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

STS - 51F, OV - 99, Challenger (8) **Time:04:26:PM**

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-51F-V-01	OI
None	**GMT:** Prelaunch		**SPR** 26F006	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Payload Data Interleaver Failed Dynamic Wrap Test. (ORB)

Summary: DISCUSSION: During pre-launch operations at approximately 210:15:10 G.m.t., the PDI (payload data interleaver) did not respond to PCMMU (pulse code modulation master unit) 1. Neither power cycling of the PDI nor switching to PCMMU 2 corrected the problem.

The PDI was not required for the STS 51-F mission and, therefore was flown in the failed condition. Postflight, the PDI was removed, replaced, and returned to the vendor for failure analysis. CONCLUSION: The PDI failure and its cause await the results of the failure analysis. CORRECTIVE_ACTION: The failed PDI has been removed, replaced, and returned to the vendor for failure analysis. The results of this activity will be tracked via CAR 26F006. CAR ANALYSIS: Failure analysis at the vendor revealed a capacitor (C30) failure in the low voltage power supply. Since this is the first failure of this capacitor in the PDI low voltage power supply, no corrective action is planned. EFFECTS_ON_SUBSEQUENT_MISSIONS: None, pending the results of failure analysis.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:09	Problem	**FIAR**	**IFA** STS-51F-V-02	APU
None	**GMT:** 210:21:09		**SPR** 26F007	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Auxiliary Power Unit 1 Lube Oil Outlet Pressure (V46P0153A) High And Gearbox Nitrogen Pressure (V46P0151A) High. (ORB)

Summary: DISCUSSION: Shortly after launch, the APU (auxiliary power unit) 1 gearbox nitrogen (V46P0151A) and gearbox lube oil outlet pressures (V46P0153A) both increased approximately 8 psia above the normal operating pressures, returned to normal, and then began to rise again. When APU 1 was shut down on orbit, the gearbox nitrogen pressure was off-scale high (above 30 psia), and the gearbox oil outlet pressure was approximately 90 psia.

The start of APU 1 for entry was delayed until 6 minutes prior to TAEM (terminal area energy management) in order to reduce the run time. The APU 1 gearbox nitrogen and gearbox lube oil outlet pressures mirrored those observed during ascent. Except for the high gearbox pressures, the APU 1 performance was normal during the mission with all other parameters being nominal. Postflight inspection of the APU 1 lube oil gearbox indicated a nominal ullage. However, analysis of samples of the lube oil indicated the presence of water (10,000 ppm). Considering water as a contaminant in the lube oil and using flight temperature data, the observed gearbox pressure response is predictable. Further inspections at the launch site revealed that a hose used during nitrogen servicing of the gearbox had been left exposed, allowing water the accumulate in the hose. Subsequent use of the hose injected water into the gearbox. CONCLUSION: The high APU 1 gearbox lube oil outlet and gearbox nitrogen pressures are attributed to water contamination in the lube oil. As the temperature increased relative to altitude, the water turned to steam, which in turn pressurized the gearbox. CORRECTIVE_ACTION: 1. The APU 1 gearbox lube oil system was drained, flushed, and filled with lube oil verified to be within applicable fluid specifications. 2. The launch site has implemented procedural changes to assure the proper protection and handling of all vehicle-to-ground fluid servicing interface hoses. CAR ANALYSIS: High pressures were concluded to be water vapor pressure. Water had been inadvertently introduced by GSE during APU servicing. Servicing procedures at KSC have been revised to preclude water being introduced. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:00	Problem	**FIAR**	**IFA** STS-51F-V-03	MPS
None	**GMT:** 210:21:00		**SPR** 26F002	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Instrumentation Failures. (ORB)

Summary: DISCUSSION: The SSME GH2 outlet pressure (V41P1260A) failed off-scale high at lift off. This measurement has failed on this engine on every flight of this vehicle.

Failure analysis of the transducers has shown broken wires in the leads from the strain gage to the connector due to launch vibration levels. The transducer for engine 2 is installed in a different orientation than the transducers on the other engines. This measurement is not included in the LCC requirements but is required as a backup in the event engine data were lost during ascent. It is also used for the performance analysis of the flow control valve. The failure history shows that if this transducer is replaced it will probably fail again. There are currently only 3 spare transducers of this type. The spares can best be used for GH2 outlet pressure measurements which occasionally fail in other engine locations. CONCLUSION: To preclude the depletion of spares, OV-099 will be flown without the SSME 2 GH2 outlet pressure measurement until a new installation design is available. CORRECTIVE_ACTION: A design change to relocate the transducer is in process. The transducer has been replaced with a plug which will be leak checked prior to flight. CAR ANALYSIS: This is a repetitive type failure. Corrective action is to delete the sensor on SSME-2 on all vehicles.

EFFECTS_ON_SUBSEQUENT_MISSIONS: This measurement will not be available for a backup in the event engine data are lost.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:05:40	Problem	**FIAR** EE0610F, EE0614F	**IFA** STS-51F-V-04	CCTV
None	**GMT:** 211:02:40		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Payload Bay Black And White TV Camera "A" Far Field Focus Failed And The RMS Wrist TV Camera Had A Bright Spot In The Middle Of The Video. (GFE)

Summary: DISCUSSION: The payload bay black-and-white TV camera "A" focused only on near field objects and was unable to focus on distant objects. During the tile survey, a bright spot was noted in the middle of the video on the RMS wrist TV camera. The bright spot is caused by excess gas building up inside the SIT (silicon intensified target) imaging tube. The spot is removed by extended camera operation with no light input (bakeout).

Both TV cameras have been removed and will be replaced. TV camera "A" was given to the vendor at KSC for failure analysis and the results will be tracked on FIAR JSC EE610F. The RMS wrist TV camera SIT tube was baked out at KSC without success. The camera was shipped to JSC for additional bakeout and failure analysis. Results will be tracked on FIAR JSC EE614F. CONCLUSION: Cause of the far-field focus problem is unknown on payload bay black-and-white TV camera "A". The bright spot in the video on the RMS wrist TV camera was caused by excess gas build-up in the SIT tube. CORRECTIVE_ACTION: Both cameras have been removed from OV-099 and will be replaced. Failure analysis on TV camera "A" is underway at the vendor and will be reported on FIAR JSC EE610F. Bakeout of the SIT tube for the RMS wrist TV camera will continue at JSC and results will be reported on FIAR JSC EE0614F. FIAR ANALYSIS: Television cameras are GFE to the Orbiter and not tracked in the Rockwell failure reporting system. However, they are tracked in the NASA failure reporting system. In this case, the lack of focusing control in camera "A" is being tracked under FIAR EE0610F and the bright spot in the middle of the wrist camera is being tracked under FIAR EE0614F.
EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-51F-V-05	BFS
None	**GMT:** Prelaunch		**SPR** None	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Backup Flight System "Store Protect" Error Logged During TMBU Uplink Processing. (FSW)

Summary: DISCUSSION: A "store protect" occurred in the BFS about the same time that a patch was being incorporated for the left solid rocket booster yaw axis rate gyro assembly problem prelaunch. The "store protect" error was due to an uplinked TMBU (table maintenance block update) for a FDA (fault detection annunciation) low-limit

set that was sent in error and contained a negative displacement in the second command word. Following the "store protect" error, the uplink process cleared the two-stage command buffer and set the "GPC-VALIDITY-UPLINK-PROCESS-SKIPPED" bit. Since it was not known whether the BFS (backup flight system) protected memory was affected, the BFS was reinitialized, which resulted in a countdown recycle and a delayed launch.

CONCLUSION: The BFS "store protect" error was caused by an uplinked TMBU, which was not properly coded. CORRECTIVE_ACTION: 1. A modification to the uplink software will be made which tests for a negative displacement on the TMBU loads and reports back a "NUMBER-OUT-OF-BOUNDS" error for negative displacements. This error checking will be incorporated into future software source builds (017C(Centaur), 018, and 019). A patch has been incorporated into the current software (016 and 017). 2. SSD (Spacecraft Software Division) has initiated an audit to identify any areas in the uplink program where incorrect uplink information could not be detected. 3. The TMBU program used by the MOD (Missions Operations Directorate) DPS (data processing system) support area to generate these uplinks will be modified to simultaneously generate the equivalent MOC (mission operations computer) command bad. This will allow a direct comparison between the off-line TMBU and the final MOC load that is sent to the vehicle. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:05:00	Problem	**FIAR**	**IFA** STS-51F-V-06	OMS/RCS
None	**GMT:** 212:02:00		**SPR** 26F003	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Right RCS Thruster R1R Injector Heater Failed And Thruster Leaked Fuel After Hot Fire. (ORB)

Summary: DISCUSSION: At approximately 212:02:00 G.m.t., the right RCS (reaction control system) primary thruster R1R injector heater failed off. The temperature stabilized at about 55 deg F for oxidizer. The thruster was reprioritized to number 1 to assure its use and thereby raise the temperatures.

At approximtely 213:00:30 G.m.t., during PDP (plasma diagnostics package) deployment operations, the right RCS thruster R1R was fired and began leaking fuel. At a fuel injector temperature of 27 deg F, the thruster was manually deselected to preclude further firings. Thruster R1R was annunciated "fail leak" when it reached the 20 deg F redundancy management limit. The fuel leak ceased after approximately 5 hours and the temperature returned to a stabilized value, maintaining less than 5 deg F difference between the fuel and oxidizer. The thruster remained deselected and was placed in the last priority until entry. Prior to entry, the thruster was reselected, but was maintained in the last priority. During entry, the thruster was fired several times without any subsequent leak indication. CONCLUSION: The right RCS thruster R1R heater failure most probably resulted from a failed solid-state heater controller. The right RCS thruster R1R fuel leak was most probably caused by contamination in the injector valve seat that subsequently cleared. CORRECTIVE_ACTION: 1. The right RCS R1R thruster was removed and the heater, sensor and controller were replaced at KSC. The heater, sensor and controller were returned to the vendor for failure analysis and will be tracked by CAR 26F003. 2. The right RCS R1R thruster

will continue to be monitored for leakage. The thruster will be flown as is if leakage does not recur after heater, sensor and controller replacement. CAR ANALYSIS: Most probable cause was fractured heater/sensor element wire on this thruster (manufactured with TAYCO heater). Welding distorts the heater which is subsequently straightened in a mandrel and cradle. Straightening breaks the leads. Corrective action has eliminated the need to straighten the heaters.
EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-51F-V-07	SRB
None	**GMT:** Prelaunch		**SPR** 26F00	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Left Solid Rocket Booster Yaw Axis Rate Gyro Assembly 3 Failed Hardover Subsequent To Prelaunch Torque Check. ()

Summary: DISCUSSION: At approximately 210:17:28 G.m.t., the left SRB (solid rocket booster) yaw RGA (rate gyro assembly) failed hardover subsequent to the torque check. The RGA has an output varying from -6 to -10 deg/sec. The LCC (Launch Commit Criteria) requires all compensated SRB RGA rates to be between -0.45 and +0.45 deg/sec. The deselection of this RGA in both primary avionics and backup flight systems allowed the LCC to be waived for this failure. The SRB's were recovered and troubleshooting at KSC repeated the hardover failure. Further troubleshooting has indicated the failure was caused by a ceramic capacitor which failed to a hard short. The failed SRB RGA is S/N 057, position 17LC. This was the first use of this S/N RGA.

CONCLUSION: The failure in the left SRB yaw RGA was isolated to a hard short failure in a ceramic capacitor. CORRECTIVE_ACTION: The left SRB yaw RGA has been removed and replaced. CAR ANALYSIS: Capacitor failure is believed to be caused by flux entering the capacitor package and carrying tin residue with it. The tin caused a bridging of the end terminations. No corrective action is planned because no other failures of this nature have occurred.
EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51F-V-08	DPS
None	**GMT:** 212:18:37		**SPR** None	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Intertial Attitude Rates Transferred From SM GPC To Spacelab In Wrong Sequence. (FSW)

Summary: DISCUSSION: During the evaluation of the SPACELAB IPS (Instrument Pointing System) experiment anomalies, it was determined that the orbiter attitude

rates were sent to the Spacelab in an XYZ order rather than as expected in the YZX order. The XYZ order corresponds to roll, pitch and yaw, respectively. It was also noted that the antenna management uses these attitude rates and expects them in the YZX sequence. These rates are used in updating the line of sight vector used by the Ku-Band antenna to point to TDRS (tracking and data relay satellite). Therefore, if any of the attitude rates are non-zero (occurs when the orbiter is in a maneuver), the calculation of line of sight will be in error. Since the TDRS does not currently support angle tracking of the forward link, the Ku-Band antenna is pointed open-loop by the GPC for all communications tracking operations. The antenna pointing will be degraded as a function of Orbiter body rate. Depending on the return link mode, Comm link dropouts may occur when the pointing vector errors exceed one degree. The S-band antenna software also uses these body rates to select the active antenna. The error in line of sight vector will have minimal impact on the selection of the active antenna.

CONCLUSION: The uplinked GMEM patch (MRAS A51F-921) corrected the sequence being sent to Spacelab and no further problems occurred in the transition of body rates to spacelab. The effects on the antenna management software were minimal for this mission. CORRECTIVE_ACTION: The problem will be corrected for flight STS-61A per DR 63177. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:21:00	Problem	**FIAR** EE0612F	**IFA** STS-51F-V-09	CCTV
None	**GMT:** 212:18:00		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: CCTV Monitor 1 Picture Quality Was Poor And Monitor 2 Had A White Spot In The Middle. (GFE)

Summary: DISCUSSION: The crew found that CCTV monitor 1 had poor picture quality particularly at high contrast. The crew used CCTV monitor 2 at high contrast to direct and evaluate solar astronomy experiments through the instrument printing system. The crew reported that there was a white spot in the middle of the monitor.

Postflight troubleshooting found that both monitors performed within specifications but that the picture was of poor quality on monitor 1 at high contrast. The white spot could not be found on monitor 2 and was probably in the solar astronomy video. Monitor 1 was removed and replaced. Checkout of monitor 2 was normal and the monitor was reinstalled on OV-099. Evaluation of CCTV monitor 1 performance will be tracked on FIAR JSC EE612F. CONCLUSION: Picture quality on CCTV monitor 1 was poor at high contrast but monitor performance was within specification. The white spot seen in the middle of CCTV monitor 2 was probably in the solar astronomy video. CORRECTIVE_ACTION: CCTV monitor 1 was removed and replaced. Performance evalaution will be tracked on FIAR JSC EE0612F. FIAR ANALYSIS: Television monitors are GFE to the Orbiter and not tracked in the Rockwell failure reporting system. However, they are tracked in the NASA failure reporting system. These monitors are being tracked in the NASA system on FIAR EE-0612F. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR EE0611F	IFA STS-51F-V-10	CCTV
None	GMT:		SPR	UA	Manager:
			IPR	PR	
					Engineer:

Title: Payload Bay Color TV Camera "D" Lost Sync And The Camera Had A White Spot In The Middle Of The Video. (ORB)

Summary: DISCUSSION: After payload bay color TV camera "D" lost sync on flight day 3, the binary GMT display was reduced to a white line, the overtemp was high, GAMMA and ALC cycled every second and the iris did not fully close. The problem was cleared by a power cycle and camera operation returned to normal. The white spot was caused by excess gas building up inside the SIT (silicon intensified target) imaging tube. Extensive camera operation with no light input (bakeout) is used to remove the spot.

TV camera "D" was removed from OV-099 and the white spot was baked out of the SIT tube at KSC. Bench testing confirmed normal camera operation. TV camera "D" will be reinstalled and checked out on OV-099. CONCLUSION: Cause of the sync loss on payload bay color TV camera "D" is unknown and camera operation continues to be normal. The white spot on the video of camera "D" was caused by excess gas buildup in the SIT tube. CORRECTIVE_ACTION: TV camera "D" was removed from OV-099 and the white spot was baked out of the SIT tube. Normal camera operation was confirmed. The camera will be reinstalled and checkout out on OV-099. FIAR ANALYSIS: Television cameras are GFE to the Orbiter and not tracked in the Rockwell failure reporting system. However, this problem is being tracked in the NASA system under FIAR EE0611F. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET: 002:11:00	Problem	FIAR	IFA STS-51F-V-11	Atmospheric
None	GMT: 213:08:00		SPR 26F004	UA	Revitalization Subsytem
			IPR	PR	Manager:
					Engineer:

Title: Smoke Detector 2B In Avionics Bay 2 Failed Self Test. (ORB)

Summary: DISCUSSION: At approximately 213:08:00 G.m.t., during the lamp and fire suppression test, smoke detector 2B failed the self test. Detector 2A, the redundant sensor in the same avionics bay, functioned properly during the self test and there was no impact to the mission.

The smoke detector will be replaced at KSC. CONCLUSION: The cause of the smoke detector failure awaits failure analysis. CORRECTIVE_ACTION: The smoke detector will be replaced and returned to the vendor for failure analysis, which will be tracked on CAR 24F004. CAR ANALYSIS: Teardown test and evaluation at the vendor determined that the failure was due to an overtemp lubricant failure. Corrective action is undetermined at this time. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 003:17:08	Problem	**FIAR**	**IFA** STS-51F-V-12	OMS/RCS
None	**GMT:** 214:14:08		**SPR** 13F001	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Right OMS Crossfeed-B Fuel-Valve Open-Position Microswitch Failed. (ORB)

Summary: DISCUSSION: At approximately 214:14:08 G.m.t., during the right OMS (orbital maneuvering system)-to-RCS (reaction control system) interconnect, the right-OMS crossfeed-B fuel-valve onboard-position indication showed barberpole (miscompare). The downlink telemetry indicated the proper valve position (commanded open). In addition, MCA (motor control assembly) 2 status 1 indicated that the valve was driving after the valve had opened. Thus the valve control switch was placed in GPC (general purpose computer) to prevent continuous power from being applied to the valve. There was no further mission impact.

Postflight, the valve actuator (containing the position microswitch) will be removed and returned to the vendor for failure analysis. A replacement actuator, which has microswitches that have been PIND (particle induced noise detection) tested, will be installed. CONCLUSION: The right OMS crossfeed-B fuel-valve open-position failure was most probably caused by a failed or contaminated microswitch. CORRECTIVE_ACTION: The OMS crossfeed-B fuel-valve actuator (containing the failed microswitch) 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: This and many other switch problems is attributed to conductive and nonconductive particles floating within the switch containers in zero G. Problem switches are being replaced as replacement switches (without contaminants) become available. EFFECTS_ON_SUBSEQUENT_MISSIONS: None pending failure analysis.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:21:06	Problem	**FIAR** HEN-0053F	**IFA** STS-51F-V-13	OI - Recorders
None	**GMT:** 213:18:06		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Operations Recorder 2 Track 6 Malfunctioned. (GFE)

Summary: DISCUSSION: On flight day 4 when the OPS-2 recorder was dumped through TDRS, track 6 would not lock bit sync. Track 6 data on two subsequent dumps

were also unreadable but the track 7 and 5 data dumps were operational. Later the OPS-2 track 6 data were dumped through TDRS at one-to-one ratio and the data was readable.

Postflight the recorder was removed from OV-099 and dumped at KSC. JSC testing found data dumped on track 7 could not be bit synced at either high (5-to-one ratio) or low speed, confirming a variation in the quality of the tracks on the tape. The recorder and tape will be returned to the vendor for troubleshooting and repair after a recorder maintenance contract has been negotiated. There are currently 2 spare OPS recorders in inventory, excluding the replacement recorder on OV-099. The failed recorder is the second one awaiting maintenance by the vendor. Failure analysis will be tracked on FIAR HEN 0053F. CONCLUSION: Cause of the OPS-2 track 6 malfunction is unknown. CORRECTIVE_ACTION: The OPS-2 recorder on OV-099 has been removed and replaced. Failure analysis will be tracked on FIAR HEN 0053F. FIAR ANALYSIS: The OPS recorders are GFE to the Orbiter and not tracked in the Rockwell failure reporting system. NASA is tracking fault isolation, failure analysis and repair on FIAR HEN 0053F. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-51F-V-14	OMS/RCS
None	**GMT:** Postlanding		**SPR** 13F001	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Right OMS Crossfeed-A Fuel-Valve-Open Microswitch Failed. (ORB)

Summary: DISCUSSION: Postlanding, at approximately 218:19:55 G.m.t., the right OMS (orbiter maneuvering system) crossfeed-A fuel-valve position read open when the valve was closed. This is indicative of a failed or contaminated valve-position microswitch.

The crossfeed valve actuator, containing the position microswitches, will be removed and returned to the vendor for failure analysis. A replacement actuator, which has microswitches that have been PIND (paritcle induced noise detection) tested, will be installed. CONCLUSION: The right OMS crossfeed-A fuel-valve open-position failure was most probably caused by a failed or contaminated microswitch. CORRECTIVE_ACTION: The OMS crossfeed-A fuel-valve actuator, containing the failed microswitch, 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: This and many other switch problems is attributed to conductive and nonconductive particles floating within the switch containers in zero G. Problem switches are being replaced as replacement switches (without contaminants) become available. EFFECTS_ON_SUBSEQUENT_MISSIONS: None pending failure analysis.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-51F-V-15	TPS
None	GMT: Postlanding		SPR None	UA	Manager:
			IPR	PR	
					Engineer:

Title: TPS Damage During Ascent. (ORB)

Summary: DISCUSSION: During the post-launch pad inspection, a piece of SOFI (spray-on foam insulation) that apparently came from the external tank was found. An inspection of the beach area near the launch pad revealed additional pieces of ET-SOFI. An on-orbit tile survey was conducted to determine the extent of possible damage to the Orbiter. The inspection showed a large number of small-diameter tile hits similar to the damage observed post-flight on STS 51-G. No tiles were missing, and there was no concern for entry with the damage observed.

The postflight inspection showed that there were a total of 553 debris hits of which 226 were greater than or equal to 1 inch in diameter. Most impact craters showed the affect of entry heating. This is the largest number of debris hits on any Orbiter flown. Review of ET separation films showed a number of large divots in the SOFI of the ET inter-tank area a piece of SOFI was found lodged in the structure beneath the right-hand ET umbilical door. Some damage was expected due to a known problem with gas trapped between successive layers of insulation of the ET interstage. (See STS-51G-11). CONCLUSION: The Orbiter debris damage was caused by insulation shed from the ET during ascent. The tank flown on this mission was the last of a series of tanks using a bonding resin which was not treated to stabilize its pot life. CORRECTIVE_ACTION: Normal orbiter tile repair procedures will be utilized to repair the debris damage. As a precaution, additional holes were drilled in the SOFI area of LWT-14 for STS 51-I and will be drilled in subsequent tanks. A design change to a one spray application of SOFI is planned for LWT-44. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-51F-V-16	OMS/RCS
None	GMT:		SPR 26F008	UA	Manager:
			IPR	PR	
					Engineer:

Title: Right OMS Ullage Pressure High. (ORB)

Summary: DISCUSSION: During the OMS-6 burn, an ullage pressure rise on the right pod indicated failure of the helium regulator to maintain control. The OMS-6 burn was performed using the B leg helium regulators, and the helium iso valves were in the GPC position. At the start of the burn, the ullage pressure was approximately 252 psia, slightly below the set point of the regulator. The pressure rose from 252 to 265 in the first 10 seconds of the burn at a flow rate indicating a failed open regulator.

After 10 seconds, the pressure rise ceased and the ullage pressure decreased for the remainder of the burn at a rate consistent with blowdown operation. Burns performed, both before and after the OMS-6 burn, using the B leg regulator were normal.

An open failure of both regulator stages requires action by the crew to close the helium isolation valves and terminate flow before excessive helium is lost overboard. Excessive ullage pressure is annunciated by a level II caution and warning alert. CONCLUSION: The B leg regulator (S/N 39) experienced an open failure during the OMS-6 burn. The regulator recovered and closed off flow at a pressure in excess of the normal lockup pressure of either the primary or secondary stage of the regulator. CORRECTIVE_ACTION: The regulator has been removed from the pod and will be returned to the vendor for failure analysis. Failure analysis will be tracked on CAR 26F008. CAR ANALYSIS: Unable to duplicate problem post-flight. Suspect that transient contamination in the regulator was cleared during the helium flow which occurred during the "stuck open" period. EFFECTS_ON_SUBSEQUENT_MISSIONS: None, pending results of the failure analysis.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-51F-V-17	OMS/RCS
None	**GMT:** Postlanding		**SPR** None	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Rough Starts For OMS Burns. (ORB)

Summary: DISCUSSION: The crew reported the onset of all OMS burns except the deorbit burn seemed very rough in comparison to OMS burn starts experienced during previous flights.

A thorough postflight inspection of the engines, injector plates, engine attach structure and OMS pod attach points showed no evidence of engine hard starts. The data for all OMS burns has been reviewed and compared with previous flights with no differences noted. A review of any sensitive vehicle acceleration data which would enable the comparison of the OMS start event has been completed with the following results: 1. Ascent ACIP data - OMS start transient evident but very small with no discernable difference from previous flights. 2. Ascent data from MADS Accelerometers in OMS pod - Same ignition transient and vibration levels as previous flights. 3. Payload Acceleration Measurements - Data was off scale during burn onset. Very sensitive accelerometers (i.e. plus/minus 5 millig's typical). 4. IMU Data - Data comparisons of selected OMS burns on STS 51-F and STS 51-I show no differences. Data are low sample rate and not usable to define ignition transients. The STS 51-I crew also reported the OMS starts felt more pronounced than during previous flights. In addition they experienced a jolt during external tank separation which was greater than what they experienced before. A structural review has identified a possible cause of the rough OMS starts on OV-099. The crew module, by design, is isolated from the foward fuselage structure. Part of the isolation hardware includes 4 adjustable stabilizing links (2 R.H. and 2 L.H.) which span the space from the crew module to forward fuselage structure in the lateral direction at the flight deck floor level at fuselage station = 475 and 575. If one or more of these links were slightly loose, while

there would be no structural concern, it could result in a jolt at OMS ignition or ET separation which may be felt by the crew. During the build-up of OV-103 the stabilizing links were loose due to the rotation of an excentric bolt which provides for link adjustment. A fix which incorporates a locking feature for the excentric bolt has been worked for OV-103 but not OV-099. CONCLUSION: A thorough engine inspection and OMS data review has produced no evidence indicating abnormal OMS engine performance. A possible explanation of the rough OMS starts and ET separation on OV-099 is a loose forward fuselage/crew module stabilizer link. The links will be inspected prior to STS 51-L. The cause of the events reported by the OV-103 crew is unknown. CORRECTIVE_ACTION: The MADS and ACIP data will be recorded during some OMS burns for the next OV-099 flight (STS 61-A). The crew module stabilization linkages will be inspected prior to STS 51-L. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:08:14	Problem	**FIAR**	**IFA** STS-51F-V-18	D&C - Lighting
None	**GMT:** 211:05:14		**SPR** None	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Payload Bay Forward-Bulkhead Floodlight Exhibited Faulty Start. (ORB)

Summary: DISCUSSION: During orbit operations at approximately 211:05:14 G.m.t., the crew reported that the payload bay forward-bulkhead floodlight flickered but did not come on. A series of fail-to-start transients (7 amperes) was present on main bus B during the time period that power was applied. Later at 211:15:40 G.m.t., the crew reported that the floodlight was working. This was again confirmed at 212:02:19 G.m.t., and the bus B current strip-chart signatures were normal for floodlight operation. There was no further problem with the forward-bulkhead floodlight operation.

The floodlights require the application of power for about 3 minutes to consistently turn on. Sometimes the floodlights will flash during this turn-on period. Postflight data review indicates that the crew applied power for 10 minutes and during this time period there was evidence of arcing as exhibited by numerous startup-current transients on main bus B. During postflight troubleshooting, the forward-bulkhead floodlight operation was normal and all PCA (power control assembly) current traces were nominal for proper operation. CONCLUSION: The cause of the faulty start-up of the payload bay forward-bulkhead floodlight was most probably intermittent arcing. CORRECTIVE_ACTION: The payload bay forward-bulkhead floodlight will be removed and replaced prior to a flight requiring its use when a replacement unit becomes available. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51F-V-19	MECH
None	**GMT:**		**SPR** 26F009	**UA**	**Manager:**
			IPR	**PR**	

Engineer:

Title: Airlock Hatch "A" Difficult To Latch For Entry. (ORB)

Summary: DISCUSSION: The crew reported difficulty seating and closing the airlock hatch for entry. After repeated attempts to seat the hatch, the hatch hinge pins were removed and the hatch was able to be positioned properly and locked in place.

Postflight hatch operations repeated the flight problem. An inspection showed the lower hinge pin and a pointer were damaged. The pointer is a device which assures the hatch has been properly positioned prior to its rotation to the open position. CONCLUSION: Damage to the hatch mechanism caused the hatch to be difficult to close prior to entry. The damage most probably occurred when the hatch was operated on the ground without the GSE support hardware. CORRECTIVE_ACTION: The damaged pin has been replaced and the pointer straightened. Ground procedures will be changed by RCN OV 6882 to require an inspection and rigging check if the hatch is opened on the ground without the GSE support hardware. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-51F-V-20	GN&C
None	**GMT:**		**SPR** None	**UA**	**Manager:**
			IPR	**PR**	

Engineer:

Title: Digital Autopilot Downmoded To Manual During Maneuver To Entry Interface Attitude. (ORB)

Summary: DISCUSSION: While maneuvering to the entry interface-5 (EI-5) attitude, the crew noted that the DAP (digital autopilot) had moded to manual. The crew reinitiated the auto maneuver, after which the DAP once again reverted to the manual mode, terminating the maneuver. The crew then manually maneuvered to the entry attitude, after which the auto mode worked correctly.

Data analysis indicated that the first downmode was caused by a very short movement of the pilot's RHC (rotational hand controller). The commander then maneuvered to approximately the desired attitude. Three minutes later, the DAP was placed in auto. Some rather large (4-deg roll, 4-deg yaw) attitude errors developed; but since these errors were within the deadband, the errors were not of sufficient magnitude to require a DAP response. Six minutes later, a roll input was made on the commander's RHC causing the DAP to downmode to manual. The attitude then drifted outside the deadband. The auto switch was again depressed, causing the DAP to mode to auto, but no keyboard input (item 27 execute) was made to cause the DAP to track the desired attitude. The Commander then maneuvered back to the desired attitude, engaged auto, and subsequent operations were normal. CONCLUSION: The DAP operated normally. CORRECTIVE_ACTION: SMS training will place increased emphasis on the TRANSDAP phases. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-51F-V-21	D&C
None	GMT:		SPR 26F010	UA	Manager:
			IPR	PR	
					Engineer:

Title: Right Display Driver Unit Data Good Bit Toggled. (ORB)

Summary: DISCUSSION: At approximately 218:19:09 G.m.t. during entry, it was reported that the right DDU (display driver unit) good bit was toggling. The "DDU Good" is a bite bit set by checking DDU circuit levels and the "E" power supply within the DDU. The crew was advised that the right-side instrumentation was suspect. However, at approximately 218:19:34 G.m.t., the bit returned which showed that the right DDU was good. Review of the onboard recorded data confirmed that the bite bit was toggling and the indication was not the result of a communications problem.

CONCLUSION: The most probable cause is an intermittent problem in the "E" power supply at the right DDU. CORRECTIVE_ACTION: Remove and replace. Reference CAR 26F010. CAR ANALYSIS: Troubleshooting between Collins and SAIL has isolated the intermittent problem to a section of the DDU. The unit is currently at Collins awaiting failure analysis and the CAR is open (9-12-86). Point of contact is Dave Smith, RI/DNY, extension 1973.
EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-51F-V-22	CREW
None	GMT:		SPR C) 26F011	UA	Manager:
			IPR	PR	
					Engineer:

Title: Miscellaneous Crew Equipment/Interface Problem Items. (ORB)

Summary: DISCUSSION: A. Galley door latch pin fell out on orbit. The pin was replaced at KSC. The pin is a press fit and will be spot welded on a target of opportunity basis to improve retention.

B. Overhead IMU filter access panel M04258F retainer screw sheared. The crew reported that the screw sheared when it was removed on orbit. The screw was replaced at KSC. Overhead access panel fasteners will be changed to a hand operated design for easier IFM access to the filters. Estimated hardware delivery to KSC is on 5/2/86. C. Volume G door under aft lockers opened during launch. KSC has assured closure of the volume G door. Design changes to improve closure during launch and reclosure on orbit are estimated for hardware delivery at KSC on 5/9/86. D. Velcro debonded on window 9 and 10 shades while on orbit. The velcro was rebonded in

place at KSC. E. Left air data probe switch looked out of detent prior to probe deployment during entry. KSC verified that the lever lock holds the switch in the aft position. F. Filters were clogged behind panels L10, 11 and 12 when cleared by crew on orbit. All filters will be cleaned again at KSC before next launch. A proposed change authorizes improvements to structural panels so that easier access will be allowed to the avionics air filter screens. CONCLUSION: See above. CORRECTIVE_ACTION: See above. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE