SSVEO IFA List **Date:02/27/2003**

STS - 36, OV - 104, Atlantis (6) **Time:04:19:PM**

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-36-V-01	EPD&C
None	**GMT:** Prelaunch		**SPR** 36RF01	**UA**	**Manager:**
			IPR 36RV-159	**PR** EPD-4-06-0747	
					Engineer:

Title: AC 2 Phase A Inverter Failure (ORB)

Summary: DISCUSSION: During prelaunch operations at approximately 54:22:44 G.m.t., the AC 2 phase A voltage fluctuated from 112 volts to 122 volts. The phase A current also fluctuated with the voltage. No AC load switching was being performed at the time. The fluctuations continued for about 1 minute. The AC 2 phase A inverter (serial number 51) was removed and replaced. There was no further problem with the AC 2 voltage or current during launch operations or during the STS-36 mission.

The failed inverter was returned to the vendor where the problem was repeated and isolated to a loose electrical connection between the 28 Vdc input and the switching transistors. The dc current is carried through a filter assembly electrically connected by an electrical bus bar and are attached by four metallic screws (two at each end). The four screws were loose, thus causing an intermittent electrical path for the dc current that resulted in fluctuations of the AC 2 phase A voltage and current. The vendor's critical screw-torquing requirement was verified on newly built hardware, however, that requirement was not incorporated into rework procedures until 1985. Inverter serial number 51 was reworked in 1983 and the rework documentation does not indicate that the torque on the four metallic connection screws was verified by the inspection group. A review of all inverter documentation has identified five additional inverters that were reworked prior to 1985: Serial Number Location

AC Bus Phase 54	OV-102	AC2 A 18	OV-104	AC3 B 38	OV-104
AC3 A 49	OV-104	AC2 B 33	KSC SPARES		

All inverters with the identified problem will be returned to the vendor for screw-torque verification prior to the next flight of these inverters. CONCLUSION: The voltage and current fluctuations that occurred on the AC 2 phase A inverter during prelaunch operations were caused by loose screws that attach the filter assembly to the switching transistors. CORRECTIVE_ACTION: The failed inverter (serial number 51) was removed, replaced with a unit that has had the screw torquing requirement verified, and returned to the vendor. All other inverters that have no confirmation (inspector's stamp) of the screw torquing requirement will also be returned to the vendor for screw-torque verification. The results of this activity will be tracked via CAR 36RF01. EFFECTS_ON_SUBSEQUENT_MISSIONS: None expected.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-36-V-02	MPS
None	**GMT:** Prelaunch		**SPR** 36RF02	**UA**	**Manager:**
			IPR 36RV-0170, 38V-0002	**PR**	
					Engineer:

Title: The Main Propulsion System (MPS) 17" disconnect B open indication dropped out for 12 seconds during the prelaunch Liquid Hydrogen (LH2) fast fill operations. (ORB)

Summary: DISCUSSION: The MPS 17-inch disconnect B open indication dropped out for 12 seconds during the prelaunch LH2 fast fill operations, causing an LH2 stop flow. The open indication recovered by the time the stop flow was completed. The indication was correct during two subsequent propellant loads and during the remainder of the mission.

When the dropout occurred, there was no change in the A open indicators or in any of the power indications associated with the valve. Since the Launch Commit Criteria requires only one of the two open indications for launch, the B open indication was masked in the ground software and the LH2 fast fill was resumed. The LH2 loading was completed without further incident. The dropout did not reoccur during the second scrub or the launch operations. The supplier measured the flapper angle at which the switch picks up relative to the horizontal plane. When the flappers are demated, the flapper must move 15.2 degrees toward the closed from the horizontal plane before the position switch will drop out. When the flappers are mated, the flapper rests at an angle of 2.39 degrees below the horizontal plane. Thus if the B indicator was to be able to drop out, the flapper must have moved a total of 2.39 + 15.2 = 17.49 degrees. But since the latch was locked in place at the time, the latch will stop movement at 0.5 degrees above the horizontal plane. The flapper is only allowed to move 2.39 + 0.5 = 2.89 degrees, which is less than the 17.49 degrees. Thus it is impossible to lose the "B" open indicator by flapper movement while mated with the latch locked. KSC has inspected the wiring from the connector to avionics bay 6. No anomalies were found during two Orbiter power-up/downs during which the flapper which operates the A and B open indication microswitches was moved and actuation of the microswitches measured. Actuation of the microswitches were within 3.7 degrees of each other, specification values is within 4 degrees. CONCLUSION: The most probable cause of the LH2 open indication drop out is that chill down due to propellant loading can have a minor effect on these microswitchs' indications. CORRECTIVE_ACTION: None. The Launch Commit Criteria on this indication is one of two, the problem was not repeatable, and troubleshooting to date shows no indication of a generic type of failure. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-36-V-03	APU
MMACS--01, MMACS-02	**GMT:** Prelaunch		**SPR** 36RF03,	**UA**	**Manager:**
			36RF04,36RF05,36RF20	**PR** APU-4-06-0160, APU-	

IPR	4-07-0167, APU-4-07-0166, APU-4	**Engineer:**	

Title: Operational Instrumentation Failures (ORB)

Summary: DISCUSSION: A. The auxiliary power unit (APU) 1 (ser. no. 307) exhaust gas temperature (EGT) 1 sensor (V46T0142A) began giving erratic readings immediately following APU 1 startup. The alternate sensor worked properly, so no further corrective action was performed during the mission. The failed sensor will be removed and replaced. This is a criticality 3 measurement for loss of output. This problem is closed.

B. The APU 1 injector temperature sensor (V46T0174A) was erratic and went off scale high during the launch scrub, ascent and entry. On orbit, it was biased low. This is a criticality 3 measurement. APU 1 was removed and replaced, and the sensor will be checked at the vendor. This problem is closed. Final closure tracked by CAR 36RF04. C. APU 1 gas generator valve module (GGVM) temperature 1 sensor (V46T0171A) showed a high bias post shutdown following the launch scrub. APU 1 was removed and replaced, and the sensor will be checked at the vendor. This is a criticality 3 measurement. This problem is closed. Final closure tracked by CAR 36RF05. D. APU 3 (ser. no. 207) EGT 2 sensor failed post-landing. The sensor was removed and replaced. This is a criticality 3 measurement for loss of output. This problem is closed. CONCLUSION: See above. CORRECTIVE_ACTION: See above. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:08	Problem	**FIAR**	**IFA** STS-36-V-04	OMS/RCS
PROP-01	**GMT:** 059:07:59		**SPR** 36RF07	**UA**	**Manager:**
			IPR 38V-213	**PR**	
					Engineer:

Title: Reaction Control Subsystem Primary Thruster R3D Declared Failed Off (ORB)

Summary: DISCUSSION: Reaction Control Subsystem (RCS) primary thruster R3D was declared 'failed off' during the External Tank (ET) separation maneuver. When the fire command was initiated, chamber pressure increased to approximately 12 psi. Redundancy Management declared thruster R3D `Fail Off' after three consecutive chamber pressure discretes of less than 29 psi. Injector temperature profiles were nominal, and Orbiter rates were inconclusive as to whether the thruster fired due to other thrusters firing during the ET separation maneuver. The chamber pressure decayed abruptly when the fire command was removed, which is not characteristic of a plugged chamber pressure transducer tube.

CONCLUSION: The most probable cause of the low chamber pressure reading is pilot only operation on one valve and nominal operation of the second valve. Analysis indicates this condition would yield a chamber pressure of 10-15 psi. CORRECTIVE_ACTION: Troubleshooting at KSC to include inspection and possible removal. A team has been formed at JSC to investigate all STS RCS thruster failures and this failure will be addressed by that effort. EFFECTS_ON_SUBSEQUENT_MISSIONS:

Spares exist at KSC and operations can be performed in parallel. There will be little effect on turnaround and no effect on subsequent missions.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:03:03	Problem	**FIAR**	**IFA** STS-36-V-05	CREW
MMACS-03	**GMT:** 059:10:54		**SPR** 36RF08	**UA**	**Manager:**
			IPR	**PR** UA-4-07-0110	
					Engineer:

Title: A. The Volume H Door and Latch Was BindingB. The LioH Stowage Container Volume Could Not Be Removed. (ORB)

Summary: DISCUSSION: A. The crew reported that due to binding of the volume H door and latch, the use of a screwdriver was necessary to unlatch and open the door. A previous modification to OV-104 (ref. E.O. V070336764-A03 & V07336751) was performed to allow the volume H frame to accommodate the middeck floor deflections experienced during flight. The attach holes were elongated on three sides of the frame and the forward edge of the frame was trimmed. Subsequent to this anomaly an investigation was performed to review the drawings from the previous E.O., the stress deflection analysis, and the dimensional correctness of the modification requested. The investigation verified that the elongation of the holes and trimming of the forward frame edge would accommodate the floor deflections. However, it was found that the enlarging of the cutouts to clear the interdeck access ladder floor attach fittings had been overlooked. This could cause the ladder fittings to engage the volume H frame when the floor deflects and cause a distortion of the volume H frame. This then could cause the frame to bind against the door causing difficulty in opening the door.

