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

STS - 1, OV - 103, Columbia (1) **Time:04:33:PM**

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** -003:21:46	Problem	**FIAR**	**IFA** STS-1-V-01		TCS
	GMT: 100:09:47		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Thermal Control System (TCS) heaters exhibited potential "creep" failures. (ORB)

Summary: DISCUSSION: Thermostatically controlled heaters/instrumentation at 11 locations exhibited anomalous or unexpected performance on the flash evaporator system (FES) feedwater zone 4 STBD 1 system, the auxiliary power unit (APU) no. 1 fuel feedline system B, the orbital maneuvering system (OMS) crossfeed high point fuel bleed line in aft and midfuselage system A and the OMS aft O2 low point drain line, the APU no. 3 primary secondary H2O cooling system A and gas generator (GG) injector water cooling system, and the RCS fuel and oxidizer forward panel heaters.

A bimetallic disc in each thermostat flexes because of temperature with a minimum acceptance dead band of 6? F. The discs are sensitive to the rate of change in temperature and may flex only partially at low rates resulting in a reduced dead band. The concern was that dithering at the lower or upper limit of the maximum allowable dead band could potentially result in exceeding limits on system fluid lines since the heat losses caused by brackets, supports, and couplings required a non-uniform distribution of heater wire and therefore non-uniform temperature distribution. Postflight analyses have shown that dithering thermostats result in temperatures within the range experienced by the system when the maximum allowable deadband is applied. An evaluation has been performed on all other thermostats to determine whether a temperature limit would be exceeded should dithering occur and in all cases, the temperatures remained within limits. CONCLUSION: Dithering thermostats provided acceptable system temperatures. CORRECTIVE_ACTION: None EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** -003:23:30	Problem	**FIAR**	**IFA** STS-1-V-02		DPS
	GMT: 100:11:31		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Interface timing skew between primary and backup computer software during countdown. (ORB)

Summary: DISCUSSION: The primary avionics software system (PASS) was found to be initiating communications with the network signal process (NSP) 40 milliseconds earlier than the backup flight system (BFS) expected. A timing skew can occur on approximately 2 percent of the first PASS general purpose computer (GPC) initializations.

CONCLUSION: At primary software initialization (IPL), a one cycle skew was introduced into the phasing of the NSP I/O timing interface preventing the BFS from synchronizing with the PASS. CORRECTIVE_ACTION: Verify proper phasing following IPL of first GPC. ---------- Action Progress : An operations (OPS) program note, dated 4/11/81, titled "Cycle Shift in Phase Scheduled Process" defined how to verify proper phasing of processes and Input/Output (I/O) in the PASS following initialization of the first GPC. EFFECTS_ON_SUBSEQUENT_MISSIONS: No effect.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** 000:00:00	Problem	**FIAR**	**IFA** STS-1-V-03	AIRLOCK
	GMT: 102:12:01		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: The airlock-to-payload bay differential pressure sensor did not respond to changes in the payload bay pressure. (ORB)

Summary: DISCUSSION: The pressure sense port to the payload bay was found capped.

CONCLUSION: Sense port was capped. CORRECTIVE_ACTION: A revised cap with vent port is being provided for STS-2 and subsequent. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** 000:00:09	Problem	**FIAR**	**IFA** STS-1-V-04	DPS
	GMT: 102:12:10		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Built-In-Test Equipment (BITE) discrete on dedicated signal conditioners (DSC) OF1 and OF4. (ORB)

Summary: DISCUSSION: Crew reported circuit breaker 2 on panel 15 was open. DSC's continued to operate properly by obtaining power from internal redundant power

supplies.

Post-mission troubleshooting isolated a short in DSC OF1. Failure analysis at the manufacturer's plant revealed that a paper clip shorted a point in the 28-volt supply line EMI filter to the case. Cards were removed from the failed box and installed in a box originally assigned to OV-099. This unit will be installed in OF1slot on OV-102. CONCLUSION: Short caused by paper clip in power supply. CORRECTIVE_ACTION: Power supply to be recycled and placed in inventory. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:02:39	Problem	**FIAR**	**IFA** STS-1-V-05		DPS - EIU
	GMT: 102:14:40		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Improper engine interface unit (EIU) port bypass indication during EIU powerdown following main engine cutoff (MECO). (ORB)

Summary: DISCUSSION: The EIU is the interface assembly between the general purpose computer (GPC's) and the main engine controllers. When the EIU's are power down, bypass conditions are expected on EIU ports 1 and 4. However, at 102:14:40 G.m.t., EIU 3, port 1 was bypass, port 4 was not, and no ports were bypassed on EIU's 1 and 2. The redundancy management data indicated that both PASS and backup flight system had the same port bypass indications.

Main engine controller 3 power was turned off within a vehicle data table (VDT) transmission to EIU 3, causing the EIU to reset which in turn caused PASS/BFS to baypss EIU 3. However, EIU's 1 and 2 were not bypassed because power was turned off when no VDT was being transmitted. CONCLUSION: Condition can vary as a function of data activity at the time of power down. This condition occurs after main engine shutdown and has no effect on performance. CORRECTIVE_ACTION: None required. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:00	Problem	**FIAR**	**IFA** STS-1-V-06		MPS
	GMT: 102:12:00		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Main propulsion system GH2 outlet temperature vent off-scale high (V41T1261A) and outlet pressure vent off-scale low (V41P1260A) for the left no. 2 Space

Shuttle main engine (SSME). (ORB)

Summary: DISCUSSION: The no. 2 SSME GH2 temperature and pressure transducers operate in a vibration environment that is more severe than their qualification level. There is a history of failure in the main propulsion test article (MPTA) due to vibration. During STS-1, both measurements were lost between 102:12:00:38 and 102:12:01:35 G.m.t.

Post-mission troubleshooting verified that both transducers failed. The pressure transducer was removed and replaced. The temperature transducer was removed and will be replaced as soon as a spare becomes available. CONCLUSION: Vibration levels exceeded qualification levels rendering both transducers inoperative. CORRECTIVE_ACTION: For STS-2, remove and replace both transducers. Also for STS-2, the temperature transducer will remain in its present location since this location is the most benign in the area. For STS-3, the pressure transducer is to be relocated to an area that has less vibration. EFFECTS_ON_SUBSEQUENT_MISSIONS: These two measurements act as backup to other MPS and SSME data and are not considered critical measurements.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:10	Problem	**FIAR**	**IFA** STS-1-V-07		OMS/RCS
	GMT: 102:12:10		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: OMS Quantity Gaging System Was Sticking During Flight And Right Fuel Probe Was Found Broken Postflight. (ORB)

Summary: DISCUSSION: Sticking of the OMS fuel gages at the start of each OMS burn was due to improper venting in the head of the forward fuel probes. Sticking of the right-hand fuel and oxygen gages at the start of OMS-5 was due to improper drainage in the aft end of the forward probes.

After the right OMS fuel tank was removed, the glass in the probe was found to be broken. The failure occurred postflight at the HMF due to a flaw in the glass. A broken probe glass will not allow propellant leakage, and there is no material compatibility problem. CONCLUSION: Vent openings in the upper and lower ends of the gaging probes are not large enough to prevent capillary action from retaining fluid. Right fuel probe failure was caused by a flaw in the glass. CORRECTIVE_ACTION: Replacement right fuel probe on STS-2 has enlarged vent holes in the head. Future probes wil have enlarged vent holes. Probes glass screening will be improved for detection of flaws. CAR Analysis: Post-flight evaluation concludes that sticking was caused by the fuel probe and vent provisions were not adequate for a .06G OMS burn acceleration. The replacement probe has an added vent hole. All probes on OV-099 and OV-103 will incorporate the vent hole. Additionally, probes for OV-103 will incorporate larger drain holes. Probe breakage was caused by a flaw in the probe surface which was aggravated by rework thermal cycles and continued to grow after exposure to MMH. The fracture process was slow indicating that impact was not the cause of fracture. The failure is considered unique to this particular probe. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: OMS forward probes will stick at start of OMS maneuver until vent hole size is

enlarged.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-1-V-08		INS
	GMT: Prelaunch		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The Development Flight Instrumentation/Pulse Code Modulation (DFI/PCM) Recorder Could Not Be Turned Off. (ORB)

Summary: DISCUSSION: Available data indicated that the recorder was not responding to normal controls. The recorder circuit breaker was activated in an attempt to record entry data.

The DFI PCM recorder was returned to the vendor from JSC for evaluation of the failure to transition from continuous record to the high sample rate mode in response to the Orbiter mode switch position change. After removal of the tape transport assembly from its sealed enclosure, it was determined that the tape had become slack as the result of the gears in the tape tensioning system being jammed by a loose shim. The shim was an extra part that had apparently fallen into the reeling assembly at the time the flight tape was installed by the vendor. After removal of the shim and verification that the gear teeth had not been damaged, the recorder was reassembled and functionally tested. It was determined that approximately 31 minutes of prelaunch and ascent phase data was successfully recorded prior to the failure. The failure prevented any subsequent recording of data. CONCLUSION: The tape tensioning mechanism was jammed by a loose shim washer. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:01:49	Problem	**FIAR**	**IFA** STS-1-V-09		TPS
	GMT: 102:13:50		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Tile Failure On OMS Pod. (ORB)

Summary: DISCUSSION: During STS-1, approximately 16 segments (2.5 in. by 2.5 in.) of undensified diced tiles were lost during ascent. These diced tiles, unlike the diced tiles elsewhere, were diced after they had been installed. No densified tiles were lost.

Undensified tiles on the OMS pod are being replaced by densified tiles, and no further dicing of tiles on the vehicle will be permitted. CONCLUSION: Problem was caused by the "on the vehicle" dicing procedure where a dull plastic knife is used to cut the RSI down to the SIP. This can cause local delamination around each diced segment which propagates into total segment failure when the maximum dynamic pressure of ascent is experienced. CORRECTIVE_ACTION: No further dicing of tiles on vehicle. Tiles on OMS pod are to be densified. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:04	Problem	**FIAR**	**IFA** STS-1-V-10		FC/PRSD
	GMT: 102:12:05		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The O2 manifold pressures were about 100 to 125 psi low compared to tank pressure during ascent on the power reactant storage and distribution subsystem (PRSD) for the fuel cells. (ORB)

Summary: DISCUSSION: The O2 manifold pressure (V45P1145A and V45P1140A) started dropping relative to tank pressure soon after lift-off, reaching a maximum difference 5 minutes later. At lift-off plus 10 minutes, manifold pressures had recovered to within 10 to 20 psi of tank pressure as expected for normal operation.

Postflight tests at Beech Aircraft showed the pressure shift to be caused by the thermal chill down transient on the O2 manifold pressure transducers. A standoff similar to the H2 sensor design provided proper temperature compensation for the O2 sensors. CONCLUSION: Instrumentation problem due to inadequate thermal isolation of the O2 manifold pressure transducers. CORRECTIVE_ACTION: Stand-off for the O2 manifold pressure transducers will be incorporated into STS-5 and subsequent. EFFECTS_ON_SUBSEQUENT_MISSIONS: No effect on STS-2 through 4. Incorporate fix for STS-5 and subsequent.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:06:06	Problem	**FIAR**	**IFA** STS-1-V-11		EPD&C - Hardware
	GMT: 102:18:07		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Aft main bus C current sensor (V76C3097) indicated open. (ORB)

Summary: DISCUSSION: The dc-to dc power converter in each current sensor has an input EMI filter. One of the three 100 microhenry chokes in the filter, L101 opened at lift-off plus 6 hr. This open choke disconnected the remainder of the current sensor from spacecraft power.

The standard practice for small chokes is to use a large enough wire to provide 500 to 1,000 circular mils per ampere. This choke's No. 40 wire carries 0.07 A and provides only 143 circular mils per ampere which could cause some heating. The heat would not dissipate in a vacuum due to the loss of convective cooling. The wire was found to be vaporized near one lead leaving a gap of 1/32 in. Vaporization would require current in excess of 1.77 A. Since this choke is marginally designed for weight saving, any crimping or narrowing of the wire at the lead could cause further heating to failure. Therefore, it is probable that the choke, as designed, is intolerant of any manufacturing errors such as over crimping the wire at the lead. CONCLUSION: Current sensor power input filter choke, L101, was found open. Overheating and vaporization of the choke wire was probably due to accidental over crimping and narrowing during manufacture combined with reduced heat dissipation in a vacuum. CORRECTIVE_ACTION: None required. Twenty-three similar units were flown on STS-1 without problems. CAR Analysis: Vendor failure analysis confirms the failure. Component design was factored with weight saving and any high off-limits operation will cause the failure described. In this case it is suspected that excessive wire crimping or narrowing of the lead could have caused overheating to failure. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 1	**MET:** 000:06:05	Problem	**FIAR**	**IFA** STS-1-V-12		OMS/RCS
	GMT: 102:18:06		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: OMS Gimbal Fault Indication (ORB)

Summary: DISCUSSION: A fault message occured during the irst gimbal profile test prior to OMS-3 maneuver at 102:18:06 G.m.t. The right OMS promary pitch actuator did not respond to the positive command, but did respond to the negative command. On the second test, the actuator did respond in both directions, but the extend rate was 0.9 deg/sec below the specified 3.2 deg/sec.

Postflight trouble-shooting of the Orbiter isolated the problem to the actuator. The problem was caused by: 1. The small gap between the armature and stator in the radial plane of the sctuator rotoe position synchronizer. 2. The axial dimensions of the motor/synchronizer interface permitted contact between the motor shaft and the synchro shaft at the dog coupling. 3. A cracked end-fitting mono-ball due to an excessive impact load during manufacturing buildup combined with the deflection intolerant design described in 1 and 2. The effect was: 1. Synchronizer rotor rubbed and impacted stator laminations. 2. Particulate contamination generated by rubbing/impact and becoming caught between rotor and stator. 3. Motor-to-synchronizer coupling damaged by motor shaft impactions, 4. Synchronizer armature windings slipped on shaft. It should be also noted that the secondary synchronizer showed the effects of rubbing between the rotor and stator. CONCLUSIONS: Excessively tight axial and radial tolerances in the actuator combined with a cracked end-fitting mono ball caused rotor/stator rubbing, impact, contamination and slipping of promary synchronizer windings. This in turn caused sluggish response and occasional jamming of moving parts in the actuator. CORRECTIVE ACTION: STS-2: Go with present design Subsequent vehicles and replacement actuators: Replace actuators with an improved design and a larger synchronizer air gap which will provide more clearance for dynamic deflections. A shorter double-dog motor-to-synchro coupleing and motor end bell modifications will provide additional axial clearance. ACTION PROGRESS:

STS-2: Replace with present design actuator. Subsequent vehicles and replacement actuators: Design and fabricate new shorter double-dog coupling from dc motor to rotor position synchronizer. Increase clearance gap between armature and rotor. Design motor end bell as a one piece unit and increase motor bearing shim shoulder. EFFECT ON SUBSEQUENT MISSIONS: Minor risk of mission success on STS-2. No catastrophic risk involved. Adequate redundancy exists in each actuator should the failure repeat. Further redundancy exists in the OMS pods themselves. Additionally, should both OMS pods become disabled, the RCS system could be used to compensate for the offset thrust vector.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:06:05	Problem	**FIAR**	**IFA** STS-1-V-12-A		GNC
	GMT: 102:18:06		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: OMS gimbal fault indication. (ORB)

Summary: DISCUSSION: The right OMS pitch actuator exhibited reduced rates in the extend direction on STS-1. The primary synchro rotor had rotated 15 degrees on its shaft. Excessively tight axial and radial tolerances in the actuator combined with a cracked end fitting monoball caused rotor/stator rubbing, impacts, contamination and slipping of the primary synchronizer windings. The failed unit was replaced with an existing design actuator for STS-2. All actuators operated within specification throughout the STS-2 mission.

An improved design with a larger synchronizer gap, a shorter double-dog coupling and a one piece rotor end bell has been made to resolve the STS-1 problem. Change out of the units on OV-102 was planned for the major? modification period. During STS-3 preflight testing the right OMS pitch actuator exhibited reduced rates from what was observed during the STS-2 flight. This problem was the result of improper finishing on a no back plate which caused excessive friction during the actuator operation. The actuator has been replaced with the STS-1 fixes incorporated. CONCLUSION: Tight tolerances resulted in an interference that caused the synchrorotor to rotate 15 degrees on its shaft during operations on STS-1. An improved design actuator has been qualified and improved units are available for installation on OV-102 when required. CORRECTIVE_ACTION: Because of a problem experienced during the checkout for STS-3 the unit was replaced with an improved design actuator. The remaining 3 OMS actuators will only be replaced if subsequent flight or ground testing result in the requirement to replace an actuator. CAR Analysis: Investigation, analysis, and corrective action concurs with the preceding. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:12:59	Problem	**FIAR**	**IFA** STS-1-V-13		Active Thermal Control
	GMT: 103:01:00		**SPR**	**UA**		Subsytem
			IPR	**PR**		**Manager:**

Engineer:

Title: Cabin temperature controller did not maintain selected temperature. (ORB)

Summary: DISCUSSION: The indicated cabin temperature was between 76?F and 83?F during the on-orbit operations. However, the crew reported cold cabin conditions during, and for a time after, the first sleep period.

During the first sleep period, starting at 103:01:00 G.m.t., the cabin equipment was powered down, thus allowing the cabin to cool down. At 103:01:21 G.m.t., the cabin temperature selector was moved from the 45-percent to the 52-percent position. Subsequently, the selector was moved to the 89-percent position (103:02:40 G.m.t.) and then to the 100-percent "full warm" position (103:03:42 G.m.t.). During this time, the cabin heat exchanger air outlet temperature decreased from 52?F to 45?F (lower sensor limit) indicating that the air bypass valve had moved from the "full cool" (no bypass) to the "full warm" (maximum bypass) position. Air outlet temperatures consistent with the full cool and the full warm bypass valve positions were determined from the data obtained when the bypass valve was pinned in these positions. Although the bypass valve was in the "full warm" position, the cold cabin condition existed. At the end of the first sleep period, the interchanger flowrate was reduced from 1038 to 712 lb/hr to warm the cabin (103:09:08 G.m.t.). However, the small decrease in cabin heat exchanger effectvieness due to the decreased water flowrate was offset by the cooler water temperatures from the interchanger. Reduction of the interchanger flowrate from 1038 to 712 lb/hr resulted in the interchanger water outlet temperature being decreased from 41?F to 38?F. After the first sleep period, the cabin temperature control selector had been placed in the full cool position. Again, in an attempt to warm the cabin, the selector was moved to the 23-percent, 49-percent, and finally 100-percent "full warm" position at 103:15:08 G.m.t. By this time, the cabin temperature sensor, which is biased hot due to its proximity to powered avionics, was above the control temperature of the "full warm" selector position. With the sensor temperature above the control setting temperature, the cabin heat exchanger bypass valve remained in the "full cool" position. The simultaneous "full warm" position of the cabin temperature selector and "full cool" position of the bypass valve was verified by the crew. Thus, to warm the cabin, the crew manually pinned the exchanger bypass valve in the "full warm" position. To provide cooler air to the avionics bays, the interchanger water flowrate of loop 2 was increased from 712 to 1200 lb/hr. With the combination of the pinned cabin heat exchanger bypass valve in the "full warm" position and with the increased interchanger water flowrate providing warmer water to the cabin heat exchanger, the crew reported that they were comfortable during the remainder of the mission, including the second sleep period. CONCLUSION: Cabin temperature sensor was biased high because of its location. CORRECTIVE_ACTION: None required. Action Progress: Procedures have been developed to provide greater flexibility in management of cabin temperature. EFFECTS_ON_SUBSEQUENT_MISSIONS: A portable temperature measurement instrument will be flown on STS-2 to find an acceptable transducer location.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:22:22	Problem	**FIAR**	**IFA** STS-1-V-14		Atmospheric
	GMT: 103:10:23		**SPR**	**UA**		Revitalization Subsytem

IPR **PR** **Manager:**

Engineer:

Title: System 1 O2/N2 control valve leaked when closed causing system 1 O2 regulator to read high (215 psia). (ORB)

Summary: DISCUSSION: Subsequent to day 2 on-orbit configuration (from system 1 to system 2) at 103:10:23 G.m.t., the O2 regulator pressure (V61P2115A) was observed to increase from 120 psia to 215 psia. The problem was caused by the failure of the O2/N2 control valve to seat properly when closed. The specification pressure differential of 5 psid was not present to close the check valve to prevent N2 pressure to builud at the O2 regulator.

CONCLUSION: Leakage caused by distortion of silicon seats as a result of a trace contaminant (freon). CORRECTIVE_ACTION: A new panel has been installed for STS-2 and the STS-1 panel is being reassembled to latest configuration for OV-099. Warning notes will be added to test documentation to prohibit use of freon during manufacturing and test operations. Action Progress: The N2/O2 control panel has been removed from the Oribter and sent to the vendor for anomaly investigation. Testing of the O2/N2 control valve (system 1) revealed a large leakage both in the panel configuration and in a component bench test. Disassembly and inspection of O2/N2 control valve revealed a slight separation of the silicon seat as well as a discoloration and distortion similar to the degradation that would be present with exposure to freon.The silicon seat was removed and replaced. The replacement was retested several times to verify the assembly procedures did not contribute to the damage. Exposure of the silicon seat to freon in another test however, did show similar damage as that seen from the STS-1 valve seat. The check valve was also tested and found to operate properly even at small differential pressures. An inspection of the check valve revealed that it had traces of a contaminant (freon). The testing indicated the check valve could be exposed to freon and the seal would distort; however, after drying out, the seal would return to original size and shape and operate properly. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 001:10:54	Problem	**FIAR**	**IFA** STS-1-V-15		D&C
	GMT: 103:22:55		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Commander (CDR) horizontal situation indicator (HSI) compass card stuck. (ORB)

Summary: DISCUSSION: During high-low test on orbit, the compass card stuck when it went to the low position. Troubleshooting at the vendor showed that an experimental servo motor without self-lubricating brush material had been inadvertently installed in the CDR's HSI. This motor was incompatible with the flight environment and has been replaced.

CONCLUSION: An experimental servo motor incompatible with the flight environment was inadvertently installed in the flight HSI. CORRECTIVE_ACTION: All servo motors have been checked and no other experimental motors are in flight hardware. CAR ANALYSIS: Investigation, analysis, and corrective action concurs with the preceding. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 001:09:48	Problem	**FIAR**	**IFA** STS-1-V-16		Water and Waste
	GMT: 103:21:48		**SPR**	**UA**		Management System
			IPR	**PR**		**Manager:**
						Engineer:

Title: Water tank B quantity transducer went from 80 percent to zero and back. (ORB)

Summary: DISCUSSION: The momentary change was reported by the crew. This problem is caused by contamination in the measurement potentiometer which is used to indicate the water tank bellows position for the tank quantity. A cycle of the potentiometer through the full scale is self-cleaning and will occur in the normal tank servicing for the STS-2 flight. No further action or analysis is required.

CONCLUSION: See above discussion. CORRECTIVE_ACTION: None required. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. ACTION PROGRESS: Tank B was cycles at Dryden Flight Research Center and will receive another cycle at KSC when the tanks are service for STS-2. No other instances of this change have been recorded.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 2	**MET:** 000:00:08	Problem	**FIAR**	**IFA** STS-1-V-17		OMS/RCS
	GMT: 102:12:09		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The reaction control system (RCS) engine leak detector temperatures were lower than predicted. (ORB)

Summary: DISCUSSION: The primary thruster fuel leak detectors were cooling at a greater rate than expected from injector residuals. Ground tests indicated no more than 2 degree F drop wheras flight data showed a maximum drop of about 25 degree F with a minimum temperature of 37 degree F. The RCS redundancy management (RM) will automatically deselect a primary thruster, if the temperature falls below 30 degrees F. No deselection occured on STS-1. However, analysis indicated deselections may occur, if the right RCS pulsing frequency is commanded. Low temperatures, due to injector residuals, are a tansient condition, since the temperature increases as soakback

occurs.

CONCLUSIONS: The current 30 degrees F RCS engine leak detector temperature is acceptable for STS-2, based on ground and flight test data and analysis. CORRECTIVE ACTION: Fly as is for STS-2. Continue to evaluate 30 degree F setting, based on ground tests and flight tests on STS-2. EFFECT ON SUBSEQUENT MISSIONS: If RCS primary thrusters are deselected, ground coverage can diagnose the cause, and the crew can reselect the thrusters. ACTION PROGRESS: Tests are being run with an upfiring engine in a hard vacuum chamber (greater than 300,000 ft. altitude) at JSC trying in an attempt to duplicate the flight response.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:08	Problem	**FIAR**	**IFA** STS-1-V-17-A		OMS/RCS
	GMT: 102:12:09		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The reaction control system (RCS) engine leak detector temperatures were lower than predicted. (ORB)

Summary: DISCUSSION: The primary thruster fuel leak detectors were cooling from injector residuals at a greater rate than expected. Ground tests indicated no more than 2? F drop whereas flight data showed a maximum drop of about 25? F with a minimum temperature of 37? F. The RCS redundancy management (RM) will automatically deselect a primary thruster if the temperature falls below 30? F. No deselection occurred on STS-1. However, analysis indicates deselections may occur if the right RCS pulsing frequency is commanded. Low temperatures, due to injector residuals, are a transient condition, since the temperature increases as soakback occurs.

To understand the probability of a deselection, a flight test objective was included on STS-2 to map the amount of cooling possible for various duty cycles. The FTO was composed of firing ten 80 millisecond pulses at 4 different off-times to determine the worst case cool-down duty cycle. The data from the test show that on orbit with an engine starting at 78? F or greater and propellant of 76? F or greater, the lowest temperature registered was 39? F after ten pulses. No deselections occurred. However, about 6 minutes after entry interface, the fuel leak detector on primary thruster R1U fell to 33? F, about 3? above the leak detector limit, after two pulses. This appears to have been caused by the fuel dribble volume pooling in the injector due to the effects of gravity, (approximatley 0.05g), and therefore cooling the leak detector more. Because this phenomena is due to gravity, only the upward firing engines are affected. The combined data indicate that a deselection may eventually occur if colder propellant and/or hardware is flown, particularly during the early entry phases. CONCLUSION: RCS engine leak detection temperature may fall below 30? F causing the RCS redundancy management to automatically deselect a primary upward firing thruster if colder propellant and/or hardware is flown particularly during entry phases. CORRECTIVE_ACTION: Fly-as-is. If RCS primary thrusters are deselected, upward firing sufficient RCS engine redundancy exists for crew safety and if ground coverage permits, the cause can be diagnosed and the thruster reselected. EFFECTS_ON_SUBSEQUENT_MISSIONS: Should the thrusters be deselected because of the dribble volume flashing, a change to the redundancy management leak detection limit may be required.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:04:52	Problem	**FIAR**	**IFA** STS-1-V-18	Star Tracker
	GMT: 102:16:53		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Star tracker shutters not cycling open and closed as expected. (ORB)

Summary: DISCUSSION: The star tracker shutter closed upon receipt of a bright object sensor alert and/or target suppression discrete. The sensor is set to the light intensity of the brightest horizon expected, -21 visual magnitude, and the discrete is set at a -8 visual magnitude. (For comparison, Sun is -28.8, Moon -12.6, Venus -4.4, Sirius -1.6, Aldeberan +0.9.)

At 102:16:53 G.m.t., the -Y star tracker shutter had been closed for over an hour and the target suppression bit was set. The shutter was opened by an override command. A simultaneous -Y star tracker target suppress bit was set and the shutter closure was observed at 103:10:26:20 G.m.t., indicating that the shutter was not being closed by the bright object sensor. At 104:099:35:03 G.m.t., the -Z star tracker shutter target suppression bit was found set after power up. The crew used the override to open the shutter and align the inertial measurement units. Analysis indicated that the -Z star tracker was pointed towards sunlit earth at that time. CONCLUSION: Low earth brightness at certain geometries was the cause of target suppress activation, but not sufficiently bright to activate the bright object sensor. CORRECTIVE_ACTION: Fly-as-is for STS-2. CAR ANALYSIS: Vendor analysis revealed that this was not a hardware failure, but was a case of vehicle and solar vector geometry that was not included in the Bright Object Alert (BOA) and Target Supression (TS) analysis. Corrective action is to continue as is for STS-2 through 4, then implement EDCP 112 and Software Change Request CR39414B on STS-5 and subs. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: May require manual override. ACTION PROGRESS: Reexamination of alert and suppression design thresholds for later missions.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:16:01	Problem	**FIAR**	**IFA** STS-1-V-19	APU
	GMT: 104:04:02		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: APU gas generator heater injector and bed temperatures triggered the failure detection annunciator (FDA) alarm. (ORB)

Summary: DISCUSSION: Argon gas had leaked at a weld in the gas generator heater case. Loss of the heat transfer gas causes the calrod heater element to overheat and melt at the break point. Loss of the argon caused both heater elements to fail.

CONCLUSION: Argon gas leaked at a weld in the heater case causing both calrod heater elements to overheat and fail. CORRECTIVE_ACTION: Fly replaced APU as is until APU requires replacement. Should heaters fail again, APU activation can be managed to maintain acceptable temperature ranges. Improved inspection techniques are being developed for all APU's prior to installation in a flight vehicle. A new heater design is also being developed. CAR ANALYSIS: Investigation, analysis, and corrective action concurs with the preceding. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None ACTION PROGRESS: Techniques are being developed to determine that the argon is still in the heater. Improved weld inspection techniques are also being developed.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** -001:23:59	Problem	**FIAR**	**IFA** STS-1-V-20		C&T - Audio
	GMT: 102:12:00		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Squeal in crews headsets. (ORB)

Summary: DISCUSSION: The crew reported squeals in the headsets. Acoustic feedback causing squeal occurs when a crewman speaks into a headset microphone and speaker-microphone unit (SMU) with both devices activated simultaneously. Turning off either one of the two systems eliminates the problem.

CONCLUSION: Squeal caused by acoustic feedback. CORRECTIVE_ACTION: 1. Minimize usage of speaker-microphone unit. If speaker-microphone unit use is necessary, operate on separate voice channel from headsets. 3. Wireless microphone will be available for STS-2 and will minimize SMU requirements. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. ACTION PROGRESS: Wireless mmicrophone development is in progress.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:04:49	Problem	**FIAR**	**IFA** STS-1-V-21		OMS/RCS
	GMT: 104:16:50		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Motor Control Assembly did not remove power from right RCS tank isolation valve motor after opening. (ORB)

Summary: DISCUSSION: There are two valve position microswitches on the ac motor valve. One of these is used for telemetry to the ground. The second switch is used to terminate power to the valve motor when the commanded position is reached and to provide on-board position talkback. This latter microswitch failed resulting in a hard cycle on the valve and damage to the nylon gears. Post-flight inspection of the valve revealed that a small piece of butyl rubber had become lodged on the contact preventing the microswitch from functioning.

An in-process procedure to inert the switch utilized butyl rubber hoses. Apparently small slivers of hose material was injected into the switch cavity. Butyl rubber is known to acquire static charge. In one-g the sliver weight overcomes electrostatic forces but in zero-g the particle can move under the influence of the electric field between the switch contacts. CONCLUSION: Electrostatic charged contaminant caused microswitch failure. CORRECTIVE_ACTION: Inerting process procedures and materials are being revised to prevent future switch contamination. All actuators have been replaced with valves having steel gears thus precluding damage if power terminating microswitch fails valve position can be obtained on the ground through telemetry. CAR ANALYSIS: CAR 01F033 supports the preceding and goes into greater detail to explain manufacturing methods, manufacturer's corrective action, and rationale by which it is determined safe to fly STS-2 and subs. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: ACTION PROGRESS: Inerting process procedures and materials are being revised.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:06:13	Problem	**FIAR**	**IFA** STS-1-V-22		C&T - Navaids
	GMT: 104:18:14		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: TACAN 2 bearing fail indication. (ORB)

Summary: DISCUSSION: The bearing value during terminal area energy management (TAEM) was in error in multiples of 40 degrees. There were 10 such errors in a row followed by one good value and then another error. After 10 seconds of unreasonable data, the Redundancy Management (RM) deselected the TACAN 2 bearing data.

The TACAN 2 (automatic gain control/AGC) indicated low signal strength, but systems 1 and 3 AGC signal strengths were up and they were locked on the same ground station (Edwards AFB) as system 2. Data indicates all 3 systems were operating on lower antennas. The Orbiter's turn and banking angles at TAEM caused the system 2 antenna not to have the optimum look angle to the ground station. (System 2 antenna is on the starboard side of the underside of the orbiter.) Immediately after the errors, the system 2 bearing data were good and could have been manually reselected by the crew. CONCLUSION: At or near TAEM, the Orbiter attitude maneuvers caused the Orbiter-to-ground station look angles to be in low gain zones of the airborne antenna radiation pattern. This results in low signal strength and resultant drop-outs with the characteristic bearing errors in multiples of 40?. CORRECTIVE_ACTION: None required. The deselected TACAN system could have been manually reselected immediately, but was not required. (After the 12-second period, system 2 bearing data agreed with the other 2 systems). EFFECTS_ON_SUBSEQUENT_MISSIONS: none

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:06:08	Problem	**FIAR**	**IFA** STS-1-V-23		FC/PRSD
	GMT: 104:18:09		**SPR**	**UA**		**Manager:**

IPR **PR**

Engineer:

Title: Fuel cell water relief nozzle temperatures exceeded the sensor upper limit of 450? F during entry. (ORB)

Summary: DISCUSSION: During entry, the fuel cell water relief nozzle temperatures, measurement numbers V45T0455A and V45T0456A, exceeded the upper measurement limit of 450? F. The primary concern was the RTV seal between the nozzle and the fuselage. Nozzle heater functioned properly after landing.

The nozzle heater and adjacent area were inspected at KSC. The nozzle heater had a slight bluish discoloration which indicated the nozzle temperature may have reached 600 to 800?F. The RTV seal was inspected and a comparison was made with pre-flight pictures of the area. There was no change in the integrity of the seal of adjacent area. CONCLUSION: Entry did not degrade the RTV seal, water relief nozzle, or adjacent area. CORRECTIVE_ACTION: None required. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:09	Problem	**FIAR**	**IFA** STS-1-V-24		OMS/RCS
	GMT: 102:12:10		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Right OMS engine oxidizer inlet pressure dropped during OMS-1 maneuver. (ORB)

Summary: DISCUSSION: A sudden drop of 6.5 psi in the right OMS engine oxidizer inlet pressure occurred 12 seconds into the OMS-1 maneuver. Engine chamber pressure experienced a corresponding drop of 0.7 percent, and a small decrease in fuel injector temperature was also noted (indicating a decrease in the engine mixture ratio). Following this step change, the pressures remained constant for the remainder of the OMS-1 maneuver.

Postflight, the right OMS feed system/engine interface filter was found to be about 50 percent blocked with an amber crystalline solid. Contamination was evident inside the line toward the propellant tank and in the engine line. The contamination was identified as a polyethylene known as Surlyn, used on food wrapping. Cleaning operations were completed on the right OMS oxidizer filter and system feed line. The engine oxidizer inlet line will be replaced. The left OMS oxidizer interface filter, the right engine ball valve and injection inlet line were clean. CONCLUSION: Polyethylene particles partially blocked the right OMS oxidizer interface filter. CORRECTIVE_ACTION: The contaminated filter and system feed lines were flushed and cleaned. The right engine oxidizer inlet line will be replaced. Manufacturing and inspection processes are being reviewed to identify areas for improvements. CAR ANALYSIS: Investigation, analysis, and corrective action concurs with the preceding. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None ACTION PROGRESS: Manufacturing processes and procedures will be evaluated to determine how the contaminant could have been introduced into the system. Testing to evaluate the impact/sensitivity of the contaminant in

N2O4 is underway. It has been recommended that the right oxidizer interface filter be inspected after STS-2 to verify no furter contamination.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:06:19	Problem	**FIAR**	**IFA** STS-1-V-25		MECH
	GMT: 104:18:20		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The left-hand outboard tire was cut during landing or towing to the Mate-Demate (MDM) facility. (ORB)

Summary: DISCUSSION: A 1 1/4" long x 3/8" wide x 11/32" deep cut was found on the left-hand outboard tire after the Orbiter was towed back to the MDM facility.

All STS-1 main gear tires will be returned to the vendor for inspection and test. Redesigned tires will be flown on STS-2. CONCLUSION: Tire cut was caused by lakebed debris. CORRECTIVE_ACTION: All main tires are to be replaced for STS-2. Runway is to be policed for rocks and debris. CAR ANALYSIS: CAR 01F004 was opened and closed, deferring inspection and further usage to OMRSD requirements. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:06:19	Problem	**FIAR**	**IFA** STS-1-V-26		MECH
	GMT: 104:18:20		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The right-hand main gear uplock roller split into several pieces and fell to the runway during gear deployment. (ORB)

Summary: DISCUSSION: The hardened uplock roller sleeve around the right main gear uplock roller split sometime during use and was found 1.54 miles prior to the touchdown point. The part has a hardened wear surface around the uplock roller bolt which carries the roller loads.

CONCLUSION: The roller material was too brittle for the application. CORRECTIVE_ACTION: New rollers will be installed on both nose and main gear roller bolts for all subsequent flights. CAR ANALYSIS: New parts, made of new materials and new processing methods, will be used on OV-102 (Flight 2) and on subsequent vehicles in-line. [not included in original proble report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:06:19	Problem	**FIAR**	**IFA** STS-1-V-27		MECH

GMT: 104:18:20	**SPR**	**UA**	**Manager:**
	IPR	**PR**	
			Engineer:

Title: Right hand inboard main landing gear (MLG) indicated unequal braking. (ORB)

Summary: DISCUSSION: The right-hand inboard brake received approximately 600 psi more than commanded on one of its two hydraulic pressure channels. This effect was compensated for by the commander with slight adjustment to the pedal command to the left-hand brake pedal to steer down the runway center line.

The failure was isolated to the brake/skid control electronic box. The box was removed and returned to the vendor. A zener diode in the hybrid regulator circuit of an internal power supply failed a pull test at the vendor. All zener diodes in the brake/skid control electronic boxes have passed a pull test at the vendor after mounting. These control boxes are standard equipment on most current commercial airliners and military transports. NASA coats the printed circuit cards for humidity and corrosion protection. CONCLUSION: The over pressure command was due to an attachment failure of a zener diode in the brake/skid control electronic box. CORRECTIVE_ACTION: The control box was replaced with a spare. Twenty-three other zener diodes were flown in the two control boxes on STS-1 without a problem. CAR ANALYSIS: Vendor failure analysis concurs with the preceding. The zener diode attachment failure is considered an isolated manufacturing defect that escaped the 100% bond pull test. Damage was also discovered during visual inspection of the right brakes (inbd and outbd). Corrective action has been taken to implement revision E03 to procurement specification MD621-0051 for OV-102 (Flight 2) and subsequent vehicles. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:04:35	Problem	**FIAR**	**IFA** STS-1-V-28	Atmospheric
	GMT: 102:16:36		**SPR**	**UA**	Revitalization Subsytem
			IPR	**PR**	**Manager:**
					Engineer:

Title: Oxygen system 2 crossover valve leakage. (ORB)

Summary: DISCUSSION: Following the day 1 on-orbit operational configuration of the pressure control system at 102:16:36, the system 2 O2 crossover valve was observed to be leaking. The leakage was again observed during reconfiguration for day 2 operation and during emergency O2 use in rehearsal day activities. The leakage was calculated to be 17 sccm's (specification leakage is 1 sccm).

The N2/O2 control panel was removed from the Orbiter and sent to the vendor for anomaly investigation. At the vendor facilities, the system 2 crossover valve was leak checked in the panel configuration and found to be leaking less than the 1 sccm specification. A component inspection and bench test also revealed within specification limit leakage. Valves have been disassembled and no contamination has been found. CONCLUSION: Unexplained anomaly. CORRECTIVE_ACTION: A new panel has been installed for STS-2. The STS-1 panel is being reassembled to latest configuration for OV-099. EFFECTS_ON_SUBSEQUENT_MISSIONS: Leakage was small and would not impact Orbiter operations

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-29		MECH
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The strike plate for the forward latch of the Orbiters right external tank door was discolored. (ORB)

Summary: DISCUSSION: The forward latch strike plate of the right ET door was exposed to entry heating because the outer edge protruded outside the outer mold line (OML) of the thermal protection system (TPS) and experienced some melting, distortion, and discoloration.

The rest of the latch assembly was well protected by the TPS and was not affected. At the three other latch locations (two on each door), the strike plate outer edge was flush with the OML and no evidence of excess heating was noted. CONCLUSION: The latch strike plate which protruded outside the OML of the TPS was discolored, warped and partly melted as the result of the outer edge being exposed to entry heating. Latch performance was satisfactory. CORRECTIVE_ACTION: The replacement strike plate for STS-2 will be installed with the outer edge flush with the OML of the TPS. CAR ANALYSIS: Cause of fitting discoloration and distortion is attributed to improperly fitted tile adjacent to the fitting. The fitting and adjacent tile will be replaced prior to STS-2. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-1-V-30		MPS
	GMT: Prelaunch		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Orbiter T-O hydrogen umbilical 8-in. disconnect leaked during propellant loading. (ORB)

Summary: DISCUSSION: During the LH2 tanking a leak appeared at the 8-inch disconnect when the tanking sequence went from topping at approximately 13 psi to the replenish mode at approximately 5 psi. The leakage went from 200 ppm to 34,400 ppm in 19 seconds. Through procedure changes the immediate problem was solved.

Testing confirmed that the leak was the result of insufficient load on the interface seal.

CONCLUSION: Leakage was caused by insufficient load on the interface seal. CORRECTIVE_ACTION: The seal load was increased by removing 0.150 in. of shims. CAR ANALYSIS: CAR analysis is documented in the preceding subsections. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-1-V-31		MPS
	GMT: 102:12		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The H2 topping valve for the main propulsion system (MPS) indicated slow closure after the propellant dump. (ORB)

Summary: DISCUSSION: The close switch indication occurred 88.5 seconds after power was removed from the H2 topping (replenish) valve solenoid, venting the actuator and allowing the spring to close the ball valve. Normal ambient temperature closure time is less than a second. The valve cycled normally for vacuum inerting and during post-flight tests. Slow closure is the result of the low temperatures, about 25? R, during the propellant dump.

The topping valve function is used to provide proper loads during the servicing operation and a slow response for closing on-orbit is not detrimental to the system performance. CONCLUSION: Slow H2 topping valve closure is caused by the low temperatures. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 3	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-32		OMS/RCS
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: OMS Pod graphite epoxy structure delamination (ORB)

Summary: DISCUSSION: Approximately 20 x 40 in. aft section of right-hand and a 14 x 16 in. section of the the left-hand OMS pods graphite epoxy structure was delaminated. the degredation of the FSRI appeared to result from a high temperature for a short duration. A series of simulated tests to duplicate the FRSI degradation were

conducted and the condition most closely simulating the degradation was a 5-second duration exposure to a surface temperature of 1600 degrees F. It is not known whether the delamination occurred because of water entrapment in the honeycomb core, or because of the temperature (postulated to have exceeded 500 degrees F locally) on the outer face sheet, or a combination of both.

CONCLUSIONS: The temperature measurement should be adequate to enable determination of the cause and the design fix should be adequate to prevent a subsequent occurence. CORRECTIVE ACTION: The aft panels on each pod have been replaced and 25 HRSI tiles will cover the area on each pod. One of the tiles on the left-hand pod will contain a surface temperature measurement for use in determining the magnitude and duration of heating exposure on STS-2. EFFECT ON SUBSEQUENT MISSIONS: The redesign will be evaluated on STS-2 through the temperature measurement and postflight inspection.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-32-A		Structures
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: OMS Pod graphite epoxy structure delamination (ORB)

Summary: DISCUSSION: About a 20 x 40 in. aft section of the right-hand and a 14 x 16 in. section of the left-hand OMS pods graphite epoxy structure was delaminated at the outer face sheet on STS-1. The aft panels were replaced and 26 HRSI tiles were located over the delaminated area on both pods in place of FRSI for STS-2.

Postflight inspection showed no delamination after STS-2. An HRSI surface thermocouple added to the left OMS pod for STS-2 was inoperative. CONCLUSION: The delamination on STS-1 was probably caused by steam pressure in the FRSI due to heating of moisture entrapped under the outer face sheet. HRSI tiles in the delaminated areas successfully protected the OMS pods in STS-2. CORRECTIVE_ACTION: A wiring short has been repaired in the left OMS pod HRSI thermocouple for STS-3. Improved water repellant will be applied to all tiles before rollout. CAR ANALYSIS: CAR analysis is documented in the preceding subsections. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-33		Water and Waste
	GMT: Postlanding		**SPR**	**UA**		Management System
			IPR	**PR**		**Manager:**

Engineer:

Title: Waste collection system had low urinal flow and low commode air flow. (ORB)

Summary: DISCUSSION: Throughout the mission, the commode air suction degraded until the commode became unusable. The postflight crew report indicated there was low urinal flow and a feces separation problem.

Postflight inspection verified (a) the urinal hose screen was blocked with lint, (b) a carry-over flow path of urine existed from the fan to the odor/ bacteria charcoal filter, (c) the presence of urine in the odor/bacteria filter, and (d) fecal matter collected on the back side of the transport tube. The post landing one-g drain of urine from the odor/bacteria filter flooded the fan cavity, verifying the presence of liquid in the odor/bacteria filter. Liquid carry-over into the odor/bacteria filter blocks the air flow through the urinal and commode. A blocked urinal hose screen can result in a liquid carry-over into the odor/bacteria filter. A flooded fan cavity can keep a fan separator from operating. Improper alignment of user with commode can result in fecal matter being collected on the back side of the transport tube. After the screen was cleaned postflight, the air flow was within specification. CONCLUSION: a. A prelaunch water flow ground test may have caused initial liquid carryover and initial commode problem. b. Some lint may have collected on the screen during ground testing. c. The lint-blocked urinal hose screen can cause liquid flow into the odor/bacteria filter. d. A wet odor/bacteria filter can block the total air flow causing problems with transportation in both the urinal and commode. CORRECTIVE_ACTION: a. Delete prelaunch water flow ground test. b. Change urinal hose screen to coarser mesh. c. Add replaceable in-line urinal filter upstream of existing screen and provide spares. d. Add spare odor/bacteria filter e. Add Apollo fecal collection assemblies in stowage. f. Add QD adapter for urine cup to contingency hose for contingency voiding overboard through the waste water dump nozzle. g. Increase crew training for seat alignment, use procedure, and inflight maintenance. CAR ANALYSIS: CAR analysis is included in the preceding subsections. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: See corrective action.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:06:19	Problem	**FIAR**	**IFA** STS-1-V-34	C&T
	GMT: 104:18:20		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Radar altimeter data dropout at 75 feet. (ORB)

Summary: DISCUSSION: During landing gear deployment at an altitude of approximately 75 feet, both radar altimeters broke lock, reading invalid zero altitude for 4 seconds. Upon reacquisition, the altitude indicated by both units was less than the actual vehicle height above the ground. This erroneous output remained until gear touchdown (altimeter height of approximately 20 feet), at which time both units returned to proper tracking through rollout.

Postflight test at KSC performed and verified both altimeters operating properly. CONCLUSION: Reflections from the nose landing gear and/or door assembly mixed with proper returns from the ground resulted in erroneous data from 75 feet to touchdown. CORRECTIVE_ACTION: A software change has been approved for STS-3 to remove altimeter data from autoland guidance. Units will be manually deselected for STS-2. EFFECTS_ON_SUBSEQUENT_MISSIONS: Radar altimeter data will not be used by the guidance system. ACTION PROGRESS: A test with full-scale mockup of antennas and nose landing gear is being proposed to duplicate the problem and evaluate a modified antenna design. A change to the altimeter gain is being studied to optimize ground returns with respect to unwanted reflections from the nose gear.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 4	MET:	Problem	FIAR	IFA STS-1-V-35		GNC
	GMT:		SPR	UA		Manager:
			IPR	PR		
						Engineer:

Title: Vehicle response overshoot poorly damped during first roll. (ORB)

Summary: DISCUSSION: Lateral roll/yaw oscillation after the first roll maneuver at a dynamic pressure of about 12 psf was poorly damped with a maximum peak-to-peak beta of 7 degrees and a period of 13 seconds.

An unexpected roll torquw from the yaw engines is the promary cause. The extimated roll torque is much closer to vacuum thrust levels at low dynamic pressure than provided for in the Aero Data Book. This results in an inability of the autopilot to coordinate the manuever properly due to inadequate roll authority. For STS-2, the initial roll will be performed manually at a reduced rate allowing for additional data gathering before modifications are made to the flight control software. CONCLUSIONS: Roll torque from the yaw engines exceeds autopilot roll authority at low dynamic pressure. CORRECTIVE ACTION: Use manual control at reduced rates for STS-2. Modify flight control software for STS-3 and subsequent after evaluation of STS-2 manual flight test data. EFFECT ON SUBSEQUENT MISSIONS: Dependent on STS-2 results.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-1-V-35-A		GNC
	GMT:		SPR	UA		Manager:
			IPR	PR		
						Engineer:

Title: Vehicle response overshoot poorly damped during first roll. (ORB)

Summary: DISCUSSION: On STS-1, a lateral roll/yaw oscillation occurred after the first roll maneuver at about 12 psf dynamic pressure. Postflight analysis indicated that the roll moment from the yaw RCS is the primary cause. On STS-2, the first roll maneuver was performed manually at 3 deg/sec, 2 deg/sec slower than the rate used in

automode. The low damping was not observed.

The reduced rate manual procedure will be used for the first roll maneuver on both STS-3 and 4. A flight control system update is planned for STS-5 and subsequent to provide improved damping in the automode based on aero derived from STS-1. Data from STS-2 has been evaluated and the flight control system changes planned for STS-5 and subsequent will provide adequate damping. CONCLUSION: Roll torque from the yaw engines exceeded the autopilot roll authority at low dynamic pressure during the first roll maneuver on STS-1. Manual control at reduced rates resulted in adequate damping on STS-2. CORRECTIVE_ACTION: Manual control at reduced rates will be used for the first roll maneuver on STS-3 and 4. Flight control system changes for STS-5 have been validated and a software change has been approved incorporating the fix. EFFECTS_ON_SUBSEQUENT_MISSIONS: Manual control at reduced rates for the first roll maneuver will be used until the flight control system is updated for STS-5 and subsequent.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:04:09	Problem	**FIAR**	**IFA** STS-1-V-36		Atmospheric
	GMT: 102:16:10		**SPR**	**UA**		Revitalization Subsytem
			IPR	**PR**		**Manager:**
						Engineer:

Title: Smoke detection system A test of "flight deck left" failed several self-test attempts and "cabin" worked only once in several attempts. (ORB)

Summary: DISCUSSION: The crew reported the smoke detection matrix self-test light failed at 102:16:10 and 102:16:35 G.m.t.

The problem is caused by the detector's air-pump bearings that bind occasionally because of the lubricant used. When the torque-load exceeds the design limit, the drive motor current exceeds the self-test limit. Repeating the self test will normally clear the fault. An improved-design detector is in production and 8 units will be available in June. CONCLUSION: Intermittent bearing problem in smoke detectors air pumps. Fly-as-is on STS-2. CORRECTIVE_ACTION: Improved air pump in production. CAR ANALYSIS: CAR analysis is included in the preceding subsections. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: Replace all detectors prior to STS-3. ACTION PROGRESS: detectors passed slef-test per the OMRSD at KSC on May 6, 1981. Smoke detectors are limited life items (800 hours) and none require replacement prior to STS-3.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 5	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-37		GNC

GMT: Postlanding	**SPR**	**UA**	**Manager:**
	IPR	**PR**	
			Engineer:

Title: Orbiter touchdown was about 3200 ft beyond planned point (ORB)

Summary: DISCUSSION: The Orbiter touched down 6053 ft past the threshold on EDW Runway 23. This touchdown point was about 3000 ft father down the runway than premission planning had predicted even though the touchdown speed and approach trajectory were near nominal. Analysis based on the onboard trajectory data, ground based measurements of touchdown point, wind and atmospheric density from a balloon released 2 minutes after landing, and onboard speed brake position information indicated that the Orbiter lift-to-drag ratios were higher than expected both in and out of ground effects.

Postflight reconstruction simulations indicated that about 2000 ft of the 3000 ft deviation could be accounted for the additive minor operational and environmental dispersions and the higher lift-to-drag ratios appear to account fot the remaining 1000 ft. Additional analyses based on control stick inputs and aerodynamic coefficient identification techniques generally confirmed that the Orbiter's basic drag was lower than expected and ground effects normal force and axial force coeffients were slightly different than those defined in premission sero data books. Postmission simulations confirm that these aerodynamic coefficient adjustments result in the equivalent of 900 to 1000 ft more range at touchdown. The aerodynamic coefficients which have been adjusted include: a. Axial force coefficient CDo reduced 0.0040. b. Speed brake drag effectiveness higher than predicted. c. Grounf effects for normal and axial force coefficients less than expected. CONCLUSIONS:Predicted landing aerodynamics were different from the actual STS-1 CORRECTIVE ACTION: Aerodynamic data base being revised to reflect STS-1 results. SMS and Shuttle training aircraft to include revised data base. Steep glide slope being revised from 20 degrees to 19 degrees. EFFECT ON SUBSEQUENT MISSIONS: none ACTION PROGRESS: Simulations continuing using the revised aerodynamics.

Tracking No	**Time**	**Classification**		**Documentation**	**Subsystem**
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-37A	GNC
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Orbiter touchdown was about 3200 feet beyond planned point. (ORB)

Summary: DISCUSSION: The Orbiter touched down 6053 feet past the threshold of the runway on STS-1. This touchdown point was over 3000 feet farther down the runway than the premission prediction. Postflight reconstruction simulations indicated that about 2000 feet of the deviation could be accounted for due to additive minor operational and environmental dispersions. A higher lift-to-drag ratio accounted for an additional 1000 feet explaining the deviation to within 200 feet.

The Orbiter touchdown on STS-2 was about 3200 feet short of the pre-mission prediction. Post-flight analysis incorporating revised input data including low energy at TAEM/autoload interface and a 25-knot headwind accounted for all but 200 feet of the deviation. CONCLUSION: The Orbiter touched down about 3200 feet beyond the pre-flight prediction on STS-1 and about 3300 feet short on STS-2. Postflight analysis has verified the aerodynamic data base. The specific touchdown distances have been analyzed and determined to be consistent with the vehicle energy state during the approach and the environmental factors at the time of landing. CORRECTIVE_ACTION: The aerodynamic data has been revised to reflect STS-1 and 2 results. The steep glide slope was reduced 1 deg after STS-1. Based on STS-1 results, the steep glide slope aimpoint was moved 1000 feet away from the threshold and the shallow aimpoint was moved 500 feet closer after STS-2. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-1-V-38		MECH
	GMT:		SPR	UA		Manager:
			IPR	PR		
						Engineer:

Title: Pyrotechnic external unlatch at the outboard position on the LH2 umbilical plate did not fire at external tank separation. (ORB)

Summary: DISCUSSION: One NASA standard detonator (NSD) was found unspent in post-flight inspection. The wiring and the associated detonator connectors were destroyed by shrapnel from the successful functioning of the companion or redundant detonator in the frangible nut. Sufficient time skew existed between firing circuits A and B to allow detonation products from the first unit fired to impact the second detonator and/or wiring.

Nominal NSD function time is 100 microseconds. Anticipated skew is 1.5 to 2 milliseconds. Postflight troubleshooting confirmed 2 milliseconds skew. An open bridge wire was found in the unfired pyro, confirming that the signal did reach the device. The reason for non-firing was that the charge had been separated from the bridgewire by the shock from the detonation prior to the signal's reaching the bridgewire. Post-flight shock tests at up to 100g demonstrated that NASA standard initiators will withstand mission shock levels. CONCLUSION: The two millisecond timing skew between redundant initiators allowed the first NSD to fire, breaking the frangible nut and producing shrapnel that prevented the redundant NSD from functioning. CORRECTIVE_ACTION: No corrective action required. System functioned as designed. CAR ANALYSIS: NSD's are GFE to the Orbiter. As such, the NASA-JSC failure reporting system is used to track these failures to their satisfactory resolution and understanding. In this case the tracking number is FIAR JSC-EP0046. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: Effect on subsequent missions: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 6	MET:	Problem	FIAR	IFA STS-1-V-39		GNC
	GMT:		SPR	UA		Manager:

			IPR	**PR**		
						Engineer:

Title: Body flap exceeded planned trim attitude by over 5? at hypersonic entry speeds. (ORB)

Summary: DISCUSSION: The body flap extended to 14?, exceeding the planned trim attitude of 8 to 9? during entry from Mach 22 through 12. Postflight analysis of longitudinal trim characteristics indicated that aerodynamic predictions for pitch trim at hypersonic speeds were in error. The additional body flap deflection increased the body flap heating environment. Elevon trim position will be changed from -1? to +1? above Mach 10 for STS-2.

CONCLUSIONS: Aero pitch trim predictions in error. CORRECTIVE ACTION: Elevon schedule will be adjusted on STS-2 to relieve bodt flap heating. EFFECT ON SUBSEQUENT MISSIONS: none ACTION PROGRESS: Body flap pulses during aero stick inputs (ASI's) on STS-2 will provide data to evaluate longitudinal effectiveness of individual control surfaces.

Tracking No	**Time**	**Classification**		**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**	**IFA**	STS-1-V-39A	GNC
	GMT:		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Body flap exceeded planned trim attitude by over 5? at hypersonic entry speeds. (ORB)

Summary: DISCUSSION: On STS-1 the body flap extended to 14?, exceeding the planned trim setting of 8? to 9? during entry from Mach 22 through Mach 12. On STS-2 the elevon trim schedule was changed from -1? to +1? during the hypersonic portion of entry to reduce the body flap heat loads. Also, the aerodynamic data was modified by adding a pitching moment (CMo) bias (.022) for the hypersonic entry speed range. STS-2 analysis results indicate no loss in elevon or body flap longitudinal effectiveness. The longitudinal trim data from STS-2 correlated well with STS-1 data. Similarly, the pitching moment bias that was added for STS-2 was validated.

CONCLUSION: The pitching moment bias at hypersonic entry speeds on STS-1 was confirmed by STS-2. CORRECTIVE_ACTION: The aero data book has been updated to reflect the pitching moment bias during the hypersonic entry speed range. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	**Time**	**Classification**		**Documentation**		**Subsystem**
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA**	STS-1-V-40	STR
	GMT: Postlanding		**SPR**	**UA**		**Manager:**

IPR **PR**

Engineer:

Title: Crew reported trouble locking doors on two stowage lockers for entry and opening waste management door. (ORB)

Summary: DISCUSSION: The STS-1 Orbiter mission had 27 modular stowage lockers installed on the middeck forward and aft bulkheads, 23 and 4, respectively. The crew experienced difficulty in locking the doors of lockers MA9L and MF14K during preparation for return. The door fasteners (2 per door) were misaligned, thus causing the crew to physically move the door to the locker frame to engage the locks. Postflight inspection showed that an out of plane condition exists in the vehicle structure at the locker interface causing distortion of the locker during installation.

The slide bolt on the waste management door jammed when latched. CONCLUSION: Modular lockers were distorted by middeck bulkhead wire tray out of plane irregularities caused by the structure movement. Slide bolt clearance setting was inadequate on the waste management door. CORRECTIVE_ACTION: Slide bolt on the waste management door was adjusted for proper clearance. Locker doors will be reshimmed for STS-2. CAR ANALYSIS: In addition to the foregoing, shims were bonded to the wire trays to correct the out-ot-plane conditions at locker door attach points. Locker door operation was verified following shim installation. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: Effect on subsequent missions: Modular lockers may exhibit difficulty in door closure due to the vehicle structure inflight movement.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-1-V-41		CREW
	GMT:		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The flight crew experienced difficulty in installing the ejection seat scramble handle safety clip during the STS-1 mission. (ORB)

Summary: DISCUSSION: The crew was able to depress the handle and install the safety clip.

The inspection by the installation team revealed that the Pilot's scramble handle release button was bent and could stick down. The Commander's scramble was inspected and was normal. CONCLUSION: Scramble handle release button was bent during use resulting in difficulty in installing safety clip. CORRECTIVE_ACTION: Defective part has been replaced. Future crews will be given additional training on the installation of the safety clips. CAR ANALYSIS: Damaged through operator misusage. Damage corrected via PR FCS-2-02-0006. CAR action not required. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-1-V-42		APU
	GMT:		SPR	UA		Manager:
			IPR	PR		
						Engineer:

Title: APU Nos. 1 and 3 had low chamber pressures during on-orbit startup. (ORB)

Summary: DISCUSSION: The low chamber pressure of about 1,000 psi versus a normal Pc of about 1,200 psi was determined either to be caused by gas bubbles in the feed system or to be generated by heat in the fuel pump or valve. Ground servicing and inflight procedures have been changed to reduce gas bubbles in the system. Tests will be run to determine APU operating margins with gas bubbles.

CONCLUSION: Gas bubbles in the APU propellant system caused low chamber pressure during startup. CORRECTIVE_ACTION: Ground servicing and in-flight procedures have been changed to reduce gas bubbles in the system. EFFECTS_ON_SUBSEQUENT_MISSIONS: None ACTION PROGRESS: STS-1 and 2 profiles will be tested in an attempt to generate decomposition bubbles. Another test will inject bubbles into the inlet of the fuel pump to determine how the APU runs with the bubbles

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-1-V-43		MECH
	GMT: Postlanding		SPR	UA		Manager:
			IPR	PR		
						Engineer:

Title: Umbilical release blast containers have cracks. (ORB)

Summary: DISCUSSION: Postflight inspection revealed a crack or fracture in the sidewall of two of the six blast containers removed from the LH2 umbilical disconnect assembly.

The LH2 umbilical aft separation blast container had a 1/2-in. fracture in the sidewall above the threaded portion of the canister. The LH2 umbilical forward separation blast container had a 3/8-in. fracture in the sidewall in the same approximate area. All fragments were contained within the blast containers. The blast containers were returned to Rockwell/Downey. Tests at JSC have verified that the blast containers are acceptable for single mission usage. CONCLUSION: Blast containers for STS-1 operated acceptably but must be replaced after each mission. CORRECTIVE_ACTION: Blast containers will be replaced for STS-2. Redesign being evaluated to provide additional mission capability for STS-3 and subs. CAR ANALYSIS: Although determined OK-to-fly by management for STS-2 provided new parts are installed,

an interim fix is in-place for STS-3 through STS-5 and a redesign is planned for STS-6 and subsequent flights. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None ACTION PROGRESS: Each of the blast containers, including the 4 undamaged cotainers, will be subjected to thread checks, dye penetrant inspections, and material verification.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-44		TPS
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Nose gear door thermal barrier fell off during landing gear deployment. (ORB)

Summary: DISCUSSION: The forward nose gear door thermal barrier was torn loose just before landing when the nose gear door was opened. This was observed on films of the landing and the thermal barrier was found on the lakebed approximately 1-1/2 miles before the touchdown point.

An inspection of this barrier and the adjacent tile surfaces revealed thermal damage on the left-hand side of the barrier at the location between the first and second tile from the edge. The thermal barrier (ten mil) inconel stiffener within the AB312 cover was burned through as was most of the thermal barrier. There were two factors leading to this failure - the alignment of adjacent tile joints and the stiffness of the thermal barrier which inhibited proper compliance of the thermal barrier with the irregularities of the tile surface. CONCLUSION: Poor thermal barrier installation was the cause of the problem. A modified, less stiff assembly should fit properly and stay in place for STS-2. CORRECTIVE_ACTION: Improved design for STS-2 and a new design for operational flights. EFFECTS_ON_SUBSEQUENT_MISSIONS: Possible replacement may be required after each flight until a completely new design with reshaped surrounding tile is adopted. ACTION PROGRESS: The replacement thermal barrier will be modified to reduce the ten-mil thick inconel stiffener in the thermal barrier to two mils. This should allow better conformance of the thermal barrier to the tile surface.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 7	**MET:**	Problem	**FIAR**	**IFA** STS-1-V-45		MECH
	GMT:		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: The Payload Bay Door (PLBD) closure overlap on rehersal and entry days was more than predicted. (ORB)

Summary: DISCUSSION: During door operations on rehersal and entry days, the crew reported an overlap in excess of 3 in. at the number 12 hatch location.

The maximum design capability is 4 in. and the pre-flight predictions indicated a gap. Post flight measurements of the gap on the left door mechanical stops and the switch transfer point on the left aft door switch module indicate that the door rigging was correct. A theodolite will be installed on STS-2 for more accurate deflection measurements. Flight data from STS-2 will be correlated with the math model. CONCLUSIONS: A more accurate measurement of PLBD deflections is required for correlation with the math model to determine when vehicle attitude constraints are required for PLBD change. CORRECTIVE ACTION: A theodolite will be installed on STS-2 so that more accurate PLBD delfection measurements can be correlated with the math model. Vehicle attitude constraints for PLBD closure will be evlauated for STS-3 and subsequent based on STS-2 results. EFFECT ON SUBSEQUENT MISSIONS: STS-2 thermal environment for PLBD operations is similar to STS-1. Vehicle attitude constraints may be required on some missions to achieve PLBD closure.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-1-V-45A		MECH
	GMT:		SPR	UA		Manager:
			IPR	PR		
						Engineer:

Title: The Payload Bay Door (PLBD) closure overlap on rehearsal and entry days was more than predicted for STS-1. (ORB)

Summary: DISCUSSION: During door operations on rehearsal and entry days, the STS-1 crew reported a door centerline overlap in excess of 3 in. at the number 12 latch location. Since the max design capability is 4 in., a theodolite measurement system was added to STS-2 to obtain more accurate data for use in refining the math model. Because of problems with the theodolite installation on STS-2, as well as mission timeline constraints, no useful theodolite data was obtained. The STS-2 crew, however, did not observe any overlap conditions as noted on STS-1.

The crew visual technique cannot be used to establish the precise magnitude of any overlap/gap condition, especially in the aft portion of the payload bay. The theodolite will be used to obtain more accurate deflection measurements on STS-3. CONCLUSION: Crew visual observations of any gap or overlap are considered acceptable as a go-no-go technique since the large magnitude of any unsafe gap/overlap condition would be readily apparent. CORRECTIVE_ACTION: No further action required. Obtain theodolite data when possible. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-1-V-46		OMS/RCS
	GMT:		SPR	UA		Manager:
			IPR	PR		
						Engineer:

Title: Temperature on left OMS nozzle bell was off-scale high during SRB firing and high during OMS burns. (ORB)

Summary: DISCUSSION: There are three DFI temperature measurements on the left OMS engine nozzle: V43T9111A and V43T9112A approximately 90? apart on the nozzle lip and V43T9110A near the nozzle flange connecting the thrust chamber to the nozzle extension. V43T9112A was not responsive to the thermal environment. V43T9111A indicated temperatures much higher than expected, going off-scale high (>3000? F) during boost and again during the OMS-1 burn. The maximum temperature expected at the nozzle lip during boost was 1600? F and during engine firing 1250? F. The nozzle flange measurement indicated a maximum temperature of 900? F during boost and 1800? F during OMS-1, approximately as expected.

Inspection at KSC indicated that the sensor mounting assembly and a measurement wiring support bracket welded to the nozzle were loose. Visual inspection of the nozzle did not indicate any damage due to overheating. CONCLUSION: Physical examination of the nozzles did not show any evidence of high temperature. The excessive temperature readings were due to the loose sensor mounting assembly. CORRECTIVE_ACTION: The left OMS engine nozzle has been changed out and the nozzle bell sensors have been checked out with a heat gun and an improved voltage to verify proper end-to-end response. CAR ANALYSIS: Failure analysis was not performed. The failed item was determined to be a sensor and wiring support bracket which was supposed to be spot-welded to the OMS nozzle bell. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:00	Problem	**FIAR**	**IFA** STS-1-V-47		INS
	GMT: 102:12:00		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: During STS-1, the DFI wideband ascent and DFI PCM recorders exhibited a dropout of approximately 400-milliseconds duration 350 milliseconds after SRB ignition. (ORB)

Summary: DISCUSSION: A review of the vibration environment induced into the crew cabin during launch shows a larger than expected 15-to-18 Hz component in the vehicle axis. The flutter of the DFI wideband ascent recorder exceeded 20 percent peak-to-peak during the drop-out period.

Analysis of the vehicle-induced vibration input to the recorders was performed in an attempt to find a frequency to which the recorder shock isolators could be tuned. A low-level sine vibration (0.25g peak-to-peak input) test was performed on the DFI PCM recorder to determine the isolator resonant frequency. Results of these tests and analysis show that the present design (45 to 50 Hz resonance) is about optimum. Any effort to change the isolator system on the recorders will require a major redesign to provide sufficient sway space. This would result in a delta qualification program which could not be completed before STS-3. CONCLUSION: Loss of data is the result of the recorders being susceptible to the frequencies experienced following SRB ignition. CORRECTIVE_ACTION: No corrective action is required. The DFI PCM

data during this time period is backed-up by real-time telemetry. The drop-out in the FDM data has no backup, but no critical data were lost.
EFFECTS_ON_SUBSEQUENT_MISSIONS: Minor data loss is expected.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-48		APU
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Hydraulic dynatube fitting on APU No. 1 pump found to be leaking and surface crack found on suction line. (ORB)

Summary: DISCUSSION: Postflight inspection indicates that approximately 1/2 gallon of hydraulic fluid was lost from APU No. 1. The dynatube connection at hydraulic pump No. 1 suction line was retorqued at DFRC to stop the leak prior to ferry back to KSC. Both the pump and the APU had been replaced prior to flight. Probable cause of the leak is improper torque during installation. The suction line was returned to the vendor. The surface crack was found to be superficial and was burnished out.

CONCLUSION: Leaking hydraulic dynatube fitting probably caused by improper torque during installation. CORRECTIVE_ACTION: All pump dynatube connections will be retorqued and the torque values recorded. CAR ANALYSIS: See write-up under PROBLEM DISCUSSION. [not included in original problem report]
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-49		STR
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Right-hand main landing gear door buckled. (ORB)

Summary: DISCUSSION: A localized region of excessive gap heating occurred on the forward portion of the right main landing gear door. The excessive heating resulted in severe tile sidewall shrinkage (4 tiles), charred filler bar and a localized buckle in the door structure.

CONCLUSION: A forward facing step, a tile gap, a tile-to-filler bar gap and an inadequate flow restrictor resulted in excess heating of the main landing gear structural surface. CORRECTIVE_ACTION: Structure and thermal protection system on door are being refurbished. Flow restrictor has been modified. CAR ANALYSIS: A redesign per MCR 7852 was accomplished to increase the effectiveness of the Thermal Protection System in the area of the Main Landing Gear doors. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None. ACTION PROGRESS: The structural buckle has been reparied using a doubler with blind

fasteners. The tiles will be reinstalled (4 replaced) with specification steps and gaps. Gap fillers will be used to fix out-of-tolerane step/gap conditions. The flow restrictor has been extended.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-50		RCS
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Forward RCS F2R oxidizer injector temperature did not respond correctly. (ORB)

Summary: DISCUSSION: Postflight data review on this thruster leak detector indicated that thruster F2R was different in that the oxidizer logic detector did not follow the fuel in the post firing evaporative cooldown caused by the dribble volume. A significant thermal lag was noticed.

Engine was removed from the vehicle and returned to the supplier for failure analysis. Inspection showed the leak detector was not installed in the boss provided for it. It was bent and installed beside the injector tube. CONCLUSION: CORRECTIVE_ACTION: The leak detector was reinstalled on the engine. ATP pass/fail criteria has been added to the Acceptance Data Review. CAR ANALYSIS: The anomaly has been determined to be a manufacturing defect (see PROBLEM DISCUSSION). An inspection step has been added to the assembly procedures to preclude this type of anomaly.[not included in original problem report]
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-51		PV&D
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Left-hand and right-hand wing vent ducts structural failure. (ORB)

Summary: DISCUSSION: During postflight change-out of the wing vent doors, inspection of the vent ducts revealed structural damage had occurred in both ducts. The left duct had an extensive crack along the bottom rivet row and across the panel to the upper rivet row. A piece about 2 1/2 in. x 4 in. was missing. The right duct had a similar crack with a piece about 1 1/2 in. x 3 in. missing. (The cross section for each duct is about one square foot.)

With a resonant frequency of about 54 Hz for the duct panels, a measured center frequency of 50 Hz at a microphone in the mid-fuselage during flight and a calculated open-end duct frequency of about 42 Hz at about Mach 1 during ascent, it appears the cracks and holes in the 0.020 in. thick aluminum ducts were the result of fatigue. Thicker aluminum duct walls will stiffen and strengthen the ducts. CONCLUSION: The thin walled ducts failed in fatigue because resonance frequency was almost the same as that of the launch environment. CORRECTIVE_ACTION: The wall thicknesses of the replacement ducts have been increased to 0.040 in. and to 0.063 in. where required for vent door loads. CAR ANALYSIS: CAR analysis is included in the preceding Flight Problem Report sections. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 8	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-52		
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Development flight instrumentation measurement discrepancies. (ORB)

Summary: DISCUSSION: Approximately 40 PCM and 35 wideband DFI measurements were found to be discrepant as a result of the STS-1 data review. Where access has been available and schedule permits troubleshooting, corrective actions have been implemented.

ACTION PROGRESS: A plan is being develope dto define the measurements which have not been repaired, the priorities for the FTR effect of each, adn the planned corrective actio and its schedule. EFFECT ON SUBSEQUENT MISSIONS: Measurement repair will be required during the turnaround activities for STS-3 and 4.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-52A		INS
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Developmental Flight Instrumentation Discrepancies. (ORB)

Summary: DISCUSSION: Approximately 44 PCM and 35 wideband DFI measurements were identified as discrepant as a result of the STS-2 Data Review. Where access was available and the schedule permitted troubleshooting, corrective actions were implemented. However, for those measurements where access will not become available during normal flow operations, an open-ended waiver has been granted. These measurements where access will become available have been identified as items to be worked during the STS-4 turnaround.

CONCLUSION: None of the STS-1 measurements that have been deferred are considered mandatory for STS-3. CORRECTIVE_ACTION: All accessible measurements that were confirmed as failed based on STS-2 data review have been fixed. CAR ANALYSIS: These Sound Pressure Level Transducers (SPLT's) were intended to measure noise levels caused by the main engines. The SPLT's were designed to survive max non-operating temperatures of 500 deg F. The supplier has examined a failed SPLT and confirmed, as expected, that overheating was the cause of failure. See preceding for corrective action. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: Effect on subsequent missions: Nine deferred measurements are planned for troubleshooting during the STS-4 turnaround.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:06:13	Problem	**FIAR**	**IFA** STS-1-V-53		GN&C
	GMT: 104:18:14		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Lateral oscillation at about 1.6 Mach. (ORB)

Summary: DISCUSSION: An unexpected, a larger rolling moment from the rudder and a lower than expected aileron rolling moment appear to have caused a 0.2 Hz, 4 deg/sec peak-to-peak oscillation with a period of 4 seconds which started about Mach 1.8 and persisted for about 6 cycles. Control margins are lower than desired in this region.

CONCLUSION: Unexpected rolling moment from rudder and lower aileron rolling moment at about 1.6 Mach resulted in reduced control margins. CORRECTIVE_ACTION: Consider software modification for STS-3 and subsequent based on STS-2 evaluation. PTI's for STS-2 have been reduced to 1/3 of original magnitude and are of a shorter duration. EFFECTS_ON_SUBSEQUENT_MISSIONS: Dependent on STS-2 results. ACTION PROGRESS: PTI's planned in this region on STS-2 will allow data extraction to facilitate a software fix forr STS-3.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:02:17	Problem	**FIAR**	**IFA** STS-1-V-53A		GN&C
	GMT: 104:14:18		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Lateral oscillation at approximately Mach 1.6. (ORB)

Summary: DISCUSSION: On STS-1, a 1/4 Hz roll oscillation was evident between Mach 1.5 to 2.5. Errors in rolling moment from the aileron and rudder are a possible source of these oscillations. Similar oscillations were observed in more limited areas on STS-2. Data from STS-2 PTI (Programmed Test Input) maneuvers in this speed

regime were not in agreement with the predicted values from STS-1. Base on the STS-1 and STS-2 data, predictions have been made for the succeeding flights. Data from STS-5 and 6 and possibly later flights will be required be fore confidence can be placed in extracted aero data. The yaw RCS will be retained for lateral-directional stability in the Mach 1.5 to 2.5 region and on down to Mach 1 until such time as the lateral aero data are finalized and the corresponding flight control system changes are made.

CONCLUSION: The assessment aero from STS-1 was not validated by STS-2 results. Several additional PTI maneuvers will be required to accurately define lateral aero characteristics in the Mach 1.5 to 2.5 region. CORRECTIVE_ACTION: Retain the yaw RCS for lateral stability control down to Mach 1.0. Continue flight test analysis on subsequent flights to determine the lateral-direction al stability and evaluate whether flight control system changes are required to delete the yaw RCS usage in the low supersonic and transonic speed regime. Perform wind tunnel tests in the transonic regime to determine if any nonlinearities or hysteresis exist in rudder and aileron effectiveness and lateral-directional stability. EFFECTS_ON_SUBSEQUENT_MISSIONS: The yaw RCS will continue to be used down to Mach 1 until such time that the lateral aero data are accurately defined and the associated flight control system changes are made.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** -001:23:59	Problem	**FIAR**	**IFA** STS-1-V-54		Atmospheric
	GMT: 102:12:00		**SPR**	**UA**		Revitalization Subsytem
			IPR	**PR**		**Manager:**
						Engineer:

Title: Cabin dp/dt exceeded -0.05 psi/min during ascent. (ORB)

Summary: DISCUSSION: After STS-1 lift-off, from T + 42 to 67 seconds, the dp/dt sensor telemetry indicated a cabin pressure drop rate sufficient to trigger atmosphere warning and the caution and warning klaxon alarm. The maximum rate was -0.065 psi/min.

The pressure resulted from cabin expansion that was caused by an increasing pressure differential between the cabin and ambient with increasing altitude. The dp/dt caution and warning limit is -0.05 psi/min. The crew did not report a klaxon actuation. Four master alarms occurred at 102:12:00:49 G.m.t. when the dp/dt was -0.049 psi/min. The crew reset the master alarm within 2 seconds. The klaxon was not heard because the crew wore special ear plugs that carried only the master alarm tone and therefore the klaxon was not heard. Also, the crew was wearing helmets with earphones; the visors were closed and breathing system was flowing oxygen. The klaxon has short-tone duration and with the launch noise could not be heard. Flight rules state for dp/dt from 0.00 to -0.12 psi/min, no action is required. Reset of master alarm was proper action. CONCLUSION: Alarm caused by cabin pressure drop which in turn was caused by cabin volume increase with altitude. CORRECTIVE_ACTION: Crew will be informed to expect caution and warning during ascent. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:05:48	Problem	**FIAR**	**IFA** STS-1-V-55		MECH
	GMT: 104:17:49		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Payload bay door hinge 7 exceeded maximum temperature limit of 1200? F during entry. (ORB)

Summary: DISCUSSION: The Payload bay hinge 7 temperature measurement reached 1530? F during entry. Peak temperatures on adjacent structures did not exceed 285? F. The subject measurement sensor is attached to a small platinum tab which is spot welded to the hinge clevis. This installation technique is subject to question as to the actual "contact resistance" of the sensor to the structure. By varying the contact resistance term analytically, the measurement could be reading up to several hundred degrees F higher than the hinge clevis itself. Thermal analysis shows that the addition of a high-emittance coating to the hinge clevis would reduce the peak temperature by 125? F. Hinge pins 7 and 9 were inspected in parallel, hardness tested and reinstalled. The lubricant (Vitrolube), with an upper temperature limit of 1000? F, also passed inspection and testing. Black high-emittance paint (Pyromark) has been applied to all bare hinges.

CONCLUSION: Postflight inspection and testing indicate that payload bay door hinges 7 and 9 could not have exceeded maximum temperature during entry. High "contact resistance" of the sensor to the structure probably resulted in the high temperature reading. CORRECTIVE_ACTION: Payload bay door hinge 7 temperatures will be extrapolated from adjacent measurements. Black high-emittance paint has been applied to all bare hinges. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:05:48	Problem	**FIAR**	**IFA** STS-1-V-56		STR
	GMT: 104:17:49		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Over temperature experienced on plate of body flap. (ORB)

Summary: DISCUSSION: During STS-1 entry DFI sensor V09T9874A indicated considerably hotter response than predicted. Peak measured temperature was 395? F on the tile carrier plate aluminum structure on the aft fuselage stub. Postflight inspection showed severe gap filler degradation adjacent to the carrier plate tiles and some indication of subsurface flow. Post-flight thermal analysis of local heating effects on the carrier plate and the adjacent waffle skin structure indicated that flight temperatures did not exceed structural capability.

CONCLUSION: Post-STS-1 thermal analysis combined with detailed visual inspection of the tiles and gaps in the stub region indicates that the over temperature was limited to the carrier plate. The over temperature is acceptable for the carrier plate structure. CORRECTIVE_ACTION: The stub carrier plate TPS will be left as is for STS-2 , with carrier plate removal/inspection planned after STS-2. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-57		D&C - Lighting
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Payload bay floodlights not operating. (ORB)

Summary: DISCUSSION: PCA bus current data showed that three of the payload bay floodlights did not operate during the flight.

The lighting system consists of two electronic packages and five metal halide light assemblies. Three light assemblies were connected to one electronic package and two lights were connected to the other electronic package. Each package has four electronic ballast circuits, each one for starting one light assembly. Each package consists of current sensing transistors, one of which controls the operation of an inverter, the output of which is fed to a power transistor and thence through a transformer to a pulse forming network (PFN) which supplies high voltage (1500 - 2000 volts) to strike the arc in the floodlight lamp. After ionization, the lamp operates at reduced voltage (approx. 100 volts); and the current reduces from an initial value of 10 amperes to about 6 amperes. Failure analysis of the electronic package revealed that one unit operated properly. In the other unit, two transistors failed in the electronic ballast circuits. CONCLUSION: Power transistor has a generic failure mode due to over heating. Current sensor transistor failed because high voltage lead from the PFN was improperly routed too close to the base lead and arcing occurred. CORRECTIVE_ACTION: A power factor correction circuit will be added to limit the current through the power transistors, thus reducing its operating temperature below failure levels (130? C). The output of the PFN will be routed away from the base lead; and, in addition, vent plugs will be added to the electronic package housing to reduce the outgassing pressure below the critical pressure of corona onset prior to floodlight operation. Modified units to be installed for STS-2. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-1-V-58		OMS/RCS
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Forward RCS oxidizer tank aft Z strut found deformed. (ORB)

Summary: DISCUSSION: The forward RCS oxidizer aft Z strut failed in Euler buckling due to the lift-off dynamic response from the SRB overpressure. The forward and aft Z axis tank struts on both the fuel and the oxidizer tanks were replaced with struts reinforced by plies of boron/epoxy. The rod end diameter of the fuel tank struts was increased by 1/16 in. to be the same as the diameter of the oxidizer struts.

The base heat shield left and right struts were reinforced and replaced. All other large mass support systems were reassessed for positive margins. CONCLUSION: Z axis accelerations exceeded design limits due to SRB overpressure which resulted in deformation of the forward RCS oxidizer tank aft Z strut. CORRECTIVE_ACTION: Forward RCS struts were modified and replaced. Base heat shield left and right struts were reinforced and replaced. All large mass structures were analyzed and found to have positive margins of safety. CAR ANALYSIS: Descriptions of damage, causes, and corrective actions are defined in the preceding. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 9	**MET:** 000:00:08	Problem	**FIAR**	**IFA** STS-1-V-59		APU
	GMT: 102:12:09		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Vibration levels were higher than expected on auxiliary power units 2 and 3. (ORB)

Summary: DISCUSSION: Six to 8 minutes after lift-off, flight data showed a rise in APU 2 X- and Z- axis vibration levels at 1200 Hz and a similar, but lower-level, vibration rise in APU 3.

Inspection showed hydraulic pump 2 to be normal, with slight erosion and no evidence of cavitation. APU 2 was found to be normal except that the turbine wheel balance was slightly out of tolerance. Rerun performance was satisfactory on both units. Data from other APU units show similar vibration, although APU 2 had the highest vibration during ATP, with APU 3 next. APU 2 data were comparable during rerun to ATP and flight data in normal speed range. CONCLUSIONS: STS-1 APU/hydraulic pump 2 and 3 vibration levels are typical, and units show near nominal wear. CORRECTIVE ACTION: APU-2 has been replaced. (See flight test problem report 19.) EFFECT ON SUBSEQUENT MISSIONS: none

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:08	Problem	**FIAR**	**IFA** STS-1-V-59A		APU
	GMT: 102:12:09		**SPR**	**UA**		**Manager:**

IPR **PR**

Engineer:

Title: Vibration levels were higher than expected on Auxiliary Power Units (APU's) 2 and 3. (ORB)

Summary: DISCUSSION: Six to eight minutes after STS-1 lift-off, flight data showed a rise in APU 2 X and Z axis vibration levels at 1200 Hz and a similar but lower level vibration rise in APU 3. APU 2 was replaced and the measured vibration levels on APU 2 were much lower on STS-2 than on STS-1. It can be concluded that the high vibration levels were not induced into APU 2 by the Orbiter mounting and/or support structure.

APU 3 vibration levels were higher than anticipated on STS-1 and the levels were basically the same on STS-2. About 8 minutes after lift-off on STS-2, APU 3 vibration levels increased. The predominate frequency changed from 600 to 1200 Hz with a 60 Hz beat appearing. Neighboring accelerometers confirmed that the vibration was not induced by the structure. The vibration level is representative of APU 3 system performance based on balance, load, ripple and other parameters. Preliminary ground test results show similar characteristics. Continued testing and analysis will ascertain if there is any degradation to the mission life cycles due to high vibration level. CONCLUSION: High vibration levels in APU 2 on STS-1 and in APU 3 on STS-1 and 2 were not induced by Orbiter mounting and/or supporting structure and are representative of individual APU system performance. High vibration levels have not degraded APU system performance and the APU's show near nominal wear. CORRECTIVE_ACTION: APU 3 will fly-as-is on STS-3. Flight and ground test data will continue to be evaluated. Additional instrumentation is planned on STS-4 for analysis of APU operation at 8 minutes after lift-off and during descent. CAR ANALYSIS: Based on post-flight testing and detailed APU subassembly examinations, no physical anomalies could be identified. However, the Vehicle End Item (VEI) specification was revised to allow increased hydraulic system ripple pressure (ref. CAR 01F099). [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Prelaunch	Problem	**FIAR**	**IFA** STS-1-V-60		C&T
	GMT: Prelaunch		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Video tape recorder vibration isolation system bottomed out. (ORB)

Summary: DISCUSSION: Although the video tape recorder (VTR) operated properly throughout the STS-1 mission, KSC reported failure of the VTR either to record or to play back audio during a pre-STS-2 checkout. While changing out the VTR, KSC also found structural damage to the VTR housing. Both the VTR and VTR housing were returned to JSC for evaluation and analysis. Significant damage was found in the VTR mounting rails and vibration isolators. These problems and potential solutions are now under investigation.

CONCLUSION: CORRECTIVE_ACTION: EFFECTS_ON_SUBSEQUENT_MISSIONS: ACTION PROGRESS: Reevaluating the design of the VTR vibration isolation system.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 10	MET:	Problem	FIAR	IFA STS-1-V-61	Purge, Vent & Drain
	GMT:		SPR	UA	Manager:
			IPR	PR	
					Engineer:

Title: OMS Helium purge flow inoperative. (ORB)

Summary: DISCUSSION: The aft compartment and OMS pod comparision of pressure data during entry indicates that the helium purge to the OMS pod did not occur.

CONCLUSIONS: CORRECTIVE ACTION: EFFECT ON SUBSEQUENT MISSIONS: ACTION PROGRESS: Flow tests are planned at KSC to verify is any blockage exists in the purge line.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-1-V-61A	Purge, Vent & Drain
	GMT:		SPR	UA	Manager:
			IPR	PR	
					Engineer:

Title: OMS helium purge flow inoperative. (ORB)

Summary: DISCUSSION: A comparison of entry pressure data from the aft compartment and the left OMS pod indicated that the helium purge to the OMS pod did not occur. Purge flow tests at KSC verified proper flow in the OMS purge line. Further, the pressure transducer was replaced prior to the STS-2 flight. STS-2 flight data shows that the required helium purge occurred in the OMS pods and aft fuselage.

CONCLUSION: The STS-1 indication of no purge flow was either caused by an erroneous transducer reading or the OMS pod cavity was not pressure tight because of delamination. CORRECTIVE_ACTION: None EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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