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

STS - 53, OV - 103, Discovery (15) **Time:04:13:PM**

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Pre-launch	Problem	**FIAR**	**IFA** STS-53-V-01	INST
INCO-01	**GMT:** 337:13:08:00.000		**SPR** 53RF01	**UA**	**Manager:**
			IPR	**PR** INS-3-16-0622	
					Engineer:

Title: The Modular Auxiliary Data System (MADS) Annunciated a BITE FAIL Indication when Commanded to MADS WB/ACIP ON. (ORB)

Summary: DISCUSSION: The MADS recorder was activated at 337:13:08:44 G.m.t. (liftoff minus 15 minutes 16 seconds) via the Mission Control Center (MCC) Multiple Command Module command sent by INCO according to normal prelaunch procedures. Recorder operation was nominal indicating BITE GOOD and tape moving forward at 15 inches per second (IPS). Ten seconds later, the MADS OFF-STNDBY command was inadvertently sent by INCO. This command caused power to be removed from the recorder. The INCO had intended to send the MADS FDM CAL/ON recorder calibration command. INCO re-issued the MADS/ACIP ON command to power the recorder 1 minute and 5 seconds after commanding it to MADS OFF/STNDBY. The MADS BITE indicated FAIL and the TRACK indicator showed that the tape was either at the end of the reel, out of the tape guide, or broken.

INCO evaluated this sequence of events and indicators and concluded that the recorder probably experienced a broken tape which is an unrecoverable failure. The MADS, a criticality 3 system, was not required for launch in accordance with the Launch Commit Criteria (LCC). INCO recommended to the Flight Director to proceed with the launch. The Mission Evaluation Room (MER) concurred with this recommendation. This included the MSFC SSME High Pressure Oxidizer Turbopump (HPOTP) data which MSFC/Rocketdyne use to make SSME-HPOTP-reuse decisions. Postflight, the recorder was removed and returned to the vendor for failure investigation. The vendor opened the recorder and found that the tape was broken. Pictures of the tape and the recorder have been received at JSC and RI-Downey and are being analyzed. Preliminary analysis of the pictures show crinkled edges on parts of the tape including the area of the tear, irregular indentation marks on the tape in the area of the tear, a 90-degree "cut or tear" from an indentation mark to the edge of the tape about 15 percent of tape width from the tape edge, and a 45-degree "tear" from the same mark to the opposite tape edge. These conditions support the following probable cause of failure. Tape slack and looping occurred when the 28-volt power to the recorder was cut off abruptly during operation in the forward direction. When power was reapplied, the tape-tension detectors caused the reel motors to go to full power in opposite directions searching for proper tape tension which was zero since most likely the tape was out of the guide and looped. This in turn caused the tape to rapidly become taut and in doing so it snagged, was cut by a sharp edge, and then tore. The failure investigation continues and the final results will be reported by CAR 53RF01. Review of

recorder flight and ground operations identified a broken tape failure on this recorder (s/n 1006) at KSC on OV-103 during STS-42 preflight processing at the pad on January 20, 1992. This was the first broken tape failure recorded on the Shuttle Program and is documented in CAR KB2009-10, closed September 22, 1992. This failure was attributed to reel brake contamination and degradation which allowed tape slack and looping after an abrupt recorder power cutoff while in the OPF. The tape subsequently broke when the recorder was powered at the launch pad. Ground operations procedures and configuration used to erase the recorder were listed as contributory causes so these procedures were revised. Since the anomaly on STS-53 has shown that damage can occur to the tape recorder when it is in the flight configuration, a CONSTRAINTS/LIMITATIONS note is being added to the SODB effective STS-55 and subsequent flights. CONCLUSION: The probable cause of this failure was removing power from the tape recorder while it was running at 15 IPS thereby causing the reel brakes to be applied abruptly which in turn caused tape slack and looping to occur. When power was reapplied, the tape loop snapped taut, snagged, was cut or tore, and subsequently broke which incapacitated the MADS recorder. A contributory cause of this failure is a design limitation of the tape recorder which allows the tape to fall out of its guides when the tape recorder is running, is in a launch orientation, and the power is removed. CORRECTIVE_ACTION: Recorder s/n 1006 has been removed and sent to the vendor for failure analysis. The results of the failure analysis will be reported an CAR 53RF01. The following corrective actions have been implemented: 1. The MADS OFF/STDBY command is being safed to significantly reduce the probability of sending this command inadvertently. A safed command must first be armed before it can be sent. 2. The layout of the Multiple Command Module is being changed so that the MADS OFF/STBY command is on a separate page from other MADS commands. 3. The MADS recorder characteristics documented in CAR KB2099-010 are being incorporated into the MADS Systems Brief, JSC-8611, Section 33. A review of the STS-42 and STS-53 failures are included. 4. The Shuttle Operational Data Book (SODB), JSC-08934 is being updated to reflect the current MADS recorder operational constraints which were not apparent prior to STS-53. 5. The GFE OEX recorder utilizes "tape keepers" attached to the four tape roller guides to keep the tape from sliding off the rollers when the recorder is in an upside down position and there is slack in the tape. Installation of "tape keepers" on the contractor provided MADS recorders is being evaluated. EFFECTS_ON_SUBSEQUENT_MISSIONS: If this failure recurs, there will be no mission impact since the system is criticality 3, but there will be a loss of all MADS data including MSFC SSME HPOTP measurements which are used to make SSME-HPOTP-reuse decisions.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:10:00.007	Problem	**FIAR**	**IFA** STS-53-V-02	GN&C
GNC-01	**GMT:** 337:13:34:00.000		**SPR** 53RF07	**UA**	**Manager:**
			IPR 56V-0002	**PR** OEL-3-16-0377	
					Engineer:

