

SSVEO IFA List

Date:02/27/2003

STS - 61B, OV - 104, Atlantis (2)

Time:04:25:PM

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: Prelaunch	Problem	FIAR	IFA STS-61B-V-01 FC/PRSD
None	GMT: Prelaunch		SPR None	UA
			IPR None	PR
				Manager:
				Engineer:

Title: Fuel Cell Cryogenic Oxygen Specification Purity Exceeded (ORB)

Summary: DISCUSSION: Oxygen gas sample analysis taken during servicing indicated excessive helium. Excessive impurities in the cryogenics will result in degraded fuel cell performance; and, if the degradation is excessive, additional purges of the fuel cells would be required. Additional oxygen samples were taken which indicated levels of up to 556 ppm of helium. This was significantly above the 110 ppm specification value.

After fuel cell start up, all three fuel cells were placed on internal reactants to monitor fuel cell performance. No fuel cell degradation was noted and the decision was made to fly as is. On-orbit fuel cell performance indicated some degradation while operating on oxygen tanks 1 and 2, but no measurable degradation was noted while operating on oxygen tanks 3 and 4. This observation was confirmed by postflight sampling of the oxygen tanks which showed that tank 1 had 22 ppm, tank 2 150 ppm, and tanks 3 and 4 less than 20 ppm of helium. The higher than normal oxygen impurity level did not require any additional fuel cell purges or result in any unexpected or large fuel cell degradation. Each oxygen tank has a helium pad pressure of 300 psi prior to oxygen servicing. Servicing of the tanks with oxygen normally purges this helium pad pressure from the tanks. This time tanks 3 and 4 reached flight pressure before tanks 1 and 2 and servicing was terminated leaving a helium ullage in tanks 1 and 2. This accounted for the helium contamination in the oxygen on those two tanks. **CONCLUSION:** Fuel cell cryogenic oxygen specification purity was exceeded because oxygen servicing was terminated prior to normal oxygen pressurization of tanks 1 and 2, thus leaving a helium ullage internal to oxygen tanks 1 and 2. **CORRECTIVE_ACTION:** The oxygen servicing procedure has been changed to require up to a one minute flow-through for each tank after the tank has reached pressurization values. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET:	Problem	FIAR	IFA STS-61B-V-02 OI - Sensors
None	GMT:		SPR A) 31F012, B)	UA
				Manager:

AC7837, C) None **PR**

IPR None

Engineer:

Title: Instrumentation Failures. (ORB)

Summary: DISCUSSION: A. Space Shuttle Main Engine 1 and 2 LH2 Inlet Pressure measurements V41P1100C and V41P1200C operated erratically and read low, respectively. At lift-off plus 30 seconds, the SSME 1 measurement read intermittently high and low while the SSME pressure was biased about 7-psi low throughout ascent.

KSC troubleshooting isolated the SSME 1 problem to the pressure sensor, which has been replaced. The failed sensor has been returned to the vendor for failure analysis which will be tracked on CAR 31F012. The bias on the SSME 2 pressure measurement is acceptable for flight. The engine manifold pressures provide backup data for these measurements during engine operation. B. Auxiliary Power Unit 1 Exhaust Gas Temperature 1 measurement (V46T0142A) read low initially, then properly throughout the remainder of the flight. Postflight troubleshooting determined that the sensor had failed. This redundant measurement is used as a backup for monitoring gas generator performance and is not mandatory for flight. The sensor has been replaced and retested. The failure has been tracked on CAR AC7837 and a proposed redesign has been disapproved. The sensors are considered acceptable for program usage. C. Body Flap Lower Centerline Bondline Temperature measurement (V09T1026A) read off-scale low during prelaunch operations and operated intermittently during ascent. KSC troubleshooting found eroded contacts in a measurement connector. The problem has been corrected and proper measurement operation has been verified. CONCLUSION: See above. CORRECTIVE_ACTION: See above. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET:	Problem	FIAR	IFA STS-61B-V-03 OMS/RCS
None	GMT: 331:04:14		SPR None	UA
			IPR None	PR
				Engineer:

Title: Orbital Maneuvering System Crossfeed Line Heater Anomalies. (ORB)

Summary: DISCUSSION: At about 331:04:14 G.m.t., three problems were experienced with the OMS (orbital maneuvering system) system-A crossfeed line heaters:

1. The OMS crossfeed oxidizer-line left-heater fluid temperature measurement (V43T6243A) cycled high (92.4 degrees). This exceeded the FDA (fault detection annunciation) upper limit of 90 degrees. The FDA upper limit was changed to 105 degrees to prevent nuisance crew alarms.
2. The OMS crossfeed oxidizer-line right-heater fluid temperature measurement (V43T6244A) cycled to within 2 degrees of the FDA upper limit of 90 degrees. The FDA upper limit was raised to 100 degrees to prevent nuisance crew alarms.
3. The OMS crossfeed oxidizer-line center temperature transducer (V43T6242A) went to a low of 50 degrees indicating a center-heater

failure (normally, the heater cycles at about 59 degrees). The OMS crossfeed heaters were switched from system A to system B and a heater cycle occurred at the proper operating temperature. Later, the OMS-crossfeed oxidizer-drain-line system-B heater fluid temperature measurement (V43T6236A) cycled to within 3 degrees of the upper FDA limit of 100 degrees. The upper limit was raised to 105 degrees to prevent nuisance crew alarms. There was no further impact to mission operations. The data from the previous flight of OV-104 indicated that the OMS crossfeed left, right, and drain line heaters activated at the same temperature as that seen on OV-099 and OV-103 during comparable attitudes; however, the cutoff temperatures were 15 to 25 degrees higher than seen on the other vehicles. This difference is the result of the temperature sensors being closer to the heater element on OV-104 than they are on OV-099, OV-102 and OV-103. Postflight, the failed oxidizer-line system-A center heater (reference V43T6242A) thermostat cycled during ground checkout. However, it was replaced since no other failure could be found during troubleshooting. If the problem recurs on the next flight of OV-104, system-B heater is available for use. **CONCLUSION:** The OMS left- and right-crossfeed line heaters (reference V43T6243A and V43T6244A) and the oxidizer drain-line-heater (reference V43T6236A) are functioning properly as installed. The high temperatures observed in flight were caused by the temperature sensors being located nearer to the heater elements on OV-104 than on other vehicles. The cause for the on-orbit failure of the OMS-crossfeed oxidizer-line system-A center heater (reference V43T6242A) is unknown. The thermostat was replaced as a precautionary measure. If the failure recurs, the system-B heater will be activated. **CORRECTIVE_ACTION:** The OMS-crossfeed oxidizer-heater fluid temperature sensors and/or thermostats will be relocated to be the same as OV-103 and OV-102. The oxidizer-line system-A center-heater thermostat has been replaced. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 000:21:50	Problem	FIAR	IFA STS-61B-V-04 D&C - Panels
None	GMT: 331:22:19		SPR 31F009 IPR None	Manager: Engineer:

Title: The Aft Event Timer Lost A Readout Segment. (ORB)

Summary: DISCUSSION: At about 331:22:19 G.m.t., the crew reported that the lower right segment of the third from the left digit on the aft event timer was not illuminated. This is the tens digit of the seconds display. The anomaly has no effect on the mission.

The anomalous condition was confirmed at KSC postflight and the aft event timer was removed, replaced, and returned to the vendor for failure analysis. **CONCLUSION:** The most probable cause of the loss of illumination of the event time display was a burned out lightbulb. **CORRECTIVE_ACTION:** The anomalous aft event time will be returned to the vendor for failure analysis. The results of this activity will be tracked via CAR 31F009. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None pending the results of failure analysis.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 001:06:02	Problem	FIAR	IFA STS-61B-V-05 Hydraulics

None **GMT:** 332:06:31 **SPR** None **UA** **Manager:**
IPR None **PR**
Engineer:

Title: Water Spray Boiler 3 Nitrogen Regulator Outlet Pressure (V58P0304) Decayed. (ORB)

Summary: DISCUSSION: After ascent, WSB (water spray boiler) 3 nitrogen regulator outlet pressure (V58P0304) constantly decreased at a rate of about 0.1 psi/hr. At 332:23:29 G.m.t, the regulator outlet pressure was a 22.7 psia rather than the normal 28 psia.

Although WSB nitrogen regulator outlet pressure decays have been noted on previous flights (reference flight problem reports STS-51A-06 on STS-51J-04), these decays have had no impact on the mission because the nitrogen supply is protected by an isolation valve. The decreasing pressure is probably caused by the relief valve not reseating properly after ascent. **CONCLUSION:** The WSB 3 nitrogen regulator outlet pressure most probably decayed because of the relief valve not properly seating after ascent. **CORRECTIVE_ACTION:** The WSB 3 regulator/relief valve will be removed from the OV-104 vehicle and returned to the vendor for repair. After repair the regulator/relief valve will be returned to the launch site for reinstallation into the vehicle and final verification prior to the next mission of OV-104.

EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 000:01:32	Problem	FIAR	IFA STS-61B-V-06 MECH
None	GMT: 331:02:01		SPR 31F001, 31F002 IPR None	UA Manager: PR Engineer:

Title: Port Payload Bay Door Indications. (ORB)

Summary: DISCUSSION: At about 331:02:01 G.m.t., after the PLB (payload bay) doors were opened, the port door aft ready-to-latch indication "B" (V37X3356Y) was present. This indication should not be displayed after door opening. Later at 331:02:24 G.m.t., the port aft ready-to-latch indication "B" cleared. This behavior is generally caused by a sticky or contaminated microswitch. The PLB door latch operations could proceed in the AUTO mode with one of the three ready-to-latch indications (microswitches) failed. In addition, the MANUAL mode was available for latch operations should two microswitches fail. There was no mission impact.

The port PLB door aft ready-to-latch indication "B" switch module will be removed and returned to the vendor for failure analysis. The switch module will be replaced and verified. Also at about 331:02:01 G.m.t., the port PLB door close "A" indication (V37X3307Y) indicated closed when the door was open. This resulted in manual payload door closing operations with single-motor drive time for the port door. This condition was present on STS-51J and was waived for the STS-61B flight. The port PLB door close "A" switch module will be removed and returned to the vendor for failure analysis. The switch module will be replaced and verified. **CONCLUSION:** The port PLB

door aft ready-to-latch "B" indication anomaly was most probably caused by a sticky or contaminated microswitch. The condition could also be caused by a mechanical rigging tolerance problem. The cause of the port PLB door close "A" indication anomaly is unknown pending failure analysis. **CORRECTIVE_ACTION:** The port PLB door aft ready-to-latch indication "B" switch module will be removed, replaced, and returned to the vendor for failure analysis. The results of this activity will be tracked via CAR 31F001. The port PLB door close "A" switch module will be removed, replaced, and returned to the vendor for failure analysis. The results of this activity will be tracked via CAR 31F002. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** None pending the results of failure analysis.

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 002:04:03	Problem	FIAR	IFA STS-61B-V-07
None	GMT: 333:04:32		SPR None	UA
			IPR	PR
				Manager:
				Engineer:

Title: Thermal Protection Blanket Raised On Upper Left Wing. (ORB)

Summary: DISCUSSION: The crew reported that the leading edge of the center portion of a thermal blanket on the top of the port wing was slightly raised. An analysis showed no thermal concern for entry in this area of the wing, with a maximum expected entry temperature of about 400 degrees F. After landing, an inspection showed no evidence of heating effects to the underlying structure, thus confirming the on-orbit analysis. The blanket was stitched to the adjacent blanket for vehicle ferry to KSC where a 22 by 1-1/2 inch area of the blanket was found to be debonded. Further inspection at KSC determined that the blanket had debonded from the structure substrate because of an insufficient amount of RTV on the substrate. The blanket was reinstalled using normal TPS installation and verification procedures.

CONCLUSION: The raised blanket on the upper left wing had debonded because of insufficient RTV on the structure substrate. Blanket bonding and inspection procedures are adequate. **CORRECTIVE_ACTION:** Normal TPS installation and verification procedures have restored the blanket to a flight-worthy condition. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 005:03:30	Problem	FIAR None	IFA STS-61B-V-08
None	GMT: 336:03:59		SPR	UA
			IPR	PR
				Manager:
				Engineer:

Title: Video Tape Recorder 3 Failed (GFE)

Summary: DISCUSSION: At 336:03:59 G.m.t., on flight day 6, the crew reported that VTR (video tape recorder) 3 "ate a video tape and died". The other three VTR's

were operational.

Postflight testing of VTR 3 and the suspect video tape showed that both the tape and the recorder operated properly. The crew reported at the postflight debriefing that VTR 3 had recorded on the video tape for about 4 minutes before "it just stopped". The crew did not have an opportunity to troubleshoot the problem in flight because it occurred late in the mission. It is possible that a reconfiguration of orbiter electrical circuits removed power from the VTR. CONCLUSION: VTR 3 stopped recording late in the flight, but was operational postflight. The actual cause of the flight anomaly is unknown. CORRECTIVE_ACTION: VTR 3 and the video tape have operated properly during several weeks of bench testing. Operation of each VTR is verified after installation in the orbiter prior to flight. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>	
MER - 0	MET: 003:11:47	Problem	FIAR	IFA STS-61B-V-09	FC/PRSD
None	GMT: 334:12:16		SPR 31F003	UA	Manager:
			IPR None	PR	Engineer:

Title: Fuel Cell 2 Performance Degradation. (ORB)

Summary: DISCUSSION: A. At 334:12:16 G.m.t., it was determined that during numerous fuel cell 2 cell-performance-monitor self tests, the substack 3 differential voltage measurement (V45V0204A) transitioned from its average operating value of 36 millivolts to its self-test voltage of 48 millivolts. After the 2- to 3-second self-test period, the differential voltage measurement went to 44 millivolts in lieu of the normal 36 millivolts.

The fuel cell performance monitor was tested at the vendor under conditions similar to the flight and the problem did not recur. Thermal cycling of the performance-monitor circuitry also did not repeat the problem. B. At 336:05:25 G.m.t., fuel cell 2 performance degradation rates closely paralleled those of fuel cell 1 and 3. However, the overall amount of fuel cell 2 degradation was excessive as compared to fuel cell 1 and 3 because a significant performance increase was achieved by fuel cells 1 and 3 during purges, whereas only a slight increase was seen on fuel cell 2 during purges. Even though fuel cell 2 purge flow rates appeared to be normal, the performance increase that should have occurred did not, indicating that the purge system was not operating properly. Fuel cell 2 performance degraded by approximately 0.4 volt during the 6-day mission. Degradation for this fuel cell during the previous mission (STS 51-J) was 0.25 volt over 4 days. Usual observed decay for any fuel cell is on the order of 0.1 volt or less for a nominal 7-day mission. STS 51-J was the first flight of this fuel cell. The fuel cell was returned to the vendor and disassembled. A subsequent component inspection revealed that one turn of a conical spring in the fuel-cell oxygen-regulator dual feed/purge valve was trapped in the valve seat. This prevented the valve from closing during the purge, thus causing the purge flow to bypass the cell. The poppet spring was reinstalled and repeated attempts to cause it to lodge in the valve seat were unsuccessful. The conical spring was most probably mispositioned on the valve poppet during the regulator assembly and not found during test or inspection. CONCLUSION: A. The cause of the differential voltage discrepancy is unknown. The performance monitor is not essential for the operation of the fuel

cell. B. The excessive performance degradation is the result of ineffective purges caused by a mispositioned poppet spring in the oxygen dual feed/purge valve of the fuel cell oxygen regulator. **CORRECTIVE_ACTION:** A. The performance monitor electronics on fuel cell 2 has been replaced. B. Fuel cell 2 was removed and replaced. A test has been added to the acceptance procedure to assure that the conical spring is properly installed in the oxygen dual feed/purge valve of the fuel cell oxygen regulator. The failure analysis was tracked on CAR 31F003, and the report has been closed. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 005:22:43	Problem	FIAR	IFA STS-61B-V-10
None	GMT: 336:23:12		SPR None	UA
			IPR None	PR
				Manager:
				Engineer:

Title: Airlock Hatch Could Not Be Latched in Full Open Position and Side Hatch "T" Handle Broke. (ORB)

Summary: DISCUSSION: A. The crew reported they could not engage the hatch latch hook in the full open position. KSC inspection showed the latch hook guide pin would not enter the bushing in the latch support assembly. Also, the rubber washer at the base of the guide pin that is compressed when the latch hook is engaged was too thick.

B. When the ground crew attempted to open the hatch for egress, the inner tube of the hatch tool broke near the end which engages the locking lever. The crew opened the hatch from the inside. Postflight inspection showed the tool had internal damage, most probably the result of improper use. The orbiter hatch 5/8-inch detent socket was damaged and the hatch lock shaft was also damaged where the shaft protrudes into the tool. **CONCLUSION:** A. An out-of-tolerance condition that existed in the latch support bushing and the guide pin washer did not permit the latch hook to engage. B. The tool and Orbiter hatch parts were damaged due to improper tool use. **CORRECTIVE_ACTION:** A. The latch pin washer has been replaced with a thinner washer and the latch pin bushing has been machined to permit latch hook engagement. Latching has been functionally verified. B. All hatch tools have been repaired and rerigged and damaged hatch parts on all Orbiters have been repaired and replaced. Procedures will be changed to require the hatch to be locked only for Orbiter flight or ferry flight. A training program for ingress/egress crews will be implemented and only certified technicians will be allowed to lock/unlock the hatch. A simplified tool will be designed for latching or unlatching the hatch, and an improved method of visual verification of the hatch lock position will be developed. The cost impact of a simplified tool design and fabrication has been initiated. **EFFECTS_ON_SUBSEQUENT_MISSIONS:** NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: 005:22:42	Problem	FIAR	IFA STS-61B-V-11
None	GMT: 336:23:11		SPR None	UA
			IPR	PR
				Manager:
				Engineer:

Engineer:

Title: Crew Access Panel For IMU Filters And Volume "H" Locker Misaligned (ORB)

Summary: DISCUSSION: The overhead panel for access to the IMU filters (M042/58F) was misaligned and interfered with volume "A" (MF57A). The crew reported that the fasteners could not be secured. The misalignment was about 1/4 inch and one captive fastener fell out. The broken fastener was replaced postflight and the panel door was realigned. See problems STS-41B-15 on OV-099 Challenger flight 4 and STS-51D-16 on OV-103 Discovery flight 4.

The volume "H" storage locker (MD23R) had to be pried open. The crew used a screw driver and a pry bar to open the locker. The door panel was trimmed postflight to provide clearance within the allowable tolerances. See problem STS-41-B-15. CONCLUSION: Door, locker and access panel misalignments are the result of on-orbit cabin deflections. Fixes for the locker doors and access panels were flight tested and evaluated on STS 41-D, the first flight of OV-103. CORRECTIVE_ACTION: A corrective design to simplify the access to the IMU filters and to improve the alignment of the locker doors has been initiated by MCR 10903.

EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

<u>Tracking No</u>	<u>Time</u>	<u>Classification</u>	<u>Documentation</u>	<u>Subsystem</u>
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-61B-V-12
None	GMT: Postlanding		SPR None	UA
			IPR None	PR

Engineer:

Title: Nose Landing Gear Strut Low. (ORB)

Summary: DISCUSSION: Postflight, the nose landing gear strut measured 2 inches below normal. The ground crew was unable to hook up the tow bar until after the strut was pumped up. A subsequent 2-week leak check showed the strut leak rate to be within specification. A liquid bubble test also did not show a leak.

The total stroke on the nose strut is 22 inches and the strut will normally stroke about 17 inches during landing. The low strut could have stroked about 3 more inches before bottoming out. Pneumatic pressure was lost in the right main landing gear strut on STS 41-D. A postflight bubble check located a gaseous nitrogen leak in the Schrader valve and the failure investigation found scratches and an annular groove on the surface of the valve seat. The OMRSD was revised after STS 41-D to add an additional bubble leak check before the installation of the valve cap and to specify minimum and maximum torque value for both the swivel nut and the valve cap. See problem STS-41D-26 and CAR 14F018. The low nose-landing-gear strut on STS 61-B may have been due to an improperly torqued swivel nut and valve cap or the result of distortion in the pneumatic seals while the gear was retracted with the Orbiter in the horizontal position. CONCLUSION: The nose landing gear strut was 2 inches low after landing, but the strut did not bottom out. The nose strut leak rate was within specification and acceptable for flight. CORRECTIVE_ACTION: The nose landing gear strut will be checked for proper inflation prior to the next launch on OV-104, Atlantis. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

