Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-01	APU
	GMT: 308:12:42		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Auxiliary power units (APU) 1 and 3 lubrication oil outlet pressure was high at 100 to 112 psia. The normal pressure is 50 to 60 psia. (ORB)

Summary: DISCUSSION: During the initial countdown, the outlet oil pressure on APU's 1 and 3 were observed to be at a level of about 100 psi compared to APU 2 which was between 50 and 60 psi. This pressure difference was at the value of the filter pybass relief valve. Following the launch scrub, the oil and filters were replaced and the high-pressure of the lubrication oil was confirmed to be caused by the filter being plugged with pentaerythritol, a crystalline substance that forms when hydrazine penetrates the gearbox. The hydrazine enters the gearbox around the seal between the fuel pump and the gearbox.

The lubrication oil systems will be flushed and the filters changed after each flight. Also, the gearbox pressure will be maintained at a minimum of 5 psi above the seal cavity drain line at all times while the APUs are not operating. Continuing action will investigate keeping the seal cavity drain line vented and separating the lubrication oil seal leakage from the fuel pump seal leakage. CONCLUSION: The hydrazine penetrated the gearbox from the seal cavity drain, and formed contaminants which plugged the filter. CORRECTIVE_ACTION: Procedures at KSC have been changed to maintain a positive pressure on the gearbox at all times. The oil has been drained and the gearboxes flushed and reserviced on all APU's in preparation for STS-3. CAR ANALYSIS: Increased lube oil pressure was caused by contaminants blocking the lube oil filter, and the filter operating in a bypass mode. The contaminants were created by hydrazine and water leaking into the lube oil and creating a sludg which clogged the filter. The common cavity for fuel pump seal leakage and gearbox seal leakage allowed hydrazine leakage into the lube oil, especiallyunder conditions where seal cavity drain pressure exceeds gearbox pressure for long periods (as during STS-1 flow). APU servicing requirements have been relocated in the ground turnaround flow to nearer the launch to preclude future effects of seal leakage contaminating the lube oil. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-02	DPS

GMT: 315:15:49		**SPR**	**UA**	**Manager:**
		IPR	**PR**	
				Engineer:

Title: MDM OF3 Secondary Port failed prelaunch. (ORB)

Summary: DISCUSSION: Prelaunch data indicated an MDM failure that was isolated to the OF3 secondary port. The MDM was replaced with an on-site spare, but the spare had a failed power supply. An MDM from OV-099 replaced the spare MDM and there were no MDM failures during flight.

The first failure was in a semiconductor die used in a hybird component due to "channeling" from inpurities within the silicon. This contamination causes a time-dependent degradation that is a function of operating voltage and temperature. The failure is the first one in this lot code die on the MDM program. The second failure resulted from an internal diode short attributed to a cracked die with probable silver migration. Records indicate a one-time vendor inspection escape prior to encapsulation. This diode is used extensively across the program with no other reported failures. CONCLUSION: Two MDM failures during countdown were the result of non-generic component failures. "Channeling" within a semiconductor die used in a hybrid component due to impurities within the silicon caused the first failure. An internal diode short due to a cracked die that escaped detection prior to encapsulation resulted in the second failure. CORRECTIVE_ACTION: MDM spares available for installation at KSC will be checked out for each flight starting with STS-3. The problems were one-time non-generic component failures warranting no further action.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-03	Active Thermal Control Subsytem
	GMT: 316:06:00		**SPR**	**UA**	
			IPR	**PR**	**Manager:**
					Engineer:

Title: Ten Orbiter heater system thermostats exhibited "dither" during the STS-2 mission. (ORB)

Summary: DISCUSSION: A number of heater system thermostats exhibited dither, an apparent change in set points to a smaller deadband. A bimetallic disc in each thermostat flexes because of temperature changes with a minimum acceptance deadband 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 deadband. The concern was that dithering at the lower or upper limit of the maximum allowable deadband could potentially result in exceeding limits on systems 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 provide acceptable system temperatures. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-04	HYD
	GMT: 3136:15:22		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Icing in the water spray boiler 3 inhibited lubrication oil cooling and caused the APU 3 gearbox outlet temperature (V460354) to exceed the 330 ?F failure detection annunciator limit at 316:15:22 G.m.t. (ORB)

Summary: DISCUSSION: APU 3 was shutdown about 2 minutes earlier than the other 2 APU's at 316:15:23:27 G.m.t., or 13 1/2 minutes after lift-off.

Each of the 3 water spray boilers had a 5 lb preload of water that was added to provide cooling, should a water flow failure occur during the ascent phase. The water preload covered the lube oil cooling tubes and the spray bars. Rapid boiling of the preload due to decreasing ambient pressure during ascent carried free water overboard and allowed the remaining water to cool very quickly. Once the water was below the lubrication oil tube bundle, water froze on the spray bars. Heat from boiler tank and tubes thawed the ice in boilers 1 and 2 in seconds on both flights, whereas boiler 3 remained frozen for 1.5 minutes on STS-1 and 17.5 minutes on STS-2 before normal cooling returned. Differences in thaw times may be due to variations in APU heat load, different rates of free water ejection and variations of the ambient pressure profile at the water spray boiler exists. Analysis has shown that lowering the water preloads will preclude icing, yet will provide adequate cooling capaicty for launch should there be a water supply failure to the spray bars. CONCLUSION: The lubrication oil overtemperature was caused by a high water preload in the water spray boilers that resulted in excessive water boil-off and thereby cooled the remaining water to the freezing point. CORRECTIVE_ACTION: Load STS-3 water spray boilers 1, 2 and 3 with 4 lb, 3 lb and 2 lb of water, respectively. CAR ANALYSIS: Examination of the vehicle installation revealed that a cooling water flex line was cross threaded at the inlet filter. No evidence of component failure or degradation could be found. Therefore, it is believed that the cooling system operated normally but when the cooling flow reached the bad joint, it leaked, flash freezing the entire line area thereby stopping water flow. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-05	OMS
	GMT: 316:15:22:30		**SPR**	**UA**	**Manager:**

		IPR	**PR**	
				Engineer:

Title: Right OMS oxidizer quantity read 14 percent high at end of OMS-1 firing. Left OMS oxidizer quantity hung up during OMS-3B firing. (ORB)

Summary: DISCUSSION: Three areas in which the quantity gages did not perform according to specification were encountered:

The right oxidizer totalizer channel jumped 20 percent 15 seconds into OMS-1 firing and gave erroneously high readings throughout the mission. The reading from the aft probe was also high at the end of mission. Checkout of the right pod totalizer and forward and aft probe electronics modules has been accomplished without finding the problem. Detail troubleshooting of the totalizer was also performed without finding the problem. When the vehicle was powered up in the vertical position, the gage reading corresponded closely with the predictions for propellant remaining. Ground instrumentation will be used for loading. Should the quantity gage continue to be erratic during the flight, prediction techniques using burn times and estimates of RCS usage will be used to determine quantity. A hang-up in the forward oxidizer probes was observed and this also occurred during STS-1. The hang-up in the forward probes is believed to be due to inadequate drain from the aft support cup. A modification to the totalizer is required to correct this problem. Hang-up occurred in left fuel probe during OMS-1 and OMS-2. This also occurred on STS-1 in both fuel probes. This hang-up is attributed to inadequate vent area at the top of the probe. The right fuel probe was replaced with one having increased vent are and the problem did not recur. CONCLUSION: The specific cause is not known, however the troubleshooting accomplished to date indicates the problem is in either the probe or the probe electronics, both of which are inaccessible. CORRECTIVE_ACTION: None. Ground instrumentation will be used for loading. Flight quantities can be determined analytically. CAR ANALYSIS: The exact cause of failure could not be determined. The most probable cause is an intermittent electrical short in the older designed aft electronics module. All older designed aft electronics modules have been replaced with newly designed modules. Effectivity is all vehicles. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: Loading accuracy is decreased and this will result in additional propellants being loading to account for accuracy loss.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-06	MPS
	GMT: 316:15:11		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: MPS engine 2 GH2 pressurant pressure failed. Temperature went off-scale high from main engine ignition to MECO. (ORB)

Summary: DISCUSSION: The pressure transducer V41P1260A monitors the GH2 pressurant pressure provided to the ET by main engine No. 2. Flight operations use this measurement as a backup to the main engine controller data in the event of loss of both engine data paths. Since the measurement tracks engine Pc, it can be used to verify that the engine is running & that throttling is occurring as required. Failure of this transducer was also experienced during MPTA testing and STS-1 because the vibration environment was more severe than the qualification level. For STS-3, the pressure transducer has been relocated in a less severe vibrational location.

The temperature measurement V41T1261A is a backup to the pressure measurement and can be used as an indication of engine operation. It also operates in a vibration environment that is more severe than the qualification level. The transducer was replaced after STS-1 because it failed. During STS-2, the transducer worked pre-launch and after re-entry. During troubleshooting, the transducer, connector, wiring and the MDM were checked, but the cause of the problem could not located. An improved design temperature transducer is planned for installation on MPS engine 2 for STS-4 and subs. Vibration levels for qualification testing of the new temperature sensor have been revised from 2000 to 5000 Hz, which was determined to be adequate through significantly below the 16,000 Hz experience in flight. These measurements are not Launch Commit Criteria nor are they RSLS monitored. CONCLUSION: The vibration environment for both transducers has been too severe thus causing failure during flight. Further failure, should it occur, would not adversely effect flight operations since both measurements are back-up indications of engine operations. CORRECTIVE_ACTION: The pressure transducer has been relocated for STS-3. The temperature transducer will be left as is for STS-3. A new design will be delivered for testing in April 1982. CAR ANALYSIS: See PROBLEM DISCUSSION regarding sensor vibration environment, qualification, and future relocation. [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-2-V-07	APU
	GMT: 316:15:34		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: APU 1 outlet and body temperatures above 200 ?F upper limit. (ORB)

Summary: DISCUSSION: Cooling system A did not provide cooling to the APU 1 fuel pump and valve. Switching to cooling system B still did not cool the pump and valve. Several pulses were noted at approximately 1 1/2 hours after shutdown.

The failure investigation showed that the water pulse valve operated properly and all lines were clear. The fitting at the APU manifold was found to be badly galled. This galling resulted in a leak path for the water which flashed when exposed to vacuum. This produces a significant heat loss and the freezing of the water in the line. Heat soakback from the APU thawed the water and the valve operated for a short period. Then the phenomenon repeated. CONCLUSION: The failure was caused by water freezing in the line because of a leak in a galled fitting which allowed the water to flash when exposed to a vacuum. CORRECTIVE_ACTION: The APU side of the galled fitting was removed and replaced during APU replacement. The cooling system side of the fitting was inspected prior to APU installation. The fitting passed a leak check after APU installation. A leak check of this fitting has been implemented for STS-3 and all future changeouts. The check will be done by flowing GN2 at 30 psig through the line and performing a bubble leak check. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-08	FCP

GMT: 316:17:45 **SPR** **UA** **Manager:**

IPR **PR**

Engineer:

Title: Fuel cell 1 failure. (ORB)

Summary: DISCUSSION: Fuel cell 1 indicated "ph High" upon acquisition of signal at 2:27 Mission Elapsed Time (M.e.t.). However, the performance remained acceptable until 4:45 M.e.t. when a sudden performance loss of 0.75 volt occurred within a 2-minute period, and this is indicative of "flooding" (KOH expulsion) of the power section. The fuel cell was removed from the bus at 4:52 M.e.t. and shut-down at 5:05 M.e.t.; the reactant valves to fuel cell 1 were closed after shutdown. A safing procedure was performed at 7:07 M.e.t. using internal fuel cell 1 heater loads to consume the trapped reactants and thereby eliminate any possibility of reactant mixing. The remaining fuel cells (2 and 3) satisfied all electrical power requirements thereafter.

Review and analysis of ac bus 1 data showed higher than normal phase-current levels and current fluctuations whenever fuel cell 1 was operating; however, during reactant purges the current returned to normal levels and was steady. This behavior is typical for the presence of water at the hydrogen pump impeller rim and, therefore, indicates hydrogen pump rim aspirator malfunction. This condition was confirmed as having been present during the September 1981 fuel-cell confidence run, the STS-2 launch scrub and STS-2 pre-launch fuel cell operation. Disassembly of fuel cell 1 at the vendor showed flooding of 4 cells at the inlet end of the cell stack. All 64 cells magnesium plates were in excellent condition and no evidence of any power section abnormality was found. The cell reactant ports were not blocked. The accessory section was also found to be normal except for the hydrogencirculating loop that showed extensive evidence of KOH corrosion in the aluminum parts of the system. The hydrogen pump inlet housing, which contains the aspirator nozzles and water discharge valve, was removed and tested with another functional hydrogen pump. These tests showed that the hydrogen pump impeller rim aspirator backflowed water to the pump rim at a rate sufficient to produce the same ac current signature observed prior to the time of failure. Subsequent inspection showed that the pump rim aspirator nozzle was partially plugged. The particle was removed and analyzed and determined to be largely aluminum hydroxide; most of the inner parts of the pump were coated with aluminum hydroxide. The removed particle was very small (<.020" dia.) and, therefore, difficult to analyze. It is possible that the particle was an external contaminant resulting from the manufacturing process. The particle became coated with aluminum hydroxide which was formed by the reaction of KOH with aluminum particles. Efforts are continuing to obtain a positive identification of the core of the particle to enable possible determination of its source for long-term corrective action. CONCLUSION: The most likely failure scenario was blockage in the aspirator system creating a sufficient pressure imbalance to cause some water to backflow to the pump impeller rim. This produced the observed ac current behavior. The pump began to sling water back into the stack and the water droplets collected in some of the hydrogen ports of the first 4 cells, thus reducing the hydrogen flow rate through those cells. Since this circulating hydrogen removes the water (as vapor) produced in the cells, the ability to remove water was therefore reduced; the high water production rates concomitant with the ascent electrical loads caused the water to build up in these cells faster than it could be removed. The volumetric capacity of these cells was eventually exceeded, and the KOH - water solution flowed out of the cells into the hydrogen stream, where it was then discharged from the fuel cell, causing the pH sensor to alarm. As the cells continued to lose electrolyte, the performance dropped ~0.75 volt, probably because of the expelled water/KOH solution shorting across one or more of the cells in the hydrogen manifold. CORRECTIVE_ACTION: Fuel cell 1 was replaced. All 3 STS-3 fuel cells plus 5 production fuel cells have been inspected for aspirator nozzle

blockage. No contamination or corrosion has been found. A fuel cell confidence run is planned for early March. The hydrogen pump ac current data will be carefully reviewed and analyzed during this run and all subsequent fuel cell operations to ensure proper operation. CAR ANALYSIS: Failure analysis, investigation, and corrective actions are fully described in the preceding. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: Long-term corrective action under consideration includes filtration of critical aspirator passages, alternate materials for aspirator nozzles and pump inlet housings, and additional fuel cell instrumentation to provide greater visibility into potential problems.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-09	INS
	GMT: 316:17:45		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Fuel cell 2 oxygen flowmeter went to an off-scale high reading. (ORB)

Summary: DISCUSSION: The flowmeter sensor (V45R0260A) indicated an off-scale high reading about 1 hour and 50 minutes into the mission and remained at the upper limit throughout the mission. The oxygen flow meters have a history of marginal accuracy.

Temperature compensation electronics were modified prior to STS-1 and new sensors were installed. The flow meters functioned within specification during the preflight tests for STS-1 and STS-2 but varied from specification during both flights. Flow meters, along with the fuel cells were changed out after STS-1. During the STS-1 countdown, the flow meters were again erratic. Extensive evaluation, redesign and qualification of a new meter system would be required to solve this problem. The outputs of the flow meters were used by the general purpose computer for automatic fuel cell purge control by monitoring the flow rate to sense that the purge valve had opened or closed. The flow meters could also be used to detect a leak in the fuel cells. Leak detection can also be derived over a longer period of time by monitoring tank consumables. The minimal operational impact of erratic flow meters does not justify an extensive effort for a new system. CONCLUSION: Flow meter was defective. CORRECTIVE_ACTION: GPC automatic purge software will be modified to inhibit purge valve open/ close checks. The flowmeter is to be reflown. CAR ANALYSIS: The failed flowmeter will be replaced when the Fuel Cell is removed and returned to the vendor for overhaul modification or repair. [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-2-V-10	EPD
	GMT: 316:17:44		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Three-Phase Circuit Breaker Indicated Open Circuit on One Phase. (ORB)

Summary: DISCUSSION: During STS-2, the OSTA pallet pump circuit breaker (CB16 on Panel MA73C) indicated an open circuit on one phase. During postflight ground checkout, the problem was duplicated by cycling the circuit breaker. Additional cycling cleared the problem. All connections to the circuit breaker were verified to be intact before it was removed and replaced. After installation of the new breaker all three phases of the a.c. power were one to two volts low. Subsequent cycling of the new breaker cleared the low voltage problem.

X-rays of the removed breaker showed a slight misalignment of the contacts, but not enough to have caused the problem. Subsequent disassembly did not reveal any major contamination; however, a slight amount of residual solder flux was present on all contacts. Additional laboratory analysis and tests did not identify a plausable cause for the anomaly. Crew procedures are being revised to require cycling of the circuit breaker should this problem recur. CONCLUSION: Minor solder flux contamination was present on all contacts. Exact cause of failure is not known. CORRECTIVE_ACTION: Circuit breaker replaced for STS-3. Crew procedures revised to require cycling of the circuit breaker should this problem recur. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-11	ECLSS
	GMT: 316:19:38		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Flash Evaporator System (FES) Control System "A" Inoperative and System "B" Erratic. (ORB)

Summary: DISCUSSION: During ascent following MECO, FES control system "A" shutdown. Manual restart of system "A" by the crew was successful. However, following radiator system activation and payload bay door opening, system "A" topping FES failed to automatically restart from "standby". Manual restart of system "A" was unsuccessful, resulting in activation of control system "B". System "B" operated, but also failed to automatically restart from "standby". Manual restarts by the crew were successful.

Diagnostic tests were conducted to determine FES health for entry. Proper full-up (high load and topping) FES operation on both systems "A" and "B" were verified. Proper high load FES operation on the secondary control system (-742) also was demonstrated. Postflight on-board failure investigations revealed that the control system "A" outlet temperature shutdown sensor had shifted 2?F high and the system "B" mid-point temperature sensor had shifted 1.9?F low. The remaining FES temperature sensors were within specification limits. Anomalous primary FES controller "A" and "B" operation was the result of temperature sensor drift. The drift in the system "A" outlet sensor can cause a rate shutdown under small heat load transients even if the FES is operating properly. The drift in the "B" mid-point temperature sensor causes the FES to be activated late and, depending on the heat load, can result in an over-temperature shutdown. The secondary controller has no shutdown provisions

CONCLUSION: Anomalous primary controller operation was the result of temperature sensor drift. CORRECTIVE_ACTION: The OV-102 FES has been reconfigured electrically by interchanging connectors so that primary FES controllers "A" and "B" use accurate sensors. The secondary controller will use the outlet sensor that drifted for topping evaporator operation and a new replacement sensor for high load operation. The outlet sensor will not be replaced because of reinstallation concerns. CAR ANALYSIS: "B" circuit sensor drift was attributed to a crack in the sensor weld bead. No correllation between the cracked bead and materials or processing has been established. The "A" sensor was not removed from the vehicle. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-12	INS
	GMT: 317:13:50		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Fuel cell 3 oxygen flowmeter operation was erratic. (ORB)

Summary: DISCUSSION: The flowmeter reading (V45R0360A) was erratic from 22 hours 40 minutes into the mission through the end of the mission. The oxygen flowmeters have a history of marginal accuracy. See problem number 9. Extensive evaluation, redesign and qualifications would be required for a new system.

The flow meters were used to sense that the purge valve had opened or closed during GPC automatic purge. The meters can also be used for leak detection. The minimal operational impact of erratic flowmeters does not justify an extensive effort for a new system. CONCLUSION: Flow meter was defective. CORRECTIVE_ACTION: GPC automatic purge software will be modified to inhibit purge vavle open/close checks. The flowmeter is to be reflown. CAR ANALYSIS: The failed flowmeter will be replaced when the Fuel Cell is removed and returned to the vendor for overhaul modification or repair. [not included in original problem report]
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-13	C&T
	GMT: 317:17:30		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: CCTV camera B, located on aft/port bulkhead, overheated during day 2 operation. (ORB)

Summary: DISCUSSION: During a TV pass, TV camera B reached a temperature of 45? C. Ground control advised the crew to turn the camera off.

Post-mission evaluation of on-board video tapes show that all payload bay/RMS TV cameras were operated continuously for 4.5 hours during the Day 2 RMS activities. The temperature data from the video tapes show that each payload bay camera started at approximately 10? C when turned on and then gradually increased to the 43 to 45? C range after 4.5 hours of operation. Later mission operation and post-mission grouond tests demonstrated proper operation of each TV camera. Post-mission tests show that with the STS-2 payload bay orientation, the bulkhead TV cameras will normally reach a 45? C temperature after 4.5 hours operation. CONCLUSION: With the payload bay orientation of STS-2, the bulkhead TV cameras will normally reach 45? C after 4.5 hours of operation. There was no anomalous conditions within the CCTV hardware. CORRECTIVE_ACTION: Restrict the planned TV camera operating time as required based on the mission thermal profile. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-14	C&T
	GMT: 317:18:39		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: The RMS wrist/elbow TV circuit breaker opened. (ORB)

Summary: DISCUSSION: During a TV telecast on Day-2 RMS operations, the RMS wrist/elbow TV camera circuit breaker opened. Resetting the breaker did not resolve the problem. Troubleshooting isolated the problem to excessive current draw by the elbow TV camera. The camera was removed and returned to the vendor where the problem has been isolated to the power supply. Analysis showed that 3 transistors failed because of an overvoltage condition in the TV camera power supply. Failure analysis and testing of the failed power supply with replacement components is continuing.

Five of these TV cameras were flown on STS-1 without a failure. Three more were added for STS-2 and this is the only failure in 13 camera missions. This design has been through about 25 hours of qualification environmental testing in addition to extensive ground tests and training without exhibiting a similar failure CONCLUSION: Problem has been isolated to an overvoltage condition in the power supply of the wrist/elbow TV camera. CORRECTIVE_ACTION: TV camera has been replaced. The failed power supply is being tested in an effort to duplicate the overvoltage condition. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-15	C&T
	GMT: 317:19:08		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Payload bay CCTV cameras A, B and C experienced lens contamination during the mission. (ORB)

Summary: DISCUSSION: During Day 2 TV operations, payload bay bulkhead cameras A, B and C demonstrated "out-of-focus" video. Post-mission investigation determined the anomalous condition to be caused by oily deposits within the lens assemblies. Chemical analysis of the oil led to the determination that the lens manufacturer had added oil to the lens assembly during manufacturing. The thermal characteristics resulted in the oil vaporizing and depositing on the glass elements, thereby degrading the optical image presented to the TV camera.

CONCLUSION: The degraded video was caused by outgassing of oil added to the lens assemblies by the manufacturer. CORRECTIVE_ACTION: Lens assemblies were cleaned. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-16	RMS
	GMT: 317:19:28		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: RMS shoulder yaw joint could not move in backup mode. (RMS)

Summary: DISCUSSION: Post-flight inspection of a cable installed between the Remote Manipulator System (RMS) display and control panel and the Orbiter wiring leading to the RMS shoulder showed that the wire to pin 5 was not connected. Four other wires were removed and pull-tested. Each wire failed in tension within 11.2 and 12.2 pounds force (specification: 8.0 pounds minimum). All five wireswere inspected using a stereo microscope and a Scanning Electron Microscope (SEM). Results of this inspection indicated that the wire to pin 5 failed due to excessive tensile loads. The inspection eliminated fatigue as a cause as well as crimp damage, although some evidence of crimp damage to 5 strands of the 19-strand wire was present. In any event, the 14 remaining strands should have provided adequate strength for normal handling loads. The 5 wires have been repaired and tested.

Review of the work activity at KSC indicates that the display and control panel was pulled forward to allow access to the RMS rotational hand controller after the RMS V1110 test sequence. Based on the inspection and pull-test results, the most likely cause is considered to be excessive loads imposed on the cable during ground handling operations. Low-fidelity mock-up studies indicate that some handling stress is to be expected and that a longer cable length may help alleviate the load. CONCLUSION: The broken cable was caused by excessive loads during ground handling activities. CORRECTIVE_ACTION: The cable has been repaired and reverified. Consideration is being given to lengthening the cable, changing wire material and tethering the mid-point of the cable to reduce the chance of wire damage on future vehicles. CAR ANALYSIS: The RMS is GFE to the Orbiter and is not tracked in the Rockwell failure reporting system. The failure is being tracked in the NASA/JSC failure reporting system under FIAR HBC 0108. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-17	INS
	GMT: 317:20:14		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Left OMS crossfeed B valves position indicators failed. (ORB)

Summary: DISCUSSION: At 317:20:14:30 G.m.t., the telemetered close valve position indicators (VPI) on the left pod B leg crossfeed valves went to zero (indicating not closed). The telemetered open valve indicators continued to read not open, with the cockpit switch in the manual position and the crew talkback correctly read valves closed. When the close position indicators went to zero, power was applied to the valves through the motor control assembly. Power was removed by having the crew place the cockpit switch to GPC position. Inspection and test at KSC could not duplicate the flight anomaly. Both valves were cycled and the valve position indicators worked properly. Wiring that was accessible at the time of the inspection was wiggled in an attempt to isolate any loose wires without success.

The valves can be cycled manually or in GPC and the crew read-out of the valve position indicators are working properly. Since crew procedure changes are being implemented to prevent continuous power application to the valves, no further action is planned. CONCLUSION: An intermittent on the telemetered close-valve position indicators of the left OMS crossfeed B valves caused continuous power application to the valves. CORRECTIVE_ACTION: Crew procedure change is being implemented requiring crew to place left OMS crossfeed B valve switch in the GPC position after every valve configuration change to prevent continuous power application to valve. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-18	INS
	GMT: 316:08:40		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Fuel cell 1 hydrogen flowmeter read low. (ORB)

Summary: DISCUSSION: The flowmeter reading (V45R0170A) started reading low during STS-2 countdown and read about 25 percent low throughout the mission.

The flowmeters have a history of marginal acccuracy. See problem numbers 9 and 12. Extensive evaluation, redesign and qualification would be required for a new system. The flowmeters were used to sense that the purge valve had opened or closed during GPC automatic purge. The meters can also be used for leak detection. The minimal operational impact of erratic flowmeters does not justify extensive effort for a new system. CONCLUSION: Flowmeter was defective.

CORRECTIVE_ACTION: GPC automatic purge software will be modified to inhibit purge valve open/close checks. Flowmeter replaced because of replacement of fuel cell 1. CAR ANALYSIS: The failed flowmeter will be replaced when the Fuel Cell is removed and returned to the vendor for overhaul modification or repair. [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-2-V-19	TPS
	GMT: 316:15:10		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Debris damaged the thermal protection system during ascent, entry, and landing. (ORB)

Summary: DISCUSSION: Minor damage occurred at several locations on the Thermal Protection System (TPS). Damage was slightly less than on STS-1.

Minor coating damage occurred to two tiles aft of the left ET door. This is assumed to be caused by baggy cord impact during ascent, or by ascent debris impact damage. The right ET door used clips for baggy attachment rather than cord and no damage occurred. Minor damage occurred to 9 tiles behind the Left Main Landing Gear (LMLG) and 4 tiles behind the RMLG resulting from impact of instrumentation wires that disconnected from the main landing gears during landing. The surface coating of 12 tiles on the body flap bubbled during entry probably due to moisture entrapped under the surface. Six (6) tiles on the surface wing glove/fuselage chine had partial in-plane fracture of their outer portions. These fractures have been proven to be the result of entrapped water (ice after ascent) which, when subjected to temperatures below -90? F during orbit, contracted and partially fractured the RSI fibers in-plane at the interface between the un-waterproofed and waterproofed tile material. The heat of re-entry generated steam pressure from the interior ice causing completion of the in-plane fracture. This occurred early in re-entry as evidenced by shrinkage of tile material along the downstream (relative to entry flow) edge of each cavity. Testing and analysis indicate that the only Orbiter region cold enough to damage the tile interior during STS-2 was the right glove. All of the tile sidewalls in this area were inspected with the result that 10 fractured tiles were replaced. An improved post-flight water repellant treatment was applied to the exposed tile surface prior to STS-3 roll-out. CONCLUSION: Two tiles aft of the left ET door were damaged probably by the baggy cord. Loose MLG instrumentation wiring damaged 13 tiles behind the MLGs. The surface coating of 12 tiles on the body flap bubbled during entry probably due to entrapped water which also fractured 10 tiles on the right wing glove/fuselage chine. CORRECTIVE_ACTION: The left ET door baggy attachment was changed to utilize clips. Redesign of MLG instrumentation wiring installation has been incorporated for STS-3. The damaged tiles on the body flap and right wing glove were replaced. Sidewall inspection cleared the wing glove region for flight. Improved water repellant was applied before rollout. CAR ANALYSIS: - Tile RSI OMS separation was corrected by revising waterproofing application techniques. - Wing glove area burn-through area showed no evidence of burn-through after the area was cleaned with isopropyl alcohol. Gap fillers were later installed. - The Orbiter/ET umbilical baggie was redesigned to eliminate the drawstring by MCR 4536 R6. - Tire pressure gage wiring was rerouted and fastened into place by a revision to drawing V070-780103 A03. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-2-V-20	DPS
	GMT: 317:22:30		SPR	UA	Manager:
			IPR	PR	
					Engineer:

Title: Display Unit CRT 1 went blank. (ORB)

Summary: DISCUSSION: DU (Display Unit) 1 CRT (Cathode Ray Tube) went blank during on-orbit operations. Recycling power did not resolve the problem. The unit was removed in flight and replaced by the DU from the aft station. This unit operated for the remainder of the mission, but it also went blank after prime crew egress.

The first failure was an internal short in a deflection amplifier power transistor due to particulate contamination from weld splash during the capping operation on the transistors. Transistors will now be Particle Induced Noise Detection (PIND) tested for contamination. Zero-g usage on STS-1 and 2 provides an acceptable screen for the two CRTs that were not replaced. The second failure resulted from internal arcing in the high voltage power supply. Additional in-process inspection and burn-in was implemented together with an in-process corona screen during early build. CONCLUSION: Two display unit failures in the DU 1 slot during and after STS-2 were the result of two different component failures. Particle contamination from weld splash during the capping operation on a power transistor caused the first failure. Corona in the high voltage power supply failed the replacement unit. CORRECTIVE_ACTION: Power transistors were PIND tested and high voltage power supplies were corona screened for replacement display units in slots 1 and 4 on STS-3. All future units will be PIND tested and corona screened. Tested and screened spare units will be available for installation prior to STS-3 launch. CAR ANALYSIS: Failure analysis and corrective actions are described in the preceding body of the Flight Problem Report. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-2-V-21	INS
	GMT: 317:19:02		SPR	UA	Manager:
			IPR	PR	
					Engineer:

Title: Run light for low aft data acquisition camera did not operate. (ORB)

Summary: DISCUSSION: The non-operating run light indicated that the camera was not operating. Post-flight investigation revealed a blown fuse. The fuse was replaced and operation was attempted. The camera motor would operate, but the gear train would not. The clutch was slipping, indicating a mechanical hang-up in the gear train. The camera covers were removed and the gear train was examined. A small piece of lacing cord was found under the bevel gears at the front end of the drive shaft. The piece of cord had become entangled in the gears causing them to bind and overload the motor.

CONCLUSION: A piece of lacing cord left from camera wiring mods became entangled in the bevel gears causing a motor overload and blowing the fuse. CORRECTIVE_ACTION: The camera was cleaned and all particles removed. The other cameras are being examined for similar conditions and will be cleaned of any particles prior to re-flight. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-23	INS
	GMT: 318:03:00		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Pressure transducer, located in water line to airlock, failed to off-scale high. (ORB)

Summary: DISCUSSION: Pressure transducer V64P0201, located on the extravehicular cooling and servicing system water supply, failed off-scale high. The failure occurred at the beginning of a supply water dump when the water pressure normally drops about 5 psig.

CONCLUSION: Pressure transducer failure. CORRECTIVE_ACTION: Transducer has been removed and replaced. CAR ANALYSIS: Supplier analysis found a 6.6% shift in sensor scaling. There was no explanation as to why the data went off-scale high. The data failure cause is unknown. The sensor was replaced on the vehicle in order to remove the suspected sensor for vendor analysis. [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-2-V-24	HYD
	GMT: 318:21:17		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: The hyd reservoir 1 fluid level dropped 14 percent and the reservoir 3 level dropped 6 percent when the landing gear isol valves were opened for gear deploy. Following deploy, volumes decreased uniformly at a rate of about 6 percent/min (approx. 5 gpm) (ORB)

Summary: DISCUSSION: The landing gear hydraulic circuit is isolated early in the Orbiter Processing Facility (OPF) turnaround activities and the isolation valves remain closed until late in the entry operations. The return lines are isolated with a check valve to reduce the risk of fluid loss.

A compressibility test early in the STS-1 turnaround operations showed that no voids existed in the system. An inspection after STS-2 showed no evidence of external leakage and a compressibility test showed no voids. When the Orbiter is raised to the vertical position, the resulting head pressure in the landing gear circuit requires a reservoir pressure of at least 40 psi to prevent fluid drain back from the nose gear lines. Additionally, the GSE is located about 60 ft below the reservoirs and if the back pressure drops below the minimum allowable value, portions of the fluid in the landing gear lines could drain back into either the flight or GSE reservoirs. Further, the check valves will prevent the voids caused by drain back from refilling until the isolation valves are opened during the entry phase of the next mission, at which time the return flow from the brake servos will slowly fill the voids. The landing gear lines can accomodate the observed reservoir volume drops. Also, the brake servos flow rates are in the range of the observed volume decrease rates. Finally, several normally static return-line temperature sensors showed increased values coincident with the flow of warmer fluid into the voids. CONCLUSION: The noted decreases in reservoir fluid volume resulted from filling the voids in the landing gear circuit. These voids were probably caused by a momentary drop in back pressure when performing hydraulic operations during the turnaround activities. CORRECTIVE_ACTION: The KSC procedures will be modified to require a short period (momentary) opening of all three landing gear isolation valves during the final servicing. This momentary opening will refill any existing voids. EFFECTS_ON_SUBSEQUENT_MISSIONS: This change is effective on STS-3 and subsequent.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-25	PYLD
	GMT:		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: OEX recorder did not respond to uplink commands. (ORB)

Summary: DISCUSSION: During the orbit prior to entry, the OEX recorder was running while it was in the standby mode. The recorder did not run during entry. Telemetry indicated that the tape was completely rewound onto the supply reel. Postflight data processing verified satisfactory recorder performance through the last on-orbit recording period with ACIP operation during the vernier RCS vehicle control mode.

Troubleshooting found the flat Kapton belt (0.005" thick, 0.312" wide, and 19.7" long) that connects the intermediate (jack) pulley to the take-up reel pulley had broken. After loss of tension by the take-up reel, the supply reel pulled the tape in reverse while the recorder was in standby. The belt failure was caused by the wrinkling or "scalloping" of the belt which was evident along the entire length of one edge. The belt mis-tracked on the driving pulley becoming scalloped when it rode hard against the pulley flange. Mis-tracking was most probably caused by residual stresses or belt asymmetry which was induced during the manufacturing process. CONCLUSION: The belt on the take-up reel broke before entry after becoming scalloped due to mis-tracking that was probably caused by residual stresses or belt asymmetry. Loss of ACIP data during entry reduced the accuracy of extracted aerodynamic coefficients. CORRECTIVE_ACTION: Replaced take-up jack pulley, cleaned all pulley faces and replaced all seven belts after screening for asymmetry, residual stresses, surface cracks or edge nicks. Verified proper belt tracking after installation and after 50 hours of recorder operating time. EFFECTS_ON_SUBSEQUENT_MISSIONS: Subsequent flights will require maneuvers to gather aerodynamic data to clear the c.g. envelope.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-2-V-27	Water and Waste Management System
	GMT:		SPR	UA	
			IPR	PR	Manager:
					Engineer:

Title: The crew observed excessive gas in the drinking water. (ORB)

Summary: DISCUSSION: Postflight analysis of the drinking water bags showed that 35 percent of the volume was gas of which 0.3 percent was hydrogen and the remainder air. As a result of the fuel cell 1 problem, Tank A was isolated and not opened and the crew drank the water directly from the fuel cells. This procedure resulted in the drinking water bags being filled at a much slower rate due to difference in pressure (2 1/2 - 3 minutes) versus a 5 second fill rate when the bags are filled from the potable water tank. Although a specific mechanism that would introduce air into the drinking bags at the lower pressure is not known, this is considered a potential source of the problem.

Another source of the problem could be air introduced into the chilled water line during deservicing at DFRC for the ferry flight or during servicing of the water system at KSC. The chilled water system has sufficient volume to provide the quantity of gas that was observed. During STS-1 servicing, the water lines were vacuum serviced. During STS-2 flow, the ambient water line was not vacuum serviced after the DFRC deservicing had been performed on this line. If, however, a procedural error has been made (records do not indicate this occurred) and the chilled water line was drained instead of the ambient line, N2 would have been introduced into the system. A ground report during the water flushing procedure that was accomplished at T-3 days prior to the STS-2 flight did indicate that gas was observed at the water gun. To protect against both possibilities, procedures have been modified to use the water tank(s) for the water source; also, Apollo drinking gas separator devices are being flown and the chilled water supply will be tested insuring that the system is gas free. CONCLUSION: Problem was caused by either low pressure on water system and the water gun which resulted in excessive air in the drinking bags or air being introduced into the chilled water during ground servicing. CORRECTIVE_ACTION: Malfunction procedures have been modified to reconfigure the system to provide a 30 to 35 psia pressure head should a fuel cell problem recur. Apollo gas separator devices are being flown. Test being performed to verify that the chilled water system is gas free. CAR ANALYSIS: Post-flight water analysis by the NASA/KSC Microchemical Analysis Section indicates that the H2 separator operated within specification. However, the separator was removed from the vehicle and returned to the vendor for successful re-acceptance testing. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-2-V-28	ECLSS
	GMT: 318:21:14		SPR	UA	Manager:

			IPR	PR	
					Engineer:

Title: Water Spray Boiler (WSB), System 1, "Ready" Signal Lost After Blackout. (ORB)

Summary: DISCUSSION: Water Spray Boiler (WSB) 1 "Ready" signal was off from 318:21:14 to 318:21:30 G.m.t. during STS-2 descent. This was caused by an anomalous "bypass" indication on the hydraulic bypass valve when the hydraulic fluid temperature was such that the valve should have been in the "heat exchanger" position. Other data indicate that the valve itself functioned properly and the WSB performed satisfactorily throughout the flight.

Postflight testing demonstrated that the bypass valve, ready indication and output signal all were functioning properly. WSB controller qualification testing demonstrated that the output signal from the "Ready" indicator is on the low end of the MDM requirement when the controller operates at the low voltage limit. A controller modification planned for STS-5 or at any earlier controller replacement will correct the marginal output signal from the WSB "Ready" indicator. CONCLUSION: "Ready" signal was lost as a result of a spurious indication during descent from the hydraulic bypass valve due to a marginal output signal to the MDM. The WSB performed satisfactorily during flight. The "Ready" signal is used as information for APU start only and is not an interlock. CORRECTIVE_ACTION: Post-flight testing demonstrated proper WSB functioning. Modified controllers will be installed on STS-5 or at any earlier controller replacement correcting the marginal output signal from the WSB "Ready" indicator. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Loss of WSB 1 "Ready" signal may occur on STS-3 and STS-4.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET: Prelaunch	Problem	FIAR	IFA STS-2-V-30	RCS
	GMT: Prelaunch		SPR	UA	Manager:
			IPR	PR	
					Engineer:

Title: Forward RCS B leg oxidizer regulator high lockup pressure. (ORB)

Summary: DISCUSSION: The forward RCS oxidizer regulator overshot the maximum specification value of 268 psia (ambient reference) during helium loading prior to STS-2. The maximum specification value was exceeded when the regulators locked up at 274 to 276 psia as measured on the flight instrumentation. Subsequent cooldown of the RCS ullage indicated the regulators flowed at about 271 psia. The flight data indicated that the regulator lockup was 255 psia (253 psia maximum specification with vacuum reference) with both the A and B regulators on line as they had been during the pre-launch period. However, when the B Leg was closed, the lockup dropped off the normal range (about 250 psia). This indicated that the B Leg regulator had a high lockup pressure. Postflight checkout was performed on the B Leg regulator primary and secondary stages. Both stages locked up at the upper specification limit and no flow or leakage anomalies were observed. The lockup pressure of the primary stage was 268 psia measured by ground Hiese gage and 269 psia as measured by the flight instrumentation. At least part of the overshoot may be accounted for by the flight transducer reading.

CONCLUSION: The B Leg oxidizer regulator experienced a slightly high lockup pressure before STS-2 and during the initial flight phase. Post-flight checkout revealed no problem with the regulator. The slight overshoot is not detrimental to system operation.   CORRECTIVE_ACTION: None.   CAR ANALYSIS: The regulator continued to lockup high through STS-5 when it was finally removed and returned to the vendor for analysis. During disassembly, the primary spring support was observed to be riding more on the outside diameter of the Bellville spring groove, while the secondary spring support was well centered in the groove. The only part out of tolerance was the spring support (out-of-round by .004"). Scratches in the housing bellows bore were also observed. Both conditions could have contributed to the high lockup pressure. [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-2-V-32	GND
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Moisture intrusion in SSME's during entry. (ORB)
<u>Summary:</U> DISCUSSION: LPS commands latent in the MDM's opened the MPS helium isolation valves when the flight crew put the valve switches in "GPC" position during the MPS entry purge prep procedure. To control the resultant helium leakage through the SSME's, the flight crew closed the MPS LO2 prevalves, preventing the LO2 system entry purge. After landing, the prevalves were opened to allow residual helium to purge the LO2 system. Because of the lack of an LO2 entry purge, there was concern that moisture may have entered the LO2 system. However, postflight dew point data confirmed that moisture level was acceptable.

The helium valve LPS command was retained in the MDM's from pre-launch because the open command was not terminated by the LPS or the flight software. The LPS will reset the helium system command prior to launch for STS-3 and subs. All other LPS commands were verified to be left in the proper state for left off. A flight software change is in process which will terminate the open commands upon transition to OPS 2. MPS entry helium purge was initiated manually by the crew on STS-1. CONCLUSION: A latent LPS command in the MDM's opened the MPS helium isolation valves when the "GPC" valve position was selected during the MPS entry purge. CORRECTIVE_ACTION: LPS commands will be reset and left in the proper state prior to lift-off for STS-3 and subs. A modification to flight software is being considered for future flights.   EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-33	DPS
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Entry energy management landing short. (ORB)

Summary: DISCUSSION: The Orbiter touched down about 800 ft past the threshold of the runway at 197 knots equivalent air speed. The touchdown point was approximately 3300 feet short of the premission prediction. Postflight analysis incorporating Rawinsonde wind and atmospheric density measurements, LIDAR wind data, estimated weight and onboard state vectors explained this deviation to within 200 feet. Low energy at TAEM/autoland interface and a 25-knot headwind were the largest contributors to landing short. Except for some indication that the vehicle accelerated on the steep glide slope faster than the post STS-1 aerodynamics predicted, post-flight analysis provided a satisfactory explanation for the short touchdown point on STS-2. Minor adjustments have been made to the CL and CD in the aerodynamic data base.

CONCLUSION: Postflight analysis, incorporating revised input data with low energy at TAEM/autoland interface and a 25-knot headwind, accounted for all but 200 feet of the 3300 feet that STS-2 touchdown was short of the pre-flight prediction. CORRECTIVE_ACTION: Aerodynamic data base being revised to reflect STS-2 results. Shuttle mission simulator and Shuttle training aircraft to include revised data base. Nominal outer glide slope aimpoint and inner glide slope aimpoint were moved 1000 feet and 500 feet, respectively, closer to threshold. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-34	GN&C
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Pilot's hand controller plus (+) roll trim switch malfunction. (ORB)
<u>Summary:</U> DISCUSSION: The pilot's plus (+) roll trim function (channel B) was intermittent during rotational hand controller (RHC) trim switch operation on orbit and at rollout. The plus roll channel 1 versus 2 miscompare was duplicated by postflight troubleshooting when a pitch deflection was introduced during roll trim.

The cause of the intermittent was a broken wire in a cable in the pilot's RHC. The broken wire was the result of localized stress introduced in the conductor during the manufacturing process at the supplier of the cable. No other wire in the cable was damaged. Detail inspection of the wiring stock and the manufacturing process did not reveal any other damage in wires. CONCLUSION: A wire broke in a cable due to localized stress induced during the cable manufacturing process.

CORRECTIVE_ACTION: The pilot's RHC was removed, replaced and tested for proper operation. The onboard rotational hand controllers are acceptable for flight based on the existing qualification test data and the successful completion of additional life cycle tests (4500 cycles in each axis) performed in all 3 axes on a controller. CAR ANALYSIS: The problem and its cause (as written above) was determined to be a random event most probably related to damage to a single conductor caused by an unknown event. [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-2-V-35	MPS
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Following the STS-2 landing, an inspection showed that both the T-O LO2 and LH2 8-in fill and drain disconnect interface-seal-insert assemblies were loose. (ORB)

Summary: DISCUSSION: After OV-102 was returned to KSC following STS-2, the torque values for the 12 fastener bolts on the interface-seal-insert assemblies were between 1 and 2 in-lb compared with the required value of 32 in-lb. Installation procedures were reviewed and an evaluation showed that the fastener bolts required torquing to 32 in-lb between 6 and 12 times and in a specific pattern to insure that the bolts would not relax after installation. Also, the installation and removal of the GSE leakage pressure plate would cause the torqued insert fastener bolts to relax.

CONCLUSION: The installation procedure was not adequate to maintain proper bolt torque values. CORRECTIVE_ACTION: The installation procedure has been rewritten and the bolt torque values will be verified. CAR ANALYSIS: Postlaunch investigation of the ground equipment found that the H2 and O2 replaceable inserts were found loose. It was traced to a ground procedures problem. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: This change is effective on STS-3 and subsequent.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-36	RCS
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Aft RCS Propellant Tanks Exposed to Pressure Surges During Deservicing. (ORB)

Summary: DISCUSSION: The aft RCS propellant tanks were exposed on two occasions to a back-pressure surge that could have damaged the tank bulkheads or entry sumps. The incident occurred when the tanks were at 80 psia pad pressure and the manifolds were at 250 psia GN2 pressure. The RCS tanks had been drained to minimum residuals. During Incident 1, the 1/2 tank isolation valves were opened on the left-hand pod and the fuel tank was exposed to a surge. During Incident 2, the left and right oxidizer and fuel tanks were exposed because of an open crossfeed valve to surges when the 3/4/5A tank isolation valves were opened because of an error in the power-up switch list. Tests were performed on the aft RCS qual test article to simulate the incidents that occurred on the fuel and oxidizer tanks. No damage occurred and therefore the orbiter tanks were considered acceptable for flight.

CONCLUSION: The OV 102 tanks were not damaged by the pressure surge incidents during deservicing. CORRECTIVE_ACTION: Deservicing procedures are being modified to preclude over pressurization of the tanks. CAR ANALYSIS: No CAR was written. This was a procedural error and subsequent testing indicated that no damage was done to the tanks. [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-2-V-37	MECH
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Eight Middeck Modular Stowage Locker Doors did not close properly. (ORB)

Summary: DISCUSSION: The crew indicated that several middeck stowage locker doors did not close and lock properly. This condition also occurred on STS-1 and some of the lockers were reshimmed as a result. The doors operated and mated properly during post-flight troubleshooting. The cause of the problem is believed to be the pressurized cabin distortion which causes the stowage locker doors to become misaligned with the locking fasteners.

CONCLUSION: The middeck modular stowage lockers were distorted by vehicle structural movement in flight since the supporting structures deforms when the cabin is pressurized. CORRECTIVE_ACTION: Rework of the modular locker door fasteners will increase the "float" tolerance of the mating halves of the door-to-frame fastener, allowing for locker distortion and misaligned fasteners. The leading edge of the frame half of the fasteners was increased to allow thread alignment prior to engagement. Also, the Orbiter wire trays were shimmed for improved in-flight locker door operation. Should the problem recur in-flight, the 8-in. punch will be used to pry the doors into proper alignment to permit closure. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-38	Star Tracker
	GMT: 316:18:27		**SPR**	**UA**	**Manager:**

			IPR	**PR**	
					Engineer:

Title: G22 star tracker alarms on -Z star tracker. (ORB)

Summary: DISCUSSION: The -Z Star Tracker (ST) detected several improperly formed incoming command words and issued transmission error bits resulting in the annunciation of three "G22 Star TRKR" alarms. During each inertial measurement unit (IMU)/Star Tracker alignment, several Manchester Not Valid (MNV) error bits were issued, and during 3 of the alignment periods, these error bits were seen by the Fault Detection System and annunciated. The Fault Detection System samples the Star Tracker register every 960 milliseconds while the star tracker samples the Manchester code error bits every 160 milliseconds. Several Bit Count Error (BCE) and Parity Error (PE) bits also were seen in the -Z ST data while turned off. In addition, approximately 50 BCE, MNV and PE error bits were seen in the -Z data during the 17-minute interval from 318:00:05 to 318:00:22 G.m.t. while the -Z star tracker was turned off. Significantly, the only Y star tracker transmission errors were also seen during this period although the Y star tracker was operated during the entire 51 hours on-orbit.

Transmission error bits are being generated in the GPC/MDM/ST/MDM/GPC PCM loop with the -Z star tracker both on and off. Since the command word is repeated continuously, there is no impact to the star tracker performance. CONCLUSION: Transmission error bits are being generated in the PCM loop with the -Z star tracker both on and off. These error bits are not a problem for star tracker operation. CORRECTIVE_ACTION: Software has been changed to remove the "G22 Star TRKR" alarm. STS-3 data will be reviewed to determine if any further action is required. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	**Time**	**Classification**	**Documentation**		**Subsystem**
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-39	Windows
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: The visibility through the Orbiter windows was marginal for the first launch attempt. (ORB)

Summary: DISCUSSION: The crew reported that the salt spray was heavy on the Orbiter windows and that condition would have resulted in marginal visibility had an RTLS abort been necessary. The windows were cleaned after the initial launch attempt and had acceptable visibility for the STS-2 flight.

A design change is in process of development which provides for a boom attached to the Orbiter access arm with pull off window covers. Development of this system will not be available until STS-5. CONCLUSION: Visibility through the Orbiter windows was degraded because of the salt spray. CORRECTIVE_ACTION: For STS-3 and 4, window covers for the Orbiter forward windows will be installed while the Orbiter is on the pad and will be removed as late as is practical in the launch countdown.

Design change is being developed for pull-away window covers for STS-4 and subsequent.   EFFECTS_ON_SUBSEQUENT_MISSIONS:

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-40	MECH
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: External tank attach spacers came loose. (ORB)

Summary: DISCUSSION: External tank (ET separation films showed the left-hand aft sturctural attachment spacer coming out. The right-hand spacer was found loose during postflight inspection when the ET door was opened.

The spacer or insert is normally held inside the Orbiter socket fitting by spring retainers after tank separation. No problem was encountered on STS-1. The hardware was successfully tested during four separation certification tests before STS-1 and reflown on STS-2. From 5 to 10 pounds of force is required to pull out the spacer, depending on the condition of the retention hardware and the force direction. Retention of the insert is required to minimize debris at separation. Spacers, retention hardware, aft attachment bolts and base assemblies were inspected postflight and no problem was identified. Pull tests on the retention springs demonstrated acceptable performance. Improper spring installation could reduce retention capability. The STS-3 installation will be verified by inspection. CONCLUSION: Retention hardware allowed the ET attachment spacers to come loose. SSpring force could be marginal, retention hardware may not be reusable or retention springs may have been installed improperly. CORRECTIVE ACTION: The retention hardware and aft attachment bolts were replaced for STS-3. An improved retention design is being considered. EFFECT ON SUBSEQUENT MISSIONS: Retention hardware will be replaced and inspected after STS-3. Considering design change for STS-4 and subs.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-40A	MECH
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: External tank attach spacers came loose. (ORB)

Summary: DISCUSSION: An insert, part number V070-565247, came loose from the Orbiter left-hand aft structural attachment at external tank separation. The right-hand spacer was found to be loose during inspection when the ET door was opened. Retention of the insert minimizes debris at separation.

On both STS-1 and 2, the alignment tip at the end of the hole plugger was bent. The bending was greater on STS-2. There was also an indication of thread marks on the I.D. of both blast container base fittings. A lateral force may have been imparted to the attach bolts at separation by the interaction of the pyro detonator, hole plugger tip and bolt. The detonators have an upward velocity at separation once the frangible nut is fractured. One detonator will strike the hole plugger's beveled surface first due to slight variations in circuit firing times. This lateral force could cock the bolt pulling out the insert at separation. The spacer or insert is normally held inside the Orbiter socket fitting by spring retainers after ET separation. No problem was encountered on STS-1. The retention hardware was successfully tested during four certification tests before STS-1 and reflown on STS-2. The retention hardware and the aft attachment bolts in the base fittings were replaced for STS-3. Retention hardware will be replaced and inspected after STS-3. CONCLUSION: The interaction of the detonator and hole plugger tip probably cocked the bolt causing the inserts to come loose. CORRECTIVE_ACTION: The alignment tip was removed from the hole plugger to minimize the lateral force transmitted to the bolt at separation for STS-3 and subs. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-41	OMS
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: OMS engine nozzle thermocouple wiring loose. (ORB)

Summary: DISCUSSION: Postflight inspection revealed that two of the clips connecting the wiring for nozzle outboard lip temperature (V43T9112A) to the left engine nozzle had debonded. A similar problem was encountered during STS-1, and a new nozzle and thermocouples were used for STS-2. The data from the STS-2 flight has been reviewed and the loose wiring had little effect on the temperature measurements. The data from both nozzle lip temperatures located 90? apart on the left OMS engine have been verified good.

DFI data obtained on STS-2 is adequate to evaluate OMS engine nozzle thermal characteristics without the nozzle outboard lip temperature data from STS-3 and 4. CONCLUSION: Adequate data have been obtained from the STS-1 and -2 flights, and therefore, the measurement is not required for future flights. CORRECTIVE_ACTION: The lead wire to the nozzle lip temperature thermocouple will be cut and removed. A metallurgical inspection has been performed on the area where the clip debonded. This inspection will be continued for STS-3 and subs. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-42	PV&D
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	

Engineer:

Title: The hazardous gas sample detection system on STS-2 did not operate properly except for 2 of 3 bottles on the right side. (ORB)

Summary: DISCUSSION: Two failures were found during postflight inspection and troubleshooting.

During sample recovery procedures, the sample bottle for sample SN-1028 (right side position 6) was found full of ambient air. Further inspection found a broken glass seal on the vacuum gage tube which accounts for the air in the bottle. Preflight vacuum checks at the time of system installation showed no problem. This failure has not occurred during qualification tests and pyro firing tests. Flight level vibration tests have been run with the left-hand sampling system and no glass seal failures occurred. The exact cause of the failure is unknown. Postflight, it was found that the valve pyros in the left-hand system did not fire and the pyro timing circuit battery was discharged. A short to ground was found in the power wire of the microphone which initiates the pyro timing sequence. The short was due to insulation damage caused by an improper junction technique used to ground the braided shield of the microphone wire. CONCLUSION: The most likely cause of the glass seal fracture in the right-hand gas sampler system is a manufacturing flaw. The failure of the left-hand gas sampler to sequence was a discharged battery caused by a short to ground in the microphone cable. CORRECTIVE_ACTION: The failed gas sampler units have been replaced. Microphone cable braided shield ground connections for all gas sampler units will be repaired. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-43	TPS
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Discoloration found in star tracker cavity on thermal blankets, after STS-2. (ORB)

Summary: DISCUSSION: Postflight inspection showed that portions of the white thermal blankets in the star tracker cavity had a yellowish-brown color.

Inspections of star tracker eyelid doors indicated that they were properly closed and sealed during re-entry. Additionally, the star tracker cavity temperatures during entry did not exceed 85? F. No evidence of light shade optical degradation was found. Analysis of samples of the discoloration indicates that it was caused by on-orbit deposition of hydrated silica, which is produced from outgassing of the red RTV material under the TPS system. The hydrated silica is deposited on all exposed spacecraft surfaces and entered the star tracker cavity through the open star tracker doors. The hydrated silica cannot be removed by cleaning, but the deposition from STS-1 and 2 has not degraded star tracker performance. CONCLUSION: The discoloration was due to hydrated silica outgassing from the red RTV and depositing on exposed surfaces. CORRECTIVE_ACTION: Deposition of silica on star tracker protective windows and lightshades may require periodic removal and replacement of these items. Frequency to be assessed after STS-4. EFFECTS_ON_SUBSEQUENT_MISSIONS: (See corrective action)

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-44	INS
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Developmental Flight Instrumentation Discrepancies. (ORB)

Summary: DISCUSSION: Seventy-one (71) developmental flight instrumentation measurements failed on STS-2. Thirty-nine (39) of the measurements have been repaired, and 23 measurements are scheduled for troubleshooting during the STS-4 turnaround activities. The remaining measurements have had troubleshooting performed to the degree that access was available. These measurements are being waived until access becomes available.

CONCLUSION: None of the STS-2 measurements that have been deferred are mandatory for STS-3. CORRECTIVE_ACTION: All measurements that were accessible within the schedule constraints have been fixed. Those measurements which were deferred until STS-4 are in the planned work flow during the STS-4 turnaround. EFFECTS_ON_SUBSEQUENT_MISSIONS:

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-45	PV&D
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Left-hand and right-hand descent wing vent relief doors opened. (ORB)

Summary: DISCUSSION: Postflight inspection revealed that both the left-hand and right-hand descent wing vent relief doors were open. Both relief doors should remain closed since the primary active wing vent doors functioned normally.

Data show the descent relief doors opened 50 seconds into the flight at a maximum pressure differential of 0.2 psid and under an ascent vibration environment. A qualification test that subjected the descent relief door to the specification vibration environment showed the doors would not open until the pressure differential reached 0.5 psid. When the descent wing vent relief doors open, the wing volume is vented into the payload bay and this venting could result in contamination of sensitive payloads primarily from tire outgassing and particle migration. The STS-1 and 2 flights show that the tire outgassing is insignificant and the particle migration is not of concern since, should the wing vent relief doors open, the flow is through the payload bay liner that acts as filter. CONCLUSION: Descent relief doors were more sensitive to flight dynamic environments than the tested specification vibration environments. Outgassing and particle migration into the payload bay as a result of the wing vent relief doors opening are insignificant. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-46	RCS
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Vernier RCS Thruster F5L exceeded 250? F Limit. (ORB)

Summary: DISCUSSION: At the end of STS-2 orbital phase, there was extensive vernier use caused by a disturbance torque from flash evaporator venting. Three hours of continuous pulsing at a rate of 2 seconds on and 20 seconds off resulted in the fuel valve body temperature on engine F5L reaching an estimated 256? F at 52 hours M.e.t. Since the valve seal temperature is about 10? F hotter, the teflon seal exceeded its qualification limit of 250 deg F for approximately 40 minutes, reaching an estimated peak temperature of 266? F. The concern with this higher-than-expected temperature is the possible cold flow distortion of the teflon seal and the consequent valve leakage. No leakage, however, has been observed during the flight or in subsequent ground testing.

Primary thrusters will be used on future missions when the payload bay doors are closed and flash evaporator dumps are expected to require extended periods of time. CONCLUSION: High temperature did not damage seals. CORRECTIVE_ACTION: Primary thrusters will be used on future missions for extended flash evaporator dumps with payload bay doors closed. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-47	CREW
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Theodolite loose within mounting system. ()

Summary: DISCUSSION: During the theodolite operation, the crewman reported instrument instability. Inspection determined that there was minimum play between the Orbiter console and the bracket and also between the bracket and the theodolite interface.

The anomaly was found to be: 1. The theodolite internal spring forces were not sufficient to provide the required stability. 2. The clearance between the parts inside the instrument was excessive. Changes to the theodolite increasing the preload and reducing the clearances were incorporated for STS-3 and subsequent. These modifications were evaluated and accepted by the STS-3 flight crew. CONCLUSION: The theodolite instability was caused by: 1. The pre-load force of the internal spring too low. 2.

The clearance between the internal parts of the instrument was excessive. CORRECTIVE_ACTION: 1. Increased the preload force of the spring from 17 lb to 27 lb. 2. Reduced the clearance between the internal parts of the theodolite. 3. Briefed the flight crews to avoid using the theodolite as a handhold during use. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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Tracking No	Time	Classification	Documentation		Subsystem
MER - 1	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-48	
	GMT: 308:14:00		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: The downlist indication of a command response pulse was missed during RSS (range safety system) check-out for STS-2. (ORB)

Summary: DISCUSSION: Checkout of the RSS prelaunch involves transmitting 10 arm and 10 fire commands to each RSS receiver/decoder. It is required that 9 of the 10 commands be received. The decoder provides a pulse output for each command received and decoded. Command receipt is verified by sampling the output of a pulse stretcher which is triggered by the decoder output.

The pulse stretcher output shoud provide pulses of 90ms on/90ms off, thus providing 2 samples per state at the 25 Hz downlist sample rate. Design tolerances in the pulse stretcher result in a pulse structure in which the first "on" state is 115ms +/- 10ms and subsequent pulses are 90ms +/- 10ms. This stretching, in conjunction with the asynchronism between the downlist acquisition process and the pulse generation, and the software architecture which allows missed samples due to process overlap, results in the possibility that only one sample of a given state may be detected, or, in the case of the first pulse, completely missed. Since the pass fail criteria allows one miss, this mechanization supports curren requirements. A change in RSS design i sproposed for STS-6 that will use four pulses with a 45ms +/- 1ms on time and a 135ms +/- 1ms off time. The pass/fail criteria for the prelaunch checkout will require 4 of 4 command pulses detected. CONCLUSION: The current RSS and software structure that will be used through STS-5 is satisfactory. CORRECTIVE ACTION: The software mechanization for solid rocket booster downlist is being reviewed for potential improvement. Timing tests on the software are underway to attempt to quantify the probability of missing data samples. EFFECT ON SUBSEQUENT MISSIONS: The proposed STS-6 RSS design with the current downlist mechanization will result in a high probability of missed command repsonse pulses. The potential for a fundamental imcompatibility between RSS design and avionics architechture exists for STS-6 and subsequent.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-2-V-48A	RANGE SAFETY
	GMT: 308:14:00		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: The downlist indication of a command response pulse was missed during RSS (range safety system) checkout for STS-2. (ORB)

Summary: DISCUSSION: Checkout of the RSS prelaunch involves transmitting 10 arm and 10 fire commands to each RSS receiver/decoder. It is required that 9 of the 10 commands be received. The decoder provides a pulse output for each command received and decoded. Command receipt is verified by sampling the output of a pulse stretcher which is triggered by the decoder output.

The pulse stretcher output shoud provide pulses of 90ms on/90ms off, thus providing 2 samples per state at the 25 Hz downlist sample rate. Design tolerances in the pulse stretcher result in a pulse structure in which the first "on" state is 115ms +/- 10ms and subsequent pulses are 90ms +/- 10ms. This stretching, in conjunction with the asynchronism between the downlist acquisition process and the pulse generation, and the software architecture which allows missed samples due to process overlap, results in the possibility that only one sample of a given state may be detected, or, in the case of the first pulse, completely missed. Since the pass/fail criteria allows one miss, this mechanization supported STS-3, 4. and 5. For STS-6 each SRB will be flown with one decoder of the new design and one decoder of the same design as flown on STS-3, 4, and 5. The new design decoder uses four pulses with a 45ms +/- 1ms on time and a 135ms +/- 1ms off time and the pass/fail criteria will require 4 of 4 command pulses detected. CONCLUSION: Design tolerances in the decoder pulse stretcher in conjunction with the asynchronism between the downlist acquisition process, the pulse generator and the software architecture allowed missed samples. CORRECTIVE_ACTION: For STS-6 the range has agreed to review RSS pulses from the recorded launch data buss data for the new decoder and review SRB downlist data for the older design decoders as was done on STS-3, 4, and 5. All decoders on STS-7 will be of the new design and an Orbiter software change will be implemented which reduces the potential for missed RSS pulses to an acceptable level. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-49	Water and Waste Management System
	GMT: Postlanding		**SPR**	**UA**	
			IPR	**PR**	**Manager:**
					Engineer:

Title: Offensive Odor in the Cabin. (ORB)

Summary: DISCUSSION: The crew reported an offensive odor near the waste collector compartment. Postflight inspection of the commode area did not indicate any odor around the commode. Inspection of the returned trash bag did reveal that a strong offensive odor was evident in a wet trash bag which had been installed on the waste collector compartment door. A used emesis bag had been placed into the trash bag without having been vacuum dried. Vacuum drying would have removed the odor. Further, the trash bag zipper will not seal in odors. Venting of the wet trash bag will remove odors. The design of this commode is such that odors can only escape into the cabin when the commode is at cabin pressure (when the commode is in use); this only occurred for 4 minutes on the second day. During commode usage, a charcoal filter is used for odor control as well as the cabin LiOH canisters. The source of the specific odor that the crew commented on could not be isolated. Charcoal canisters are to be flown for STS-3 and subsequent. Should an odor problem occur, one of the charcoal canisters will be installed in 1 of the 2 LiOH canister slots in the atmospheric revitalization system. In addition, an odor masking device will be flown.

CONCLUSION: One source of odor was isolated to the wet trash bag. The specific offensive odor was not isolated. CORRECTIVE_ACTION: Procedures will emphasize vacuum drying and the stowing of emesis bags in the commode. Further, the wet trash bag will be vented continuously. Charcoal canisters will be flown and be installed in the ARS system should an odor problem occur. Further, an odor masking device will be added. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-2-V-50	PYLD
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Film evaluation from payload deployment and retrieval system (PDRS) cameras indicates that two cameras may have run at wrong frame rate. (ORB)

Summary: DISCUSSION: The six PDRS cameras are operated in pairs for positional data for RMS operations. The frame rates for both cameras in a pair are selected by a single switch. Therefore, both cameras in a pair should operate at equal frame rates and, therefore, consume equal amounts of film. Postflight evaluation revealed that the aft cameras in two pairs apparently operated at faster frame rates than the forward cameras in those pairs.

Laboratory testing at JSC and checks in the Orbiter at KSC reveal no wiring problems with the Orbiter or cameras and control panel. However, electrical resistance in the 6 ft/sec and 12 ft/sec signal lines between the camera control panel and the aft bulkhead in the Orbiter was measured at 5.2 ohms for all three aft cameras. When a 5 ohm resistance was added into the 6 ft/sec and 12 ft/sec signal lines in the JSC laboratory set-up, the aft cameras operated at 24 ft/sec when 12 ft/sec was selected at the control panel. The forward cameras operated at 12 ft/sec in this case. At 6 ft/sec and 24 ft/sec all cameras operated properly. CONCLUSION: The 12 ft/sec circuitry in the camera is sensitive to proper grounding. The 5.2 ohm resistance is sufficient to cause the loss of electrical ground in the 12 ft/sec position. CORRECTIVE_ACTION: For STS-3 and STS-4, procedures will be revised to allow operation only at 24 ft/sec. For subsequent usage, circuitry will be added to camera enclosures to assure that cameras have proper grounding. EFFECTS_ON_SUBSEQUENT_MISSIONS: Operation for STS-3 and STS-4 will be constrained procedurally to 6 ft/sec and 24 ft/sec.