| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** Prelaunch | Problem | **FIAR** | **IFA** STS-3-V-01 | EPD |
| | **GMT:** Prelaunch | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** RPC (Remote Power Controller) 2 in cryo control box 1 failed "on" (ORB)

**Summary:** DISCUSSION: Prior to launch, the hydrogen tank 1 heater B was failed "on" in the automatic mode. The problem was isolated to RPC 2 in cryo control box 1. Heater B was de-energized by placing the panel control switch in the "off" position. Only one heater per tank is required for flight, and the crew procedures were changed to use only heater A in hydrogen tank 1.

Postflight tests and inspection isolated the problem within the RPC to a "short" between lead wire 4 and terminal pad 3 of the current regulator LID (leadless inverted device). This allowed the RPC to remain on without the presence of a control signal. Improper routing of the lead wire caused an electrical breakdown between the lead wire and the terminal pad. This is the fourth RPC failure due to LID lead wire "shorts" experienced in the shuttle program with 1000 series RPC's. Production and inspection has included longer leads and a visual clearance check to ensure proper lead routing before potting for all LID's in the 2000 series RPC's. This series RPC is used for replacement on OV-102 and for all the RPC's on OV-099 and subsequent vehicles CONCLUSION: The RPC failure was due to a "short" between the lead wire and a terminal pad of the current regulator leadless inverted device. This failure has occurred on other OV-102 RPC's and corrective actions to eliminate the short have been taken for OV-102 replacement RPC's, and the RPC's for OV-099 and subsequent vehicles CORRECTIVE_ACTION: The failed RPC in cryo control box 1 has been replaced with an upgraded design and the cryo box has been retested for STS-4. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** Prelaunch | Problem | **FIAR** | **IFA** STS-3-V-02 | EPD |
| | **GMT:** Prelaunch | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** MCA Power AC3 Three-Phase Circuit Breaker (CB 11 Pnl. MA 73C) Failed to Latch When Actuated. (ORB)

**Summary:** DISCUSSION: Prior to STS-3 flight, the MCA power AC3 circuit breaker could not be actuated. This breaker MCA Power AC3 protected the -Z star tracker door, motor No.1, the right ADTA motor no. 1 and the left vent door 1/2 motor no. 1. An external mechanical latch was installed which closed the breaker. This configuration remained intact throughout the flight. The circuit breaker has been removed and replaced by another similar breaker. Analysis indicated the clevis pulled out of the socket, thus preventing the breaker from operating properly. This specific failure mode can inhibit the "trip free" (CB operates with handle held in place) feature of the circuit breaker. This possibility was recognized prior to flight and accepted based on the fact that if a short would have developed, the current limiting circuit in the inverter would have opened prior to overloading the wire.

CONCLUSION: The most likely cause of the failure was excessive force being used to open the breaker. CORRECTIVE_ACTION: Users will be cautioned not to use excessive force when pulling breakers. CAR ANALYSIS: The failure was traced to a workmanship induced failure. It was apparent, upon examination, that a mechanical tool, such as pliers was used to pull the breaker open. With these forces, the breaker was broken. [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-3-V-03 | PRSD |
| | **GMT:** 81:16:03 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Heater "A" trip indication on O2 tank 3. (ORB)

**Summary:** DISCUSSION: At T-35 seconds after lift off O2 tank 3 heater "A" current level detector (CLD) tripped inhibiting the heater. Since the heaters were "off" and the pressures were too high to activate the heaters in "auto", this was a nuisance trip. This CLD was reset and did not trip again. If the CLD does not reset, the detector can be inhibited by opening the circuit breaker. The O2 tanks have redundant heater systems and each system has redundant CLDs.

Postflight testing has verified proper operation of the CLD and did not identify a cause for the trip indication. Analysis indicates that the driver latches in 3 to 4 milliseconds and a 70 millisecond glitch can trip the CLD CONCLUSION: The cause of the trip indication is unknown. The CLD is operational.
CORRECTIVE_ACTION: Postflight testing verified proper current level detector operation. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-04 | ECLSS |
| | **GMT:** 081:16:04 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** WSB (Water Spray Boiler) 3 Allowed APU 3 Lubrication Oil to Exceed the High Limit. (ORB)

**Summary:** DISCUSSION: WSB3 froze during ascent of STS-3 resulting in APU shutdown. WSB3 worked properly during on-orbit checkout and entry.

Extensive tests were performed at the JSC test facility and the vendor. Neither test was able to exactly duplicate the failure under simulated flight-type conditions. One failure did occur at the vendor test facility when heat loads were reduced below flight levels (60 Btu/min). Tests did show that the present 1.25" steam vent orifice allows freezing conditions to be reached in the boiler during ascent. Tests also demonstrated that a 0.8" orifice keeps conditions above freezing on ascent and provides good performance for on-orbit and entry conditions. (more discussion in problem reports STS-3-4A and STS-3-4B) CONCLUSION: The freeze-up of WSB3 caused the APU lube oil to exceed the high limit. WSBs 1 and 2 have performed satisfactorily on the 3 previous flights. Ground tests with simulated flight conditions have not exactly duplicated the flight problem. CORRECTIVE_ACTION: The existing 1.25" steam vent orifice on WSB3 will be replaced with a 0.8" orifice. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-04A | Water and Waste Management System |
| | **GMT:** 081:16:04 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** WSB (Water Spray Boiler) 3 allowed APU 3 lubrication oil to exceed the high limit. (ORB)

**Summary:** DISCUSSION: Each WSB is normally serviced with a 5 lb water precharge for passive cooling of APU lubrication oil during ascent. During launch, this precharge flashes or boils off as the decreasing ambient pressure causes the water to boil at a continually decreasing temperature, corresponding to the water vapor pressure. Eventually the boiler internal pressure drops to the water triple (0.088 psi) at which time the water was cooled to 32 degress F and ice starts to form within the boiler. Typically the freezing conditions occur about 90 seconds before MECO, and remain until the lubrication oil requires cooling some 110 seconds later. On several occasions, transient freezeup caused the lube-oil to temporarily exceed the 250 degree F control point, and on STS-2 and 3, the over temperature exceeded the then existing 325 degree F redline, requiring early APU 3 shutdown. On STS-2, WSB 3 started cooling shortly after the APU was shut down; projected maximum lube-oil temperatures, had the APU continued running, would have remained below 350 degrees F. The current redline is 375 degress F. On STS-3, WSB 3 was launched without any preload water, except for residual water trapped around the spraybars; this flashed and froze early in ascent.

A reduced flow area orifice (0.8 in. diameter vs 1.24 in. diameter baseline) was installed on WSB 3 for STS-4. The oriface was sized to slow down the rate of preload boiloff such that the lubrication oil reached active cooling before the boiler cooled to freezing temperatures. The oriface caused the expected major shift in boiloff rate, deferring the onset of required cooling by some 320 seconds. Unfortunately, this particular APU operated with a badly conatminated lubrication oil circuit. This apparently allowed freezing conditions to develop some 13 seconds before cooling was required. (Refer to STS-4 problem closeout 5) APU 3 and WSB 3 were removed after STS-4 and replaced with new units. Postflight testing with the flight units duplicated the flight temperature profile, including icing conditions for the baseline (1.24 in. diameter orifice), but failed to duplicate tansient feezeups. CONCLUSIONS: The freeze up of WSB 3 on STS-3 caused the APU lubrication oil temperature to exceed the old high limit of 325 degrees F. On STS-4 a badly contaminated lubrication oil circuit on APU 3 probably allowed freezing conditions to develop before cooling was required. CORRECTIVE ACTION: The 0.8 in. diameter steam vent orifice will be used again on WSB 3 for STS-5 to reduce the boiloff rate so that active lubrication oil pulse cooling occurs before the boiler cools to freezing conditions. Water spray boilers 1 and 2 have functioned properly on STS-1 thru 4. The probable long term fix is to install an 0.8 in. diameter orifice in each WSB concurrent with lowering the control temperature from 255 degrees F to 230 degrees F to assure reaching pulsing before freezing. EFFECT ON SUBSEQUENT MISSIONS: none

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-04B | Water and Waste Management System |
| | GMT: 018:16:04 | | SPR | UA | |
| | | | IPR | PR | Manager: |
| | | | | | Engineer: |

**Title:** WSB (Water Spray Boiler) 3 allowed APU 3 lubrication oil to exceed the high temperature limit. (ORB)

**Summary:** DISCUSSION: The history of the WSB freezing problem is discussed in problem STS-3-4A.

STS-5 was flown with a new APU (Auxiliary Power Unit) and new WSB installed in the no. 3 location. A 0.8-in. diameter orifice was installed in WSB 3, as was flown in STS-4. WSB's 1 and 2 were flown with the baseline 1.24-in. diameter orifices, as in previous missions. WSB's 1 and 2 each reached feezing conditions during ascent, as in all previous missions, but functioned normally when lubrication oil required cooling. Entry performance was also normal for all 3 WSB's on STS-5. The 0.8-in. orifice in WSB 3 provided the desired effect of preventing freezing conditions prior to the lubrication oil heating to the cooling set point. The boiler had cooled to only 50 degrees F on STS-5, when the lubrication oil cooling was initiated. On STS-4 WSB no. 3, the boiler cooled to freezing conditions some 13 seconds prior to the lubrication oil heating to the cooling set point which resulted in a transient 23 degrees F lubrication oil over temperature before the boiler thawed and started cooling. CONCLUSIONS: Installation of an 0.8-in. diameter orifice preented freezing conditions from occuring prior to lubrication oil heating to the active cooling set point. The difference in the STS-4 and STS-5 WSB 3 performance is believed to be caused by the severe lubrication oil contamination observed on STS-4. CORRECTIVE ACTION: The 0.8-in. diameter orifice will be installed in each WSB for STS-6 and subsequent. The need to lower the lubrication oil active cooling set point, should additional margin be required, will be evaluated after STS-6. EFFECT ON SUBSEQUENT MISSIONS: none

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-05 | APU |
| | GMT: 081:16:00 | | SPR | UA | Manager: |
| | | | IPR | PR | |
| | | | | | Engineer: |

**Title:** APU 2 Fuel Cavity Drain System Leaking. (ORB)

**Summary:** DISCUSSION: The APU 2 fuel cavity drain line leaked to 0 psia approximately 21 hours after launch. During entry, the leak rate was much greater, approximating the increasing atmospheric pressure.

A post-flight system leak check at KSC isolated the problem to the drain relief valve. When the valve was disassembled at the vendor, the soft seat was found to have a depression across the sealing surface. The valve was also heavily contaminated. The majority of the contamination was cotton fiber, gold, brush fiber, glass granules, clear nylon, and polymer. These materials are not present in the APU. The remaining particles (iron oxide, 303 stainless, and aluminum), while they may have come from the APU, were not of sufficient magnitude to cause concern for APU performance or wear. The contamination was most probably introduced during APU replacement after STS-1. A possible source of the contamination is the catch bottles on OV-102 which were used in a mock up prior to vehicle installation. They were not ultrasonically cleaned (as now required), but were flushed after installation. CONCLUSION: The leak was caused by a depression in the soft valve seat of the drain relief valve due to contamination. The contamination was most probably introduced during APU replacement after STS-1. CORRECTIVE_ACTION: The APU 2 drain relief valve has been refurbished and reinstalled. The drain lines on all three APU's have been flushed with alcohol for cleaning. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-06 | RCS |
| | GMT: 081:17:37 | | SPR | UA | Manager: |
| | | | IPR | PR | |
| | | | | | Engineer: |

**Title:** VRCS Engine F5L OX Injector Temperature Not Accurately Tracking. (ORB)

**Summary:** DISCUSSION: Vernier reaction control system (VRCS) engine F5L oxidizer injector temperature, a leak detector, was not accurately tracking the engine injector temperature as measured by the fuel injector temperature. Normally the oxidizer to fuel difference is less than 10? F, but the F5L Ox leak detector showed a non-linear bias ranging up to 60? F depending on temperature. The Ox temperature read low and the higher the temperature, the greater the difference. The detector did work adequately to prevent an erroneous leak indication.

KSC electrical troubleshooting of the sensor and signal conditioner shows normal operation. Both the OX and Fuel Injector temperatures tracked properly during a heat test at KSC to a temperature of 190? F. Additional troubleshooting would require removal of the engine. This action is not considered necessary since the sensor locations in the thrustesr can detect either an OX or a fuel leak CONCLUSION: The cause of this problem is unknown. CORRECTIVE_ACTION: A memory read/write software change will be verified for STS-4 allowing the FRCS vernier thrusters to use only the fuel leak detectors. Fly "as is" with this software backup. CAR ANALYSIS: Teardown and analysis revealed that the problem was caused by a variation in thermal contact resistance between the sensors and the injector as a function of temperature environment and thruster duty cycle. Corrective action will be to add thermal grease to the exterior of the sensor probe. New thrusters will be built with this improvement and recycled thrusters will be modified to include the improvement. [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-3-V-07 | ECLSS |
| | **GMT:** 82:00:00 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Smoke detectors, 3A and left flight deck, failed to self-test (ORB)

**Summary:** DISCUSSION: Smoke detector 3A failed to self-test twice (Day 1 and 3). On day 3, the left flight-deck smoke detector also failed to self-test. Both smoke detectors passed the postflight self-test. These detectors had already exceeded their age life (800 hours) and were waivered for flight use. The air pump bearings are the life limiting items. Bearing torque increases with operation and this causes the motor current to exceed the self-test limit.