Title: Speedbrake Actuator Channel 3 Position Measurement Changed from -1.5 Degrees to +44.35 Degrees. (ORB)

Summary: DISCUSSION: Approximately 9 minutes after lift-off, the operational instrumentation (OI) measurement for speedbrake channel 3 position (V57H0252A) became erratic for several seconds, then became static at +44.35 degrees. This corresponds to a zero volt input to the OI MDM. The symptom cleared approximately 49 minutes later (prior to transition to OPS 2).

In OPS 1, speedbrake position feedback failure detection logic is not active. Also, the flight critical position feedback measurements (those that are processed by the flight critical MDM's for use by flight control software) are now downlisted. In addition, during ascent, the speedbrake is commanded to the overclose position of -9.9 degrees, causing the speedbrake motors to be stalled against the stop and the driver currents to be at the current limit. If, while in this configuration, the transducer were to drop to zero volts, the resultant error would be larger and all four driver currents would remain at the limit; therefore, no secondary delta pressure force fight would occur, and there would be no channel fail indication. For the above reasons, it was not possible to determine from the available flight data, whether an actual flight control channel position-feedback failure had occurred or if the anomaly was confined to the OI instrumentation only. In an attempt to isolate the problem should it recur in flight, ASA 3 was powered for the remainder of the flight and the flight critical position feedback measurement (V57H0203C) was placed in the variable parameter downlist. Also, a special test was performed in which the speedbrake was commanded away from the overclose position. The anomaly did not recur during this test, nor for the remainder of the flight. Troubleshooting at KSC revealed that intermittent signals could be induced when the wires were wiggled at connector 70P38/50J38. Further inspection revealed that the signal wire was not securely crimped to the contact for pin 27 in connector 50J38. This wire carries the speedbrake channel 3 position feedback transducer signal to aerosurface servo amplifier (ASA) 3. The connector is located between the tail section and the aft compartment. The connector was repaired and the system was satisfactorily retested. CONCLUSION: The anomaly observed during ascent was caused by transducer signal dropout due to intermittent contact of pin 27 in connector 50J38. Had the anomaly occurred during a time when the speedbrake flight control system was active, a flight control channel 3 failure would have been annunciated. CORRECTIVE_ACTION: The faulty connector has been repaired and retested. Consideration will be given to flight software change proposals to either allow redundancy management to run during ascent, or to place the flight critical position feedback measurements in the ascent downlist. This would provide data to differentiate between an instrumentation failure or an actual control system failure. Final corrective action will be documented on the CAR. EFFECTS_ON_SUBSEQUENT_MISSIONS: None anticipated. Existing Flight Rules invoke a minimum duration flight for confirmed loss of a flight control channel.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:09:52:00.007	Problem	**FIAR**	**IFA** STS-53-V-03	ECLSS
EECOM-01	**GMT:** 337:23:16:00.000		**SPR** 53RF08	**UA**	**Manager:**
			IPR 56V-0012	**PR**	
					Engineer:

Title: Supply Water Nozzle Temperature Drop (ORB)

Summary: DISCUSSION: During the first supply water dump of the STS-53 mission, the supply water dump nozzle experienced an unexplained drop in temperature. The temperature drop is similar to the expected drop if power to the heater had been interrupted for a short time. The temperature profile on the subsequent supply water dumps was nominal.

Three of the ten supply water dumps during the STS-39 mission also experienced unexplained temperature drops. The temperature drop on the last dump occurred prior to the flow of water, ruling out ice build-up as a possible cause. Following STS-39, the supply dump nozzle heater was operated for eight hours without a recurrence of the anomaly. Additionally, all accessible connectors were demated and inspected. Connector 40P311 was found to have moisture in two places, one was around a pin that was

part of the heater circuit. The moisture was removed from the connector. During the preparations for STS-48, the next flight, an unused discrete measurement was spliced into the supply water nozzle heater power circuit at the heater. This measurment would verify power to the heater should a dropout recur. A nozzle temperature dropout occurred during one supply water dump during the STS-48 flight. The temporary discrete measurement revealed that power was available to the heater during the dropout. Following STS-48, and in response to this problem, as well as a leak detected in the supply water dump valve (IFA STS-48-V-04), the valve, nozzle, and nozzle heater were removed from the vehicle and sent to JSC for vacuum chamber testing. New hardware was installed on the vehicle for STS-42. The testing of the dump nozzle at JSC revealed an intermittent open circuit in the nozzle heater wiring at the entry point in the nozzle assembly. During the STS-42 mission, all supply water dumps were made using the flash evaporator system (FES). Thus, it is not known if the anomalous condition existed during this flight. A switch-scan measurement (V62S0442E) is powered from the same switch contacts as the dump line heater. As this switch-scan operated nominally during STS-53, the circuit breaker and switch are not a suspect in the failure. As part of the troubleshooting for this probem following the STS-53 mission, the heater was operated and all accessible wires in the heater circuit were inspected and manipulated with no recurrence of the problem observed. The test procedure paid particular attention to the area where the previous failure occurred. The environment of the supply dump hardware is monitored throughout each dump. Procedures are in place to terminate any dump in which the nozzle temperature reaches 90?F. Termination of the dump at this point provides sufficient margin to avoid problems. Should a dump be terminated prior to its planned completion, alternate methods are available to dump the remaining water. The next flight of the vehicle, STS-56, includes plans for a supply water dump simultaneous with a waste dump in support of DTO 325. During the DTO, the remote manipulator system (RMS) wrist camera will be positioned to observe the flow of water from both nozzles. The STS-56 flight plan calls for the supply water to be managed through the flash evaporator system (FES) with the exception of the water dump for the DTO. Should the anomaly recur, the dump nozzle will be replaced during the STS-60 flow. This anomaly will continue to be tracked on CAR 53RF08-010. CONCLUSION: The cause of the supply water nozzle temperature drop is unexplained at this time. The most probable cause is an intermittent open in the heater. CORRECTIVE_ACTION: All heater circuits in the supply water dump valve and the dump nozzle have had continuity checks performed as well as wire-wiggle tests in an attempt to locate any intermittent opens in the circuit. The testing did not reveal any anomalous conditions. Should the anomaly recur on a future flight, the nozzle heater will be replaced as part of the troubleshooting effort to determine the cause of the anomaly. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. If the phenomenon recurs, it appears to be transient and recoverable. Should the supply water nozzle heater completely fail, the supply water can be managed through alternate methods. The existing supply water dump procedures terminate the dump whenever the dump nozzle temperature falls below 90 degrees F. The current plan on STS-56 is to manage the supply water using the FES with the exception of one simultaneous supply/waste water dump in support of DTO 325.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Pre-launch	Problem	**FIAR**	**IFA** STS-53-V-04	MPS
None	**GMT:** Pre-launch		**SPR** 53RF05	**UA**	**Manager:**
			IPR 53V-0184	**PR**	
					Engineer:

Title: MPS Helium Reg Pressures Exceeded LCC Limits (ORB)

Summary: DISCUSSION: Approximately one hour after external tank (ET) cryogenic loading began, the SSME 3A 750 psi helium regulator outlet pressure (V41P1354A)

increased from 784 psia to 788 psia following a three minute SSME fuel system helium purge. This violated the Launch Commit Criteria (LCC) upper limit of 785 psi. Within thirty minutes, the pressure rose one more bit count to 792 psia. During the next fuel system purge, the outlet pressure dropped to 772 psia which is nominal performance during a fuel system purge. When this purge ended, the outlet pressure again rose to 792 psia. A similar signature occurred during the next fuel system purge one hour later. During this same three-hour period, the SSME 1B regulator outlet pressure (V41P1153A) exhibited similar performance, starting at 780 psia and rising twice to 788 psia.

Following MPS helium bottle pressurization to flight pressure that occurred 3 hours 20 minutes prior to the planned lift-off time, all regulators showed a decrease in outlet pressure. After another fuel system purge was performed, the steady-state regulator outlet pressures were all less than or equal to 780 psia. No more infractions of the 785 psia LCC upper limit occurred during the countdown. An LCC waiver was approved for the excess pressures that were noted. This was the first flight of -0006 modifications to the MPS 750-psi helium regulators on this vehicle. A higher regulator pressure setpoint was made with this modification, as well as the regulator reference being changed from absolute to ambient pressure. OV-105 was delivered with -0006 regulators installed, and these have exhibited slightly higher pressures during cryogenic loading than the pressures normally seen using the -0005 regulators. A small, within-specification upward bias in the pressure instrumentation could contribute to pressure readings above the LCC limit. CONCLUSION: The higher-than-normal helium regulator outlet pressures experienced during no-flow conditions prior to helium bottle pressurization are most probably a characteristic of the new -0006 regulators used during this flight combined with pressure instrumentation inaccuracies. Once normal flight pressure was achieved, all helium regulator outlet pressures returned to acceptable values. CORRECTIVE_ACTION: Changes were made to the LCC and OMRSD to increase the allowable outlet pressure for -0006 regulators. The time effectivity for the LCC limit was changed from start of ET cryogenic loading to initiation of purge sequence 4, which is after helium tank pressurization to flight pressure. Final corrective action will be documented in CAR 53RF05-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:20:50:00.007	Problem	**FIAR**	**IFA** STS-53-V-05	ECLSS
EECOM-03	**GMT:** 339:10:14:00.000		**SPR** 53RF09	**UA**	**Manager:**
			IPR 56V-0014	**PR**	
					Engineer:

Title: Supply Water Dump Valve Leakage (ORB)

Summary: DISCUSSION: During the supply water dump line bake-out period following several of the supply water dumps, water was observed to leak from the supply dump valve. This type of leakage was observed on STS-48 following the fifth supply water dump, IFA STS-48-V-04. Following STS-48, the supply water dump valve along with the dump nozzle were removed from the vehicle and shipped to JSC for vacuum chamber testing. A new supply water dump valve and nozzle were installed in

the vehicle for the STS-42 mission. Vacuum chamber testing at JSC did not duplicate the leakage, and later testing and inspection at the vendor facilities proved the valve to be good.

During the STS-42 mission, no supply water dumps were made through the dump nozzle. On STS-53, leakage through the dump valve was observed again. Following STS-53, the heater wraps around the supply water dump valve were inpsected. The number of heater wraps found did not conform with the number of wraps specified in the installation drawing. The original drawing was revised for OV-103 and subsequent vehicles. This revision did not clearly define the correct heater installation. When the dump valve was removed following STS-48, the dump line heater was removed from the valve and remained with the vehicle. The heater installation was not inspected to determine if it complied with the drawing before it was removed. Without the number of heater wraps that are specified in the installation drawing, it is possible for the valve to reach a temperature that allows water to freeze inside the valve near the bellows. When the water freezes around the bellows, the bellows are expanded and this causes the poppet to crack, allowing water to enter the valve. The warm water entering the valve then melts the ice, thus allowing the poppet to reseat. Due to the influence of gravity , this scenario has not been able to be verified during vacuum chamber testing. The OV-104 supply water dump valve has also exhibited a similar type of leak. This leakage has not been observed on either OV-102 or OV-105. CONCLUSION: The most probable cause of the supply water dump valve leakage is the formation of ice in the valve around the bellows and this causes the bellows to expand and allows water to flow. The cause of the ice build-up is most likely the line heater not being installed correctly. CORRECTIVE_ACTION: The installation drawing is being updated to correct the heater installation deficiencies. The OV-103 supply water dump valve heater will be removed and reinstalled per the correct print. The OV-104 supply water dump valve will be inspected and installed correctly during OMDP, if it is found to not have been installed correctly. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:11:36:00.007	Problem	**FIAR**	**IFA** STS-53-V-06	RCS
None	**GMT:** 339:01:00:00.000		**SPR** 53RF02	**UA**	**Manager:**
			IPR 56V-0003	**PR**	
					Engineer:

Title: L RCS Oxidizer Helium A Regulator Primary Stage Leak (ORB)

Summary: DISCUSSION: When the left reaction control system (RCS) tank isolation valves were closed during a configuration to left orbital maneuvering system (OMS) interconnect, the left RCS oxidizer ullage and tank pressure began rising. Using the A helium leg, the pressures increased past the primary helium regulator stage lockup pressure of 255 psia to the secondary lockup pressure of 262 psia over a period of approximately 18 hours. This indicated a primary stage leakage rate of approximately 2500 SCCH, exceeding the OMRSD requirement of 360 SCCH. When the helium system was switched to the "B" leg at the normal time to verify redundancy, no leakage was noted.

During vehicle processing prior to the flight, the primary "A" helium regulator leakage was measured as 124.3 SCCH. The leak rate was calculated to be approximately 300 SCCH during launch pad operations. These leakages were within the 360 SCCH OMRSD limit, so no waiver was required. Regulator testing performed following flight confirmed the leak was still present at approximately 2900 SCCH. CONCLUSION: The most probable cause of the primary regulator leakage is particulate contamination which affected the poppet seals. CORRECTIVE_ACTION: The left OMS pod LP04 was replaced with LP01 for the next flight of OV-103. The regulator wll be removed from LP04 and undergo failure analysis. Final corrective action will be documented in CAR 53RF02-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:21:23:00.007	Problem	**FIAR**	**IFA** STS-53-V-07	GFE
INCO-02	**GMT:** 339:10:47:00.000		**SPR**	**UA**	**Manager:**
			IPR DR BH230412	**PR** PV6-236584	
					Engineer:

Title: Camera C Failed (GFE)

Summary: DISCUSSION: When Camera C was powered up, the crew reported that brightly colored horizontal lines were visible on the camera monitor. During subsequent operations the picture appeared normal.

CONCLUSION: The problem may indicate that some degradation in the power supply is occuring. CORRECTIVE_ACTION: Tests at KSC failed to duplicate the problem. Camera C was then sent to Boeing/Flight Equipment Processing Contractor (FEPC) for evaluation. Lab tests at FEPC also failed to duplicate the problem. The camera will be placed back in inventory for subsequent flights, but will be used only if other cameras are unavailable for flight. Since there are no spare power supplies presently available, whenever the camera is scheduled for a flight it will be used in a limited manner and monitored for further degradation.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:20:00:00.007	Problem	**FIAR** JSCEE-0679F	**IFA** STS-53-V-08	GFE
INC0-03	**GMT:** 341:09:24:00.000		**SPR**	**UA**	**Manager:**
			IPR	**PR** 3U9230015	
					Engineer:

Title: Text and Graphics System (TAGS) Jam (GFE)

Summary: DISCUSSION: The TAGS jammed after receiving the first page of the flight day 4 morning mail, which was transmitted during the crew sleep period. A page advance command was sent, but the jam did not clear. Shortly after the crew awakened, one of the crew noticed that the booster rollers were not turning. These rollers

should turn continuously. The crew subsequently cycled power to the TAGS, but the problem remained. The decision was made to power down the TAGS and use the teleprinter and the portable audio data modem (PADM) for uplinking messages for the remainder of the flight.

CONCLUSION: The TAGS unit was removed at the landing site and shipped to JSC. Failure analysis revealed that the developer motor was stalling. No further discrepancies were found. The motor will be analyzed to determine why it is stalling. This will be done in-house because the original vendor is no longer in business. CORRECTIVE_ACTION: The TAGS developer motor was removed and replaced. The unit successfully passed ATP and is ready for use on a subsequent flight. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 007:06:31:00.007	Problem	**FIAR**	**IFA** STS-53-V-09	RCS
PROP-01	**GMT:** 344:19:55:00.000		**SPR** 53RF03	**UA**	**Manager:**
			IPR 56V-0013	**PR** FRC3-0379	
					Engineer:

Title: RCS Jet F1L Oxidizer Leak (ORB)

Summary: DISCUSSION: The forward reaction control system (RCS) thruster F1L began leaking oxidizer at 344:19:55 G.m.t. following the completion of the forward RCS (FRCS) dump burn during entry. Upon closure of the manifold isolation valves (normal procedure following the FRCS dump), the manifold oxidizer pressure continued to decay from 275 psia to about 56 psia, confirming the leak. The leak rate was calculated to be 13.5 cc/hour of oxidizer.

