.F. supply valve.

Calibrated Pos. #1 and 3 pitch and yaw actators with control and recorder room. Recalibrated Pos. #2 and 4, pitch and yaw actuators.

Removed manual engine actuators from Pos. #1.

Reinstalled manual engine actuator bracket covers, Pos. #1, 2, 3, & 4.

Attempted checkout on Greer hydraulic unit. Still no luck.

Continued cocoon installation, Pos. #3 and 5.

Changed out MV74VE stop backup solenoid, Pos. #3. Out - S/N 10, In - S/N 309.

July 27, 1965

Installed two new APCO pressure regulators (dome loaded) in hydraulic skid panel.

Changed out DA14A-1, Pos. #1.

Filled the trich tank.

Checked level of inert prefill tank. Full.

Completed checkout of Greer unit. OK.

Trouble was three problems:

- a. Backflow through flush bypass valve.
- b. Bad diode cord in checkout console.
- c. Servo accumulator pressure low due to erroneous reading on faulty gage.

Installed suction line on Pos. #3 pitch actuator to carry away piston leakage.

Fabricated and installed actuator purge lines and hypergol purge lines at Pos. #3, utilizing old engine area purge lines.

Gimbaled Pos. #1 and 4 with motion cameras on actuator return lines:

- 1 c.p.s. $\pm 2^{\circ}$ yaw - Sine
- 2 c.p.s. $\pm 1^{\circ}$ yaw - Sine
- 2 c.p.s. $\pm \frac{1}{2}^{\circ}$ yaw - Sine
- 2 c.p.s. $\pm \frac{1}{2}^{\circ}$ pitch - Sine
- $\pm 2^{\circ}$ step yaw - 1 c.p.s.
- 1 c.p.s. $\pm 2^{\circ}$ yaw - Sine

Recalibrated Pos. #1, 2, 3, & 4, pitch and yaw actuators for $\pm \frac{1}{2}^{\circ}$, $\frac{1}{2}^{\circ} = 2$ inches, with control and recorder room.

Re-plumbed photocon water drain line, Pos. #5.

Continued cocoon installation Pos. #3 & 5.

Calibrated Pos. #1, dome position pitch and yaw planes, Pos. #1 - $\pm 2^{\circ}$, $2^{\circ} = 1$ inch.

July 28, 1965

Greer hydraulic unit main No. 1 pump shaft seal went out over night leaking approximately 200 gal. of RP-1. Greer unit was started but seal leak did not improve.

Performed complete engine components, and sequence test. Performed gimbal system checkout and dry run of gimbal program at 0.10 degree.

Pressurized LOX and fuel systems and leak checked.

Tanked fuel down to engines, leak checked and closed fuel prevalues, drained down fuel system.

Re-installed: DA3A-1, DA3-1, DA22-1, DA1012-2

Welded four camera mounts below each holddown arm and one mount on north side of S.E. tower leg for Jack Moss.

Removed and plugged up DA8A-3 & 5.

Welded the following thermocouples on the engines:

CA5049-2, CA5051-2, CA5055-1A, CA5055-4, CA5055-5, CA5058-2, CA5059-2.

July 29, 1965

Performed Saturn pre-test countdown per Procedure No. 76.

Ran dry run gimbal program checkout and re-calibrated where required.

Leak checked LOX and fuel systems.

Conducted components and sequence test.

Conducted Test S-1C-09. Cutoff due to LOX pump inlet, Pos. #3, S/N F-2008 below redline. (Auxiliary pressurizing valve did not open).

Pos. #4 pitch actuator, S/N 18 went hard over extend to 3.75 degrees after cutoff. In attempt to bring actuator back to null, nozzle extension struck handrail bracket on lower engine platform causing damage to lower hat band and skirt shingle.

Performed partial engine post-test inspection and servicing:

a. Removed hypergol

- b. Detanked propellants
- c. Drained engines
- d. General engine inspection

Completed measuring program check-off prior to test.

July 30, 1965

1. Ran two sequence tests for Lindsey. Pressurizing valves worked OK.
2. Inspected main injectors on all engine positions. Injectors OK.
3. Trich flushed and water flushed thrust chamber jackets on all engine positions. Found one transverse tube crack, tube 9B, zone 3, engine Pos. #1. Same crack noted after S-IC-08.
4. Preserved turbopumps, Pos. #1, 2, 3, 4, & 5.

August 2, 1965

1. Drained down hydraulic control system, removed heat shield manual engine actuators, Pos. #4.
2. Changed out pitch actuator, Pos. #4:
P/N out 50M35008, S/N out M.18
P/N in 50M35008, S/N in H.R. 020
3. Changed out shaft seal on Greer main pump No. 1 as follows:
 - a. Disconnected electrical J-box.
 - b. Knocked out 2 dowel pins on motor and pulled motor back.
 - c. Removed 4 mounting bolts on motor.
 - d. Used wheel puller to remove pump half of coupling.
 - e. Changed out seal.
 - f. Reassembled pump and motor. Used dry ice to pack pump shaft and heated pump coupling.
4. Changed out CA4012-3.
5. Removed, cleaned, and replaced strainer in A.M.F. water supply line.
6. Removed DA8A-1, 2, 3, & 4. These were dropped.
7. Changed out CA9-1, 2, 3, 4, & 5.
8. Changed out CA2-1, 2, & 4.
9. Fabricated new bracket and replumbed DA1019-4.

August 3, 1965

1. Brought up hydraulics (A.M.F. unit) approx. 8:30 a.m. with main No. 1 and conducted engine components, and 8 sequence tests.
2. Pressurized LOX and fuel systems with prevalues open and performed leak checks.
3. Inspected all actuator null positions and all actuator return lines for buckling. Insulation was removed on Pos. #3 for inspection. Everything OK.
4. Tanked 770 gal. of RP-1 in Greer unit, 100 gal. in A.M.F.
5. Started Greer hydraulic unit and completed checkout. Seal OK.
6. Calibrated actuators on Pos. #1 and 2 with control and oscillographs.
7. Weld repaired skirt on Pos. #4 and tube crack on Pos. #1.
8. FCSM was found bad on Pos. #5.
9. Removed manual engine actuators from Pos. #4 and reinstalled manual engine actuator bracket heat shield covers.

August 4, 1965

1. Brought up hydraulics (Greer unit) at approx. 9 a.m. No indications on crossover valves due to a short somewhere in control wiring.
2. Conducted complete engine components test and six sequence tests, trying for a 1-4 cutoff.
3. Calibrated actuators on Pos. # 3 & 4 with control and recorder room. Ran a gimbal system checkout and a dry run on the gimbal program.
4. Tanked fuel (208,000 gal.) with hydraulics off and stage supply and return valves closed. Prevalues on Pos. #3 and 5 were open; Pos. #1, 2, & 4 were closed..
5. Pressurized fuel tank to 8 p.s.i.g. and leak checked fuel system on Pos. #3 and 5.

6. Performed engine drains, Pos. #3 and 5.
7. Reinstalled CA9-2.

August 5, 1965

1. Brought up hydraulics (Greer unit) and ran engine components test and sequence test. During first components test the No. 2 MLV, Pos. #4, S/N F-2007 did not give a closed indication when valves were re-cycled.
2. Shut down hydraulics, drained control system, and repaired position switch on MLV. The pin retaining the yoke with the block had fallen out.
3. Removed the water strainer from the Greer unit and at the water pump No. 2 inlet when water pressure at Greer unit dropped to zero.
4. Checked off measuring program.
5. Safety wired all drain quick disconnects.
6. Performed Saturn Pre-Test countdown.
7. Conducted Test S-IC-10 at approx. 4:02 PM for 143 seconds for inboard
147 " " outboard
8. Performed visual inspection on engines and post-test securing operations.
9. Drained engines and went home.
10. Fires were found under cocoon on Pos. #3 and 5, still burning 1 hour after test, when removing service panels on insulation. Fires were at top of nozzle extension around turbine exhaust igniters area, drain quick disconnects and weep holes. Dry chem. exting. were used to put out fires.

August 6, 1965

1. Brought up hydraulics (Greer unit) and ran 2 sequence tests.
2. Trich. flushed and water flushed all engine position jackets.
3. Leak checked thrust chambers on all engines. Pos. #5, S/N F-2003 had 3 tube cracks:
 - a. Tube 95, zone 2, transverse weld crack.
 - b. Tube 128B, zone 4, seeper at manifold.
 - c. Tube 168B, zone 4, seeper at manifold.

4. Preserved turbopumps, Pos. 1 thru 5.

August 9, 1965

1. Inspected main injectors, Pos. #1 thru 5. Injectors on Pos. #1, 3, 4, & 5 were OK. Pos. #2, S/N F-2010 injector was found cracked as follows:
 - a. A 0.003" separation 1-inch long between the LOX ring to land area, along the outer edge of the first LOX ring outside the outer circumferential baffle in compartment 1.
 - b. Compartment 6, a 0.003" separation 2-inches long, same as above.
 - c. Compartment 7, a 0.003" separation 5-inches long, same as above.
2. Drained down hydraulic control system.
3. Started removal of cocoon insulation, Pos. #3 & 5.

August 10, 1965

1. Continued removal of cocoon insulation, Pos. #3 & 5. cursory inspection revealed that fires had reached above throat on engines. External chambers were heavily sooted from throat down.
2. Cleaned up the 10th level in the sw. tower leg.
3. Removed thr thrust OK pressure switch manifold and installed blind flange on Pos. #3, S/N F-2008. Manifold was given to Tepool for F-1 Test Stand.
4. Inspected pitch and yaw actuator return lines, Pos. #1, 2, 3, & 4 for buckling.

August 11, 1965

1. Completed removal of cocoon on Pos. #3 & 5 except for heat exchanger lines and wraparound lines insulation.
2. Removed heat shield covers over manual engine actuator brackets, Pos. #1, 2, 3, & 4.
3. Installed manual engine actuators, Pos. #1, 2, 3, & 4.

August 11, 1965

1. Completed removal of cocoon on Pos. #3 & 5 except for heat exchanger lines and wraparound lines insulation.
2. Removed heat shield covers over manual engine actuator brackets, Pos. #1, 2, 3, & 4.
3. Installed manual engine actuators, Pos. #1, 2, 3, & 4.

August 12, 1965

1. Disconnected supply and return lines to pitch and yaw actuators, Pos. #1, 2, 3, & 4.
2. Installed gimbal actuator locks on pitch and yaw actuators, Pos. #1, 2, 3, & 4.
3. Removed: DA1015 - 1, 2, 3, & 4
DA1017-1, 2, 3, & 4
DA1018-1, 2, 3, & 4
DA1019-1, 2, 3, & 4
CA1014-1
4. Removed servo-valve covers on Pos. #1 pitch and yaw, Pos. #2 pitch and yaw, and Pos. #4 yaw actuators and disconnected all accelerometers.

August 13, 1965

1. Removed pitch and yaw actuators, Pos. #1, 2, & 3. Removed yaw actuator Pos. #4.

<u>Location</u>	<u>P/N Out</u>	<u>S/N Out</u>
#1 Pitch	50M35008	H.R. 016
#1 Yaw	50M35008	M. 13
#2 Pitch	50M35007	M. 23
#2 Yaw	50M35008	M. 25
#3 Pitch	50M35008	M. 22
#3 Yaw	50M35008	M. 19
#4 Yaw	50M35008	M. 17

2. Began cleaning soot from burned areas on Pos. #3 and 5.
3. Removed, cleaned and replaced water strainers in water pump No. 1 and No. 2 pump inlets, and Greer H.E. water supply line.

August 16, 1965

1. Delivered seven actuators to Astrionics Lab for re-work.
2. Completed cleaning engines Pos. #3 & 5.
3. Continued cocoon insulation removal on Pos. #3 and 5. (Wraparound lines and heat exchanger lines.)
4. Began engine torque checks, Pos. #1, 2, 3, 4, & 5.
5. Welded grating down at the Ne. entrance to the rolling deck.

August 17, 1965

1. Removed Pos. #1, pitch and yaw actuator return lines and gave lines, seals, nuts, bolts and washers to F-1 Stand to be used on F-2009, Test FW-011.

Pitch - P/N out R-1143, S/N out 000002

Yaw - P/N out R-1143, S/N out 000001

2. Performed dye penetrant check on turbine exhaust manifold, heat exchanger helium and LOX inlet and outlet flanges, and igniter bosses on Pos. #1, 2, 3, 4, & 5:

Pos. 1 - 3 - $\frac{1}{4}$ " weld cracks in omega joints.

Pos. 2 - 2 - $\frac{1}{4}$ " weld cracks in omega joints; 2 - $\frac{1}{4}$ " weld cracks at top of gussets.

Pos. 3 - 2 - $\frac{1}{4}$ " cracks in gusset welds.

Pos. 4 - 11 cracks in gusset welds.

Pos. 5 - y cracks in gusset welds.

See thrust chamber exhaust manifold damage report forms for location.

3. Removed cocoon from rolling deck and stored in Nw tower leg.

4. Stored Aircraft Poros Media filters in Nw. tower leg.

August 18, 1965

1. Performed heat exchangers drop-off test on helium and LOX coils on engine Pos. #1, 2, 3, 4, & 5:

<u>Pos.</u>	<u>S/N</u>	<u>LOX</u>	<u>He</u>
1	F-2005	4.5 ($\frac{1}{4}$ " seal)	3.5
2	F-2010	2.5	3.5
3	F-2008	4.0	4.0
4	F-2007	1.0	4.5 ($\frac{1}{4}$ " seal)
5	F-2003	1.5	5.0 ($\frac{1}{4}$ " seal)

2. Re-installed heat exchanger helium and LOX inlet and outlet flanges, torqued bolts. Used old seals, Pos. #1, 2, 3, 4, & 5.

3. Completed engine torque checks, Pos. #1, 2, 3, 4, & 5.

4. Delivered LOX pre valve to Fab Lab.

5. Cleaned up rolling deck and engine levels.

6. Removed pitot static pressure pickup from nozzle extension on Pos. #5.

7. Removed, inspected, and re-installed thrust chamber drain quick disconnects on Pos. #1, 2, 3, 4, & 5. New seals were used (901-SC, Pos. #1, 2, 3, & 5; 900-S, Pos. #4).

8. Began prep. on Pos. #5, S/N F-2003 for engine removal.

August 19, 1965

1. Completed prep. on engine Pos. #5 for removal.

2. Prepared engine Pos. #1 and 2 for removal:

a. Disconnected wraparound lines.

b. Removed all but four bolts in FPI and LPI.

c. Removed all but eight bolts on skirt.

d. Disconnected fuel bubbling lines and DA2010-1 and 2.

e. Removed four gimbal block bolts.

- f. Removed engine area purge lines.
- g. Removed overboard drain lines.
- 3. Had engine dollies and engine vertical installer delivered to test stand.
- 4. Had all electrical control and instrumentation cabling disconnected from Pos. #1, 2, & 5.
- 5. Disconnected flame curtains from Pos. #1, 2, & 5.
- 6. Removed access platform sections at Pos. #2 & 4.
- 7. Brought lift-a-loft to stand from support shop.

August 20, 1965

- 1. Loaded LOX outboard PVC compression tool and handling fixture on truck for shipment to Rocketdyne EFL.
- 2. Removed Engine Pos. #1, S/N F-2005 and sent to Engine Prep Shop.
- 3. Removed Engine Pos. #2, S/N F-2010 (one with cracked injector) and sent to Engine Prep Shop.

August 23, 1965

- 1. Removed the remainder of the cocoon insulation, Pos. #3 & 5.
- 2. Began re-installation of engine area purge lines, Pos. #3 & 5.
- 3. Ran cocoon purge checkout tests for data verification.
- 4. Tightened up all firex nozzles on rolling deck level and engine de-luges.
- 5. Installed drain valves on swirl chamber for hydraulic control system, Pos. #1, 2, 3, 4, & 5.
- 6. Began weld repair of rolling deck.

August 24, 1965

- 1. Continued installation of engine area purge tubing, Pos. #3 & 5.
- 2. Continued weld repair of rolling deck.
- 3. Fabricated and installed new handrail sockets for engine platforms, Pos. #4.

4. Ordered new gimbal block bolts, nuts, and washers.
5. Completed tightening all engine deluge and rolling deck level firex nozzles.
6. Removed flak curtain bracket covers and began fabrication of new metal covers.

August 25, 1965

1. Continued weld repair of rolling deck.
2. Completed fabrication of new flak curtain bracket covers, and installed on T-bird. (8 covers)
3. Began fabrication of new handrails for chamber entry rigs, made of aluminum (for 2 rigs).
4. Fabricated drain buckets for turbopump preservation operation.

August 26, 1965

1. Installed new southwestern pressure switch in hydraulic skid valve panel for hydraulic press. OK (1400 p.s.i. pickup, 1370 p.s.i.g. drop-out).
2. Completed weld repair of plating on rolling deck.
3. Continued fabrication of chamber entry rig personnel platforms.
4. Installed hand valve upstream of remote controlled valve in inert prefill line.
5. Installed new remote controlled solenoid valve in inert prefill line.

August 27, 1965

1. Released a section of skirt cocoon, Pos. #5, S/N F-2003, (portion around pitot tube) to Mr. Brunnett of Boeing by J. Odom's OK.
2. Began fabrication and installation of auxiliary hydraulic reservoirs fill line. (Off fuel fill line downstream of filter.)
3. Continued fabrication of chamber entry rig platforms.

August 28, 1965

1. Completed fabrication and installation of hydraulic auxiliary fill line.
2. Continued fabrication of thrust chamber entry rig platforms.
3. Replaced tygon tubing on thrust chamber drain hoses.

August 30, 1965

1. Replaced all thrust chamber 3/8" quick disconnects and added new lines as required to provide 4 each at each engine position.
- 2/ A slight amount of fuel drained from Pos. #1 and 2 hydraulic supply and return lines at Sta. 109 when M.E. Lab people disconnected umbilical plate No. 2. When air entered the lines, some residual fuel bled out of the lines.
3. Installed blind flanges on hydraulic supply and return stage interfaces, Pos. #1 & 2.
4. Completed fabrication of 2 new thrust chamber entry rig platforms and handrails.
5. Began fabrication of equipment cabinet at Pos. #4, rolling deck level.

August 31, 1965

1. Completed installation of preservative oil buckets and drain lines, Pos. #1, 2, 3, 4, & 5.
2. Modified thrust chamber entry rig by adding a ram bleed valve for emergency lowering.
3. Removed heavy grating over access panel for bottom of rolling deck at Ne. corner and fabricated a hinged access door.
4. Completed fabrication of equipment cabinet at rolling deck.
5. Modified thrust chamber entry rigs for portable extension cord, storage rack, quick removal of controls, and hooks for breathing gear and lamp.

September 1, 1965

1. Replaced GG injector assembly with latest configuration, Eng. S/N F-2003.

P/N out - 308331

S/N out - 3597918

P/N in - 308335

P/N out - 4073872

2. During injector disassembly, the strainer in the GG ball valve LOX inlet was found to have a portion of the wire strand missing at the apex of the wire mesh. Installed a new strainer assembly. P/N in and out - 308432.

3. Fabricated strainer screens for preservative oil drain buckets, Pos. #1, 2, 3, 4, & 5.

4. Sent old GG water shield covers to warehouse.

5. Bolted down two plates on rolling deck.

September 2, 1965

1. Installed shelf in new storage cabinet and painted.

2. Completed installation of new GG injector, S/N F-2003.

3. Began installation of thrust vector control system on S/N F-2003, hardware was obtained from S/N F-2010.

4. Began installation of name plates on engine service tubing interfaces.

5. Installed safety lines on engine access platforms where engines had been removed.

6. Delivered old GG injector from S/N F-2003 to Test Support Shop for dye penetrant inspection. No cracks were found. Hinkle stored injector.

September 3, 1965

1. Completed name plate installation on service tubing interfaces.

2. Installed name plates on hydraulic firex control panel. Installed missing nameplates on hydraulic skid valve panel.
3. Fabricated and installed new telephone stand for 12th level sw. tower leg.
4. Straightened up cabinets in 11th level sw. tower leg and performed general clean up.

September 7, 1965

1. Installed new bolts and locknuts on engine servicing ladders.
2. Checked all engine servicing flexhoses and replaced damaged ones.
3. Painted hoists and snatch blocks on engine level.
4. Removed remaining cocoon bracketry on S/N F-2003.
5. Fabricated and installed new hooks for holding back folddown portions of engine access platforms, Pos. #2, 4.

September 8, 1965

1. Mounted air breathing pump permanently on rolling deck.
2. Began fabrication of protective enclosure for air pump and breathing gear.
3. Began fabrication of handling dolly for actuators.
4. Began inspecting and preparing gimbal block bolts for engine installation.

September 9, 1965

1. Completed fabrication of protective enclosure for air pump and painted.
2. Cleaned inspected and lubricated actuator bolts for upper and lower connections.
3. Replaced all 3/8" tygon drain hoses, Pos. #2.
4. Fabricated and installed a door lock assembly for air pump enclosure.
5. Fabricated hanger assemblies for engine service ladders and installed on engine deck.

September 10, 1965

1. Cleaned, inspected, and lubricated all upper and lower actuator attach bolt assemblies.
2. Began fabrication and buildup of facility panels for MTF.

September 11, 1965

1. Continued fabrication and buildup of facility panels for MTF.
2. Removed nozzle extension and engine from Pos. #5, S/N F-2003.
3. Installed engine S/N F-2003 and nozzle extension in Pos. #2.
4. Installed new fuel pump inlet and LOX pump inlet seals with new bolts.
5. Installed gimbal block bolts and hooked up manual engine actuators to Pos. #2.

September 13, 1965

1. Continued fabrication and buildup of facility panels for MTF.
2. Continued hook-up of Pos. #2, S/N F-2003 as follows:
 - a. Torqued and dsfety wired LOX and fuel pump inlets.
 - b. Installed overboard drain lines.
 - c. Began installation of engine area purge tubing.
 - d. Hooked up wraparound.

September 14, 1965

1. Continued fabrication and buildup of facility panels for MTF.
2. Changed out engine servicing flexhoses, 9 each, at each engine position.
3. Continued hook-up of Pos. #2, S/N F-2003 as follows:
 - a. Torqued and safety wired wraparound lines.
 - b. Completed installation of engine area purge tubing.
 - c. Torqued nozzle extension bolts.

September 15, 1965

1. Continued fabrication and buildup of facility panels for MTF.
2. Changed out stop backup solenoid valve on Pos. #3, S/N F-2008.
P/N out - MV74E, S/N out - 309
P/N in - MV74VE, S/N in - 308.
3. Continued installation and hook-up of Pos. #2, S/N F-2003.

September 16, 1965

1. Continued fabrication and buildup of facility panels for MTF.
2. Fabricated a delta P gage control panel for performing heat exchanger coils drop-off tests.
3. Prepared rolling deck and engine access platforms for center engine installation.
4. Ordered new LOX and fuel pump inlet seals and bolts for F-3T1.

September 17, 1965

1. Installed engine in Pos. #5, S/N F-3T1. Installed nozzle extension using new seal and Falpro C5.
2. Hooked up stiff arms on Pos. #5. Stiff arms were not re-set. Used same lengths as for F-2003.
3. Hooked up wraparound lines and installed overboard drain lines.
4. When installing Pos. #5, the LOX and fuel PVC's were too short. LOX PVC was approx. 0.500-inch short, No. 1 fuel - 0.25-inch short, No. 2 fuel - 0.125 inches short. PVC's were connected to the pump inlets by using over length bolts and pulling them down.

September 18, 1965

1. Began installation of engine area purge tubing, Pos. #5, S/N F-3T1.
2. Installed bleed line and 0.200-inch orifice from fuel baby-pants to fuel H.P. duct.
3. Installed control system drain quick disconnect, Pos. #5.

4. Began fabrication of brackets and tubing for fuel bubbling line, Pos. #5.

5. Removed all static pressure transducers from Pos. #2, S/N F-2003 and installed on Pos. #5, S/N F-3T1.

September 20, 1965

1. Continued Pos. #5 installation as follows:

- a. Torqued and safeteyed LOX and fuel pump inlets.
- b. Torqued and safeteyed wraparound line and interfaces to stage.
- c. Torqued skirt.
- d. Installed overboard drain lines.

2. Completed installation of fuel bubbling lines, Pos. #5.

3. Continued buildup of MTF facility panels.

September 21, 1965

1. Began removal of all static pressure transducers for re-calibration Pos. #3, 4, & 5.

2. Continued buildup of MTF facility panels.

3. Performed H.E. LOX and helium coild drop-off tests. LOX - 4.5-inches, He - 4.0-inches, Pos. #5, S/N F-3T1.

4. Picked up five actuators from ASTR, delivered to ME Lab for set lengths, and then delivered them to test stand.

September 22, 1965

1. Began welding modifications to overboard drain line brackets on skirt of Pos. #5, S/N F-3T1.

2. Completed removal of all static pressure transducers from Pos. #2, 3, & 4 for re-calibration.

3. Picked up static pressure transducers from Ace Perry's shop (R-TEST-SA) Eng. S/N F-2010 and delivered to instrumentation for calibration.

4. Installed 5 H.R. actuators as follows:

<u>Eng. Pos.</u>	<u>Eng. S/N</u>	<u>Loc.</u>	<u>Outrigger</u>	<u>PPS/N</u>	<u>Length</u>
2	F-2003	Pitch	1	022	59.632
2	F-2003	Yaw	2	027	59.823
3	F-2008	Pitch	2	033	59.722
3	F-2008	Yaw	1	034	59.690
4	F-2007	Yaw	2	016	59.820

5. Continued buildup of MTF facility panels.
6. Returned 5 actuator shipping boxes to ASTR.
7. Fabricated brackets for pitch and yaw actuator delta P piston transducers, Pos. #2, 3, & 4.
8. Installed LOX dome flush kit, Pos. #5.

September 23, 1965

1. Completed welding overboard drain line brackets on skirt, Eng. S/N F-3T1.
2. Weld repaired all exhausterator cracks, Pos. #2, 3, & 4, S/N F-2003, F-2008, F-2007, respectively.
3. Weld repaired tube cracks on Pos. #2, S/N F-2003.
4. Welded modifications to overboard drain lines.
5. Picked up LOX heat exchanger coil bypass orifices from shop and installed as follows:
 - Pos. #2, S/N F-2003, .169-inch
 - Pos. #3, S/N F-2008, .169-inch
 - Pos. #4, S/N F-2007, .170-inch
6. Installed pitch and yaw brackets for actuator piston delta P, Pos. #2, 3, & 4.
7. Removed, flushed with trich and re-installed GG injector and combustor leak seal lines and overboard drain line.

8. Picked up combustor drain plug from S/N F-2010, Ace's shop, and installed on Pos. #5, S/N F-3T1.

9. Continued buildup of MTF facility panels.

10. Removed gimbal actuator locks, pitch and yaw actuators, Pos. #2, 3, & 4.

September 24, 1965

1. Weld repaired the lower hatband in two places on skirt, Pos. #5, S/N F-3T1.

2. Had skirt for Pos. 1, S/N F-4T2 delivered to stand and installed skirt seal and Falpro C-5.

3. Picked up two actuators from STTW and delivered to ME Lab for setting lengths.

4. Picked up above actuators from ME and returned to stand. Set lengths were set as follows: S/N 23 - 59.534, S/N 26 - 59.689.

5. Removed DA3003 for recalibration.

6. Prepared rolling deck and engine access platforms for Pos. #1 engine installation.

7. Delivered MTF facility panel No. 8 to paint shop in ME.

8. Continued buildup of MTF facility panel No. 7.

9. Ordered bolts and pump inlet seals for fuel and LOX, Pos. #1, and bolts for actuator supply and return lines.

10. Installed the following pressure transducers: DA33, DA9, DA5, DA7, DA10, DA11, DA8, DA3, Pos. #2, 3, 4, & 5.

September 25, 1965

1. Installed actuators in Pos. #1, for Eng. S/N F-4T2 as follows:

Pitch - S/N 026, 59.689-inches.

Yaw - S/N 023, 59.534-inches.

2. Installed engine S/N F-4T2 in Pos. #1, and nozzle extension. F-4T2

L0X pump was disassembled, cleaned and dried out down to the primary L0X seal before delivery to test stand.

3. Hooked up manual engine actuator on No. 2 side of engine, Pos. #1.
4. Hooked up both pitch and yaw actuators, Pos. #1.
5. Conducted hydraulic system checkout on A.M.F. hydraulic unit.
6. Disconnected hydraulic supply and return lines at flexhose interface and installed blind flanges.

September 27, 1965

1. Began installation of engine area purge tubing, Pos. #1.
2. Installed pitch and yaw actuator return lines, Pos. #2, S/N F-2003:
Pitch - P/N 60B83004-1A, S/N 00000002
Yaw - P/N 60B83004-1C, S/N 0000036
3. Hooked up, torqued, and safety wired pitch and actuator return lines, Pos. #1, 3, & 4.
4. Reinstalled DA3003.
5. Hooked up ground hydraulic supply and return lines at flexhose interface.
6. Installed overboard drain lines, Pos. #1. Wra
7. Hooked up torqued, and safety wired wraparound lines, Pos. #1.
8. Torqued and safety L0X and fuel pump inlets, Pos. #1.
9. Installed the following pressure transducers:
Pos. #1 DA33, DA9, DA5, DA2, DA7, DA10, DA11, DA8, DA3, DA6, DA14A, DA1018, DA1019, DA1A, DA12A, DA4, DA1, DA7A, DA12, DA37, DA22, DA14, DA39.
Pos. #2 DA1018, DA1019, DA1, DA12A, DA2, DA14, DA6, DA14A, DA4, DA12, DA22, DA7A, DA1A, DA39.
Pos. #3 DA7, DA1018, DA14A, DA12, DA4, DA1, DA2, DA14, DA6, DA39, DA12A, DA1019, DA22, DA1A.
Pos. #4 DA1018, DA1019, DA6, DA1, DA12A, DA1A, DA12, DA14A, DA4, DA22, DA39, DA7A, DA2, DA1A

Pos. #5 DA1A, DA37, DA14, DA4, DA39, DA12A, DA1, DA2, DA6, DA7A, DA12, DA14A, DA22.

10. Installed orifice in downstream side of stop backup solenoid valve, Pos. #2. (0.060-inch dia.)

September 28, 1965

1. Inspected main injectors, Pos. #1 & 5, and found the following discrepancies:

a. Position #5, S/N F-3T1 - the radial baffle dividing compartments 11 and 12 was found eroded in an area approximately 1-inch inside the edge of the outer circumferential baffle on the #12 compartment side. The erosion was approximately $1\frac{1}{2}$ -inches wide by $2\frac{1}{2}$ -inches long and about $\frac{1}{2}$ -inch deep at the upper end.

b. Position #1, S/N F-4T2 - The radial baffle to injector weld was cracked (hairline) approx. $\frac{1}{4}$ -inch long on the compartment No. 7 side adjacent to the outer circumference of the injector.

2. Performed heat exchanger coils drop-off test, Pos. #1, S/N F-4T2. LOX - 3.5", He -3.0".

3. Completed engine area purge tubing installation, Pos. #1, S/N F-4T2.

4. Torqued nozzle extension bolts, Pos. #1.

5. Removed and stored throat plugs, Pos. #1 & 5.

6. Installed LOX H.E. coil bypass orifice, Pos. #1, out - .200, in - .170-inch.

7. Ordered skirt igniter adapters for Pos. #1 & 5.

8. Fabricated bracket for DA5004-1 and installed.

9. Fabricated and installed new fuel bubbling line, Pos. #1.

10. Installed the following pressure transducers:

[DA13, DA13A, DA2010, DA4000, DA4009], [DA1015, DA1017, DA1013], [DA18,]

↓
Pos. 1, 2, 3, 4, & 5

↓
Pos. 1, 2, 3, & 4

↓
Pos. #1

September 29, 1965

1. Prepared Pos. #5, S/N F-3T1 for removal. Installed protective closures over LOX and fuel pump inlets.
2. Removed nozzle extension and engine from Pos. #5, S/N F-3T1, and delivered to engine Prep Shop for injector replacement. Plastic weather protector was installed completely over dishpan. Also, was installed on the engine, the entire blue plastic weather cover.
3. Replaced rolling deck in full closed position.
4. Center engine was removed without having to remove any other engines, skirts, or any engine access platforms. The Pos. 4 chamber exit spray manifold and the Se. Pos. #5 chamber exit spray manifolds were removed. Rolling deck and engine installer were operated simultaneously for removal.
5. Removed the LOX high pressure duct drain plugs from Pos. #1, S/N F-4T2 and inspected for water. NONE. Reinstalled plugs.
6. Checked the orifice size in stop back-up solenoid, Pos. #4 - 0.039-inch.
7. Checked the LOX and fuel PVC's on Pos. #5, Eng. S/N F-3T1 (Flexonics ducts). Measured the length of the center position of the bellows with engine installed:

LOX PVC center bellows - 5 5/8-inches

No. 1 Fuel PVC center bellows - 6 3/8-inches

No. 2 Fuel PVC center bellows - 6 1/2-inches

September 30, 1965

1. Installed Pos. #5, S/N F-3T1 after injector replacement, and nozzle extension.
2. Torqued and safety wired LOX and fuel pump inlets; torqued skirt bolts; hooked up, torqued and safety wired wraparound lines; installed overboard drain lines; installed engine area purge tubing; hooked up stiff arms; used new LOX and fuel pump inlet bolts; installed chamber drain disconnects.

3. Changed out 0.060-inch orifice to 0.040-inch orifice in discharge side of stop-backup solenoid, Pos. #2.
4. Reinstalled 0.039-inch orifice in discharge side of stop-backup solenoid, Pos. #4.
5. Checked alignment of Pos. #1, S/N F-4T2 with results as follows:
Off $\frac{1}{4}$ -inch to the east and 2 $\frac{7}{8}$ -inches to the north.
6. Conducted high LOX dome and GG LOX injector purge checkout with results as follows:

Loader in Boeing Panel -1050 p.s.i.g.

DA4033 (Umbilical Supply) -740 p.s.i.g.

DA4000 (Engine CCP)-1 600 p.s.i.g.

-2 630 p.s.i.g.

-3 615 p.s.i.g.

-4 610 p.s.i.g.

-5 607 p.s.i.g.

CA4019 (Umb. Supply Temp) -

7. Conducted LOX pump seal purge checkout by pressurizing stage purge sphere to 1500 p.s.i.g. Results as follows:

DA4009 -1 - 84 p.s.i.g. (Engine CCP)

" -2 - 86 p.s.i.g.

" -3 - 85 p.s.i.g.

" -4 - 84 p.s.i.g.

" -5 - 84 p.s.i.g.

October 1, 1965

1. Removed manual engine actuators, pitch and yaw, from all outboard engine positions.
2. Removed gimbal actuator locks, Pos. #1.
3. Performed ground hydraulic system components test. Received erroneous

indication of A.M.F. filter high delta P. Failed to pick up open indication on A.M.F. return valve.

4. Brought up hydraulics, A.M.F. 4-pumps, pressurized to 1500 p.s.i.g. and performed all leak checks on facility, stage, engine closing control, and thrust vector control systems. All hydraulic leak checks completed except for engine opening control system. Ran hydraulics for approx. $1\frac{1}{4}$ hrs. flush.

5. Removed drain quick disconnects from MFV's, Pos. #1, S/N F-4T2 and installed 3/4-inch plugs.

6. With hydraulics up, checked null position on all actuators:

<u>Pos.</u>	<u>Pitch Act. Shift</u>	<u>Yaw Act. Shift</u>
1	9'	12'
2	0	6'
3	6'	6'
4	0	9'

7. Trich flushed LOX dome on Position #1, S/N F-4T2 with low LOX dome purge on. (125p.s.i.g. on loader).

8. Filled inert prefill tank to 2000 gal. of 50% ethylene glycol-water solution.

9. Repaired leaks on A.M.F. hydraulic unit.

10. Installed brackets and pickups for DA15-1, 2, 3, 4, & 5.

11. Installed CA1A-1 and CA1A-5.

12. Leak checked hydraulic supply and return lines in stage from umbilical No. 2 engine ccp's.

13. Checked out and re-set pressure switch to 100 p.s.i.g. in inert pre-fill supply line.

14. Modified engine platforms for clearance at Pos. #2 and 4.

15. Hooked up all engine service lines.

October 2, 1965

1. Flushed the LOX domes and GG LOX injectors, Positions #2 and 5.
2. Brought up hydraulics (A.M.F. unit) and completed control system leak checks.
3. Performed engine components test. Failed to pick up open signal on No. 1 MLV, Pos. #2, S/N F-2003. Failed to get indications on Pos. #5 stop-backup solenoid. Failed to get turbopump heater power, Pos. #4, S/N F-2007.
4. Activated low LOX dome purge system, Loader - 360 p.s.i.g.; Reg. outlet - 350 p.s.i.g., DA4000-1 - 200 p.s.i.g.
5. Performed 5 engine sequence tests.
6. Applied gimbal servo-valve current to pitch actuators and exercised pitch actuators, Pos. #1, 2, 3, & 4.
7. Performed all engine purge systems leak checks.
8. Trouble-shoot No. 1 MLV switch problem. Attributed to control wiring.
9. Changed out DA13-4 and DA18-1.

October 4, 1965

1. Pressurized to 10 p.s.i.g. the LOX and fuel propellant feed systems and leak checked.
2. Changed out stop-backup solenoid valve, Pos. #5, S/N Out - 159; S/N In - 158.
3. Picked up new gimbal block torque wrench from machining shop and checked out operation. Design M.A. was 6:1, True M.A. is 5:1.
4. Torqued gimbal block bolts, Pos. #1 and 5.
5. Removed manual engine actuators from stage Pos. #1, 2, and 4.
6. Leak checked LOX and fuel pressurization systems.
7. Picked up eight new Resistoflex actuator return ducts from P&VE. Ducts had not been cleaned.
8. Brought up A.M.F. hydraulic unit and performed complete engine components

and sequence tests. Attempted stage sequence test.

9. Pos. #2 yaw actuator has a bad leak at the servo-current connector (S/N 027). Pos. #2 pitch actuator is nervous. (S/N 022).

10. Torqued gimbal block bolts, Pos. #2. Set torque wrench to 1450 in. - lbs.

11. Encountered trouble starting No. 1 main motor on A.M.F. hydraulic unit. High current overload would kick motor out of startup. Suspect check valve failure downstream of compensators on either pump No. 1 or No. 2.

12. Checked out Pos. #4 turbopump heater problem. Engine OK - Open circuit in control wiring.

October 5, 1965

1. Changed out $\frac{1}{4}$ -inch check valve in compensator outlet lines, pumps No. 1 and No. 2, A.M.F. hydraulic unit.

2. Trouble-shot main motor No. 1, A.M.F. unit startup problem. Electrical problem. No current to unload valve at start command.

3. Actuated pitch and yaw actuators, Pos. #2. Pitch has bad vibration. Yaw has bad leak at servo-current input connector. Both must be changed out prior to firing.

4. Installed nozzle extension igniter adapters, 2 each, Pos. #1 and 5.

5. Installed gimbal block boots, Pos. #1, 2, & 5.

6. Changed out: DA3-5, CA2-1, CA9-1, CA1014-1, CA4009-5, CA2-2, CA9-2, CA4008-5, CA2-3, CA9-3, CA10-1, CA2-4, CA9-4, CA10-5, CA2-5, CA9-5

7. Removed DA5A-2, 3, & 4.

8. Installed pitch and yaw manual engine actuators, Pos. #2.

9. Performed engine components and sequence tests.

10. Found fuel leak on opening control port, Pos. #1, S/N F-4T2, No. 2 MFV.

11. Changed out following flight transducers: D9-1 P/N Out - NA5-27316T15-1C, S/N Out - 1703; P/N In - NA5-27316T15-1C, S/N In - 2133

D9-5 P/N Out - NA5-2712T15, S/N Out 3946; P/N In - NA5-27316T15-1C, S/N In - 2131

D10-5 P/N Out - NA5-27316T1-1C, S/N Out - 2121; P/N In - NA5-27316T1-1C, S/N In - 2122

Bad transducers were given to Bob Henry for investigation and UCR written up.

12. All main engine valves were cycled five times.

October 6, 1965

1. Trich flushed, water flushed, and leak checked thrust chamber jackets, Pos. #1 & 5.

2. Water leak checked thrust chamber jackets, Pos. #2 & 3.

3. Installed manual engine actuators and gimbal actuator locks, Pos. #2.

4. Picked up two new actuators and changed out Pos. #2 actuators.

Pitch (P/N 50M35008) S/N Out - 022, S/N In - 031

Yaw (P/N 50M35008) S/N Out - 027, S/N In - 052

5. Pressurized inert prefill tank and checked out pressure switch and inert prefill valve. OK.

6. Continued trouble-shooting A.M.F. hydraulic unit. Everything worked OK. Problem appears to be intermittent. Either MV74 hangs up or control relay sticks.

7. Conducted several sequence tests. High LOX dome purge comes on at X-20 sec. (Full pressure).

8. Exercised pitch and yaw actuators, Pos. #2.

9. Removed manual engine actuators and gimbal actuator locks from Pos. #2.

10. Retorqued Pos. #1, S/N F-4T2, MFV No. 2 opening control seal and stopped leak.

11. All main engine valves were cycled 9 times.

October 7, 1965

1. Brought up hydraulics, A.M.F. unit, and calibrated all actuators.
2. Conducted components test.
3. Performed 3 sequence tests with oscillographs on. One sequence test, the T. E. and GG igniters were hot-fired. Failed to pick up GG ball valve open signal, all engine positions, all three sequence tests.
4. Performed dry-run gimbal program.
5. During actuator calibration, pitch and yaw actuators, Pos. #1, had high frequency oscillations at 0.2° retract.
6. Installed $\frac{1}{4}$ -inch hand loader and 0-200 p.s.i.g. gage in F.P. No. 5 and plumbed $\frac{1}{4}$ -inch line to bottom of preservative oil tank for agitation. Installed $\frac{1}{4}$ -inch check valve at bottom of tank inlet.
7. Installed delta P level gage and 0-500 p.s.i.g. pressure gage on preservative oil tank.
8. Removed manual engine actuators, Pos. #2.
9. Installed manual engine actuator heat shield covers, Pos. #1, 2, 3, & 4.
10. Patched tube crack in S/N F-2003, Pos. #2 with R.T.V.

October 8, 1965

1. Brought up hydraulics, A.M.F. unit, at 9 a.m. and took hydraulic samples at 10 a.m. See sample log book for results.
2. Ran engine sequence test with oscillographs for GG ball valve signals.
3. Performed engine components test and one more sequence test for control.
4. Did not get GG ball open on oscillograph. Cycled each engine, one at a time and metered GG ball valve switches to verify ball valve operation. All switches OK.
5. Filled A.M.F. hydraulic reservoir during fuel fill operations.
6. Recalibrated all pitch and yaw actuators.

7. Approximately 12:30 p.m., Pos. #2 yaw actuator return line was found cracked and leaking. Shutdown hydraulics and changed out line:

P/N Out - 60B83004-1C, S/N Out - 0000036

P/N In - 60B83004-1B, S/N In - 0000006

8. Repeated hydraulic sample analysis.

9. Developed pump heater problem, Pos. #5, S/N F-3T1 after LOX loading. Problem was blown fuse in Control current amplifier.

10. Completed all items on pre-test countdown.

11. Conducted S-1C-11, duration.

12. Secured test facility and went home.

October 11, 1965

1. Brought up hydraulics and performed trich flush and water flush procedure on all engines.

2. Water leak checked thrust chamber jackets, all engine position. Old leak on S/N F-2003, Pos. #2 reoccurred. Leak was due to transverse weld crack, tube 95, zone 2.

3. Preserved turbopumps, Pos. #1 thru 5.

4. Inspected main injectors, Pos. #1 thru 5. Pos. #3 was found cracked. Refer to inspection report for details.

5. Gage readings on tap LBI during turbopump preservation were as follows:

Pos. #1 - 200 p.s.i.g.

Pos. #2 - 190 p.s.i.g.

Pos. #3 - 215 p.s.i.g.

Pos. #4 - 200 p.s.i.g.

Pos. #5 - 240 p.s.i.g.

Tank was pressurized to 240 p.s.i.g.

October 12, 1965

1. Began preparing Pos. #3, S/N F-2008 for removal.

a. Drained down hydraulic control system.

b. Disconnected all wraparound lines from stage and installed protective covers.

c. Removed overboard drain lines.

d. Disconnected engine area purge lines.

e. Removed all but four LOX and fuel pump inlet bolts.

f. Removed 4 gimbal block bolts.

g. Removed all but 8 nozzle extension bolts.

h. Disconnected actuators, installed locks.

i. Installed manual engine actuators.

j. Disconnected flame curtain from dishpan.

2. Began preparation on Pos. #5, S/N F-3T1 for cocoon insulation installation.

3. Removed engine area purge tubing from Pos. #5.

4. Prepared rolling deck and engine access platforms for engine removal.

October 13, 1965

1. Removed Engine Position No. 3, S/N F-2008 and sent to R-TEST-SA for injector replacement.

2. Removed nozzle extension from Pos. #3, S/N F-2008 and set on ground level at base of test stand.

3. Put rolling deck back in and secured.

4. Secured engine access platforms.

October 14, 1965

1. Began rounding up hardware for filter installation on hydraulic skid.

2. Installed new gasket and Falpro C-5 on nozzle extension flange, for Pos. #3, S/N F-2008.

3. Began engine torque checks on Positions No. 2 and 5.

October 15, 1965

1. Installed new fuel pump balance cavity return lines on Pos. #1, S/N F-4T2 and Pos. #2, S/N F-2003:

Pos. #1

P/N Out - 19-458782

S/N Out - None

P/N In - 19-458784

S/N In - None

Pos. #2

P/N Out - 19-458782

S/N Out - None

P/N In - 19-458784

S/N In - None

2. Began familiarization of Boeing personnel with facility and operations.
3. Began cocoon installation on Pos. #5, S/N F-3T1.
4. Installed 0.843 orifices in fuel pump balance cavity return lines, Pos. #1 and #2. Same as old ones.

October 16, 1965

1. OFF-DAY.
2. Ace's people worked on cocoon installation, Pos. #5.

October 18, 1965

1. Installed fuel pump balance cavity return line on Pos. #5, S/N F-3T.

P/N Out - 19-458782

S/N Out - None

P/N Out - 19-458784

S/N In - None

2. Installed engine and nozzle extension in Pos. #3, S/N F-2008.
3. Completed engine torque checks on Pos. #1, 2, 4, and 5.
4. Dye penetrant inspected the turbine exhaust manifolds on Pos. #1, 2, 4, and 5. OK.
5. Installed 0.844 orifice in fuel pump balance cavity return line, Pos. #5, S/N F-3T1 - Same as old ones.
6. Continued cocoon insulation installation.

October 19, 1965

1. Completed installation of Pos. #3, S/N F-2008 as follows:
 - a. Torqued and safety wired LOX and fuel pump inlets.

- b. Installed and torqued overboard drain lines.
 - c. Hooked up and torqued wraparound lines.
 - d. Connected engine area purge lines.
 - e. Hooked up actuators to engine, torqued, and connected and torqued actuator supply lines.
 - f. Torqued nozzle extension bolts.
 - g. Installed chamber drain disconnects.
 - h. Removed gimbal actuator locks.
2. Secured engine access platforms and installed hand rails.
 3. Installed new fuel pump balance cavity return in Pos. #4, S/N F-2007:

P/N Out - 19-458782	P/N In - 19-4588784
S/N Out - None	S/N In - None
 4. Changed out pitch and yaw actuator return lines on Pos. #3, S/N F-2008:

<u>Pitch</u>	<u>Yaw</u>
P/N Out - 60B83004-1F	P/N Out - 60B83004-1F
S/N Out - 000007S	S/N Out - 0000062
P/N In - R11423-5	P/N In - R11423-5
S/N In - 05	S/N In - 06
 5. Completed torque checks on Pos. #3, S/N F-2008.
 6. Changed out control orifices in Pos. #5, S/N F-3T1 as follows:

#1 MLV Opening - Out - 0.161, In - 0.180
#2 MLV Opening - Out - 0.161, In - 0.180
#1 MFV Opening - Out - 0.089, In - 0.082
#2 MFV Opening - Out - 0.089, In - 0.082
GG ball valve opening - Out - 0.079, In - 0.098
 7. Fabricated and installed new bracket for stop backup solenoid, Pos. #5.
 8. Installed 0.775 orifice in fuel pump balance cavity return line, Pos. #4, S/N F-2007. Same as old one.
 9. Continued cocoon insulation installation.

October 20, 1965

1. Changed out pitch and yaw actuator return lines, Pos. #1, S/N F-4T2; Pos. #2, S/N F-2003; and Pos. #4, S/N F-2007, using new seals and bolt assemblies. Torqued and safety-wired all connect flanges.

Pos. #1	P/N Out - 60B83004-1F S/N Out - 0000066	P/N Out - 60B83004-1F S/N Out - 0000064
	P/N In - R11423-5 S/N In - 01	P/N In - R11423-5 S/N In - 02
Pos. #2	P/N Out 60B83004-1A S/N Out - 0000002	P/N Out - 60B83004-1B S/N Out - 0000006
	P/N In - R11423-5 S/N In - 04	P/N In - R11423-5 S/N In - 03
Pos. #4	P/N Out - 60B83004-1F S/N Out - R11423-5	P/N Out - 60B83004-1E S/N Out - 0000065
	P/N In - R11423-5 S/N In - 08	P/N In - R11423-5 S/N In - 07

2. Installed new fuel pump balance cavity return line, Pos. #3, S/N F-2008:
P/N Out - 19-458782, P/N In - 19-458784
S/N Out - None, S/N In - None
3. Weld repaired chamber tube leak, Pos. #2, S/N F-2003.
4. Fabricated and installed calorimeter purge line, Pos. #5, S/N F-3T1.
5. Deleted GG injector to combustor and GG combustor to turbine inlet leak seal parts and overboard vent line, Pos. #5, S/N F-3T1.
6. Installed 0.843 orifice in fuel pump balance cavity return line, Pos. #3, S/N F-2008, same as old one.
7. Continued cocoon insulation installation.

October 21, 1965

1. Changed out MV74 pump unload solenoid valve for main motor No. 1, A.M.F. hydraulic unit.

2. Changed out boost pump pressure OK pressure switch on A.M.F. hydraulic unit. Replaced old dual-snap with Wouthwestern. New switch set at 50 p.s.i.g.

3. Changed out control orifices in Pos. #1, 2, 3, & 4 as follows:

Pos. #1, S/N F-4T2:

#1 MLV Opening - Out - 0.161	In - 0.180
#2 MLV Opening - Out - 0.161	In - 0.180
#1 MFV Opening - Out - 0.089	In - 0.180
#2 MFV Opening - Out - 0.089	In - 0.082
GG Ball Valve Opening - Out - 0.079	In - 0.098

Pos. #2, S/N F-2003:

#1 MLV Opening - Out - 0.160	In - 0.180
#2 MLV Opening - Out - 0.161	In - 0.180
#1 MFV Opening - Out - 0.089	In - 0.082
#2 MFV Opening - Out - 0.089	In - 0.082
GG Ball Valve Opening - Out - 0.079	In - 0.098

Pos. #3, S/N F-2008:

#1 MLV Opening - Out - 0.161	In - 0.180
#2 MLV Opening - Out - 0.161	In - 0.180
#1 MFV Opening - Out - 0.088	In - 0.082
#2 MFV Opening - Out - 0.089	In - 0.082
GG Ball Valve Opening - Out - 0.079	In - 0.098

Pos. #4, S/N F-2007:

#1 MLV Opening - Out - 0.161	In - 0.180
#2 MLV Opening - Out - 0.161	In - 0.180
#1 MFV Opening - Out - 0.089	In - 0.082
#2 MFV Opening - Out - 0.089	In - 0.082
GG Ball Valve Opening - Out - 0.079	In - 0.098

4. Flushed LOX dome and GG LOX injector on Pos. #3, S/N F-2008.
5. Replaced the following transducers:
DA1-3, CA2-2, CA9-2, DA7-1, DA15-3, CA2-3, CA9-3, DA18-1, CA9-1, CA2-4,
CA9-4, DA13-2, CA2-1, CA2-5, CA9-5.
6. Removed manual engine actuators from Engine Positions No. 2, 3, and 4.
7. Removed gimbal actuator locks, Pos. #3.
8. Continued cocoon insulation installation.

October 22, 1965

1. Brought up hydraulics and performed engine components test. (A.M.F. unit)
2. Ran quick check test on high LOX dome purge system after new 2-inch supply line installation. DA4000-1 through 5 ranged from 640 to 660 p.s.i.g. with loader at 1000 p.s.i.g.
3. Checked out LOX pump seal purge - OK.
4. Checked out hydraulic supply flowmeter.
OK at 1525 p.s.i.g., flowrate was 108 g.p.m.
5. Changed out flight transducer DI7-5:
P/N Out - NA4-27316T20-1C, P/N In - NA5-27316T20-1C
S/N Out - 2484, S/N In - 1372
6. Changed out DA5004-1.
7. Installed pitch and yaw potentiometers for dome plane measurements on Pos. #1 & 3. Fabricated bracket for No. 3 yaw potentiometer.
8. Changed out DA5004-1.
9. Pressurized fuel system to 12 p.s.i.g. and leak checked all positions.
10. Relocated DA15-3.
11. Set up for components and sequence tests.
12. Continued cocoon insulation installation.

October 23, 1965

1. Removed manual engine actuators from Pos. #3 and 4 and secured on level
- 10.

2. Ran stage components and sequence test with engine simulators installed.
3. Ran engine components and sequence test.
4. Began calibration on engine actuators. Calibrated Pos. #4, Pitch and Yaw.
5. Yaw actuator, Pos. #2 went rough with hydraulics up. Installed 1/16-inch orifice in actuator supply line and installed gimbal actuator lock.
6. Stage hydraulic return line flex-hose ruptured while stepping Pos. 2 yaw actuator $\pm 2^\circ$.
7. Replaced stop-backup solenoid valve on Pos. #3, S/N F-2008.
P/N Out - MV74VE, P/N In - MV74VE
S/N Out - 308, S/N In - 312
8. Replaced bearing coolant pressure transducer, Pos. #4, S/N F-2007.
P/N Out - NA5-27316T10-1C, P/N In - NA5-27316T10-1C
S/N Out - 1688, S/N In - 1979
9. Changed out stage hydraulic return hose
P/N Out - , P/N In -
S/N Out - , S/N In -
10. Continued cocoon insulation installation.

October 25, 1965

1. Ran LOX dome purge test. No data was obtained on umbilical pressure; therefore, test must be repeated.
2. Pressurized the fuel and LOX pressurization systems and leak checked.
OK.
3. Changed out the main fuel feed and the GG LOX feed orifices in Pos. #1, S/N F-4T2 as follows:
MFV No. 1: Out - RD251-4100-3784
In - RD251-4100-3870
MFV No. 2: Out - RD251-4100-3784
In - RD251-4100-3871

GG LOX: Out - RD251-4072-1004

In - RD251-4072-1046

4. Changed out DA1-4 and DA2-4
5. Ran purge sphere and LOX pump seal purge test.
6. Continued cocoon insulation installation.

October 26, 1965

1. Ran LOX dome purge test with results as follows:

DA4033 (umbilical) - 751 p.s.i.g.

DA4000-1 - 615 p.s.i.g.

DA4000-2 - 632 p.s.i.g.

DA4000-3 - 632 p.s.i.g.

DA4000-4 - 612 p.s.i.g.

DA4000-5 - 624 p.s.i.g.

Loader supply was 950 p.s.i.g. No calibration on temperature at umbilical.

2. Calibrated Pos. #1, 2, and 3 pitch and yaw actuators with control and oscillographs. Did not calibrate GA22-1 and 3 and GA23-1 and 3.
3. Ground supply duct to gimbal filter manifold, Pos. #3, S/N F-2008 was found with broken wire braid and a deformed convolution. Must replace prior to test S-1C-12.
4. Changed out yaw actuator, Pos. #2.
P/N Out - 50M35008, P/N In - 50M35008
S/N Out - 052, S/N In - 014
5. Calibrated yaw actuator, Pos. #2 with control and oscillograph.
6. Ran cocoon purge test. CCP pressure was 132 p.s.i.g. at 200° F at flow-meter.
7. Continued cocoon insulation installation.
8. Weld repaired the prefill detector braces on Pos. #2, 3, & 4.

Run thru here for 10m

October 27, 1965

1. Changed out the ground supply duct to gimbal filter manifold, Pos. #3, S/N F-2008.

P/N Out - 60B83004-3E, P/N In - 60B83004-3E

S/N Out - 0000022, S/N In - 0000030

2. Ran cocoon purge test. CCP pressure was 132 p.s.i.g. Could not obtain temperature above 105° F. Must repeat test.

3. Pressurized LOX and fuel systems and leak checked. OK.

4. Changed out DA5004-1.

5. Changed out CA4019-5 (cocoon purge).

6. Began operation and checkout of Greer hydraulic unit. Ran hydraulics to the engines at 200 p.s.i.g.

7. Continued cocoon insulation installation.

8. Discovered damaged braid on hypergol to injector line assy., Pos. #3, S/N F-2008. Line had been burned by weld arch when repairing prefill detector braces. Must be changed prior to test S-IC-12.

October 28, 1965

1. Continued checkout of Greer hydraulic unit. Pumps No. 1 and No. 2 are calibrated.

2. Brought up A.M.F. hydraulic unit, both main motors for gimbal system calibration. Attempted to calibrate GA22-1 and 3 and GA23-1 and 3. No luck; instrumentation troubles.

3. Developed leaks on A.M.F. and Greer supply valves. Seals must be changed prior to test S-IC-12.

4. Ran cocoon purge test again. Bad thermocouple. Must repeat test.

5. Changed out CA4019-5 (cocoon purge).

6. Completed cocoon insulation installation.

7. Received new engine supply line to gimbal filter manifold for Pos. #1, S/N F-4T2.

Friday, October 29, 1965

1. Changed out engine supply line to gimbal filter manifold, Pos. #1, S/N F-4T2.

P/N Out - R1162D-1, P/N In - 60B83107-1A

S/N Out - None, S/N In - 1000003

2. Changed out hypergol to injector line assy., Pos. #3, S/N F-2008

P/N Out - 407877, P/N In - 407877

S/N Out - None, S/N In - None

3. Calibrated GA22-1 and 3 and GA23-1 and 3 with control and oscillograph.
4. Completed checkout of Greer hydraulic unit. All problems encountered were electrical controls.

October 30, 1965

1. Removed A.M.F. and Greer supply valves from system and installed new split housing seals. Reinstalled valves.
2. Fabricated adapter block for A.M.F. supply valve position indicators and installed.
3. Changed out O-ring seal on GN₂ supply to accumulator panel.

November 1, 1965

1. Discovered leak on A.M.F. supply valve grayloc hub. Changed out seal ring.
2. Reset A.M.F. and Greer supply valve position switches. Installed new cam follower drive shaft on Greer supply valve switches.
3. Brought up Greer hydraulic unit at 10:45 a.m.
4. Discovered fuel leak on opening port of GG ball valve, Pos. #4, S/N F-2007. Installed new orifice seal (0.098-inch) and leak was still there. Further investigation revealed a small pin hole in the supply block assembly. The line was removed by cutting in half. A new line was installed by cutting in half and installing a union. Investigation of the old line

revealed a large metal erosion internal to the block assembly.

P/N Out -

P/N In - 602054

S/N Out -

S/N In - None

5. Filled A.M.F. and Greer hydraulic reservoirs while tanking fuel to the vehicle.
6. Ran one engine components, one engine sequence test and two complete stage and engine sequence tests.
7. Recalibrated pitch and yaw actuators, Pos. #1 through 4, with control and oscillographs.
8. Tanked fuel below pre valves. Pressurized fuel tank and leak checked fuel system, all engine positions.
9. Closed pre valves and drained down engines.
10. Ran dry run gimbal program with oscillographs on.

November 2, 1965

1. Drained hydraulic control system and inspected GG ball valve opening control lines, Positions #1, 2, and 3. Positions #2 and 3 had slight erosions in the block assembly. Pos. #1 line, engine S/N F-4T2 had a large erosion internal to the block assembly. The line was removed by cutting in half. A new line was installed in Position #1 by cutting in half and installing a union.

P/N Out -

, P/N In - 601561

S/N Out -

, S/N In - None

2. Reran dry run gimbal program after recalibrating all pitch and yaw actuators with control and oscillographs.
3. Checked off S-IC-12 measuring program.
4. Pos. #1, GG ball valve opening control line was modified to block #1 type configuration by welding sleeve adapters before installation.

5. Ran engine components test and engine sequence test.

November 3, 1965

1. Brought up hydraulics, Greer unit at 7:10 a.m.

2. Conducted engine components test.

3/ Rechecked calibration on pitch and yaw actuators, Pos. #1 through

4.

4. Took hydraulic samples at approximately 10 a.m. See sample log book for results.

5. Dropped fuel to the engines, pressurized fuel tank, and leak checked. OK.

6. Developed LOX leak on Pos. #1, at LPI/PVC leak meter. Disconnected line and installed cap.

7. After tanking LOX, pressurized LOX tank to 12 p.s.i.g. and leak checked OK.

8. Completed all items on the Saturn pre-test countdown procedure No. 59.

9. During chamber prefill operations, times were as follows:

Pos. #1 - 15 sec. Tank pressure was 200 p.s.i.d. umbilical

Pos. #2 - 18 sec. pressure was 90 p.s.i.g.

Pos. #3 - 19 sec.

Pos. #4 - 15 sec.

Pos. #5 - 17 sec.

10. Conducted test S-IC-12 at 4:41 p.m. Duration was 90.64 seconds main-stage. Premature cutoff by redline observer. Human error on LOX tank ullage pressure.

11. Drained engine fuel system, boiled off residual LOX, secured facility, and went home.

November 4, 1965

1. Trich. flushed and water flushed thrust chamber jackets, Pos. #1 through 5.
2. Preserved turbopump bearings, Pos. #1 through 5.
3. Water leak checked the thrust chamber tubes, Pos. #1 through 5. Pos. #1, 3, 4, & 5 OK. Position #2 has 4 seep leaks at bottom of jacket manifold. Will repair with RTV.

November 5, 1965

1. Trich. flushed LOX dome and GG LOX injector on Pos. #3.
2. Began cocoon insulation removal, 5 panels only, Pos. #5, S/N F-3T1 for repair.
3. Began engine torque checks, Pos. #1 and 5.
4. Inspected main injectors, Pos. #1 through 5. Positions #2 through 5 OK. On Pos. #1, S/N F-4T2, a 0.007-inch separation approximately $2\frac{1}{2}$ inches long was found in compartment 1 at the baffle toiland weld area just outside the outer circumferential baffle.

November 6, 1965

OFF-DAY

November 8, 1965

1. Set up chamber entry rig and reinspected injector, Pos. #1, S/N F-4T2. Crack was verified. Decision to remove engine for injector replacement.
2. Greer factory representatives began retro-fit modifications to Greer hydraulic unit.
3. Continued engine torque checks, Pos. #1 through 5.
4. Continued partial cocoon insulation removal, Pos. #5, S/N F-3T1.
5. Changed out ground half 3/4-inch quick disconnect on Pos. #3.
6. Drained hydraulic control system, control lines, Pos. #1 through 5 and inspected for erosions. All positions were eroded except for Pos. #1.

Positions #2 and 3 were worst. Must be reinspected prior to next test with possible change out.

7. Changed out CA9-1 through 5.

8. Changed out CA2-1 through 5.

November 9, 1965

1. Brought up hydraulics, A.M.F. unit, and ran engine components and sequence tests.

2. Began preparing Pos. #1, S/N F-4T2 for removal:

a. Disconnected and capped off all wraparound and crossover lines.

b. Disconnected overboard drain lines.

c. Disconnected engine area purge lines.

d. Removed all but 8 nozzle extension bolts.

e. Removed four gimbal block bolt assemblies.

f. Removed all but four each LOX and fuel PVC bolts.

g. Installed manual engine actuators.

h. Installed gimbal actuator locks.

i. Disconnected actuator supply and return ducts, and disconnected pitch and yaw actuators from engine.

j. Disconnected instrumentation and control cabling from engine.

November 10, 1965

1. Disconnected flame curtain from dishpan on Pos. #1, S/N F-4T2.

2. Prepared engine access platforms and rolling deck for deck roll-out.

3. Removed nozzle extension and engine S/N F-4T2 from Pos. #1. Sent engine to Ace's shop for injector replacement.

November 11, 1965

1. Trich flushed LOX dome and GG LOX injector on Pos. #2 and 5.

2. Installed trich flush unit on Pos. #4.

3. Changed out DA7A-5.

4. Relocated and plumbed DA9-3.
5. Removed heat shield panel between Pos. #2 and 3.

November 12, 1965

1. Flushed LOX dome and GG LOX injector with trich, Pos. #4.
2. Replaced 0-3000 p.s.i.g. hydraulic supply gage on hydraulic skid.
3. Began activation and checkout of cape inert prefill unit.
4. Greer factory people continued retro-fit modifications to Greer hydraulic unit.

November 13, 1965

OFF-DAY

November 15, 1965

1. Greer factory people continued retro-fit modifications to Greer hydraulic unit.
2. Dye penetrant checked exhausters, Pos. #2, 2, 4, & 5.
3. Replaced DA3-1, DA4026, DA2-2, DA22-2.
4. Activated and checked out cape inert prefill unit. Pump will dead-head 300 p.s.i.g. pressure at umbilical.
5. Filled cape and MSFC inert prefill reservoirs with ethylene glycol water solution.
6. Continued engine torque checks, Pos. #2, 3, 4, & 5.

November 16, 1965

1. Installed engine Pos. No. 1, S/N F-4T2 and nozzle extension as follows:
 - a. Installed and torqued gimbal block bolts.
 - b. Hooked up LOX pump seal purge, LOX dome purge, and inert prefill supply wraparound lines.
 - c. Hooked up pitch and yaw actuators to engine, torqued and installed cotter pins.

d. Hooked up and torqued pitch and yaw actuator supply and return ducts.

e. Installed nozzle extension bolt assemblies.

f. Hooked up LOX and fuel pump inlets, using new seals, and installed bolts.

2. Removed stage hydraulic supply valve, and filter bypass valve from hydraulic skid and delivered to valve lab. for shaft seal replacement.

3. Greer factory people continued retro-fit modifications to Greer hydraulic unit.

4. Began installing DA36-1 thru 5 and DA37-2, 3, & 4.

November 17, 1965

1. Greer factory people continued retro-fit modifications to Greer hydraulic unit.

2. Completed installation of DA36-1 thru 5.

3. Installed DA37-2, 3, & 4.

4. Removed and dropped DA8-1 and DA18-1.

5. Fabricated and installed solid plates on doors on rolling deck level.

6. Weld repaired LOX dome purge supply line, No. 1 side, Pos. #4, S/N F-2007.

7. Brought up A.M.F. hydraulic unit and leak checked engine control system and facility.

8. Installed stage hydraulic supply valve and filter bypass valve after seal change out. Leak checked. OK.

9. Ran engine components test and sequence test.

10. Completed installation of Pos. #1, S/N F-4T2.

November 18, 1965

1. Greer factory people completed retro-fit modifications to Greer hydraulic unit.

2. Tanked 900 gal. of RP-1 fuel in Greer reservoir and 150 gal. RP-1 into A.M.F.
3. Filled Greer servo reservoir with 10 gal. of quality cleaned MIL-C-5606 oil.
4. Changed out DA1-2.
5. Calibrated gimbal control system with control and oscillographs.
6. Weld repaired access steps to engine deck.
7. Weld repaired steel decking on rolling deck.
8. Ran engine components and 3 sequence tests. (Using A.M.F. unit.)
9. Obtained sample from cape unit prefill reservoir for sample analysis.

Results as follows:

Water -

Ethylene Glycol -

Sodium Nitrite - 0.001%

November 19, 1965

1. Filled trich tank from 55 gal. barrels, Type 1.
2. Reactivated and check out of Greer unit. Bled air from system and leak checked. Numerous leaks found.
3. Set up and flushed LOX dome, Pos. #1, S/N F-4T2. Odom contaminated LOX dome while running cocoon purge test. Re-flushed LOX dome, Pos. #1.
4. Changed out gimbal filter manifold, Pos. #4, S/N F-2007:
P/N Out - 11-10308E, S/N Out - 0000012
P/N In - 11-10308E, S/N In - 0000016
5. Installed new seal on H.E. LOX inlet, Pos. #1, S/N F-4T2.
(I goofed - 6 and 7 on next page, and this is part of No. 7)
#1 P/N - PS5883-1135, S/N - 25257
#2 P/N - PS5883-1135, S/N - 25255
#3 P/N - PS5883-1135, S/N - 25256

6. Installed CA4006-2, 3, & 4.
7. Installed 3 thrust OK pressure switches, Pos. #1, S/N F-4T2 (see under No. 5 on sheet before for numbers).
8. Rechecked gimbal system calibration and ran dry run gimbal program. Cut program after 1-15 c.p.s. yaw.
9. Performed complete components test and 3 sequence tests with oscillographs.
10. Continued cocoon installation.
11. Ran cocoon purge test and checkout.
12. Leak checked GOX and helium pressurization systems.
13. Leak checked LOX and fuel systems.
14. Changed out helicoil on pitch actuator, Pos. #1 at supply inlet.

November 20, 1965

1. Brought up hydraulics, Greer unit, pumps 1 and 2 only and ran components test and 8 sequence tests.
2. Ran cape inert prefill unit in flush mode during sequence tests.
3. Continued cocoon insulation installation, Pos. #5.
4. Changed out GG ball valve opening control lines, Pos. #2 & 3, S/N F-2003 and F-2008, respectively, as follows:

<u>Pos.</u>	<u>P/N Out</u>	<u>S/N Out</u>	<u>P/N In</u>	<u>S/N In</u>
-------------	----------------	----------------	---------------	---------------

2

3

5. Inspected Pos. #1 and 4 GG ball valve open control lines. OK.

6. Checked out pickup pressures on Pos. #1 TOKPS

#1 - 1135 p.s.i.g.

#2 - 1130 p.s.i.g.

#3 - 1140 p.s.i.g.

7. Brought up hydraulics and leak checked engine control system. OK

8. Pressurized LOX and fuel systems to 15 p.s.i.g. and leak checked. OK

9. Installed new hydraulic reservoir fill line upstream of fuel filter and installed a 10 micron, 200 p.s.i.g. filter.

November 22, 1965

1. Completed cocoon insulation installation, Pos. #5, S/N F-3T1.
2. Rechecked gimbal system calibration and ran two dry run gimbal programs.
3. Ran Greer hydraulic unit and conducted engine components and sequence test.
4. Tanked fuel with prevalues closed and hydraulics off.
5. Topped off Greer unit reservoir with 150 gal. of RP-1 during fueling operation.
6. Started up hydraulics, Greer unit, opened fuel prevalues and admitted fuel into the engines. Pressurized fuel tank to 14 p.s.i.g. and leak checked. No leaks.
7. Closed prevalues, drained fuel from engine system and secured hydraulics.
8. Ran cocoon purge test at 200° F.
9. Changed out following transducers:
D8-1 P/N In - NA5-27316T15, S/N In - 1701
P/N Out - NA5-27316T15, S/N Out - 1346
D8-2 P/N In - NA5-27316-T15, S/N In - 1697
P/N Out - NA5-27316-T15, S/N Out - 1880
D8-4 P/N In - NA5-27316-T15, S/N In - 1334
P/N Out - NA5-27316-T15, S/N Out - 1338
10. Added $2\frac{1}{2}$ gal. of 36% sodium nitrite/water to cape prefill unit reservoir bringing total sodium nitrite concentration up to .113% by weight.

November 23, 1965

1. Brought up hydraulics (Greer unit) and ran components and sequence tests. Held main valves open for oscillograph room to set main valves span.

the reproduced for Jan

2. Hooked up all actuators and checked for movement. Disconnected actuators.
3. Opened fuel prevalues and admitted fuel to engines. Leak checked. OK.
4. Turned off Greer main pump No. 3.
5. Took 15 hydraulic samples for contamination analysis. See log for results. Approximately 10:30 a.m. All samples OK.
6. Checked off S-IC-13 measuring program.
7. Torqued and safety-wired all engine drain and purge quick disconnects.
8. Discovered fuel leak approximately 12 p.m. on No. 1 fuel pump inlet drain quick disconnect, Pos. #5, S/N F-3T1. Closed No. 1 fuel prevalues, drained down and attempted to change out quick disconnect. No. 1 fuel prevalue leaked so that we could not change out quick disconnect. Worked poppet a little and installed new pressure cap. Leak was never stopped and remained at about 1 drop/sec.
9. During prefill operation, stage prefill valve failed to open. Cape unit pump outlet pressure overcame dome pressure on 3-way select valve and allowed pressurizing MSFC tank. Both relief valves oppped and tank pressure reached 500 p.s.i.g. The valve problem was corrected, MSFC unit selected and prefill operation completed.
10. Checked off S-IC-13 measuring program.
11. Completed all items on pre-test countdown.
12. Countdown was held at X=4 seconds due to low LOX dome purge pressure. From time engine C.O. valves rotated to engine position until Greer unit shutoff was 3 minutes 50 seconds. Greer unit shut off automatically when reservoir low level signal occurred. Approximately 500 gal. of reservoir fuel was pumped into engines. A.M.F. unit was immediately selected and turned on.

13. After inspecting pressurization panel, high LOX dome purge regulator was found to be set at 600 p.s.i.g.
14. Decision was made to hold propellant and fire tomorrow.
15. Removed all GG igniters, turbine exhaust igniters and hypergols, Pos. #1 thru 5.
16. Disconnected electrical cables to all pitch and yaw actuators.
17. Ran environmental unit all night directing one flow line each to the GG ball valves.
18. Heat lamps were inserted into chamber throats all night to restrict and minimize injector frosting.
19. Hold condition was maintained throughout the night while continually checking the following:
 - a. Heater power ON, (Verify bearing temps. OK)
 - b. Verify LOX pump seal purge ON.
 - c. Monitor GG ball valve skin temp.. Pos. #5 (10° F turn on heated purge). Cocoon purge on at 8 p.m.
 - d. Keep stop solenoid backup valves disconnected.
 - e. Check drain lines at fuel manifold inlet quick disconnects.
 - f. Check DA10-1 thru 5, closing control pressure.
 - g. Check Pos. #5, No. 1 FPI drain quick disconnect. No problems encountered.
20. Removed LOX pump seal purge flowmeter from Pos. #1, instrumentation checked it out, reinstalled flowmeter.
21. Retanked Greer hydraulic reservoir utilizing auxiliary fill method and fuel transfer pump.

November 24, 1965

1. Continued propellant hold. At 1:13 a.m. the A.M.F. unit was shutdown and the Greer unit put in operation, main pumps No. 1 and No. 2 only.

Total down time was 1 minute, 15 seconds. No problems encountered during hydraulic switchover.

2. Ran test stand inspection every hour until 7 a.m. Continued monitoring item 19 check list, previous day.

3. Continued thawing injectors with heat lamps. At 5 a.m. Pos. #1, 2, & 5 looked A-OK.

4. Topped off chamber jackets with inert prefill.

5. Completed all items on Saturn pretest countdown.

6. Conducted test S-IC-13 with scheduled duration of approximately 148.55 Sec. mainstage.

7. Drained down engines, boiled off residual LOX, secured and went home.

November 25, 1965

Off Day - Thanksgiving Holiday!

November 26, 1965

Off Day - Two men worked and unloaded 6 tank cars of fuel and 7 trucks of LOX.

November 27, 1965

Off Day

November 29, 1965

1. Preserved turbopump bearings, Pos. 1-5.
2. Inspected main injectors, Pos. 1-5. Pos. 5, S/N F-3T1 had a 0.010-inch crack, $\frac{1}{2}$ -inch long in comp. 7 between the 9th LOX ring and land area. Pos. 1-4 were OK.
3. Began removal of cocoon insulation, Pos. 5.
4. Disconnected, trich flushed, and weld repaired the No. 2 MLV opening control line, Pos. 4, S/N F-2007. Re-installed line.
5. Changed out the engine supply duct to the gimbal filter manifold Pos. 2, S/N F-2003.

P/N Out - 20M55050, S/N Out - 1327

P/N In - 20M55050, S/N In - 1525

November 30, 1965

1. Brought up hydraulics, A.M.F. unit and installed gimbal actuator locks, Pos. 1 thru 4.
2. Trich flushed and water flushed thrust chamber jackets, Pos. 1 thru 5.
3. Inspected thrust chamber jackets for leaks, Pos. 1 through 5. Pos. 2, S/N F-2003 had 10 seepers at tube manifold. Must be repaired with RTV.

4. Drained the IMV sense lines, Pos. 1 thru 5.
5. Continued removal of cocoon insulation, Pos. 5.

December 1, 1965

1. Continued removal of cocoon insulation, Pos. 5.
2. Dye penetrant inspected engine exhausters, Pos. 1 thru 5. All OK.
3. Changed out No. 1 LOX dome purge line, Pos. 4, S/N F-2007:

P/N Out - 407994, S/N In - None

P/N In - 407994, S/N In - None

December 2, 1965

1. Weld repaired LOX dome purge line, No. 2 side, Pos. 4, S/N F-2007.
2. Completed removal of cocoon insulation, Pos. 5, S/N F-4T2.
3. Began installation of engine area purge tubing, Pos. 5.
4. Changed out the following flight transducers:

<u>Pos.</u>	<u>Eng. S/N</u>	<u>Meas. No.</u>	<u>P/N Out</u>	<u>S/N Out</u>
4	F-2007	D3-4	NA5-27316-T20-1c	1369
4	F-2007	D13-4	NA5-27316-T10	1979
3	F-2008	D8-3	NA5-27316-T15	1335

<u>Pos.</u>	<u>Eng. S/N</u>	<u>Meas. No.</u>	<u>P/N In</u>	<u>S/N In</u>
4	F-2007	D3-4	NA5-27316-T20-1B	1222
4	F-2007	D13-4	NA5-27316-T10-1C	1691
3	F-2008	D8-3	NA5-27316-T15-1C	2135

5. Changed out the following static measurement transducers:

DA5004-1	CA9-1	DA11-3	DA11-1
CA2-1	CA9-2	DA13-2	
CA2-2	CA 9-3	DA22-4	
CA2-3	CA9-4	DA7-1	
CA2-4	CA9-5	DA7A-1	
CA2-5	DA36-3	DA1013-1	

6. Picked up two M00G actuators from STTW and delivered to ME Lab for set lengths.

December 3, 1965

1. Continued installation of engine area purge tubing, Pos. 5, S/N F-3T1.
2. Installed manual engine actuators Pos. 4, and drained hydraulic system.
3. Picked up new M00G actuators from ME Lab.
4. Changed out pitch and yaw actuators, Pos. 4, S/N F-2007:

<u>Out</u>	<u>P/N</u>	<u>S/N</u>	
Pitch	50M35008	H.R. 020	
Yaw	50M35008	H.R. 016	

<u>In</u>	<u>P/N</u>	<u>S/N</u>	<u>Length (inches)</u>
Pitch	50M35008	33	59.815
Yaw	50M35008 50M35008	41	59.821

5. Reversed the pitch and yaw actuator return lines on Pos. 4, S/N F-2007.
6. Removed old Pos. 4 pitch and yaw actuators from engine deck and stored in Nw. tower leg, ground level.
7. Removed CA1A-1 and CA1A-5 for checkout.
8. Repaired 8 seep leaks at tube manifold on Pos. 2, S/N F-2003 with RTV compound.
9. Installed new seals on Greer servo reservoir H.E. and reinstalled heat exchanger.
10. Repaired the A.M.F. and Greer heat exchanger bypass water valves.
11. Brought up hydraulics, A.M.F. unit and performed control system and gimbal system leak checks; closing control system ~~XXXXXXXXXXXX~~ only. Hydraulic pressure was increased to 2500 p.s.i.g. accidentally due to negligence.
12. Ran a gimbal system amplifier response test without hydraulics on,

but with oscillographs. Current inputs were 2.5, 5, and 10 ma at frequencies of 1-15 c.p.s., pitch and yaw.

13. Operated Cape inert prefill unit and set relief valve at 250 p.s.i.g.

14. Received new pressure transducer and flow totalizer conditioner from P&VE-VMI and installed on Cape inert prefill unit.

December 4, 1965

1. Continued engine area purge tubing installation, Pos. 5, S/N F-3T1.

2. Brought up Greer hydraulic unit and bled all air from servo system.

3. Performed engine and hydraulic system components test.

4. Performed several engine and stage sequence tests.

December 6, 1965

1. Changed out the No. 1 fuel pump inlet drain quick disconnect (Aeroquip) on Pos. 5, S/N F-3T1.

2. Drained hydraulic control system, and inspected GG ball valve opening control lines, Pos. 1 through 5. OK.

3. Installed flowmeters in LOX pump seal purge wraparound line, Pos. 2, 4, & 5.

4. Reversed (swapped each other) Pos. 1 & 3 LOX pump seal purge flowmeters.

5. Changed out the LOX coil bypass orifices on heat exchangers, Pos. 1 through 5. New orifice sizes are 0.100-inch.

6. Removed old flame curtain and installed new curtain around dishpan, Pos. 5.

December 7, 1965

1. Installed thermocouple and pres. trans. on Eng. Pos. No. 2 at LOX pump seal flowmeter DA-62-2 CA- -2

2. Calibrated gimbal system.

3. Installed pres. trans. on G.F.M, Pos. No. 2 inlet and outlet Meas. No. DA-1013A-2 DA-1020.

4. Installed thrust OK pres. switches on Pos. 3, P.N PS5883-1135; Pos. 1 S/N 25259; Pos. 2 S/N 25258; Pos. 3 S/N 25254.

5. Modify calorimeter bracket Pos. 2.

December 8, 1965

1. Flushed LOX dome Eng. Pos. No. 5.

2. Leak checked fuel and LOX systems. OK.

3. Leak checked GOX and helium lines.

4. Removed manual eng. actuators.

5. Removed flight supply duct to G.F.M. Eng. Pos. No. 2 & installed one equipped with strain gages.

6. Removed No. 2 bearing ther. Eng. Pos. No. 2 P/N NA5-27333T1-1, S/N 210.

7. Tanked fuel with prevalues closed.

8. Conducted multi sequences.

9. Flushed Eng. Pos. No. 4 GG.

December 9, 1965

1. Brought up hydraulics at 8 a.m.

2. Dropped fuel after components and sequences.

3. Installed No. 2 bearing temp. trans. Eng. No. 2, P/N NA5-27333T6-1F, S/N 645.

4. Conducted S-IC-14 150 Sec. 1-4 cutoff.

5. Post-test inspection revealed broken line on No. 1 LOX dome purge on Pos. No. 4.

December 10, 1965

1. Preserved turbopumps found leaky bearing seal on Eng. Pos. No. 5, Eng. S/N F-3T1.

2. Inspected main injectors Pos. No. 5 only one cracked. Didn't increase on test S-IC-14.

3. Changed out purge line on Pos. No. 4. Installed new Rocketdyne line, P/N 407994.

December 11, 1965

1. Trich and water flushed fuel jackets.
2. Removed GG ball valve on Eng. Pos. No. 4, S/N F-2007, to inspect for contamination. OK.
3. Upon installation the stage fuel tank was pressurized with prevalues open. The ball valve was saturated with fuel. It was removed and sent to R-TEST-SA for servicing.
3. Inspected LOX dome on Eng. Pos. No. 4 with boreoscopr. OK.
4. Installed actuator locks.
5. Torque checked all engines.
6. Inspected GG opening control line on Pos. No. 5, must be replaced.
7. Replaced fuel bootstrap seal on Pos. No. 3, duct eng, P/N 19-406337-5.
8. Water leak checked and trich leak checked thrust chamber jackets, Pos. 1-5. Found two bad cracks on Pos. No. 2 and 1 on Pos. No. 5 that must be weld repaired. Found numerous other seepers on all engines. Refer to thrust chamber damage report form for details.
9. When fuel tank standby pressure of 5 p.s.i.g. was applied, Eng. Pos. 3, 4, and 5 were inadvertently washed down with fuel due to the engine fuel system being open and the fuel prevalues open. Pos. No. 3 fuel bootstrap line was open for seal replacement. Pos. No. 5 GG ball valve open control line was disconnected for inspection. Pos. No. 4 GG ball valve was open and disconnected for GG LOX injector inspection. The LOX GG ball valve, GG LOX injector, and LOX bootstrap line were contaminated with fuel on Pos. No. 4, S/N F-2007.

December 13, 1965

1. Repaired thrust chambers Eng. Pos. No. 2 and No. 5 - repaired ex-hausterator on Eng. Pos. No. 2.

2. Inspected GG and turbine exhaust igniters. OK.
3. Replaced GG ball valve opening line Pos. No. 5, P/N 602054.
4. Replaced CA2-1-5 and CA9 1-5.
5. Removed for calibration DA5-1-5, DA6 - 1-5.
6. Leak checked GOX helium lines. OK.

December 14, 1965

1. Changed out the following flight transducers:

<u>Meas. No.</u>		<u>P/N</u>	<u>S/N</u>
D8-2	In	NA5-27316T15	2130
	Out	NA5-27316T15-1C	1697
D2-2	In	NA5-27316T20	510
	Out	NA5-27316T20	1749
D4-2	In	NA5-27316-T2	1833
	Out	NA5-27412-T2-1	2959
D5-2	In	NA5-27316-T2	1951
	Out	NA5-27412T2-1	3003
D13-3	In	NA5-27316-T10	1867
	Out	NA5-27316T10	1684

2. Changed out the following static transducers:

DA22-1	DA7A-1	DA5-4	DA6-3
DA22-2	DA5-1	DA5-5	DA6-4
DA22-3	DA5-2	DA6-1	DA6-5
DA22-4	DA5-3	DA6-2	

3. Reinstalled GG ball valve and GG LOX injector, Pos. No. 4.
4. Removed manual engine actuators, Pos. 4.
5. Ran components and sequence test.
6. Continued miscellaneous safety-wiring.
7. Began gimbal system calibration.

8. Replaced the following static transducers:

DA1015-4 DA4-3 DA5-1 (twice) CA5049-2

DA5-1 (twice) CA5051-2

9. Flushed LOX domes and GG LOX injectors, Pos. 4 & 5. Pos. No. 4 LOX dome was flushed for 3 minutes rather than the normal 30 sec., by Rocket-dyne request.

December 15, 1965

1. Installed new relief valve for 200 p.s.i. loader outlet on hydraulic skid. Set at 250 p.s.i.g.
2. Continued calibration of gimbal system. Many problems encountered due to electrical bias between Boeing GSE and flight type amplifiers.
3. Ran components and sequence tests.
4. Completed safety wiring.
5. Tanked fuel to prevalues without hydraulics. Topped off both hydraulic units.
6. Opened fuel prevalues and admitted fuel to engines. Found leak on Pos. No. 3, S/N F-2008, No. 2 MFV. Closed fuel prevalues and drained engine fuel system.
7. Changed out Pos. No. 3, S/N F-2008, No. 2 MFV:
P/N Out - 405280, S/N Out - 4062638
P/N In - 405280, S/N In - 4067375
(New MFV was taken from Engine S/N F-2009):

December 16, 1965

1. Brought up hydraulics at approximately 8 a.m.
2. Ran engine components and sequence test.
3. Dropped fuel below prevalues, pressurized fuel tank to 12 p.s.i.g. and leak checked. OK.
4. Prefilled chambers using the Cape unit obtained the following data:

- a. Pump outlet press. - 125 p.s.i.g.
- b. Umbilical supply press. - 60 p.s.i.g.
- c. Flowrate - 25 g.p.m.
- d. Gallons pumped to overflow -

Pos. 1 - 460 gal.

Pos. 2 - 595 gal.

Pos. 3 - 611 gal.

Pos. 4 - 470 gal.

Pos. 5 - 535 gal.

- 5. Installed new No. 2 LOX bearing temp. thermocouple, Pos. no. 3.
- 6. Tanked LOX, pressurized LOX tank and leak checked. OK.
- 7. Checked off measuring program.
- 8. Pos. No. 1 yaw actuator became nervous approximately 3 hrs. prior to test. This was corrected by applying a 2 ma. signal.
- 9. Performed test S-1C-15 for scheduled duration of 40 sec. mainstage with a 1, 2-2 cutoff. Stage hydraulic supply valve failed to open after cutoff. Approximately 4 minutes after cutoff valve opened by itself. Must investigate. Hydraulics firex came on during firing.
- 10. Drained fuel, secured and went home.

December 17, 1965

- 1. Preserved the turbopump bearings, Pos. 1 thru 5.
- 2. Trich flushed and water flushed thrust chamber jackets, Pos. 1 through 5.
- 3. Leak checked thrust chamber jackets, Pos. 1 thru 5. Several leaks found that must be weld repaired. Refer to damage report form.
- 4. Inspected main injectors, Pos. 1 thru 5. All OK except Pos. No. 5. Crack still had not propagated.

December 18, 1965

Off-Day

December 20, 1965

1. Checked out operation of stage hydraulic supply valve as follows:
 - a. Cycled valve three times under no pressure.
 - b. Closed valve, pressurized system, and cycled valve open twice.

The following data were taken:

- a. Closing Times (No Pressure)

<u>Sig. - Sw.</u>	<u>Sw. - Sw.</u>
3.000 Sec.	0.884 Sec.
2.608 Sec.	0.976 Sec.
2.472 Sec.	0.952 Sec.

- b. Opening Times (No Pressure)

<u>Sig. - Sw.</u>	<u>Sw. - Sw.</u>
1.904 Sec.	0.652 Sec.
1.828 Sec.	0.636 Sec.
1.788 Sec.	0.624 Sec.

- c. Opening Times (Pressurized)

<u>Sig. - Sw.</u>	<u>Sw. - Sw.</u>
Sec.	Sec.
Sec.	Sec.

2. Began temperature studies on actuators with hydraulics on. Temp. was increased to 118° and then lowered to 70° F. Measurements were taken on Pos. No. 1 yaw actuator. Limit cycle occurred between 80 - 85° F, and did not seem to increase with temperature increase.

3. Began removal of engine area purge lines, Pos. No. 1 thru 5.

4. Replaced the cracked IMV sense line on Pos. No. 1, S/N F-4T2, P/N in and P/N out was 602060-3, S/N in - 5689578, S/N out - 2702250.

5. Removed the LOX pump seal purge flowmeters from Pos. No. 1, 2, & 3.

December 21, 1965

1. Ran two engine components test using the Greer unit and simultaneously giving start signal to all 5 engine control valves. This was done by paralleling all solenoid valves with one switch. The tests were done with 2 main pumps and with 3 main pumps on the line. DA3003 data showed no difference using 2 pumps and 3 pumps. Tests were run with engine oscillographs and osc. 25 (DA3003). Max, pressure drop was 190 p.s.i.g.

2. Continued temperature studies on actuators with hydraulics on. Took measurements on Pos. No. 4 pitch actuator. M00G actuators experienced no limit cycle affects with temperature increase but all hydraulic research actuators reacted to temperature.

3. Performed automatic startup of Greer hydraulic unit using computer command.

4. Performed engine components test using computer.

5. Removed LOX dome pots from Pos. No. 1 and 3, removed pots from Pos. No. 1 LOX PVC and Pos. No. 5 fuel PVC bellows, got 2 pots from Tepool, and gave all 8 pots to Don Jones, Astrionics Lab.

December 22, 1965

1. Completed removal of engine area purge tubing, Pos. No. 1 thru 5.

2. Continued and completed hydraulic oil temperature studies on actuators.

3. Installed actuator locks, Pos. No. 1 thru 4.

4. Began removing nozzle extension bolts, Pos. No. 1 thru 5.

5. Continued automatic checkouts.

December 23, 1965

1. Continued automatic checkouts.

2. Picked up 8 actuator shipping boxes from Astrionics and placed on rolling deck level.

3. Completed removal of all nozzle extension bolts (8 left on each skirt),

Pos. No. 1 thru 5.

December 25, 1965

Off Day - Merry Christmas!

December 27, 1965

1. Continued automatic checkouts.
2. Removed overboard drain lines, Pos. No. 1 thru 5 and tagged for identification.
3. Painted engine serial numbers on nozzle extensions, Pos. No. 1 thru 5.

December 28, 1965

1. Continued automatic checkouts.
2. Cleaned up engine platforms and rolling deck.
3. Removed water strainer element from A.M.F. hydraulic unit cooling water system, cleaned element, and reinstalled.
4. Began fabrication of storage boxes for engine servicing flexhoses.

December 29, 1965

1. Continued automatic checkouts.
2. Prepared thrust chambers for weld repair by marking all cracks.
3. Inspected all engine servicing purge lines for cracks or damage.
4. Continued fabrication of storage boxes.

December 30, 1965

1. Continued automatic checkouts.
2. Completed fabrication of storage boxes.
3. Continued preparing engines for removal.

December 31, 1965

Off Day

January 1, 1966

Off Day - Happy New Year!

January 3, 1966

1. Fabricated brackets and installed two pulleys and hoists for raising and lowering engine platforms around Pos. No. 2 and 4.
2. Installed temperature bulb in preservative oil tank.
3. Continued automatic checkouts.
4. Weld repaired thrust chambers, Pos. No. 1 and 3. Pos. No. 2, S/N F-2003 is too bad to weld repair in test stand.

January 4, 1966

1. Completed installing hoists for engine access platforms.
2. Removed heat shield covers from crossbeam support brackets and installed manual engine actuators pitch and yaw, Pos. No. 1 thru 4.
3. Picked up 8 drip pans from Fab. shop and placed on hydraulic platform. Installed 4 drip pans beneath Greer unit and one under A.M.F. unit.
4. Ran automatic engine components, sequence test, and Greer unit start up using computer.
5. Continued automatic checkouts.
6. While stage crew was removing a fuel pre valve, they inadvertently dropped a 5/16" nut and washer down into the No. 2 fuel pump inlet at Pos. No. 2 S/N F-2003.

January 5, 1966

1. Disconnected the flame curtains from engine dishpans, Pos. No. 1 thru 5.
2. Removed all but four each bolts from the LOX pump inlet and both fuel pump inlet flanges, Pos. 1 thru 5.
3. Removed four each gimbal block bolts, Pos. 1 thru 5.
4. Ran engine components and sequence test by computer.
5. Continued and automatic checkouts.

January 6, 1966

1. Continued and completed automatic checkouts.
2. Ran engine components and sequence test using Greer unit and computer.
3. Disconnected LOX and GOX and helium system wraparound lines and installed protective closures.
4. Removed firex nozzles around engines on engine deck for additional clearance during engine removal.
5. Removed chamber exit spray manifold on East side of rolling deck.

January 7, 1966

1. Installed manual engine actuators, Pos. No. 1 thru 4.
2. Drained hydraulic system, engine control system and thrust vector control systems.
3. Drained all residual fuel from engines.
4. Disconnected hydraulic supply and return wraparound lines from Pos. No. 1 thru 5 and installed protective closures.
5. Disconnected LOX dome purge, LOX pump seal purge, and inert prefill supply wraparound lines from Pos. No. 1 thru 5 and installed protective closures.
6. Began removal of all static measuring transducers, Pos. No. 1 thru 5.

January 8, 1966

1. Removed pitch and yaw actuators, Pos. No. 1 thru 4 and placed in shipping boxes on rolling deck level.
2. Completed removal of all static measuring transducers, Pos. No. 1 thru 5.
3. Prepared engine access platforms and rolling deck for moving.
4. Disconnected hydraulic supply and return lines from umbilical plate No. 2.

5. Sent torque wrenches to R-QUAL for recalibration.
6. Washed down engine Pos. No. 1 thru 5 with trich.

January 10, 1966

1. Prepared rolling deck and engine access platforms for operation.
2. Removed nozzle extensions, Pos. No. 1 thru 5.
3. Removed Engine Pos. No. 4 and sent to Ace Perry's shop - R-TEST-SA.
4. Returned rolling deck to position.

January 11, 1966

1. Removed Engine Pos. No. 1, 2, & 3, and 5 and sent to R-TEST-SA.

January 12, 1966

1. Secured and stored all engine removal hardware and tools.
2. Rounded up all T-bird engine throat plugs, protective skirt covers, and overboard drain lines and delivered to R-TEST-SA.
3. Assisted Support Shop welders in fabrication and installation of LOX and fuel PVC retainer brackets.
4. Removed manual engine actuators, pitch and yaw, Pos. No. 1 thru 4 and delivered to ME Lab for installation on 501 vehicle.
5. Removed center engine stiff arms and stored. (This required partial removal of heat shield panels around center engine position.)
6. Removed heater hoses and adapters from aft compartment and stored.
7. Installed heat shield covers over stage manual engine actuator brackets.
8. Greer people began retro-fit modifications to hydraulic unit.

January 13, 1966

1. Delivered 10 actuators to Astrionics Lab (8 H.R. and 2 M00G).
2. Continued assisting Test Support Shop welders in fabrication and installation of LOX and fuel PVC retainer brackets.
3. Cleaned up test stand working levels.

4. Stored S-IC-T engine hardware.
5. Brought engine blue cards up to date and returned to engine Prep Shop.
6. Assisted Greer people on hydraulic modifications.

January 14, 1966

1. Continued assisting welders on PVC brackets.
2. Prepped engine area for booster removal.
3. Completed storing S-IC-T hardware.
4. Removed engine deluge firex nozzles for on-stand firex flush test.
5. Continued assisting Greer people on hydraulic unit modifications.

January 15, 1966

Off Day

January 17, 1966

1. Continued assisting welders in PVC bracket fabrication.
2. Secured all loose hardware around engine area.
3. Removed engine platforms at Pos. No. 2 and 4 and modified for engine clearance.
4. Continued assisting Greer people on hydraulic unit modifications.

January 18, 1966

1. Continued preparation of booster for removal.
2. Secured and cleaned up the North hydraulic platform and the rolling deck for firex test.
3. Continued supporting Greer people on hydraulic unit modifications.
4. Completed welding modifications to Pos. No. 2 and 4 engine platforms.

January 19, 1966

1. Reinstalled engine platforms at Pos. No. 2 and 4.
2. Mounted hoists for raising and lowering platforms at Pos. No. 2 and 4.
3. Wrapped all open line connections on hydraulic platform with foil and taped for water flush test.

4. Continued assisting Greer people in hydraulic unit modifications.
5. Removed S-IC-T stage from test stand and sent to Fab Lab.

January 20, 1966

1. Completed securing the North hydraulic platform and the Greer unit for the test stand firex system flush.
2. Changed out the old pipe assemblies with the latest modification on the S-IC inert prefill unit.
3. Performed pressure-flow checkout on the S-IC inert prefill unit. Relief valve was found defective. Continuous leakage across valve. Leakage increased in proportion to pump back pressure to a maximum of approximately 30 g.p.m. Relief valve outlet was flanged off and flowrate was 55 g.p.m.
4. Continued assisting Greer people in hydraulic unit modifications.
5. Completed modifications to engine platforms at Pos. No. 2 and 4.
6. Removed the Greer hydraulic supply and return lines (facility piping) and delivered to Bldg. 4481 for modifications. Also delivered old components removed from Greer unit to same.
7. Fabricated storage racks for strip heaters.
8. Fabricated storage cabinet for engine flexhoses and installed on 10th level.

January 21, 1966

1. Picked up new boxes from carpenter shop for storage of engine LOX dome flush kit and for gimbal block torque wrench.
2. Fabricated and installed new bracket for drain valve on Greer hydraulic unit.
3. Completed the on-stand firex flush test.

January 22, 1966

1. Began installation of new drip pans for Greer and S.M.F. hydraulic units.
2. Fabricated drain manifolds for above.
3. Fabricated and installed legs for drip pans.

R-TEST-SB

STAGE S-1C-T/4

PRE-TEST ACTIVITIES FOR TEST S-1C-20

1. Remove firex supply line and Flex-flo valve beginning at "Tee-off from 3-inch-water supply line on North Level 12.
2. Remove 3-inch Flex-flo valve (heat exchanger supply) from water supply line on North Level 12.
3. Install a 3-inch spool piece where the Flex-flo valve and firex supply line were removed in Items 1 and 2.
4. Add a 3-inch firex supply line and Flex-flo valve "Teeing" off from the AMF heat exchanger water supply line, located on North Level 12, extending through the North Hydraulic Platform and connect to existing firex system above AMF Hydraulic Unit.
5. Remove the Greer heat exchanger water supply Flex-flo valve and attaching 3-inch line and install a 3-inch blind flanger, located on North level 12.
6. Remove the 3-inch Greer heat exchanger return line from the 3-inch drain line located on North Level 12 and install a welding cap.
7. Remove the 2-inch Greer RP-1 supply line from the hydraulic reservoir fill line and add a 2-inch GR20 Grayloc Welding hub.
8. Remove the "stub-outs" from the firex structural supports around the Greer Unit.
9. Install $\frac{1}{4}$ -inch aluminum plates over openings in North Hydraulic Platform.
10. Replumb the hydraulic firex control panel to be compatible with above hardware changes.
11. Remove GN_2 supply line to Greer Unit.
12. Remove GN_2 supply to hydraulic cross-over valves and control valves in hydraulic firex control panel.
13. Remove AMF and Greer hydraulic cross-over valves and install spool pieces and blind flanges.
14. Remove relief bypass system from hydraulic skid and AMF unit and install plug in relief valves. Set relief valves at 1800 p.s.i.g.

~~THIS HAS NOT BEEN DONE~~

0361 WORK SHEET

15. Replumb damaged tubing on AMF hydraulic unit and add clamps where required.
16. Reactivate and checkout AMF hydraulic unit. Specifically check pump shaft seal leakage on SW pump. Remove pump and send to Ball's shop for servicing, if required.
17. Measure and record delta P on AMF filter and hydraulic skid ball type filter under maximum flow conditions. Remove and clean filter elements, if necessary.
18. Replace Engine S/N F-3T1 turbine manifold and LOX pump seal and reinstall in Position 5.
19. Change out engine opening control orifices, ECP 444.
- ~~20. Change out Position 4 pitch actuator (leaking piston seal).~~ 6-21-67
21. Modify Rocketdyne LOX dome flush kits to provide GG fuel purge.
22. Prepare measuring program for Test S-1C-20.
23. Update and revise operating procedures.
24. Service filter in W. Kidde pre-fill unit and in Chamber Prefill Panel.
25. Add filter in chamber prefill supply line just upstream of umbilical flex-hose.
26. Change pre valve backup system to two (2) normally closed solenoid valves that operate from one switch.
27. Inspect and repair or replace all engine/stage dishpan connectors due to corrosion.
28. Check on foaming problem with stage distributors.
29. Modify and rework the S-1C Pneumatic Console.
30. Leak check and weld repair all engine thrust chamber jacket tube cracks.
31. Prepare and incorporate LOX and fuel tanks pressurization schedule for Test S-1C-20.
32. Investigate and correct, if necessary, fuzz leak on fuel tank lower bulkhead fitting.
33. Check on ECP 222E on LOX Interconnect Valves. Has it been incorporated, and if not, is it required?

34. Investigate and make appropriate operational changes during sequence tests, to minimize LOX tank vacuum problem.
35. Check on configuration and status of LOX and fuel tanks propellant loading equipment.
36. Make determination as to requirement for Fuel Prepress. pressure switch at umbilical.
37. Determine requirement for LOX low overpressure switch and make necessary changes.
38. Obtain and install screens in the fuel vent duct extensions.
39. Determine the requirement and obtain all necessary System A transducer brackets for engines.
40. Obtain and install one additional stage purges sphere, if desired.
41. Determine whether or not to use the Parker LOX tank vent valve and make installation or removal, whichever required.
42. Remove heat shield blast plates, if required for Liftoff Switch Program.
43. ~~Determine parts availability and requirement for engine redundant shut down valve. Install valves, if available.~~
44. Fill Inert Prefill Ground Storage Tank and W. Kidde Unit reservoir and checkout systems.
45. Delete hydraulic malfunction cutoff circuitry.
46. Weld repair the deflector and checkout.
47. Checkout hold-down arms, level as required for stage installation.
48. Load test the 150-ton and 200-ton derricks.
49. Purge and sample the following pneumatic circuits prior to stage hookup:
 - a. LOX dome purge
 - b. LOX bubbling
 - c. LOX pre-pressurization

- d. LOX auxiliary pressurization
- e. Control and purge spheres fill
- f. Helium bottle fill
- g. Fuel tank pre-press
- h. Fuel tank auxiliary pressurization
- i. LOX and forward tanks GN₂ purge
- j. LOX and fuel tanks air purge
- k. LOX dome servicing purge
- l. T/C jacket purge
- m. Hypergol purge

50. Inspect S-IC-T/4 to GSE interfaces and make any required repair or modifications.

51. Install stage and perform stage receipt inspection per Procedure No. 5.

52. Reassembly the S-IC Test Stand replacing all test stand platforms braces, and roof cap.

53. Prepare Redline/Blueline list and instructions.

54. Apply standby purges or pressures to the LOX and fuel tanks, as required.

55. On the 22nd level:

- a. Connect the forward umbilical.
- b. Connect all services to the forward umbilical and checkout.
- c. Checkout and verify proper FECU operations. Remove any covers from cannister openings.
- d. Connect the LOX tank vent extensions and bracketry. Assure LOX vent valve actuator vent lines are unplugged.
- e. Connect the LOX auxiliary pressurizing duct.

- f. Install forward compartment access equipment, if not installed.
 - g. Install the forward stabilization system and check out.
 - h. Install bulkhead protection equipment, as necessary.
 - i. Remove all bellows protective covers.
 - j. Install static test instrumentation.
 - k. Connect all other services required, such as LOX tank vents override.
56. Prepare Pre-Test Information memorandum.
57. On the 17th level:
- a. Install the fuel vents "bird screens".
 - b. Install the LOX emergency drain valve and duct. Check out operation of the valve.
 - c. Connect the fuel auxiliary pressurizing duct.
 - d. Install intertank access equipment, if not installed.
 - e. Install quartz lights.
 - f. Install bulkhead protective equipment as required.
 - g. Install all static test instrumentation.
 - h. Remove all bellows covers.
 - i. Install the LOX fill and drain flexible ducts.
 - j. Install special R-TEST fuel tank pressure switch.
 - k. Connect all other services, such as fuel tank vent overrides.
58. Install aft umbilicals number 1, 2 and 3. Connect all required services and checkout.
59. Install fuel emergency drain duct.
60. Connect all R-TEST gages used to monitor stage operation such as fuel and LOX tank pressures, control and purge pressures, and helium bottle pressures.
- ✓ 61. Connect center engine area purge supply line.

62. Install aft compartment water deluge flexible ducts. Assure that all water has been drained from the line.

63. In the thrust structure:

a. Install ladders, quartz lights, intercom boxes, and any protective equipment necessary.

b. Install AECU thermostat in aft compartment and operate the AECU. Assure correct airflow and temperature available. Remove any covers over the openings of the distribution manifold.

c. Remove all bellows covers.

d. Install all static test instrumentation.

e. Install the sliding access panels on the heat shield, if not installed.

64. On the engine level:

a. Install, adjust and lock in place all engine area firex nozzles, as required.

b. Remove engine protective covers, bellows covers, and throat plugs.

c. Install stop solenoid backup valves, and associated tubing and brackets.

d. Install System A transducer brackets and transducers per measurement program.

e. Install manual engine actuators, as required.

f. Install servo-actuator jacks, as required.

1-2 g. Remove servo-actuator locks.

h. Leak check and checkout the stage hydraulic system per Procedure No. 30.

i. Make a gas leak check on the LOX and fuel systems per Procedure No. 14.

j. Make a gas leak check on the helium and GOX systems per Procedures No. 15 and 16.

k. Leak check the LOX pump seal and LOX dome purge systems.

l. Install engine area purge tubing and supply manifolds.

{ 2, 3 complete 1, 4 partially
7-12-67

- m. Perform engine components and sequence tests.
 - n. Checkout turbopump heaters.
 - o. Make required engine torque checks.
 - p. Install thrust chamber drain Q.D.'s.
 - q. Install thrust chamber nozzle extensions and overload drain lines.
 - r. Trichloroethylene flush and leak check thrust chamber jackets after weld repairs.
 - s. Trichloroethylene flush LOX domes and GG LOX injectors.
 - t. Perform pressure switch checkout on TOKPS.
 - u. Inspect main injectors.
 - v. Install hypergol simulators.
 - w. Remove servo-actuator jacks, if installed.
 - x. Remove manual engine actuators, if installed.
 - y. Incorporate any other planned engine modifications.
65. Install, hookup, and checkout the HDA AFT Horizontal Stabilization Systems.
66. Load LOX and fuel storage tanks to required levels to support static firing operations for Test S-1C-20.
67. Fill Trichloroethylene Storage Tank and checkout system.
68. Perform stage torque check per Procedure No. 6.
69. Leak check and checkout the stage purge and control pressure systems per Procedure No. 12.
70. Perform LOX tank prepressurization and GOX systems leak check per Procedure No. 15.
71. Perform fuel tank pressurization systems checkout and leak check per Procedure No. 16.
72. Leak check all other stage systems and umbilical connections.
73. Calibrate and checkout all pressure switches per Procedure No. 58.

74. Perform complete components test per Procedure No. 56.
75. Checkout the test stand firex system and make all required repairs.
67. Perform simulated static firing per Procedure No. 66, to verify all interlocks and operational readiness.
77. Incorporate all necessary or desired stage modifications.
78. Checkout and calibrate the thrust vector control system per Procedure No. 36.
79. Complete all required safety-wire.
80. Hookup and checkout the FUSU.
81. Fabricate and install servo-actuator current input and potentiometer feedback harnesses.
82. Install and checkout LOX and fuel tanks propellant loading equipment if not installed.
83. Install heat shield panels under outriggers at Positions 1 and 4.
84. Determine and install proper orifices in LOX and fuel auxiliary pressurization valves.
85. Checkout the GFCV per Procedure No. 24.
86. Checkout the GFCV tester for proper operation.
87. Enter the LOX tank and inspect the interior, if required. In particular inspect the suction duct screens for buckling and torque check the helium bottle retainer nuts.
88. Perform prevalve timing tests.
89. Obtain flight type amplifiers from Astrionics for gimbal system and checkout.
90. Perform automatic checkout procedures as time permits.
91. Fill the four (4) oilers on the AMF hydraulic unit main motors.
92. Checkout pressure switch settings on "Boost Pump Pressure OK", "Hydraulic Pressure OK" "Heat Exchanger Water Pressure OK".
93. Install new hydraulic oil temperature gauge on AMF control panel on Level 12.

94. Calibrate all gauges in hydraulic system.
95. Check relief valve setting in 100 psi. GN_2 supply system in hydraulic skid control panel.
96. Checkout and operate engine area purge systems after installation.
97. Perform turbopump torque checks per Procedure No. 31.
98. Weld rolling deck plates back over grating.
99. Convert one of the LOX storage tanks to LN_2 storage.
100. Completely service the Preservative Oil System. Drain all residual oil from tank and flush the tank, Preservative Oil Panel, and all associated plumbing until all residual oil has been removed. Refill the tank with new preservative oil.
101. Obtain hydraulic supply and return line instrumentation spacers from MTF and install at stage umbilical.
102. Drain the W. Kidde Prefill Unit Reservoir and flush the system with potable water.
103. Checkout and service water pumps No. 1 and No. 2 for the hydraulic system. Replace the pump packing if necessary.
104. Clean the engine servicing flexhoses connecting the engine access platforms to the test stand. Replace all damaged flexhoses.
105. Replace Position 4 GGBV opening control line, if new type available, and desired. If not, inspect old line for erosion.
106. Modify engine drain system for larger funnel to prevent fuel from overflowing.
107. Obtain the 40 ground half engine quick disconnects loaned to MTF and install in drain system.
108. Obtain the two hypergol simulators loaned to Michoud. Service all five hypergol simulators prior to installation.
109. Service the stop solenoid backup valves and install on engines. Use .040-inch orifice in discharge port of Engines 2 and 4.
110. Change out the GG ball valve opening control line on Position 4, S/N F-2010 to the new configuration.

July ~~22~~ 1967
24

1. Remove Stop Back Up Solenoids & Send to Value Lab For Service

2. Fill T.C. Jackets with Trick
Per. Proc. # 34

*3. Install Cox Boot Strap Orifice F 37/
Pos. 5 New 1.019 in Old 0.980

4. Check out & Repair Hypocog Simulator
~~Pos. 5~~ Pos. 4

5. Eng. Leak Check on opening Side of
Main Valves Per Proc. # 30

6. Re install Stop Back Up Solenoids Same
Positions ^{SPs} (1) 536 (2) 534 (3) 518 (4) 533 (5) 534

7. Remove Actuator Locks Pos. 1 & 2

* The orifice was noted to be cut wrong
by Tepool & is being investigated

#1 c.w. B R
95 90

c.c. 85 80

#2 c.w. 90 85

c.c. 90 85

#3 c.w. 100 90

c.c. 110 100

#4 c.w. 95 85

c.c. 100 90

#5 c.w. 90 80

c.c. 95 85

25
~~24~~
July ~~25~~, 1967

1. Remove LOX Bootstrap orifice From 2007 & 2010 Pos 2 & 4 For inspection
2. Replace DA 1-3 & DA 4009-5
3. Torque Turbo Pumps Per Proc. #31
4. Install LOX Bootstrap Orifice F3T1 - Pos 5
5. Re-install LOX Bootstrap orifice Pos 2 & 4 Exgs. 2007 & 2010
6. Components & Sequence Test
7. Sent hoist to Valve Lab. For Repairs

July 26, 1967

1. Change out DA 3043 Hyd Pot.
2. Repaired LEAK A-M.F. Unit
3. LEAK Check Gox System Proc' 15 & 16
& Helium System (Fuel Press)
4. LEAK Check Lox & Fuel Systems
(No leaks Reported)
5. Change out DA 15-2
6. Flush Domes Pos 1 & 2 Per: Proc. 32
7. Sequence Test

July 27, 196

1. CONT. Dome Flush Per. Proc. 32

Pos. 3, 4, 5

2. Remove & inspect I.M.V. Pos. 5-F371

3. Remove & Re-drill Stop Back up

Orifice Pos. 2 & 4 .044

4. Re-install I.M.V. Pos 5

5. Re-install Stop Back up orifice

Pos 2-4 size .044

6. Remove Actuator Locks Pos. 3

7. Check out Inert Pre-fill - OK

8.

July 28, 1967

1. R.T.V. Pos 1 & 5 Chamber
Leak

2. Remove Actuator Locks Pos. 4

*3. Check out Thrust Vector Control
System Per. Proc. 36

4. Sequence Test, Components Test
etc.

5. Check out Inert Pre-Fill unit

6. Leak Check I.M.V. Pos. 5

Thrust Vector Control System

Zero Gauge

P

Y

MAX. Amplitude

P

Y

	P	Y		Ret.	Ex.	Ex.	Ret.
1.	0.1 EX	0.1 EX	1.	5.22	5.20	5.20	5.20
2.	0.05 EX	0.1 EX	2.	5.20	5.18	5.19	5.18
3.	0.1 EX		3.	5.20	5.12	5.11	5.21
4.	0	0.05 RE.	4.	5.20	5.15	5.18	5.20

Aug. 1, 1967

1. Change out DA 15-3 & DA 4000-4
2. Prep. For Static Firing SIC-20
3. Change out CA 9-2 & CA 9-4
4. Prep. For Static Firing SIC-20
5. Secure After SIC-20

August 2, 1967

1. Secure Rolling deck etc.
2. Check Fuel Pre Valve Drainage
5 seemed to leak overnight
3. Sequence test, Components test
4. Thrust Vector Control System
Calibration
5. Change out & Check out GG Ball Valve
Position Indicator Pos. 2
6. Change out DA 7-2, DA 7-5, DA 7A-1
DA 7A-3, DA 7A-4
7. Inspect Injector & Jackets
8. Calibrate different transducers with
instrumentation on Pos. 2 Check Tube
& Fittings DA 7A-4 (For Sludge)
9. Remove Combuster DRAINS All GG's
10. Check Press. (with Gage) High Lox on Pos. 1
610 PSIG

August 3, 1967

1. Change out DA 14A-1, DA 12A-3, DA 1019-4
DA 1019-2, DA 1018-2 DA 1-5

January 24, 1966

1. The 501 vehicle arrived at SSTF at approximately 9 a.m. The LOX pump seal purge was not applied to the engines while rotating the vehicle from the horizontal to the vertical because the stage orifices had been removed for resizing.
2. The bird was placed on the holddown arm pads at approximately 1:30 p.m.
3. The rolling deck was returned to the IN position and the engine access platforms were lowered into place and secured.
4. Mr. Cliff brought the new orifices for the stage LOX pump seal purge piping. The old orifices were 0.140-inch and the new ones were 0.391-inch for all positions.
5. Reinstalled the engine deluge firex nozzles, Positions 1 through 5.
6. Began installation of stop solenoid backup valves, and associated tubing and bracketry, Positions 1 through 5.
7. Continued installation of new drip pans for hydraulic units.

January 25, 1966

1. Installed new MV7aVE stop backup solenoids, Positions 1 through 5. This required removal of Rocketdyne line P/N and installation of MSFC line with a tee for venting the MV7aVE into the engine overboard fuel drain line.

Pos. 1 - S/N 307

Pos. 2 - S/N 309

Pos. 3 - S/N 310

Pos. 4 - S/N 311

Pos. 5 - S/N 317

2. Went to Ace's shop and picked up spare brackets for static firing instrumentation.

3. Installed the following static firing instrumentation brackets:

DA2010-1	DA4000-1	DA4009-1	DA15
DA2010-2	DA4000-2	DA4009-2	DA12A
DA2010-3	DA4000-3	DA4009-3	DA13A
DA2010-4	DA4000-4	DA4009-4	DA33
DA2010-5	DA4000-5	DA4009-5	

4. Reinstalled engine area purge manifolds and piping on test stand.

5. Completed installation of all engine deluge firex nozzles.

6. Continued installation of new drip pans for A.M.F and Greer hydraulic units.

7. Changed out 1½-inch water valve for engine service tubing. (Old one froze and cracked.)

8. Ordered new flexhoses for engine area purge supply lines.

9. Installed new flexhoses on engine servicing supply lines, as required.

10. Continued supporting Greer people on hydraulic unit modifications.

January 26, 1966

1. Completed installation of new drip pans for A.M.F. and Greer hydraulic units.

2. Continued supporting the Greer people on the hydraulic unit modifications.

3. Met with Gerald Thompson and got him started with the A.P.M. filter installation on the hydraulic skid and the new purge manifold for the center engine.

4. Removed the water strainer assembly from the Greer hydraulic unit which had ruptured due to freezing.

5. Continued installation of static firing instrumentation brackets. Replumbed DA22-1 thru 5 (ME Lab had plumbed these in to sense control supply pressure instead of hydraulic control return pressure.
6. Relocated DA7-5, plumbed in DA1-2, 3 & 5.
7. Ordered additional flexhoses for Pos. 1 and 5 engine area purge manifolds. 1 line 36" long and 6 lines 17" long, 3000 p.s.i. w.p.
8. Ran the LOX dome service purge at all engines in preparation for quality sample.
9. Changed out return flow transducer on Greer unit. On old one, the flow straightener and turbine assembly had been blown through housing.
10. Fabricated and installed brackets for new heaters on engine deck. Installed new heaters.
11. Fabricated special bypass valve assembly for connecting umbilical ends of stage hydraulic supply and return lines.

January 27, 1966

1. Changed out the umbilical feedback transducer on the Greer unit with the new type 18 v PT135.
P/N Out - PT111-3M, S/N Out - 18648
P/N In - PT135-3M, S/N In - 28792
2. Fabricated special cocoon instrumentation rectangles, Engine Pos. 1 through 5.
3. Continued supporting the Greer people on the hydraulic unit modifications.
4. Replaced some of the engine servicing flexhoses, which had been damaged.
5. Installed bypass valve between supply and return lines on Greer unit for checkout.
6. Installed new heater brackets for calrod strip heaters on engine deck.
7. Fabricated aft compartment heater hose brackets.
8. Fabricated and installed engine identification plates and brackets,

Engine Positions 1 through 5.

9. Installed DA5-1 through 5 and DA2010-2.

January 28, 1966

1. Installed the following static firing transducers:

DA1-1	DA10-1	DA13-1	DA3-1	
DA1-2	DA10-2	DA13-2	DA3-2	
DA1-3	DA10-3	DA13-3	DA3-3	
DA1-4	DA10-4	DA13-4	DA3-4	
DA1-5	DA10-5	DA13-5	DA3-5	
DA12-1	DA12A-1	DA11-1	DA2010-1	CA1A-1
DA12-2	DA12A-2	DA11-2	DA2010-2	CA1A-5
DA12-3	DA12A-3	DA11-3	DA2010-3	
DA12-4	DA12A-4	DA11-4	DA2010-4	
DA12-5	DA12A-5	DA11-5	DA2010-5	

2. Continued supporting Greer people on hydraulic unit modifications.

Greer people went back to Los Angeles without completing the job. Flush bypass valve position switch was not installed; pump feed back pot housing were not reassembled; and none of the system had been checked out.

3. Filled Greer servo reservoir and flushed and bled system. Began setting the pump feedback pots. No. 3 servo-valve would not respond to voltage input.

4. Fabricated new brackets for H.E. helium inlet and outlet transducers to be mounted in aft compartment.

5. Fabricated and installed new hydraulic flush bypass valve umbilical half of hydraulic supply and return lines.

6. Installed a 0.060-inch orifice in the stop backup solenoid outlet port, Pos. 2 & 4.

January 29, 1966

Off day due to bad weather (8 inches of snow).

January 31, 1966

1. Delivered a.p.m. filters to weld shop for fit-up and jig with new manifolds.
2. Removed canvas and ice blocks from roof supports on North hydraulic platform.

(Bad weather today - 12° below zero and 8 inches of snow.)

February 1, 1966

1. Support shop completed new hydraulic manifolds and delivered to test stand. Manifolds were fitted up to hydraulic skid using new a.p.m. filters. Filter flanges were misaligned $\frac{1}{4}$ -inch in two planes. Flanges were finally mated by using "come-alongs" and warping the lines.
2. Removed hydraulic manifolds and hydrostat tested manifolds and 2" GR-AH adapters to 3000 p.s.i.g. Delivered hardware to Wyle Lab for cleaning.
3. Continued adjustment of feedback pots on Greer pumps. Still no response from pump No. 3 pot.
4. Tanked 300 gal. RP-1 into Greer unit. Stopped tanking operation when bad leaks were noticed at pump end cap gaskets. No 3 was worst. During tanking of Greer reservoir, Fuller inadvertently pumped 7000 gal. RP-1 to F-1 test stand.
5. Drained down Greer system and began removing main pump end caps. When Greer factory people modified pumps, they reinstalled old gaskets. Called Ball's people for installing new gaskets. Completed installation of new gasket on main pump No. 1.

6. Repaired gauge mounts on a.m.f. panel.
7. Installed new filter delta "P" gauge on a.m.f. unit.
8. Newly modified Greer facility hydraulic supply and return lines were received from Wyle Lab after cleaning.
9. Installed the following static firing transducers:

DA3044-1	DA4009-1	CA4006-1
DA3044-2	DA4009-2	CA4006-2
DA3044-3	DA4009-3	CA4006-3
DA3044-4	DA4009-4	CA4006-4
DA3044-5	DA4009-5	CA4006-5
DA13A-1	DA33-1	
DA13A-2	DA33-2	
DA13A-3	DA33-3	
DA13A-4	DA33-4	
DA13A-5	DA33-5	

February 2, 1966

1. Ball's people completed installing new end cap gaskets on pumps No. 2 & 3, Greer unit.
2. New filter manifolds arrived from Wyle Lab. Installed new a.p.m. filters and manifolds on hydraulic skid using new o-rings and new GR20 and GR25 grayloc seal rings.
3. Continued adjusting feedback pots on Greer pumps. No.3 pot was 180° out of phase. Servo-valve was o.k.
4. Purged and flushed Greer servo system. Checked p.s. setting on servo system. P.N. - 1500 p.s.i.g. D.D. - 1275 p.s.i.g.

5. Added 4 gal. of clean MIL-H-5606 fluid to servo system.
6. Changed out o-ring seal on calibration port of Greer accum. pre-charge panel.
7. Tanked 600 gal. RP-1 into Greer unit. Noticed pump end cap gasket leak on No. 1 pump. Ran boost pump at 100 p.s.i.g. Leak increased and system was shut off. Began drain down of system. Leak was due to a piece of string, which was used to install gasket, lodged under gasket.
8. Removed old feedback pot housing drain lines from Greer pumps.
9. Installed the following static firing transducers.
DA6-1 DA3042
DA6-2
DA6-3
DA6-4
DA6-5
10. Installed brackets for H.E. helium outlet transducers, Pos. 1 thru 5.
11. Re-torqued and safety-wired the H.E. seal bleed plugs on Pos. 3 and 4.
12. Removed engine deck handrails, removable platforms, etc. and rolled deck out for pipe filters on drain lines. Returned deck to IN position.

February 3, 1966

1. Valve Lab. installed new end cap gasket on pump No. 1 Greer unit.
2. Tanked 600 gal. RP-1 into Greer hydraulic unit. Seal was o.k.
3. Continued checkout of Greer unit. Ran servo system and set offset on each feedback pot. Flow transducer operated and responded to flow change. Accuracy questionable. Main pumps were bled and operated. No. 2 pump servo valve did not enable. Pump did not provide any flow.

4. Installed blind flanges on Greer supply and return lines so a.m.f. unit could be operated.
5. Set the new Greer facility supply and return lines in place on the hydraulic platform.
6. Opened a.m.f. unit supply and return valves and started main No. 1 and boost pump. New manifolds leaked at 3" GR25 at 300 p.s.i.g. Drained down system, installed new 3GR25 and refitted all graylocs. Still leaked. New manifolds must be made due to excessive misalignment.
7. Reset pressure switches in hydraulic skid valve panel. Hyd. press. O.K. - 1400 p.s.i.g. on decrease. Hyd. malfunction - 650 p.s.i.g. on increase.
8. Torqued and safetied numerous seal bleed plugs on Positions 3 and 4.
9. Fabricated and installed new access ladder from engine deck to hydraulic skid.

10. Continued installation of static firing transducers:

DA4-1	DA14-1	DA15-1	DA22-1
DA4-2	DA14-2	DA15-2	DA22-2
DA4-3	DA14-3	DA15-3	DA22-3
DA4-4	DA14-4	DA15-5	DA22-4
DA4-5	DA14-5	DA15-5	DA22-5
DA7A-1	DA14A-2		
DA7A-2	DA14A-3		
DA7A-3	DA14A-4		
DA7A-5	DA14A-5		

11. Installed cocoon purge calibration and instrumentation cross at CCP on Pos. 1 thru 5.

February 4, 1966

1. Continued checkout of Greer hydraulic unit. No. 2 would run but wouldn't put out flow or pressure. It was determined that the trouble had to be internal to the pump. Drained down the Greer system and pulled the end cap on pump No. 2. A linkage connecting the feedback pot to the hanger was missing. Rebuilt pump.
2. Removed new a.p.m. filter inlet manifold because of mismatch and plumbed in 1" tubing. Ran a.m.f. unit and began flushing system. Performed 2000 p.s.i.g. leak check on facility system. Found split housing seal leak on a.m.f. supply valve. Changed out seal and continued leak check. Developed grayloc seal ring leak and shut down again, drained and changed out GR25 seal ring.
3. Began modifying servo-actuator handling jacks, for use with Hydraulic Research actuators.
4. Tanked 500 gal. RP-1 fuel into a.m.f. hydraulic unit reservoir.
5. Continued installation of static firing transducers:

DA4000-1	DA4026-1	DA1A-1	DA7A-4
DA4000-2	DA4026-2	DA1A-2	DA14A-1
DA4000-3	DA4026-3	DA1A-3	
DA4000-4	DA4026-4	DA1A-4	
DA4000-5	DA4026-5	DA1A-5	
6. Installed hypergol simulators, Positions 1 through 5.

February 5, 1966

1. Continued checkout of Greer and a.m.f. hydraulic units. Tanked 600 gal. RP-1 into Greer reservoir. Set offset on pump feedback pots. Calibrated local and remote pressure transducers on Greer unit. Reset minimum volume stop on pump No. 3. Verified accuracy of return flowmeter.

2. Leak checked crossover valve Grayloc seals on a.m.f. unit and began flushing down to hydraulic skid.
3. Took hydraulic contamination samples on a.m.f. reservoir, Greer reservoir, stage supply and return. See Log book on sample results. Supply and return were clean. Shut down hydraulics and hooked up stage return line. While hooking up stage supply line, three pieces of a hard teflon substance were found lodged in the ground umbilical coupling. Investigation revealed that part of the upstream seat of the stage supply valve was missing. Removed the stage supply valve and sent to valve lab. for complete rebuild and cleaning. Installed new ground umbilical coupling in stage hydraulic supply.
4. Disconnected all pitch and yaw manual engine actuators from outboard engines.
5. Checked out operation of LOX pump seal purge and verified pressures:
Pos. 1 - 80 p.s.i.g. Pos. 4 - 77 p.s.i.g.
Pos. 2 - 79 p.s.i.g. Pos. 5 - 80 p.s.i.g.
Pos. 3 - 79 p.s.i.g.
6. Completed modifications to servo-actuator handling jacks and installed on engines.
7. Steam cleaned the north hydraulic platform and the fuel platform.
8. Continued static firing transducer installation as follows:

DA4040-1	CA4012-1	DA13-1
DA4040-2	CA4012-2	DA13-2
DA4040-3	CA4012-3	
DA4040-4	CA4012-4	
DA4040-5	CA4012-5	

9. Hooked up Greer unit stage supply and return lines using new GR seal rings.
10. Began modifying servo-actuator handling jacks (for H.R. actuators) and installed one set on Moog actuators.

February 7, 1966

1. Installed stage hydraulic supply valve after seat replacement.
2. Connected stage hydraulic supply hose to umbilical No. 2
3. Installed DA3041 and DA3042.
4. Brought up hydraulics at 10:20 a.m. (a.m.f. unit and increased pressure from 400 to 1850 at skid outlet). Leak checked all skid system, facility system, TVC system, and engine closing control system. Shut down a.m.f. unit and started Greer unit. Pressurized system to 1850 p.s.i.g. and leak checked all new flange connections.
5. Performed hydraulic systems components test; all skid valves, crossover valves, and Greer valves. All O.K. Shutdown hydraulics at 11:10 a.m.
6. Resumed hydraulics (Greer unit) at 1:15 p.m., shut down at 2:50; resumed at 3:30 and shut down and secured hydraulics at 5:30.
7. Hydraulic samples were taken for contamination analysis at 11:30 p.m. at the stage supply, return, and all outboard pitch and yaw actuator supplies.
8. Performed hydraulic system pressure-flow tests with recorder room. Verified all engine hydraulic requirements.
9. Leak checked engine hydraulic opening control system at 1800 p.s.i.g.
10. Performed individual engine components tests, 5-engine components test, sequence test, and complete stage sequence test. Developed trouble with the hypergol simulators. Trouble was electrical between the subgrade and the blockhouse.

11. While conducting hydraulic tests, developed trouble with ramp generator on Greer unit. Both rates of increase were 100 p.s.i./sec, and generator stuck on both increase and decrease.

12. Verified hydraulic pressure o.k. switch setting. D.D. 1375, P.U. 1400 p.s.i.g.

13. Opened all pre-valves and pressurized LOX and fuel systems to 15 p.s.i.g. with hydraulics on and leak checked. O.K.

14. Continued installing static firing transducers as follows:

DA13-1	DA7-1	DA9-1	CA2-1	CA9-1
DA1-5	DA7-2	DA9-2	CA2-2	CA9-2
DA5-1	DA7-3	DA9-3	CA2-3	CA9-3
DA5-2	DA7-4	DA9-4	CA2-4	CA9-4
DA5-3	DA7-5	DA9-5	CA2-5	CA9-5
DA5-4				
DA5-5				

15. Pressurized and leak checked LOX pump seal and calorimeter purge systems. All O.K.

16. Discovered a concave depression in the stage fuel upper bulkhead approx. 36" diameter by 2" deep.

February 8, 1966

1. Brought up hydraulics (Greer unit) at 7:45 a.m. Turned on LOX pump seal purge at 8:00 a.m.

2. Tanked fuel to full load and pressurized and leak checked. Filled Greer reservoir during tanking. (Did not pick up full indication)

3. Observed IMV internal seal leaks on Positions 1, 2 and 3. Found fuel coming out overboard drain lines and disconnected drain line from IMV to pinpoint leakage.

4. Prepared inert prefill system for chamber fill. Transferred all fluid from Cape unit to MSFC unit. Crossover valve solenoid failed to operate.

Filled chambers to overflow in following times:

Pos. 1 - 16.0 min.

Pos. 2 - 19.8 min.

Umbilical Supply

Pos. 3 - 20.7 min.

Pressure - 100 p.s.i.g.

Pos. 4 - 16.2 min.

Pos. 5 - 18.0 min.

Overflowed for 30 seconds. Low LOX dome purge was on for 22 minutes with no frost observed (on injectors).

5. Tanked LOX to full load, 323, 876 gal., pressurized LOX system to 12 p.s.i.g., and leak checked. Engine systems O.K.

6. Performed countdown to X-4 seconds and had automatic hold for 60 seconds. Engine checkout valves were in engine return for approx. 80 sec. Based on flowrate of 89 g.p.m., estimate a loss of 120 gal. of hydraulic fluid (53"x75" x 7" ÷ 231).

7. After auto-hold, inspection of all injectors revealed no frost or icing.

8. Detanked LOX and fuel. Secured hydraulics at 9:35 p.m. Hydraulics on for approximately 14 hrs.

9. Odom completed cocoon purge test and checkout.

10. Allowed prefill to stay in chambers all night.

February 9, 1966

1. Began preparing engines for lowering to remove pump inlet screens.

a. Hooked up servo-actuator handling jacks to actuators, Positions 1, 2 and 4.

1. (Con't)

b. Disconnected wraparound lines Positions 1 thru 5. Some residual fuel was splashed into the Pos. 3 LOX pump seal and LOX dome purge wraparound lines. Covered all line openings with foil. Notified Bridges for detect and cleaning.

c. Removed 4 gimbal block bolts from each engine; removed all but 8 bolts from the fuel pump inlets and the LOX pump inlet on each engine.

d. Disconnected the actuators from the stage outriggers.

e. Disconnected miscellaneous dishpan connections.

2. Leak checked the thrust chambers. No leaks. Drained chambers, Positions 1 thru 5.

3. Reinstalled manual engine actuators, Positions 1 thru 5.

4. Drained hydraulic system and removed filter inlet tubing on hydraulic skid.

5. Prepared engine access platforms and rolling deck for operation.

February 10, 1966

1. Vertical engine installed couldn't be placed on rolling deck until 3:00 because of high winds.

2. Rotated the filter outlet manifold to the filter inlet side to clear filters of 20" water line above hydraulic skid. Shop welders began fabricating a new filter outlet manifold.

3. M.E. began changeout of engine fuel pump inlet elbows ("babypants") due to expected cracks. They replaced Pos. 3, No. 2 side, and Pos. 5, No.2 side.

4. Replaced stop backup solenoid, Pos. 1:

P/N OUT - MV74VE, S/N OUT - 307

P/N IN - MV74VE, S/N IN - 318

5. Dropped engines in the following order for LOX and fuel pump inlet screen removal: 1-2-5-4-3 and reinstalled engines. Took approx. 1½ hrs. per engine. Had trouble with engine installer relief valve; had to raise setting to increase load capacity. All LOX screens were exceptionally clean; fuel slightly dirty. Pictures were taken. New seals were used to reinstall pump inlets. Also, new gimbal block bolts were used.

6. Installed H.E. helium outlet orifices as follows:

Pos. 1 -

Pos. 2 -

Pos. 3 -

Pos. 4 -

Pos. 5 -

February 11, 1966

1. Continued reinstallation of all engines:

a. Connected all wraparound lines.

b. Pressurized LOX tank to 12 p.s.i.g. and leak checked LOX pump inlet seals, Pos. 1 thru 5. All O.K.

2. Installed nozzle extensions, Pos. 1 thru 5. (Following order 1-2-3-5-4.) Installed new seals and Falpro C-5.

3. M.E. worked two 12 hr. shifts and continued changeout of babypants.

4. Disconnected manual engine actuators, Positions 1 thru 4.

5. Welders completed new filter outlet manifold. Fitup was O.K. Hydrostated to 3500 p.s.i.g. for 30 minutes. Delivered manifold to Wyle Lab. for cleaning.

6. Began torquing skirt bolts.

7. Hooked up all positions pitch and yaw actuators to stage outriggers.

Bridges detected Pos. 2 yaw stage attach bolt due to marring.

8. Removed the following instrumentation:

CA4012-1	DA4026-1
CA4012-2	DA4026-2
CA4012-3	DA4026-3
CA4012-4	DA4026-4
CA4012-5	DA4026-5

February 12, 1966

1. Torqued the bolt assemblies on the nozzle extension, Positions 1 thru 5.
2. Installed overboard drain lines, Positions 1 thru 5.
3. M.E. continued installing new fuel pump inlet elbows. Worked two 12-hour shifts.
4. Torqued gimbal block bolts to 400 ft-lbs, Positions 1 thru 5.
5. Astrionics people installed 2 new accelerometer mounting blocks on the Position 4 Moog actuators.
6. Began installation of engine area purge tubing, Positions 1 thru 5.
7. Began removal of servo-actuator handling jacks from all actuators.
8. Picked up new filter manifold from Wyle Lab. and installed on hydraulic skid. Installed new drain valve on manifold and plumbed in drain line.
9. M.E. installed new LOX dome purge line and new LOX pump seal purge, lines (wraparound lines which had been contaminated).

LOX Dome Purge

P/N OUT - NAS-26882, S/N - None

P/N IN - NAS-26882, S/N - 071

LOX Pump Seal

P/N OUT - NAS-26881, S/N OUT - None

P/N IN - NAS-26881, S/N IN - 010

February 13, 1966

1. M.E. Lab worked two 12-hr. shifts and completed installation of fuel pump inlet elbows except for torquing bolts, brackets, etc.
2. M.E. changed out all flight supply ducts to gimbal filter manifolds, Positions 1-4.
3. Overboard fuel drain line on Position No. 3 was bent while installing engine area purge lines.
4. Two of our men worked on each shift in support of M.E. people.
5. M.E. changed out the delta "P" pressure transducer on the filter manifold, Position 1.

February 14, 1966

1. Brought up hydraulics and leak checked all of hydraulic control system. No leaks. Performed hydraulic system components test and ran both a.m.f. and Greer units. Had position indicator problems on stage hydraulic supply valve and Greer return valve.
2. Continued installation of engine area purge tubing.
3. Removed servo-actuator locks from Position No. 1 with hydraulics up. Secured hydraulics at 4:05 p.m. Total hydraulics time today was approx. 45 minutes.
4. M.E. changed out the G.G. LOX bootstrap downstream orifices, Positions 1, 2, 3 and 5.
5. M.E. began installation of thrust O.K. pressure switches.
6. Leak checked the GOX and helium systems, all engine positions. All O.K.

February 15, 1966

1. Brought up hydraulics, Greer unit, at 8:15 a.m.

2. Pressurized fuel system to 12 p.s.i.g. and leak checked. Engine systems O.K.
3. Removed servo-actuator locks with hydraulics on, utilizing manual current generator boxes, Positions 2, 3 and 4.
4. Performed high LOX dome purge checkout with results as follows:
 - Loader Setting - 1000 p.s.i.g.
 - Umbilical Supply - 780 p.s.i.g.
 - DA4000-1 - 600 p.s.i.g.
 - DA4000-2 - 640 p.s.i.g.
 - DA4000-3 - 640 p.s.i.g.
 - DA4000-4 - 620 p.s.i.g.
 - DA4000-5 - 640 p.s.i.g.
5. Ran engine components, engine sequence and complete stage sequence test and found the following discrepancies:
 - a. Engine Positions No. 1 and No. 3; the MFV No. 2 potentiometer and limit switches were slow on closing times -- 2.5 to 3 sec. on closing.
 - b. Engine Position No. 4 - MLV No. 1 potentiometer trace was ratty or ragged.
 - c. Engine Position No. 5 - MFV No. 2 trace direction was reversed.
6. Ran a 3-2 cutoff test by dropping power to all five stop backup solenoid valves. Recorded times on oscillographs.
7. Hydraulics off at 11:15 a.m. and on again at 1:30 p.m. for gimbal system calibration.
8. After removing servo-actuator locks, checked the null shift on all actuators with hydraulics up:
 - No. 1 Pitch - 6' extend
 - No. 1 Yaw - 6' extend
 - No. 2 Pitch - O.K.

8. (Continued)

No. 2 Yaw - O.K.

No. 3 Pitch - O.K.

No. 3 Yaw - 6' extend

No. 4 Pitch - 1' retract

No. 4 Yaw - 7' extend

9. Completed installation of engine area purge tubing, Positions 1 thru 5.
10. Pressurized LOX tank with prevalues open and leaked engine systems. O.K.
11. Began calibration of gimbal system. Zeroed all piston indicators before starting. Had electrical problems with gimbal controller.
12. M.E. completed installation of TOKPS on Positions 2, 4 and 5.
13. Ran a 3-2 engine cutoff sequence test with oscillographs by dropping power to stop backup solenoids, all five simultaneously. Time from stop backup de-energized to GG ball valve limit switch leave open:
 - No. 1 - .050 (OSC)
 - No. 2 - .064 (OSC)
 - No. 3 - .041 (OSC)
 - No. 4 - .072 (DEE Time)
 - No. 5 - .050 (OSC)

No good. Must change orifices in Pos. 2 and 4 from .060 to .030. (Stop-Backup)

14. Received two new MFV resister assemblies and gave to Mr. Clift of M.E.
15. Installed GA22-1 and 3 and GA23-1 and 3.
16. All day long, with hydraulics on, Engine Position No. 1 was nervous. This is a result of either pitch or yaw actuator limit cycling, or a combination of both. However, I suspect the yaw actuator.

17. Flushed the LOX domes and GG LOX injectors, Positions 1 thru 5.
18. Performed a hot fire functional test on both GG and TB igniters. Igniters were not installed but secured to the engines, Positions 1 thru 5.
19. Performed engine area purge checkout O.K.
20. Received new relief valve for inert prefill unit and installed. Set to relieve at 390 p.s.i.g., must reset to 250 p.s.i.g.
21. Filled both inert prefill tanks with prefill to new spec. (1% Pulled 2 samples for chem. and contamination analysis)

February 16, 1966

1. M.E. Lab. changed out the MFV No. 2 pot and switch assemblies on Engine Positions 1 and 3.

Pos. 1

P/N OUT - 408063 ,S/N OUT - 8278546

P/N IN - 408063 ,S/N IN - 8296892

Pos. 3

P/N OUT - 408063 ,S/N OUT - 8287531

P/N IN - 408063 ,S/N IN - 8296893

2. Replaced the discharge orifices in the stop backup solenoid valves, Positions 2 and 4. Dia. OUT-.060-Inch. Dia. IN-0.030-Inch.
3. Disconnected, inspected and reinstalled the GG ball valve opening control line flanges, Positions 1 thru 5. Slight erosion at all positions, but all are O.K. This required drain down of hydraulic control system.
4. Repaired position indicator on Greer return valve. Micro-switch was shorting out due to water entrapment.
5. Completed installation of hydraulic skid drain line. Re-torqued grayloc couplings on new a.p.m. filter installation.

6. Removed manual engine actuators, Engine Positions No. 1 thru 4.
7. Installed heat shield panels over manual engine actuator brackets, Positions 1 thru 4. All heat shield panel installations are now complete.
8. Checked off Measuring Program.
9. When power was applied, no indications were obtained on Positions 1 and 3 MFV No. 2 pots. The valves were not cycled. Drained down hydraulic control system, removed pots and found that they had been improperly installed by M.E. Reinstalled MFV No. 2 pots on Pos. 1 and 3 and they were O.K.
10. Ran two sequence tests and two dry run gimbal programs. O.K.
11. Ran a 3-2 cutoff with stop backup solenoids de-energized.
12. Tanked fuel, 218,000 gal. down to engines with prevalues open. Pressurized and leak checked. O.K.
13. Drained down engine fuel system and secured hydraulics at 8:30 p.m.
14. Fabricated and installed new position indicator bracket on stage hydraulic supply valve. Checked indications with control. O.K.
15. Completed all instrumentation, torque checks, and safety-wiring.
16. Performed dryrun gimbal program with oscillographs; limited amplitude to max. of $\frac{1}{2}^{\circ}$.
17. Checked settings on all TOPS, Positions 1 thru 5. All switches picked up between 1020 and 1050 p.s.i.g.
18. Installed skirt and GG 28 volt igniter adapters, Positions 1 thru 5.
19. Filled a.m.f. and Greer hydraulic reservoirs while tanking fuel.
20. Pulled two samples of inert prefill for contamination analysis per MSFC Spec. 164

<u>As Received</u>	<u>After 2 hr. Flush</u>	<u>Micron Range</u>
400	DHA	100-175
25	21	175-700
4	0	700-2500
0	0	2500

February 17, 1966

1. Checked out and set up hydraulic system. Brought up hydraulics, Greer unit, at 8:15 a.m.
2. Performed engine components and sequence test. DEE times from STUS open to GGBV leave open:
 - Pos. 1 - 0.048 sec.
 - Pos. 2 - 0.224 sec.
 - Pos. 3 - 0.040 sec.
 - Pos. 4 - 0.292 sec.
 - Pos. 5 - 0.052 sec.
3. Calibrated GA22-1 and 3 and GA23-1 and 3 with digital and oscillograph.
4. Opened fuel pre valve and dropped fuel down to engines at 8:45 a.m.
5. Pre-filled the thrust chamber jackets with the MSFC unit and completed at 10:20 a.m. The KSC unit was not used due to problems encountered in the facility electrical controls system. Chemical analysis on prefill was:
 - 48.3% Water
 - 50.7% Ethylene Glycol
 - 1.0% Sodium Nitrite
6. Tanked LOX to full load; began at approx. 10:20 a.m. Completed tanking at 12:00 a.m.
7. Began hypergol installation at 11:00 a.m. Completed installation on all engines at 11:20 a.m.
8. Pressurized LOX tank and leak checked. O.K.
9. During pre-fill operations, the chamber "FULL" lights came on as follows:
 - 4, 5, 3, 1 and 2. No. 4 and 5 came on approx. 4 min. after start of fill.

10. Fired for a duration of 45 seconds at approx. 3:17 p.m. No problems. During gimbal program, Pos. 4, yaw position pot plug fell out indicating actuator was hard over.
11. Post-test inspection revealed the following:
- Fuel seal leak on Position 4, No. 1 MLV opening control line.
 - Position 1, fuel seal leak at flight supply line to 4-way control valve, at the No. 2 high pressure duct.
 - Position 4 yaw actuator position pot connected had fallen out. No damage, improper installation.
12. De-tanked LOX and fuel, performed engine fuel systems drain, hypergol purge, etc.
13. Secured hydraulics at 8:00 p.m. and went home. Total time of hydraulics on today was 11.75 hours.

February 18, 1966

- Trich. flushed and water flushed thrust chamber jackets, Positions 1 thru 5.
- Leak checked thrust chamber jackets, Positions 1 thru 5. No leaks. All O.K.
- Changed out the following instrumentation:

CA9-1	CA2-1	DA7A-4
CA9-2	CA2-2	DA7A-5
CA9-3	CA2-3	
CA9-4	CA2-4	
CA9-5	CA2-5	
- Visually inspected turbine exhaust manifolds and nozzle extensions, Positions 1 thru 5. All O.K.
- M.E. changed out the fuel overboard drain line on Position 3, S/N F-3016:
P/N OUT - 408243 , S/N OUT - 002
P/N IN - 408243 , S/N IN -

6. Hydraulics (Greer unit) was on for approx. 2 hours during engine flush.
To date - total time - 51.75 hours.

February 19, 1966

1. Inspected main injectors, Positions 1 thru 5. All O.K.
2. Replaced the fuel seal on the engine supply line to the 4-way control valve, Position 1, at high pressure duct flange.
3. Changed out the pitch LOX dome pots on Engine Position No. 1
4. While preserving turbopumps, a leak was noted on the Position 1 GSE adapter on the bearing coolant control valve. Replace the adapter seals:
 - 1 o-ring MS 29513-128
 - 2 teflon backup rings MS 28774-128
5. Installed new relief valve on KSC inert pre-fill unit.
6. Re-torqued the loose bolt on flange in opening control line to No. 1 MLV, Position No. 4.

February 21, 1966

1. Completed all torque checks, Positions 1 thru 5.
2. Brought up hydraulics, a.m.f. unit, at approx. 10:00 a.m. and had Bill Howard and Jim Smith to look at nervous H.R. actuators. They attempted to bleed actuators, but this didn't help.
3. Calibrated the pitch and yaw LOX dome pots on Positions 1 and 3.
4. Secured hydraulics at approx. 12:00 p.m. Total time to date 53.75 hours.
5. Checked out operation of KSC inert pre-fill unit both in local and remote modes, for pre-fill operation and tophoff operation. Simulated TC jackets full with supply disconnected from stage and checked out automatic 30 seconds overflow. New relief valve popped at 300 p.s.i.g. Everything functioned properly.

6. Stage crew worked until 8:00 reinstalling LOX pre valves after removing flowmeters. While installing last pre valve above Engine Position No. 2, they dropped a 7/16" stud into the LOX pump inlet. They couldn't find stud so engine will have to be removed for LOX pump teardown.

February 22, 1966

1. Began prepping Engine Position No. 2, S/N F-3015 for removal:
 - a. Installed gimbal locks on all actuators, Positions 1 thru 4.
 - b. Installed servo-actuator handling jacks, pitch and yaw actuators, Position 2.
 - c. Disconnected wraparound lines, installed protective closures.
 - d. Disconnected engine area purge lines.
 - e. Removed overboard drain lines.
 - f. Removed all bolts from LOX and fuel pump inlets, and all skirt bolts.
 - g. Prepared engine area platforms for rolling deck operation.
 - h. Disconnected flame curtain from stage.
 - i. Disconnected fuel bubbling lines and instrumentation from fuel pump inlets.
2. Removed skirt and engine from Pos. No. 2, S/N F-3015 and sent to Ace's shop for pump teardown and removal of stud.
3. Returned rolling deck to IN position and secured facility, went home.
4. Ace's people found stud in the No. 2 LOX pump outlet volute at approx. 7:00 p.m. Primary LOX seal was in good shape. They rebuilt pump and will be ready for installation tomorrow morning.

February 23, 1966

1. Received Eng. S/N F-3015 from Ace's shop and installed in Position 2.
 - a. Installed LOX pump and fuel pump inlet bolts torqued and safety-wired.
- Installed new LOX and fuel pump inlet seals.

1. (Continued)

- b. Installed gimbal block bolts and torqued to 400 ft-lbs.
- c. Connected actuators to stage, torqued bolts, and installed coffer pins.
- d. Removed servo-actuator handling jacks, pitch and yaw actuators.
- e. Connected and torqued all wraparound lines.
- f. Installed skirt, 240 bolts, torqued.
- g. Installed LOX, fuel, and purge overboard drain lines.
- h. Reinstalled engine area purge lines.
- i. Reinstalled fuel bubbling lines and instrumentation on fuel pump inlets.
- j. Reinstalled flame curtain.
- k. Installed manual engine actuators.
- l. Removed servo-actuator locks.

2. M.E. changed out LOX overboard drain line on Position 1, S/N F-3013:

P/N OUT - 408244 , S/N OUT - 3651724

P/N IN - 408244 , S/N IN - 2634845

However, they inadvertently bent the new line in approx. same place as old one during installation. Should be changed before flight.

3. Changed out filter manifold delta "P" transducer on Position 1, S/N F-3013:

P/N OUT - 60B72077-1A, S/N OUT - 0140059

P/N IN - PL356TC-300-350, S/N IN-91

New one installed is an R&D type for P&VE. Old one is O.K. and will be re-installed after test S-IC-17.

4. Obtained new orifices from Hinkle, sent to Pepper for cut, and installed in fuel pump balance cavity supply line, Positions 2 and 3.

Pos. 2 P/N OUT - RD251-4087-0149 Size OUT 0.149"
P/N IN - RD251-4087-0219 Size IN 0.219"

Pos. 3 P/N OUT - RD251-4087-0275, Size OUT 0.275"
P/N IN - RD251-4087-0324, Size IN 0.324"

5. Pressurized the GOX system to 450 p.s.i.g., fuel system to 200 p.s.i.g., and leak checked. O.K.

6. Flushed and purged (trich. flush procedure) the LOX dome and GG LOX injector, Position 2.

7. Changed out DA4041-2.

February 24, 1966

1. Brought up hydraulics, a.m.f. unit, at approx. 9:00 a.m.
2. Performed hydraulic control system leak check, opening and closing control, at 1800 p.s.i.g.
3. Performed engine components and engine sequence tests.
4. Shut down a.m.f. unit at 1:05 p.m. and brought up the Greer unit.
5. Pressurized LOX and fuel systems, leak checked. O.K.
6. Began gimbal system calibration at 11:00 a.m. Could not calibrate current traces due to extreme noise. Ran dry run gimbal program at maximum amplitude of 0.5° . Experienced a hydraulic zero shift of 12' extend on No. 3 yaw actuator. Re-zeroed scale.
7. Developed high fluid temp. problems on a.m.f. unit which caused us to changed over to Greer unit. Must investigate later.
8. Conducted 2 stage and engine sequence tests with oscillographs.
9. Ran calips test on all TOKPS. All were within spec.
10. Completed all torquing and safety-wiring.

11. Tanked fuel with hydraulics on and prevalues open. Pressurized and leak checked. Closed fuel prevalues and drained down engine fuel systems.
12. Filled thrust chamber jackets with KSC prefill unit. After 150 gal. had been pumped, the unit began cutting off and on intermittently due to all T/C jacket lights picking up and dropping out. Data was recorded as follows:

Pump Outlet Pressure - 320 p.s.i.g.

Umbilical Supply Pressure - 150 p.s.i.g.

Flow rate - 45 g.p.m.

Gallons to Overflow:

Pos. 1 - 456

Pos. 2 - 560

Pos. 3 - 565

Pos. 4 - 468

Pos. 5 - 514

30 Sec. Overflow - 610 g.p.m.

13. Began disconnecting all D21 and D22-1 thru 4 flight transducers on actuator delta "P"'s, due to faulty pickups. They will be replaced with static measuring pickups.
14. Secured hydraulics at 6:00 p.m. Makes a total time to date of 62 $\frac{1}{4}$ hours.
15. Drained inert pre-fill from fuel inlet manifolds, Positions 1 thru 5.

February 25, 1966

1. Brought up hydraulics, Greer unit, at approx. 8:40 a.m.
 2. Performed hydraulics and engine systems components tests.
 3. Completed changeout of all servo-actuator delta pressure pickups.
- Installed DA1018-1 thru 4 and DA1014-1 thru 4.

4. Performed turbopump torque check, Positions 1 thru 5. All O.K.
5. Dropped fuel to engines, one at a time by opening fuel prevalues pressurized fuel tank and leak checked. O.K.
6. Topped off T/C jackets with KSC pre-fill unit at 9:30 a.m.
7. Began tanking LOX at 9:20 a.m.
8. Completed tanking LOX at 12:00, pressurized LOX system and leak checked. O.K.
9. Completed igniter installation at 9:25 a.m.
10. Took hydraulic system samples at 10:00 a.m. for fluid contamination analysis.
11. Began hypergol installation at 11:00 a.m.
12. Continued countdown with plenty of time - firing came at 2:59 p.m. - intended to run for 120 or 130 seconds, but redline observer cut the test after 83.2 seconds of mainstage following the loss of the primary and backup chamber pressure measurements (DA-7 @ 8 or 9 sec. and DA7-A @ 83.2 sec. mainstage) on Engine Position No. 1.
13. Also lost DA7A (Pc) on Eng. Pos. No. 5 - occurred during startup.
14. Test was very successful - post-test engine inspection revealed no visual damage, no leaks, etc.
15. Purged hypergol, drained fuel from engines, detanked LOX and fuel, and secured engines.
16. The Greer hydraulic unit was prematurely shut down at 4:30 p.m. - control switched to amf unit as fast as possible (took less than a minute) - investigation revealed that the lock-nut on the servo-pump pressure adjust compensator had vibrated loose, allowing the pump output pressure to decrease sufficiently to cutoff the unit.
17. AMF hydraulics taken off at 6:25 p.m. This gave 10 hours of hydraulic time on the engines today.

February 26, 1966

1. Data session held this morning. Everything indicated a successful test. The engine start sequence was within the predicted limits resulting in a near perfect 5, 1-3, 2-4 start with 300 milliseconds stagger time. Cutoff was the planned 3-2 sequence 100 milliseconds apart.
2. Preliminary evaluation of test data indicated no appreciable effect from the orifice change on Eng. Pos. No. 3. Thrust level is still high at ~ 1,550,000 lbs.
3. Performed post-test servicing, flushed chambers with trich., preserved turbopumps, etc.
4. Checked chambers for leaks and found none.
5. Ran hydraulics approx. $1\frac{1}{2}$ hours today during servicing. Total of 73.75 hours in Test Lab to date.

February 28, 1966

1. Inspected chambers and injectors today. All injectors looked good except #1 engine. 12 small cracks ($\frac{1}{4}$ " to 1" in length) were found on the outer circumferential baffle stub-outs. Looks like material failure.
2. Rocketdyne started cleaning the injector baffles for etching with nitric acid.
3. Started removing overboard drain lines and engine area purge lines.
4. Removed DA-7 and DA-7A (Pos. 1 and 5).
5. Started removing extension skirt bolts.

March 1, 1966

1. Completed removal of over-board drain lines and engine area purge lines.
2. Installed protective covering on engines (just like they came from M.E. Lab).

3. Installed gimbal actuator locks on engines 1 thru 4; we were going to bring up hydraulics for this job, but control had problems in the blockhouse so we installed manual engine actuators on engines 1 and 4 and used them for lock installation - then pushed engines 2 and 3 manually to get locks on.
4. Installed servo-actuator jacks on engines 1 and 4. Boeing will fit-check some flight heat shields at these positions later this week. This will require gimbal actuators to be moved outward from the stage a little bit.
5. We conducted a test on the inert pre-fill unit (Cape) today. Attempting to get full flowrate of 50 g.p.m. out of the pump. Took the relief valve off so no pre-fill could recirculate into the supply tank.

The level sensors were disconnected from the automatic cutoff circuitry in the blockhouse. Lights always come on early because of pre-fill splashing on the sensors. Started up Kidde unit at 1:25 p.m., 10 sec.

flow was 48 to 49 g.p.m.

pressure at pump outlet - 365 p.s.i.g.

pressure at umbilical - 178-180 p.s.i.g.

Engines overflowing at:

Engine 1 - 1:34, 20 sec.

Engine 4 - 1:34, 40 sec.

Engine 5 - 1:35, 30 sec.

Engine 3 - 1:36, 10 sec.

Engine 2 - 1:36, 30 sec.

then had 30 sec. overflow.

Turned off pump at 1:37 p.m., 0 sec.

6. Drained pre-fill, flushed chambers with water, and purged chambers.

March 2, 1966

1. Lowered engine deck platforms and prepared for rolling out 10th level deck.
2. Removed extension nozzles (skirts) from engines. Took from 9 a.m. to 1 p.m. to get all 5 nozzles to the ground level. No. 4 skirt has a small dent on the bottom hat-band (underneath) but it was that way when it came from M.E. May have to put a patch on it later.
3. Rolled deck in and set up engine platforms for normal operation.
4. Drained IMV sense lines this morning.
5. Rocketdyne cleaned injector baffles and prepared for acid-etching.
6. Checked actuator positions for the mechanical null:
 - #1 yaw - 8' retract
 - pitch - 6' retract
 - #2 yaw - 0
 - pitch - 0
 - #3 yaw - 5' extend
 - pitch - 5' extend
 - #4 yaw - 3' retract
 - pitch - 3' extend
7. Started removing instrumentation from #2, 3, 4, and 5 engines. #1 engine will be left as is since the engine will be static-tested later in March with a new injector.

We are saving tubing from the engines for S-IC-502.
8. Boeing started to work on fitting the flight heat shields at #1 and 4 positions.

9. Amplifier response tests were run on the eight flight type amplifiers using the gimbal program tape from test S-IC-17. Hydraulic power was not applied to the engines. The test consisted of four runs as follows:

Run No. 1 - Servo current input cables connected to all actuators.

Run No. 2 - Servo current input cables disconnected from actuators, 100 ohm resistor substituted for servo-valve.

Run No. 3 - All wires disconnected from the blockhouse to the actuators. 100 ohm dummy load applied at the amplifier output terminals.

Run No. 4 - Computer and programmer eliminated from system. Ran signals for null studies.

March 3, 1966

1. Rocketdyne etched all the injector baffles last night. Found no other cracks.
2. Removed more instrumentation from engines 2, 3, 4, and 5. Not removing #1 engine.
3. M.E. removed flight curtains from engines.
4. Installed extension nozzles in crates for shipment.
5. Torqued actuator locks (engines 1 thru 4) to 100 ft-lbs.

March 4, 1966

1. Continued removal of instrumentation, installing plugs, safety-wiring, etc.
2. Started repairs to AMF hydraulic unit. When we removed the water inlet section from the heat exchanger, we found a broken plate that divides the water in and water-- thus allowing water not to circulate through the tubes. (Otherwise the tubes look clean.) We will send the inlet section to the shop for weld repairs.

3. M.E. has installed two new LOX pre valves (Whittaker). Lack three more.
4. Boeing is still working on fitting up flight heat shields at positions 1 and 4.
5. Working on plumbing up cocoon lines, crosses for temp. and pressure transducers, etc. This is for the cocoon purge test next week.

March 5, 1966

1. Fabricated position switch brackets for Jamesbury valves.
2. Repaired leak on Greer unit servo-system and refilled with 5606 Hyde oil.
3. Removed DA1017-1 and DA1018-1 and replaced flight hardware (Δ P's on gimbal actuators).
4. Repaired 2 leaks on GN₂ service Panel #5. Replaced 4 gages (one was 0-5000, another 0-500, and two were 0-100). Plumbed new tube to supply gage.
5. Removed manual engine actuators and servo-actuator jacks from engine 4. Re-pinned the actuators. Placed manual engine actuators and jacks on engine #3. Boeing will fit-check heat shields at #2 and 3 positions next.
6. Made ramp from rolling deck to NE tower for hauling hardware when crane is not in use.
7. Leak checked the fuel pressurization lines (helium at engines 1 thru 5).
8. Installed transducer bracket for hydraulic return pressure at skid.

March 7, 1966

1. M.E. is working on LOX pre valve installation. Still lack two.
2. Boeing is fitting up flight heat shields at engines 2 and 3. We assist them as necessary.

3. Removed static instrumentation from engine #1 (at request of Marty. He wants transducers from 501 and 502).

4. Installed pins in actuators at engine #2.

5. Removed actuator jacks from engine #2.

March 8, 1966

1. Installed pins in actuators at engine 3.

2. Removed manual engine actuators and jacks from engine 3.

3. Torqued top pins and inserted cotter pins at actuators, engines 1 thru 4.

4. Installed AMF heat exchanger water inlet section and leak checked.

All O.K.

5. Last two LOX prevalues installed.

6. Leak checked LOX and fuel systems. All O.K.

March 9, 1966

1. Adjusted micro-switch and bracket on Greer cross-over valve.

2. Waited most of day on control personnel in blockhouse to get set up for components and sequence tests (with computers).

3. After computer problems were straightened out, components and sequence tests were conducted:

1st one conducted at 4:15 p.m.

2nd one conducted at 5:03 p.m.

both with computer-controlled equipment.

Hydraulics up at 6 p.m. for rest of evening (only ran 15 min. each for first two components tests).

Ran another components test (manual) at 6:11 p.m.

3. (Continued)

Conducted a sequence test at 6:40 p.m., preparing for a 500 volt igniter test.

Conducted sequence test with 500 volt igniters at 7:15 p.m. Igniters fired O.K., but control had some burn-out problems in their computer system.

4. Hydraulics off at 9:00 p.m. Makes 3.5 hours today and 77.25 hours to date in Test Lab.

(Had about three leaks on Greer hydraulic unit. Small ones.)

March 10, 1966

1. Hydraulics up at 10:00 a.m. for LOX load test - mainly to check out new Whittaker LOX prevalues.

2. Tanked partial tank of LOX for leak test - cycled LOX prevalues, leak checked, etc. Everything O.K.

3. Conducted cocoon purge test. Obtained some acceptable data.

4. Quality has defected exhaust manifold on engine 5. Has a crack about $\frac{1}{4}$ " long in a weld. We understand this crack was there prior to shipping 501 here. The crack did not get worse after 2 tests. Rocketdyne specifications call for cracks up to $\frac{1}{2}$ " long as being acceptable, but we will get the crack weld repaired before 501 leaves Test Lab.

5. LOX was drained out #5 suction line to the field after the load test. Only had a few thousand gallons.

6. Took hydraulics off at 6:30 p.m. This was 8.50 hours today and now totals 85.75 hours in Test Lab for S-IC-501.

March 11, 1966

1. Prepared stage and engines for removal. Installed remainder of protective covers, etc.

2. Shop weld-repaired the crack on the exhaust manifold of #5 engine.

3. Removed and reinstalled cocoon orifices at engine positions 1 thru 5; and repeated cocoon purge test.
4. Removed hydraulic supply and return at umbilical.

March 12, 1966

1. Put final touches on engines prior to removal of S-IC-1. Scheduled for removal on Monday, March 14, 1966.
2. Removed cocoon instrumentation at engines 1 thru 5.
3. Installed thrust chamber throat plugs.
4. Made final inspection of engines, cleaned them good, etc.
5. Completed protective covers on engines.
6. Re-set scales to "zero" on actuators on engines 1 thru 4.
7. Wrapped hydraulic supply and return lines with asbestos.
8. Pulled GG combustor drains - all engines.
9. Prepared rolling deck for operating.
10. Installed LOX and fuel bootstrap orifices in engine 3 so that tanks could be pressurized. These orifice sizes are unknown and will be removed by M.E.

March 14, 1966

1. Removed S-IC-1 from test stand this morning.
2. Rolled deck to IN position.

March 15 through 18, 1966

1. Re-located accumulator pre-charge panel on Greer unit.
2. Completed freight elevator ramp.
3. Installed 0-1000 p.s.i. gage for LOX GN₂ service to engine.
4. Installed 0-500 p.s.i. gage for fuel GN₂ service to engines.
5. Removed filter from hydraulic reservoir fill line. Sent to valve lab to be serviced.
6. Delivered (5) manual engine actuators to M.E. for installation on 502.

1st week

Jepool

ENGINE SYSTEMS - S-IC-502

May 17, 1966

1. The 502 stage was received this morning. It was installed in the test stand by Vandersee's shop personnel. The LOX pump seal purge was not applied to the engines while rotating the stage from the horizontal to the vertical position.
 2. The center engine throat plug fell out during stage rotation. (The boot was not pressurized.)
 3. Stage was placed on the holddown arm pads at approximately 1:00 p.m.
 4. Rolling deck was returned to the IN position - engine access platforms were set up, handrails installed, etc.
 5. Installed engine deluge firex nozzles at Positions 1 through 5.
 6. Inspected stage and engines - started to hook up drain hoses to the engines to see if they contained fuel; but first, the fuel tank was pressurized and vents closed, and by the time vents were opened, we could not find Quality personnel as witnesses; so we will wait until tomorrow.
 7. We know there was some fuel though, because one drain hose temporarily hooked to Engine No. 1 showed about 2 gallons of RJ-1.
 8. Installed stop backup solenoids (MV74VE) at Positions 1 through 5. Had to remove Rocketdyne line P/N 408836 and install MSFC line (with a tee) between the checkout valve and the cross in the fuel overboard drain line. The tee is for venting the MV74VE into the engine overboard fuel drain line.
- Pos. 1 - S/N 318
2 - S/N 309
3 - S/N 310
4 - S/N 311
5 - S/N 317

May 17, 1966 (Con't)

9. Installed GN₂ supply manifolds for engine area purges - Pos. 1 through 4.
10. Found some dents in exhaust manifolds on Engines 1, 4, and 5. 4017*

(see cross-marks) →

4018 4020
4019

May 18, 1966

- ① Hooked up drain hoses to engines and checked for RJ-1. Found the following amounts:

	Amount In Gallons				
	Engine				
	1	2	3	4	5
#1 fuel turbopump inlet	0.5	1.0	2.5	1.0	0.0
#2 fuel turbopump inlet	1.5	3.0	1.5	2.5	2.0
#1 high press. fuel duct	0.0	0.0	0.125	0.0	0.0
#2 high press. fuel duct	0.0	0.25	0.0625	0.0	0.0
Engine return line	0.0	0.25	0.0	0.0	0.50
GG ball valve	0.0	0.0625	0.0	0.0	0.0
Eng. hyd. supply to 4-way valve	0.0	0.0	0.0	0.0	0.0
#1 side of fuel manifold	small trickle	0.0	0.0	0.0	0.0
#2 side of fuel manifold	0.125	0.0	0.0	0.0	0.0
Total	2.125	4.5625	4.1875	3.50	2.50
	gal.	gal.	gal.	gal.	gal.

- ② M.E. started removing fuel pump inlet elbows on the engines to check the torque on the fairing bolts and make the fix on the bolts. The fix consists of installing high strength bolts with apoxy - torquing them to 110 in-lb (higher torque than before).
- ③ (a) #1 engine was checked first. 3 of 4 bolts were not up to torque, the other one was up to torque. 3 bolts had to be turned $\frac{1}{4}$ turn to be the required 80-inch-lb.
- (b) Completed the fix on the bolts, not buttoned up yet. 4. #2 engine was then checked. One bolt had to be turned $\frac{1}{4}$ turn to be the required 80-inch-lb.

May 18, 1966 (Con't)

④ (continued)
Three bolts were up to torque - made the fix - re-installed fuel pump inlet elbows with new seal at inlet to turbopump - old seals and screws at inlets to elbow.

5. Started installing transducers. Completed the following today:

DA1-1, -3, -5
DA10-1, -2, -3, -4, -5
DA13-1, -2, -3, -5
DA2-3, -5

6. Pulled throat plug from #1 engine and inspected for RJ-1. None was found.

May 19, 1966

1. M.E. continued work on removing fuel pump inlet elbows and fairing fix. Removed elbows from #4 engine. All 4 bolts on fairing were up to torque of 80 in-lb. Made the fix on the fairing bolts. Re-installed elbows with new seals on inlets to turbopump, old seals and screens on inlets to elbows.

2. Removed elbows from #3 engine. All 4 bolts on fairing were up to torque. Made the fix on the fairing bolts. Re-installed elbows as on other engines.

3. Worked on transducer installation. Installed the following today:

(New bracket & tubing) → DA12A-5, -3, -1

DA12-5, -3

DA2-2

4. Re-installed elbows on #1 engine. Installed new seal at inlet to turbopump. Put old seals and screens at inlets to elbows. Only put about 4 bolts at each screen flange, though, since we will attempt to check the "pump inlet screen removal" tomorrow on #1 engine.

May 19, 1966 (Continued)

5. Note: Did not have to remove elbows from #5 engine. Fix was made to this engine last week at M.E. and Qual.

6. We were going to run the Greer hydraulic unit and just recirculate RJ-1 through the skid lines, etc. (not hooked to stage, yet), but control was not ready to support us with power.

7. Removed throat plugs from engines 2, 3, and 4.

May 20, 1966

1. Replaced stop backup solenoid on #1 engine. Blockhouse not getting signal on old one.

S/N out - 318

S/N in - 308

2. Installed the following transducers:

(New bracket & tub.) DA14A-5, -4, -1, -2, -3

DA14-5, -4, -1, -2, -3

DA12-4, -1

(New bracket & tub.) DA12A-4, -2

DA13A-4, -1, -2, -3, -5

DA1A-1, -2, -3, -4, -5

DA13-4

DA2-1, -4

DA1-2, -4

DA2010-1, -2, -3, -4, -5

DA3044-1, -2, -3, -4, -5

3. M.E. worked on tightening bolts for fuel pump inlet elbows. (Some they did not finish yesterday.)

4. Could not attempt "pump inlet screen removal" on #1 engine because of work on pre-valve removal above the engine.

May 20, 1966 (Con't)

5. Started flushing hydraulic systems today with RJ-1. Not hooked to stage yet, just recirculating. First, we had the stage and return valves closed. Had trouble with position switch on Greer supply valve. Finally got it to show an "Open" light.

Had a small water leak on the water press. pickup line. Got it fixed, though.

Water press. OK indication was 20 psi when we turned the water pumps on.

10:00 a.m., turned on the servo pump and checked it out. Press. dropout was 1350 psi. Press. pickup was 1400 psi.

Next, we turned on the supercharge or "boost" pump. Press. OK was at 40 psi.

Between 10:10 and 10:15 a.m., we checked out the main pumps. Bumped each one 2 or 3 times (separately) to get them primed. They all worked satisfactorily when brought up for full operation.

Shut everything down and tried automatic start at 10:16 a.m. Everything worked OK. Turned system on and off several times, could only get 1750 psi on hyd. press. for awhile, had to switch from one local press. transducer to another to get on up to 2000 psi. Checked to see what press. relief popped at. All three main pumps relieved at 2025 psi (checked them separately).

Next, we opened stage and return valves. Recirculated from 10:55 to 11:15 a.m. at 1050 psi.

No leaks on hydraulic unit. Looked good - even umbilical lines.

Ran Greer hydraulic unit from 12:25 to 3:25 p.m. (at 1050 psi). Took samples and they were OK. They are as follows:

May 20, 1966 (Continued)

5. (Con't)

<u>Supply Line</u>	<u>Return Line</u>
620 (10-25 mi-cron range)	200
60 (26-50)	15
13 (50-100)	7
1 (over 100)	1
0 (fibers)	1

<u>Reservoir</u>	<u>5606A (servo valve supply) (servo system fluid)</u>
960	920
60	40
18	13
1	2
0	1

6. Switched from Greer to AMF unit. Had trouble getting "Closed" indication on Greer supply valve.
- Turned on water pumps and supercharge pump at 3:37 p.m.
- Turned on main motors 1 and 2 at 3:40 p.m. Adjusted pressure to 1050 psi. (Hyd. temp. was 81°F.)
7. Flushed AMF unit @ 1050 psi. Shut down hydraulics @ 5:25 p.m. Turned off water supply to water pumps.

May 21, 1966

1. Removed servo actuator locks from engine 1. Prepared for pump inlet screen removal (just LOX pump - the fuel pump inlets are easy to get to).
2. The LOX PVC compression tool was already installed. We did not compress the PVC, though.
3. Removed bolts from LOX pump inlet flange, also removed one electrical connection line from underneath dishpan (was in way of pulling screen through the access door of the dishpan).
4. Using the manual engine actuators, we moved the engine outward about $3\frac{1}{2}^{\circ}$ (actually 3.6° pitch and 3.8° yaw). Manual engine actuator on #1 side was hitting the #1 high press. duct, so we could not have gone farther.
5. Could not remove the screen without going through the access door on the dishpan. So we removed the access door. The screen was then easily removed through the dishpan. Also the LOX pump inlet seal.
6. Inspected the LOX seal. It had been leaking during Quality checks. We found it was scratched quite a bit in one place.
7. Installed a new LOX seal and the screen. Moved the engine back into place and bolted everyone together as before. No problems.

May 21, 1966 (Continued)

8. Began removing access doors from dishpans on engines 2, 3, and 4.
9. Installed no transducers today. Did not have any.
10. Brought up AMF hydraulic unit at 1:00 p.m. Took hydraulic samples about 1:30 for contamination analysis.
11. Sample results came back at 2:30 and were OK. We shut down AMF unit about 2:35 p.m.
12. Attempted to hook up hydraulics to stage, but could not get stage supply and return lines drained. Lots of RJ-1 kept pouring from stage supply and return lines. Just left it hooked up to drain over the week-end.
13. Re-installed servo actuator locks on engine #1.
14. M.E. began installation of cocoon lines on engines (attaching to old GG fuel injector ~~lines~~ ^{purge} lines.)

2nd week

ENGINE SYSTEMS
5-1C-502

Jepool

May 23, 1966

1. M.E. finished installation of cocoon lines on engines 1 through 5.
2. Weld-repaired a groove $\frac{1}{2}$ " long by .040" deep in thrust chamber flange of #2 engine where the thrust chamber joins the skirt at hole location 118 (had been defected at Quality). Also straightened out the dent 3" long at the same location.
3. Installed following transducers:

DA4009-1, -2, -3, -4, -5	CA9-1, -2, -3, -4, -5
DA3-1, -2, -3, -4, -5	CA2-1, -2, -3, -4, -5
DA4-1, -2, -3, -4, -5	CA10-1, -2, -3, -4, -5
DA5-1, -2, -3, -4, -5	CA1A-1, -5
DA8-1, -2, -3, -4, -5	DA12-2
DA3041	DA3042
DA3043	DA3003
4. Started to install the DA7B transducers, but they do not fit flush at the top location. Will have to make a small fix for these transducers.
5. Plugged and safety-wired several seal bleed ports - all engines.
6. Torqued LOX pump inlet of #1 engine.
7. Pulled and serviced the hydraulic skid return valve. Found it was leaking at low pressure, OK at high pressure.
8. Prepared the rolling deck for skirt installation tomorrow. Vertical installer arrived at the test stand.
9. Hooked up the hydraulic supply and return lines to the stage. The return line drained quite a bit over the week-end (lost several hundred gallons of RJ-1 from AMF reservoir).

May 23, 1966 (Continued)

10. Hooked up manual engine actuator between engines #3 and 5 - just to see if we can use this method to manually push engine 5 over enough to remove the pump inlet screens. It looks good so far.
11. Installed hypergol simulators on engines 1 through 5.
12. Greased main motors 1, 2, and 3 on the Greer hydraulic unit.
13. New relief valve has been recently installed on the Kidde pre-fill unit. Set to relieve @ 400 p.s.i.g.
14. M.E. completed stage to engine alignment checks.

May 24, 1966

1. Installed following transducers:

DA7A-1, -2, -3, -4, -5 (new location on LOX dome)

DA15-1, -2, -3, -4, -5 (new tubing and brackets)

DA1018-3 (bypassed the flight Δ P transducer)

DA1019-3 (" " " " ")

2. Lifted vertical installer to 10th level this a.m.
3. Installed movie identification numbers on engines 1 through 5.
4. Received 4020 extension skirt this morning. It is for the center engine.
5. Removed bad Δ P transducer (P/N 60B72077-2, S/N 0140058) from actuator piston on #2 ^(YAW) side of #2 engine. It had been defected at Quality because of leakage. We will replace the transducer with a new one.
6. Installed flight harnesses (P/N 502932) for 500-volt igniters (GG and TE) on all engines today.

May 24, 1966 (Continued)

7. Started up AMF hydraulic unit at 10:45 a.m. Circulating through stage and engines at 900 psi. Had pre-filtration bypass valves open on the engine actuators (to bypass the servo-valve until flushing was complete).
8. Had low level of RJ-1 in AMF reservoir since the return valve leaked through over the week-end. Hydraulic temp. ran 88-90°F. Hydraulics flushing continued until 11:15 a.m. before AMF was shut down for lunch.
9. Small leaks showed up on the Moog actuators, pitch and yaw on engines 3 and 4, at the flange of the pre-filtration bypass valves. Leaking because valves were open.
10. Also had a bad hydraulic leak in the main housing of the pitch actuator on #2 engine. The yaw actuator/#2 engine had a small leak, but finally quit.
11. Started up AMF hydraulic unit again about 12:15 p.m. Ran until 1:15 p.m. to flush and take contamination samples. Sample results came back OK.
12. Tanked 375 gal. of RJ-1 into the AMF reservoir at 2:00 p.m., also topped off the Greer reservoir with 105 gallons.
13. Checked out functional operation of high LOX dome purge at 1:20 p.m. Looks OK.
14. Turned on LOX/pump seal purge at 1:45 p.m. Left it on for components and sequence tests.
15. Started cycling pre-valves to verify valve timings, etc.
16. Checked out engine area purge valves at 3:15 p.m., and they operated satisfactorily after a few checks.
17. AMF hydraulics were brought up at 4:25 p.m. for high pressure leak checks. Went up to 1800 psi, and everything on engines looked OK except pitch actuator leak on #2 engine. The pre-filtration bypass valves were closed now, so the MOOG

May 24, 1966 (Continued)

17. (Con't)

actuators did not leak.

18. Hydraulic pressure was set at 1550 psi and LOX dome purge at 500 psi. Then components tests were begun at 4:45 p.m. On first engine components test, did not get signal on fuel valves "open" on #3 engine (found Q.D. not on IMV).

Next, two components tests showed fuel valves not open on #4 engine. IMV would not unlock, and hypergol simulator was working properly. Increased the simulator supply pressure and then IMV operated satisfactorily for two more components tests.

During one components test, we leak checked hydraulic opening lines at 1800 psi while valves were open. Looked OK.

19. Ran engine components test from blockhouse (high LOX dome pressure @ 1000 psi) at 5:03 p.m. Looked good.

20. Shut down hydraulics at 5:15 p.m. and secured engines.

Total time on engine hydraulics today was 2.25 hours.

21. Found a dent on the 4020 extension skirt - located at the lower hat band (about $\frac{1}{2}$ " deep and 2" long). Will have to be repaired.

22. Received skirts for engines 1, 2, and 3. Began installing them at 5:30 p.m. Installed #1 engine first, then #2, and last #3. Completed job by 7:35 p.m. Rolled deck to IN position and went home.

23. Skirts on #4 and 5 engines will not be installed until after the propellant load test.

May 25, 1966

1. Set up engine access platforms, installed handrails, etc.
2. Torqued the bolts and nuts on extension skirts 1, 2, and 3 (240 bolts per engine).
3. Started installing engine area purge lines on engines 1, 2, and 3.
4. Tanked Kidde pre-fill unit to overflow this morning.

5. Installed following transducers today:

CA3-1, -2, -3, -4, -5 (just hooked up static cable to the flight measurement)

DA11-1, -2, -3, -4, -5

DA2000A-1, -2, -3, -4, -5

DA22-1, -2, -3, -4, -5 (new tubing and bracketry)

DA33-1, -2, -3, -4, -5 (new tubing and bracketry)

DA4000-1, -2, -3, -4, -5

DA6-1, -2, -3, -4, -5

DA7-1, -2, -3, -4, -5

DA7B-1, -2, -3, -4, -5 (added adapter on transducer)

CA4008-1, -2, -3, -4, -5

DA9-1, -2, -3, -4, -5

DA1018-1 (bypassed the flight ΔP transducer)

DA1019-1 (" " " " ")

(Changed out DA1-5, DA1-2, DA1-3, DA13-2, DA13-3, DA13-5, DA2-2 because of bad transducers.)

6. Found broken electrical connection on ΔP transducer on pitch actuator piston of #1 engine.

P/N 60B72077-3A

S/N 0140042

This is D21-101. The transducer will be replaced.

May 25, 1966 (Continued)

7. Found tension ties (between heat exchanger and thrust chamber) on #5 engine to be warped. Rocketdyne specs. says 2" deflection is allowable, and we do not have that much. (MAYBE CLOSE TO $\frac{3}{4}$ ")
8. Brought up AMF hydraulics at 3:00 p.m. Today the leaks on #2 engine's actuators have completely stopped. This is a mystery! The pitch actuator housing had a pretty good leak yesterday.
9. Leak checked GOX and helium systems. All engines look good.
10. Leak checked LOX and fuel systems - 10 psi on LOX tank, 15 psi on fuel tank. Engines looked OK except for a very slight leak on the LOX pump inlet flange of #1 engine.
11. Had leak in hydraulic supply line at umbilical. Changed out O-ring to repair the leak.
12. Began engine sequence tests. On the 1st one at 4:15 p.m., the IMV on #4 engine did not work.
13. Increased pressure to hypergol simulators, and the next sequence test was OK on all engines.
14. After another engine sequence test at 4:21 p.m., an automatic stage and engine sequence test was conducted at 5:40 p.m.
15. Conducted a hydraulic pressure check at 5:45 p.m. Only had the following measurements:

(DA3003 not accurate) used control gage

	Pressure (psi)		
	1500	1550	1600
DA3044-1	1480	1530	1580
DA3044-2	1485	1527	1585
DA3044-3	1482	1530	1585
DA3044-4	1482	1522	1589
DA3044-5	1488	1530	1590

May 25, 1966 (Continued)

16. Another stage and engine sequence test ^{WAS CONDUCTED} at 6:30 p.m. Only got 5 seconds. Cutoff was due to thrust OK pressure switches.
17. Hydraulics was shut down @ 6:30 p.m. This made 3.5 hours on engines today and 5.75 hours to date on engines in Test Lab.

May 26, 1966

1. Removed lower part of PVC compression tools (engines 1 through 4) in preparation for the propellant load test.
2. AMF hydraulics brought up at 10:25 a.m. for sequence tests.
3. Conducted automatic sequence test at 10:50 a.m. from X-90 seconds on. Was good test except none of the IMV's worked. None of the fuel valves showed "open". We had 150 psi on the hypergol simulator supply pressure.
4. Installed a dial gage on the hypergol simulator supply line at #4 engine. The gage showed 140 p.s.i.g.
5. Conducted a good sequence test at 11:20 a.m. for 130 + seconds (with oscillographs). The IMV's worked this time. Some changes in the blockhouse electrical circuitry must have done the trick.
6. The gage on #4 engine's hypergol simulator dropped from 140 to 25 psi after mainstage operation.
7. AMF hydraulics off at 11:25 a.m. for lunch.
8. AMF hydraulics up again at 1:15 p.m.
9. Conducted fluid verification tests on:
 - (a) Hydraulic flow and pressures (look OK).

May 26, 1966 (Continued)

9. (Cont'd)

(b) LOX dome and GG LOX inj. ~~purge~~ ^{PURGE}

DA4000-1 thru -5 = 650 p.s.i.g.

(c) LOX pump seal and GG act. housing purge

DA4009-1 thru -5 = 75 p.s.i.g.

10. Leak checked engine purge systems. They are all OK.

11. Continued engine area purge installation. Engines 2 and 3 were completed.

12. No leakage appeared on the #2 ^{ENGINE} actuators today. Look OK.

13. Had a leak on the AMF hydraulic unit. Main pump #4 compensator shutoff valve. O-ring seal was leaking. Repairs were made and it is OK now.

14. Checked engine oscillographs from yesterday's sequence tests. Had several traces missing; these things will be corrected.

15. Another thing showed up on the osc. traces. #1 engine fuel pre-valves were closing too fast (150 milliseconds). Found out the control orifice had blown out of the special made union in the control line. Corrections will be made.

16. Removed engine protective covers, bellows covers, etc.

17. 1:45 p.m. - trouble developed on the stop back-up solenoid of #5 engine. Control jumpered it out to start sequence tests.

18. 1:53 p.m. - conducted sequence test - engine #2 fuel valves showed "closed".

19. 2:00 to 2:30 - Astronauts from Houston visited the test stand. About 20 of the new ones. They looked the engines over good, because some day they will ride atop them!

20. 2:35 p.m. - Started tanking fuel for the propellant load test.

May 26, 1966 (Continued)

21. Discovered a fuel leak on engine #4 fuel pump. Located at flange where pump impeller back-casing line enters the pump. Looks like an O-ring leak. The flange was hard to get to, but we tightened the flange bolts the best we could.
22. Removed the GG combustor drain plugs on all engines per Procedure 44.
23. Fuel tanking completed @ 4:30 p.m.
24. Hydraulics off @ 4:30 p.m. for pressurized fuel system leak check. New Rocketdyne requirement is to leak check MFV's with hydraulics off.
25. Conducted leak check per propellant load test checklist. All engines OK except the #4 fuel pump leak.
26. Hydraulics on 4:40 p.m. Closed fuel pre-valves and drained fuel below pre-valves per Procedure No. 54.
27. Hydraulics off @ 5:12 p.m. This made 4.75 hours on engine hydraulics today and a total of 10.50 hours as of the date in Test Lab.
28. Torqued turbopumps today:

Engines 1 -	120	110
2 -	110	100
3 -	100	80
4 -	110	100
5 -	95	90
29. Changed out stop backup solenoid on #5 engine:

S/N OUT -	317
S/N IN -	499
30. Began removing #4 fuel pump impeller back-casing line to replace the O-ring. Will finish up tomorrow morning.

May 27, 1966

1. Completed changing of O-ring on #4 fuel pump impeller back-casing line (P/N MS 29513-121). The old one was broken in two places.
2. Brought up AMF hydraulics @ 8:05 a.m. for components and sequence tests.
3. Checked LOX pump heaters @ 8:20 a.m. All OK.
4. Conducted engine sequence test @ 8:25 and spanned oscillographs on valve traces. Conducted another sequence @ 8:30 a.m.
5. Dropped fuel below pre-valves @ 8:35 a.m.
6. Leak checked fuel systems @ 8:47 a.m. Engines OK under pressure.
7. Pressurized LOX tank for leak check @ 9:05. Engines OK.
8. LOX tanking began @ 9:15 a.m.
9. When LOX tank was almost full, a pressurized leak check was conducted on the engine systems. Completed check @ 10:45 a.m. Engines were OK.
10. GG drain plugs were removed during LOX tanking and leak checks.
11. Changed out DA13-5, DA1-5 (bad transducers).
12. Conducted wet simulated countdown at 3:00 p.m. All the way to the X-4 seconds, everything looked good. Lost approximately 150 gallons of RJ-1 from the AMF reservoir while engine checkout valves were rotated to the engine return position. This was planned.
13. Detanked LOX and fuel.
14. There is a purge leak in the GG actuator housing on engine #4. (NOT BAD THOUGH)

May 27, 1966 (Continued)

15. Hydraulic leaks reappeared today on:

(a) Pitch actuator housing of #2 engine.

(b) Yaw actuator pre-filtration bypass flange of #4 engine.

16. Hydraulics off at 7:00 p.m. This makes 11.00 hours today, and a total of 21.50 hours on engines in Test Lab as of now.

3rd and 4th weeks
May 31, 1966

ENGINE SYSTEMS
S-IC-502

Japool

1. Prepared for pump inlet screen removal. Removed locks from actuators, positions 1 through 4.
2. Also, following things were done. All engines:
 - a) Removed water from PVC's and flame curtains.
 - b) Removed all dirt and foreign objects around PVC's.
 - c) Removed fuel bubbling lines.
 - d) Removed CA1A thermocouples.
 - e) Removed static cables and plugs from DA1A.
 - f) Unhooked flame curtains from dishpans.
 - g) Removed access doors from dishpans.
 - h) Removed electrical cable from dishpan so LOX screen could be removed.This cable is for the flight thermocouples for the bearing temps., etc.

3. Removed screens from #5 engine first. Engine was gimbaled manually by installing a manual engine actuator between #5 and #3 engines and using come-alongs with leather straps on the #5 engine's outriggers. Removed the stiff arm struts. There were no problems in removing the screens.

The fuel screen on the #2 side of this engine was torn badly. About half of the screen was torn loose. We can not figure out the cause.

4. Removed #2 engine screens next. The fuel bubbling line on the #1 side was inadvertently bent and will have to be replaced. Also broke 2 flight press. transducers (D147-115, D146-115) on the bottom of the fuel PVC's (engines 2⁴ & 5 ARE only engines with these).

May 31, 1966 (Continued)

5. Engine No. 4 was next. No problems were encountered in removing the screens.
6. Engine No. 3 was next. Tried to gimbal engine with manual engine actuators attached to No. 5 engine. It would not work. Interference was on housing of manual engine actuator hitting fuel pump inlet elbow. Manual engine actuators were installed the correct way and everything was OK.
7. No. 1 engine was last. Screens were removed but manual engine actuator on No. 2 side pinched an electrical cable ^{ARMORED HARNESS A1073, P/N ASSY 703737} that goes to flight transducers on 4-way control valve. This cable already had one part of it defected by Quality because of broken overmold.

Also, some aluminum foil was inadvertently dropped into the No. 2 babypants. It was removed easily, though.
8. All engines were gimballed approx. 3.5° to 4.0° . Could not have gone farther because manual engine actuator hits the No. 1 fuel pump outlet duct at 4.0° .
9. Took pictures of all screens. The only torn screen was the No. 5 engine (No. 2 side). LOX screens were exceptionally clean. Fuel screens only slightly dirty.
10. Installed new LOX and fuel seals at the pump inlets. All engines.
11. Torqued and safety-wired pump inlets. All engines.
12. Facility people have installed a larger regulator in the supply line to the hypergol simulators. This should give us more GN_2 to operate the IMV's during sequence tests.

May 31, 1966 (Continued)

13. We found that the LOX PVC compression tools were not required for the screen removal. They were not used today and there were no problems.

14. Installed 0.020" orifices in some of the flight transducers. Installed

RD-251-4084-0020.

DG-101 } NO. 1 FUEL PUMP ~~INLET~~ ^{OUTLET} PRESS.
DG-105 } REMOVED P/N CA2551

D4-101 } No. 1 fuel pump inlet press.
D4-105 } removed P/N CA2551 RD 251-4084-0050

D11-101 } Engine control closing press.
D11-105 } removed P/N CA2551

D12-101 } Engine control opening press.
D12-105 } removed P/N CA2551

D13-101 } LOX pump bearing jet press.
D13-105 } removed P/N CA2551

D126-101 } Engine control return press.
D126-105 } removed P/N CA2551

P/N CA2551 is Rocketdyne spec. 19-40634.

June 1, 1966

1. M.E. removed babypants from No. 2 side of No. 5 engine. Nothing was found.

Babypants reinstalled. Will fire as is.

2. Installed skirts on engines 4 and 5. Torqued bolts and nuts.

3. Removed protective covers from engines 4 and 5.

4. Started installing overboard drain lines and engine area purge lines on engines 4 and 5.

5. Removed LOX PVC compression tools from positions 1 through 4.

6. Re-plumbed tubing on DA22-1, -2, -3, and -5 from tap NH4 to tap NH5b.

This makes them like the 501 configuration (DA22-4 will also be done).

June 1, 1966 (Continued)

7. Changed some plugs in the MFV's (engines 1 through 5). Old ones could not be safety-wired, new plugs can be safety-wired.
8. Installed GA22 and GA23 (pitch and yaw dome pots) on engines 1 and 3.
9. Pulled all thrust OK pressure switches from engines 1 through 5. Quality inspected all fuel manifold ports and all were OK. We found 9 of 15 O-ring seals to be defective. The O-rings were flat in places. We replaced the bad seals (P/N RD-251-4125-0040) and reinstalled all 15 pressure switches.
10. Installed a new Δ P transducer on the yaw actuator piston of No. 2 engine (P/N 60B72077-3A). New S/N ~~0140024~~⁰¹⁴⁰⁰²³; old one was 0140058.
11. Installed a new Δ P transducer on the pitch actuator of No. 1 engine (P/N 60B72077-3A). New S/N 0140024; out S/N 0140042.
12. Hydraulic Research personnel and Astrionics personnel changed out piston bypass valves on pitch and yaw actuators of engines 1 and 2. The bypass valves have been recently modified in an attempt to eliminate shaking actuators.

P/N out 300205

P/N in 300205 (revised) (no S/N's)
13. We replaced the pitch actuator on engine 2 today because of the past leakage problems on the main housing.

S/N out 053, S/N in 067

to be set @ 59.944, "desired 59.948", "true= 59.945"

NOTE: Hydraulic fluid was drained down prior to the actuator removal.
14. Replaced (2) O-ring seals (and back-ups) on pre-filtration bypass of the Moog (yaw) actuator on No. 4 engine (had been leaking). Astrionics personnel replaced the seals.

June 1, 1966 (Continued)

15. Installed center engine area purge manifold for engine area purge lines.
16. Inspected GG opening control lines on all engines. All look OK, only slight erosion in places.
17. Started setting up LOX dome and GG LOX injector flush kit on engine No. 1.
18. Fabricated (4) new "diffusers" out of $\frac{1}{4}$ " bulkhead unions - to be used on the GG's during LOX dome and GG LOX injector flushing procedure.

June 2, 1966

1. Started engine torque checks today. Did not finish all engines yet.
2. M.E. completed re-installation of fuel babypants on engine No. 5.
3. M.E. installed flight curtain on No. 5 engine.
4. Re-plumbed DA22-4 from NH4 to NH5b.
5. Changed out DA22-1, DA13A-1, DA13A-5, and DA12A-3 because of bad transducers.
6. Removed servo-actuator lock from new pitch actuator of engine No. 2.
7. Removed manual engine actuators from engines 1 through 4.
8. Worked on installation of engine area purge lines and overboard drain lines on engines 4 and 5. Not complete yet.
9. Conducted pressurized leak checks of GOX and helium systems at 1:30 p.m.
Engines OK.

June 2, 1966 (Continued)

10. At 3:15 p.m. conducted pressurized leak checks of the LOX and fuel systems. Engines OK.

11. Brought up AMF hydraulics at 3:45 for leak check. Admitted hydraulics to stage system at low pressure and slowly increased to 1800 psi. There were no leaks on the TVC system.

Hydraulic pressure was set at 1525 psi and the actuators were stroked to the full extend and retract positions (using the portable engine gimbaling unit).

This freed system of air entrapment. Also obtained the hydraulic null positions.

	Fully Retracted	Fully Extended	Hydraulic Null
Engine 1 - pitch	5.25°	5.25°	3' retract
- yaw	5.20°	5.23°	2' extend
Engine 2 - pitch	5.20	5.22°	0
- yaw	5.21	5.24	3' extend
Engine 3 - pitch	5.18	5.20	0
- yaw	5.18	5.18	3' retract
Engine 4 - pitch	5.18	5.18	5' retract
- yaw	5.18	5.18	6' retract

12. All actuators were then re-zeroed.

13. AMF hydraulics off @ 4:30 p.m.

14. Switched to Greer unit. Had a few problems getting Greer to start up automatically. The main problem was the local transducer was bad. Switched to remote transducer and Greer unit started up OK @ 4:45 p.m.

15. Conducted a full sequence test at 5:05 p.m. using live 500-volt igniters. Also used simulator boxes instead of cycling the engine valves. All igniters fired OK.

June 2, 1966 (Continued)

16. Turned gimbal system over to blockhouse for gimbal checkouts. They had a few problems there, so the gimbal calibration was not accomplished today.

17. We have no shaking actuators on the engines.

18. Had to ^{SHUT}~~start~~ Greer unit off from 5:50 p.m. to 6:15 p.m. because of a 5606 oil leak in the servo-valve on main motor No. 1. Had to replace a bad O-ring in the supply line to the servo-valve. Also had to add 5 gallons of 5606 oil to the servo-system reservoir.

19. 7:05 p.m. - Greer unit shut off for the day. This made 2.50 hours on hydraulics today and a total of 24.00 hours in Test Lab to date.

20. Installed two fuel drain disconnects on each thrust chamber. Engines 1 through 5 (for draining chambers).

21. Quality measured the deflection of the exhaust manifold inlet tension ties:

	<u>No. 1 Side</u>	<u>No. 2 Side</u>
Engine 1	1/16" down	3/32" up
Engine 2	3/16" up	3/32" down
Engine 3	1/2" down	1/8" up
Engine 4	1/8" Up	1/16" up
Engine 5	7/8" down	3/4" up

2" deflection is allowed per Rocketdyne specs.

June 3, 1966

1. Completed engine torque checks today. All 5 engines.

2. From about 7:30 a.m. to 2:00 p.m., the LOX domes and GG LOX injectors were flushed per the new Procedure 32. Two flush kits were utilized. One engine would be flushed while the other kit was being set up on another engine.

June 3, 1966 (Continued)

3. Replaced the bad Greer local transducer:

P/N out - PT111-3M, S/N out - 28052

P/N in - PT135-3M, S/N in - 28212

4. Started installing access doors on the dishpans. Also bolting flame curtains to dishpans.
5. Greer hydraulics were brought up @ 9:45 a.m. to get the engines in the null position. (The servo-actuator locks were off, also the manual engine actuators were off.)
6. Hydraulics off at 12:30 p.m. (at which time tric flushing was completed). Only had final purging to do.
7. Completed installation of engine area purge lines and overboard drain lines on all engines today.
8. The fuel overboard drain line on engine No. 4 was inadvertently dented while installing engine area purge lines. This was brought to the attention of Quality personnel. Even though it is a small dent (only 1/8" deep), it was requested that Quality replace the line.
9. Hydraulics (Greer) brought up at 1:40 p.m. for final purging of flush procedure.
10. Discovered a bad thermocouple on engine No. 1. LOX pump bearing No.1 temp. — Rocketdyne was requested to obtain a new one.
11. Engine components tests were begun at 3:00 p.m. IMV's looked OK on (2) components tests.

June 3, 1966 (Continued)

12. Greer hydraulics off from 3:20 p.m. to 3:45 p.m. for replacement of bad pressure transducer on engine No. 4 hydraulic supply line. Changed out DA3044-4.
13. Also installed a new transducer at hydraulic skid, DA3003, which was recently calibrated. Changed out DA12A-3 (bad transducer). Calibrated dome pots GA22 and 23 on engines 1 and 2.
14. Calibrated thrust OK pressure switches. All look OK. Data will be in the Pre-Test Information report.
15. Started calibrating the gimbal system at 3:50 p.m. Completed calibration at 6:20 p.m. A dry run gimbal program was conducted at 6:35 p.m., and everything looked good. The actuators are not shaking the engines on this vehicle. Apparently, the modifications on the Hydraulic Research piston bypass valves solved that problem.
16. An engine components test was conducted at 6:40 p.m.
17. Automatic sequence tests were attempted at 7:00 and 7:25 p.m., but were unsuccessful. Engine valves did not operate. Control had problems, even in computers.
18. Another engine components test was conducted at 8:20 p.m. Looked OK.
19. Greer hydraulics off at 8:25 p.m. This made 9.00 hours on engines today, and a total of 33.00 hours as of now in Test Lab.

June 4, 1966

1. Removed manual engine actuators from stage.
2. Continued miscellaneous safety-wiring.

June 4, 1966 (Continued)

3. Tightened up access doors on dishpans and bolted flame curtains to dishpans - engines 2 thru 5.
4. Shop weld-repaired the dent on the extension skirt of center engine 4020; located on the lower hat-band.
5. Greer hydraulics brought up @ 10:15 a.m. Conducted two engine components tests OK.
6. Replaced LOX pump bearing No. 1 temp. transducer on engine No. 1.
P/N out NA5-27333T7-1 P/N in NA5-27333T7-1
S/N out 563 S/N in 652
7. Several stage and engine sequence tests were conducted, and finally a couple of successful sequence tests were made. Two problems showed up on the engines:
 - (a) Hypergol simulator on No. 2 engine was sluggish.
 - (b) Position switch on MFV No. 2 of No. 4 engine was erratic.
8. Tric flushed the thrust chambers of all engines. Leak checked chambers and found no leaks.
9. Hydraulics off @ 2:30 p.m. This was 4.25 hours on hydraulics today and a total of 37.25 hours as of now in Test Lab.
10. Repaired the hypergol simulator on engine No. 2. Found it was a mechanical problem. The hypergol tool was rubbing internally. Corrections were made.

June 4, 1966 (Continued)

11. Replaced the resistor assembly (potentiometer) on MFV No. 2 of No. 4 engine. Now getting signals OK at blockhouse.

P/N out 408063

P/N in 408063

S/N out 8287550

S/N in 8287531

June 6, 1966, X-1 DAY

1. Tightened up access door on dishpan of No. 1 engine.
2. Changed out DA22-2 and DA22-4 (bad transducers).
3. Replaced flight pressure transducer on fuel pump inlet No. 2 of No. 2 engine (other one damaged during screen removal).

P/N out 60B72204-001A

P/N in 60B72204-1A

S/N out 0140021

S/N in 0140035

4. Tightened engine firex nozzles.
5. Serviced hypergol simulators - all engines.
6. Took miscellaneous photographs of engine instrumentation.
7. Conducted miscellaneous leak checks of LOX and fuel systems with pressurized LOX and fuel tanks.
8. Greer hydraulics brought up at 10:35 a.m. Accumulators were charged prior to bringing up hydraulics.
9. Had trouble with hydraulic pressure slowly increasing, so switched from Greer local to remote transducer.

June 6, 1966 (Continued)

10. Conducted 2 or 3 engine components and sequence tests OK.
11. A stage and engines sequence test was conducted from the blockhouse at 11:35 a.m. No. 3 engine's fuel valves were not open. Hypergol troubles again.
12. Corrections were made to the hypergol simulator on engine No. 3 to keep the hypergol tool from rubbing internally.
13. 2 more engine components tests were conducted OK.
14. No. 1 MLV of No. 1 engine has a bad position switch. Apparently, it was an open wire in the dishpan. Technicians looked for the problem.
15. A successful stage and engines sequence test was conducted at 12:05. Everything looked good. Obtained data on 1-2-2 startup and 3-2 cutoff:

1-2-2 Start

Time from ignition to start solenoid energized.

Engine 5	- .056 ms
1	- .000
3	- .312
2	- .164
4	- .624

3-2 Cutoff

Engines 1, 3, and 5, then engines 2 and 4 with 175 ms stagger time.

16. Replaced flight supply duct to gimbal filter manifold on engine No. 2. Old one had too much time on it.

P/N out and in	60B83107-1A
S/N out 0000012	S/N In 1000013

June 6, 1966 (Continued)

17. Conducted gimbal checkouts and dry gimbal program from about 12:30 to 5 p.m.
18. Facility GN₂ relief popped off around 12:30 and crews had to ~~SHUT~~^{SHUT} off GN₂ for awhile. The Greer hydraulic pressure became erratic with low GN₂ pressure. The hydraulic pressure went up to 2100 psi and popped the hydraulic relief. This is not supposed to happen. Control kept a watchful eye on the pressure to maintain 1525 psi.
19. Started tanking fuel at 1:25 p.m. after GN₂ was turned on again.
20. Fuel tanking was completed at approx. 3:25 p.m.
21. Pressurized fuel tank for leak checks at 5:07 p.m. Delay due to gimbal checkouts.
22. GG combustor drain plugs were out for the leak check.
23. No fuel leaks were found on the engines even with hydraulics off from 5:10 to 5:20 p.m. per the new procedure. Leak checks completed at 5:25 p.m.
24. A small hydraulic leak appeared on the GG opening control line flange of engine No. 1. The seal will be replaced tomorrow.
25. GG drain plugs were re-installed.
26. Closed fuel pre-valves and after assurance was given that the pre-valve backup system was OK (so pre-valves would not open), fuel was drained below the pre-valves.
27. Hydraulics off at 5:55 p.m. This made 7.25 hours on hydraulics today, and a total of 44.50 hours on engines in Test Lab as of this date.

June 6, 1966 (Continued)

28. Checked out engine area purge on engines. All look OK.

29. Some discrepancies were found on the oscillograph traces from the sequence test today:

Engine 1 - traces 23 and 24 were reversed.

- no trace on MLV No. 1 (open wire in dishpan).

- no trace on MFV No. 2 (blown fuse).

Corrections being made for these.

Engine 2 - fuel prevalues' traces too close together.

- MFV No. 2 position indicator is too slow on closing - Hinkle.
brought another resistor assy. for change out tomorrow.

Engine 3 - MFV No. 1 position indicator is too slow on closing - Hinkle
brought a resistor assy. for change out tomorrow.

Engine 4 - MLV No. 1 trace is ragged (like S-IC-501).

Engine 5 - MFV No. 1 position indicator is slightly slow on closing.

Hinkle is trying to find another resistor assy. as a replacement.

June 7, 1966, FIRING DAY

1. Replaced resistor assembly (potentiometer) on MFV No. 2 of engine No. 2.

P/N out and in 408063

S/N out 8287544 S/N in 8287546

2. Replaced resistor assembly (potentiometer) on MFV No. 1 of engine No. 3.

P/N out and in 408063

S/N out 8287555 S/N in 8333232

3. Replaced flight pressure transducer on fuel pump inlet No. 1 of engine No. 2
(other one damaged during screen removal).

P/N out 60B72204-1A P/N in 60B72204-1A

S/N out 0140036 S/N in 0140000

June 7, 1966 (Continued)

4. Replaced fuel bubbling lines on fuel PVC's 1 and 2 of engine No. 2 (old ones damaged during screen removal).

P/N in on No. 1 side - 60B43014-27

P/N in on No. 2 side - 60B43014-58

5. Replaced seal RD251-4098-0079 in flange of GG opening control line of engine No. 1. - one that leaked yesterday. No more leaks showed up today at the flange.

6. Safety-wiring final items today.

7. Brought Greer hydraulics up @ 8:50 a.m.

8. Conducted engine sequence test OK @ 9:00 a.m. and spanned oscillographs.

9. Conducted another engine sequence test @ 9:10 a.m.

10. Dropped fuel below pre-valves @ 9:25 a.m. One engine at a time.

11. Started tanking LOX (pre-chilling at 9:15 a.m.).

12. 9:30 a.m. to 10:50 a.m.; torqued gimbal block bolts prior to tanking LOX.

Quality said the bolts needed to be checked since we did not drop the engines for screen removal (they had anticipated dropping the engines). 1, 2, 3, and 4 engines OK. 4 bolts loose on Engine 5.

13. Conducted pressurized fuel tank leak check at 10:00 a.m. Engines OK.

(Greer hydraulics off for 5 or 10 minutes during leak per new procedure).

14. Took hydraulic samples around 10:30 a.m.

June 7, 1966 (Continued)

15. Filled chambers with pre-fill by 10:35 a.m. Order of overflow was 1, 4, 5, 2, and 3. No problems with KSC pre-fill unit.

16. Topped off AMF and Greer reservoirs with RJ-1 (from a truck on ground level) at 11:00 a.m. Total of 240 gal. tanked (almost all going to AMF reservoir).

17. Started tanking LOX @ 10:55 a.m.

18. Conducted some gimbal actuator calibrations - out to $\frac{1}{4}^{\circ}$ only. Finished @ 11:25 a.m.

19. Started hypergol installation @ 11:30 a.m. Finished with all engines @ 11:55 a.m.

20. Completed LOX tanking at 12:24 p.m. Conducted a pressurized leak check of LOX system. Engines OK. Next, completed all heat shield panel installations for final countdown.

21. Discovered hydraulic leak on Greer unit filter. (The large first stage filter.) Tightened as much as possible. Leak almost quit.

22. Proceeded with countdown with no problems until after the X-30 minute announcement. First, there were problems with the facility engine area purge valves. Next, the LOX pump seal pressures were too low (around 50 psi when the purge sphere was pressurized to 3000 psi). Apparently, the stage regulator was bad. Another problem was a main valve in the deflector water system.

After all these problems were resolved, the countdown proceeded to X-8 seconds when an automatic hold began. The fuel tank vent valve was indicating "open".

June 7, 1966 (Continued)

22. (Con't)

After a couple of minutes, the test was aborted and countdown recycled to start all over again. The time was about 3:30 p.m. Decision was made to try again at 6 p.m.

23. Approx. 260 gal. of RJ-1 was pumped into the engine return during the hold at X-8 seconds. The engine check-out valves had already rotated to the engine return positions.

24. The test stand was cleared for the normal crews, and the deck was rolled to the IN position. Stage crew had to go into the aft compartment and replace the purge sphere regulator for the LOX pump seal purge. We utilized a GN_2 purge off the calorimeter purge system for LOX pump seals during this replacement.

25. Corrections were made to the engine area purge valves.

26. The RJ-1 truck was on stand-by. We called them around 4:00 p.m. Tanked 260 gallons of RJ-1 into the Greer reservoir by 4:15 p.m.

27. Rocketdyne said that too much RJ-1 was pumped into the pump inlets. So we drained fuel below pre-valves on all engines in an attempt to get RJ-1 out of system. (This was approx. 1475 gallons of fuel drained for all 5 engines.)

28. Dropped fuel to engines by opening pre-valves.

29. Resumed countdown again and fired at approx. 6:43 p.m. for the intended duration of 125 seconds. No problem this time. Test went real good.

June 7, 1966 (Continued)

30. Post-test inspection revealed the following:

- (a) Spurter leak on a tube of engine No. 3 - inside chamber at 10:1 expansion area location.
- (b) Suspected GG igniter leak (hot gas) on engine No. 4. Not bad at all. Later found the igniter was loose and not tightened quite enough.

31. De-tanked LOX and fuel, drained engine fuel systems, purged hypergol, etc.

32. Conducted a post-test gimbal calibration around 9 p.m.

33. Secured hydraulics at 10:00 p.m. This made approx. 13.00 hours on hydraulics today, and a total of 57.50 hours as of this date in Test Lab.

June 8, 1966

1. Conducted post-test servicing on engines. Tric flushed the thrust chamber jackets, positions 1 thru 5.

2. Leak checked thrust chambers. Only found the one spurter in engine 3 as found last night after the firing. (*BOTTOM OF TUBE 102 B*)

3. Greer hydraulics brought up at 9:30 a.m. for the post-test servicing. The leak on the first stage filter was much worse today.

4. Hydraulics off at 11:00 a.m. This was 1.50 hours on engine hydraulics today and a total of 59.00 hours on the engine hydraulics in Test Lab for the S-IC-502 vehicle.

5. Preserved turbopumps, engines 1 thru 5.

June 9, 1966

1. Inspected injectors, positions 1 thru 5. All look OK.
2. Removed engine area purge lines and overboard drain lines. All engines.
3. Removed bolts from skirts, positions 1 through 5, and prepared for skirt removal.
4. Tightened flange on Greer first stage filter to maximum torque valves in an attempt to stop the hydraulic leak.

June 10, 1966

1. Brought up Greer hydraulics about 8:30 a.m. to install servo-actuator locks, positions 1 through 4.
2. Engines were gimbaled $\frac{1}{4}^{\circ}$ from blockhouse, pitch first, then yaw next for lock installation. Hydraulics shut off at 8:45 a.m.
3. Hydraulics on again from 9:30 to 11:45 a.m. for components and sequence tests. Several sequence tests were made from the blockhouse. Had to install hypergol simulators.
4. Had approx. 2.50 hours on engine hydraulics today. This makes a total of 61.50 hours on the engine hydraulics in Test Lab on S-IC-502.
5. Obtained mechanical null on actuators after locks were installed:

Engine No. 1 - yaw - 0
pitch - 0

2 - yaw - 3' retract
pitch - 0

3 - yaw - 3' extend
pitch - 1' retract

4 - yaw - 5' extend
pitch - 4' extend

June 10, 1966 (Continued)

6. Removed extension skirts from engines 1 thru 5. No problems.
7. Secured rolling deck and engine access platforms.
8. Started removing static instrumentation.
9. Greer hydraulic unit had no leaks today.

June 11, 1966

1. Installed extension skirts in crates for shipment.
2. Removed static instrumentation - all 5 engines. Capped up tubing, installed safety-wiring in places, etc.
3. Removed stop backup solenoids - all engines.

5th WEEK

ENGINE SYSTEMS S-IC-502

June 13, 1966

1. Installed protective covers on engines 1 through 5.
2. Continued preparing engines for stage removal.

June 14, 1966

1. Installed throat plugs in thrust chambers - engines 1 thru 5. Had trouble with engine 5 plug; it leaked pressure and fell out.
2. Weld-repaired the tube leak inside engine No. 3 (tube 102B).
3. Inspected the flame curtain above engine No. 5. It is torn in about 5 places, as much as 18" to 24" in about 3 places, and 6" to 9" in other 2 places.

June 15, 1966

1. Removed the special 0.020" orifices from the following flight transducers:

D4101 and -105
D6101 and -105
D11-101 and -105
D12-101 and -105
D13-101 and -105
D126-101 and -105

P/N out - RD-251-4084-0020
P/N in - Same as taken out May 31, 1966

2. Installed new throat plug in thrust chamber of engine 5.
3. Made final preparations for removal of S-IC-2 stage.

June 16, 1966

1. Removed S-IC-2 stage from test stand this morning. The LOX pump seal purge was applied during stage rotation.
2. Rolled deck back to IN position.

Monday, October 3, 1966

1. The S-IC-503 stage arrived at SSTF at approximately 10:30 a.m. The LOX pump seal purge was not applied to the engines while rotating the stage from the horizontal to the vertical position. Vandersee's shop personnel installed the stage in the test stand assisted by Boeing personnel.
2. The booster was placed on the holddown arms at approximately 2:30 p.m.
3. Rolling deck was returned to the IN position, engine access platforms were set up, handrails installed, etc.
4. Inspected stage and engines - found a fuel leak on engine #1. It was a loose B-nut on a dummy transducer (DA11) coming off the 4-way control valve. Quality notified.
5. Also found some RP-1 fuel on the #2 high pressure duct of engine #2 - around area of fuel bootstrap line. Source is unknown.
6. There is a hydraulic flight supply line on the pitch actuator of engine #1 that is installed out-of-line. This should be corrected by relocating the clamp that holds this line in place. Quality notified.
7. Started removing the bolts from the fuel pump inlet elbows, starting with engine #1. We are preparing engines for Rocketdyne technicians to change out the fuel pump inlet elbows (babypants) and make the fairing fix. The fix consists of installing high strength bolts with apoxy, torqueing them to 110 in.-lb. (higher torque value than before).

Tuesday, October 4, 1966

1. There is a broken electrical connector on the filter manifold Delta P transducer on engine #2. Quality notified.
2. Some of the bolts that were taken from the fuel pump inlet elbows showed "signs" of galling. Quality notified. They do not believe it is a problem - not really galling.
3. There is a broken clamp for an electrical cable on the #1 high press. fuel duct of engine #5 at rear of turbopump. Quality notified.
4. Installed stop back-up solenoid valves per procedure 66B10704 this morning:
Engine #1 - S/N 534
#2 - S/N 312
#3 - S/N 315
#4 - S/N 313
#5 - S/N 318
- sent old MV74VE's to shop for servicing (S/N 308, S/N 309, S/N 310, S/N 311 and S/N 499).
5. Rocketdyne brought five technicians in for changing the babypants and fairing fix, etc. We assisted them by removing fuel pump inlet bolts on all engines.

Tuesday, October 4, 1966 (continued)

6. Rocketdyne completed fairing fix on #1 engine - now installing new baby-pants on #1 engine.
7. Started engine area purge line installation on engines 1 thru 5 for procedure 66B10704.
8. Removed heat shield covers from stage for access to thrust structure.
9. Installed engine area firex nozzles - all outboard engine.
10. Repaired (2) ΔP gages and changed out (1) ΔP gage on Greer hyd. unit.

Wednesday, October 5, 1966

1. Rocketdyne completed fairing fix and replaced fuel pump inlet elbows on engine #2. They are now working on engines 3 and 4.
2. Continued installation of engine area purge lines - installed GN_2 purge supply manifold at engine #5 - all this done per Procedure 66B10704.
3. Installed hypergol simulators on engine 1, 2, 4, and 5 per procedure 97 of D5-11789-003.
4. Started up Greer hydraulics at 11 a.m. for flushing - had a leak on the ΔP gage that was replaced yesterday (just a loose B-nut). Tightened the B-nut and the leak stopped.
5. Did not finish hydraulic system flushing - the hydraulic reservoirs are not full enough. They need topping off.
6. Started installing heat shield brackets over outboard engines engines #1 and 4.
7. Removed most of protective closures from engines - still lack some of the closures.
8. Removed heat shield covers for access to thrust structure - also covers for manual engine actuator attach points.
9. Tried A.M.F. emergency stop using boost pump only. Checked o.k.
10. Removed gimbal filter manifold ΔP pickup from engine #2 - one that had the UER on the broken connector.

Thursday, October 6, 1966

1. Rocketdyne continued fairing fix and baby-pants mods. - completed engine 3 and 4, now working engine #5.
2. Continued engine area purge line installation.
3. Installed test shield brackets at engine position #4. #1 engine brackets are complete.
4. Received M or TP papers and Boeing drawings on installing static transducers at 2 p.m. Instrumentation calibrated several transducers yesterday and today. We will test installing these transducers tomorrow.
5. Preparing to receive extension skirts tomorrow. We will install these skirts on Monday, October 10, 1966.

Friday, October 7, 1966

1. Continued Rocketdyne modifications. Completed fairing fix on engine #5 - installed new baby pants. Now just re-installing all bolts, cables, etc.
2. Continued engine area purge line installation per proc. 66B10704.
3. Installed hypergol simulator on engine #3 per proc. 97 - all engines now have simulators installed.

4. Received 3 extension skirts today:

<u>Engine Pos.</u>	<u>Engine S/N</u>	<u>Skirt S/N</u>
1	4023	8285576
2	4022	8285577
4	4026	8297420

5. Hoisted vertical installer and skirt for engine #1 to the 10th level deck - skirts for engines 3 and 5 will come in Monday. Skirt installation will begin Monday.

6. Rocketdyne brought us the loose equipment that goes with the skirts; bolts, seals, etc. We hoisted them to the 10th level.

7. Started installing static instrumentation transducers - System "A" measurements per proc. 80 and Boeing drawings SK60B68999 (Issue5).

Installed the following:

DA3044 - (1 → 5)
DA3-1,-2,-3, - 5
DA2-1,-3, - 5
DA14-1,-2,-3,- 5
DA4-1,-3, - 5
DA6-1,-2,-3, - 5
DA1-1,-2
DA8-1,-2
DA9-1,

8. Removed the following engine measurements that are no longer required for test S-1C-19:

DA10 (1→5) Boeing dwg. did not show-removal
DA11 (1→5) Boeing dwg. showed removal
DA64 (1→5) Boeing dwg. did not show removal

Had to redline Boeing drawings on the DA10 and DA64 measurements - Quality notified, also.

Saturday, October 8, 1966

1. Continued with Rocketdyne modifications - finished fairing fixes and baby pants replacement. They started installing the new 500-volt igniter cables, engines 1-5.
2. Continued installation of static transducers - completed the following today:

DA4-2
DA13-1
DA13A-3, -1
DA7-3, -5, -1
DA7A-3, -5, -2, -1
DA1-3
DA8-3, -5
DA9-3, -2
DA14A-3, -5
DA2-2

3. Filled Greer and AMF reservoirs with RP-1
4. Prepared skirt (for engine #1) for installation - installed seal around the top of it.
5. We are running into problems with the installation of some of the System "A" static transducers. Review of the Boeing SK60B68999 drawings (Issue 5) shows:

1) DA5-

R-TEST installation (S-IC-502) was on the No. 1 FP0 flange. Boeing shows this moved to the No. 1 fuel pump inlet duct.

2) DA7-

R-TEST was on the #1 side of the engine on the No. 1 fuel valve. Boeing shows this on the #2 side of the engine on the LOX dome - installed in a vertical position.

3) DA7A-

R-TEST was on the #2 side of the engine on the LOX dome - in a horizontal position. Boeing shows this on the No. 1 side of the engine on the LOX dome - in a vertical position.

4) DA12-

R-TEST was on the No. 1 FP0 flange. Boeing shows this on the bottom of the No. 2 fuel inlet to the turbopump, underneath the bearing coolant valve - installed in a horizontal position.

5) DA12A-

R-TEST was on the No. 2 side of the bearing coolant valve. Boeing shows this on the No. 1 side of the bearing coolant valve but more underneath the bearing coolant valve - in a horizontal position.

6) DA13-

R-TEST was on the No. 1 LP0 flange. Boeing shows this on the No. 1 LP0 flange, but rotated 90° toward the fuel inlet duct.

(An interference problem exists here - the bracket hits the fuel PVC unless 1 bolt hole is cut off - that leaves 4 bolts holding this bracket instead of 5 bolts).

- 7) DA13A
R-TEST was on the No. 1 FPO flange.
Boeing shows this on the No. 1 LPO flange (where DA13 was).
- 8) DA14A
R-TEST was on the No. 1 side of the engine on the turbopump outrigger.
Boeing shows this on the No. 2 side of the engine on the turbopump outrigger.
- 9) DA15-
R-TEST was on the No. 2 side of the engine on the Lox dome.
Boeing shows this on the No. 2 side of the engine on the outrigger.
- 10) DA33-
R-TEST was on the No. 1 turbopump outrigger and tags location GG2a, (top of GG).
Boeing shows this transducer in the same location except tags, location GG2c, which is the GG drain plug.
- 11) CA1a- (thermocouple)
R-TEST was on the bottom of the No. 2 fuel PVC.
Boeing shows this on the No. 2 fuel pump inlet elbow (babypants).

6. Michoud is supposed to be sending mod. kits for the System "A" transducer installation, but none have arrived yet. Meanwhile, we are plumbing as many transducers as possible without the kits - even using some Rocketdyne and MSFC hardware such as brackets, tubing, fittings, etc.

Monday, October 10, 1966

1. Installed extension skirts per proc. 33 on engines #1 and 5 today per the following:

- a) Rolled deck to the OUT position - got started on engine #1 at 8:30 a.m. - had some delay due to misalignment underneath the checkout valve - finally got all the bolts in. Also, we had to loosen some of the Boeing instrumentation lines on the turbine exhaust manifold. The bracket that held these instrumentation lines then had to be bolted at the skirt interface. Completed skirt #1 at 9:15 a.m.
- b) Skirt #2 was installed by 10:20 a.m. with no problems.
- c) Had a delay in receiving skirts #3 and 5. Transportation brought them at 10:15 a.m. Hoisted skirt #3 up to 10th level at 10:40 a.m., installed seal on it by 10:50 a.m., then set it up to the engine at 10:55 a.m. before stopping for lunch.
- d) Skirt #3 was installed by 12:40 p.m. with no problems.
- e) Skirt #5 was installed by 1:15 with no problems.
- f) Skirt #4 was installed by 1:50 p.m. with no problems.

2. Rolled deck to the IN position, secured the engine access platforms, set up the handrails, etc.

3. The skirt S/N's for positions 3 and 5 are:

<u>Engine Pos.</u>	<u>Engine S/N</u>	<u>Skirt S/N</u>
3	4025	8297440
5	4024	8297419

4. Installed the following instrumentation:

DA13-3, and -2
DA13A -2, -5, -4
DA1-5
DA2-4
DA3-4
DA6-4
DA14A-1

5. Leak checked both Greer and A.M.F. hydraulic units. Completely flushed Greer unit - need 30 more minutes on the A.M.F. Unit.

6. Found A.M.F. boost pressure switch was sticking. Must be replaced.

7. Engine mod. kits for System "A" instrumentation arrived from Michoud this afternoon. Parts control now verifying what was received prior to releasing kits to us.

TUESDAY OCTOBER 11, 1966

1. Continued installation of Systems A transducers. The following were installed today:

- DA1-4
- DA8-4
- DA9-4
- DA13-4
- DA12-4,-3
- DA7-4
- DA5-5,-3
- DA14A-2,-4
- DA12A-3

The mod. kits for the transducers (from Michoud) were released to us today, but were no good. Too many parts were missing. We just installed most of the "controversial" measurements as they were on S-IC-502, per Elmer Neal's instructions. As of today only 3 measurements differ from S-IC-502, and they are:

- DA7 - Moved from No. 1 fuel valve to the Lox dome.
- DA13A - Moved from the No. 1 FPO flange to the No. 1 LPO flange.
- DA14A - Moved from the No. 1 turbopump outrigger to the No. 2 turbopump outrigger

2. Rocketdyne installed the thrust OK pressure switches on all (5) engines this afternoon.
3. We installed a new gimbal filter manifold ΔP flight transducer on engine #2. (Had a UER on it).
4. Completed fairing heat shield installation (Fins A and D)
5. Started torquing some of the skirt bolts.
6. Continued engine area ~~gauge~~ ^{purge} line installation (especially around skirts).
7. Started installation of overboard drain lines on engines.
8. Could not operate hydraulic unit due to control section working with automatic power up and power down procedure.
9. Replace boost pump pressure switch. (A.M.F. unit)
10. Found MV583 (A.M.F. select) control solenoid was blowing through the vent. Replaced the solenoid, but problem was not cured. Sent old solenoid to valve lab to get checked out. Later, problem seemed to cure itself. Investigation will continue.

WEDNESDAY OCTOBER 12, 1966

1. Rocketdyne worked on ECP 423, the dishpan post mod.
2. Flushed Greer and AMF hydraulic units, obtained samples, and sample results were good.
3. Installed the following static measurements:

WEDNESDAY OCTOBER 12 (Continued)

DA12-1,-2,-5
DA12A-5,-4,-2,-1
DA33-1,-2,-3,-4-5
DA5-1,-2,-4
DA8A-1,-2,-3,-4,-5
CA1A-1,-5
CA2-2,-3,-4
CA9-2,-3,-4
CA10-2,-3,-4
DA9-5
DA4-4

4. Continued engine area purge line installation.
5. Continued installation of overboard drain lines on engines.
6. Checked out the thrust OK pressure switches - they were OK.
7. Checked out the hypergol simulators (electrical mechanical check) they were all OK.
8. We have been working 10 hours per day until today - went on 8 hours per day per Elmer Neal's instructions.

THURSDAY OCTOBER 13, 1966

1. Attached hydraulic lines to stage at umbilical.
2. Installed measurements DA3041 and DA3043 in hydraulic supply and return lines.
3. Completed all engine instrumentation installation, that is, all that is known at this moment - coordination has been initiated among Boeing, Rocketdyne, and NASA to agree on locations for all static measurements on the engines, especially the ones that have had a high failure rate in the past.
4. Continued with overboard drain lines and engine area purge line installation.
5. Rocketdyne continued dishpan "post" changes. ~~Removed to the throat plug.~~

FRIDAY OCTOBER 14, 1966

1. Removed all the throat plugs.
2. Completed overboard draw line installations.
3. Rocketdyne completed gap check portion of EFIR FL-4A.
4. Removed and redrilled engine area purge throat rings on three engines.

MONDAY OCTOBER 17, 1966

1. Completed Engine area purge tubing installation.
2. Did not bring hydraulics up because power was not applied to the stage until late in the afternoon.

TUESDAY OCTOBER 18, 1966

1. Brought hydraulics up (AMF) per procedure 27 & made initial low pressure (400 p.s.i.g.) leak check (proc. 30).
2. Took hydraulic samples at each actuator and at the umbilical supply and return. Analysis indicated all within specs except supply sample. Took second sample at umb. on the supply line - results were good.
3. Increased hyd. pressure to 1800 p.s.i.g. & leak checked closing side - no leaks.
4. Bled gimbal filter manifolds, gimbal filter manifold ΔP transducers and bottom side of piston ΔP transducers with pre-filtration valves open and only hydraulic reservoir head on the system.
5. Bled the upper side of the piston ΔP transducers on some actuators by closing prefiltration valves - brought up hydraulics to bleed remainder (quite a bit of air bled from upper side of piston ΔP transducer).
6. Started removing access doors in the dishpan. Installed bolts at the walking beam to post connection on all 4 engines.
7. Wrapped coon purge lines at heat shield.
8. Installed electrical connectors in dishpan on engines 1 & 4 (removed for walking beam post mod.).

WEDNESDAY OCTOBER 19, 1966

1. Replaced Engine Position No. 2 stop back-up solenoid (MV-74 S/N IN 317 S/N OUT 312)
2. Brought hydraulics up per procedure No. 27 (A.M.F. unit) and completed leak check per procedure No. 30.
3. Ran hydraulic system fluid verification test per Procedure No. 83.
4. All 5 access doors in the dishpan removed connected servovalve current input cables for Bonnet (locks on - no hydraulics)
5. Completed hyd. system fluid requirement verification test per procedure 83.
6. Completed engine spot torque check.
7. Removed GG combustor drain plugs on engines 1, 2 & 5 to check for possible drainage - nothing drained - reinstalled plugs.

THURSDAY OCTOBER 20, 1966

1. Ran LOX dome purge checkout per procedure No. 66B10742. While running the low level LOX dome purge, the procedure calls for 350 p.s.i.g. at the pneumatic console and 200 ± 20 p.s.i.g. at the C.C.P. The pressure at the C.C.P. was actually 230 p.s.i.g. Rocketdyne is recommending 130 p.s.i.g. at the C.C.P.
2. Conducted LOX pump seal purge - G.G. act. housing purge checkout per Procedure 66B10740. No problems.
3. Installed camera numbers and the five engines.
4. Ran engine components test with oscillographs (pots on main valves not connected)

THURSDAY OCTOBER 20 (Continued)

5. Discrepancies noted on oscillographs were:

Eng. #1 - No link break signal no start signal, MFV #2 slow closing
Eng. #5 - No start signal,
All engines - No GGBV indications (opeing or closing)

FRIDAY OCTOBER 21, 1966

1. Removed and re-installed actuator locks on Engine Position No.'s 1 & 4. While removing lock from Position No. 4 yaw actuator, the actuator was prematurely extended, jerking one hell-coll out of the actuator housing as well as about half of the housing thread.

LOCKS OFF NULL
AND
ACTUATOR STROKE LIMITS

ENGINE # 1
PITCH

EXT. RET.
5.23 ° 5.23 °

NULL OFF 0.02 ° EXT.

YAW

EXT. RET.
5.23 ° 5.20 °

NULL OFF 0.03 ° EXT.

ENGINE # 4
PITCH

EXT. RET.
5.22 ° 5.23 °

ZERO NULL SHIFT

YAW

EXT. RET.
5.23 ° 5.22 °

NULL OFF 0.02 RET.

2. F-1 engine F-4T2 was fired for 108 seconds at 1:30 p.m. in the West Area.

3. Ran quick engine components test after F-1 engine firing with the hypergol simulator supply pressure at 150 p.s.i.g. at the panel. All fuel valves cycled.

4. An earlier sequence test (10:50 a.m.) was unsuccessful because some of the engine fuel valves failed to open - apparently, we did not have enough hypergol simulator supply pressure - corrections were made.

5. Installed manual engine actuators on stage.

6. Safety - wired hydraulic umbilical supply and return.

7. Coordinated System "A" static firing installation with Boeing, Rocketdyne, and NASA - final decisions for S-IC-503 will be made soon.

SATURDAY OCTOBER 22, 1966

1. Brought hydraulics up at 10:40 a.m. for sequence tests.
2. On the first sequence test at 10:50 a.m., engine #3 was hanging up - for some strange reason, the start solenoid failed to operate. Jerry Starr says the solenoid received the start signal - and he said the stop backup solenoid was closed.

The next seq. test at 11:10 a.m. was OK - no problems.

At 11:25 a.m. another seq. test was conducted, and none of the engine fuel valves operated - the hypergol supply was OK - finally found wiring problem in block house, and all fuel valves opened OK

Hydraulics off at 11:40 a.m.

3. Leak checked GOX system - no engine leaks, but had one leak in stage. Had been leaking since PMC.
4. Conducted engine area purge checkout at 1700 p.s.i.g.

MONDAY OCTOBER 24, 1966

1. Leak checked helium systems on engines during fuel tank pressurization leak check per Proc. 66B10745 - all engines were o.k.
2. Checked LOX pump heaters per Proc. 66B10753 - all engines o.k.
3. Replaced some bad engine static transducers:

DA3-5
DA5-2
DA6-4
DA4-3
DA1-1
DA2-2
DA13-3

DA13-2 to be changed out, too - as soon

as we get the transducer.

4. Conducted LOX and fuel tank confidence leak checks per Proc. 66B10744 - leaks noted were:

- a. LPI flanged on engine #5 (bad leak)
 - b. LPI flange on engine #4 (slight) - (no problem)
- No fuel system leaks were noted.

5. Attempted to tighten bolts on engine #5 LPI flange - found they were over-torqued already - anyway, another LOX leaks check still showed excessive leakage.

Decision was made to remove the LPI seal from engine 5 for inspection. Mechanics started removing the bolts. Will complete the job tomorrow.

6. Removed all eight servo-actuator mid-stroke locks and cycled the actuators on Engine Positions No. 2 & 3 with the Portable Engine Gimbaling Unit (PEGU).

ENGINE #2

PITCH ACT.

EXTEND

RETRACT

5.23 °

5.22 °

OFF 0 ° on null

YAW

EXTEND

5.23 °

OFF 0 ° on null

ACT.

RETRACT

5.21 °

ENGINE #3

ENGINE #3
PITCH ACT.

EXTEND

RETRACT

5.23 °

5.21 °

OFF 0 ° on null

YAW ACT.

EXTEND

RETRACT

5.23 °

5.20 °

OFF 0.03 ° on null RET.

7. Found A.M.F. supply valve was leaking excessively. Had to shut down hydraulic and drain the system after closing the A.M.F. Boost, pump inlet valve, supply and return valves and switch to A.M.F. select in order to preserve fluid in the Greer unit.

8. Re-installed actuator locks on Engine Position #3 in order to use MEA's to move the center engine for LPI seal removal.

9. Made a servo-actuator polarity check per port f steps 7 & 8 of Procedure 66B10751. Will calibrate actuators after propellant load test.

TUESDAY OCTOBER 25, 1966

1. Removed the LPI seal from engine #5 per proc. 95 (the LOX Pump Inlet Screen Removal Procedure). Centered the center engine with manual engine actuators between engine #3 and center engine. Removed bolts from fuel pump inlets as well as LOX inlet in order to control the engine.

By the way, the pump inlet bolts were safety-wired. They should not have been until after the screen removal following the propellant load test.

The LPI seal had a piece of teflon inadvertently installed between the seal and PVC - no wonder it leaked! The teflon was a circular strip about $\frac{1}{2}$ " wide almost the circumference of the LPI seal.

2. Re-installed everything on engine #5 and torqued the pump inlets conducted a fuel and LOX leak check and pump inlets were o.k.

3. By the way, Michoud had not supplied us with any new LPI seals yet (60B41149-65). We obtained one from NASA for engine 5.

4. Found A.M.F. supply valve actuator shaft o-ring had been virtually dissolved and we had to replace it. Tom Shaner, R-TEST-SB recommends a Viton-A o-ring replacement but none are available.

5. Ran a leak check with the Greer unit and the leak did not recur. (Proc. 17)

6. Re-installed the other six servo-actuator mid-stroke locks.

7. Removed MEA's from Engine Position No. 5.

8. Conducted several engine sequence tests, and some wire with oscillographs. Discrepancies noted were:

Engine #1 - MFV #2 - bad pot (closing)
Engine #3 - MFV #1 - bad pot (closing)
Engine #4 - MLV #1 - ratty trace
Engine #5 - MFV's - #1 - 920 MS (closing)
(no start signal)
(No GGBV indications, all 5 engines)

9. Started preparing the engines for fuel loading, but time did not permit fuel tanking today - will start tomorrow.
10. Removed gimbal filter manifold P transducer on engine 4 - it was bad.
11. Removed GG combustor drain plugs - all 5 engines.

WEDNESDAY OCTOBER 26, 1966

1. Started tanking fuel to stage and engines per proc. 52, 39, and 44 at approx. 9:30 a.m. - completed tanking 11:24 a.m.
2. Topped off AMF and Greer hydraulic reservoirs with RP-1 during fuel tanking.
3. Discovered a fuel leak on engine #5 fuel pump. Located at flange where pump impeller back-casing line enters the pump. Looks like an o-ring leak. The flange is hard to get to.
4. Conducted pressurized fuel system leak check by 12:00 o'clock noon - engines o.k., #5 engine leak no worse (GG drain plugs were out per Proc. 44).
5. Started tanking LOX about 12:20 p.m. - completed at 2:05 p.m.
6. Conducted pressurized LOX system leak check - engines o.k.
7. Conducted wet simulated countdown by 4:25 p.m. - everything on engines o.k.
8. Detanked LOX and fuel.
9. At 6:30 p.m. it was noted that frost was forming on the fuel volute of #2 engine.
#1 Bearing temp. indicated 58 ° and falling.
A check was made on all engines.

#1 Eng. - 93°	}	6:35
#2 Eng. 58°		
#3 Eng. 80.6°		
#4 Eng. 96°		
#5 Eng. 64.4°		

WEDNESDAY OCTOBER 26, 1966 (Continued)

9. (Continued)

Disconnected the heater elect. supply plug at the dishpan and checked the power to the engine heater and found 2000 w at the plug. (Same as other four eng.)

Temp. check at 7:00

#1 Eng. 93 °
#2 Eng. 66 ° (with external heat duct)
#3 Eng. 78 °
#4 Eng. 95 °
#5 Eng. 64.4 °

Number 5 and 3 engines started to frost on the fuel volute and continued to decrease in temp.

NOTE: 1-The volute housing did not frost ^{so} in the area where the heater Cal-Rod enters the turbopump which indicated the heaters were operating.
2-The heater "undertemp" light in the blockhouse did not come on.

Temp. check at 8:15

#1 Eng. 87.5 °
#2 Eng. 47.7 °
#3 Eng. 67.6 °
#4 Eng. 87.7 °
#5 Eng. 52.3 °

At 8:45 the temp. on Eng. #2 and 5 reached the lowest point and then started to rise

#2 Eng. 43.2 °
#5 Eng. 47 °

Temp. check at 9:00 p.m.

#1 Eng. 87.8 °
#2 Eng. 46.3 °
#3 Eng. 67.2 °
#4 Eng. 86.1 °
#5 Eng. 72.4 °

The temp. continued to rise and at 11:30 the final reading was

#1 Eng. 139.3 °
#2 Eng. 112 °
#3 Eng. 120 °
#4 Eng. 135 °
#5 Eng. 139 °

NOTE: D. furnish stated the heaters did not cycle even when hyper. temp. was reached.

THURSDAY OCTOBER 27, 1966

1. Removed servo-actuator locks from all actuators after installing all manual engine actuators.
2. Removed LOX and fuel pump inlet screens per proc. 95 - completed all but LOX screen on engine #5. The LOX screens were clean - the fuel screens slightly dirty.

3. Interferences found were:

Engine #1 - a. flight calorimeter (60B71954-1) on #1 fuel high press. duct (had to be rotated 90 ° to install manual engine actuator)

b. flight accelerometer on LPI flange in dishpan - 60B71908-1 (had to be removed) - then re-installed

All engines - fuel bubbling lines too short after screen removal - UER made up

4. Rocketdyne replaced position indicators on:

Engine #1 - MFV #1

Engine #3 - MFV #2

Engine #5 - MFV's 1 & 2

5. During LOX screen removal, spot torque checks were made on the flange bolts - some were overtorqued - range was 500 to 1000 in-lbs. Boeing dwg. calls out 550-670 in-lbs.

6. Reinstalled new pumps inlet seals and bolts.

7. Rocketdyne replaced o-ring in fuel pump impeller back-casing line of engine #5 - part of the old o-ring is lost, it was broken in three sections, two sections have been found. Approx. 1/3 of the o-ring is missing as of now.

8. Fabricated a test harness to checkout the turbopump heater circuits on engines 2 and 4 #2 eng. being the lowest temp. (43.2 °) and #4 eng. being the highest

	HEATER #1 RES.	HEATER #2 RES.	HEATER #1 VOLT	HEATER #2 VOLT	HEATER #1 AMP	HEATER #2 AMP	HEATER #1 WATTS	HEATER #2 WATTS
ENG. 2	29 r	30.8 r	194 v	194 v	6.25	6		
ENG. 4	28.5 r	31 r	191 v	191 v	6.5	6		

The above figures are within limits RDKN and proc. 66B10753.

FRIDAY OCTOBER 28, 1966

1. Remove screen from LOX pump inlet of engine #5 - it was clean.
2. Performed tric flush and leak check of thrust chambers per proc. 34.
3. Removed manual engine actuators from engines.
4. Rocketdyne inspected the fuel impeller back-casing line on engine 35, in an attempt to recover the missing section of o-ring. (The new o-ring that was installed yesterday was found broken). They will now attempt to vacuum out the missing section of o-ring that was lost yesterday.
5. Repaired Greer hyd. supply valve - found a bad o-ring.
6. F-1 engine F-4T2 was fired for 125 sec. in the West Area.
7. Took pictures of all pump inlet screens.
8. DEE checkout valve times during the propellant load test were as follows.

Engine Position No.	To Engine Return	To Ground Return
1	2.540	2.628
2	2.316	2.284
3	2.416	2.452
4	2.504	2.320
5	2.744	2.752

9. T/P Heater Problem

Attempted to record heater rise rate on all engines using the Beckman, however the Beckman system was inoperative and the data will be take a.s.a.p.

10. Data from Hydraulic fluids verification test per procedure 83 was evaluated - DA3003, hydraulic supply pressure, was recorded both on strip chart & on a beckman. The data on the strip chart read 20-30 p.s.i. Higher than that from the Beckman. This test will be rerun.

11. Data from the LOX Dome purge test per procedure 60B10742 is missing. This test will be rerun.

SATURDAY OCTOBER 29, 1966

1. Started installing the following heat exchanger measurements:

DA36-2,3, and 4
DA37-2,3, and 4
LA4006-1,2,3,4, and 5

2. Rocketdyne attempted to vacuum out the missing section of o-ring from engine #5 fuel pump - no success, could not find it.
3. Calibrated gimbal system per proc. 66B10751 and conducted a dry run gimbal program - no problems
4. Checked the hydraulic system flowrates with servo-actuator locks off - it was 110 gpm at 1550 p.s.i.g.

With locks on, it was 118 g.p.m. at 1550 p.s.i.g.

Could not get FA3000 flowmeter to verify the Greer Unit flowmeter. FA3000 was showing 164 g.p.m. at 1550 p.s.i.g.

MONDAY OCTOBER 31, 1966

1. Started relocating the following transducers on engines:

all
049 tubing {
DA5 - to #1 T/P outrigger
DA12 - to #1 FPI flange
DA12A - to #1 side of bearing coolant valve
DA13 both on double mount
DA13A bracket - #2 T/P outrigger } both on double mount bracket -
#2 T/P outrigger

2. In places where .035" tubing had been installed, we replaced tubing with .049" size - that is DA7 and DA7A, DA33, & DA14-A.

3. Rocketdyne checked #5 engine fuel pump with a boroscope- could not see anything.

We tanked fuel to #5 engine in an attempt to flush the o-ring out. Still no success.

4. Replaced gimbal filter manifolds on engines 1 through 4 per E0 4 to 66B83000 -3.

5. Replaced flight supply lines to gimbal filter manifolds on engines 1 through 4 per E0 3 to 66B83000-3. An interference problem was noted - the new line rests on the ground hyd. supply line to the gimbal filter manifold. The decision has been made to install Resistoflex lines for -503. This will be done tomorrow.

MONDAY OCTOBER 31, 1966 (Continued)

6. Installed a new flight ΔP transducer on the gimbal filter manifold of engine #4. Had a UER on it since 10-25-66.

7. Checked Greer hyd. flow; recirculating Greer flow thru LUT bypass - with 1 pump, 2 pumps, then 3 pumps. Flow check revealed flowmeter was approx. 8 g.p.m. high per pump.

TUESDAY NOVEMBER 1, 1966

1. Continued relocating the following transducers on engines: DA5, DA12, DA12A, DA13, & DA13A.

2. In all places where .035" tubing was used, we replaced it with .049" size - we first tried Type 304, MIL-T-6845, but had "cracking" problems on flaring - it was too hard.

Went to single F-1 engine stand and obtained Type 304, MIL-T-8504, which was softer - much easier to flare and work with, so we are using this tubing for S-IC-503.

3. Received 4 Resistoflex flight supply lines to gimbal filter manifolds. One of these was tested on the single engine test Friday, 10-28-65.

These lines will be installed tomorrow in place of the Anaconda lines.

4. Rocketdyne prepared engine #5 to flush with fuel tomorrow. This time they will attempt to flush the o-ring onto the supply line (impeller back-using line).

WEDNESDAY NOVEMBER 2, 1966

1. Continued relocating the following transducers on engines: DA5, DA12, DA12A, DA13, & DA13A. Completed tubing up Engine #1. Also, we decided where all tube clamps will be installed - trying to clamp at least every 14" of tubing.

2. Installed Resistoflex flight supply lines to gimbal filter manifolds on engine 1 through 4.

3. Tanked a full tank of fuel this morning in order to assist Rocketdyne in flushing the fuel pump of engine #5. Tried flushing without pressure in fuel tank, then with pressure in, fuel tank. Still no success; can't find the missing section of o-ring (Found no leaks on engines during pressurized leak check).

4. Closed fuel prevalues, drained fuel below prevalues, and left fuel on-board all night.

5. Ran hydraulics at 800 p.s.i.g. with pre-filtration valves, open. FA3000 was 359 g.p.m. Took samples and all were good.

Continued search for missing section of o-ring in #5 engine.

On 11-1-66 RKDN conducted a series of a method of flushing the turbopump with RP-1 fuel to recover any foreign substance located within the fuel side of the T/P.

3 sections of o-ring were inserted into the fuel balance cavity. The fuel supply was pressurized to 30 p.s.i.g. measured at the pump inlet. An over-board system consisting of a hard line, flex hose, hand valve and filter was installed at the fuel balance cavity port on the T/P. The T/P was rotated in both directions during the flushing operations.

Two of the sections of o-ring were recovered in this manner with RKDN feeling the third section being flushed out but not recovered.

The above stated procedure was performed on Engine #5 with the following special notations.

1 - 200,000 + gals of RP1 fuel was tanked aboard the stage to provide sufficient head pressure at the pump inlet.

NOVEMBER 2, 1966 (Continued)

- 2 - 28.5 p.s.i.g. fuel pressure was used.
- 3 - The first attempt to flush was terminated after approx. 3 min. when it was noted insufficient flow thru the 40 MICRON filter. The filter element was removed and a wire mesh screen installed. Good flow-flushed for 20 min. Inspected filter no o-ring.
- 4 - Fuel prevalues were closed and fuel drained from prevalue thru engine.
- 5 - With the fuel tank pressurized, the fuel prevalues were opened and fuel dropped into the Eng. with the special overboard drain hand valve open. Fuel flow continued for approx. 10 minutes. The filter was removed, and inspected with negative results.

The flushing operation was terminated at this time.

THURSDAY NOVEMBER 3, 1966

1. Continued relocating instrumentation on engines 1 thru 4.
2. The decision has been made to remove engine #5 (F-4024) and replace it with the spare engine F-4027. The spare engine was flown from New Orleans today.
3. Started stripping engine #5 in preparation for removal tomorrow. Removed Systems "A" instrumentation transducers, tubing, and brackets we had installed - also, removed engine area purge tubing.
4. Tanked LOX to 20,000 gal. today - special test to check Eng. 3 LOX prevalue position indicator device (which had failed during a routine valve timing test following LOX detanking on the propellant load test day) - also, to check LOX pump heaters on engines 2 and 5 which had not operated satisfactorily on the propellant load test day.
5. Cycled LOX prevalues several times during LOX tanking, detanking, thawing out period, and all prevalues operated satisfactorily. No. 3 LOX prevalue had no problems.
6. Fuel was detaked shortly after 3 p.m.
7. See next page for heater temps.

Checked FA3000 on hyd. flow today:

DA3003 - 1560 p.s.i.g.
FA3000 - 110 g.p.m.

Greer Panel:

Supply Press. - 1550 p.s.i.g.
Return Flowrate - 114 g.p.m.

Servo-actuator locks were on.

NOVEMBER 3, 1966 (Continued)

7. (Continued) Turbopump heater check
At 10:25 the T/P heaters were turned on.
10:30 LOX tanking was started.

Temp check at 10:45 on CA3-1, 2, 3, 4 & 5

CA3-1-
2- 128°
3-
4-
5-

The following temp recordings were taken on CA3-2 (Eng. #2)

11:00 - 117°
11:30 - 87°
12:00 - 80°
1:00 - 76°
2:00 - 69°
3:00 - 69.6°
4:10 - 69°

A temp check was made at 5:00 on all heaters CA3-1, 2, 3, 4 & 5.

CA3-1 - 88.5°
2 - 66.8°
3 - 81.5°
4 - 78°
5 - 71.7°

Temp. check at 5:30

CA3-1 - 90.4°
2 - 66.5°
3 - 81.3°
4 - 77.6°
5 - 71.9°

NOTE: Recorder Rqdm
Personnel Secured
At 5:30 - No More
Temp. checks were made.

At 12:00 a check was made on No. 2 and 4 Eng. power to the heater.

No. 2 Eng.	Heater 1	Heater 2	Heater 1	Heater 2
	180 V	182 V	6 AMP	5 AMP
No. 4 Eng.	180 V	180 V	6 AMP	6 AMP

LOX was in the pump approx. 4 hours during this test.

At 2:00 light frost was noted on the fuel volute of No. 2 Eng. This condition existed for the duration of the test but did not progress.

NOVEMBER 3, 1966 (Continued)

7. (Continued)

Notable Results -

Reference 10-26-66 & 10-27-66 Log Sheet.

The low temp. on #2 Eng. on 10-26-66 was 43.2° - Today low temp. was 66.8° .

Voltage check on 10-27-66 showed 194v to No. 2 Eng. today it was 180 - 182v (208v supply at umbilical)

Why such a voltage drop - See J. Starr.

FRIDAY NOVEMBER 4, 1966

1. Removed engine #5, S/N F-4024 from stage per procedure 28. Skirt was removed per procedure 33 (prior to engine removal).

No problems were encountered - engine #3 and 4 were canted as far as possible in the pitch plane, and there was sufficient clearance for the center engine removal.

2. Prior to engine removal, the LOX pumps inlet bolts were checked for break-away torque (#5 engine). Break-away torque averaged about 550 in-lb. One happened to be 350, one was 650, but most were 500 or 550. The bolts had been torqued to 450 in-lb. last week (with no lubricant).

3. Engine 4024 was sent to M.E. Lab. The skirt for 4024 was left at the bottom of the test stand - it is scheduled to be installed on the spare engine 4027.

4. Removed the engine #1 flight supply line to GFM - it will be fired on engine F4T2 at the single engine test stand next week.

SATURDAY NOVEMBER 5, 1966

1. Sent stiff arm struts to M.E. Lab for adjustments to fit spare engine F-4027.

2. Rocketdyne and Boeing personnel are working this weekend in Bldg. 4755 on F-4027 - preparing engine for installation on the stage. Rocketdyne takes care of the required ECP's and Boeing takes care of the Boeing hardware mounted on the center engine (accolorometers, calorimeters, etc.)

3. Continued relocating static firing instrumentation on engine position 1 thru 4.

MONDAY NOVEMBER 7, 1966

1. Installed engine F-4027 at position 5 per procedure 28. Installed skirt from F-4024 on this engine per procedure 33. No problems, the skirt interchanged o.k. (Also, installed the newly adjusted stiff arm struts).
2. Installed a new LOX pump inlet seal and new FPI seals. Torqued LPI bolts to 550 in-lb. with lubrication. (Also lubed the FPI bolts).
3. Torqued skirt bolts.
4. Installed stop back-up solenoid on 4027 (same as on 4024). The Rocketdyne ECP 452 had been incorporated on this engine, so we had to remove the $\frac{1}{4}$ " line to the override port on the stop solenoid. We capped their tee in the $\frac{3}{8}$ " drain line. Otherwise, installation just like 66B10704.
5. Started installing Systems "A" instrumentation on 4027. Ran into some problems with the thermal insulation bracketry that is installed on this engine. It is going to be difficult to install DA33 and DA5 on the T/P outrigger on #1 side; there is a tight fit. DA13 tubing will have to be rerouted close to tape location because of T.I.S. A U.E.R. is being written on DA12A because of T.I.S. bolt changeout.
6. There are also interference problems with installing the engine area purge lines - interferes with T.I.S. - We will have to make up some new engine area purge tubing.
7. Worked on installation of DA36 and DA37 on engines 2,3, & 4.
DA36 bolts provided with kit are too short and we are substituting with bolt P/N RD111-4010-0429.
8. Started installation of engine area purge tubing.
9. Started installation of the O.B. drain lines.
10. Installed only 4 gimbal bolts, awaiting new nuts before installing the remaining bolts (will have to replace the four which are installed.)

TUE. NOVEMBER 8, 1966

1. Continued build-up of engine 4027, installed some of the engine area purge tubing, continued Systems "A" transducer installation, etc.
2. Removed LPI bolts, engine #1, lubricated them and reinstalled at a torque value of 450 ± 10 in-lbs.
3. Q&RA bought off Systems "A" static measurements on engine #1 - all other engines are nearing completion of installation. Finished up on DA36 and DA37 on engines 2,3, & 4 today.
4. Started bringing engine F-4024 back to delivered configuration. It was moved from Bldg. 4755 to prep shop today.

WEDNESDAY NOVEMBER 9, 1966

1. Due to low voltage reading on turbo pump heater circuit (182V at the dishpan) the supply was increased from 208v to 227v. will check sys. tomorrow.
2. Continued plumbing engine area purge system on No. 5 Eng. (F-4027)
3. Modified mount bracket for DA-12A transducer, installed and plumbed in Eng. 5 PER UER DISPOSITION.
4. Continued System "A" Installation.
5. Rocketdyne completed igniter harness clamping
6. Found bad threads on 2 gimbal block bolts No. 5 Eng. new ones to be flown in from Michoud.
7. Repaired leaking filter shut off valve at the hydraulic skid.
8. Continued bringing engine F-4024 to original configuration:
 - a. installed access door on dishpan
 - b. Capped all electrical connections in dishpan
 - c. installed misc. protective closures
 - d. installed throat plug, lock, and pressurized to 5 p.s.i.
 - e. installed several dummy transducers, tubing, brackets, clamps, etc.
 - f. misc. safety - wiring of plugs

9. Stagger times for engine start sequence for test S-1C-19 are as follows:

Engine Position	Stagger Time (MS)
5	0
1	60
3	280
2	900
4	600

WEDNESDAY NOVEMBER 10, 1966

1. Completed Eng. area purge tubing Eng. No. 5
2. Completed lubricating, retorquing, and safety wire L.P.I. Bolts on all engines.
3. Leak checked the following systems:
 - a. LOX Pump Inlet
 - b. Fuel Pump Inlet
 - c. GOX System
 - d. Helium System

Had 2 leaks: one at H.E. helium line to stage at CCP, one at GOX line to stage at CCP - we installed new seals, leak checked again and had no leaks this time.

THURSDAY NOVEMBER 10, 1966

4. Completed purge verification test on all engines - Recorded Data in blockhouse.
5. Started to conduct turbopump heater check - 50% complete when a facility fuse went out - will complete 11-11-66.
6. Conducted components and sequence test on all engines including simulated static test with 500 v igniters.
7. Removed locks from actuators engines 1 thru 4.
8. Conducted hydraulic fluid verification test - Recorded data in blockhouse.
9. Hydraulic samples were taken from the supply and return lines at the umbilical.
10. NASA fired F-4T2 at 3:30 - Final Test
11. Engine F-4024 was completed and QUAL. turned it over to NASA.
12. Checked Greer flowmeter readings against FA3000 and at pressures ranging from 1500 to 1800 p.s.i.g. the readings were within 5-8 p.s.i.g.

^{R1}
FRI DAY NOVEMBER 11, 1966

1. Discrepancies noted on yesterday's osc. were:
 - Eng. 1 - no trace on MFV #2
 - Eng. 2 - no trace on GGBV
 - Eng. 3 - MFV #2 slow closing (880 ms.)
 - Eng. 4 - no trace on GGBV
 - Eng. 5 - MFV #2 slow closing (1.8 sec.)
2. Rocketdyne changed MFV #2 pots on Eng. 3 & 5.
3. Trich. flushed jackets and leak checked engines 101 and 105 (101 being done again because of suspected contamination) - no leaks on engines
4. Flushed LOX domes & GG LOX injectors - all 5 engines - per proc. 32; finished all except from steps 62, which will be done tomorrow.
5. Rocketdyne removed and replaced 4-way control valve on engine #3. Decision was made today by Rocketdyne since the start solenoid failed to activate on the 1st set of automatic seq. test. (10-22-66)
6. Run AMF hydraulics during LOX dome flush (AMF return valve was leaking GN_2 - this caused Greer supply valve to not operate due to excessive low GN_2 pressure).
7. Checked polarity on gimbal actuators - only took a few minutes.
8. Contained misc. safety wiring
9. Installed flight supply to GTM, engine #1.
10. Checked engine F-4027 red lines. They are as follows:
 - $P_c = 1197$ p.s.i.g.
 - $LPOP = 1669$ p.s.i.g.
 - $FPOP = 1960$ p.s.i.g.
11. Checked TOPS per procedure No. 58. All o.k.

SATURDAY NOVEMBER 12, 1966

1. Finished final steps of LOX dome flush procedure.
2. Checked LOX pump heaters - all ok
3. Leak checked hyd. opening and closing lines on eng. 5 - also 4-way control valve and lines on eng. 3 (up to 1800 psi) - no leaks
4. Conducted components and sequence tests this morning everything on engines ok. Conducted simulated static firing for 127 seconds at 11:30 a.m. - no problems
- After lunch we ran 5 engine starts on all engines (to satisfy eng. 3 requirements)
- Also, ran a 3-2 cutoff check by dropping power to all 5 stop backup solenoids.
5. Removed (DA3044 -1,-2,-3,-4-5 from hydraulic lines
6. Removed manual engine actuators from stage.
7. Decision was made today to changeout the No. 3 LOX pre valve that malfunctioned on the propellant load test (10-26-66) (See notes of 11-3-66.)
8. Spanned gimbal actuators - did not calibrate (will be done Monday(- did run a dry run gimbal program, though.
9. Changed out several bad transducers - instrumentation keeps the list of them.
10. Misc. safety - wiring was continued today.
11. Checked sequence test oscillographs, and all traces were normal - also, valve timings were in spec. - start-up and cutoff looked good. (Data recorded in proc. 66B10777).

MONDAY NOVEMBER 14, 1966

1. Conducted components and sequence tests and simulated static firing test per 66B10777 (X-1 DAY)
2. Discovered problems with stop backup solenoid valve timings.

Saturdays results were:

<u>osc.</u>	<u>DEE</u>
Eng. 1 - .035	.052
2 - .290	.308
3 - (ran out of osc. paper)	.156
4 - .290	.320
5 - .040	.056

The osc. results were from stop B.U. de-energized to main LOX valves L.O.
The DEE results were from stop B.U. to GGBV L.O.

3. We re-orificed engines 2 and 4 from .030" to .039". A 3-2 cutoff check today showed:

	<u>DEE</u>	
Eng. 1 -	.052	
Eng. 2 -	.200	
3 -	.200	
4 -	.300	(From S.B.U. to GGBV L.O.)
5 -	.060	

MONDAY NOVEMBER 14, 1966 (continued)

4. Eng. #3 was so slow, we checked the stop back-up solenoid. We found the $\frac{1}{4}$ " union to the override port (that came on the valve) was orificed and it should not have been (even had a small screen in the union). We reinstalled the correct union (open all the way through).
4. We will check engines 2 and 4 tomorrow.
5. Conducted pressurized LOX and fuel leak checks - no leaks on engines.
6. Tightened all flame curtain bolts today, including center engine.
7. Loaded fuel per proc. 39 from 5 to 7 p.m. - conducted pressurized fuel leaks check. Only leak was DA5-5 tubing (will be re-flared).
8. Conducted engine area purge checkout at 3000 psi. Engines ok.
9. Closed fuel prevalues and drained fuel below prevalues per proc. 54
10. Osc. data showed 2 bad MFV pots:

Eng. 1 - MFV #2

Eng. 5 - MFV #1

Rocketdyne will change out tomorrow.

11. Calibrated gimbal system - no problems.
12. Braced sense line of DA3003
13. Topped off AMF and Greer reservoirs during fuel tanking.
14. When the Greer hyd. unit was on during propellant loading, it was attempted to replace a broken terminal in the Greer water press. switch. This terminal was broken while attempting to move a wire to gain access to the pressure switch adjustment instruction. While the terminal was being replaced, it was inadvertent-ly shorted out, causing control voltage to be momentarily lost to the Greer unit shutting it down. It was immediately restored.

TUESDAY NOVEMBER 15, 1966 (FIRING DAY)

1. Had to change out MFV pots -this morning - MFV #1 on engine 5
MFV #2 on engine 1
2. Replumbed tubing from top NH1a to stop back-up solenoid valves on engines 2 and 4 (made them just like 1, 3, and 5). Installed two new orifices (both approx. 0.040"). Ran a seq. test and 3-2 cutoff showed engines 1, 3, & 5 were approx. 0.050 ms and engines 2 and 4 between .140 to .180 (stop break-up de-energized to valves 0.0).
3. Completed components and sequence tests.
4. When hydraulic fluid was first applied to engines this morning, fuel was found leaking from GG drain plug of Engine #2. Was blowing out with LOX dome purge. In addition, the actuator pre-filtration bypass valves were open on Eng. 2 and had to be closed to get the engine in the null position.
5. Decision was made not to flush GG LOX injector of #2 engine - no contamination suspected - run as is.
6. Stop backup solenoid valve on engine #4 was leaking at taps NH1a - took hyd. off for a few minutes, installed a flare saver at the tap, and the leak stopped when hyd. fluid was applied again.
7. Dropped fuel to engines from fuel prevalues (one engine at a time)

NOVEMBER 15, 1966 (continued)

8. Completed fuel tank pressurized leak check by 10:32 a.m.
9. Started inert pre-fill using KSC unit - unsuccessful due to high pressures at pumping unit (380 psi) and ground side of umbilical (250 psi). Transferred to MSFC pressure tank unit and filled engines 1, 5, 3, than 2. Could not get engine 4 filled. The system was shutdown, removed prefill line orifice ASSD, 60B37525-5, to engine 4 - found it was .060". UER was written and orifice redrilled to .312". After reinstallation engine 4 was filled ok with KSC unit (pump pressure @ 310 psi and umbilical was 150 psi)
10. Obtained hydraulic samples.
11. Tanked LOX from 11:30 a.m. to 12:57 a.m.
12. Installed GG and TE igniters.
13. Conducted pressurized LOX leak check.
14. Installed hypergol.
15. Proceeded with countdown per Proc. 66B10785 - Firing Command given @ 3:36 p.m. - went full duration (121.7 sec. of mainstage) - test was successful with no major problems.
16. Post-test inspection revealed:

Engine #1 - a. fuel leak from top side fuel drain fitting
b. fwd. leak from #1 side fuel drain fitting
c. skirt accelerometers shaken up

Engine #2 a. slight fuel leak #2 FPO dust, from one of the two instrumentation taps.
b. seep leak @ tube 26 between A & B, bottom of tubes, at weld (inside chamber)

Engine #3 - no damage to engine - EAP line at 10:1 area underneath GG fwd. a B nut that vibrated loose after ignition.

Engine #4 a. GG combustor drain plug inadvertently not installed prior to test - just left black soot on engine from hot gas - little effect on engine performance.

b. fuel leak from bottom side fuel drain fitting

Engine #5 - fuel leak from #2 side fuel drain fitting

On all engines, there were signs of overmold melting on the Rocketdyne electrical harnesses around the turbopumps - too much heat during firing caused this.

17. Detanked LOX & fuel, drained fuel systems, purged hypergol, etc.

WEDNESDAY NOVEMBER 16, 1966

1. No work done on engines.
2. Data review all day - quick look results show the following measurements were lost during the test:

DA6-2

DA6-3 not relocated for this firing

DA6-5

DA4-4

DA12A-1 - relocated per SK60B68999 dwg.

NOVEMBER 16, 1966 (continued)

2. (continued)

Also, DA7A-3 did not return to zero after the test - both DA7A-3 and DA7A-4 were erratic during the middle of the firing.

3. Startup was in this order:

5, 1-3, 4, then 2

Skirt change on F-4027 had little or no effect on start time.

4. Eng. #3 checkout valve chattered wildly during firing with a loss of the position switch @ T+95 sec.

THURSDAY NOVEMBER 17, 1966

1. Conducted TVC post-test gimbal calibration per proc. 66B10751
2. Trick. flushed chambers and leak checked - only leak was one on engine #2 (tubes 26A&B) as noted yesterday.
3. Install servo-act. locks (engines 1 through 4)
4. Conducted sequence tests and simulated static firing - engines ok - no problems
5. Started removing EAP tubing
6. Started removing skirt bolts
7. Preserved turbopumps 1 thru 5 - had no interference with DA12A and bearing coolant valve Q.D.
8. Hypergol simulators installed today.
9. Systems "A" instrumentation on engines will not be removed - ship to Michoud as is, even with transducers

FRIDAY NOVEMBER 18, 1966

1. Took photographs of Systems "A" instrumentation on engines - also engine area purge lines (Engines 3 and 5)
2. Removed engine area purge lines - engines 1 through 5
3. Removed O.B. drain lines.
4. Inspected injectors 1 through 5, found no damage (Proc. 45)
5. Removed hypergol simulators.
6. Pumped almost all of hydraulic fluid to fuel facility reservoir (from Greer and AMF).
7. Drained hydraulics from stage and engines per proc. 99.
8. Removed stop back-up solenoid valves per proc. 94.
9. Rocketdyne incorporated ECP 452 (4 way control valve) on engine #4
10. Started installing engine protective closures.
11. Rotated checkout valves and obtained DEE times - did not have drain hoses on engine return lines when checkout valves were cycled, so all RP-1 was not drained (still some upstream of checkout valves) - we can get that tomorrow.
12. Removed heat shield covers over engines 1 and 4 - do not need to remove over engines 2 and 3.

SATURDAY NOVEMBER 19, 1966

1. Drained fuel from upstream of engine checkout valves by removing plug underneath each checkout valve - reinstalled plugs.

NOVEMBER 19, 1966 (continued)

2. Installed protective closures on engines.
3. Removed skirts from engines 1 through 5, crated them up and shipped them out.
4. Rocketdyne incorporated ECP 452 (4 way control valve) on engines 1, 2, and 3- all engines now have ECP 452.
5. NASA Quality started engine alignment checks with stage - completed engine #4 check.
6. Removed engine area firex nozzles for stage removal.
7. All umbilical disconnections completed.
8. Rounded up dummy transducers to be shipped back to Michoud with stage - also LPT & FPT screens.

SUNDAY NOVEMBER 20, 1966

1. NASA Quality completed engine alignment checks on engines 1, 2, 3, and 5
2. Installed throat plugs and locks - engines 1 through 5.
3. Continued preparing engines for stage removal - final protective closures installed - then prepared rolling deck for stage removal.

MONDAY NOVEMBER 21, 1966

1. The S-1C-503 stage was removed from the test stand this morning. The LOX pump seal purge was applied during stage rotation.
2. The GG drain plugs were not removed for stage rotation - decided not to perform this procedure.
3. Installed protective covers over stage and engines in preparation for loading on the barge tomorrow.