B. In order to perform a contingency Inflight Maintenance (IFM) procedure to clean up free water from the humidity separator, an attempt was made by the crew to remove the fasteners on the LiOH stowage container volume. All fasteners were removable except one. This prevented the crew from being able to remove the volume and perform the attempted IFM procedure. The LiOH stowage container volume is flush mounted with torque set fasteners and was designed to be a very tight fit. CONCLUSION: A. The ladder floor attach fittings foot print was not considered in the original deflection analysis that determined the previous modification to volume H. This is the most probable cause for the volume H door binding. B. There is no design requirement for the LiOH stowage container volume to be removable for IFM. CORRECTIVE_ACTION: A. A new E.O. is being developed to modify the volume H door to prevent the binding action. This will be accomplished by enlarging the cutouts in the volume H frame. Final corrective action will be documented in CAR 36F08-010. B. A proposal will be considered to modify the LioH stowage container volume to be removable inflight. EFFECTS_ON_SUBSEQUENT_MISSIONS: A. Continual difficulties may arise during volume H door openings until the revised modification is performed. B. Continual difficulties may arise if a contingency IFM is required to remove the LiOH stowage volume. Alternate access areas for free water removal are available.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** -001:23:59	Problem	**FIAR**	**IFA** STS-36-V-06	OMS/RCS
PROP-03, PROP-05, PROP-04	**GMT:** 059:07:50		**SPR** 36RF09	**UA**	**Manager:**
			IPR 38V-0019, 38V-0020, 38V-0021	**PR**	**Engineer:**

Title: RCS Valve Position Indications Intermittent:A. RCS Right Ox Manifold 1 Valve Open Position Indication B. RCS Left Ox 'B' Leg Tank Isolation Valve Open Position IndicationC. RCS Left Ox 1/2 Crossfeed Valve Closed Position Indication (ORB)

Summary: DISCUSSION: A. The aft right Reaction Control System (RCS) oxidizer manifold 1 valve lost the open position indication 3 seconds prior to launch. Forty minutes after launch, the cockpit panel switch was changed from GPC to the open position and an open valve position indication was achieved. The valve position indication read nominally throughout the remainder of flight.

B. The RCS aft left oxidizer 'B' leg tank isolation valve lost the open position indication 8 seconds after launch for one data sample. The data sample rate of this valve is one sample per second. The open position on the valve was lost for 2 seconds, which corresponds to a one sample per second data dropout. The valve position indication read nominally throughout the remainder of flight. C. The RCS aft left oxidizer 1/2 crossfeed valve lost the close position indication 45 seconds after launch. Forty minutes after launch the cockpit panel switch was changed from GPC to closed position and a closed valve position indication was achieved. The valve position indication read nominally throughout the remainder of flight. All three of the valves have their position set prelaunch by timed Launch Processing System (LPS) ground commands. These ground commands are set on by the LPS for 1.4 seconds. These LPS commands are sent to the Orbiter over the Launch Data Bus (LDB). When there is heavy uplink traffic on the LDB, uplink commands are stacked in the order received and then uplinked. When the valve open or close commands are sent by the LPS to the LDB, the 1.4 second timer starts. Since the specification maximum travel time on these valves to fully open or close is 1.3 seconds, this delay by the LDB in uplinking the command may not allow enough time for the valve to reach full travel. On this type of valve, if the valve is driven fully open or fully closed, the mechanical parts within the actuator will mechanically lock into the open or closed position and activate the microswitch if the valve is driven fully open or fully closed. The design of these parts is such that if the valve is driven just short of the fully opened or closed position, the microswitch can be activated, but the actuator's mechanical parts will not be mechanically locked and vibration can cause intermittent microswitch activation. CONCLUSION: The most probable cause of these intermittent indications for 6A and 6C is that the Launch Processing System (LPS) open and close commands were removed before the valve was driven fully open or closed. The most probable cause of the 6B intermittent indication is a one sample telemetry dropout. Troubleshooting at KSC is required for alternate failure mode elimination. CORRECTIVE_ACTION: Each of the three valve's actuators have been removed and sent to the vendor for analysis. Consideration is being given to increasing the timed LPS open and close commands from 1.4 seconds to 2.0 seconds. EFFECTS_ON_SUBSEQUENT_MISSIONS: Spare actuators and valve position indicators exist at KSC and operations can be performed in parallel. There will be little effect on turnaround and no effect on subsequent misions.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:03:24	Problem	**FIAR**	**IFA** STS-36-V-07	HYD
MMACS-04	**GMT:** 059:11:15		**SPR** 36RF10	**UA** UA-4-06-0044	**Manager:**
			IPR	**PR**	
					Engineer:

Title: WSB 2 Vent Temperature Did Not Respond on Controller A (ORB)

Summary: DISCUSSION: During post-insertion activities, water spray boiler (WSB) vent heater A was reactivated to melt any ice formation in the vent areas. WSB 2 vent heater A cycled twice and then appeared to fail (temperatures below 122?F are not detectable).

WSB 2 heater A was reselected during entry. The heater cycled again twice, and then operated erratically. The crew switched to the B controller and a normal response was obtained. This same heater failed to respond during STS-34 deorbit preparation (Ref. STS-34-18 FPR). Troubleshooting in preparation for STS-36 included shaking the wire harnesses and tapping the related connectors while heater current was being measured. Also, connectors were demated/mated and inspected for possible damage incurred during the "B" controller upgrade. Ground check-out failed to reproduce the anomaly or show any discrepancies. Troubleshooting in preparation for STS-38 has included replacement of WSB controller 2A. The unit was returned to the vendor for failure analysis and no discrepancies were noted. Also, steam vent nozzle heater system resistance and insulation resistance tests were conducted, and no out-of-specification values were measured. Prior to STS-26, the WSB vent nozzle assembly insulation configuration was modified. The modification included the installation of nozzle-gap filler between the nozzle assembly and the vehicle tile, and room temperature vulcanized (RTV) sealant was inserted between the vent nozzle assembly and the vehicle skin. These changes were incorporated in an effort to resolve prelaunch problems experienced during previous missions, where it was suspected the temperature sensor and/or heater was thermally shorted by water intrusion. CONCLUSION: Troubleshooting has failed to detect any WSB vent heater hardware discrepancies. One explanation is that the configuration changes made prior to STS-26 resulted in an increase in heat loss from the vent nozzle assembly into the vehicle skin. This change in combination with a small 50-watt vent heater and the operating environment inflight resulted in the appearance of a heater failure, since temperatures below 122? F can not be measured. Flight data also indicate that system 2 is the most sensitive of three systems to environmental influences. Other possible causes for the heater failure include the controller, heater, or the associated wiring and connectors problems that have gone undetected during ground troubleshooting. CORRECTIVE_ACTION: The WSB controller was replaced. WSB vent heater B will be activated during post-insertion activities in place of heater A to melt any ice formation in the vent areas, and the heater will be left on for a minimum of 3 hours in an effort to confirm that the occurrence is not unique to system A. For flight control system (FCS) check-out and entry, the A heaters will be selected earlier in the timeline. EFFECTS_ON_SUBSEQUENT_MISSIONS: If heater A fails again, a redundant steam vent nozzle heater and control circuit is available. If the alternate heater fails, the result is the possible loss of an auxiliary power unit (APU) due to loss of cooling capability, if the vent should become clogged with ice. To protect against the loss of the APU, the APU start can be delayed for entry.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:04	Problem	**FIAR**	**IFA** STS-36-V-08	HYD
MMACS-05	**GMT:** 059:07:55		**SPR** 36RF11	**UA**	**Manager:**
			IPR 38V-0004	**PR** V070-0194	
					Engineer:

Title: Hydraulic System 1 leak (ORB)

Summary: DISCUSSION: During STS-36 ascent, the hydraulic system 1 reservoir quantity remained constant when it should have increased due to thermal effects. In addition, the reservoir pressure fluctuated and was not tracking the other two systems (Ref. STS-36-20 FPR).

During on-orbit operations, the reservoir quantity and pressure tracked the other two hydraulic systems as expected. During the flight control system checkout, hydraulic circulation pump 1 was run and no reservoir quantity drop was detected at the circulation pump pressure of 300 psi. After auxiliary power unit (APU) start for entry (entry interface minus 13 minutes), the reservoir quantity began to decrease and reservoir pressure was again lower than the other two systems. It was decided that external fluid leakage was occurring in system 1. The hydraulic main pump was switched to low-pressure operation to minimize fluid loss. The pump outlet pressure should have dropped to 800 psia, but instead went from 3000 to 2100 psia and then ramped up to 2500 psia for almost 6 minutes before dropping to 600 psia where it remained (Ref. STS-36-17 FPR). During low-pressure operations, the reservoir quantity stayed relatively constant, indicating the leak had slowed. At terminal area energy management (TAEM), the pump was taken back to normal pressure operation for approach and landing. System 1 successfully supported landing gear deployment and nose wheel steering operations. APU 1 was shutdown less than 1 minute after wheel stop. Postflight inspection of the aft compartment at Dryden Flight Research Facility revealed a 1-inch tear in the outer chafing guard of the main pump 1 high-pressure flex hose. A fine coating of hydraulic fluid was found on a majority of exposed areas on the port side of the aft compartment. A detailed inspection of the main pump flex hose at Rockwell-Downey revealed two creases in the Teflon liner. The Teflon liner was pressurized and submerged in water and the leak area was isolated to a pinhole approximately 1-inch from one of two creased areas (and 8 inches from the 1-inch tear in the chafing guard). A 0.18-inch longitudinal crack was found beneath the leak site on the inside diameter (ID) of the Teflon liner. The creases seen in the Teflon hose are similar to those caused by severe bending (bend radius less than 8 inches). The Teflon hose material showed indications of marginal gravity and melting point. Also, microscopic examination revealed incomplete sintering on the fracture surface of the flaw. Kinking of this hose material produced longitudinal crazing in the corners of the kink site. Low-cycle testing (1.3 million cycles at 10 Hz maximum) of the hose material at the kink site did not propagate the crazing into a through-crack. Kinking of a sample of completely sintered hose material did not produce the crazing. The main pump high-pressure hose sees an environment of ? 550-psi maximum pump ripple at approximately 600 Hz during pump operation. It cannot be pressurized above reservoir pressure during regular ground operations due to an in-line check valve. All hydraulic hoses are exposed to multiple pressure transients (as high as 3800 psia on the supply side) during system operation due to aerosurface activity. Examination of the flaw site revealed a crack-like area of incomplete sintering on the ID of the Teflon liner, probably due to a bump extrudate during manufacture. Because processing screens did not detect this crack-like area, this area may not have developed into a full crack until subjected to the high stresses associated with buckling. Beyond this crack area was evidence of crack propagation due to low-cycle fatigue, perhaps due to pump ripple or the normal pressure transients seen during operation of the hydraulic system. A

third region of crack propagation beyond this fatigue crack area was not identified, but may be due to mishandling of the hose (kinking) or improper sintering. The final region leading to the breakthrough was identified as a fast-fracture structure, perhaps occurring at the initial application of main pump at APU startup. CONCLUSION: The failure mode is leak before burst. Once a crack extends through the Teflon wall, the crack growth rate is retarded by the outer wire braid restraining the line and preventing the crack opening. There was no evidence of fatigue crack growth at the flaw area after the crack broke through the wall. Therefore, the resultant leak rate would probably not have grown significantly after the initial leakage. However, a larger initial flaw could produce a higher leak rate than was observed with this hose and lead to total loss of the associated hydraulic system. The most probable cause of the leak was damage during manufacturing which created a crack-like low strength (incompletely sintered) area at the ID of the Teflon liner. Full crack development may have resulted from hose mishandling with crack propagation resulting from cyclic fatigue. Crack propagation may have been accelerated by marginal sintering. A very low probability exists for repetition of the failure as it requires damage during manufacture which goes undetected during the acceptance test procedure (ATP) couple with mishandling or marginal sintering. However, should the failure recur, redundancy exists in the hydraulic system to support safe flight. CORRECTIVE_ACTION: The main pump outlet flex hose was replaced. The inventory will be purged of all hoses from the same lot due to evidence of marginal sintering. The hydraulic system 2 and 3 pump outlet hoses and system 1 pump inlet hose will be removed and inspected for evidence of buckling and/or cracks. EFFECTS_ON_SUBSEQUENT_MISSIONS: OV-103 and OV-102 pump outlet hoses will also be removed after STS-31 and STS-35, respectively, for similar inspections.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:23:19:38.000	Problem	**FIAR**	**IFA** STS-36-V-09	DPS
DPS-01	**GMT:** 061:07:10:00.000		**SPR** 36RF12	**UA**	**Manager:**
			IPR	**PR** DIG-4-07-0159	
					Engineer:

Title: Aft Flight Deck Display Unit 4 Went Blank (ORB)

Summary: DISCUSSION: At 061:07:07 G.m.t., the crew reported that display unit (DU) 4 went blank with brightness set at full intensity. The DU power was cycled twice and the display regained. Subsequent to regaining the DU function, several displays were successfully called up. Approximately 2 hours later, the DU failed again and was recovered with another power cycle. The DU failed again about an hour later and was powered off for the remainder of the mission. Real-time analysis of DU BITE data indicated a possible power supply problem.

DU 4, serial number (S/N) 22, was removed and sent to the vendor for failure analysis. The problem was isolated to a cracked solder joint on a ceramic capacitor in the horizontal deflection amplifier page. This failure caused an unstable load on the power supply, which accounts for the power supply BITE bits being set. The same failure has occurred four times in the field; however, this is the first occurrence in-flight. CONCLUSION: The cause of the failure of DU 4 (S/N 22) was a cracked capacitor solder joint in the horizontal deflection amplifier page. This failure occurs where excess epoxy, which adheres the capacitor to the page, has bridged over and adhered to the nearby stiffener. Thermal expansion and contraction of the epoxy is exaggerated by the increased heat load from the metal stiffener which also acts to prevent strain relief. The strain is eventually relieved in the form of a cracked solder joint. This problem has been isolated to pages which have the capacitor mounted "pins down" and

with over 8000 hours of run time. CORRECTIVE_ACTION: The excess epoxy will be freed from the stiffener on all suspect boards. DU's in the field with the suspect boards will be returned to the vendor prior to flight with the exception of DU's S/N 3 and S/N 20. One page on S/N 3 (OV-102 slot 3) is of the suspect configuration, but has less than 8000 hours. Therefore, S/N 3 will be monitored and replaced when the hours approach 8000. DU S/N 20 (OV-104 slot 4) has two pages with the suspect configuration, with one above 8000 hours. However, no spares are available at this time and DU 4 is not critical during the dynamic phases of flight. S/N 20 will be replaced during the next flow of OV-104. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR** BFCE-026F0001	**IFA** STS-36-V-10	GFE
ECCOM-02	**GMT:**		**SPR**	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Pressure Control System Oxygen Bleed Orifice Leak (GFE)

Summary: DISCUSSION: During the flight, the pressure control system (PCS) oxygen bleed orifice leaked and caused a cabin alarm to be set off. The crew subsequently tightened the elbow fitting nut, which reduced the leak and restored normal oxygen flow rates.

CONCLUSION: The orifice was removed and returned to JSC, where is was checked and no discrepancies were noted. The most likely cause of this problem was the bleed orifice fitting backing off from the elbow tube during prelaunch cleaning activities. CORRECTIVE_ACTION: Future bleed orifices will be pressure/flow checked by Boeing/FEPC personnel. Those orifices not meeting the leak specifications will be refurbished or scrapped. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:09:55	Problem	**FIAR**	**IFA** STS-36-V-11	Atmospheric
EECOM-04	**GMT:** 061:17:46		**SPR** 36RF13	**UA**	Revitalization Subsytem
			IPR	**PR** ECL-4-07-0399	**Manager:**
					Engineer:

Title: Free water near Humidity Separator (ORB)

Summary: DISCUSSION: Nine hours after switching to water separator A, at approximately 061:17:46 G.m.t., the crew reported finding 1 to 2 cups of water outside water separator A. The crew reconfigured to water separator B, and then performed the free fluid disposal in-flight maintenance procedure. A similar problem occurred on OV-102 during STS-32 (ref. STS-32-07), and this was attributed to debris either in the air ducts or the heat exchanger.

Water separator A was removed from OV-104 at Dryden Flight Research Facility to prevent loss of failure evidence during ferry to KSC. A subsequent teardown revealed fibrous material on the pitot tube inlet and contamination throughout the separator. During the STS-38 turnaround activities, the cabin heat exchanger was air flushed (the same procedure that was used on OV-102). CONCLUSION: The problem was most likely caused by debris collecting in the cabin heat exchanger from the air revitalization system (ARS) ducts. This debris then could have been passed on to the water separators, blocking or restricting the pitot tube. The postflight informal failure analysis revealed debris on the pitot tube, indicating that debris is indeed the primary cause of the failure. CORRECTIVE_ACTION: The OV-102 and OV-104 cabin heat exchangers were air flushed in an attempt to remove debris. A refurbished water separator was installed on OV-104 and the quantitative water flush procedure (which verifies separator performance) was successfully performed on the separator. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:07:26	Problem	**FIAR**	**IFA** STS-36-V-12	OMS/RCS
PROP-06	**GMT:** 062:15:17		**SPR** 36RF14	**UA**	**Manager:**
			IPR 38V-212	**PR** RPOP-12-0343	
					Engineer:

Title: Reaction Control Subsytem Primary Thruster R4R Declared Failed Off (ORB)

Summary: DISCUSSION: Reaction Control Subsystem (RCS) primary thruster R4R was declared failed off during the RCS hot-fire test. When the fire command was initiated, chamber pressure increased to approximately 9.5 psi. Redundancy Management declared thruster R4R 'Fail Off' after three consecutive chamber pressure discretes of less than 29 psi. Injector temperature profiles were nominal, but Orbiter rates indicated no thruster firing . Chamber pressure decayed abruptly when fire command was removed, which is not characteristic of a plugged chamber pressure transducer.

CONCLUSION: The most probable cause of the low chamber pressure reading is pilot only operation on one valve and nominal operation of the second valve. Analysis indicates this condition would yield a chamber pressure of 10-15 psi. CORRECTIVE_ACTION: Troubleshooting at KSC to include inspection and possible removal of thruster. A team has been formed at JSC to investigate all STS RCS thruster failures, and this failure will be adressed by that effort. EFFECTS_ON_SUBSEQUENT_MISSIONS: Spares exist at KSC and operations can be performed in parallel. There will be little effect on turnaround and no effect on subsequent missions.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 1	**MET:** Prelaunch	Explained Condition	**FIAR**	**IFA** STS-36-V-13	Water and Waste
EECOM-05	**GMT:** Prelaunch		**SPR** 36RF15	**UA**	Management System
			IPR 36RV-0126	**PR** ECL-4-06-0397	**Manager:**

Engineer:

Title: Supply Water Tank A & B Check Valve Reverse Leakage Prelaunch (ORB)

Summary: This problem was deleted because is was a Known condition preflight

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:02:55	Problem	**FIAR**	**IFA** STS-36-V-14	Active Thermal Control
EECOM-03	**GMT:** 060:10:46		**SPR** 36RF16	**UA**	Subsytem
			IPR 38V-0014	**PR**	**Manager:**

Engineer:

Title: Flash Evaporator System (FES) Primary Controller A Shutdown (ORB)

Summary: DISCUSSION: While the radiators were operating at the Hi Set Point (57 degrees) and the FES was in Standby, a FES water dump was begun. The FES subsequently shut down due to an overtemp condition. An overtemp shutdown occurs when the Evaporator Out temperature remains above 41 degrees F for more than 40 seconds. When this occurs, the affected controller must be power cycled to reenable the FES. FES primary controller A was cycled and the FES then began to operate properly. Postflight, the FES was checked out and no anomalies were found.

CONCLUSION: The most likely cause of the FES shutdown is the reduced water feedline pressure when operating at 10.2 psia cabin pressure. Reduced feedline pressure results in less feedwater flow, which causes the FES response to be slower for rapid temperature changes. With the radiators at the Hi Set point, the FES could not cool the Freon down at a fast enough rate to satisfy the controller logic. CORRECTIVE_ACTION: Fly as is. The problem can be corrected procedurally by power cycling the FES controller whenever this condition occurs. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:05:44	Problem	**FIAR**	**IFA** STS-36-V-15	D&C - Lighting
EECOM-07	**GMT:** 063:13:35		**SPR** 36RF17	**UA**	**Manager:**
			IPR 38V-0007, 38V-0008, 38V-0006	**PR** EPD-4-07-0769	**Engineer:**

Title: Three Payload Bay Floodlights Failed (ORB)

Summary: DISCUSSION: The STS-36 crew reported that, prior to payload bay door closure, the aft starboard floodlight was flickering. Also, it was reported that the aft port and mid port floodlights were inoperative.

During postflight testing, the aft starboard floodlight (Ser. No. 231) did not illuminate. The lamp assembly was replaced with Ser. No. 581 and the floodlight was successfully retested. The aft port floodlight (Ser. No. 453) flickered initially during postflight testing and subsequently failed. After the floodlight electronics assembly 2 (FEA 2) and the lamp assembly were replaced, the floodlight was successfully retested. Whether the FEA 2, the lamp assembly, or both caused the in-flight anomaly will be determined during failure analysis. The mid port floodlight failure could not be repeated during postflight testing and the unit operated normally over approximately 10 on/off switch cycles. The cause for this in-flight problem could not be determined, and the condition will be tracked as a deferred unexplained anomaly. CONCLUSION: The aft starboard floodlight anomalous indication was caused by a failed lamp assembly. The aft port floodlight inoperative condition was caused by a failed FEA 2 and/or a failed lamp assembly. The failure of the mid port floodlight to operate in-flight is unknown. CORRECTIVE_ACTION: The lamp assembly for the aft starboard floodlight was removed and replaced. The lamp assembly and the FEA 2 for the aft port floodlight were removed and replaced. Both floodlights were successfully retested. All failure hardware was sent to the NASA Shuttle Logistics Depot for failure analysis. The results of this activity will be tracked via CAR 36RF17. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 2	**MET:** 004:10:19	Explained Condition	**FIAR**	**IFA** STS-36-V-16	APU
None	**GMT:** 063:18:10		**SPR** 36RF18	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: APU 1 Shutdown Off Nominal (ORB)

Summary: This problem was deleted because it was an Explained Condition.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:09:47	Problem	**FIAR**	**IFA** STS-36-V-17	HYD
MMACS-05	**GMT:** 063:17:38		**SPR** 36RF19	**UA**	**Manager:**
			IPR	**PR** HYD-4-07-0250, HYD-4-07-0251	**Engineer:**

Title: Hydraulic System 1 Low Pressure Operations (ORB)

Summary: DISCUSSION: After auxiliary power unit (APU) start for entry (entry interface minus 13 minutes), the reservoir quality began to decrease (Ref. STS-36-08 FPR). The hydraulic main pump 1 was switched to low-pressure operation to conserve hydraulic fluid as a result of the external fluid leak. The main pump outlet pressure should have dropped to approximately 800 psia when depressurized. Instead, the pump outlet pressure dropped to 2100 psi and then ramped up to 2500 psi. After 200 seconds, the pressure became erratic and after 350 seconds, the pump fully depressurized (600 psi) where it remained for the rest of the depressurized operation.

At terminal area energy management (TAEM), the pump was taken back to normal-pressure operations (approximately 3000 psia) for approach and landing. Pump performance was nominal. APU 1 was shutdown less than 1 minute after wheel stop due to the external fluid leak. The hydraulic system 1 main pump was removed at KSC and shipped to the vendor (Abex) for failure analysis. First, the pump was installed and operated in the ATP test stand, and the output in normal-pressure operation was measured. Nominal pump operation was seen. Then the depressurization valve was cycled several times. Again, nominal pump operation was seen (i.e. the failure could not be duplicated.) The pump disassembly was initiated. The interior of the cap/housing for the depressurization stroking piston was found severely scored and pitted. The piston appears undamaged. Some scratch marks were also observed on the main pump housing depressurization piston bore. These marks coincided with the depressurization piston's interfacing bearing surface, and appeared to be the result of a contaminant being wedged between the sliding surfaces. During disassembly of the depressurization piston from the pump housing, all parts were cleaned and no foreign contamination was discovered. CONCLUSION: Failure characteristics of the anomalous pump depressurization response are consistent with transient contamination temporarily hanging up the depressurization piston within its bore. This condition is not considered a hard failure since the pump cleared itself. This is the first occurrence of a slow response to the depressurization command, and it occurred during an off-nominal operating condition (going from 3000 psi to 850 psi). Normally the pumps are depressurized for APU start to limit the torque load during start-up (70 psi to 850 psi). However, should a hard failure occur, redundancy exists in the hydraulic system to support safe flight. CORRECTIVE_ACTION: The hydraulic main pump was removed and replaced. EFFECTS_ON_SUBSEQUENT_MISSIONS: A similar condition that does not clear itself would result in the loss of one hydraulic system. If failure occurs during prelaunch operations, the result is a launch scrub. If the failure is detected during APU start-up for entry, redundancy exists to support a safe landing.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:19:39	Problem	**FIAR** None	**IFA** STS-36-V-18	TAGS
INCO-02	**GMT:** 060:03:30		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Text and Graphics System Paper Folding (GFE)

Summary: DISCUSSION: At about 060:03:30 G.m.t., the crew reported that a page had folded over on itself in the text and graphics system (TAGS) hardcopier output

paper tray, causing the subsequent four pages of that message sequence to improperly stack in the tray. No jam occurred, and the crew was able to retrieve all the pages from the tray. Normal operations were continued with the accumulated number of pages in the tray being limited to ten. Folded pages were noted on two other occasions during the mission. In both cases, a single page had folded over on itself, and the subsequent pages had fed normally over the folded page.

This pages-folding phenomenon is a known design deficiency that has been observed in all flight units. It occurs randomly, but with increasing frequency as the number of pages accumulated in the tray increases. The net effect is to reduce the total number of pages that can be accumulated in the tray. A jam is likely to be induced if the total exceeds 30 pages. A design change to significantly increase the capacity of the tray and to eliminate the causes of the page-folding phenomenon is in work. The amount of paper allowed to accumulate in the tray at any one time is currently operationally limited to 20 pages. CONCLUSION: The TAGS page-folding condition that was observed during the STS-36 mission was expected and is due to a known hardware design deficiency. CORRECTIVE_ACTION: Continue to operationally limit the tray paper accumulation to 20 pages. No hardware corrective action is recommended at this time. The TAGS hardcopier, Part No. AV14453-303, Serial No. 004, was not removed and should continue to be flown as is until the design changes currently in work are finalized. EFFECTS_ON_SUBSEQUENT_MISSIONS: None expected.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:10:19	Problem	**FIAR**	**IFA** STS-36-V-19	D&C
GNC-01	**GMT:** 063:18:10		**SPR** 36RF22	**UA**	**Manager:**
			IPR	**PR** DIG 4-07-0160	
					Engineer:

Title: Right Dedicated Display Unit Intermittent BITE Indications After Landing (ORB)

Summary: DISCUSSION: After landing, the right-side (pilot's) dedicated display unit (DDU), serial number 19, generated intermittent DDU good BITE "off status" indications for approximately 8.5 minutes. Data from the DDU were valid during this time which suggests that these were false BITE indications. No problems were encountered during the mission.

The DDU was removed and sent to the vendor for failure analysis. The failure was duplicated and isolated to the AMI fail monitor transition detection circuit. This is a known problem with the BITE circuitry in the -0003 configured DDU's. The upgrade to the latest configuration (-0004) eliminates this problem. CONCLUSION: The cause of this problem is a marginal time constant in the transition detection circuit. This is a known deficiency that is eliminated with the -0004 upgrade. CORRECTIVE_ACTION: DDU, serial number 19, will be modified to the -0004 configuration. Both the Commander's and Pilot's DDU on OV-104 are now of the -0004 configuration. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Though this failure is a nuisance, it does not affect the validity of the data dipslayed by the DDU

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-36-V-20	HYD
None	GMT:		SPR 36RF23	UA	Manager:
			IPR None	PR	
					Engineer:

Title: Hydraulic System 1 Low Pressure and Fluctuations (ORB)

Summary: DISCUSSION: During ascent and entry, the hydraulic system 1 reservoir pressure fluctuated and exhibited low pressure. These conditions were also detectable on the hydraulic system 1 circulation pump pressure measurement.

The reservoir provides pressurized fluid to the main pump inlet by means of a differential area piston that is acted upon by system pressure. The reservoir is designed to allow volumetric expansion and contraction as the temperature changes. During ascent, the reservoir quantity normally increases approximately 6 percent because of the increase in hydraulic fluid temperature. No quantity increase was observed on this flight. The cause was later determined to be a hydraulic system 1 leak, which was not known at the time (Ref. STS-36-08 FPR). This leak probably contributed to the off-nominal reservoir pressure observed. During the on-orbit operations, the reservoir pressure did track the other two systems as expected. KSC has visually inspected the reservoir for signs of damage. Also, the ambient cavity was inspected for excessive fluid in accordance with standard OMRSD requirements. The reservoir piston was cycled from 0 to 100 percent to verify the free movement. No discrepancies were noted. CONCLUSION: The off-nominal reservoir pressure was most likely caused by the allowable piston stiction (accumulator and/or reservoir) coupled with the hydraulic leak documented by FPR STS-36-08. The low pressure in the reservoir did not affect the operational integrity of the system and ground check-out did not detect any discrepancies. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.