Postlanding, the ground crew confirmed a 1 ppm to 2 ppm oxidizer concentration in the area of the F1L thruster, and after nearly 2 hours of monitoring during which the level remained essentially the same, a fan was used to clear the area of fumes so that the crew could exit the vehicle. Prior to being fired during the FRCS dump burn, F1L had been fired on-orbit during the previous day's RCS hotfire. The thruster (S/N 412) had flown two times without incident prior to the post-STS-51L thruster instability protection system wire-wrap modification. This was its first flight since completion of that modification. CONCLUSION: RCS thruster F1L experienced oxidizer leakage that was most probably caused by contamination on the oxidizer-valve Teflon seat. When the oxidizer valve closed following the FRCS dump, the contamination presented a leak path on the seat. CORRECTIVE_ACTION: The thruster was removed and replaced. Since the oxidizer valve is the -505 configuration, the thruster will be flushed at WSTF and returned to service. Final corrective action will be documented in CAR 53RF03-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 007:06:48:00.007	Problem	**FIAR**	**IFA** STS-53-V-10	ECLSS

EECOM-04	**GMT:** 344:20:12:00.000	**SPR** 53RF04	**UA**	**Manager:**
		IPR 56V-0013	**PR**	
				Engineer:

Title: PPO2 Sensor C Erratic (ORB)

Summary: DISCUSSION: Shortly before landing, the output of the partial pressure oxygen (PPO2) sensor in position C became erratic and exhibited shifts in the output of up to 1.2 psi. Postlanding, the sensor was removed from the vehicle and returned to the vendor for failure analysis. Three PPO2 sensors are flown each flight. Two of these sensors, located in positions A and B, are used to automatically control the cabin atmosphere. The third sensor, in position C, is used only for monitoring the cabin environment. On this flight, a new sensor design, which is being implemented due to obsolescence of the previous design, was installed in the C position. This same sensor design had been flown on STS-49, 50, and 54 in position C with no noted anomalies.

The vendor analysis revealed loose anode particles on the cathode side of the sensor membrane. When the anode material contacts the cathode, the output of the sensor is affected. Based on the design of the cell, it has been determined that the anode particles were mislocated during the manufacturing process, and this has prompted the manufacturer to implement the procedures described in the corrective action section. These new procedures were not yet in place when the STS-53 sensor cell was manufactured. The new design sensor cell used in position C during the STS-54 mission functioned as expected. This sensor did not receive the additional ultrasonic screening prior to its installation in the vehicle for the STS-54 mission. This problem will continue to be tracked on CAR 53RF04-010. CONCLUSION: The erratic output by PPO2 sensor C was caused by a manufacturing defect that placed anode material on the cathode side of the sensor menbrane. CORRECTIVE_ACTION: Due to similar manufacturing problems with other sensors, the manufacturer has implemented several new or revised procedures in an effort to eliminate this manufacturing defect. A more detailed inspection will be performed on the anode. The technicians are cautioned on the need for cleanliness during the assembly of the sensor. Additionally, an orientation test is being added following acceptance vibration testing, and this test will monitor the cell output while it is rotated about each axis. An additional screening test involves the ultrasonic screening of a sample from the lead anode lot prior to the incorporation of the anodes in the sensor cells. Sensors in the field that have not been through the upgraded screening process have been shipped back to the manufacturer. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Until the revised manufacturing procedures have been proven to eliminate the manufacturing defects from the sensor cell, the new design sensors will only be used in position C.

Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:** 007:05:23:00.007	Problem	**FIAR**	**IFA** STS-53-V-11	HYD
MMACS-03	**GMT:** 344:18:47:00.000		**SPR** 53RF06	**UA**	**Manager:**
			IPR 56V-0017	**PR**	
					Engineer:

Title: WSB 1B Steam Vent Temp Erratic ()

Summary: DISCUSSION: The improved auxiliary power unit (IAPU) ran for about 8.75 minutes for the flight control system (FCS) checkout on flight day 6. Water spray boiler (WSB) spray cooling was observed for approximately 1.5 minutes. The WSB vent heaters cycles using the B controller were normal for all three systems. Since ice deposition on the WSB 1 steam unit vent nozzle after FCS checkout was postulated, the WSB 1B steam vent heater was activated for about 1 hour and 45 minutes on flight day 7. No irregularities were seen in the WSB steam vent temperatures at that time.

During pre-entry operations (flight day 8), approximately 2 1/2 hours after WSB 1 B heater activation, the steam vent temperature became erratic and dropped below the 130?F WSB-ready temperature about 1 hour later. Switching from the B to A controller resulted in a temperature increase indicating heater recovery. WSB 1 was switched back to the B controller following the deorbit burn. Data show erratic heater operation on the B heater, but not on the A heater, indicating anomalous performance of the B heater. Ground testing of the WSB 1 vent systems did not reproduce the observed heater signatures. On an early flight of OV-102, WSB 2 vent heater A exhibited a similar erratic signature during entry (STS-61C, 1986). This configuration of heater contained a braze joint at a 90-degree bend. Subsequent failure analysis of the vent heater after removal indicated that vibration and thermal stresses on the braze at the 90-degree bend led to brittle fracture at the joint. This in turn caused a reduction in peformance and finally the failure. A similar failure was observed recently on an OV-103 heater during checkout at KSC (flow 12, 1991). Subsequently analysis revealed a similar failure condition. Numerous WSB 2 vent heater A system anomalies had been reported during the past five flights of OV-104. Extensive ground checkout failed to isolate or reproduce the anomalies. The vent nozzle/heater assembly was subsequently removed during Orbiter Maintenance Down Period (OMDP)-1 for failure analysis. This configuration of heater also contains a braze joint at a 90-degree bend. Failure analysis again failed to reproduce the anomalies. After disassembly of the WSB vent system, the braze weld of the lead wire to the heater element was discovered to have some porosity in the braze area, which reduced the junction contact area by approximately 20 percent. However, preliminary anlysis indicates this porosity should not have caused the flight failures (i.e., no evidence existed of fracture or localized overheating at the braze area). Analysis is continuing. The current corrective action established after the OV-102 failure is that fabrication of all future heater elements will be to heater drawing which incorporates Engineering Change 163416-2. This change specifies that the braze joint will be located within the section of the heater that is in contact with the nozzle assembly wall and not within the unsupported 90-degree bend area. An X-ray is taken of this braze joint area verifying the location after the heater is bent to shape. This change ensures an effective heat sink and limits vibration and thermal cycling displacements. The effectivity of this change is by attrition only. CONCLUSION: The braze weld on the WSB 1 vent B heater is suspected to have caused the erratic temperature signature observed during the pre-entry period. CORRECTIVE_ACTION: Troubleshooting of the WSB vent heater systems included extended heater cycle runs starting from ambient temperature. The heaters were powered-on for 4 hours with normal signatures. The troubleshooting was unable to reproduce the anomaly that occurred during entry. The WSB 1 vent assembly has been removed and replaced. Failure analysis will be performed at RI-Downey under CAR 53RF06-010. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 007:03:46:00.007	Problem	**FIAR**	**IFA** STS-53-V-12	GFE, C&T
INCO-05	**GMT:** 344:17:10:00.000		**SPR** None	**UA**	**Manager:**
			IPR None	**PR**	
					Engineer:

Title: Poor Quality on Air/Ground (A/G) Channel (GFE)

Summary: DISCUSSION: During deorbit preparation activities, a "buzzing" noise was heard on the air/ground audio when one of the crewmembers was using the hand-held microphone with the mission specialist (MS) audio terminal unit (ATU). The noise was not audible to the crew, and presented no impact to mission operations.

CONCLUSION: The hand-held microphones used during this flight were tested at the Flight Equipment Processing Contractor in Houston. All the units performed nominally. The low volume and buzzing was probably caused by suit-fan noise coming through the neck ring of the launch/entry suit (LES). No further testing is considered necessary. CORRECTIVE_ACTION: Crewmembers should be aware of possible noise/interference when using the hand-held microphone/ATU while wearing the LES and using the suit fan. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.