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

STS - 51G, OV - 103, Discovery (5) **Time:04:26:PM**

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-01		INS
	GMT:		**SPR**	**UA**		**Manager:** L. Jenkins F.
			IPR	**PR**		Rotramel
						x6171
						Engineer:

Title: Instrumentation Failures. ()

Summary: DISCUSSION: A. SSME 2 GH2 outlet pressure (V41P1260A) measurement failed off-scale high at about 215 seconds mission elapsed time. This measurement is on the ullage repressurization line from the main engine and is used as a backup measurement to determine engine failure. This measurement has failed on a number of previous flights and poses no impact. The sensor will be replaced and the failure tracked on CAR 24F002.

CAR ANALYSIS: This is a repetitive type failure. Corrective action is to delete the sensor on SSME-2 on all vehicles. B. Left main-landing-gear hydraulic brake pressure (V51P0522A) measurement of channel 4 read low. During landing rollout channel 4 brake pressure indicated 1000 psi while the other channels were indicating 1500 psi at brake application. Postflight brake hydraulic tests could not duplicate the low brake pressure on channel 4. There was no impact to system performance as a result of indicated lower brake pressure on channel 4. Fly as is. CAR ANALYSIS: Unable to duplicate problem postflight. Most probable cause was a servo valve sticking which was freed by braking pressures during rollout. C. Left OMS (orbital maneuvering system) feedline temperature (V43T4216A) increased during postflight safing. The feedline temperature increased from ambient to about 130 deg F and returned to ambient over a 5-hour time period while the system was dormant. The OMS pod heaters were verified to be off during the excursion. Data review of the corresponding temperature measurements in the area around the oxidizer temperature transducer did not indicate any kind of thermal response. Also, the pressure transducer located adjacent to the oxidizer feedline temperature transducer did not indicate a pressure rise during the indicated temperature increase. Sufficient measurement redundancy exists should the oxidizer feedline temperature measurement be lost for the STS 51-I mission. An interim discrepancy report (IPR) has been initiated by Launch Operations on the left OMS feedline temperature measurement. Troubleshooting of this discrepancy will take place during the post-STS 51-I mission turnaround flow. Fly as is. CONCLUSION: See above. CORRECTIVE_ACTION: See above. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-51G-V-02		APU
	GMT:		SPR	UA		Manager: Walter Scott
			IPR	PR		x6171
						Engineer:

Title: Auxiliary Power Unit 2 Fuel Pump Water Cooling Valve System A Failed. ()

Summary: DISCUSSION: After ascent and the APU's (auxiliary power units) were shutdown, the APU fuel pump/GGVM (gas generator valve module) water cooling system A was activated. Cooling was observed on APU 1 and 3; however, the APU 2 fuel pump and GGVM temperatures continued to rise to a value of 190 deg F and 150 deg F, respectively. At 168:12:01:55 G.m.t., APU fuel pump/GGVM water coolng system B was activated. APU 2 fuel pump and GGVM temperatures suddenly dropped indicating the initiation of cooling. At 168:14:15:08 G.m.t., APU fuel pump/GGVM water system A shutdown leaving system B activated. Immediately, all three APU fuel valves and GGVM temperatures started to rise with APU 2 exceeding the thermostat set point for cooling initiation. At 168:17:01:04 G.m.t., the APU water cooling system A was again activated followed by shutdown of water cooling system B. APU 2 fuel valve/GGVM temperatures were observed to decrease, indicating cooling was again occurring. At 168:17:36:26 G.m.t., water cooling to all three APU fuel pumps and GGVM's was terminated by shutting down water system A with the three APU fuel pumps and GGVM's temperatures stabilized at an acceptable level.

Postflight inspection at the launch site revealed that the APU 2 fuel valve/GGVM water cooling system A and B were crosswired such that both systems (A and B) had to be activated for cooling of APU 2 to occur. The wiring error occurred prior to the mission when new configuration APU water cooling valves were installed. The APU 2 water valves A and B crosswiring has been corrected and verified operational. APU 1 and 3 water system valves A and B were verified to be in the proper configuration. CONCLUSION: The APU 2 fuel pump/GGVM water cooling system A failure was due to a crosswiring between the systems A and B water pulsing valves. CORRECTIVE_ACTION: The APU 2 fuel pump/GGVM water cooling system A and B valve crosswiring was corrected and the system was verified to be operational. Launch site procedures are being changed to provide individual checkout of each redundant APU water cooling system. CAR ANALYSIS: Postflight troubleshooting revealed that system A and system B cooling valve solenoid wiring was reversed at TB8, Post 7 & 8. The wiring has been restored to print and no further corrective action will be taken. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-51G-V-03		ECLSS
	GMT:		SPR	UA		Manager: Eugene Winkler
			IPR	PR		

x3343

Engineer:

Title: Waste Collection System Fan Separator 1 Motor Current High. ()

Summary: DISCUSSION: At about 168:17:51 G.m.t., during the WCS (waste collection system) fan separator 1 operation, normal start-up ac currents (2 amperes per phase) were observed, but the currents did not drop off to the run levels of 0.6-ampered per phase within 6 to 7 seconds. The currents remained at 2 amperes per phase for two start attempts; one of 25 seconds duration, and one of 47 seconds duration. The crew then switched to fan separator 2 and reported that it produced about twice the air flow as that observed from fan separator 1. The ac current data for fan separator 2 was normal. From the data, it was concluded that fan separator 1 had flooded and after ground testing, a procedure to clear fan separator 1 was developed for use should fan separator 2 be lost.

The WCS (S/N 415) has been removed and returned to the vendor for failure analysis. The failed unit will be replaced with S/N 124. The WCS in OV-099 (STS 51-F) has a new motor in fan separator 1 which has a higher starting torque and this is expected to reduce the likelihood of flooding. CONCLUSION: None pending failure analysis. CORRECTIVE_ACTION: S/N 415 has been removed and returned to the vnedor for failure analysis. The results of this activity will be tracked via CAR 25F003. The failed unit will be replaced with S/N 124. CAR ANALYSIS: Testing has indicated that the problem could be caused by the fan separator being shut-off while liquid transfer was still taking place. To preclude this occurrance, a NASA directive (TWX W1226MA) was issued to incorporate a delay in the shut-off of the fan separator controls to prevent separator flooding in the event of premature turn-off before they have cleared. EFFECTS_ON_SUBSEQUENT_MISSIONS: None, pending the results of failure analysis.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-04		RCS
	GMT:		**SPR**	**UA**		**Manager:** Gene Grush
			IPR	**PR**		Roberto Egusquiza
						x3851
						Engineer:

Title: Reaction Control System Valve Position Microswitch Failures. ()

Summary: DISCUSSION: During the interconnect operations of the left OMS (orbital maneuvering system) to the RCS (reaction control system) at 169:09:29 G.m.t., several valve position microswitches failed.

The right RCS fuel crossfeed 3/4/5 valve open downlink discrete failed to indicate open. The onboard valve position indication was proper. Following inflight troubleshooting, the open downlink discrete indication was proper after the interconnect was reestablished at 169:10:17 G.m.t., and there was no further anomalous indication. The left RCS oxidizer and fuel 1/2 isolation valve-position onboard indications were barberpole during the left OMS/RCS interconnect; however, the downlink discretes indicated that both valves had cycled to the proper or commanded position. This isolated the problem to the position microswitch in either the oxidizer or the fuel valve that drives the onboard valve position indication. The right RCS oxidizer tank isolation 3/4/5 B valve open downlink discrete did not indicate open, and it was confirmed that continuous power was being applied to the valve. The crew reported that the onboard valve position indication was barberpole (miscompare between oxidizer and fuel valve position). The fuel valve open downlink discrete was present; thus, the problem was isolated to the open contact on the oxidizer valve-position microswitch. The crew was instructed to return all affected valve command switches to the GPC (general purpose computer) position which prevents continuous power from being applied to the valves. The right RCS fuel crossfeed 3/4/5 valve actuator and the right RCS oxidizer tank isolation 3/4/5 B valve actuator will be removed, replaced, and returned to the vendor for failure analysis. The actuators on both the left RCS oxidizer and fuel 1/2 isolation valves will be removed, replaced, and returned to the vendor for failure analysis. CONCLUSION: The most probable cause of the anomalous onboard and downlink discrete RCS valve position indications was failed or contaminated microswitches. CORRECTIVE_ACTION: The valve actuators containing the position indication microswitches will be removed, replaced, and returned to the vendor for failure analysis. The results of this activity will be tracked via CAR 13F001. CAR ANALYSIS: Analysis indicated that the problem was caused by faulty microswitches. PIND testing is now required on all switches and manufacturing/handling procedures have been improved. Close this CAR.
EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-05		C&T
	GMT:		**SPR**	**UA**		**Manager:** D. S. Eggers
			IPR	**PR**		x2128
						Engineer:

Title: Lower Left S-Band Antenna Beam Switch Operated Intermittently And/Or Stuck. ()

Summary: DISCUSSION: On at least three occasions, the lower left S-band antenna failed to switch from the aft beam to the forward beam. The indications were that the switch was partially made in that an RF path was still present, but the reflected power increased and the signal strength decreased. The design of the switch is such that it should latch in one of the two positions. Telemetry data showed both positions open. This condition most probably resulted from a mechanical problem in the switch that prevented the switch from latching and making full contact. The switch was made in each case by switching beam switch electronic units and this resulted in the retransmitting the switching command.

CONCLUSION: The lower left S-band antenna has an intermittent failure mode which could result in loss of the antenna. CORRECTIVE_ACTION: KSC flow constraints prevent replacement of the antenna prior to the next flight. The antenna will be removed and replaced at the first available opportunity. Flight procedures are being re-evaluated to minimize the loss of communications, should the antenna switch fail. EFFECTS_ON_SUBSEQUENT_MISSIONS: Some loss of comm and/or

possible attitude constraints will occur if the antenna hard fails.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-06		DPS
	GMT:		**SPR**	**UA**		**Manager:** R. I. Macias
			IPR	**PR**		x2391
						Engineer:

Title: Multiplexer/Demultiplexer FA3 Had An Intermittent Failure. ()

Summary: DISCUSSION: A fault message "BCE String 3D" occurred at 172:19:16:48 G.m.t., and it was also noted that several commands associated with MDM (multiplexer/demultiplexer) FA3 were not being processed (firing commands to aft manifold 2 RCS thrusters). The MDM was moded to the secondary port; however, this port moding resulted in interference with command processing of the primary port of MDM FF3 which is tied to the secondary port of MDM FA3. MDM FA3 was moded back to the primary port for the remainder of the flight. The problem did recur during FCS (flight control system) checkout; however, all thrusters operated properly during the RCS hot-fire test. The manifold 2 thrusters were reprioritized to last priority for the remainder of the flight.

Inflight analysis and vendor test experience indicates that all the observed anomalies can result from interference produced by intermittent output from the core power supply of the secondary port of FA3. CONCLUSION: The most probable cause of the problem is an intermittent output from the internal power supply for the secondary port of FA3. CORRECTIVE_ACTION: The MDM has been removed and replaced. Detailed analysis of the unit will be tracked on CAR 25F002. CAR ANALYSIS: CAR remains open at this date (10-28-86). EFFECTS_ON_SUBSEQUENT_MISSIONS: None, pending results of CAR 25F002.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-07		EPD
	GMT:		**SPR**	**UA**		**Manager:** Richard
			IPR	**PR**		Burghduff
						x2766
						Engineer:

Title: Payload Bay Forward Floodlights Failed. ()

Summary: DISCUSSION: At about 174:09:19 G.m.t., the crew reported that the PLB (payload bay) forward bulkhead floodlight had failed. In addition, it was reported that both the port and starboard forward floodlights had failed.

During postflight troubleshooting, it was confirmed that all three floodlight had failed. The units will be removed, replaced, and returned to the vendor for failure analysis. CONCLUSION: None pending failure analysis. CORRECTIVE_ACTION: The failed PLB forward floodlights will be removed, replaced and returned to the vendor for failure analysis. The results of this activity will be tracked via CAR AC3370-010. CAR ANALYSIS: Failure of the early designed payload bay lamps is not uncommon due to a design which proved to be unworkable and their early failure is predictable. It has been determined that improved design lamps are in stock and will be employed as replacements when the early lamps fail. EFFECTS_ON_SUBSEQUENT_MISSIONS: Unknown pending failure analysis.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-08	EPD
	GMT:		**SPR**	**UA**	**Manager:** Gary Kitmacher
			IPR	**PR**	
					x2643
					Engineer:

Title: AC-3 Power Spikes Using Panel A15 Outlet. ()

Summary: DISCUSSION: Two 7-ampere current spikes occurred on the AC-3 phase B utility power bus when the vacuum cleaner was turned on. The bayonet connector had been inserted into the utility power outlet on panel A15, but had not been tightened (rotated fully). After tightening the connector, the vacuum cleaner operated properly. Higher starting spikes can occur if all three phases are not properly connected.

During postlfight debriefings, the crew reported that the vacuum cleaner plug was difficult to tighten into the panel A15 utility outlet. Troubleshooting revealed that the tightening torque for the vacuum cleaner plug in A15 outlet was high, but the torque was within specification. Tests in 1 g showed that the bayonet connector was difficult to tighten, and this could result in extra effort being required on-orbit to complete the connections. CONCLUSION: The spikes on the AC-3 phase B utility power bus were probably caused by starting the vacuum cleaner with the plug not tightened into the utility power outlet on panel A15. CORRECTIVE_ACTION: The STS 51-F crew was informed that extra effort may be required to tighten plugs into the utility power outlets for proper 3-phase operation. Use of a Skylab-type strap wrench is being evaluated. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-09	GFE
	GMT:		**SPR**	**UA**	**Manager:** G. D. Nealis
			IPR	**PR**	x6406
					Engineer:

Title: Flight Deck Speaker Microphone Unit Reportedly Had Intermittent Reception. ()

Summary: DISCUSSION: The crew reported that the flight deck SMU (speaker microphone unit) reception was intermittent. An inflight test verified that the ATU (audio terminal unit) worked properly with a headset. Postflight tests at KSC did not reproduce the problem or reveal anything wrong with either the SMU or the ATU.

CONCLUSION: The intermittent problem could not be reproduced in ground tests, and the unit will be flown as is. CORRECTIVE_ACTION: No corrective action taken as problem could not be duplicated. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-10		D&C
	GMT:		**SPR**	**UA**		**Manager:** T. E. Lewis
			IPR	**PR**		x2126
						Engineer:

Title: Surface Position Indicator Off Flag Failed. ()

Summary: DISCUSSION: During the dedicated-display flag-test portion of the FCS (flight control system) checkout, the crew reported that the SPI (surface position indicator) off-flag was not visible. It was later reported that the off flag was not visible with the instrument powered off. There were no problems reported with the high and low tests of the SPI, indicating that all surface position data was displayed correctly.

CONCLUSION: The most probable cause is an electromechanical failure in the SPI off-flag mechanism. CORRECTIVE_ACTION: The SPI has been removed and replaced. Detailed analysis of the unit will be tracked under CAR 25F007. CAR ANALYSIS: Thermal and vibration tests were conducted on the flag solenoid and it was found to perform properly. Disassembling the solenoid revealed no discrepant tolerances from specification. In short, failure analysis couldn't isolate the problem. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-11		TPS
	GMT:		**SPR**	**UA**		**Manager:** J. Smith D. Lee
			IPR	**PR**		x3676
						Engineer:

Title: Overall Tile Debris Damage Excessive and Left Outboard Elevon Tile Slumped. ()

Summary: DISCUSSION: A. The postflight TPS inspection showed approximately 315 debris hits of which 144 were equal to or greater than 1 inch area. The majority

(231) of hits were on the Orbiter underbody and were concentrated in the right-hand wing-glove area. The 315 debris hits are a significantly higher number than has occurred during any of the last 10 Orbiter flights and represent the highest number of an upward trend during the last 3 Orbiter flights. The glazed condition of the debris craters indicates the damage occurred during ascent.

Review of ET (external tank) separation photographs from OV-099 STS 51-B shows a number of large divot holes in the intertank insulation areas where two different types of foam insulation are bonded together. Review of the ET insulation application processes has identified a faulty batch of bonding resin that was used on the external tanks flown on the last 3 Orbiter flights. The resin causes a chemical reaction at the dissimilar insulation bondline and this results in trapped gas bubbles. Differential pressure during ascent causes ejection of pieces of the insulating foam from the ET. The faulty bonding has been isolated to LWT (light weight tanks) 10 through 13. Three of these tanks were flown on the last three Orbiter flights and LWT 12 is scheduled to fly on STS 51-F. B. Inspection also showed tile slumping and the gap filler missing between the two outermost tile of the left-hand elevon. Plasma flow has discolored the outboard portion of the tile carrier panel interior surface and the outermost "tempi label" dots were discolored to indicate temperatures above 400 deg F. The Korpon coating on the structure beneath the carrier panel was also discolored. Similar damage has been observed in this area on previous flights. (See STS 51D-14). CONCLUSION: A. Excessive debris damage to the Orbiter TPS was caused by insulation that was shed from the ET during ascent. The insulation was loosened by gas bubbles between two insulation layers on the ET because of a chemical reaction at the bondline caused by a faulty bonding resin. Core sample density and subsequent repair has established a reasonable level of confidence that any insulation shed would be limited to small areas and would result in limited debris hits on the Orbiter for STS 51-F. B. Hardness tests of the structure beneath the elevon carrier panel show no damage. The carrier panel structural hardness tests show some weakening; however, the carrier panel is acceptable for one additional flight. CORRECTIVE_ACTION: A. Additional core-sample pull testing has been conducted in the affected areas of the ET scheduled to be flown on STS 51-F. Normal tile repair procedures will be utilized to repair debris damage. For additional corrective actions, see MSFC LWT 12 insulation problem. B. The tile carrier panel will be replaced after STS 51-F, and detailed postflight inspections will continue. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	**Time**	**Classification**		**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-12		D&C
	GMT:		**SPR**	**UA**		**Manager:** Richard
			IPR	**PR**		Burghduff
						x2766
						Engineer:

Title: G Meter Read 1 G Throughout Flight. ()

Summary: DISCUSSION: During the postflight debriefing, the crew reported that the G meter did not respond to flight profile and read 1 g throughout the mission.

Postflight troubleshooting at KSC revealed that the meter was caged.

The G meter measures g's in the Z axis to show the wing loads during entry. Pad closeout photos of OV-099 show that the meter was uncaged with a correct reading of zero g. However, pad closeout photos of OV-103 show that the meter has been caged for all five flights of OV-103. The G meter on OV-103 has been uncaged for that vehicle's next flight. CONCLUSION: The G meter read 1 g throughout the flight because the G meter had been caged for the first five flights of OV-103. CORRECTIVE_ACTION: Pad closeout photos will be checked preflight to insure that the G meter has been uncaged on all flight vehicles. KSC uncaged the G meter on OV-103 and will verify that it has been uncaged on OV-104. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51G-V-13		OMS
	GMT:		**SPR**	**UA**		**Manager:** John Hooper
			IPR	**PR**		Richard Burghduff
						x3851
						Engineer:

Title: Left OMS Engine Arm/Pressure Switch Lacked Positive Detent. ()

Summary: DISCUSSION: Prior to the deorbit burn, the crew armed the OMS (orbital maneuvering system) engines by moving the OMS engine left and right switches to ARM/PRESS (panel C3); however, the left OMS engine did not respond by being armed and pressurized. After the right OMS engine was armed and pressurized, approximately 7 seconds elapsed at which time the left OMS engine switch indicated ARM/PRESS position followed by ARM position and then back to ARM/PRESS. The left OMS engine arming and pressurization was then nominal as was the succeeding deorbit burn.

The left OMS engine switch has three positions (OFF, ARM/PRESS, ARM) with detents in the ARM/PRESS and OFF positions. Apparently when positioning the left OMS engine switch for the initial arming and pressurization, the switch was moved through the detent to a non-engaged (ARM/PRESS) position. The crew did not get an indication of engine pressurization and then cycled the switch. This was observed on the switch scan by the position changing serially from ARM/PRESS to ARM and back to ARM/PRESS. Previous left and right engine swtich actuations indicated an ARM/PRESS position within one data count of each other. The left OMS engine switch was mechanically inspected in the simulator by cycling the switch several times. It was found that the OMS engine switch can be moved through the detent position duplicating the sequence of events experienced during the mission. CONCLUSION: The left OMS engine did not arm/pressurize initially for the deorbit burn because the left OMS engine switch was passed through the ARM/PRESS detent to a non-engaged position. CORRECTIVE_ACTION: KSC has removed and replaced the left OMS engine arm/pressure switch. Crew training will emphasize that the OMS engine switch can be passed through the ARM/PRESS position to a non-engaged position. CAR ANALYSIS: Investigation failed to reveal any anomaly or discrepancy to account for the reported condition. However, the switch was replaced at astronaut request. No

further action is planned. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-51G-V-14		GFE
	GMT:		SPR	UA		Manager: Rudolph
			IPR	PR		Trabanino
						x2191
						Engineer:

Title: Galley Water Dispenser Erratic. ()

Summary: DISCUSSION: The crew reported postflight that the galley did not dispense water at the preset quantity, and the water control level shutoff operation was erratic.

Troubleshooting at KSC found that the water control level was binding, thus preventing normal cutoff. The control level has been cleaned, adjusted and lubricated, and normal operation has been restored. Extensive testing has not reproduced the metering problem. It is possible that transient foreign matter could have altered flow in the control orifice for the water flow meter. CONCLUSION: The erratic shutoff operation of the control lever on the galley water dispenser was caused by binding in the lever. The water quantity metering may possibly have been altered by transient foreign matter in the flow control orifice. CORRECTIVE_ACTION: The galley was removed, repaired, tested and returned to KSC. The control lever for the water dispenser was cleaned, adjusted and lubricated to preclude binding. The water dispenser is metering the proper quantity. The galley from OV-102 has been installed in OV-103. FIAR ANALYSIS: The galley is GFE to the Orbiter and not tracked in the Rockwell failure reporting system. NASA is tracking fault isolation, failure analysis and repair on FIAR JSC-SP-5041F. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE