SSVEO IFA List

Date:02/27/2003

STS - 34, OV - 104, Atlantis (5)

Time:04:20:PM

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-34-V-01	D&C
None	**GMT:** Prelaunch		**SPR** 34RF01	**UA**	**Manager:**
			IPR 34RV-0226	**PR** DIG-4-5-144	
					Engineer:

Title: Display Driver Unit 1 Failed Prelaunch (ORB)

Summary: DISCUSSION: During the prelaunch countdown, the left-hand Alpha Mach Indicator (AMI) acceleration scale indicated an erroneous value. Troubleshooting traced the cause to display driver unit (DDU) 1, which was removed, replaced, and retested prior to launch. The failed unit (serial number 12) was sent to the vendor. A faulty shift register was identified, and the unit has been repaired.

CONCLUSION: The anomaly was caused by a failed component in DDU 1. CORRECTIVE_ACTION: Corrective action will be documented on CAR 34RF01. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-34-V-02	DPS - EIU
BSTR-01	**GMT:** Prelaunch		**SPR** 34RF02	**UA**	**Manager:**
			IPR 34RV-0241	**PR** DIG-A0009	
					Engineer:

Title: Engine Interface Unit 3 Momentary Operational Instrumentation Control Fail BITE and Loss of 60 Kilobit Data (ORB)

Summary: DISCUSSION: At 291:09:00 G.m.t. (prelaunch), an "operational instrumentation (OI) control fail" BITE (bit 13 of the OI BITE register) was annunciated against engine interface unit (EIU) 3 and 60 kilobit data were momentarily lost. The commands and data between the EIU and the Space Shuttle main engine (SSME) controller were not affected. Analysis revealed good frames of data, but bad frame synchronization which confirmed a problem within the OI control card. EIU 3 functioned without incident for the remainder of the count and the flight.

CONCLUSION: An intermittent problem exists within the OI control card of EIU 3 (serial number 9); however, troubleshooting at the vendor is required to further isolate the failure. The EIU has been removed and sent to the vendor. CORRECTIVE_ACTION: All three EIU's on OV-104 were scheduled to be removed and replaced with the modified EIU's after STS-34. This removal and replacement has been performed and the replaced EIU's have been sent to the vendor for modification. EIU 3 will be tested and repaired as well as modified. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. This failure is not considered generic and affected only the 60 kilobit data not the EIU/SSME controller command and data path.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-34-V-03	OI
B) MMACS-01, D)	**GMT:**		**SPR** A) 34RF03, B)	**UA**	**Manager:**
MMACS-07, E) MMACS-08			34RF04, C) 34RF18, D) 34RF19, E) 34R	**PR** A) APU 153, B) APU 152, C) APU 152, D) APU	**Engineer:**
			IPR A) 34RV-0246, 36RV-0022, E) 36RV-0002	152152	

Title: Operational Instrumentation Failures (ORB)

Summary: DISCUSSION: A) The auxiliary power unit (APU) 3 injector temperature (V46T0374A) was biased low prior to launch. KSC also saw fluctuations prior to lift-off. During postflight turnaround activities, KSC switched the leads to a backup set of leads, and the test shows a 6? bias on the backup leads. This bias is acceptable for flight. This is a criticality 3 measurement. This problem is closed.

B) APU 3 exhaust gas temperature (EGT) 1 (V46T0342A) failed low before lift-off. KSC postflight troubleshooting confirmed that the transducer had failed. KSC has removed and replaced the sensor. Failure analysis will be tracked by CAR 34RF04. This is a criticality 3 measurement. This problem is closed. C) APU 3 EGT 2 (V46T0340A) operated erratically during ascent and failed during flight control system checkout. KSC has removed and replaced the sensor. Failure analysis will be tracked by CAR 34RF18. This is a criticality 3 measurement. This problem is closed. D) APU 3 EGT 1 failed (V46T0242A) during entry. KSC has removed and replaced the sensor. Failure analysis will be traced by CAR 34RF19. This is a criticality 3 measurement. This problem is closed. E) Water spray boiler (WSB) 3 regulator outlet pressure (V58P0304A) became erratic approximately 8 minutes after landing. The erratic data lasted for approximately 8 minutes and then cleared up. Troubleshooting at KSC has not been able to reproduce the problem. It has been determined that the sensor may fly as is. An unexplained anomaly (UA) report has been submitted and approved. This is a criticality 3 measurement. This problem is closed. CONCLUSION: See above. CORRECTIVE_ACTION: See above. EFFECTS_ON_SUBSEQUENT_MISSIONS: See above.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:01	Problem	**FIAR**	**IFA** STS-34-V-04	APU

MMACS-02	**GMT:** 291:16:55	**SPR** 34RF05	**UA**	**Manager:**
		IPR 36RV-0025	**PR**	
				Engineer:

Title: APU 1 Uncommanded Shift to High Speed During Ascent (ORB)

Summary: DISCUSSION: During ascent, at 291:16:56:15 G.m.t., auxiliary power unit (APU) 1 experienced an uncommanded shift to high-speed operation. The crew placed the APU Speed Select switch on panel R2 to the high-speed position 15 seconds later per normal procedures to eliminate the fault detection and annunciation alarm. APU 1 remained in the high speed mode until nominal APU shutdown after 12 minutes 47 seconds on high-speed run time. During the entry profile, APU 1 was started and run in the high-speed mode for 13 minutes, 12 seconds with start delayed until the Orbiter had reached Mach 10 and shutdown occurring shortly after landing. APU 1 operated a total time of 25 minutes 59 seconds in high speed during the mission and had 11 minutes of high-speed run time before the mission. Specifications allow each APU a maximum of 46 minutes in high-speed operation.

An APU's operating speed is controlled by the pulsing of one of two valves which are installed in series downstream of the fuel pump: the pulse control valve (primary) or the fuel shutoff valve (secondary). To maintain normal speed, the pulse control valve cycles while the fuel shutoff valve stays fully open. To operate in high speed, the pulse control valve stays fully open and the fuel shutoff valve cycles. Postflight failure analysis at the vendor revealed a thermally sensitive failure of a transistor within the APU controller that produced an open circuit in the pulse control valve circuit. When the operating signal was removed by this malfunction during the mission, the pulse control valve faulted to its normally open state, thus enabling the shutoff-valve speed control to run the APU in the high-speed mode. The transistor exhibited a degraded condition known as "purple plague". The point at which both the base and emitter wires were connected to the die was surrounded by a discolored gold, aluminum, and oxidized silicon intermetallic compound. This condition is typically caused by excessive temperature during the die-attach operation. The formation of the intermetallic compound resulted in extensive voiding, which ultimately consumed the base bond and created an open-circuit condition. The emitter bond also exhibited severe voiding which reduced the original cross-sectional area of the bond by greater than 80 percent. This bond would probably have failed in the near future. An examination of several other transistors from the same lot did not reveal any others with such severely degraded conditions. The malfunction of this transistor is classified as a random, rather than a generic, failure. CONCLUSION: An electrical failure within the APU 1 controller caused the pulse control valve to remain open, thus defaulting speed control of the APU to the high speed mode of the shutoff valve speed control. CORRECTIVE_ACTION: The APU 1 controller was removed and replaced. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. If another high-speed failure were to occur and cause the specification limit of 46 minutes to be exceeded, the technical community is confident that the integrity of the unit would be preserved.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:** 000:00:35	Problem	**FIAR**	**IFA** STS-34-V-05	DPS - MDM
DPS-01	**GMT:** 291:17:29		**SPR** 34RF06	**UA**	**Manager:**

IPR 36RV-0024 **PR**

Engineer:

Title: FA1 Input/Output Error (ORB)

Summary: DISCUSSION: At approximately 291:17:29:15:44 G.m.t., multiplexer/demultiplexer (MDM) flight aft (FA) 1 (serial number 133) failed and was detected by both the primary avionics software system (PASS) and backup flight system (BFS). An unsuccessful attempt was made to recover the MDM with a GNC input/output reset. Power cycling temporarily recovered the unit on two separate occasions. The crew initiated a port mode (move string 1 from the primary port to the secondary port) during OPS 2 and recovered the unit. The remainder of the mission was flown with FA1 in this configuration. Postlanding tests performed on both ports at Dryden Flight Research Facility verified that the port had failed. This is the first total port failure for MDM FA1 serial number 133.

CONCLUSION: The primary port on FA1 serial number 133 failed. CORRECTIVE_ACTION: A spare MDM serial number 134 has been installed on OV-104. MDM serial number 133 was sent to the vendor for failure analysis (CAR 34RF06). The problem has been isolated to the primary port core power supply. The power supply was replaced and MDM serial number 133 is now fully functional. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:05:06	Problem	**FIAR**	**IFA** STS-34-V-06	APU
MMACS-03	**GMT:** 291:22:00		**SPR** 30RF15, 34RF07	**UA**	**Manager:**
			IPR	**PR** UA-4A0007	
					Engineer:

Title: APU 2 Fuel Pump Heater A Inoperative (ORB)

Summary: DISCUSSION: The auxiliary power unit (APU) 2 gas generator/fuel pump system "A" heaters failed to respond after being selected by the panel switch at 291:23:00 G.m.t. The "B" heater system was activated and used until it also experienced anomalous behavior (Flight Problem STS-34-10). On the second flight day, the A heaters were reselected and the system temperatures were allowed to become low enough to verify that all heaters on the circuit were not working. The A heaters were non-functional for the duration of the mission.

This same heater system has failed to operate on the last two flights of OV-104 (STS-27 and STS-30). The STS-27 failure was determined to be an intermittent panel A12 switch. The switch was replaced prior to STS-30. After the STS-30 A heater failure, the switch and heater circuitry were thoroughly checked out during postflight turnaround prior to STS-34. All connectors were demated and pins checked from the switch to the aft load control assembly (ALCA) 2. ALCA 2 and the APU 2 controller were replaced. No anomalous conditions were found, and STS-34 was flown with an unexplained anomaly on this circuit. STS-34 postflight troubleshooting at KSC

revealed no anomalies. Consistent with the prior two flights, the heater system functioned normally during postflight testing. The two remaining items in the APU 2 heater system that had not been replaced prior to STS-34 were the associated thermostat on the APU and the wire run from the switch to the APU. The thermostat was removed and replaced and returned to the vendor for failure analysis. No anomalous conditions were found that were deemed capable of causing the observed problem. Spare wires were selected for the wire run between the crew compartment and the aft compartment. Connectors were repinned. CONCLUSION: APU 2 was generator/fuel pump heater system A was inoperable during the on-orbit portion of the mission. The system functioned nominally on the ground. A similar condition existed during the previous flight of the vehicle. No definite cause has been identified. CORRECTIVE_ACTION: All major components of the heater system have been replaced. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:12	Problem	**FIAR**	**IFA** STS-34-V-07	Active Thermal Control
EECOM-01	**GMT:** 291:17:06		**SPR** 34RF08	**UA**	Subsytem
			IPR None.	**PR**	**Manager:**
					Engineer:

Title: FES High Load Inboard Duct Temperature Low (ORB)

Summary: DISCUSSION: Approximately 12 minutes after launch, the flash evaporator system (FES) high-load inboard duct temperature (V63T1820A) was observed to be decreasing. The FES controller was switched from primary A to secondary and both duct heaters were enabled to prevent ice formation in the duct. On the second day of the flight, the topping FES was successfully operated using the primary A and primary B controllers. FES operations during entry were nominal.

After the flight, a number of troubleshooting activities including electrical tests of the duct heaters and inspection of the FES anti-carryover device, spray nozzles, and ducts revealed no hardware problems that could have caused the drop in duct temperatures. Subsequent analysis revealed that the low duct temperatures were an indication of excessive water carryover from the high load evaporator. The added heat load from the payload's radioisotope thermal generator (RTG), coupled with slightly high freon flow rates unique to OV-104, caused the design coefficient of heat transfer to be exceeded for the FES. The primary controller responded by supplying a higher water flow rate than the high load evaporator could evaporate. This excess water was carried into the ducts and lowered the duct temperature. This condition did not affect the flash evaporator's ability to provide vehicle cooling, and proper temperature control was maintained. Since the heat load from future RTG payloads will be approximately one-half the RTG heat load experienced on this flight, this problem was mission-unique and should not recur. CONCLUSION: The STS-34 high load evaporator low duct temperature problem was most probably caused by excessive water carryover from the high load evaporator. CORRECTIVE_ACTION: None. Fly as-is. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:19:06	Problem	**FIAR**	**IFA** STS-34-V-08	APU
None	**GMT:** 293:12:00		**SPR** 34RF09	**UA**	**Manager:**
			IPR 36RV-0027	**PR**	
					Engineer:

Title: APU 3 Seal Leak Into Drain Bottle (ORB)

Summary: DISCUSSION: Auxiliary power unit (APU) 3 exhibited a small static fuel pump leak of hydrazine into the seal cavity drain system. This was evidenced by a steady increase in the seal cavity drain line pressures (V46P0390A and V46P0391A) from 19 to 26 psia during the mission with the fuel pump inlet pressure (V46P0310A) concurrently decreasing from 400 psia to 125 psia. Since the drain line pressures were approaching the entry backup flight system (BFS) systems management (SM) alert value of 25 psia, the alert value was raised to 28 psia prior to entry. This leakage had not impact on the mission.

Postflight processing revealed that approximately 60 cc of hydrazine had leaked into the 500-cc catch bottle. The OMRSD maximum leakage limit is 150 cc. A similar leak was noted in the same APU during the last flight of OV-104 (STS-30) and 39 cc of hydrazine was removed from the catch bottle after the flight. The leak was deemed acceptable to fly with no modifications to APU 3. CONCLUSION: A hydrazine leak occurred past the fuel pump seal of APU 3. The leakage was within specifications. CORRECTIVE_ACTION: None. APU 3 will fly as is for the next mission of OV-104. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:21:59	Problem	**FIAR**	**IFA** STS-34-V-09	OMS/RCS
PDRS-01	**GMT:** 293:14:53		**SPR** 43RF13	**UA**	**Manager:**
			IPR 35RV-0004	**PR** RP03-09-0386.	
					Engineer:

Title: The Right Orbiter Maneuvering Subsystem System "B" Cover Heater Failed To Operate When Activated (ORB)

Summary: DISCUSSION: The right Orbital Maneuvering Subsystem (OMS) Engine Cover "B" heater failed to operate following initial OMS pod heater configuration at 46 hours MET. While on system "A" heaters the monitoring measurement cycled normally between 54 and 69 degrees F. When the heaters were switched to system "B" this measurement declined steadily from 67 to 51 degrees at which time the pod heaters were switched back to system "A".

Upon vehicle return to KSC, the pod was removed from the vehicle and returned to the Hypergolics Maintenance Facility (HMF). Following initial troubleshooting on the failed heater at the HMF, the problem was believed to be either a bent pin in a connector or a faulty splice, both of which were repaired and passed retest successfully prior to the pod's return to the Orbiter Processing Facility (OPF). The heater is mounted on an access panel which was installed at the OPF and subsequent interface verification

determined that the anomalous condition persisted. OPS troubleshooting uncovered a break in a wire on the access panel leading to the heater, the break was repaired, and the retest was successful. CONCLUSION: The most probable cause of the right OMS Engine Cover "B" Heater failure to operate during flight was a faulty splice within the OMS pod. CORRECTIVE_ACTION: The faulty splice and bent connector pin were repaired at the HMF. The broken wire was repaired at the OPF. Post-repair checkout confirmed proper resistance and continuity in the heater circuit. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:10:06	Problem	**FIAR**	**IFA** STS-34-V-10	APU
MMACS-04	**GMT:** 294:03:00		**SPR** 34RF11	**UA**	**Manager:**
			IPR 36RV-0026	**PR** APU-154	
					Engineer:

Title: APU 2 Fuel Pump Heater B Controlled At High Temperature (ORB)

Summary: DISCUSSION: Because of a failure of the auxiliary power unit (APU) 2 fuel pump/gas generator "A" heater system to operate (IFA STS-34-06), the B heater system was activated at 292:02:00 G.m.t. The B heaters maintained nominal temperatures for 49 hours; the fuel pump and line heater thermostat then began to cycle erratically, allowing the heater duty cycles to grow progressively longer. APU 2 fuel line temperature 3 (V46T0228A) increased to 200 ?F from its normal heater cycle temperature of about 100 ?F and a caution and warning alarm was annunciated at 180 ?F. At this point, the B heaters were deactivated by the crew.

A postflight analysis of the thermostat performed at the vendor revealed excessive wear to the bi-metallic disc component of the thermostat. This wear produced a large amount of conductive contaminants within the thermostat. In zero gravity, these contaminants migrated between the electrical contacts, thus requiring a higher disc deflection to open the contacts. This higher disc deflection resulted in the observed higher thermostat heater turn-off temperatures. Additionally, worn bi-metallic discs have been shown to result in increased heater setpoints and higher cycling rates. Further analysis showed that the excessive wear to the thermostat components was caused by vibration. The thermostat is mounted on the APU reference line. Vibration instrumentation placed on the reference line on test APU's has shown that the line may experience vibrations with g-load amplitudes exceeding the thermostat design levels. The vibration levels of the reference line appear to vary among different APU's due to installation differences. Thus, some APU's will produce higher thermostat degradation than others. APU 2 had accumulated 5.9 hours of run time. APU's 1 and 3, which had normal heater operation, had 10.4 and 20.6 hours of run time, respectively. CONCLUSION: High amplitude vibration of the thermostat caused excessive wear of its bi-metallic disc component, producing conductive wear products which migrated between the electrical contacts in zero gravity. This, combined with the effects of a worn bi-metallic disc, produced the increasing heater control temperatures. CORRECTIVE_ACTION: The thermostat was removed and replaced. The addition of a vibration dampening clamp to the reference line of each APU is being investigated. Workarounds for a thermostat that may fail on future missions, before the dampening clamp can be added, include switching to the back-up heater system, orienting the vehicle to maintain proper temperatures, and/or manual control of the heater. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:20:14	Problem	**FIAR** BFCE-210F004	**IFA** STS-34-V-11	Hasselblad Camera
MMACS-05	**GMT:** 294:13:08		**SPR**	**UA**	**Manager:**
			IPR None.	**PR**	
					Engineer:

Title: Hasselblad 70-mm Camera Failed (GFE)

Summary: DISCUSSION: At 294:13:08 G.m.t., the crew reported that the shutter on the 100-mm lens on one of the 70-mm Hasselblad cameras had jammed in the closed position. In addition, the lens could not be removed from the camera body. The crew used the second Hasselblad camera for the remainder of the flight with no problems.

CONCLUSION: During postflight disassembly, the vendor found that a lever in the electric motor drive gear sequence had moved from its nominal position and caused the jam. The lever has been repaired. This problem is not related to the Hasselblad camera jam experienced on STS-30. CORRECTIVE_ACTION: The lever which moved out-of-position and caused the jam had been repaired. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:09:35	Problem	**FIAR**	**IFA** STS-34-V-12	FC/PRSD
EECOM-02	**GMT:** 293:02:29		**SPR** 34RF12	**UA**	**Manager:**
			IPR 36RV-0003	**PR**	
					Engineer:

Title: Cryogenic 02 Manifold 2 Isolation Valve Did Not Close (ORB)

Summary: DISCUSSION: At approximately 293:02:29 G.m.t., the power reactant storage and distribution (PRSD) system 02 solenoid manifold valve did not close when the crew placed the switch to the closed position. The crew repeated the switch activation during the postsleep period and the valve closed on the first attempt. The switch for this valve was not activated again until postlanding (pre-egress), at which time the valve was successfully opened by the crew on the first attempt. Review of the essential bus 2CA data at the time of the anomaly was a 1-bit data change, and the bus voltage showed many 1-bit changes during the time period.

The in-flight anomaly could not be repeated during postflight troubleshooting. Loose or intermittent wiring was suspected. The only accessible wires were those in the connector that mated directly to the O2 manifold 2 solenoid valve. Each wire was manipulated individually while the manual switch was cycled open and closed. The anomaly could not be repeated. CONCLUSION: The cause of the PRSD 2 manifold 2 solenoid valve failure to operate during flight is unknown. The valve has operated normally on the ground. CORRECTIVE_ACTION: Postflight troubleshooting was performed and no anomalous condition was discovered. EFFECTS_ON_SUBSEQUENT_MISSIONS: None expected. If a manifold iso valve fails to close and a leak is present it is possible to loose two fuel cells.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:08:14	Problem	**FIAR** None	**IFA** STS-34-V-13	TAGS
INCO-02	**GMT:** 294:01:08		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Text and Graphics System (TAGS) Developer Overtemperature Indication. (GFE)

Summary: DISCUSSION: At about 229:01:08 G.m.t., the TAGS developer overtemperature telemetry point latched, indicating that one of the three developer heaters had been detected at a higher than normal operating temperature and had been shut off. A few minutes later, the temperature-normal telemetry point indicated a low developer temperature, verifying that the heater had shut off correctly. The TAGS power was cycled off and then back on to reset the latch. Over the course of several hours, overtemperature indications recurred several times with increasing frequency. The indications eventually were occurring immediately after power-on when the heater was below normal operating temperature. This was a verification that the overtemperature indications were false. At this point, operations were continued without resetting the heater. Good quality images continued to be produced with a slight lightness in the center of the pages, indicating that the center heater was off. Normal operations continued with the cennter heater off for about 24 hours, at which point the TAGS was powered off to conserve Orbiter power. When the TAGS was powered on again for use, no overtemperature indication occurred and none occurred for the duration of the mission. This anomaly had no mission impact and TAGS performance was considered excellent in all other respects.

Postflight testing and failure analysis isolated the cause of the anomaly to a defective developer slipring contact, specifically the one carrying resistance thermometer current from the center heater. Whenever current was interrupted, a high temperature was momentarily indicated for that heater and the overtemperature latch was set. The entire developer assembly was replaced in this flight unit. The developer heater is a permanently sealed assembly that does not allow removal of the sliprings for repair, replacement, or inspection. A destructive analysis of the defective developer assembly will be performed following an extended period of testing to determine if the performance of the sliprings will degrade any further with use. This appears to be an isolated defect, probably due to misalignment of one of the slipring contacts during manufacture, that causes it to fail to make positive continuous electrical contact. No other flight units have exhibited this problem. This same flight unit exhibited a similar problem for a short period of time during STS-29, but at that time the cause was attributed to an incorrect electrical adjustment. The subject slipring defect undoubtedly was a factor in that anomaly, but did not manifest itself during subsequent failure analysis. A design change has since been made to all TAGS hardcopiers to enable a direct reset of overtemperature indications by uplink command, so that cycling of power is not required. CONCLUSION: The cause of the false overtemperature indications was a defective slipring contact in the TAGS hardcopier developer assembly. The defect appears to be non-generic. Other flight units have not exhibited this problem. CORRECTIVE_ACTION: The TAGS hardcopier, Part No. AV14453-302, Serial No. 003, was removed, replaced, and repaired. The defective developer assembly was replaced. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:17:11	Problem	**FIAR**	**IFA** STS-34-V-14	C&T - S-Band
INCO-03	**GMT:** 295:10:05		**SPR** None	**UA**	**Manager:**
			IPR 36RV-0028	**PR** COM-078	
					Engineer:

Title: S-Band Upper Right Antenna Failed to Switch Beams (ORB)

Summary: DISCUSSION: At about 295:10:05 G.m.t., the S-band upper right antenna, while on electronics 2, failed to switch from aft to forward beam position for Tracking Data Relay Satellite System (TDRS) communications. The crew used the manual mode to cycle through all antennas and only the URF beam failed to be properly selected. This caused loss of antenna beam switching redundancy on the UR antenna; however, mission operations were completed using the switch beam electronics assembly 1.

During postflight troubleshooting, a loose pin was found in the 576 bulkhead feedthrough connector, and this caused the beam switching circuit to be open. The connector was replaced. The S-band quad antenna, which was removed for troubleshooting, was returned to the vendor for a planned thermal confidence test (screen for stripline cracking and cold solder joints). CONCLUSION: The stated anomaly was caused by a loose pin in the 576 bulkhead-connector that caused the beam switching circuit to be open. There was no problem with the UR antenna. CORRECTIVE_ACTION: The faulty feedthrough connector has been replaced. The UR S-band quad antenna has been replaced with a spare unit. EFFECTS_ON_SUBSEQUENT_MISSIONS: None expected.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:19:46	Problem	**FIAR**	**IFA** STS-34-V-15	D&C - Panels
GNC-01	**GMT:** 295:12:40		**SPR** 34RF14	**UA**	**Manager:**
			IPR DIG-0147	**PR**	
					Engineer:

Title: Pilot's Horizontal Situation Indicator (HSI) PRI MILES Indication Erroneous. (ORB)
<u>Summary:</U>DISCUSSION: The crew reported that during the on-orbit dedicated-display checkout, the pilot's HSI primary miles indicator was erroneous in the second (100's) digit. The high test indicted 3300 (should be 3000), and the low test indicated 300 (should be 200). The digit was erratic during the approach and landing phase. The crew also reported that visible moisture was present on the inside of the instrument during ascent, but it later cleared.

Postflight troubleshooting at KSC confirmed the failure. The unit was removed, replaced, and sent to the vendor for leak testing and failure analysis. The unit passed leak testing. Failure analysis identified a faulty mechanical component associated with the drive wheel for the second digit. CONCLUSION: The erroneous indication was caused by a failed component within the HSI. The cause of the visible moisture is unknown. CORRECTIVE_ACTION: The failed unit has been repaired. Corrective action will be documented on CAR 34RF14. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR** BFCE-029-F013	**IFA** STS-34-V-16	CCTV
INCO-01	**GMT:**		**SPR**	**UA**	**Manager:**
			IPR PV6-144336	**PR**	
					Engineer:

Title: a) Darkened Arc Across CCTV Camera C Image b) Spot on CCTV Camera B Image (GFE)

Summary: DISCUSSION: a) A dark, arc-shaped area of degraded image was noted on closed circuit television (CCTV) camera C during the mission. This degradation has been traced to a burned silicon-intensifier target (SIT) tube which serves as the image sensor for the camera. The tube evidently was burned up being exposed to excessive illumination in-flight.

b) A small dark spot was noted on the CCTV camera B image during the mission. The spot was above and to the right of center of the image and its diameter is 5 video lines which comprises approximately 1 percent of the total vertical raster. This spot was also caused by a burned SIT tube, however, the magnitude of the burn was much smaller than that suffered by camera C. CONCLUSION: Both CCTV cameras experienced burned SIT tubes. CORRECTIVE_ACTION: a) Camera C has been returned to the vendor for replacement of the SIT tube. b) Camera B will be flown as-is. The spot on its image is minimal and does not affect the camera's performance or reliability. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:07:04	Problem	**FIAR**	**IFA** STS-34-V-17	C&T - S-Band
INCO-04	**GMT:** 295:23:58		**SPR** 34RF15	**UA**	**Manager:**
			IPR	**PR** COM-77	
					Engineer:

Title: The S-band Upper Left Antenna Failed To Switch Beams (ORB)

Summary: DISCUSSION: At approximately 295:23:58 G.m.t., the S-band upper-left antenna, while on electronics 1, failed to select the forward beam. This occurred during a transition from the upper left aft to the upper left forward beam. Telemetry indicated that neither beam position was actually selected. The problem was corrected

by cycling to electronics assembly 2. Data review showed an incomplete switching; however, there was no link dropout or loss of data. The problem only occurred once during the flight and did not impact mission operations.

During postflight troubleshooting, the problem could not be repeated. The observed operation and data review indicate a mechanical radio frequency (RF) switch problem. This type of problem has been previously experienced. The upper left (UL) S-band quad antenna was removed, replaced with a spare unit, and returned to the vendor for failure analysis. CONCLUSION: The most probable cause of the S-band UL antenna failure to switch beams was a mechanical problem with the RF switch. CORRECTIVE_ACTION: The S-band upper left quad antenna has been returned to the vendor for failure analysis and repair. The results of this activity will be tracked via CAR 34RF15. EFFECTS_ON_SUBSEQUENT_MISSIONS: None expected. In-flight procedures exist to circumvent loss of beam switching should the problem repeat.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:20:51	Problem	**FIAR**	**IFA** STS-34-V-18	HYD
MMACS-06	**GMT:** 296:13:45		**SPR** 34RF16	**UA**	**Manager:**
			IPR 36RV-0031	**PR**	
					Engineer:

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

Summary: DISCUSSION: Water Spray Boiler (WSB) 2 controller/heater switch as was left in the A position for approximately 51 minutes during deorbit preparation. During this time frame, the vent temperature did not rise. The crew switched to the B controller and obtained a normal response.

The system A heater has worked without failure since OV-104's return to the Orbiter Processing Facility. Troubleshooting of vent heater A included operation of the A and B heaters for a number of cycles and visual inspection and shaking of wiring and connectors associated with the system A heaters, and no anomalous conditions have been noted. The WSB system has had no history of similar failures. This problem appears to be unique to OV-104. The heaters are redundant and a mission can be completed on a single string of heaters. Loss of the A heater system is detectable in-flight through temperature measurements. CONCLUSION: The cause of this problem has not been determined. The heater has performed properly on the ground and during ground checkout. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: The mission affect, should the heater A system fail in-flight, is to switch to the alternate heater system. If the alternate system fails, the result is the possible loss of the auxiliary power unit (APU) due to loss of cooling capability, if the vent should become clogged with ice. To protect against this scenario, the APU start could be delayed if the failure is detected prior to the deorbit maneuver.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-34-V-19	MECH
None	**GMT:** Prelaunch		**SPR** 24RF17	**UA**	**Manager:**
			IPR 36RV-0032	**PR** MEQ-0273	
					Engineer:

Title: Right Vent Door Motor 3 Operating on 2 Phases. (ORB)

Summary: DISCUSSION: During both the opening and closing operations of right-hand vent door 3 motor 1 of the power drive unit (PDU) failed to draw current on all three phases. During opening, phase B was lost; and during closing, phase C failed. The anomaly was traced to a shorted coil in motor 1 and the PDU was removed from the vehicle and sent to the vendor for failure analysis. A spare PDU is at KSC and has been installed on the vehicle.

CONCLUSION: Vent door 3 PDU motor 1 failure due to shorted coil. CORRECTIVE_ACTION: PDU 1 motor replaced with spare. Failed unit sent to vendor for failure analysis. Failure analysis being tracked by CAR 34RF17-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-34-V-20	MECH,PYRO
None	**GMT:** Postlanding		**SPR** 34RF21	**UA**	**Manager:**
			IPR	**PR** PYR-4-05-0073	
					Engineer:

Title: External Tank Aft Separation Hole Plugger Did Not Move Full Stroke. (ORB)

Summary: DISCUSSION: During the postflight inspection at Dryden Flight Research Center, it was discovered that the aft External Tank (ET) structural attach on the LOX (starboard) side did not seat properly. It had stopped two inches short of the full extension and had been jammed by the detonator booster and detonator. A similar anomaly occurred on STS-29R (Reference Inflight Anomaly STS-29-19).

CONCLUSION: The aft separation hold plugger was prevented from seating due to the debris which lodged in its path during separation. The hole plugger accomplished its purpose by preventing the debris from escaping into the umbilical cavity. CORRECTIVE_ACTION: Fly as-is based on the following rationale: The interference with the hole plugger is a random occurrence. The probability of a fragment preventing ET door closure is considered remote. The vehicle moves away from any escaping debris during the ET separation phase. Any escaped debris would have to abruptly change direction perpendicular to the original trajectory and then make its way to the clevis/rod to create a jam. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-34-V-21	MECH,PYRO,STR
None	**GMT:** Postlanding		**SPR** 34RF22	**UA**	**Manager:**
			IPR	**PR** PYR-4-06-0085	
					Engineer:

Title: Forward External Tank/Orbiter Separation Assembly Centering Ring Right-Hand Stop Bolt Bent. (ORB)

Summary: DISCUSSION: During the postflight inspection of the forward separation assembly (P/N V070-562004) at Dryden Flight Research Facility, obvious deformation was noted on one of two stop bolts on the forward separation assembly centering ring. The right-hand stop bolt was bent forward and inboard. The parts were returned to the contractor for analysis.

The centering mechanism on the lower forward fuselage of the Orbiter is used to align the forward attach spherical bearing and maintain the outer mold line (OML) laminar boundary layer during entry. The centering mechanism (P/N SKD26100098-501) has two tapped holes 180 degrees apart. These tapped holes are used to install two stop bolts (P/N V070-a562030-001) which align the centering mechanism assembly to prevent it from rotating enough to allow the forward frangible bolt piston to protrude beyond the OML in the event one of two alignment spring plungers fails to align. Any additional heating caused by earlier transition may result in additional TPS degradation, but is not a safety-to-flight issue. When the 5/16-inch A286 (non-structural) bolts are installed per the drawing requirements, a 0.170 ? 0.010 inch gap exists between the ends of the bolts and the forward attach bearing plate. Prior to ferry flight, the centering ring stop bolts were evaluated. Only the right-hand stop bolt had sustained damage. There was no evidence that the right-hand stop bolt had contacted the spherical bearing surface under flight loads; therefore, it is probable that the damage occurred during ground operations. The contractor's engineering analysis determined that the bending which deformed the bolt occurred below the base plate. It was analytically determined that approximately 10,000 in-lb of moment is required to bend to bolt, and 2.7 degrees of kinematic movement is required for the bolt tip to hit the plate. The predicted yaw angle of STS-34 was 0.45 degree. It is unlikely that the bolt was bent after being installed on the centering mechanism bolt/bearing assembly, or during installation of the bearing assembly to the Orbiter forward fuselage, or during installation of the yoke assembly because the energy required to cause deformation is not available in these instances. It is also not likely that the bolt was bent after mating and prior to launch, nor is it probable that the bolt was bent due to flight loads or pyrotechnic impact because no known flight loads of this magnitude exist and the separation loads do not impart loads that could cause a bent bolt. The most probable time that the bending occurred was during mating of the yoke to the ET because the energy required to cause the deformation was available through the ground support equipment (GSE). Improper sequencing of GSE model H72-0590 can produce a yaw moment that can bend the bolt. Since the yoke position during the forward ET mate was determined to be the most likely cause for the bent stop bolt, the yoke on OV-102 was disassembled and the bolts were inspected prior to rollout for STS-32R. A GSE temporary fix was developed to determine the null position of the yoke, and a new method of maintaining the null position of the forward ET yoke during the forward ET mate is being developed. A similar problem occurred on STS-9, flight 6 of OV-102 (Ref. IM AC7367), in which one of the stop bolts could not be removed postflight due to damaged threads and interference from the bent portion of the bolt. The bolt met the assembly drawing requirements (the 0.170-inch gap between the stop bolt and the bearing) and the bending in the bolt was incidental to its function. The forward separation centering mechanism is inspected during ground turnaround. There is no way of

detecting a bent stop bolt during flight. In the event a bent bolt affects the OML laminar boundary layer, any additional heating caused by an early transition could result in additional TPS degradation, but is not a safety-to-flight issue. A bent bolt has no effect on a mission and is not a constraint to flight. CONCLUSION: Determined to be a GSE and procedural problem. During mating of the yoke to ET, improper sequencing caused the GSE to input a moment which bent the bolt. CORRECTIVE_ACTION: The forward ET yoke on OV-102 was disassembled and the bolts were inspected prior to rollout for STS-32. A temporary fix to the GSE was developed to determine the null position of the yoke. A new method of maintaining the null position of the yoke during the forward ET mate is being developed.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None.