Replacing the smoke detectors with the new design units requires removal of avionics boxes for access which impacts the turnaround timeline. Should access become available, the failed units will be replaced. CONCLUSION: The problem was caused by the air pump bearings that bind occasionally because of the lubricant used. Repeating the self-test will normally clear the fault. CORRECTIVE_ACTION: Replace units, if access become available. EFFECTS_ON_SUBSEQUENT_MISSIONS: The remaining six smoke detectors of the old design may fail the inflight self-test.

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-08 | C&T |
| | **GMT:** 082:15:23 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** RMS Wrist TV Camera Inoperative ()

**Summary:** DISCUSSION: The RMS TV circuit breaker number 55 on panel R15 tripped when the camera was activated. A component failure inside the power supply resulted in an electrical short. The RMS elbow camera on STS-2 and the aft bulkhead camera "C" on STS-3 also experienced the same failure mode. In each case, the camera temperatures were approximately 0? C.

Failure analysis and tests have determined that the failures were caused by the erratic operation of the camera dc/dc power converter at cold camera temperatures near 0? C. Cold temperatures decreased the base-emitter voltage of the switching transistor resulting in a decreased voltage at the collector. This created an unstable frequency within the dc/dc converter that generated high voltage spikes shorting the output transistor. CONCLUSION: Cold temperatures decreased the base-emitter voltage of the switching transistor resulting in a decreased voltage at the collector. This created an unstable frequency within the dc/dc converter that generated high voltage spike shorting the output transistor. CORRECTIVE_ACTION: The input resistor has been changed to provide more voltage drive to the switching transistor. Diodes have also been added to protect the output transistor from high voltage spikes. All flight TV cameras were modified and tested prior to STS-4.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-09-1 | MECH |
| | **GMT:** 082:23:17 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Forward Bulkhead PLBD (Payload Bay Door) Switch Module Showed "Ready To Latch" After Port Door Was Opened. (ORB)

**Summary:** DISCUSSION: During the port-door opening sequence after a long cold soak with the Orbiter tail to sun, the 3 forward ready-to-latch (R-T-L) switches failed to transfer to the OFF position, indicating the R-T-L switch actuating arm failed to rotate enough to allow switch transfer. After 15 minutes of the top-to-sun attitude, the port door was closed and the forward and aft bulkhead latches operated normally. The port door was then opened andd the forward R-T-L indi cator returned to its normal "off" position. All components operated normally for the remainder of the mission.

Tests and analysis of the switch module verified that the combination of low temperatures and mininal arm-to-housing clearances caused binding that prevented the actuating arm from rotating to the point required for switch transfer. This condition does not prevent successful door operation as long as the "doo closed" switch transfers and recovery is always possible by a vehicle attitude change to warm the module. CONCLUSION: The combination of low temperatures and minimal arm-to-housing clearances caused binding that restricted rotation of the actuating arm in the PLBD switch module. Failure of the ready to latch switch to transfer does not prevent successful door operation and the switch will operate properly if the vehicle attitude is changed to warm the module. CORRECTIVE_ACTION: Fly as is for STS-4. A design change has been recommended to increase the spring force and open the clearance between the arm and the housing. EFFECTS_ON_SUBSEQUENT_MISSIONS: Possible recurrence of the problem under cold conditions.

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| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-09-2 | MECH |
| | **GMT:** 082:23:17 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Aft bulkhead actuator on port door stalled during latch closure. (ORB)

**Summary:** DISCUSSION: During the door closure test following approximately 23 hours with the orbiter in the tail-to-sun attitude, the aft port bulkhead latch gang failed to reach the fully latched position. The forward and aft latches were then unlatched, the door was opened, and the vehicle was reoriented to a top-sun attitude for 15 minutes followed by 42 minutes of PTC. The door was then successfully closed and latched. Subsequent door operations were normal. Tests/Analysis/Inspection revealed the following: 1. Actuator - Two of four mounting lugs were cracked, the torque limiter slipped at the proper limit, there was no internal damage or wear that could have caused the problem, and the actuator housing was not properly heat treated. The reduced strength housing still resulted in a high margin of safety for the design case and would have failed due to an external jam if properly heat treated. 2. Thermal - The forward bulkhead seals were significantly colder than the aft bulkhead seals and were warmer than design limits. Door-to-vehicle distortions were eliminated as possible causes because the door was essentially latched and theodolite data did not indicate any significant door deflection. 3. Motor Current Data - The motor current began to increase after 15 seconds operation and stalled at 20 seconds. Nominal runtime is 24 seconds. 4. Other damage - None. 5. Analysis - The load required to cause the failure was isolated to the #1 latch.

CONCLUSION: Based on observed damage, motor current data, and elimination of other failure modes, the anomaly was most probably caused by jamming due to an external object. Based on motor current the object was compressible and began to load the motor at 15 seconds (3/8 inch object) and went to stall at 20 seconds (1/16 inch object). CORRECTIVE_ACTION: The hardware has been fully inspected and all damaged components have been replaced. The payload bay has been inspected and cleaned. Functional and structural margins have been reverified. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-09A | MECH |
| | GMT: 082:23:17 | | SPR | UA | Manager: |
| | | | IPR | PR | |
| | | | | | Engineer: |

**Title:** Forward Bulkhead PLBD (Payload Bay Door) Switch Module Showed "Ready To Latch" After Port Door Was Opened. (ORB)

**Summary:** DISCUSSION: During the port-door opening sequence after a long cold soak with the Orbiter tail to sun, the 3 forward ready-to-latch (R-T-L) switches failed to transfer to the OFF position, indicating the R-T-L switch actuating arm failed to rotate enough to allow switch transfer. After 15 minutes of the top-to-sun attitude, the port door was closed and the forward and aft bulkhead latches operated normally. The port door was then opened andd the forward R-T-L indi cator returned to its normal "off" position. All components operated normally for the remainder of the mission.

Tests and analysis of the switch module verified that the combination of low temperatures and mininal arm-to-housing clearances caused binding that prevented the actuating arm from rotating to the point required for switch transfer. This condition does not prevent successful door operation as long as the "doo closed" switch transfers and recovery is always possible by a vehicle attitude change to warm the module. The ready-to-latch switches operated properly on STS-4. CONCLUSION: The combination of low temperatures and minimal arm-to-housing clearances caused binding that restricted rotation of the actuating arm in the PLBD switch module. Failure of the ready to latch switch to transfer does not prevent successful door operation and the switch will operate properly if the vehicle attitude is changed to warm the module. CORRECTIVE_ACTION: Fly as is for STS-5. A design change to increase the spring force and open the clearance between the arm and the housing will be implemented in line for OV-103 and subsequent. OV-102 and OV-099 will be retrofitted with the design change on a non-interference basis. CAR ANALYSIS: AFT Bulkhead Latches: Cause of the failure to obtain a "latched" indication was that the LH aft bulkhead latch actuator stalled and the torque limiter slipped. The reason for the stalled condition was not determined. Ready-to-Latch Indication: Cause of the incorrect "Ready-to-Latch" indication was that the switch arm in the V070-594222 switch module hung up in the "Ready-to-Latch" position. It's postulated that the return springs couldn't overcome the increased friction/binding induced by low temperatures. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: Possible recurrence of the problem under cold conditions.

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-10 | INS |
| | GMT: 081:16:02 | | SPR | UA | Manager: |
| | | | IPR | PR | |
| | | | | | Engineer: |

**Title:** Operational Instrumentation Failures (ORB)

**Summary:** DISCUSSION: The following operational instrumentation failures occurred during STS-3:

a. V41T1261A- Main engine 2 GH2 outlet temperature measurement went off-scale high for 8 minutes and then returned to normal. b. V41P1300C- Main engine 3 LH2 inlet pressure failed off-scale high. c. V45Q2205A- PRSD Hydrogen tank 2 quantity failed off-scale high. d. V58T1143- Hydraulic system 1 mid-body return line temperature was biased low. e. V58T0198- Hydraulic system 1 rudder speed brake return line temperature response lagged another measurement on same line. f. V58T0398- Hydraulic system 1 rudder speed brake line return temperature failed off-scale high. g. V62Q9150- Water tank quantity shifted from 85 percent to zero and back to normal. This was the result of a known contamination problem with the sensor wiper. CONCLUSION: Measurement failures as noted. CORRECTIVE_ACTION: a. Transducer replaced with improved design; b. Transducer replaced; c. Defective signal conditioner replaced; d. Measurement in tolerance, so fly as is; e. Attributed to sensor location, so fly as is; f. Transducer replaced; g. Tank removed for STS-4 so no action required. The PRSD H2 Tank Quantity measurement is the only measurement used for Launch Commit Criteria on Ground Launch Sequence operations and it has been repaired. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-11 | GN&C |
| | **GMT:** 082:06:30 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** IMU 3 accelerometer bias shifted abruptly on the first day. (ORB)

**Summary:** DISCUSSION: At approximately 82:05:45 G.m.t. IMU 3's null bias acceleration shifted by -321 micro g in the x axis and +383 micro g in the y axis. The bias was updated and has since remained stable. The probable cause of the shift was particle conamination within the accelerometer which has disturbed the pendulum and caused a small shift from the nominal null position, thus affecting both the x and y outputs. Other possible causes for the problem are the accelerometer flex tape or transformer intermittency. IMU 3, serial number (S/N) 012, was removed from the vehicle and shipped to the JSC Inertial Systems laboratory (ISL) for special testing.

The bias shift was verified and the up axis drift noted preflight was confirmed at 0.075 deg/hr. The IMU is now at the vendor for analysis, testing and repair. The cause of the bias shift is unknown at this time. (further discussion is contained in problem reports STS-3-11A and STS-3-11B) CONCLUSION: The IMU x and y accelerometer bias shifted and then remained stable. The cause of the bias shift is unknown pending results of analysis and tests at the vendor. CORRECTIVE_ACTION: IMU 3 S/N 012 was removed and replaced by S/N 016. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 1 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-11A | GNC |
| | **GMT:** 082:06:30 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** IMU 3 Accelerometer Bias Shifted Abruptly on the first day. (ORB)

**Summary:** DISCUSSION: At approximately 82:05:45 G.m.t. IMU 3's null bias acceleration shifted by -321 micro g in the x axis and +383 micro g in the y axis. The bias was updated and has since remained stable. The probable cause of the shift was particle conamination within the accelerometer which has disturbed the pendulum and caused a small shift from the nominal null position, thus affecting both the x and y outputs. Other possible causes for the problem are the accelerometer flex tape or transformer intermittency. IMU 3, serial number (S/N) 012, was removed from the vehicle and shipped to the JSC Inertial Systems laboratory (ISL) for special testing.

The bias shift was verified and the up axis drift noted preflight was confirmed at 0.075 deg/hr. A latching noise was noted in the coil-restoring current. After extensive testing of the IMU at the vendor, the x-y accelerometer bias shifted back to the former value and the noise was no longer evident. Attempts to induce the latching noise by temperature cycling and vibration tests were unsuccessful. Possible causes include failure of the accelerometer pendulum lower cement joint, the accelerometer preamplifiers, or the transformer. The IMU is being disassembled for component test and analysis. CONCLUSIONS: The IMU x and y accelerometer bias shifted due to a latching noise and then remained stable. The cause of the latching noise is unknown at this time. CORRECTIVE ACTION: IMU 3 serial number 012 was removed and replaced by serial number 016 for STS-4. All IMU's operated satisfactorily on STS-4.

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 2 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-11B | GNC |
| | **GMT:** 082:06:30 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** IMU 3 accelerometer bias shifted abruptly on the first day. (ORB)

**Summary:** DISCUSSION: At approximately 82:05:45 G.m.t. IMU 3's null bias acceleration shifted by -321 micro g in the x axis and +383 micro g in the y axis. The bias was updated and has since remained stable. IMU 3, serial number 012, was removed from the vehicle and has completed special testing.

The bias shift was verified and the up axis drift noted preflight was confirmed at 0.075 deg/hr. A latching noise was noted in the coil-restoring current. After extensive testing of the IMU at the vendor, the x-y accelerometer bias shifted back to the former value and the noise was no longer evident. Attempts to induce the latching noise by temperature cycling and vibration tests were unsuccessful. Possible causes include failure of the accelerometer pendulum lower cement joint, the accelerometer preamplifiers, or the transformer. Component test and analysis did not identify the problem. CONCLUSIONS: The IMU x and y accelerometer bias shifted due to a latching noise and then remained stable. The cause of the latching noise is unknown. CORRECTIVE ACTION: IMU 3 serial number 012 was removed and replaced by serial number 016 for STS-4. All IMU's operated satisfactorily on STS-4 and STS-5.

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-12 | MECH |
| | **GMT:** 082:20:52 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** RMS Ready-for-latch Indicator Switch Failed to Transfer. (ORB)

**Summary:** DISCUSSION: The RMS aft pedestal system 1 ready-for-latch switch failed to transfer when the RMS was cradled at 82:20:52 G.m.t. Only the system 2 switch transferred when the wrist section of the arm contacted the pedestal. The aft pedestal temperature was -40? F when the switch failed to transfer. In subsequent manipulator arm operations at higher temperatures, both system 1 and 2 switches operated properly.

Actuation of either redundant switch gives the required indication on the display and control panel. Failure of both indicator switches would not affect arm stowage or subsequent manipulator operations. The crew can determine that the RMS has been properly cradled by a comparison of visual marks on the RMS and the pedestal. All indicator switches operated properly during RMS post-flight tests and checkout. In systems qualification tests, the ready-for-latch switches operated satisfactorily at -100? F. The failure may have been caused by friction in the switch acutation mechanism. CONCLUSION: The RMS aft pedestal system 1 ready-for-latch switch failed to transfer on only one occasion when the wrist section contacted the aft pedestal during cold system operations. The failure was not repeated during subsequent inflight operations or post-flight testing. The cause of the single failure to transfer has not been determined. CORRECTIVE_ACTION: No discrepancies were found during post-flight inspections, test or checkout. No work-around is required if an RMS indicator switch fails to transfer again. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-13 | C&T |
| | **GMT:** 083:20:47 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** The video tape recorder (VTR) cassette jammed in the recorder while the crew was removing the cassette. (ORB)

**Summary:** DISCUSSION: After the cassette jammed the crew was instructed to cut the tape to remove the cassette. The VTR requires approximately 10 seconds to release the tape from the recorder drum mechanism when the recorder is stopped. If the "eject" or power "off" buttons are pushed before the tape is released, the tape will be stripped from the cassette and jam the VTR. The STS-3 flight crew confirmed they had removed the cassette too soon. A hardware modification has been designed to physically prevent cassette ejection before tape release and if approved could be added at a later date.

CONCLUSION: The VTR cassette jammed because the crew removed the cassette before it had been released by the recorder mechanism. CORRECTIVE_ACTION: The ten-second delay requirement will be emphasized to each flight crew during pre-mission training. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-14 | Water and Waste Management System |
| | **GMT:** 083:14:07 | | **SPR** | **UA** | |
| | | | **IPR** | **PR** | **Manager:** |
| | | | | | **Engineer:** |

**Title:** Waste Management System (WMS) Slinger Speed Erratic and Circuit Breaker Opened. (ORB)

**Summary:** DISCUSSION: A used emesis bag was placed in the WCS (Waste Collection System) per crew procedures prior to first commode use. The slinger circuit breaker opened at the end of the first commode use. The crew closed the circuit breaker and tried the slinger in the high-speed mode (feces). The breaker reopened. The slinger was then tried in the low-speed mode (emesis). It ran at about 60 rpm instead of the normal 200 to 300 rpm and continued to degrade until day 6 when the slinger completely stopped.

Post-flight inspection found the emesis bag caught on a bottom tine with the bag velcro closure and plastic insert completely torn off. The bag was wrapped around the slinger filter 1-1/2 times causing the excessive motor current which eventually stopped the slinger. Since air flow through the commode started prior to slinger activation, the bag could have been drawn to the slinger prior to its start. The commode design is not compatible with the present emesis bag. CONCLUSION: The commode design is not compatible with the present emesis bag as the current bag material does not lend itself to shredding by the slinger. CORRECTIVE_ACTION: A modification has been incorporated which results in the slinger being activated after commode repress but before the air flow starts. The purpose of this modification is to prevent materials from impeding the slinger while it is rotating. A procedure change has been implemented which will have the emesis bag stowed in the wet trash. These changes are incorporated for STS-4 and subs. Additional changes to improve WCS operations for STS-5 are being considered. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-14A | Water and Waste |
| | **GMT:** 083:14:07 | | **SPR** | **UA** | Management System |
| | | | **IPR** | **PR** | **Manager:** |
| | | | | | **Engineer:** |

**Title:** Waste Management System Slinger Speed Erratic and Circuit Breaker Tripped. (ORB)

**Summary:** DISCUSSION: A used emesis bag was placed in the WCS (Waste Collection System) per crew procedures prior to first commode use. The slinger circuit breaker opened at the end of the first commodeuse. The crew closed the circuit breaker and tried the slinger in the high-speed mode (feces). The breaker tripped again. The slinger was then tried in the low-speed mode (emesis). It ran at about 60 rpm instead of the nomral 200 to 300 rpm. The crew continued to use the WCS in this mode for the rest of the mission.

Upon disassembly and inspection, it was noted that an emesis bag had been torn, making a strip of bag material approximately 27 inches long and this was caught on a bottom tine at one end and wrapped around the filter. The bag being wrapped around the filter resulted in a drag load on the slinger motor thus causing an electric current drain in excess of the circuit breaker trip point when the WCS was operated in the high-speed mode. CONCLUSION: The slinger rotation creates a vortex air flow in the WCS stowage tank. This vortex flow keeps debris and bags in the tank away from the bottom slinger tines. The STS-3 WCS activation sequence had the slinger startup as the last event to occur. Since the air flow through the commode was started prior to the slinger-created vortex, the air flow drew the emesis bag into the bottom slinger tines where it became caught when the slinger was started. CORRECTIVE_ACTION: The slinger power-on sequence was changed for STS-4 so that the slinger was activated prior to the start of air flow through the commode and remained activated until the air flow was stopped. The OV-099 WCS was removed and the power-on sequence was changed. OV-103 and subsequent WCS drawings were updated for slinger activation before start of airflow. Emesis bags will not be stowed in the WCS. They will be stowed in the wet trash as was done on STS-4. The lower tines will be swept back for STS-5 and subsequent to make them self cleaning of paper. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-15 | C&T |
| | **GMT:** 082:14:36 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** CCTV Camera "C" Failed. (ORB)

**Summary:** DISCUSSION: The crew compartment TV circuit breaker number 34 on panel R15 tripped when the aft bulkhead TV camera "C" was activated. A component failure inside the power supply resulted in an electrical short. The RMS elbow camera on STS-2 and the RMS wrist camera on STS-3 experienced the same failure mode. In each case, the camera temperatures were approximately 0? C.

Failure analysis and tests have determined that the failures were caused by the erratic operation of the camera dc/dc power converter at cold camera temperatures near 0? C. Cold temperatures decreased the base-emitter voltage of the switching transistor resulting in a decreased voltage at the collector. This created an unstable frequency within the dc/dc converter that generated high voltage spikes shorting the output transistor. CONCLUSION: Cold temperatures decreased the base-emitter voltage of the switching transistor resulting in a decreased voltage at the collector. This created an unstable frequency within the dc/dc converter that generated high voltage spikes shorting the output transistor. CORRECTIVE_ACTION: The input resistor has been changed to provide more voltage drive to the switching transistor. Diodes have also been added to protect the output transistor from high voltage spikes. All flight TV cameras were modified and tested prior to STS-4.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-16 | TPS |
| | **GMT:** 081:15:59 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Tiles and pieces of tiles were lost from the upper forward fuselage and upper body flap surface during STS-3. (ORB)

**Summary:** DISCUSSION: Twenty-one (21) tiles and 16 pieces of tiles were lost from the upper forward fuselage and 16 tiles were lost from the upper body flap surface.

Based on the launch photography, on-orbit TV and upon retrieval of many tiles and tile pieces in areas surrounding the launch pad, it has been concluded that the tiles were lost during ascent. No densified tiles or pieces of densified tiles were lost. Pre-entry thermal and structural analysis showed no issue with safety of flight, but did show some potential for sructural overtemperature. Post-flight inspection showed no structural overtemperature in the areas where tiles were lost. CONCLUSION: Extensive post-flight testing and vehicle tile chemical analysis indicate that the probable cause of tile loss is a combination of poor bond to the filler bar, damage due to high traffic, taping damage, and possible excessive application of waterproofing agent. Excesssive downhand applications (i.e., spraying in a downward direction) can affect the undensified tile-to-filler bar and "SIP" bonds. CORRECTIVE_ACTION: All undensified tiles on the upper forward fuselage and the upper body flap will be densified prior to STS-4. Specific procedures for tape application and removal, to be performed by experienced personnel only, have been implemented. Downhand spraying will be minimized and procedures to minimize puddling have been developed. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-17 | Atmospheric Revitalization Subsytem |
| | **GMT:** 082:18:00 | | **SPR** | **UA** | |
| | | | **IPR** | **PR** | **Manager:** |
| | | | | | **Engineer:** |

**Title:** ARPCS GN2 usage excessive. (ORB)

**Summary:** DISCUSSION: During STS-3, a GN2 leak in the Atmospheric Revitilization Pressure Control System (ARPCS) was isolated to System 2 downstream of the regulator inlet valve but outside the cabin upstream of the Xo 576 bulkhead penetration. The leak was stopped in flight by closing the System 2 regulator inlet valve. The leak was temperature dependant occurring only in a cold attitude. The first leak started at a structural temperature of -45? F stopping as the vehicle warmed during PTC. The leak repeated at -25? F in conjunction with GN2 flow induced by a potable water dump but stopped again after the vehicle warmed in a top-to-sun attitude. Tests at KSC at ambient temperatures did not show a leak.

Thermal predictions of the STS-4 tail-to-sun attitude indicate that the supply panel structural mounting temperatures will be about 15? F warmer than experienced on STS-3 which is about the temperature (-45? F) at which the leak started on STS-3. By closing the System 2 regulator inlet valve during the cold soak attitudes the leak can be stopped and there will be no effect on the mission. CONCLUSION: The GN2 leak occurred only during cold soak attitudes. And is between the System 2 regulator inlet valve and the cabin bulkhead penetration. CORRECTIVE_ACTION: Crew procedures will be used on STS-4 to isolate the System 2 leak during the 65 hour tail-to-sun attitude. The OV-103 panel will be cold soak tested and then exchanged with the OV-102 panel after STS-4 or 5. The leaking GN2 panel will be returned to the vendor for test and rework. EFFECTS_ON_SUBSEQUENT_MISSIONS: The GN2 System 2 regulator inlet valve will be closed during cold soak attitudes on STS-4.

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 3 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-17A | Atmospheric Revitalization Subsytem |
| | **GMT:** 082:18:00 | | **SPR** | **UA** | |
| | | | **IPR** | **PR** | **Manager:** |
| | | | | | **Engineer:** |

**Title:** ARPCS (Atmospheric Revitalization Pressure Control System) GN2 usage excessive. (ORB)

**Summary:** DISCUSSION: During STS-3, a GN2 leak in the ARPCS was isolated to system 2 downstream of the regular inlet valve, but outside the cabin and upstream of the Xo 576 bulkhead penetration. The leak was temperature dependent, occurring only when in a cold attitude. The GN2 leakage experienced on STS-3 was verified to occur at the same temperatures. The leakage rate remained essentially the same (approximately 1.5 lb/hr) on STS-4, indicating that the leak did not increase and was not affected by the additional launch vibration and low temperature exposure. The leak was stopped on STS-4 as on STS-3 by closing the system 2 regulator inlet valve.

The OV-103 supply panel was subjected to low temperature testing at the vendor, and the two nitrogen and one oxygen relief valves started leaking between -28 and -33 degrees F, indicating that the leakage is a generic problem. The leak may recur on STS-5 during the cold attitude (starboard side to sun); however, the system 2 regulator inlet valve should be closed during this period. Testing and design analysis will continue in an effort to determine a fix to prevent relief valve leakage at low temperatures. CONCLUSIONS: The Gn2 leak occurs only during cold-soak attitudes. The leak is located between the system 2 regulator inlet valve and the cabin bulkhead penetration. The leak rate did not increase during STS-4. Ground tests have demonstrated that 3 relief valves on the OV-103 supply panel started leaking at low temperatures, indicating that the leakage is a generic problem. CORRECTIVE ACTION: Crew procedures should be used on STS-5 to isolate the system 2 leak during the starboard side to sun attitude. This leak is not a constraint to the operation of PCS system 2. EFFECT ON SUBSEQUENT MISSIONS: none

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 4 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-17B | Atmospheric Revitalization Subsytem |
| | **GMT:** 082:18:00 | | **SPR** | **UA** | |
| | | | **IPR** | **PR** | **Manager:** |
| | | | | | **Engineer:** |

**Title:** ARPCS (Atmospheric Revitalization Pressure Control System) gaseous nitrogen usage excessive. (ORB)

**Summary:** DISCUSSION: During STS-3, a GN2 leak in the ARPCS was isolated to system 2 downstream of the regulator inlet valve, but outside the cabin and upstream of the Xo 576 bulkhead penetration. The leak was temperature dependent, occuring only when in a cold attitude. The leak recurred on STS-4 and STS-5 at essentially the same low temperature conditions. The leakage rate was approximately 15 lbs/hr. The leakage was stopped on STS-3, -4, and -5 by closing the system 2 regulator inlet valve. The OV-103 supply panel was subjected to low temperature testing at the vendor, and the two nitrogen and one oxygen releif valves started leaking between -28 and -33 degrees F, indicating that the leakage is a generic problem. The cause of leakage of the nitrogen relief valve and the oxygen relief valve is shrinking of the silicone elastomer seal with cold temperature. A new mold was designed and manufactured to produce additional protrusion of the elastomer seal on the nitrogen relief valves. A new molding process was employed on the oxygen relief valve to eliminate excessive recession of the elastomer seal. The OV-103 valves were retested at -65 degrees F subsequent to incorporation of the above fixes and no leakage occurred.

CONCLUSIONS: The source of the GN2 leakage was isolate to the nitrogen relief valves. The leakage was caused by shrinking of the silicone elastomer seal on the relief valves due to cold temperatures. CORRECTIVE ACTION: The OV-102 supply panel will be removed and the relief valves will be worked to modify the silicone elastomer seals prior to STS-9. The OV-099, 103, and subsequent supply panels have been reworked to modify the seals. EFFECT ON SUBSEQUENT MISSIONS: none

| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-18 | CREW |
| | **GMT:** 082:15:14 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** All PDRS DAC (16mm) cameras inoperative except mid-aft (ORB)

**Summary:** DISCUSSION: Power to the cameras was not turned on until first required usage. Therefore, the cameras were exposed to a long cold soak during the tail-to-sun thermal tests without camera heaters being activated. Five of the six cameras did not operate when they were turned on. The sixth camera operated but popped a circuit breaker shortly after activation. The camera operated after the circuit breaker was reset and pulled the full roll of film, however 90 percent of the film was run off before the camera stopped. Post-flight examination of th cameras revealed blown fuses in the five cameras that did not operate. All the cameras were operational post-flight.

Post flight tests at KSC and JSC evaluation of the camera circuitry have not revealed a cause for the sixth cameras failure to stop when commanded. CONCLUSION: 1. A cold start caused motor overloads in five camera, blowing fuses. 2. The camera which operated had a fuse which was apparently of higher current capability than the other five (operating on high side of specified tolerance). 3. The failure of the sixth camera to stop when shutoff by the crew is unexplained. CORRECTIVE_ACTION: 1. Procedures have been initiated to turn camera power on early after attaining orbit to assure that camera heaters are active. 2. Fuses in the cameras have been by-passed. Circuit protection is provided by circuit breakers on the camera control panel. 3. A procedure to stop a camera by opening its circuit breaker if it does not stop normally has been proposed for addition to the PDRS operations checklist. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-19 | Water and Waste Management System |
| | **GMT:** 084:13:59 | | **SPR** | **UA** | |
| | | | **IPR** | **PR** | **Manager:** |
| | | | | | **Engineer:** |

**Title:** WCS Vacuum Vent Valve knob came off. (ORB)

**Summary:** DISCUSSION: The knob on the vacuum vent valve came off during STS-3 when the valve was moved. The valve could not be closed for entry. The knob was retained by a flat tip set screw which does not exert enough force. The set screw could not be reset by the crew.

CONCLUSION: The set screw did not exert sufficient force to retain the knob. CORRECTIVE_ACTION: Rollpins have been added to retain control knobs on the WCS. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-20 | C&T |
| | **GMT:** 084:17:06 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** CCTV camera "B" lens stuck in a zoom "out" mode during flight. (ORB)

**Summary:** DISCUSSION: Attempts by ground command and by the crew failed to correct the zoom anomaly. The camera (S/N 006) and lens (S/N 004) were removed from the spacecraft and returned to the CCTV contractor for failure analysis. The lens was demated from the TV camera and operated on a set of special test equipment. The zoom function was still stuck as previously reported. After approximately ten zoom "in" commands, the lens became unstuck and operated properly.

Since the initial flight failure occurred during a "cold" case environment, the lens was then exposed to 0? C, -20? C, and -40? C test environments. In each environment, the lens operated properly without any tendency to stick. After removal from the test chamber, the lens assembly cover was removed, A motor torque test was run, and lens drag torque was measured. Each function was with acceptable limits. The lens and motor were removed from the assembly and returned to the vendor for inspection. Both units were disassembled and inspected for potential flaws. The vendors found no problem within the lens or the motor. The motor was temperature cycled at temperatures from -20? C to -60? C and checked for any electrical discontinuities. No problems were found. This is the only zoom failure in a total of 10 camera positions flown during the past 3 missions. No failures of this type have occurred during ground testing. The use of the zoom feature for the cameras on STS-4 is not mandatory for RMS operations. CONCLUSION: At this time, no specific flaw has been found to account for the flight anomaly. CORRECTIVE_ACTION: The lens assembly has been replaced for STS-4. Testing at the vendor continues. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 5 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-20A | C&T - Ku-band |
| | **GMT:** 084:17:06 | | **SPR** | **UA** | **Manager:** |

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|---|---|---|---|---|---|
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** CCTV camera "B" lens stuck in zoom "OUT" mode during flight. Attempts by ground command and by the crew to correct the zoom anomoly failed. (ORB)

**Summary:** DISCUSSION: The lens, serial number 004, was demated from the TV camera, serial number 006, at the vendor and operated on a set of special test equipment. After approximatedly ten zoom "IN" commands, the lens became unstuck and operated properly.

Cold case environment test of 0 degrees C, -20 degrees C, and -40 degrees C verified proper operation of the lends in the flight thermal environment with no tendency to stick. A motor torque test and measurement of the lens drag torque confirmed that each function was within acceptable limits. Examination of the stepper motor drive board under a microscope showed evidence of potting material in two pins of the board connector. All pins associated with the motor phases were cleaned and/or replaced. The lens assembly successfully completed functional tests, a single axis random vibration test and temperature chamber tests. The product assurance instructions were revised to require a 7-power microscope inspection of the connector during assembly. CONCLUSIONS: Potting materials in pins of the board connector for the stepper drive motor cause the CCTV camera "B" lens to stick in the zoom "OUT" mode during flight. CORRECTIVE ACTION: All pins associated woth the stepper drive motor phases were cleaned and/or replaced. A 7-power microscope will be used for inspection of the connector during assembly. EFFECT ON SUBSEQUENT MISSIONS: none

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-21 | C&T - S-Band |
| | **GMT:** 085:01:17 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** S-band transponder 2 (SN 304) failed in the low power mode (STDN/SGLS) in both the high- and low-frequencies. (ORB)

**Summary:** DISCUSSION: Transponder 2, along with power amplifier 1, was configured in the STDN-high power mode for the PDP (plasma dynamics package) EMI test at 84:21:46:20 G.m.t. When transponder 2 was configured back into the STDN low-power high-frequency mode at 84:21:46:20 G.m.t., the downlink was lost and a drop in received signal strength was observed. At 85:01:33:30 G.m.t., a test was conducted with transponder 2 in SGLS, high-frequency mode and downlink was lost. A test at 85:02:13:20 G.m.t. with transponder 2 in STDN low power low-frequency also provided no downlink.

After landing at White Sands, a test was run to exercise transponder 2 in the modes that it had failed in flight. As a result, the transponder returned to normal operation. Transponder 1 (ref. problem 23) was removed, tested and inspected and found to have relays contaminated with epoxy and coating materials. The transponder 1 relays as well as those in transponder 2 are of the same lot, and therefore it has been concluded that the problem is generic especially since cycling the relays cleared both units. Since the problem cleared with cycling and since the spare hardware has potentially the same problem, transponder 2 will not be replaced for STS-4. CONCLUSION: The

most likely causes are particles of epoxy and other contaminants in the RF control relays that interferred with the relay mechanism and fouled the relay contacts in zero gravity.  Cycling the relays at White Sands in the 1g field cleared the problem by loosening and/or burning the contaminants on the contacts.    CORRECTIVE_ACTION: No action has been taken to replace suspect RF relays in transponder 2.  If problem recurs in flight, repeated mode selections may clear fouled relays.  In future, the precapping inspection for contamination in the RF cavity of the relay will be conducted using higher resolution inspection optics.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| **Tracking No** | **Time** | **Classification** | **Documentation** | | **Subsystem** |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-22 | RMS |
| | **GMT:** 083:15:21 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** RMS Encoder Check False Alarms (ORB)

**Summary:** DISCUSSION: When the RMS was powered up following the temperature monitoring mode during cold soak, the wrist pitch encoder issued false alarms at 83:15:21, 84:14:10, 85:15:00 G.m.t.  The encoder check is designed to catch discontinuities in encoder data of 1? or greater.  The check is inhibited during power on initialization (POI), until the port arm select signal is received by the GPC.  The manipulator controller interface unit (MCIU) delays the port arm select signal from the arm for 1 second after power is applied to the arm to allow for joint power conditioner (JPC) and servo power amplifier (SPA) power up and initialization.  This is to insure that the GPC only processes valid data from the arm.  The auto RMS mode is inhibited unless the encoder check is passed.

Prior to exiting the POI the encoder data read 0?.  When POI is exited, the encoder data jump to actual angles.  In the stowed position these are equivalent to joint angle biases.  For the wrist pitch this is a value of 1.401? which exceeds the 1? limit in the encoder check.  If the first valid encoder data are received after the port arm select flag is received by the GPC the encoder check is initialized to 0? and the next cycle exceeds the 1? limit. At ambient temperature the JPC/SPA initialization occurs in about 900 milli seconds.  Worse case analysis shows this initializaiton procedure could take up to 1.009 seconds at low temperatures. All the false alarms occured only when the arm was cold.   CONCLUSION: At low temperatures the POI sequence for wrist pitch exceeded the 1 second MCIU delay time for the port arm select signal.  A false alarm was generated.    CORRECTIVE_ACTION: Fly as is for STS-4.  If the wrist pitch encoder issues a false alarm after POI, the crew will release the auto mode inhibit by a reset of the encoder check through the aft orbiter keyboard. Proposed modifications include changing the SPA timing, increasing the delay in the MCIU or delaying the port arm select signal in the GPC software.    EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| **Tracking No** | **Time** | **Classification** | **Documentation** | | **Subsystem** |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-23 | C&T - S-Band |
| | **GMT:** 085:03:43 | | **SPR** | **UA** | **Manager:** |

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|---|---|---|---|---|
| | | | IPR | PR |
| | | | | Engineer: |

**Title:** S-Band transponder 1 (SN 301) failed in STDN high- and low- power and high-frequency modes. (ORB)

**Summary:** DISCUSSION: While troubleshooting the failed transponder 2 problem (problem No. 21), a ground command was executed at 85:03:43:55 G.m.t. to select transponder 1 in the STDN high-power, high-frequency mode and the downlink was lost. At 85:03:45:00 G.m.t., the crew was asked to configure transponder 1 in the STDN low-power, high-frequency mode and downlink was again lost. Degradation in the uplink received signal strength was also noted.

At 85:18:13:25 G.m.t., transponder 1 was again selected in the STDN high-power, high-frequency mode and cycled through the transmit/receive and receive-only modes, but the downlink was never recovered. A postlanding test was conducted at White Sands and the transponder 1 failed modes were recovered. Transponder 1 was removed from OV-102 and returned to the vendor. Contamination in the form of epoxy and coating material was found in the RF cavity of all the RF control relays S1, S2, S3 and S4. Loss of these relays would have resulted in the failure symptoms observed during the flight. CONCLUSION: The most likely cause is particles of epoxy and other contaminants in the RF control relays that interferred with the relay mechanism and fouled the relay contacts in zero gravity. Cycling the relays at White Sands cleared the problem by loosening and/or burning the contaminants off the contacts in a 1g field. CORRECTIVE_ACTION: The defective relays were removed and replaced with relays from a different vendor. In the future, the pre-capping inspection for contamination in the RF cavity of the relay will be conducted using higher resolution inspection optics. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-24 | APU |
| | GMT: 081:16:15 | | SPR | UA | Manager: |
| | | | IPR | PR | |
| | | | | | Engineer: |

**Title:** APU 3 fuel tank pressure decay. (ORB)

**Summary:** DISCUSSION: APU 3 fuel tank pressure decayed 12 psi during the STS-3 flight. A GN2 QD (quick disconnect) was verified leaking at tank residual pressure. An analysis of the failed QD showed indentations and 2 flakes of rust on the poppet sealing surfaces. Also, there were indentations and smaller rust particles on the QD cap. A fine coating of rust was evident throughout the QD and a nylon-type fiber was found on the QD filter. The source of contamination is not known, but possibilities include moisture from the air, the ground half coupling, or freon cleaning GSE. Until recently, the GSE was cleaned with freon. Freon in the presence of hydrazine is known to attack stainless steels. This method of cleaning has been discontinued at KSC.

CONCLUSION: The pressure decay in APU 3 fuel tank was caused by a leaking GN2 QD. The leakage was due to contamination and indentations on the QD sealing surface. The contamination could have come from humidity or an improper cleaning method. CORRECTIVE_ACTION: The QD has been replaced and the new QD leak checked by mass spectrometer. The use of freon to clean the GSE has been discontinued. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-25 | C&T |
| | GMT: 086:14:17 | | SPR | UA | Manager: |
| | | | IPR | PR | |
| | | | | | Engineer: |

**Title:** Loss of transmit function on CDR's Wireless Crew Comm Unit (WCCU Unit A). (ORB)

**Summary:** DISCUSSION: During the 5th day (086:14:16:00 G.m.t.) the CDR reported that he had lost the capability to transmit on his WCCU but could still receive. The battery was replaced but the problem was not cleared. The spare WCCU (Unit C) was deployed and communications were restored

Post flight analysis showed that the failure was caused by a broken wire in the CDR's leg unit antenna. Several antennas were severely bent when stowed for landing during STS-2. CONCLUSION: The antenna wire break was caused by repeated bending and straightening of the antenna which occurs when the crewman moves about the cabin and snags his antenna. CORRECTIVE_ACTION: Antennas with a history of severe bends will be replaced and the remaining antennas will be reworked by moving the shrink-on ID label to an area where it will provide strain relief. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-26 | CREW |
| | GMT: 086:16:40 | | SPR | UA | Manager: |
| | | | IPR | PR | |
| | | | | | Engineer: |

**Title:** Cap seal on several drink bags failed. (ORB)

**Summary:** DISCUSSION: During flight the crew reported the failure of the cap seal on several beverage packages. Packages sealed at the same time as those used in flight were rehydrated in the JSC Flight Food Processing Laboratory. The flight failure was repeated as the heat seal intended to secure the dispenser valve assembly to the beverage body yielded. The failure occurred when the package was slightly overfilled. The rupture in the cap seal was from 1/8 to 1/4 inches long and permitted about 1 ounce of liquid to escape. By pulling slightly on the cap it would easily be removed from the package. The complete beverage assembly was designed to withstand internal pressure in excess of 20 psi.

A checkout of the heat sealing equipment used in package fabrication revealed that the temperature controller was cutting out the heater element 50 degrees below the minimum required to produce the optimum heat seal.   CONCLUSION: The cause of the heat seal failures is a faulty temperature controller in the manufacturing process which failed to maintain the proper heat seal temperature.    CORRECTIVE_ACTION: The beverage sealing equipment was overhauled and the temperature controller cleaned, reset and tested.  A safety temperature sensor/switch was installed in the unit to render the equipment inoperative below the minimum heat seal temperature.  The optimum heat sealing range was highlighted on the temperature indicator to accentuate the proper sealing temperature to the operator.
EFFECTS_ON_SUBSEQUENT_MISSIONS: During beverage packaging operations for STS-4 inspections of the heat seal area will be increased to 100%.  For STS-5 and subs a new packaging system similar to the skylab plastic food liner will replace the current skylab accordian type beverage container.

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-27 | C&T |
| | **GMT:** 86:14:40 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** DFI wideband mission recorder bite No. 1 failed at 86:14:40 G.m.t. during STS-3. (ORB)

**Summary:** DISCUSSION: The recorder was operated during all subsequent planned record cycles and all other telemetry was normal until AOS following blackout.  At that time, the tape motion telemetry became intermittent, indicating that the recorder was operating at less then 7 1/2 ips.  At approximately 3 minutes prior to touchdown, the bite 2 (record indicator) telemetry also indicated fail.

Data playback was done at JSC and the entry data was unrecoverable.  The recorder was returned to the vendor and a failed lamp was found in the tape tension servo circuitry.  This failure accounts for the observed telemetry indications.  The failed lamp is rated by the manufacturer for dc operation at 500 hours.  Operations time on this recorder was estimated to be 300 hours.  A filament inspection showed that the filament failure was due to a complex grain notching phenomena which is common in lamp failures.  Grain boundary notches form on the filament and cause localized heating which in turn aggravates the notching and ultimately results in failure. The lamps in this recorder will be replaced with 2500 hour rate lamps selected for uniform current characteristics.  The power transistors in the motor drive circuits will be replaced as a precautionary measure.   CONCLUSION: This problem was caused by the premature failure of a lamp in the tape tension servo control circuit.
CORRECTIVE_ACTION: For STS-4 the recorder has been replaced with the backup recorder, a refurbished qualification test unit.  The lamps in the replacement recorder are the 500 hour rated lamps.  The estimated operation time on this recorder is 120 hours well below the 500 hour rated lamp life time.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 6 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-28 | C&T - S-Band |

| | | | | |
|---|---|---|---|---|
| | **GMT:** 086:09:06 | **SPR** | **UA** | **Manager:** |
| | | **IPR** | **PR** | |
| | | | | **Engineer:** |

**Title:** The S-Band power amplifier 1 telemetry measurement indicated that the power output degraded from 130 watts during the mission. (ORB)

**Summary:** DISCUSSION: A slow reduction in output power from power amplifier (PA) 1 was observed after it was selected for the plasma diagnostic package (PDP) EMI experiment and later when it was selected with transponder 2 in the STDN HI power mode. Most of the power drop (about 6 watts) occurred in the first 5 or 6 hours of operation and then settled down to a loss of 4 or 5 watts per day.

The PA assembly was removed post flight for failure analysis. The traveling wave tube (TWT) exhibited the same loss of power as observed during the flight but never degraded below 100 watts. The vendor has completed extensive tests on the TWT and will tear it down for a detailed metallurgical inspection. The TWT has a design life of 20,000 hours but degraded after only about 1000 hours of operation. The cause of the failure is unknown at this time. If a TWT fails or degrades on STS-4, either the back up power amplifier or the low power mode can be selected. CONCLUSIONS: The PA 1 TWT power output degraded below specified limits after several hours of operation. The cause of the failure is unknown at this time. Failure analysis continues at the vendor. CORRECTIVE ACTION: The defective PA assembly was replaced by the spare unit with about 550 hours of operating time on the TWT. EFFECT ON SUBSEQUENT MISSIONS: none

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 7 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-28A | C&T - S-Band |
| | **GMT:** 086:09:06 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** S-Band power amplifier 1 indicated a downward trend in power output during STS-3. (ORB)

**Summary:** DISCUSSION: The S-Band PA (power amplifier) telemetry measurement indicated that the power output degraded from 130 to 103 watts durin ghte STS-3 mission. Repeated testing and analysis verified the problem at the vendor and showed degradation of power output over periods of time. The TWT (traveling wave tube) exhibited the same degradation of power under controlled test conditions on the bench as was noted during the flight.

The problem was isolated to the manufacturing processes that allowed abnormally high zirconium-nickel ratios all over the face of the cathode and physical separation of the cathode heater potting nickel matrix from the back face of the cathode. The separation cause the cathode temperature to drop. The combination of high-Zr interface and potting emitter temperature was enough to cause the observed degradation. This problem would be detectable during a mission only with usage over a long period of time so that the decrease in power output could be observed. This failure mode is non-catastrophic since a 7 to 10 day mission could be completed using the power amplifier with the reduced power. If a TWT fails or degrades on STS-5, either the back-up power amplifier or the low power mode can be selected. CONCLUSIONS: The PA 1 TWT power output degraded below specified limits after several hours of operation on STS-3. Degradation of the TWT cathode occurred during the manufacturing process. CORRECTIVE ACTION: The supplier has implemented the following changes for the manufacture of four spare tubes: 1. Processing will eliminate high-Zr interface cathodes. 2. Alcohol will be used as a lubricant for machining stages on the heater cavity surface. 3. 1000 hr burn-in will be required prior to integration. For the tubes already fabricated for OV-102 through OV-104, flight test and burn-in data will be evaluated to identify degraded performace prior ro excessive power loss. EFFECT ON SUBSEQUENT MISSIONS: none

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| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 8 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-28B | C&T - S-Band |
| | **GMT:** 086:09:06 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** The S-band power amplifier (PA) 1 indicated a downward trend in power output. (ORB)

**Summary:** DISCUSSION: The RF power output of PA 1 dropped approximately 10 watts after 8 hours of operation and a total of 27 watts (130 to 103 watts) during the STS-3 mission. After disassembly and test of the Traveling Wave Tube (TWT) it was decided that the use of oil during the milling of the cathode has left a deposit ofoil that prevented a good bond for a subsequent nickel plating process. TWT output degradation due to the separation of the nickel plating from the cathode has been detectable within the first 1000 hours of operation. The PA flight spare was flown on STS-4 and STS-5 without incident. Preliminary performance data from the unit to be flown on OV-099 appears nominal.

CONCLUSIONS: Questionable TWT cathode milling procedures may have caused cathode failure during STS-3. The PA units now on OV-102 and OV-099 have ben performing within specifications and are expected to continue to do so. There is concern that the cathode milling proccedure used to manufacture these TWT's may have shortened their expected useful life. CORRECTIVE ACTION: The vendor now uses alcohol instead of oil in the cathode milling process. TWT's manufactured with this improved process will be available for replacing defective TWT's by mid 1983. EFFECT ON SUBSEQUENT MISSIONS: none

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| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-28C | C&T - S-Band |
| | **GMT:** 086:09:06 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** The S-band Power Amplifier (PA) 1 Output Slowly Decreased. (ORB)

**Summary:** DISCUSSION: The RF power output of PA 1 dropped approximately 10 W after 8 hours of operation and a total of 27 W (130 W to 103 W) during the STS-3 mission. The problem was isolated to the manufacturing processes of the TWT. Abnormally high zirconium-nickel ratios were allowed all over the face of the cathode and the cathode heater potting nickel matrix physically separated from the back face of the cathode. The separation caused the cathode temperature to drop. The combination of high-Zr interface and potting emitter temperature was enough to cause the observed degradation.

After disassembly and test of the traveling wave tube (TWT), it was decided that the use of oil during the milling of the cathode had left a deposit of oil that prevented a good bond for a subsequent nickel plating process. TWT output degradation due to the separation of the nickel plating from the cathode has been detectable within the first 1000 hours of operation. The PA flight spare was flown on STS-4 and STS-5 without incident. The performance data from the unit flown on STS-6 appears nominal. Since the same unit and flight profile will be used on STS-7, no TWT changeout will be made. CONCLUSION: Questionable TWT cathode milling procedures may have cause cathode failure during STS-3. The PA units now on OV-102 and OV-099 have been performing within specifications and are expected to continue to do so. There is a concern that the cathode milling procedure used to manufacture these TWT's may have shortened their expected useful life. CORRECTIVE_ACTION: The vendor now uses alcohol instead of oil in the cathode milling process. TWT's manufactured with this improved process will be available for replacing defective TWT's by mid-1983. Four TWT's of the new design with 1000 hours ATP are on order and will be available through the end of 1983. Two additional TWT's will be ordered to provide logistics spares through September 1985. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-29 | DPS |
| | **GMT:** 087:18:10 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Cathode Ray Tube 1 did not respond to entries. (ORB)

**Summary:** DISCUSSION: Cathode ray tube 1 did not respond to entries. The crew performed a malfunction procedure which indicated a stuck keyboard switch might be the problem. A replacement switch from the aft keyboard was substituted and the problem cleared.

This problem has been seen in ground facilities when switches of that specific vintage have been used for several years. The fundamental problem is attributed to a "weak" spring which has chosen to minimize zero-g depression forces. An improved design is being phased in on an attrition, not mandatory basis. CONCLUSION: The problem was caused by a weak spring in a keyboard switch. CORRECTIVE_ACTION: The present attrition-based plan will continue. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-30 | RMS |
| | **GMT:** 087:16:09 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** SPA (servo power amplifier) commutator failure message on RMS wrist yaw joint. (RMS)

**Summary:** DISCUSSION: A SPA commutator failure message for the wrist yaw joint was received 12.5 seconds after selecting RMS port arm at 87:16:09:25 G.m.t. The arm-based electronics (ABE) warning annunciator remained on until the arm was deselected and powered down 20 seconds later. The commutator scanner BITE alarm did not recur on subsequent power ups of the RMS during flight.

The commutator scanner detects motor position and transmits these data through a three-bit code to the motor control electronics. These signals are combined with motor speed commands to cause the necessary phase switching of the three phase motor. The commutator scanner BITE circuit is designed to detect invalid codes from the commutator scanner. If an error is detected, the BITE flag is latched within the SPA and can only be reset by cycling the power. The commutator scanner BITE alarm did not repeat and proper motor operation was demonstrated during extensive post-flight testing. The cause of this anomaly is unknown. A signal transient probably upset the commutator scanner BITE circuit latching the BITE flag. A 4 to 5 microsecond signal transient can trip the commutator scanner BITE circuit. A single false or transient BITE signal can be reset by cycling power to the RMS. A continuous false BITE signal maintains the ABE warning light on, but RMS operations can be continued. After a true commutator scanner failure the associated motor would fail to drive in the primary mode because of improper phase switching commands. However, the arm could be cradled in the backup mode. CONCLUSION: The cause of this anomaly is unknown. CORRECTIVE_ACTION: Turnaround testing has demonstrated proper operation of all RMS modes and functions. A proposed redesign would make the commutator scanner BITE circuit self-resetting for reduced sensitivity to signal transients. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-31 | ECLSS |
| | **GMT:** 087:23:21 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Erratic flash evaporator Primary B controller operation and shutdown during full-up (topping and high-load) operation. (ORB)

**Summary:** DISCUSSION: During the payload bay door closure test on day 6 (approximately 87:23:21:00 G.m.t.), the flash evaporator system (FES) Primary B controller exhibited erratic temperature control while operating in the full-up mode for approximately 30 minutes, resulting in a system shutdown. The evaporator outlet temperature cycled between 39? F and 56? F prior to shutdown.

The Primary B unit mid-point temperature sensor which provides "startup" and "standby" functions as well as an "anticipator" input to the controller was known to have a slower response time than the other sensors.  This response time has been used in the Hamilton Standard analytical FES performance model resulting in a predicted erratic operation very similar to that observed on STS-3.  The Primary B controller was removed and has completed checkout at the vendor with no indication of controller problems.   CONCLUSION: The erratic operation of the Primary B controller was caused by the slow response of the mid-point temperature sensor.  The FES is fully operational for STS-4.    CORRECTIVE_ACTION: The Primary B mid-point temperature sensor has been replaced on OV-102 and the new installation has been verified to have a proper time constant.    EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 9 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-31A | |
| | **GMT:** 087:23:21 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Erratic flash evaporator primary B controller operation. (ORB)

**Summary:** DISCUSSION: During the payload bay door closure test on day 6 (approximately 87:23:21:00 G.m.t.), the flash evaporator system (FES) Primary B controller exhibited erratic temperature control while operating in the full-up mode for approximately 30 minutes, resulting in a system shutdown.  The evaporator outlet temperature cycled between 39? F and 56? F prior to shutdown.

The problem resulted from a slow-responding mid-point temperature sensor. This was confirmed by prior observations during STS-3 and by subsequent analysis. The primary B controller was removed and showed no indication of controller problems. Operation of the FES replacement primary B controller and the replacement mid-point temperature sensor was normal during STS-4. The mid-point temperature sensor had been damaged during assembly due to excess thermal grease. Assembly procedures have been revised to use a special tool. This tool will insure that the proper amount of thermal grease is applied to each temperature sensor during assembly. Test data was reviewed on OV-99 and none of the sensors had a sluggish response.  CONCLUSIONS: The erratic operation of the promary B controller was caused by a slow-responding mid-point temperature sensor. The sensor had been damaged during assembly due to excess thermal grease. The sensor was removed and replaced for STS-4. The FES is fully operational for STS-5 and subsequent. CORRECTIVE ACTION: The primary B mid-point temperature sensor and controllerwere replaced on OV-102 prior to STS-4 and the new installation was verified to have the proper time constant furing STS-4 preflight and flight operations. Assembly procedures have been improved for OV-103 and subs. Test data indicates that all of the sensors on OV-99 have the proper response. EFFECT ON SUBSEQUENT MISSIONS: none

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-32 | D&C |
| | **GMT:** 088:14:36 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** The payload main bus C talkback did not operate. (ORB)

**Summary:** DISCUSSION: During the STS-3 flight, the payload main bus C talkback (DS17 PNL R1A1) did not operate when the power was turned on. Power was on as indicated by the downlink measurement and the bus current. Troubleshooting after the flight confirmed the inflight data. Teardown of the talkback by the supplier disclosed an open at a coil lead solder joint. The cause of the failure was a bad (cold) solder joint.

Accumulative environmental effects including vibration and thermal cycling of the talkback probably caused the cold solder joint to open. This is the first occurrence of this type of problem with talkbacks. This failure is an isolated incident since almost 200 talkbacks have operated satisfactorily on OV-102. CONCLUSION: The talkback did not operate because a cold solder joint failed at a lead to the coil due to accumulative environmental effects. This failure is an isolated incident in the soldering process. CORRECTIVE_ACTION: The talkback has been replaced. The vendor will review his soldering processes to determine if any action can be taken to improve reliability. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-33 | ECLSS |
| | **GMT:** 088:17:46 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Smoke detector 2A had a continuous alarm. (ORB)

**Summary:** DISCUSSION: Smoke detector 2A in avionics bay 2 failed on with a continuous false alarm. It was reset by the crew twice with the same result. The circuit breaker for this detector was opened.

The false alarms occurred again at White Sands when the smoke detector was powered, but did not recur at KSC. During troubleshooting at the vendor, the problem could not be repeated. Additional tests are in process. CONCLUSION: At this time, no cause for this problem has been found during tests at the vendor. Testing will continue. CORRECTIVE_ACTION: The smoke detector has been replaced for STS-4. Should this problem recur, the redundant smoke detector in the bay would detect a fire and should it fail a fire bottle would be discharged in the bay prior to entry. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 10 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-33A | |
| | **GMT:** 088:17:46 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Smoke detector 2A gave a continuous flase alarm. (ORB)

**Summary:** DISCUSSION: Smoke detector A in avionics bay 2 failed with a continuous false alarm during STS-3. The smoke concentration output of the sensor remained at the normal background level well below the alarm trip point. The detector was reset twice and triggered the alarm immediately after being reset. The detector was powered down for the remainder of the mission.

A loose gold chip was found in the LSI (large scale integrated circuit chip) used to analyze the sensor output for triggering the alarm sequence. The loose gold chip caused the continuous false alarm in flight. This failure can be immediately identified as a false alarm. The failed sensor can be powered down and the redundant sensor can be used for smoke detection. Nine stock LSI's were screened for loose particles and none were found. This is the first smoke detector failure due to this problem. Based on the screening of the 9 stock LSI's and the successful flight experience with the operation of the smoke detectors, the loose gold chip found in the failed LSI is not considered a generic problem. CONCLUSIONS: The continuous flase alarm was caused by a loose gold chip in the LSI used to analyze the sensor output for triggering the alarm sequence. Test data and flight experience indicate that their failure is not a generic problem. CORRECTIVE ACTION: The smoke detector was replaced for STS-4. There were no flase alarms from the smoke detectors during STS-4. Fly as is for STS-5. EFFECT ON SUBSEQUENT MISSIONS: none

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-34 | EPD |
| | **GMT:** 089:13:50 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Midbody motor control assembly (MMCA) 3 operational status 4 was "0" but should have been "1". (ORB)

**Summary:** DISCUSSION: The problem occurred after the last vent door sequence prior to deorbit, indicative of a latched "on" hybrid relay. Post-flight data review disclosed that coincidental with this problem, left vent door 3 motor 1 continued to run even after the motor 1 close inhibit signal had been reveived by the MMCA 3 series hybrid relays, K4 and K18. Hybrid relay K4 is in the MMCA 3 operational status 4 "Daisy Chain". K4 remained latched even after the MDM control signal had been removed. Left vent door 3 troubleshooting at KSC did reproduce the problem one time. The box was removed from OV-102, and troubleshooting was performed on the box at Rockwell with no success in duplicating the problem. Relays K4 and K18 were replaced as a precautionary measure and for additional investigation. Extensive detailed failure analysis on both relays could not identify any anomalies.

The problem could not be reproduced at the box level or the relay level. The failure symptoms indicate that the most probable cause was an intermittent breakdown on the hybrid module substrate between the inhibit input and the relay control coil causing the relay to remain latched without the presence of a control signal. A component breakdown and failure analysis of the hybrid module substrate is continuing at the vendor for the specific details of this unique substrate failure mode. There are over 550 of these hybrid relays in use on the vehicle and this the first failure of this type seen in the flight test program. This problem was a unique failure of a hybrid module substrate. The faulty operation of a hybrid relay is detectable in flight. CONCLUSION: A latched "on" hybrid relay caused left vent door 3 motor 1 to continue running even after the motor 1 close inhibit signal was received. The most probable cause was an intermittent breakdown on the hybrid module substrate between the inhibit input and the relay control output. CORRECTIVE_ACTION: Suspect hybrid relays K4 and K18 were replaced and the box was retested satisfactorily on OV-102. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-35 | ECLSS |
| | **GMT:** 089:16:21 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Ammonia boiler controllers A and B failed. (ORB)

**Summary:** DISCUSSION: ABS (ammonia boiler system) "A secondary" controller failed to control the temperature when activated at 89:16:21 G.m.t. Then the "B secondary" controller failed to activate. The problem was reproduced during troubleshooting at White Sands.

Disassembly of the system A isolation valve at the vendor revealed a large amount of ammonium chloride contamination under the seat and this reduced the valve stroke and increased the pressure drop. The source of this contamination is unknown, but it may have been induced during valve assembly. The system B isolation valve was contaminated with iron rust on the side of the sliding poppet and on the wall of the barrel in which the poppet slides. The rust probably prevented the valve from opening when first activated and caused "sticky" valve operation during subsequent troubleshooting. The source of the rust is unknown. The valve had not been operated for about 7 months before flight while the ABS was fully serviced. Ammonia has a high affinity for water and should inhibit rust formation after servicing. CONCLUSION: Ammonium chloride contamination in the system A isolation valve pushed the poppet seat partially out of the groove in which it rests. This resulted in a shortened valve stroke and an increased differential pressure. Iron rust in the system B isolation valve most probably prevented the valve from opening when activated and caused "sticky" valve operation during troubleshooting. The source of the ammonium chloride contamination and the rust is unknown. CORRECTIVE_ACTION: The isolation valves have been replaced and the ammonia has been checked to verify the absence of contaminants for STS-4. Valve assembly, storage, and shipping procedures are being reevaluated to minimize the possibility of contamination or rust.    EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| **Tracking No** | **Time** | **Classification** | | **Documentation** | **Subsystem** |
|---|---|---|---|---|---|
| MER - 11 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-35A | |
| | **GMT:** 089:16:21 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Ammonia boiler controllers A and B failed during STS-3. (ORB)

**Summary:** DISCUSSION: The ABS (ammonia boiler system) "A secondary" controller failed to control the temperature when activated at 89:16:21 G.m.t.  Then the "B secondary" controller failed to activate.  The problem was reproduced during troubleshooting at White Sands. A subsequent investigation showed that the problems were caused by ammonium chloride contaminant in the system A isolation valve and by iron rust contaminant in the system B isolation valve.

CONCLUSION: Ammonium chloride contamination in the system A isolation valve pushed the poppet seat partially out of the groove in which it rests.  This resulted in a shortened valve stroke and an increased differential pressure. Iron rust in the system B isolation valve most probably prevented the valve from opening when activated and caused "sticky" valve operation during troubleshooting.  The source of the ammonium chloride contamination and the rust is unknown.    CORRECTIVE_ACTION: The isolation valves have been replaced and the ammonia has been checked to verify the absence of contaminants for STS-4. System A performed normally during STS-4 post-landing operation. The Flight Operations Directorate is planning to alternate the use of systems A and B from flight to flight to exercise both systems and expose any potential problems. Valve assembly, storage, and shipping procedures are being reevaluated to minimize the possibility of contamination or rust.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| **Tracking No** | **Time** | **Classification** | | **Documentation** | **Subsystem** |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-36 | MECH |
| | **GMT:** 089:16:01 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Loss of radiator "latch" indication. (ORB)

**Summary:** DISCUSSION: During orbiter descent at GMT 89:16:01:23, 3 minutes and 23 seconds prior to touchdown, the port radiator forward panel latches 1 through 6 systems 1 and 2 together with the starboard radiator aft panel latches 7 through 12 system 2 did not indicate "latch" or "release".  After landing, latch operation returned all the "latch" indications in 0.7 seconds compared to a normal latch operating time of 25 to 30 seconds.  This indicated that all the latches had been locked during entry.

Motor current data and the crew debriefing indicate that the Control and Display (C&D) Panel control switch was moved from the "latch" position, through the "off" position and momentarily (0.5 - 0.7 seconds) to release, then to "off". At this point, the talkback for the starboard radiators indicated a not latched posture with the down list data showing loss of "latch" position on the starboard radiator latch actuator forward panel (latches 1-6). The panel control switch was then returned to the "latch" position, proper talk back was received, and the switch was returned to "off". In moving the panel control switch to the release position momentarily, all four latch actuators were driven toward an unlatched position; however, because of the short drive time, only the switches in the starboard forward panel actuator transfered. Therefore, when the panel control switch was returned to the "latch" position the starboard forward actuator was the only one of the four actuators capable of being powered toward the latched direction. This left the three remaining actuators in a position such that the actuator control/indicating switches were "near" their transfer point. CONCLUSION: The switches transfered during entry because of either vibration or a temperature increase causing the system to backdrive and the switches to transfer. Because of the overcenter position of the latch linkage and the latch mechanical stop, the system remained in a safe, completely latched position. This design/rigging feature assures that once the crew observes the proper talkback indication, with the panel switch in the "off" position, the system will remain safely latched for entry.
CORRECTIVE_ACTION: None required - System design and crew procedures are adequate to assure a safe latch posture for entry.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-37 | DPS |
| | **GMT:** | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** MDM FF4 Input/Output Error ()

**Summary:** DISCUSSION: During entry preparations, all redundant set general purpose computers reported a one-time input/output error (word-gap time out) against MDM FF4. This was coincident with MEC power on and a not unexpected "MIA Burp" on the FA MDM's. Postflight interrogation of FF4's BITE status register indicated an attempted simultaneous access on both data bus ports. This would invoke internal interlock and cause the MDM to terminate whatever legitimate response was in progress.

Testing in FSL (Flight Software Laboratory) and at the MDM vendor confirmed that the MEC power-on event as seen by the MDM (MIA burp) can trigger MDM address detection logic to look for its address, in this case a 1010 hexidecimal pattern unique to this MDM. This occurrence on the MDM secondary port simultaneous with its legitimate output on the primary port causes the MDM bite bit and a termination of its legitimate output. The output termination is sensed by the GPC's and causes an input/output error for 1 cycle only. The next GPC cycle will be clear of any fault and therefore no impact is evident in the GPC functions. CONCLUSION: Testing in FSL (flight software laboratory) and at the MDM vendor indicates the "MIA Burp" signature on FA4 bus could confuse the MDM to the extent that it would "see" a legitimate access attempt. In response, it then terminates an ongoing response on the FF4 bus thereby causing a GPC input/output error. CORRECTIVE_ACTION: None. One time input/output errors are not detrimental to overall performance. The ground would see the indicated input/output error but the crew would not.

EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-38 | MPS |
| | **GMT:** | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Electrical Leaks in Main Propulsion System Engine 3 LOX prevalve Remote Power Controller C (ORB)

**Summary:** DISCUSSION: While on-orbit, a LOX prevalve measurement (PCA-MPS 3 LOX prevalve close RPC C) came on, and remained on, indicating either a failed on or leaking RPC. This RPC provides power thru a series driver to a solenoid operated valve in the He system which pneumatically closes the MPS #3 prevalve.

Initial postflight testing could not duplicate the problem. However, after about 1 week of power-on testing, the measurement came on again. Testing verified that the valve was in the open position and that the remote power controller (RPC) had not failed on. The RPC was leaking (shorting) internally, causing the failed-on indication. Internal leaks of the RPC's have been experieced on Orbiter 102 because of the sensitivity of the Mark I transistors to humidity. A shimmed mounting technique that will retain RPC hermeticity and M Mark II transistors that have a thick dielectric layer over the collector base junction will be used on Orbiter 099 and subsequent and on all replacement units for OV-102. Should this leaking RPC go to a failed on condition the series driver prevents the LOX prevalve from closing. If the series driver also fails on the pre valve is prevented from closing during engine main stage by the pneumatic pressure applied with the same type control system on the LOX prevalve open side. Therefore, adequate redundancy exists even if the leaky RPC degrades further. CONCLUSION: The RPC is electrically leaking but not enough to supply power to close the solenoid. CORRECTIVE_ACTION: If the RPC goes to a continuous "on" state it will be retested after STS-4 to verify that it has not degraded further to a "failed on" condition. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 12 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-38A | MPS |
| | **GMT:** | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Electrical leaks in main propulsion system engine 3 LOX prevalve remote controller C. (ORB)

**Summary:** DISCUSSION: While on-orbit, a LOX prevalve measurement (PCA-MPS 3 LOX prevalve close RPC C) came on, and remained on, indicating either a failed on or leaking RPC. This RPC provides power thru a series driver to a solenoid operated valve in the He system which pneumatically closes the MPS #3 prevalve.

Initial postflight testing could not duplicate the problem. However, after about 1 week of power-on testing, the measurement came on again. Testing verified that the valve was in the open position and that the remote power controller (RPC) had not failed on. The RPC was leaking (shorting) internally, causing the failed-on indication. Internal leaks of the RPC's have been experieced on Orbiter 102 because of the sensitivity of the Mark I transistors to humidity. A shimmed mounting technique that will retain RPC hermeticity and M Mark II transistors that have a thick dielectric layer over the collector base junction will be used on Orbiter 099 and subsequent and on all replacement units for OV-102. Should this leaking RPC go to a failed on condition the series driver prevents the LOX prevalve from closing. If the series driver also fails on the pre valve is prevented from closing during engine main stage by the pneumatic pressure applied with the same type control system on the LOX prevalve open side. Therefore, adequate redundancy exists even if the leaky RPC degrades further. The RPC continued to leak on STS-4. A retest after STS-4 verified that the RPC leak had not degraded to a "failed on" condition. CONCLUSION: The RPC is electrically leaking but not enough to supply power to close the solenoid. CORRECTIVE_ACTION: The RPC will either be replaced after STS-5 or be retested to verify that it has not degraded further to a "failed on" condition. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 13 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-38B | MPS |
| | **GMT:** | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Electrical leaks in main propulsion system engine 3 LOX prevalve remote power controller C. (ORB)

**Summary:** DISCUSSION: While on-orbit during STS-3, a LOX prevalve measurement (PCA-MPS 3 LOX prevalve close RPC C) came on, and remained on, indicating either a failed on or leaking RPC. This RPC provides power thru a series driver to a solenoid operated valve in the He system which pneumatically closes the MPS #3 prevalve.

Initial postflight testing could not duplicate the problem. However, after about 1 week of power-on testing, the measurement came on again. Testing verified that the valve was in the open position and that the remote power controller (RPC) had not failed on. The RPC was leaking (shorting) internally, causing the failed-on indication. Internal leaks of the RPC's have been experieced on Orbiter 102 because of the sensitivity of the Mark I transistors to humidity. A shimmed mounting technique that will retain RPC hermeticity and M Mark II transistors that have a thick dielectric layer over the collector base junction will be used on Orbiter 099 and subsequent and on all replacement units for OV-102. Should this leaking RPC go to a failed on condition the series driver prevents the LOX prevalve from closing. If the series driver also fails on the pre valve is prevented from closing during engine main stage by the pneumatic pressure applied with the same type control system on the LOX prevalve open side. Therefore, adequate redundancy exists even if the leaky RPC degrades further. The RPC continued to leak on STS-4 and STS-5. A retest after STS-5 will verify that the RPC lack has not degraded to a "failed on" condition. CONCLUSION: The RPC is electrically leaking but not enough to supply power to close the solenoid. All RPCS on OV-099 are of the new design and no failures of this type have been experienced with those RPC's. CORRECTIVE_ACTION: The RPC will be retested after subsequent flights to verify that it has not degraded further to a "failed on" condition. The RPC will be replaced if Aft Power ControlAssembly 6 is removed for other reasons or if it degrades to a "failed on" condition.    EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| **Tracking No** | **Time** | **Classification** | **Documentation** | | **Subsystem** |
|---|---|---|---|---|---|
| MER - 0 | **MET:** Postlanding | Problem | **FIAR** | **IFA** STS-3-V-39 | MPS |
| | **GMT:** Postlanding | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** High MPS helium usage during entry. (ORB)

**Summary:** DISCUSSION: The post landing LOX side MPS purge ended in 1 hour rather than the predicted 5 hours. The flow rates were high and the MPS 3 inlet pressure matched the LOX manifold pressure during manifold repressurization although it should have been much less. A similar flow rate to that observed during the post-landing purge was seen during a prelaunch external tank blowdown test. The high prelaunch flow rate was stopped by closing valves upstream of the POGO recirculation check valves.

Troubleshooting isolated the probelm to the MPS 3 POGO recirculation check valve. X-ray confirmed the valve had an open flapper. The valve was removed and found to have a broken spring. The spring had been installed backwards causing the spring to fail due to adverse spring loading. A similar failure on STS-4 would result in high He usage during entry or the possibility of undesirable oxygen leakage with one engine shut down during ascent. CONCLUSION: The MPS 3 POGO recirculation check valve was failed for the entire flight due to a broken internal spring. Adverse spring loading due to improper installation caused the spring to fail. CORRECTIVE_ACTION: The failed check valve has been replaced and leak checked for STS-4. Valve springs in spare units have been inspected to verify proper spring installation. Inspection procedures now require definite verification of proper spring installation during assembly.    EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| **Tracking No** | **Time** | **Classification** | **Documentation** | | **Subsystem** |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-40 | C&T |
| | **GMT:** | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** The crew observed the "NO VIDEO" light on the VTR at various times within the mission. (ORB)

**Summary:** DISCUSSION: The illumination of the "NO VIDEO" light is intended to indicate the absence of video at the VTR (Video Tape Recorder). However, the crew played back several tapes which were recorded when the "NO VIDEO" was on and verified good recordings. Post-mission tests have determined that a potentiometer within th video level detection circuitry was not properly adjusted.

The setup procedures specify a fully clockwise setting of the video level potentiometer. It was set fully counterclockwise on this VTR, apparently a technician error during initial setup. CONCLUSION: The problem was caused by an improperly adjusted potentiometer in the video level detection circuitry. CORRECTIVE_ACTION: The VTR video level potentiometer has been readjusted for STS-4. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** Postlanding | Problem | **FIAR** | **IFA** STS-3-V-41 | GN&C |
| | **GMT:** Postlanding | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Evaluation of high winds aloft on "wave-off" day and landing with a high touchdown velocity, a lateral offset error, and a pitchup during derotation. (ORB)

**Summary:** DISCUSSION: Winds aloft: Although the "wave-off" on the seventh day was based on excessive surface winds, the winds aloft were also excessive. It was doubtful that the planned approach geometry with the extreme winds above 25,000 feet would have provided a manageable energy situation. Simulations have been conducted to evaluate procedures and system capability for accommodating various extreme wind conditions. The result is a set of placards that relate the wind magnitude and direction to the direction of the heading alignment turn. This will insure that the resulting trajectory is within the vehicle energy management capability.

Touchdown velocity: The velocity at touchdown was about 225 knots estimated air speed rather then the desired 195 knots. At crew takeover from autoland, the airspeed was 6 knots greater than nominal. Simulations indicate that autoland would have flown the vehicle to touchdown at 201 knots. The planned late takeover from autoland did not provide sufficient time for the pilot to feel the vehicle response. Attempts to make some minor trajectory adjustments resulted in a touchdown sooner than intended at a higher than planned airspeed. Future flight procedures will plan the takeover prior to preflare or let the autoland go to touchdown. Offset error: The landing offset, some 28 feet to the right of the runway centerline, was a known problem with the MSBLS antenna system and is acceptable for lakebed landings. A hardware modification to the ground antennas will be made prior to STS-5 to eliminate the offset. Derotation pitchup: This problem was aggravated by the high landing velocity. The derotation after main gear touchdown was allowed to start at too high an airspeed and required the pilot to try to stop it at too low a pitch angle. The rapidly changing elevator trim requirements made it difficult to avoid over-controlling in this situation. The way to avoid it is to concentrate immediately after touchdown on keeping the nose up until the vehicle slows to 180 knots. Flight procedures will be more explicit for STS-4 and the SMS simulation of this situation is being improved to provide better crew training. CONCLUSION: The actual "wave-off" was based on excessive surface winds, but a "wave-off" due to excessive winds aloft was also required. The planned late takeover from autoland did not allow the pilot time to get the feel of the vehicle, resulting in a premature touchdown at high speed. The landing offset was a known problem with the MSBLS antenna system and is acceptable for lakebed landings. The pitchup during derotation resulted from starting the pitchover above 180 knots where over-controlling is difficult to avoid once the nose drops below about 3 degrees. CORRECTIVE_ACTION: The new wind placards will be adopted for STS-4 and subsequent flights. On future missions, manual takeover from autoland will not be planned between start of preflare and touchdown. MSBLS antennas are being modified prior to STS-5 to eliminate the lateral offset error. Procedures will be more explicit, the SMS updated, and more specific crew training provided in the derotation maneuver, especially for high-speed landings. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-42 | CREW |
| | **GMT:** 081:16:00 | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Early Shutdown of Debris Camera (ORB)

**Summary:** DISCUSSION: The debris camera shutdown approximately 1.5 seconds after SRB ignition. The camera controller electronics were designed to remove battery power from the camera after approximately 3.5 minutes. Postflight tests of system elements identified a properly operating camera, adequate remaining battery capacity, and a "timed out" condition of the controller. The 10 seconds of exposed film contained satisfactory imagery with no indication of a camera problem.

Vibration testing was performed. During the first test the camera stopped, and the power connector to the camera was found demated. A second vibration test was successfully performed without identifying any cause for the early shutdown. The connector involved was a Deutsch DM 9702-195 push/pull type of the same generic family used on Apollo utility outlets. Further bench testing of the system identified the condition of camera operation for a time period of approximately 10 seconds, even with a timed out controller. A charge counting device (E-cell) in the controller acts as a cap acitive element under timed out (i.e., discaharged) conditions, and stores enough energy for a short period of camera operation. Also, tests showed that the controller would time out if the system were switched on with or without the connector mated to the camera. An additional time out (discharge) mode was identified as a possibility when using a VOM for circuit/battery condition checks. No single cause of early shutdown was identified. No report was made by the flight crew or destow personnel of connector demate. CONCLUSION: The camera operate time correlates with a timed out controller. The controller may have been timed out by either circuit testing of controller/battery condition during flight system integration on system "turn on" with electrical connector demated before or after installation, or electrical connector demate during launch phase. No other possible causes for a timed out controller conditions were identified. CORRECTIVE_ACTION: The controller electronics have been removed and operation shall be via crew-actuated hard-wired toggle switch for "on" and "off". The electrical connector interface to the camera will be taped securely to preclude a possible disconnection for any reason. EFFECTS_ON_SUBSEQUENT_MISSIONS: Requires crew participation for camera turn off.

| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** Postlanding | Problem | **FIAR** | **IFA** STS-3-V-43 | MECH |
| | **GMT:** Postlanding | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Cracked Rotor on Right Hand Outboard Brake (ORB)

**Summary:** DISCUSSION: One of the orbiter's 16 brake rotors had a 3/8-inch crack at one of the drive notches on its periphery. The small crack was on the outmost rotor of the right hand outboard (RHOB) brake. The RHIB and LHIB brakes also had galling and bending on some rotor drive lugs. The outboard rotors on all brakes had scraped their inside diameters on the torque tube. One stator on the LHIB brake was scraped by the wheel.

Postflight evaluation at the vendor has determined that the damage was probably caused by excessive axle, wheel and brake deflections resulting from high loads during landing and roll out. Most of the damaged rotors can be reused. Some may need minor refurbishment or the direction of rotation can be reversed by exchanging sides. This reversal would apply the loads to the unused rotor drive lug surfaces. The STS-3 brake damage is not a safety of flight issue but the galling and scraping would substantially reduce brake life increasing refurbishment and turn around costs. CONCLUSION: High loads during landing and roll out probably resulted in excessive axle, wheel and brake deflections causing the damage to the brake rotors. This is not a crew safety problem but it is a brake life, cost and turn around issue. CORRECTIVE_ACTION: Four new brake assemblies were installed for STS-4 and full design capability exists. Moderate braking not to exceed 8 to 10 fps? is planned for STS-4. Proposed redesign include adding C-5A type caps to the rotor drive lugs, stiffening the axle,and adding a foot support between the axle and torque tube. EFFECTS_ON_SUBSEQUENT_MISSIONS: Similar brake damage may occur on STS-4. All brake rotors will be inspected for evidence of galling, bending or scraping after STS-4.

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 14 | **MET:** Postlanding | Problem | **FIAR** | **IFA** STS-3-V-43A | MECH |
| | **GMT:** Postlanding | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Cracked rotor on right hand outboard brake. (ORB)

**Summary:** DISCUSSION: One of the orbiter's 16 brake rotors had a 3/8-inch crack at one of the drive notches on its periphery. The small crack was on the outmost rotor of the right hand outboard (RHOB) brake. The RHIB and LHIB brakes also had galling and bending on some rotor drive lugs. The outboard rotors on all brakes had scraped their inside diameters on the torque tube. One stator on the LHIB brake was scraped by the wheel.

Postflight evaluation at the vendor has determined that the damage was probably caused by excessive axle, wheel and brake deflections resulting from high loads during landing and roll out. Most of the damaged rotors can be reused. Some may need minor refurbishment or the direction of rotation can be reversed by exchanging sides. This reversal would apply the loads to the unused rotor drive lug surfaces. The STS-3 brake damage is not a safety of flight issue but the galling and scraping would substantially reduce brake life increasing refurbishment and turn around costs. Moderate braking nor ro exceed 10 ft/sec2 was planned for STS-4. Actual braking averaged about 7.5 ft/sec2. There were no cracks at the rotor drive notches and no rotor drive lugs were bent on STS-4. However, there was a small amount of chafing on the contact

face of some notches. CONCLUSION: High loads during landing and roll out probably resulted in excessive axle, wheel and brake deflections causing the damage to the brake rotors. This is not a crew safety problem but it is a brake life, cost and turn around issue. CORRECTIVE_ACTION: Four new brake assemblies were installed for STS-4 and full design capability existed. Proposed redesigns include adding C-5A type caps to the rotor drive lugs, stiffening the axle,and adding a foot support or saddle between the axle and torque tube. EFFECTS_ON_SUBSEQUENT_MISSIONS: Similar brake damage may occur on STS-5. All brake rotors will be inspected for evidence of galling, bending or scraping after STS-5.

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-44 | Water and Waste |
| | **GMT:** | | **SPR** | **UA** | Management System |
| | | | **IPR** | **PR** | **Manager:** |
| | | | | | **Engineer:** |

**Title:** Water in Airlock Drag in Duct. (ORB)

**Summary:** DISCUSSION: The STS-3 crew observed water collection/around the outside of the airlock flex duct where the flex section enters the fairing on the airlock. Later in the mission the crew disconnected the duct and found water collecting inside the duct.

Post flight inspection of the cabin heat exchanger face showed chipped hydrophilic coating. The coating also failed the H2O droplet test. However neither of these irregularities would cause the inflight problem based on vendor certification testing. The air flow measurement with each seperator running indicated 13-14 lb/hr discharge air flow as compared to the specified value of 37 to 39 lb/hr minimum. With the separator disconnected from the heat exchanger slurper section the separator air flow increased to 68 lb/hr. Fiber optics inspection of the slurper interior and separator inlet check valves indicated no abnormalities. The slurper was subjected to reverse GN2 pressurization of >= 4 psig. A small amount of dust was observed to be blown free from the heat exchanger outlet face. Retest with the fan separator attached to the heat exchange slurper resulted in discharge air flow of 51.3 to 51.8 lb/hr. CONCLUSION: The problem was caused by clogging of the slurper portion of the heat exchanger assembly. Should the clogging recur on STS-4, the air-cooled electronics would not be affected by the water in the cooling ducts. Contingency water removal equipment is onboard. CORRECTIVE_ACTION: The slurper obstruction has been removed with the GN2 purge. Analysis of the material blown from the slurper is in progress at the vendor. Cleanup and maintenance procedures for the slurper/heat exchanger are being developed. EFFECTS_ON_SUBSEQUENT_MISSIONS: Periodic cleaning of the hydrophilic coating and heat exchanger slurper will be required during turnaround.

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 15 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-44A | Water and Waste |
| | **GMT:** | | **SPR** | **UA** | Management System |

| | | | | |
|---|---|---|---|---|
| | | | **IPR** | **PR** | **Manager:** |
| | | | | | **Engineer:** |

**Title:** Water in airlock drag-in duct. (ORB)

**Summary:** DISCUSSION: The STS-3 crew odserved water collection around the outside of the sirlock flex duct where the flex section enters the fairing on the airlock. Later in the mission the crew disconnected the duct and found water collecting inside the duct. Postflight testing revealed that the slurper portion of the hear exchanger assembly was clogged. A GN2 purge removed the slurper obstruction.

Two inflight inspections of the heat exchanger outlet air duct were performed during STS-4 by the crew to check for evidence of water carryover from the cabin heat exchanger. The crew reported that the duct was dry during both inspections and did not find any evidence of water carryover from the cabin heat exchanger. In addition, no water was noticed around the outside of the airlock flex duct as had occured on STS-3. The seperator discharge airflow test was repeated at KSC subsequent to STS-4. Test results indicated no degradation or clogging of the slurper section of the cabin heat exchanger as was evidenced during post STS-3 testing. CONCLUSIONS: The water separator/cabin heat exchanger combination performed satisfactorily on STS-4. The airflow test performed at KSC subsequent to STS-4 indicated that the condensate collection system is ready to support the STS-5 mission. CORRECTIVE ACTION: The airflow test, visual inspection, reverse flow GN2 purge and an analysis of any contamination will be repeated after STS-5. Periodic cleaning of the hydrophilic coating and heat exchanger slurper may be required during turn around. EFFECT ON SUBSEQUENT MISSIONS: none

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| Tracking No | Time | Classification | Documentation | | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | **MET:** | Problem | **FIAR** | **IFA** STS-3-V-45 | CREW |
| | **GMT:** | | **SPR** | **UA** | **Manager:** |
| | | | **IPR** | **PR** | |
| | | | | | **Engineer:** |

**Title:** Crew compartment end-of-film lights inoperative on several magazines. (ORB)

**Summary:** DISCUSSION: The STS-3 crew reported that the end-of-film lights on several film magazines did not function. Post-flight checks of the cameras and film magazines show no hardware problems exist. The new interior film flown for the first time on STS-3 had to be respooled from large rolls of film by hand, making rolls of consistent diameter almost impossible to achieve. Since the end-of-film light switch is actuated by an arm riding on the take-up roll in the magazine, a small diameter film roll may not actuate the switch. Adjustment of the actuation point of the switch will correct this situation.

CONCLUSION: The end of film light not operating is most probably caused by a small diameter roll of film not actuating the end-of-film switch. CORRECTIVE_ACTION: The end-of-film switch has been adjusted to actuate with a smaller diameter film roll. EFFECTS_ON_SUBSEQUENT_MISSIONS: None

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| Tracking No | Time | Classification | | Documentation | Subsystem |
|---|---|---|---|---|---|
| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-46 | TPS |
| | GMT: | | SPR | UA | Manager: |
| | | | IPR | PR | |
| | | | | | Engineer: |

**Title:** Broken tabs on vertical tail graphite seals. (ORB)

**Summary:** DISCUSSION: A 1/4-inch cube of graphite was found in the Orbiter main engine 1 expansion chamber and was identified as a part of the vertical tail graphite seal.

This thermal conical seal consists of graphite rubbing seal blocks which press against the conical panels on the vertical tail. These blocks are contained within Inconel channels and are spring loaded against the Inconel panels. The seal blocks overlap and have tabs which interlock to provide redundancy in their support. Ten (10) tabs were broken of a total of approximately 150 seal blocks. Five were broken on each of the upper and lower panels, (6 on the lefthand side and 4 on the right-hand side). The vertical stabilizer test article (VSA-16) was inspected and no broken tab were found. It has been subjected to the 100-mission vibro/accoustic tests. Tab breakage could have occurred during installation or during the flight. The broken tabs do not affect the retention of the seal blocks within the Inconel channels. A missing tab will result in a minor flow path not affecting the primary sealing surfaces. Any resulting increased heating would be localized and analysis shows it to be well below the thermal limits of the seal materials. CONCLUSION: The cause of the broken tabs is unknown; however, the seal is fully effective with broken tabs. CORRECTIVE_ACTION: None. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

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| Tracking No | Time | Classification | | Documentation | Subsystem |
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| MER - 0 | MET: | Problem | FIAR | IFA STS-3-V-47 | Water and Waste |
| | GMT: | | SPR | UA | Management System |
| | | | IPR | PR | Manager: |
| | | | | | Engineer: |

**Title:** Urine leak between the urine cup and filter. (ORB)

**Summary:** DISCUSSION: The STS-3 crew reported that urine would build-up outside the urinal at the cup and filter interface after the spare filter was installed. A dimensional check of the flight urine cup and filter determined that the gasket on the spare filter was too thin. The spare gasket had been shaved during a fit check to allow mating into the locked position because the material was not soft enough to compensate for the dimensional tolerances of the cup and filter.  Fit checks postflight found some flight units could not be locked into place because the gaskets were too thick and stiff.

CONCLUSION: The urinal filter gasket was too thin and stiff to compensate for the mating dimensional tolerances and ensure a seal between the urine cup and the filter.
CORRECTIVE_ACTION: A new softer and thicker material shall be used in the urinal filter gaskets to seal the interface between all urinal cups and filters, but still allow the units to be easily locked together.  The urine quick disconnect adapter gasket will be changed to the same material.  The new gaskets have been installed for STS-4.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None