STS - 61C, OV - 102, Columbia (7)

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET: Prelaunch	Problem	FIAR	IFA STS-61C-V-01	MPS
None	GMT: Prelaunch		SPR None	UA	Manager:
			IPR None	PR	
					Engineer:

Title: Main Propulsion System Liquid-Oxygen (LO2) Inboard Fill-And-Drain Valve Did Not Close. (This resulted in about 2000 pounds per minute of LO2 draining from the vehicle through the 8-inch LO2 fill and drain line.) (ORB)

Summary: DISCUSSION: At launch minus 4 minutes 40 seconds, the closed-switch indication for the main propulsion system (MPS) liquid-oxygen replenish valve was not received. Even though the replenish-valve closed-switch indication was not available, the auto sequencer continued operation using the valve position indication, the flowrate, and the actuator pressure to status the position of the replenish valve. At launch minus 4 minutes 20 seconds, the command to close the liquid-oxygen inboard fill-and-drain valve was blocked in the liquid-oxygen loading sequencer by the failure of the prerequisite control logic to receive the mission facility replenish-valve closed-switch indication. This resulted in the auto sequencer initiating a launch hold. A continue command was issued at launch minus 2 minutes and 55 seconds that allowed the liquid-oxygen terminal-count sequencer to open the tail-service-mast vent and drain valves without closing the Orbiter inboard fill-and-drain valve. This unknowingly permitted the offloading of liquid oxygen until the Orbiter inboard fill-and-drain valve was noted to be open and manually closed. Liquid-oxygen prepressurization was initiated; however, the ground helium-gas supply was unable to satisfy the control-band pressure requirement because of the ullage-volume increase resulting from the rapid offloading of liquid oxygen. The tank ullage pressure decreased to -0.12 psid, at which time the fill-and-drain valve closure allowed repressurization to begin again.

During the liquid-oxygen offloading, the low-level cutoff sensors temporarily indicated dry. This was probably caused by the termination of the helium feedline anti-geyser injector approximately 20 seconds after the tail-service-mast drain valve was open. A hold was initiated at launch minus 31 seconds to review the previous out-of-sequence loading termination and obtain a 5-minute liquid-oxygen drain through the main engines. During the hold, the liquid-oxygen main engine temperature dropped below the engine start requirement of 168.3 deg R by approximately 3 degrees. The engine limit was exceeded because the amount of liquid oxygen lost overboard through the fill-and-drain valve caused the colder, more-dense liquid oxygen to be drawn in from the external tank. The countdown was recycled to launch minus 20 minutes and oxygen replenish flow was reestablished. The launch was scrubbed when it was determined that the vehicle could not be recycled within the allowable launch window. A liquid-oxygen ullage-pressure of -0.12 psid was experienced when the liquid-oxygen vent valve was closed, and the helium supply terminated during liquid-oxygen drain

back. Subsequent visual examination of the liquid-oxygen tank revealed no cracks or debonded areas. Analysis indicated that with the 98-percent level propellant load present at the time of occurrence of the negative pressure (-0.2 psi used for analysis), a safety factor of greater than 1.25 was maintained. There was no effect on tank cycles. Review of the above-nominal surge pressure at the engine inlet and the liquid-oxygen manifold was evaluated because the fill-and-drain valve was closed during flow conditions (valve not certified to be closed under flow). The surge pressures observed and the valve opening/closing times all were deemed acceptable for flight. CONCLUSION: The MPS liquid-oxygen inboard fill-and-drain valve was not commanded closed because the liquid-oxygen loading sequencer did not receive the closed-switch indication from the replenish valve as required by the prerequisite control logic. The operator verified replenish-valve closure, but did not close the inboard fill-and-drain valve prior to issuing the resume command to the automatic sequencer.   CORRECTIVE_ACTION: 1. The prerequisite control logic that blocked the close command to the liquid-oxygen inboard fill-and-drain valve was overridden for STS 61-C and STS 51-L. This eliminated the inconsistency between the liquid-oxygen loading sequencer software and the prerequisite control software. 2. The launch commit criteria (LCC) will be changed to verify that the liquid-oxygen inboard fill-and-drain valve is closed after replenish valve closure and prior to tail-service-mast vent and drain opening. The count will be held if the fill-and-drain valve closed-indication is lost during the remainder of the count down until T-31 seconds. 3. The helium repressurization "pulse purge" will be turned on if less than 0.25 psi is read on the liquid-oxygen low-range pressure transducers. The monitoring will be done automatically with a manual call to pressurize, if required. 4. The minimum external tank (ET) ullage pressure rise rate will be verified at T-120 seconds. This rate was established at 0.85 psi/second as a check on tank-ullage volume, and therefore, liquid level. The existing ET ullage pressure check has been removed from T-125 to T-133 seconds to assure compliance with ET liquid-oxygen tank structural requirements.
EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-61C-V-02	FC/PRSD
None	**GMT:** Prelaunch		**SPR** AD0733	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Fuel Cell 1 Power To Essential Bus 1 BC Lost. (ORB)

Summary: DISCUSSION: On January 6, 1986, prior to the launch scrub on January 10, 1986, the fuel cell 1 voltage reading (V45V0100A) indicated erratic operation. After the January 10, 1986, launch scrub, ground tests verified that the fuel cell 1 power to essential bus 1 BC was lost. Tests at Kennedy Space Center verified that redundant power still existed to essential bus 1 BC from main buses B and C. The failure was isolated to main distribution control assembly (MDCA) 1. This would cause the erratic reading on the fuel cell 1 voltage. The failure had no impact on the STS 61-C mission.

During postflight troubleshooting, the fuse cap on fuse F31 in MDCA 1 was examined. When no anomaly was observed, the cap and fuse were removed and visually examined. No anomalies were noted. MDCA 1 was removed, replaced and sent to the vendor service center where the anomaly could not be duplicated. Troubleshooting was followed by vibration and acceptance testing, but no problem was found in the failed control assembly. Retest of the replacement MDCA showed that the problem had been corrected on the vehicle. Based upon the available information, the most probable cause for the failure of MDCA 1 was contamination within a fuse holder of the control assembly. Oxidation in the fuse holder was probably displaced and unobserved when the fuse was removed and examined during postflight troubleshooting in the vehicle. The problem could never be duplicated after the suspect fuse was removed and replaced. It is significant to note that MDCA 1 had been in storage for nearly a year and exhibited the anomaly when initially installed on OV-102.   CONCLUSION: Fuel cell 1 power to essential bus 1 BC was lost prior to flight. The failure was probably due to oxidation in a fuse holder on MDCA 1.   CORRECTIVE_ACTION: MDCA 1 has been removed and replaced. The fuses were removed from MDCA 1 and both the fuses and the fuse holders were cleaned with denatured alcohol. The fuses were reinstalled and the control assembly passed a complete vibration and acceptance test. The failure analysis was tracked on CAR AD0733 and the report has been closed.   EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:14	Problem	**FIAR**	**IFA** STS-61C-V-03	APU
None	**GMT:** 012:12:10		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Auxiliary Power Unit 1 Gearbox Nitrogen Pressure High. (ORB)

Summary: DISCUSSION: About 15 minutes after liftoff, the gearbox nitrogen pressure (V46P0151A) on Auxiliary Power Unit (APU) 1 read about 10 psi high. High gearbox nitrogen pressure on APU 1 during flights 8 and 9 of OV-099 Challenger was due to water contamination in the lube oil. See problems STS-51F-02 and STS-61A-04. APU 3 was used for flight control system checkout. APU 1 was started first for entry and operated satisfactorily during entry, landing and rollout.

Postflight analysis of the lube oil in APU 1 found no contamination. APU 1 on flight 7 of OV-102 was the first flight of a new APU. The high gearbox nitrogen pressure was probably due to tight seals on the new APU.   CONCLUSION: The high gearbox nitrogen pressure on APU 1 was probably due to tight seals on the first flight of a new APU.   CORRECTIVE_ACTION: NONE REQUIRED   EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-61C-V-04	OI - Sensors
None	**GMT:**		**SPR** A) 32F001, B) 32F012	**UA**	**Manager:**
				PR	
			IPR None		**Engineer:**

Title: Instrumentation Failures. (ORB)

Summary: DISCUSSION: A. SSME 2 GH2 Outlet Temperature (V41T1261A) failed off-scale high at approximately 6 minutes and 30 seconds after lift-off. The transducer for this measurement is known to be adversely affected by launch vibration levels. It has been replaced with an improved-design sensor less sensitive to launch vibrations. The measurement is not required by the Launch Commit Criteria (LCC). The failure will be tracked on CAR 32F001.

B. SSME 3 Helium Supply Pressure (V41P1350C) operated erratically during the launch interval triggering 3 helium leak fault summary messages. Post-MECO, the helium remaining in the 3 engine systems showed no evidence of a helium leak. Troubleshooting isolated the problem to a faulty MDM channel. MDM FA3 was removed and replaced and the measurement reverified. Vendor MDM testing at the circuit component level has isolated the failure to a hybrid circuit in this MDM channel. Failure analysis will continue and will be tracked by CAR 32F012.   CONCLUSION: See above.   CORRECTIVE_ACTION: See above.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None pending failure analysis.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:09:54	Problem	**FIAR**	**IFA** STS-61C-V-05	APU
None	**GMT:** 012:21:50		**SPR** 32F006	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Auxiliary Power Units 1 and 3 Isolation Valve Temperatures Low. (ORB)

Summary: DISCUSSION: Immediately after lift-off, the temperatures (V46T0173A and V46T0373A) of the isolation valves on auxiliary power units (APU's) 1 and 3 began decreasing. A temperature sensor is located on only one of the two isolation valves on each APU. After about 10 hours, the APU 3 isolation valve temperature decreased below the fault detection and annunciation (FDA) limit of 45 degrees F. The vehicle attitude was changed to heat the starboard side of the aft compartment and the APU 3 isolation valve temperature increased to a satisfactory level. However, the APU 1 isolation valve temperature continued to decrease, violating the FDA limit about 12 hours later. The vehicle attitude was again changed to heat the port side of the aft compartment, and thereafter, the vehicle attitude was managed to maintain the APU 1 and 3 isolation valves above 40 degrees F. Payload attitude requirements were compromised, but the isolation valve temperatures were maintained within an acceptable range throughout the extended mission.

Postflight inspection determined that the isolation valve insulation on APU's 1 and 3 had been improperly installed, thus providing two major heat shorts to the environment. Incorrect emissivity tape was used on the insulation enclosures, the fuel line insulation, and the temperature transducers, thereby reducing the effectiveness of the insulation and the sensors. The valve-body heater wrap was improperly installed with an excessive amount of heater wrap on the test line. Also, the heater wrap was taped to the adjacent structure creating a thermal short and reducing heat to the valve. This decreased the capability of the heater elements to maintain the proper valve and line temperatures. The APU 3 isolation valve was removed and replaced. A valve body mock-up will be used to train technicians in the use of the specified emissivity tape and the proper installation of the insulation and the heater wraps. A temperature sensor will be added to the uninstrumented isolation valve on each APU before the next flight. All APU isolation valves installed on OV-103 and OV-104 have been inspected for the proper installation of the insulation and the heater wraps, and the correct use of the specified emissivity tape. All discrepancies have been corrected. In addition, the isolation valve insulation enclosure on APU 3 was wetted with oil from the solenoid coil on the uninstrumented isolation valve. The oil leak was caused by a defective O-ring seal around the cover of the solenoid coil. The O-ring had a thin spot in one segment. The defective O-ring was removed and replaced. Certification procedures have been changed to inspect 100 percent of the O-rings and a modification in the O-ring cover groove is being evaluated. Also, the isolation valves on OV-103 and OV-104 were inspected to insure that no solenoid coil was leaking oil. CONCLUSION: The low isolation valve temperatures on APU's 1 and 3 were caused by the use of incorrect emissivity tape and the improper installation of the insulation and the heater wrap. An oil leak on APU 3 in the solenoid coil of the uninstrumented isolation valve was caused by a defective O-ring seal around the cover of the solenoid coil. The O-ring had a thin spot in one segment. CORRECTIVE_ACTION: The APU 3 isolation valve was removed and replaced. Technicians will be trained to install the insulation and the heater wrap properly and to use the specified emissivity tape. The APU isolation valves installed on OV-103 and OV-104 have been inspected and discrepancies corrected. The defective O-ring was removed and replaced. Certification procedures have been changed to inspect 100 percent of the O-rings, and a modification in the O-ring cover groove is being evaluated. Instrumentation is being added to the non-instrumented isolation valves on all APU's to provide more inflight information on the isolation valves. The failure analysis is being tracked on CAR 32F006. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:** 000:09:54	Problem	**FIAR**	**IFA** STS-61C-V-06	APU
None	**GMT:** 012:21:50		**SPR** 32F008	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Auxiliary Power Unit 3 Fuel Line System B Heater Appeared Not to Cycle. (ORB)

Summary: DISCUSSION: On flight day 1, Auxiliary Power Unit (APU) 1 fuel line temperature fell to 51 degrees F while on heater system B, and before system A was reactivated. Both system A and B heaters were active for the remainder of the mission. Even with both systems active, vehicle attitude management was necessary throughout the mission to maintain isolation valve temperatures above 40 degrees F. See problem STS-61C-05.

Postflight troubleshooting determined that the fuel line heater thermostat for APU 3 system B was cycling low, but within the 55 +\-5 degree F band required for acceptable operation. The thermostat was removed and replaced when the heaters and the insulation were repaired to resolve problem STS-61C-05. The thermostat was sent to the vendor for laboratory tests which confirmed acceptable operation in the low end of the allowable temperature range. CONCLUSION: Postflight analysis revealed no failure of the System B heater thermostat. The heaters were unable to maintain isolation valve temperature due to improperly installed insulation and heater wrap and the use of incorrect emissivity tape (Ref STS-61C-05 and CAR 32F006). This led to an erroneous appearance that the thermostat had not cycled on. CORRECTIVE_ACTION: No corrective action required for fuel line heater thermostats. Test resultes are documented on CAR 32F008 which has been closed. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:01:29	Problem	**FIAR**	**IFA** STS-61C-V-07	OMS/RCS
None	**GMT:** 014:13:25		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Vernier RCS Thrusters Fired Excessively. (ORB)

Summary: DISCUSSION: On flight day 3 during on-orbit digital autopilot (DAP) maneuvers, all six vernier thrusters exceeded a 1000-command per hour firing rate. The Shuttle Operational Data Book (SODB) has a constraint of no more than 1000 on-commands in 1 hour to avoid overheating the pressure transducer. Postflight data review determined that the maximum number of on-commands had been about 600 in 1 hour for one thruster. These excessive firings were due to inertial measurement unit (IMU) switching combined with a tight attitude deadband. The IMU switching was caused by at least two IMU's being very close to each other; i.e. very small drift, which in turn causes the Mid Value Select (MVS) to switch from one IMU to the other. During the remainder of the mission where cases of a tight deadband existed, one of the IMU's was deselected to preclude IMU switching. Software change request CR79144D has been approved for software release OI-11 to eliminate IMU switching.

CONCLUSION: The excessive vernier-RCS-thruster firings were caused by the combination of a tight attitude deadband and IMU switching. The IMU switching was eliminated through the deselection of an IMU. Excessive vernier thruster firings cause unnecessary wear and tear on RCS hardware. CORRECTIVE_ACTION: Mission operations procedures will deselect an IMU to eliminate excessive vernier RCS thruster firings during minimum IMU drift and tight attitude-deadband situations. Software change request CR79144D has been approved for software release OI-11 to eliminate IMU switching. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:10:01	Problem	**FIAR**	**IFA** STS-61C-V-08	C&T - S-Band
None	**GMT:** 014:21:57		**SPR** 32F009, 32F010	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: S-Band Upper-Left and Lower-Right Antenna Performed Erratic (ORB)

Summary: DISCUSSION: On flight day 2, the reflected power on the S-Band upper-left antenna varied between 6 and 13 watts with no observable performance degradation. On flight days 3 and 4, the reflected power variation on the upper-left antenna was accompanied by degraded communications performance, high bit errors and dropouts in the forward link. On flight day 4, multiple forward link dropouts were also observed on the S-Band lower-right antenna with good look angles and low specific phase error. S-Band antenna performance was sufficient for entry.

Postflight troubleshooting could not confirm the anomalous operation. The S-Band upper-left and lower-right antennas were removed and replaced. During troubleshooting at the vendor, the lower-right antenna failed functional and pattern testing. Disassembly and evaluation identified a fault in the radiating element assembly. The output stripline displayed excessive changes in impedance during stripline thermal-cycling confidence tests. Cracked solder joints were found at the center conductor pins of the stripline connectors. The output striplines were replaced with units of a new improved design. The upper-left antenna successfully passed functional testing, pattern measurements, and thermal cycling. Individual components were examined and tested including extensive thermal-cycling confidence testing of the input and output striplines. The upper-left antenna was reassembled, the acceptance tests were passed, and the antenna is now ready for flight. CONCLUSION: Failure of the S-Band lower-right antenna was caused by cracked solder joints at the center conductor pins of the connectors on the output stripline in the radiating element assembly. The cause of the erratic performance of the S-Band upper-left antenna is unknown. CORRECTIVE_ACTION: The S-Band upper-left and lower-right antennas have been removed, replaced, and returned to the vendor. Stripline design and manufacturing have been changed including reinforced eyelets, strain relief loops, cleaning and handling, moisture control, soldering, and manufacturing aids. The output striplines on the lower-right antenna were replaced with the improved design units. The upper-left antenna passed confidence and acceptance testing and is ready for flight. The failure analyses were tracked on CAR's 32F009 and 32F010 and both reports have been closed. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation				Subsystem
MER - 0	MET: 002:10:17	Problem	FIAR	RCA-TVD-1231	IFA	STS-61C-V-09	CCTV
None	GMT: 014:22:13		SPR		UA		Manager:
			IPR		PR		
							Engineer:

Title: Payload-Bay Color-TV Camera "D" Flickered. (GFE)

Summary: DISCUSSION: On flight day 2, the video from payload-bay color-TV camera "D" flickered in a manner similar to an out-of-synchronization color wheel. The problem could not be corrected by the ground color converter, but the condition cleared as the camera operation continued. The camera was usable for the remainder of the mission.

Postflight troubleshooting at the vendor isolated the problem to the wide-angle lens assembly. Failure analysis on the wide-angle lens assembly, serial number 009, at the vendor found that some wires were improperly positioned in the circuit so that one circuit board could not seat completely when it was installed in the lens assembly. CONCLUSION: Payload-bay color-TV camera "D" flickered due to an intermittent circuit in the wide-angle lens assembly caused by an improperly positioned wire that prevented the complete seating of a circuit board. CORRECTIVE_ACTION: Payload-bay color-TV camera "D" has been removed, replaced and returned to the vendor for failure analysis and repair. Inspection procedures will insure that the wires are located properly before the circuit boards are installed in the lens assembly. The failure analysis was tracked on FIAR-RCA-TVD-1231 and the report has been closed. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:10:04	Problem	**FIAR**	**IFA** STS-61C-V-10	Atmospheric
None	**GMT:** 015:22:00		**SPR** 32F003	**UA**	Revitalization Subsytem
			IPR	**PR**	**Manager:**
					Engineer:

Title: ECLSS Pressure Control System 2 Oxygen Flow Transducer Read Low. (ORB)

Summary: DISCUSSION: During flight day 4, data from the oxygen flow-rate transducer (V61R2205A) of atmospheric revitalization pressure control system (ARPCS) 2 read low, indicating a failure of the flow transducer. Visibility was lost on the amount of oxygen flow from ARPCS 2 and the caution and warning for high oxygen flow on ARPCS 2 was inoperative for the remainder of the mission. Postflight troubleshooting repeated the low oxygen flow reading on ARPCS 2.

The oxygen/nitrogen control panel was removed and sent to the vendor for failure analysis of the oxygen flow transducer. The spare control panel was installed in the vehicle. Vendor tests repeated the problem, and an inspection showed a poor solder joint where a flow sensor element wire joined the printed-circuit board. The solder joint failure was due to poor joint preparation (i.e. tinning). The failed unit was thoroughly inspected and no further discrepancies were found. CONCLUSION: The low ARPCS 2 oxygen flow reading was caused by a faulty solder joint in the flow transducer. This failure had no impact on the mission. CORRECTIVE_ACTION: The oxygen/nitrogen control panel was removed, replaced and sent to the vendor. The repaired control panel has been tested and returned to spares. The flow sensor soldering is now performed at the control panel vendor under more closely controlled soldering and inspection procedures. The failure analysis was tracked on CAR 32F003 and the report has been closed. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:23:44	Problem	**FIAR**	**IFA** STS-61C-V-11	HYD
None	**GMT:** 016:11:40		**SPR** 32F011	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Water Spray Boiler 3 Steam Vent Heater System A Operation Erratic. (ORB)

Summary: DISCUSSION: On flight day 4, when the water spray boiler (WSB) steam-vent heaters were activated prior to the first two deorbit attempts, the WSB 3 steam-vent temperature (V58T0265A) cycled once with a significant lag when compared with the WSB 1 and 2 steam-vent temperatures. The WSB 3 system A steam-vent heaters did not come back on and the system B controller was selected. Midway through the WSB 3 system B heater cycle, the system A controller was reselected. The temperature cycled upward and system A heater turned off, but failed to come back on again. The same erratic operation occurred on flight day 5. WSB 3 steam-vent heater system B was used for entry. Operation was satisfactory and there was no mission impact.

The system A controller was removed and replaced at KSC, but the system A steam-vent heater operation was still erratic. The nozzle assembly, which includes the steam-vent heaters, was removed, replaced, and returned to the vendor. Retest on OV-102 confirmed proper WSB 3 heater operation. Troubleshooting located an electrical open circuit on the steam-vent nozzle-heater wiring in a sharp, unsupported 90-degree bend that is adjacent to the heater coil. The heat-affected zone on the nickel cold-end conductor side of the nickel-to-Nichrome-V-wire brazed junction had fractured. The junction was slightly embrittled and was most likely subjected to excessive heat and mechanical vibration because it was structurally unsupported. The fabrication of the heater has been modified so that the brazed junction will not be located within the unsupported 90-degree bend. The junction will be repositioned to physically contact the steam-vent nozzle wall. This physical coupling will help minimize thermal and mechanical stresses by serving as a heat sink and support. CONCLUSION: Water spray boiler 3 steam-vent heater system A operation was erratic after the steam-vent heaters failed because of a stress fracture of the brazed junction in an electrical circuit located in an unsupported 90-degree bend that is adjacent to the heater coil. CORRECTIVE_ACTION: The WSB 3 system A nozzle assembly, which includes the steam-vent heaters, has been removed and replaced. Heater fabrication has been modified to position the brazed junction in physical contact with the steam-vent nozzle wall. Failure analysis was tracked on CAR 32F011 and the report has been closed. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:22:24	Problem	**FIAR**	**IFA** STS-61C-V-12	OMS/RCS
None	**GMT:** 016:10:20		**SPR** 32F007	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Left RCS Oxidizer Tank Helium Regulator Leg B Leaked. (ORB)

Summary: DISCUSSION: On flight day 4, after switching to the leg-B helium regulators for operation in the interconnect mode, the left-RCS oxidizer-tank pressure reached 259 psi, 6 psi above the primary regulator lockup pressure. The pressure-rise rate over a 5-hour period was equal to an internal helium leak rate of about 8500 scch through the primary regulator. The regulator internal leakage specification is 100 scch. Subsequent operation of the left-RCS oxidizer-tank leg-B helium regulators was normal during straight-feed oxidizer flow.

Postflight troubleshooting on leg-B at KSC revealed 2200 scch leakage on the primary and 391 scch leakage on the secondary. The regulator package (S/N 20) was removed from the vehicle and sent to the vendor for failure analysis where leakage rates of less than 300 scch (primary) and less than 100 scch (secondary) were identified during functional tests. Tear-down inspection revealed a 1/32 in. copper-like particle embedded in the primary valve seat. The particle was apparently from an external source since there is no material of this type in the regulator. CONCLUSION: The internal leakage of the left-RCS oxidizer tank helium regulator leg-B was most likely caused by externally induced particle contamination. The source of the contamination is unknown. In previous cases of particle contamination, the source was from within the regulator. CORRECTIVE_ACTION: Corrective action for this problem is being tracked under CAR 32F007. The Operations and Maintenance Requirements and Specification Document requires a leak/functional test on each vehicle flow to verify primary and secondary regulated pressures, lock-up pressures, and leakage rates. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 006:01:50	Problem	**FIAR**	**IFA** STS-61C-V-13	HYD
None	**GMT:** 018:13:46		**SPR** AD0927	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Water Spray Boiler 1 Water Rate Usage Excessive. (ORB)

Summary: DISCUSSION: During entry, the auxiliary power unit (APU) lube oil temperaturees in system 1 were low. Water spray boiler (WSB) 1 controller A was turned off, and the temperatures increased. Controller B was turned on, and remained on for the remainder of the mission. Postflight inspection revealed that the WSB 1 water tank was empty at landing. Troubleshooting and data analysis indicated erratic operation of the system 1 hydraulic bypass valve. The WSB was removed from the vehicle and sent to the vendor for analysis. A functional test required abnormally high torque to break away from the bypass position. Disassembly and inspection revealed that the valve spool size exceeded specifications. The component was shortened to the specification length, reinstalled in the WSB, and has been returned to KSC for use as a spare.

CONCLUSION: Improper operation of the hydraulic fluid bypass valve was caused by an oversized valve spool which experienced binding in the inflight thermal environment. The valve remained in the bypass position. Hydraulic fluid temperature reached approximately 235? F causing the controller to call for water. This resulted in excessive APU lube oil cooling, and depletion of all water from WSB 1. CORRECTIVE_ACTION: The vendor has developed a test fixture to field-check end-play on the effected valve spools. All valves will be inspected before they are flown again. All KSC valves have been inspected and three more were found out-of-tolerance. Rework is in progress. The vendor quality control program has been modified for improved supplier surveillance and qualification. This activity is documented under CAR AD0927. EFFECTS_ON_SUBSEQUENT_MISSIONS: See above

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-61C-V-14	MECH
None	**GMT:** Postlanding		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	

Engineer:

Title: Right Main Landing Gear Inboard Brake Damaged. (ORB)

Summary: DISCUSSION: Postflight inspection of the brakes at the vendor revealed that the right main landing gear inboard brake had major thermal damage. The number 3 stator failed and scraped on the wheel drive lugs for 1/8 rotation. The number 3 stator was cracked in 4 locations at the inner diameter root. The inner diameter of the number 3 stator was melted/forged. There was some beryllium carbide damage on the number 2, 3 and 4 rotors and the number 2 and 3 stators of the right inboard brake and the plating on some T clips was melted. There was no dynamic-stability-type damage such as carbon edge chipping.

The right-hand inboard brake energy dissipated was 33.9 million foot pounds with a maximum temperature label on the brake hydraulic actuator assembly of 200 deg F and a maximum brake pressure of 1176 psi. Braking deceleration varied from 7 to 9 feet per second square with brakes on at 138 knots and a brake on-time of 37 seconds. According to prior histories, the damage incurred would not have been anticipated at this energy level. The landing was normal and crew procedures were properly followed. Postflight running clearance was normal. A thicker number 2 and 3 stator configuration has already demonstrated the ability to sustain STS 61-C, STS 5 and STS 51-D energy level stops without damage during laboratory dynamometer tests. CONCLUSION: The right main landing gear inboard brake damage was similar to STS-5 and STS 51-D but did not result in stator breakup. The brake pressure versus time was not high enough to deliver the STS 51-D level of energy into the STS 61-C right inboard brake. There was no dynamic-stability-type damage such as carbon-edge chipping. The failure signature at the brake-energy level encountered would have probably propagated into a stator breakup had energy levels been higher. CORRECTIVE_ACTION: Major brake improvements for the next flight include thicker number 2 and 3 stators with high energy wear in, six brake orifices per brake, stiffened main landing gear axles with deflection reduced 47 percent, balanced brake pressures on the 4 pressure commands to each strut and brake servo modifications preventing uncommanded brake pressures prior to touchdown. Redundant brake-pressure monitoring is being evaluated. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE