	Presenter:
	Organization/Date: Orbiter/03-26-02

BACKUP INFORMATION

	Presenter:
	Organization/Date: Orbiter/03-26-02

PREVIOUS FLIGHT ANOMALIES BACKUP

	Presenter:
	Organization/Date: Orbiter/03-26-02

STS-109
IN-FLIGHT ANOMALIES

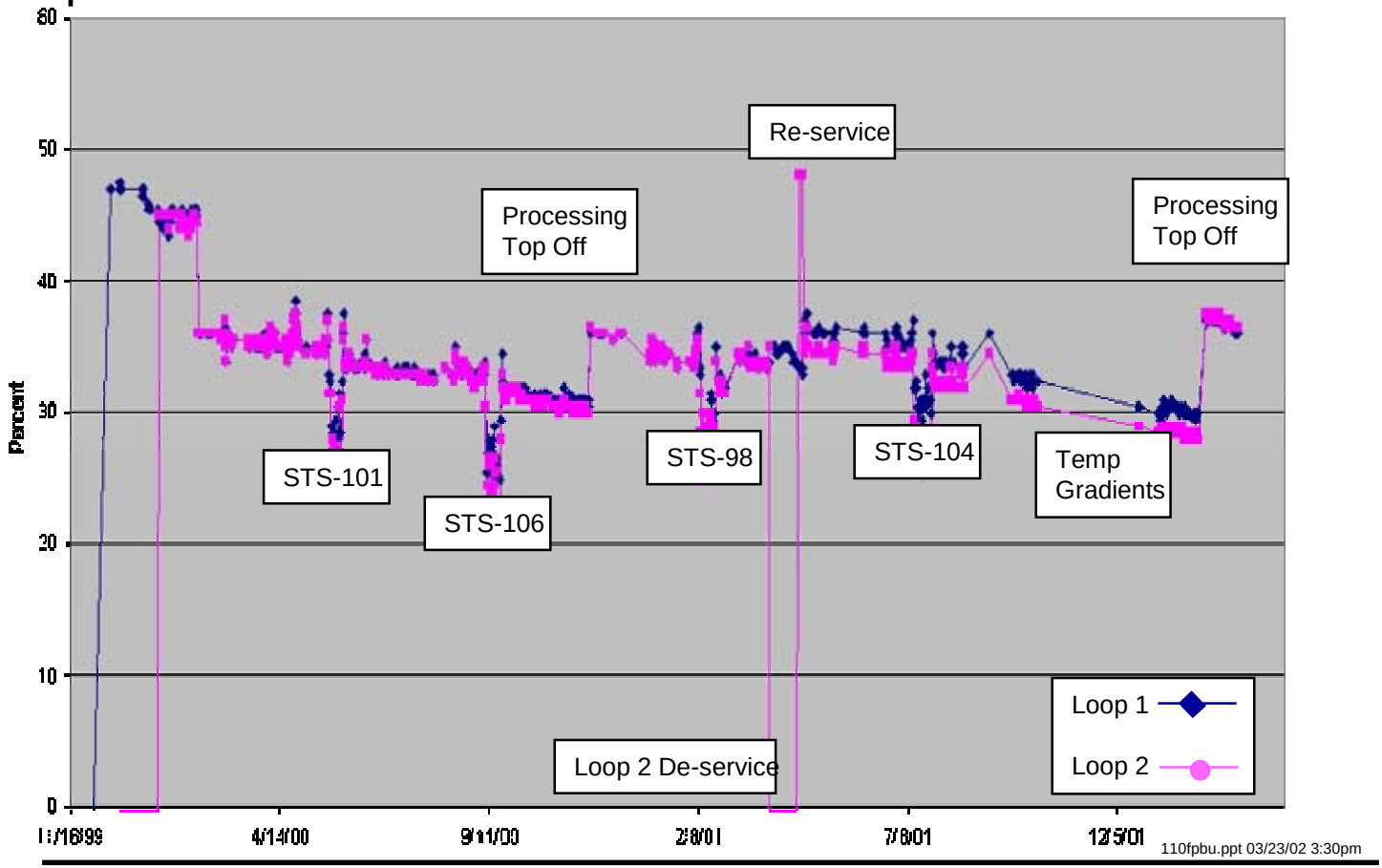
STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:
Ken Duong

Organization/Date:
Orbiter/03-26-02

Actions Taken: (cont)

No leakage observed on OV-104s FCL accumulator quantities



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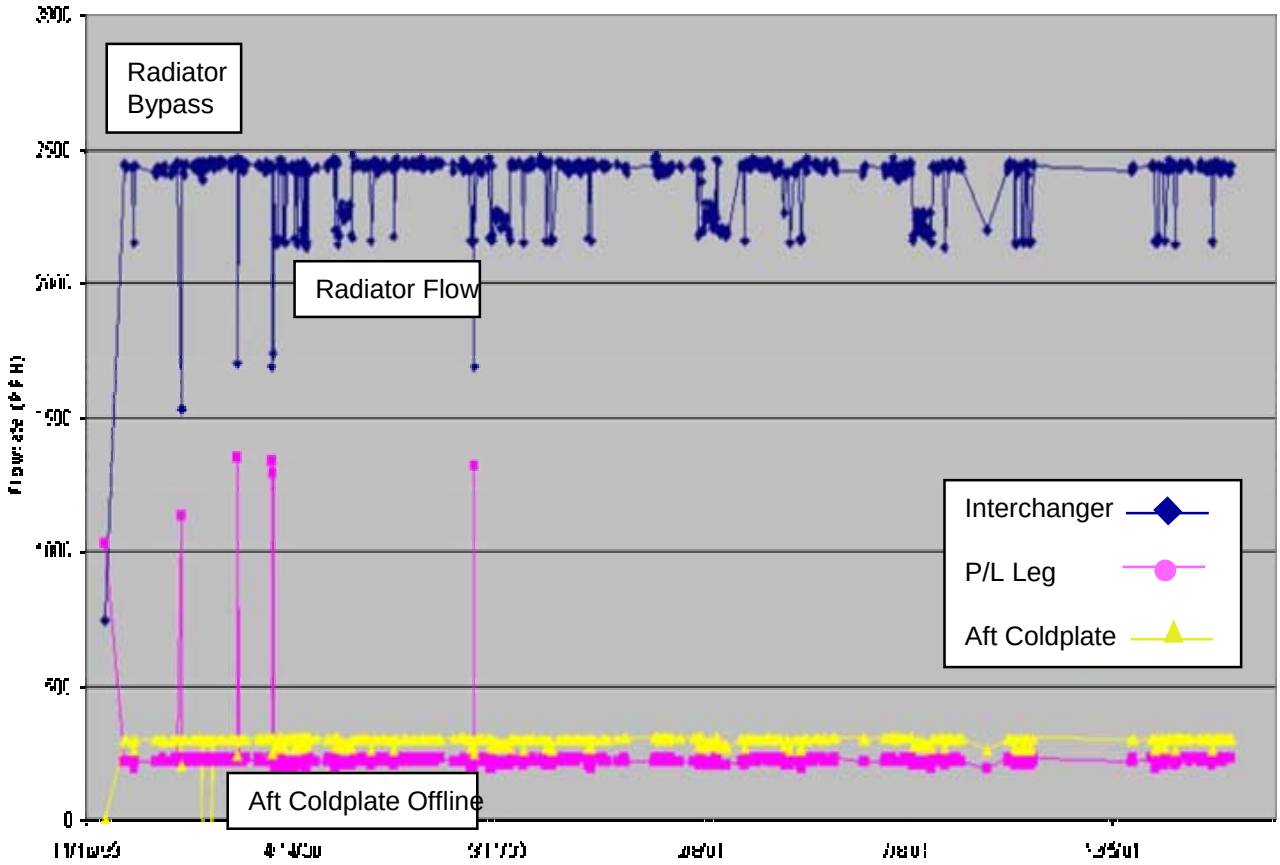
STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:
Ken Duong
Organization/Date:
Orbiter/03-26-02

Actions Taken: (cont)

Freon Coolant Loop 1 flow rates showed no degradation



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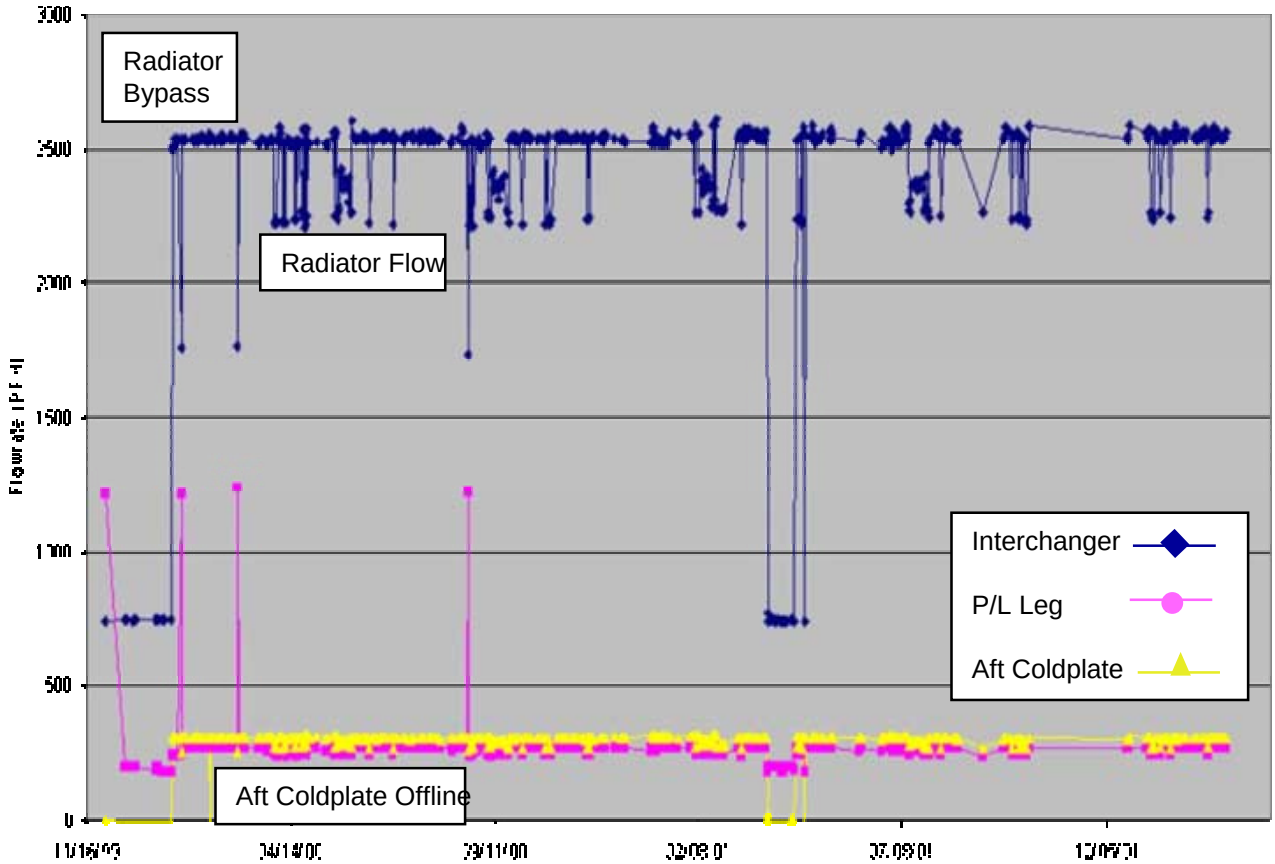
STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:
Ken Duong

Organization/Date:
Orbiter/03-26-02

Actions Taken: (cont)

Freon Coolant Loop 2 flow rates showed no degradation



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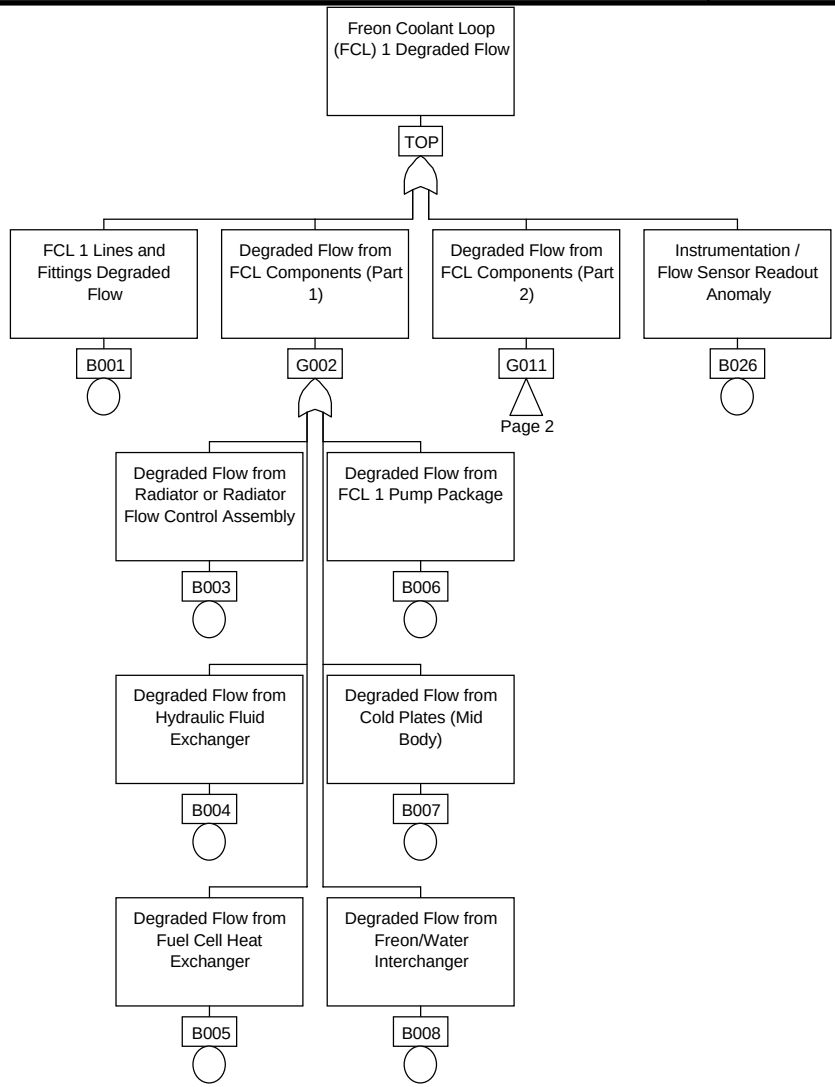
STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:

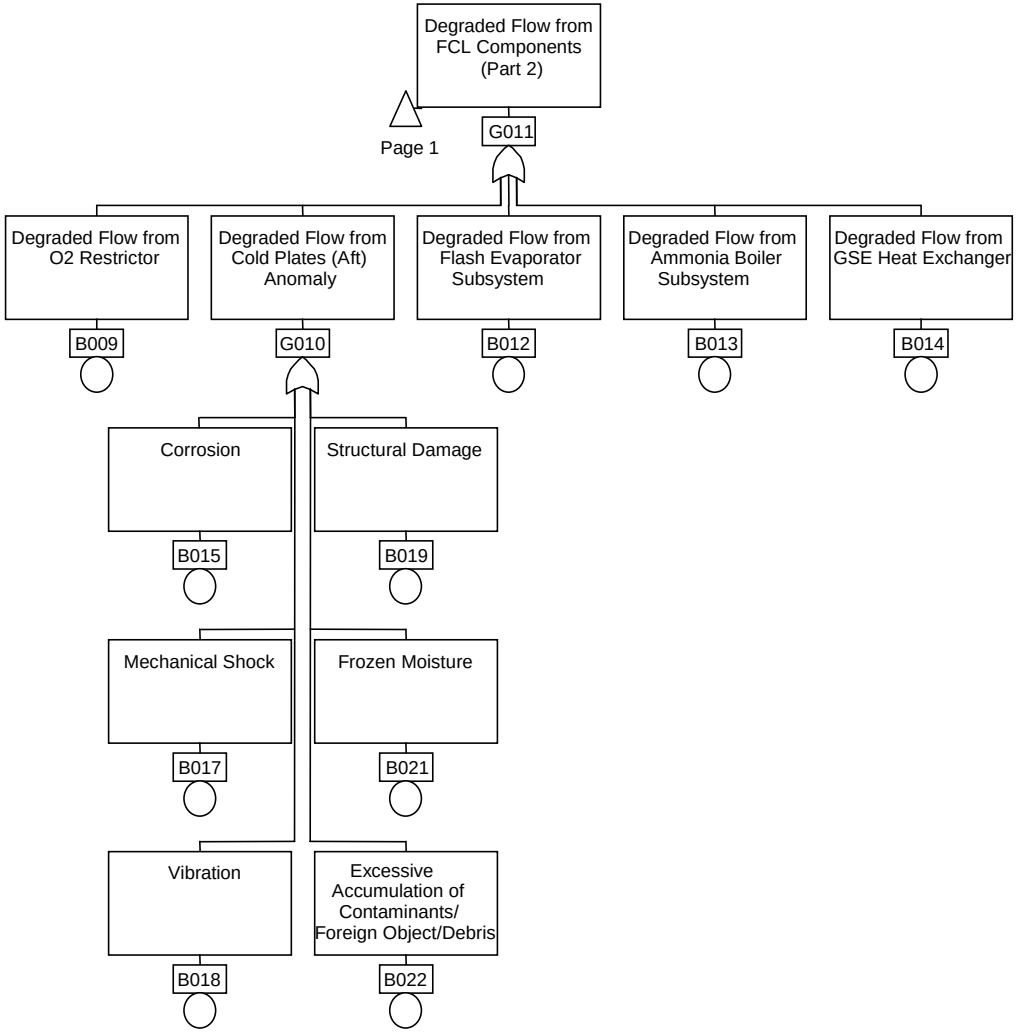
Organization/Date:
Orbiter/03-26-02



STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:

Organization/Date:
Orbiter/03-26-02



STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:

Organization/Date: Orbiter/03-26-02

	Description	Resolved (Y/P/N)	Comments/Closeout Rationale
B001	FCL 1 Lines and Fittings Degraded Flow	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B003	Degraded Flow from Radiator or Radiator Flow Control Assembly	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B004	Degraded Flow from Hydraulic Fluid Exchanger	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B005	Degraded Flow from Fuel Cell Heat Exchanger	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B006	Degraded Flow from FCL 1 Pump Package	Y	Total Flow Is Unchanged, Pump Performance Is Unchanged & Normal
B007	Degraded Flow from Cold Plates (Mid Body)	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B008	Degraded Flow from Freon / Water Interchanger	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg

STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:

Organization/Date: Orbiter/03-26-02

	Description	Resolved (Y/P/N)	Comments/Closeout Rationale
B009	Degraded Flow from O2 Restrictor	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B012	Degraded Flow from Flash Evaporator Subsystem	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B013	Degraded Flow from Ammonia Boiler Subsystem	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B014	Degraded Flow from GSE Heat Exchanger	Y	Doesn't Match Symptoms, Reduced Flow Is In Wrong Leg
B015	Corrosion	P	Possible Source Of Contamination
B017	Mechanical Shock	Y	No Shock At Time Of Failure
B018	Vibration	Y	Vibration Damage Would Have Cause Leakage, May Be Contributor To Contamination

STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:

Organization/Date: Orbiter/03-26-02

	Description	Resolved (Y/P/N)	Comments/Closeout Rationale
B019	Structural Damage	Y	No Moving Parts In The Area, At Time Of Failure, To Cause Structural Damage
B020	Freon Pump Assembly Internal Leakage	Y	Total Freon Flow Did Not Degrade, Pump Performance Is Normal
B021	Frozen Moisture	Y	Aft Coldplate Loop Temp > 33 Degree F, Freezing Not Possible
B022	Excessive Accumulation of Contaminants/Foreign Object/Debris	N	Most Probable Cause Of Failure
B023	Pinched Line	P	No Moving Part In Area To Pinch A Line, At Time Of Failure
B024	Internal Leakage between Loops	Y	Pressure Differential Between Loops Shown No Inter Loop Leakage
B025	Failure of Radiator Flow Control Valve and Bypass Valve	Y	Would Affect Radiator Flow Rate Not Aft Coldplate Leg

STS-109-V-01: FREON COOLANT LOOP 1 DEGRADED AFT COLD PLATE FLOW

Presenter:

Organization/Date:
Orbiter/03-26-02

	Description	Resolved (Y/P/N)	Comments/Closeout Rationale
B027	Piece Part Failure	P	Piece Parts In The Area Would Not Reduce Flow Rate Except As A Source Of Debris (No Valves Or Moving Parts In This Leg)
B028	Freon Pump Assembly Internal Leakage	Y	Temperature In Area Were Stable To <10 Degree. No Extreme Temperatures Or Rapid Temp Changes
B026	Instrumentation / Flow Sensor Readout Anomaly	Y	Flow In Other Legs Increased When This Leg Was Restricted Showing Failure Is A Restricted Flow In The Aft Coldplate Leg.

STS-109-V-04: TRANSLATION HAND CONTROL ANOMALY

Presenter:

Organization/Date:
Orbiter/03-26-02

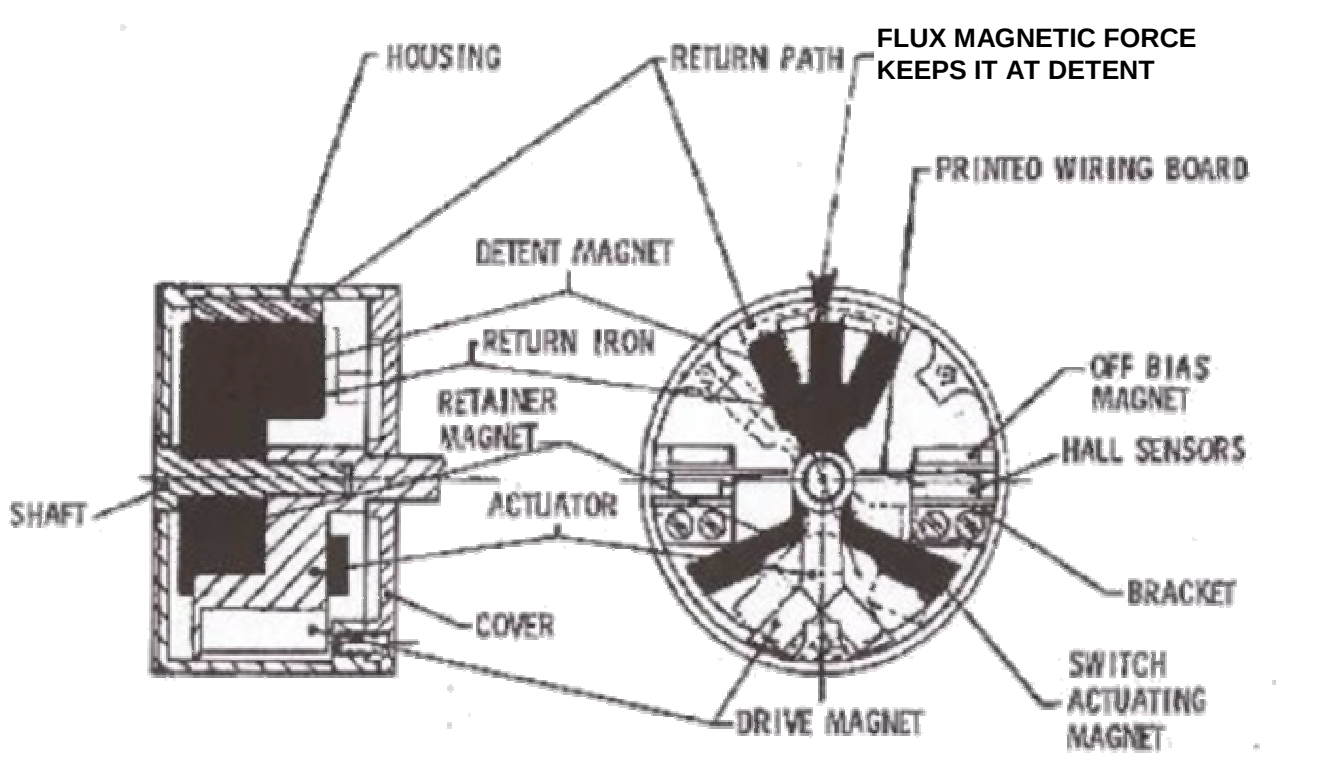
HALL EFFECT DEVICE OPERATION

- Visualize a conductor with current flowing through it (a rectangular box shape similar to a shoe box works best for illustration)
- Apply a magnetic field perpendicular to the current flow
- A small voltage will be detectable perpendicular to both the direction of the current flow and the magnetic field - this voltage is the “Hall Effect”
- In a practical Hall element, the voltage produced will be on the order of tens of micro-volts
  - This small voltage necessitates that an integrated Hall device includes a preamp to raise the voltage to a usable level
  - The integrated device may also include a voltage regulator and other signal inverting or conditioning circuit components

STS-109-V-04: TRANSLATION HAND CONTROL ANOMALY

Presenter:

Organization/Date:
Orbiter/03-26-02



	Presenter:
	Organization/Date: Orbiter/03-26-02

STS-104
IN-FLIGHT ANOMALIES

STS-104-V-01: FORWARD BULKHEAD FLOODLIGHT RETURN LINE LOW TEMPERATURE

Presenter:

Organization/Date:
Orbiter/03-26-02

Observation:

- Flood light coldplate water coolant loop 1 temperature dropped to 36°F during STS-104 at MET 1:17 hr

Issue:

- The water line temperature needs to be maintained above 32°F to prevent line freezing

Discussion:

- Line temperature sensor installed at last OMM at coldplate outlet line at coldest temperature location
- During STS-104, temperature dropped to 36°F at MET 1:17

Actions Taken:

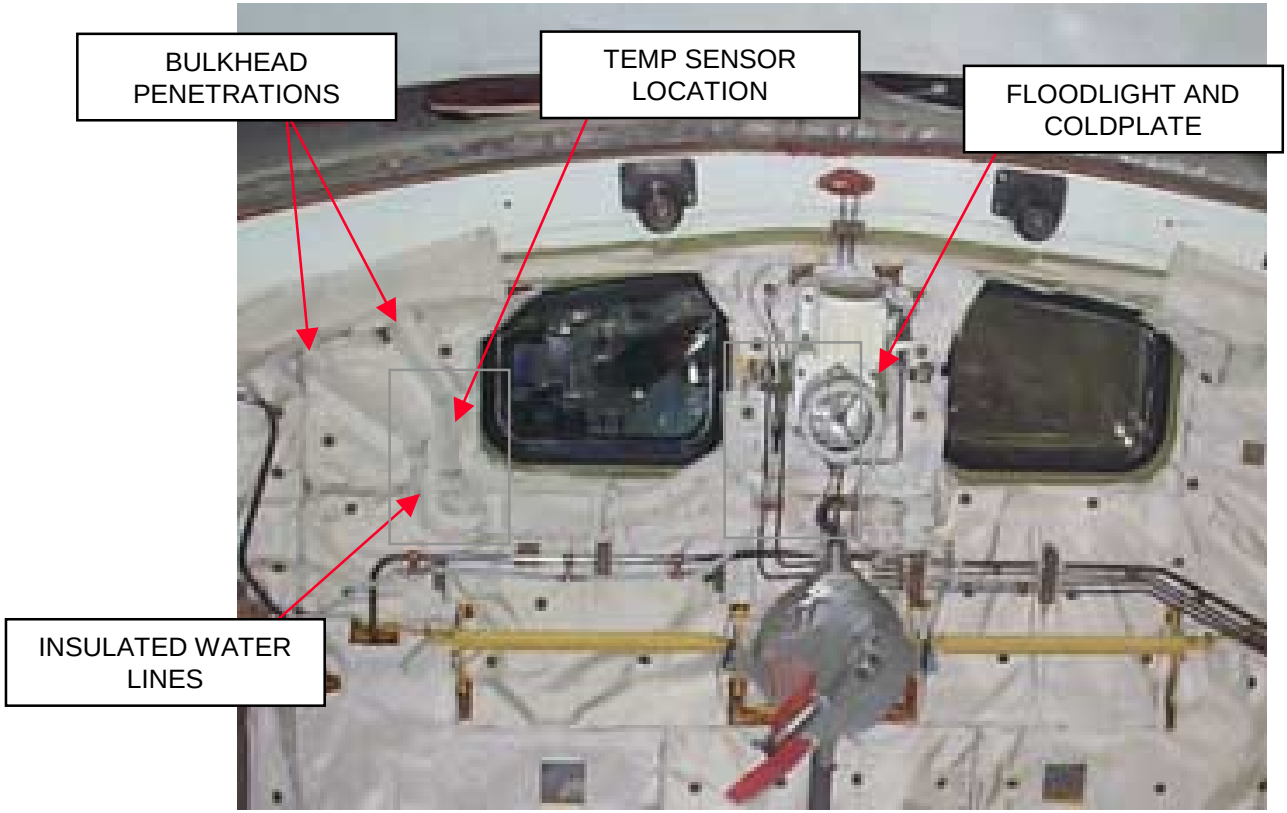
- Review of three previous OV-104 flights (all since last OMM) revealed temperature drop as low as 31°F
  - STS-104 temperature signature closely followed orbital cycling, indicating most likely cause was a problem with the line insulation

STS-104-V-01: FORWARD BULKHEAD FLOODLIGHT RETURN LINE LOW TEMPERATURE

Presenter:

Organization/Date:
Orbiter/03-26-02

FORWARD BULKHEAD FLOODLIGHT, COLDPLATE AND WATER LINES



STS-104-V-01: FORWARD BULKHEAD FLOODLIGHT RETURN LINE LOW TEMPERATURE

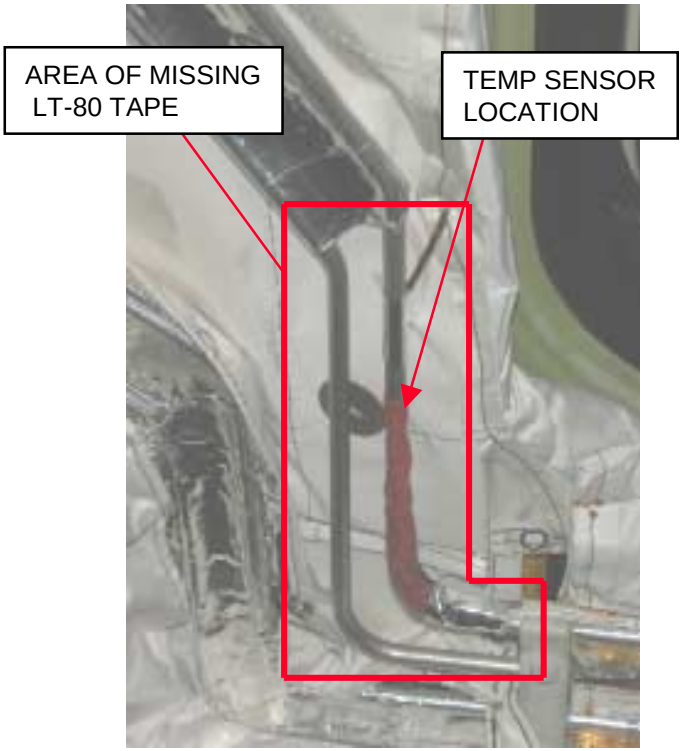
Presenter:

Organization/Date:
Orbiter/03-26-02

Actions Taken: (cont)

- Post flight inspection found improper thermal tape at area of temp sensor – subsequently corrected

POST-FLIGHT INSPECTION



CORRECTED CONFIGURATION
(TAKEN BEFORE ALL MLI BLANKETS REINSTALLED)

STS-104-V-01: FORWARD BULKHEAD FLOODLIGHT RETURN LINE LOW TEMPERATURE

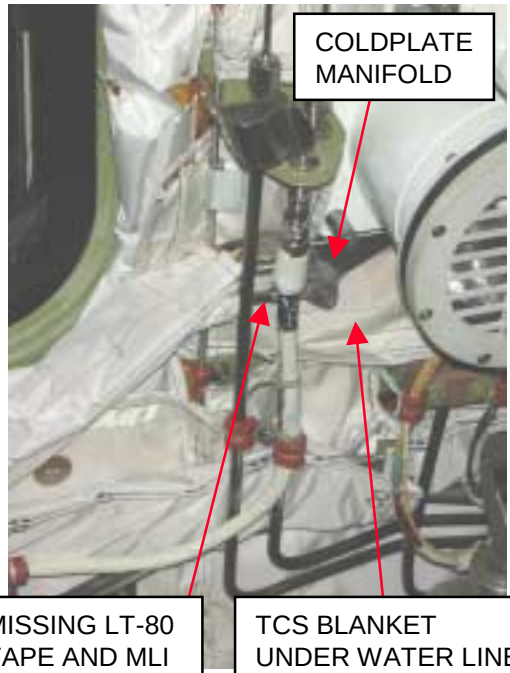
Presenter:

Organization/Date: Orbiter/03-26-02

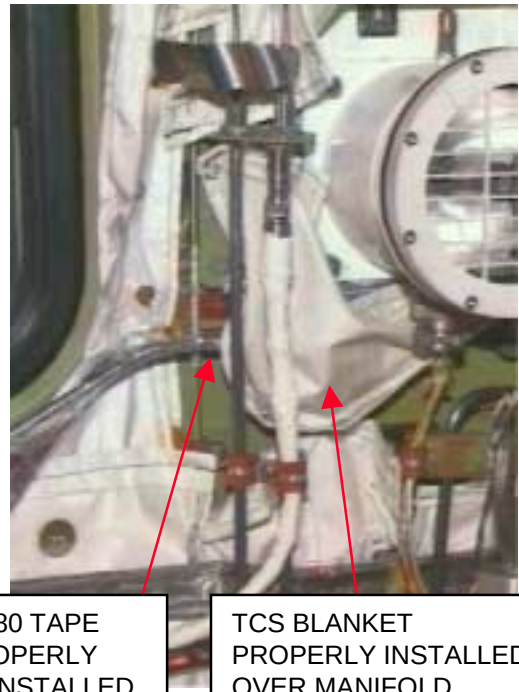
Actions Taken: (cont)

- Post flight inspection found improper tape and insulation at area of cold plate – subsequently corrected

POST-FLIGHT INSPECTION



CORRECTED CONFIGURATION
(TAKEN BEFORE ALL MLI BLANKETS REINSTALLED)



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STS-104-V-01: FORWARD BULKHEAD FLOODLIGHT RETURN LINE LOW TEMPERATURE	Presenter:
	Organization/Date: Orbiter/03-26-02

Actions Taken: (cont)

- OV-104 bulkhead water line insulation was returned to print

Action Planned:

- Modification to remove bulkhead floodlight/coldplate and water lines planned for STS-114 flow

Acceptable For STS-110 Flight:

- Insulation was returned to print
- Proper insulation combined with automatic cycling of WCL1 ensures water lines will not freeze

STS-104-V-02: FES H_2O FEED LINE A HEATER STRING 1 FAILED

Presenter:

Organization/Date:
Orbiter/03-26-02

Observation:

- FES hi-load and accumulator H_2O feed line A, heater 1 failed off

Discussion:

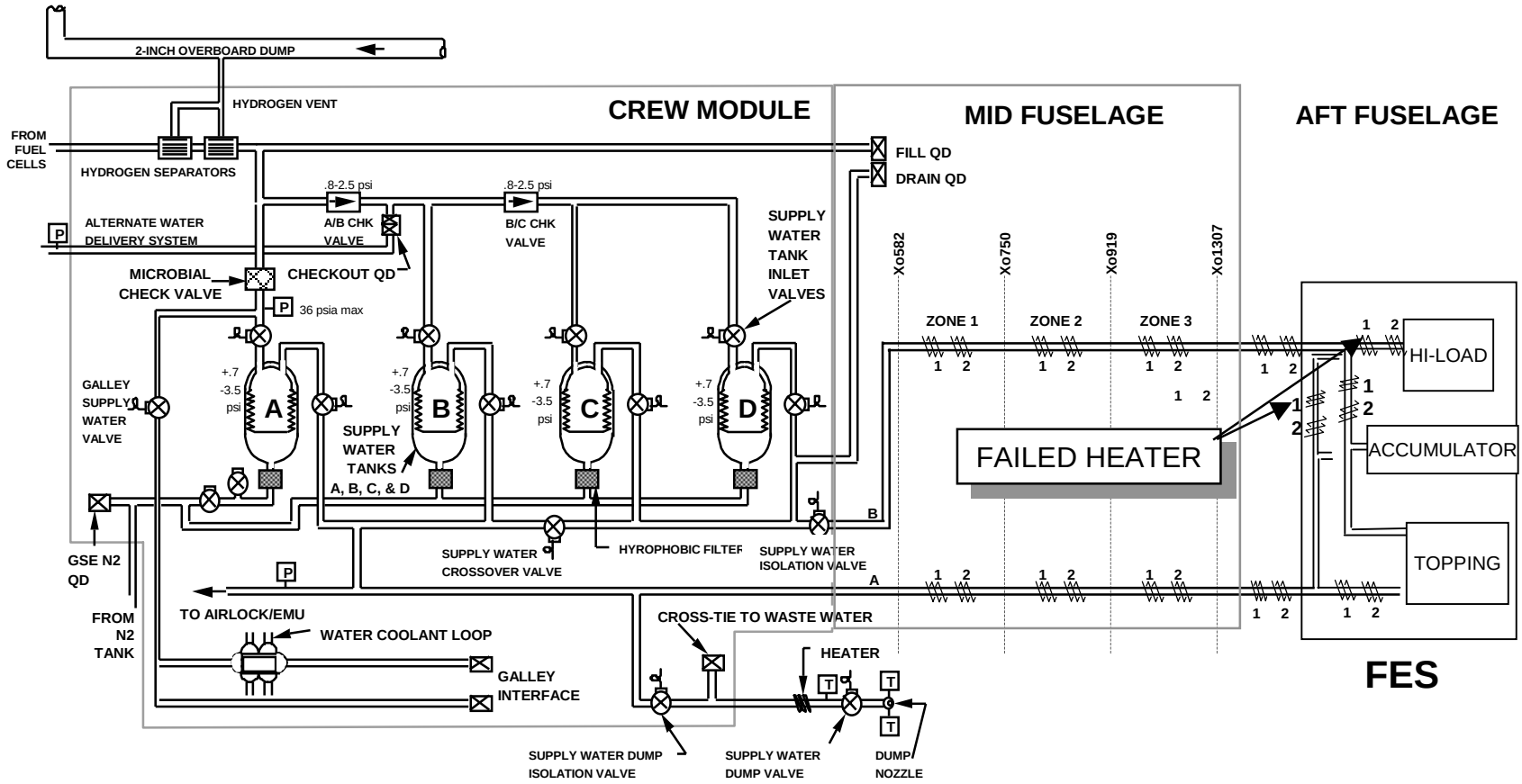
- Two redundant heater strings provide water line temperature control to prevent freezing
  - Hi-load line temperatures cycle between 150°F and 180°F
  - Accumulator line temperatures typically cycle between 75°F and 95°F
- The heater performed nominally until approximately MET 003:13:00
  - Line temperatures dropped to 90°F and 53°F respectively
  - Data showed heater cycling before failing indicating possible thermostat failure
- Crew switched to redundant heater string which performed nominally for the rest of the mission

STS-104-V-02: FES H_2O FEED LINE A HEATER STRING 1 FAILED

Presenter:

Organization/Date:
Orbiter/03-26-02

SUPPLY WATER SYSTEM



STS-104-V-02: FES H_2O FEED LINE A HEATER STRING 1 FAILED	Presenter:
	Organization/Date: Orbiter/03-26-02

Actions Taken:

- Post-flight troubleshooting did not duplicate the anomaly
- Most probable cause is a sticky thermostat
- The thermostat was removed and replaced
- The system was successfully retested

Risk Assessment:

- With the loss of both heater strings, a contingency procedure to purge the affected line is available to prevent freezing and allow recovery of the system for entry

Acceptable For STS-110 Flight:

- In the event of a heater failure, the redundant heater string may be used
- Procedures to prevent freezing and recover the line for entry are available if both heaters fail
- FES heater string operation was verified as part of ground checkout

STS-104-V-03: KU-BAND FAILURE TO ACQUIRE FORWARD LINK COMMUNICATION

Presenter:

Organization/Date:
Orbiter/03-26-02

Observation:

- During STS-104 mission, Ku-Band failed to acquire forward link communication

Concern:

- Inability to acquire Ku-Band forward link will result in loss of voice and command

Discussion:

- Anomaly occurred on eight separate occasions

ORBIT	Start time GMT	End time GMT	Cumulative dropout time	Comment
127	**201:10:39**	**201:11:17**	**38 min**	**Power recycled, TDRS west**
148	**202:18:01**	**202:18:30**	**29 min**	**TDRS west**
153	**203:02:51**	**203:03:18**	**27 min**	**TDRS east**
154	**203:04:20**	**203:04:26**	**6 min**	**TDRS east**
163	**203:17:02**	**203:18:39**	**1 hour, 37 min**	**TDRS west**
165	**203:20:57**	**203:22:26**	**1 hour, 29 min**	**TDRS east**
168	**204:01:49**	**204:02:47**	**58 min**	**Power recycled, TDRS east**
170	**204:05:12**	**204:06:11**	**59 min**	**TDRS east**

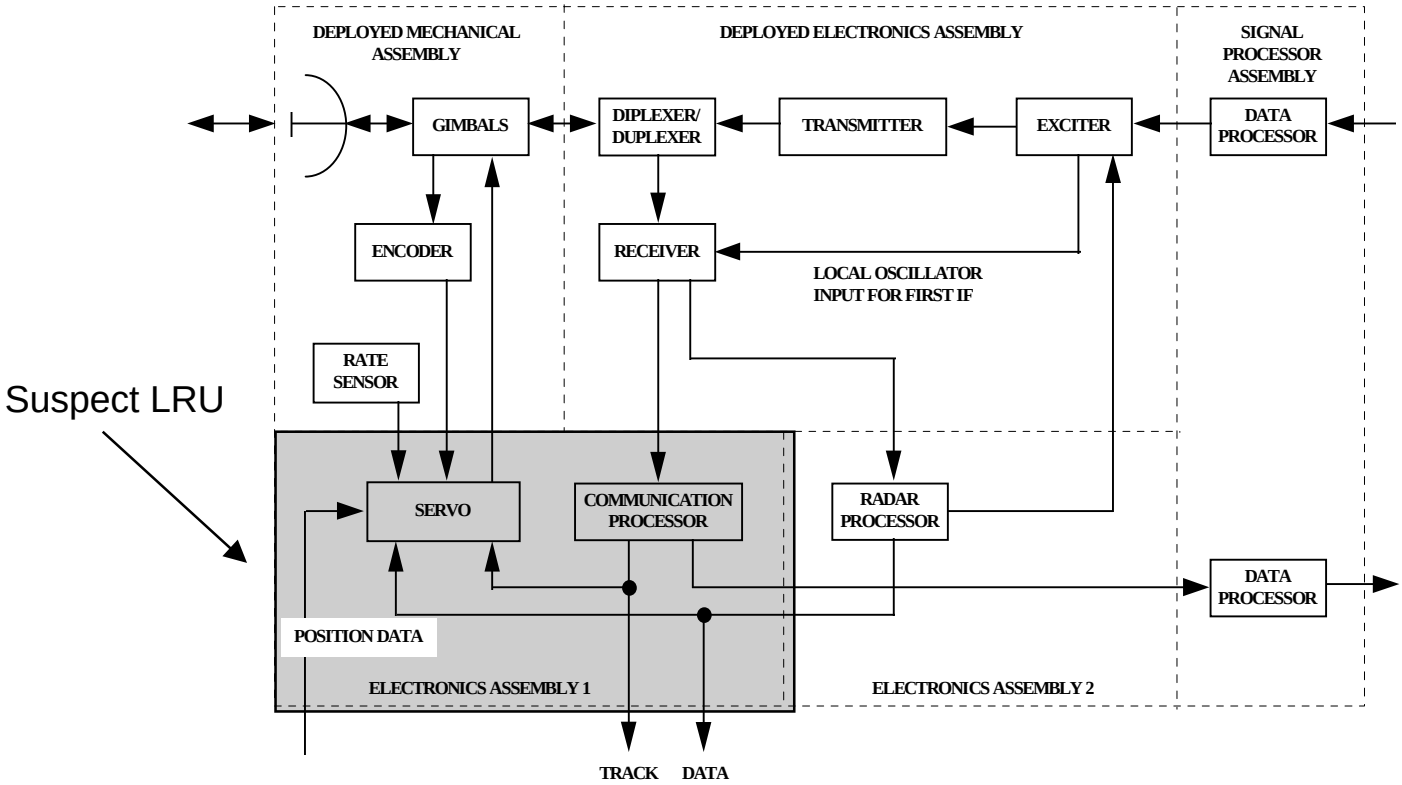
STS-104-V-03: KU-BAND FAILURE TO ACQUIRE FORWARD LINK COMMUNICATION	Presenter:
	Organization/Date: Orbiter/03-26-02

Discussion: (cont)

- Review of flight data suggested problem most likely associated with the Electronic Assembly-1 (EA-1) LRU located in avionics bay 3A
  - EA-1 is responsible for processing the forward link communication signal
  - Communication AGC and detect & track flags are generated within the EA-1
    - Detect & track flags were absent during the dropout period
- Comparison of this failure signature to Ku-Band failure history does not show any evidence of a trend or generic problem
  - One previous IFA related to loss of forward link during handover from TDRS West to TDRS East during STS-69
  - Anomaly isolated to failed component on PN/PSK card set

STS-104-V-03: KU-BAND FAILURE TO ACQUIRE FORWARD LINK COMMUNICATION	Presenter:
	Organization/Date: Orbiter/03-26-02

Ku-Band Functional Diagram



STS-104-V-03: KU-BAND FAILURE TO ACQUIRE FORWARD LINK COMMUNICATION

Presenter:

Organization/Date:
Orbiter/03-26-02

Actions Taken:

- Post-Flight vehicle troubleshooting could not duplicate the anomaly
- EA-1 was removed and replaced, the system was successfully retested
- EA-1 was sent to NSLD where the anomaly was duplicated during incoming functional test
- Subsequent troubleshooting indicated the anomaly was within the PN/PSK card set
  - The PN/PSK card set was removed and replaced
  - EA-1 has passed functional testing
  - LRU ATP is ongoing
  - The PN/PSK card set will be analyzed to determine failure cause

STS-104-V-03: KU-BAND FAILURE TO ACQUIRE FORWARD LINK COMMUNICATION	Presenter:
	Organization/Date: Orbiter/03-26-02

Risk Assessment:

- Inability to acquire Ku-Band forward link results in loss of voice and command
- Ku-Band system is criticality 1R3 for the observed failure (loss of state vector updates)
- S-Band system provides backup capability
  - No coverage when S-Band antennas are pointing towards Orbiter nose/tail

Acceptable for STS-110 Flight:

- Based upon the observed failure signature, there is no evidence to suggest a generic problem associated with the EA-1 hardware
- New EA-1 has been installed and all Ku-Band OMRSD testing completed

STS-104-V-04: LEFT HAND VENT DOORS 8 & 9 LIMIT SWITCH ANOMALY

Presenter:

Organization/Date:
Orbiter/03-26-02

Observation:

- Left hand vent doors 8 & 9 OPEN limit switch #2 temporarily failed off during entry

Concern:

- Potential launch delay if both switches fail
  - LCC requires one of two OPEN indications prior to launch

Discussion:

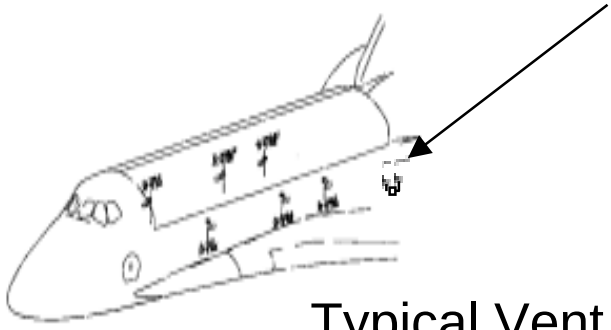
- After entry interface the vent doors are commanded open
- Left hand vent door 8 & 9 CLOSED indication went off and the motor 1 OPEN went on as expected
- Motor 2 OPEN indication failed off and motor 2 continued to run
  - After driving for 10 seconds (single-motor run time), motor 2 was shut down normally by software
  - Approximately 1 minute and 45 seconds later the motor 2 OPEN indication came on
- RH Vent doors 8 & 9 operated normally

STS-104-V-04 LEFT HAND VENT DOORS 8 & 9 LIMIT SWITCH ANOMALY

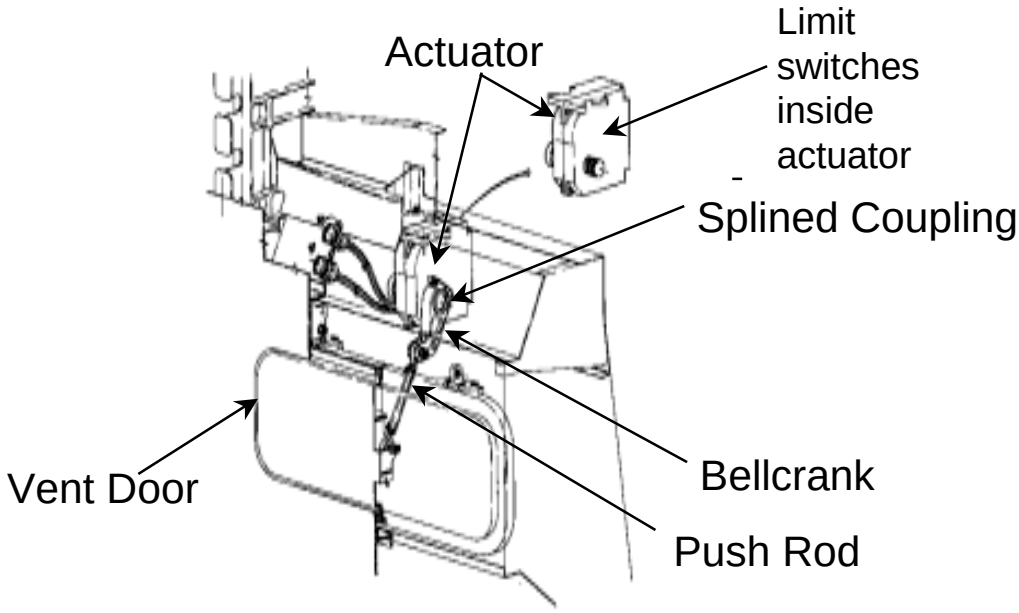
Presenter:

Organization/Date:
Orbiter/03-26-02

Location of Vent Door # 8 & 9 - AFT Fuselage



Typical Vent Door Actuator



STS-104-V-04: LEFT HAND VENT DOORS 8 & 9 LIMIT SWITCH ANOMALY

Presenter:

Organization/Date:
Orbiter/03-26-02

Actions Taken:

- Actuator was removed and replaced
- Newly installed actuator was successfully retested
- Removed actuator was sent to NSLD for TT&E
  - Most probable cause is a degraded limit switch

STS-104-V-04: LEFT HAND VENT DOORS 8 & 9 LIMIT SWITCH ANOMALY

Presenter:

Organization/Date:
Orbiter/03-26-02

Risk Assessment:

- Purpose of OPEN limit switch is to turn off motor when door is opened
- Without OPEN indication, actuator continues to run and stalls against mechanical hard stops until terminated by software
  - Actuator certified for prolonged stall operation
  - Loss of OPEN indication for this condition does not inhibit motor operation
- Worst case anomaly could cause launch delay due to LCC requirements if both switches fail
  - One of two switch indications required prior to launch
- This failure mode is criticality 3/3
  - No impact during a mission

Acceptable for STS-110 Flight:

- OV-104 has successfully completed all vent door OMRSD testing

	Presenter:
	Organization/Date: Orbiter/03-26-02

CONFIGURATION CHANGES AND CERTIFICATION STATUS

BACKUP

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:
John Ito
Organization/Date:
Orbiter/03-26-02

- There are three unresolved anomalies which have been reviewed and do not affect OV-104 LRUs

Anomaly	Operational Impact	Acceptability
SBC Reset anomaly S/N 104	Affects SSR function only Criticality 3/3 Temporary interruption of data recording or playback	Workaround exists to reduce data loss Recovery is automatic but SSR must be re-commanded if operation interrupted Both recorders will be operated simultaneously during mission
SSR Reset anomaly S/N 104	Affects SSR function only Criticality 3/3 Temporary interruption of data recording or playback	Workaround exists to reduce data loss Recovery is automatic but SSR must be re-commanded if operation interrupted Both recorders will be operated simultaneously during mission
SSMM Ready Discrete Failure S/N 102	Inability to IPL corresponding GPC Criticality 2R3	SSMM discretes verified on OV-104 Redundancy and workaround exists Can IPL from other SSMM

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Current Mission Requirements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19563 SSME Thrust Structure Strain Gauge Instrumentation Mission Kit MVO886A				N/A *	N/A	* Boeing certification is not required. Micro-SGU and Micro TAU instrumentation and installation certified by GFE GCAR.

- Thrust Structure Micro-Strain Gauges Units (SGU):
  - Life analysis of orbiter primary structure to performance enhancement environments showed there are four aft fuselage titanium thrust structure components with life limitations
    - Engine 1, 2 & 3 pitch actuator fittings and the “upper beam”
    - Strut attach lugs on these components are critical
  - Fracture analysis conservatism will be validated using instrumentation flight data
  - Stand-alone Micro-SGU’s were installed at six locations on thrust structure struts which attach to these lugs to collect actual flight strain data to aid in the component life extension
    - The six locations have been instrumented by two strain gauges each with the measurements at each location recorded by a Micro-SGU recording unit (six locations, twelve total strain gauges, six Micro-SGU recording units)

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Future Mission Requirements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 18509 Condensate Separation and Collection		X		01C-23-623200-001C	10/12/00A	• ECLSS system certification
			X	05-35-643051-001D	08/01/01A	• ECLSS airlock mission kit system certification
Mission Kit MVO828A			X	02-22-621-0008-0007F	11/28/01A	• Water separator cert update
			X	04-24-271-0089-1004E	11/16/00A	• Flex hose certification
			X	05-24-271-0089-1004F	7/27/01A	• Flex hose certification update
			X	141-04-390001-001L	7/25/00A	• Structure certification

- Modification to the ECLSS waste management system which will allow condensate effluent to be separated from urine waste water
  - Provides the capability to collect the separated condensate in CWC's at a new, permanent crew interface point
- Mod driven by ISS requirement that Orbiter waste water dumps be inhibited during docked operations to preclude contamination of sensitive station components
  - Collecting condensate in CWC's increases the waste tank ullage available for urine, extending the time required between waste water dumps
- Mod involved laying in a new plumbing run to collect condensate from the humidity separator B test port and route it to a new collection interface QD in an existing middeck floor feedthru plate
  - Allows for easier crew access and setup for condensate separation operations by eliminating the need for the crew to access the ECLSS equipment bay and install and route a temporary DTO hose for condensate collection
- Mod also plumbs the humidity separator outlet line directly to the waste tank, eliminating its cross-tie to the urine waste water line
  - This allows the waste tank to be isolated, using the tank isolation valve, from the condensate line preventing waste urine from being introduced during condensate collection operations
- Middeck waste water subsystem switch panel ML31C was also modified with updated schematic nomenclature to reflect the subsystem modifications

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Future Mission Requirements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19484 Cargo PC Orbiter Scar Wiring				N/A *	N/A	* Previously certified materials and processes.

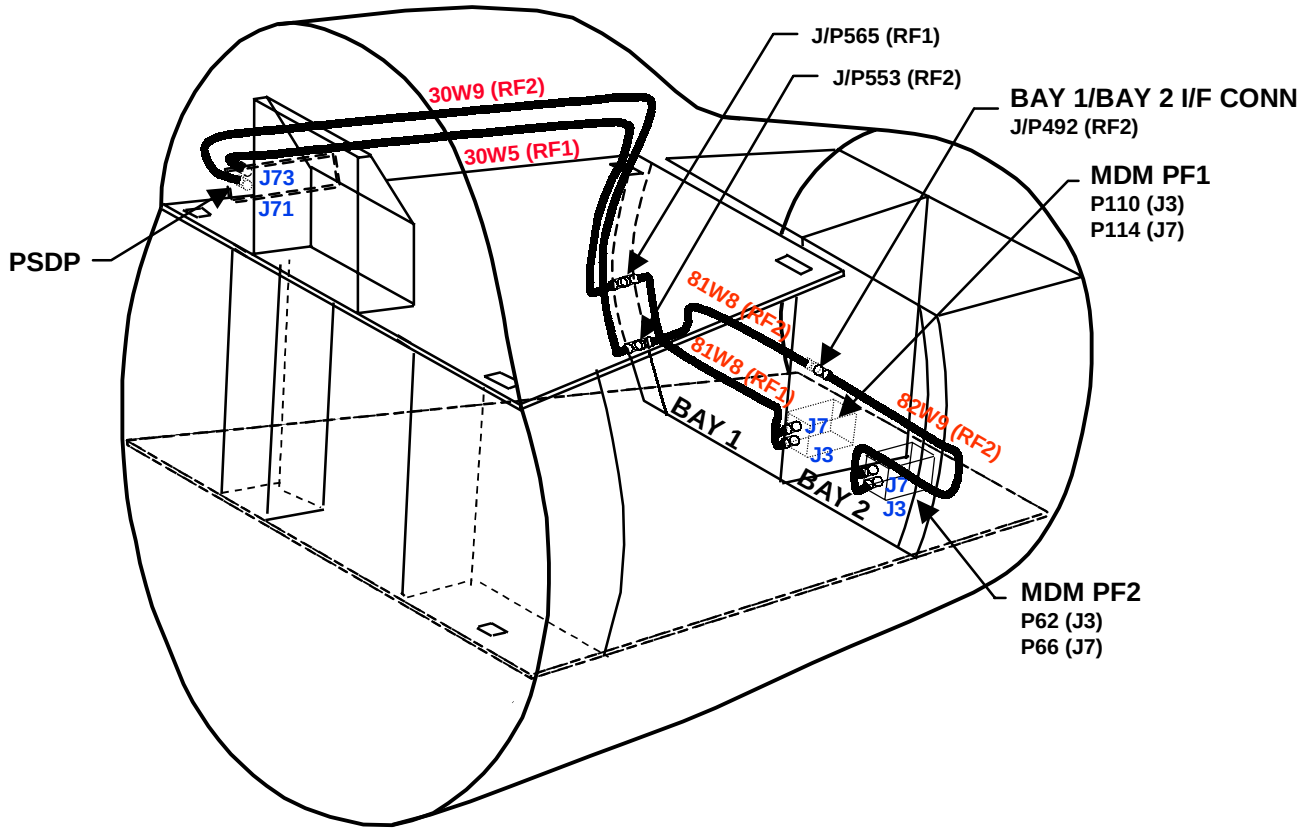
- Cargo PC is a flight reinvention activity, developed to decouple vehicle and cargo flight software reconfiguration
  - Utilizes portable general support computers (PGSCs) to provide software control and monitoring of payloads and payload functions
  - Reduces cargo software mission production template
- The Cargo PC system will interface with the orbiter GPC via payload MDMs PF1 and PF2 spare channels
- Implementation of Cargo PC involves orbiter scar wiring mods and payload integration wiring mission kits
  - Orbiter scar wiring installed this flow in the crew module from payload MDMs PF1 and PF2 in middeck avionics bays 1 and 2 to the payload station distribution panel (PSDP) on the flight deck
  - Payload wiring, to be installed at a later flight, will route from the orbiter interface at the PSDP to a PGSC interface in a flight deck payload interface panel (typical aft flight deck SMCH installation).

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

Cargo PC Wiring Diagram



CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Future Mission Requirements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19029 DDU	X			01-17-464-0154-0001A	10/18/01A	

- New DDU replaces the existing DDU's in conjunction with MEDS
  - Display function removed from existing DDU's with MEDS
  - DDU provides triple redundant power to the orbiter flight controllers
- New DDU improves system safety and provides logistics benefits to the program
  - Solves progressively worsening EEE parts obsolescence problems, high failure rates and high repair turnaround times with old DDU's
- There are three DDU LRU's per Orbiter
  - STS-110 flight configuration - new DDU in CDR, PLT and AFT stations

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Corrective Action Mandatory

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19527 Critical Wire Redundancy Separation				N/A *	N/A	* Previously certified materials and processes.

- In 129 instances across the fleet, redundant wiring for crit 1 functions were routed together in common wire harnesses
  - 107 affected areas on OV-104 (OV-103 & subs) - 22 being unique to OV-102
  - Increased risk of system failure - loss of single wire harness could result in the loss of a critical function
  - Condition previously waived
- As part of the corrective actions from the fleet wiring investigation, it was determined these wires should be separated
  - Primary option was to separate redundant wires into separate existing or new harness runs
  - Secondary option was to separate redundant wires within a bundle using barrier material (i.e. convoluted tubing, teflon or mystic tape
  - Correction was not implemented if the determination was made that there would be significant risk to damaging wiring in the rework area versus benefit of the separation, or if major rework/redesign was required to accomplish(i.e. guillotines & hinged D&C panels)
- During this processing flow, 53 circuits were separated (33 crew module, 12 mid fuselage and 8 aft fuselage circuits)
  - The remaining 49, (48 in the crew module and 1 in the aft fuselage) will addressed at OMM
  - Note - During the OV-105 flight 17 flow implementation for this mod it was determined that 3 of the “in flow” separations (2 in the crew module and 1 in the aft fuselage) would be deferred to be worked with the OMM group due to the intrusive access required. This is effective for all orbiters.

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Corrective Action Mandatory

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19596 Separation of Inverter AC Wiring				N/A *	N/A	* Previously certified materials and processes.

- Redundant AC wire runs from the three crew module inverter distribution and control assemblies (IDCAs) in avionics bays 1, 2 & 3 to their respective circuit breaker panels, ML73C & L4, share common routing in twelve areas
  - Primary and secondary AC power could be lost due to a single event, resulting in loss of critical AC bus circuits
- This concern was readdressed as part of the fleet wiring investigation corrective actions
  - Redundant AC wiring in these twelve areas will be reworked as follows:
    - Rerouted into separate harness bundles and clamps (4 locations)
    - Where rerouting was not possible, separate or protect AC wire runs in the same bundle from each other using convoluted tubing (7 locations) or teflon tape (1 location)
- During this processing flow, nine of the twelve locations were reworked
  - The remaining 3 will be reworked at OMM due to the intrusive nature of access required

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 18872 Panel L4 Circuit Breaker Replacement				N/A *	N/A	* Previously certified materials and processes.

- Capability exists to isolate the radiators from the Orbiter freon loops should a freon leak develop in a radiator panel
  - Hardware mods including radiator panel isolation valves were installed in previous flows
- Documentation and closeout photo review during the OV-104 STS-104 flow revealed that panel L4 circuit breakers 137 and 138, which provide power to the two radiator panel isolation valves, were oversize
  - 5 amp circuit breakers installed, should be 3 amp
- Analysis showed that the maximum current draw allowed by a 5 amp circuit breaker could cause an over-current shut-down of its associated inverter if a short in the circuit were to occur downstream of the circuit breaker
  - "Race" condition would exist between the circuit breaker tripping off and the inverter over-loading
  - Loss of inverter output is classified as a criticality 1R3 condition
    - Associated 3 phase ganged circuit breakers are opened, causing loss of redundancy in multiple payload bay door latch gangs
    - However, IFM allows the shorted bus to be isolated from the 3-phase ganged circuit breakers
- During this flow, the 5 amp circuit breakers in positions 137 and 138 on panel L4 were changed out with the correct size 3 amp circuit breakers

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19652 Tissue Equivalent Proportional Counter (TEPC) Mounting Adapter Plate Mod			X	03-25-661612-001 G	10/26/01A	• TEPC panel certification • Shifts mounting hole pattern on the TEPC mounting adapter panel to eliminate an interference between the window shade assembly and the inboard side of the TEPC. • Interference caused by tolerance accumulation – combination of orbiter mounting hole locations, TEPC mounting adapter panel hole locations, TEPC units and window shade containers.
WSB Coolant Development (PGME)	X	X		16-30-250-0019-0001V	3/25/02S	• Submitted 2/25/02

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			

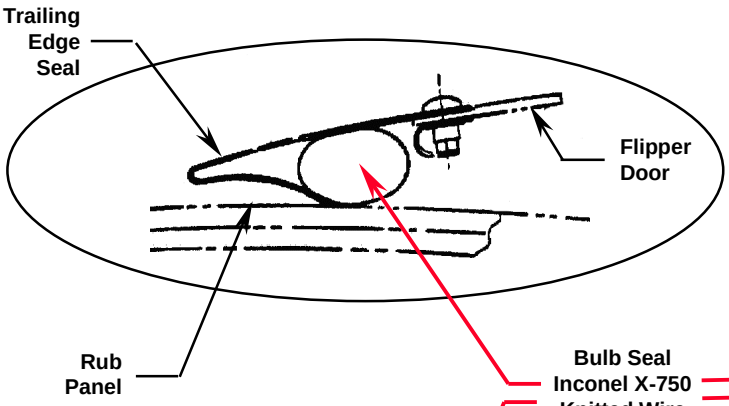
MCR 19554
Elevon Flipper Door Trailing Edge Bulb Seal Mod (Attrition)
				N/A	N/A	• Certification not affected
						• The flipper door inconel wire mesh bulb seals help close out the flipper door to rub panel interface surface
						  • Aids in maintaining the shape and positive contact of the trailing edge seal to the elevon rub panel
						• These seals have a history of occasionally dislodging from their retainers and coming loose in flight
						  • Could become lodged in the wing trailing edge mechanisms
						  • Access and repair or replacement of loose or lost seals is a time consuming ground operations task
						• Modification corrects the condition by adding fasteners to mechanically hold the seal in position

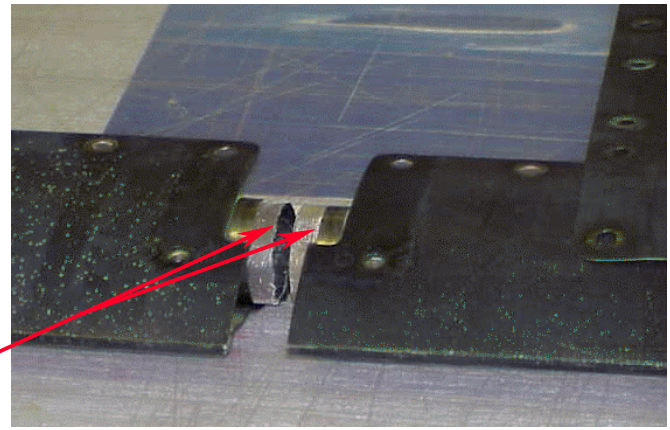
CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

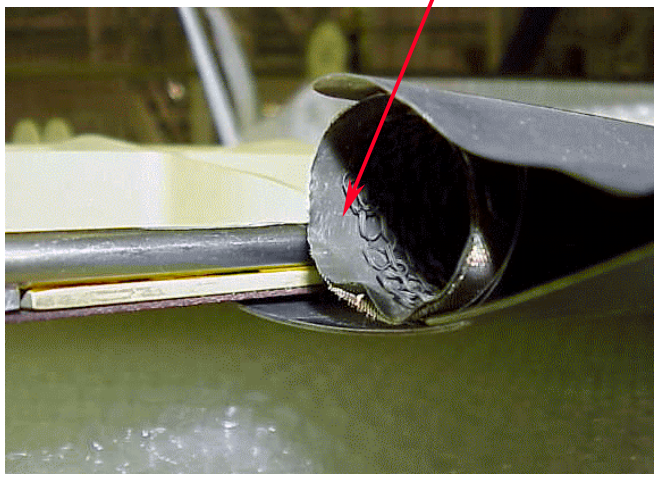
Organization/Date:
Orbiter/03-26-02

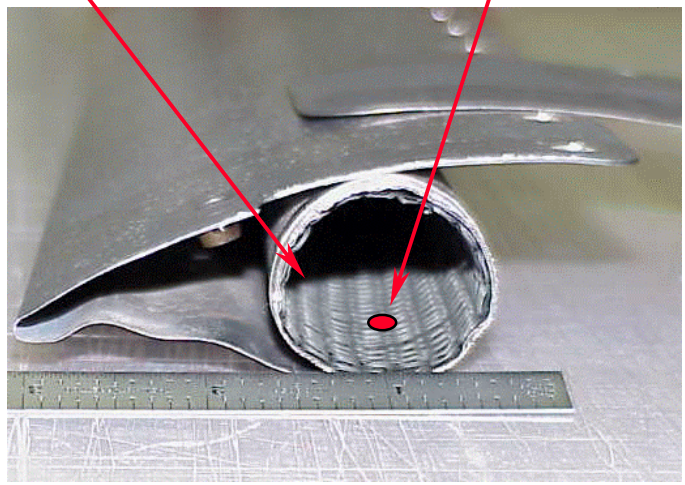
Elevon Flipper Door Trailing Edge Bulb Seal Mod





Fastener added here at both ends of bulb seal





CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

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Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Corrective Action Optional / Process Improvement

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19531 ET Separation Camera Mod		X		163-03-350013-001K	7/5/01A	• Structural interface certification for new GFE cameras
		X		163A-03-350013-001K *(submitted 8-28-01)*	10/19/01A	• Structural interface certification for single 16mm camera configuration

Mission Kit MV0456A						• The 35 mm and 16 mm GFE ET umbilical separation cameras have been redesigned.
						• New cameras are heavier, requiring Orbiter structural interface verification analysis, as well as certification and ICD updates.
						  • STS-110 will only fly the new 35 mm still camera.
						  • The 16 mm cameras for this flight will be the old design
						• Boeing effort also included engineering changes to make the camera installation documentation consistent across the fleet.
						  • Tech orders will be used to install the cameras to allow flexibility in camera manifesting
						  • Vehicle engineering will install the camera all other Orbiter support hardware

CONFIGURATION CHANGES AND CERTIFICATION STATUS

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Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 11620 Wing to Fuselage Bolt Torque Change		X		159-02-340004-002M	8/21/01A	* Structural certification update

- The minimum class 3 torque requirement (1560 in-lbs) on a 9/16" RD111-4009-0936 wing-to-fuselage attach bolt at LH & RH Xo 1191 (1 on RH side, 1 on LH side) is less than the minimum torque required to prevent joint gapping (S/B 1570 in lbs)
  - The requirement is no gapping at limit load
  - There is high bolt positive margin, > 32% based on bolt material, however, bolt positive margin refers to static strength for a one-time load application
  - Bolt fatigue is affected when the applied load exceeds the pre-load, causing joint gapping.
    - The bolt cycles through a bigger stress range (max stress to min stress).
    - There is a compounding feature when the joint gaps, the joint can then "chatter", and this repeated opening and closing can wear on the joint face, accelerating the rate of loss of pre-load.
  - Increasing preload range to non-standard torque increases margin to prevent joint gapping.
- Mod engineering revises the torque range for these bolts from 1560-1680 in-lbs to 1580-1680 in-lbs

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 18755 Forward and Aft Winch Mod			X	09-25-650007-001M	7/5/01A	• Installs modified forward and aft GFE winches which incorporate new 4 ball pip pins and safety wiring
MCR 14696 MPS Check Valves	X	X		02-10-284-0472-0012	12/12/97	• Installs a longer skirt designed CV38 check valve to alleviate wear concerns
MCR 18888 M063P Panel Decal Addition				N/A		• Installs a decal that identifies orbiter DC power bus B as the source for the M063P panel
MCR 17222 TAA Lighting Installation				N/A		• Installs TAA Harness per the Core MECSLSI requirements
MCR 19193 Orbiter Permanent Marking				N/A		• Permanently marks coordinates on the vehicle structure

CONFIGURATION CHANGES AND CERTIFICATION STATUS

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OV-104 STS-110 Modifications and Certification

Process Improvement

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19033 Orbiter Umbilical Plate Gap Delta Pressure Transducers		X	X	01-10-415920-010	7/27/01A	• MPS system certification
		X		03-20-449-0178-0101D	2/26/01A	• Pressure transducer certification
				03-14-271-0100-0001F*	*	* Note: Flex hose design previously certified per this CAR

- Modification installed a primary and redundant pressure transducers to measure purge pressure in the LH2 and LO2 ET/Orbiter disconnect plate gap.
  - Purge protects against hazardous gas ignition and GN2 or air intrusion which could result in icing of the electrical monoball, disconnect mechanisms or pyro bolt canister
- Provides direct and accurate verification of positive plate gap cavity purge during cryo loading
  - Secondary benefits of potentially identifying gross hydrogen or oxygen leakage in the umbilical area and provide correlation of plate gap conditions to aft helium concentration (largest component of aft helium concentration during cryo loading is from plate gap purge)
- Current method of monitoring plate gap purge only provides a gross indication that purge is flowing and is not sensitive to local system leaks which would could have a significant affect on plate gap purge
  - Requires lengthy operations to setup purge at Orbiter/ET mate
  - Drag-on pressure measurement installed at existing provision in electrical monoball
  - Purge is increased until proper plate gap pressure is achieved - this GSE purge pressure is recorded
  - LCC limit is based on a 25% drop in GSE supply pressure
- Modification utilizes an unused LH2 and LO2 umbilical electrical monoball GSE port as a permanent plate gap pressure tap site
  - A new flexhose and hardline ports the cavity pressure from each umbilical plate gap to two redundant pressure transducers mounted on structure just aft of the umbilical area
  - New wiring installed to route pressure transducer signals to the LH and RH T-0 umbilicals and will be picked up by the LPS (ground measurement only).
- The drag on purge set up and its associated LCC will be used with the new instrumentation for 4 flights to collect and evaluate comparative data.
  - Eventually the use of the drag on purge setup will be eliminated and, at that time, a revised LCC associated with the new pressure measurements will be put in place

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Process Improvement

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19533 ET Monoball Production Break		X		N/A * 162-03-350013-001K	N/A 5/25/01A	* Wiring - previously certified materials and processes. • Aft fuselage structure installation

- The harnesses routed to the LH2 and LO2 electrical monoball are in a high traffic area and therefore vulnerable to damage during ground processing operations
  - The harnesses are demated from the monoball for access to the area and temporarily stowed locally
  - Excessive and repeated flexing of the harnesses and exposure to incidental contact has resulted in wire damage
- Modification adds a monoball wiring production break
  - Existing wiring is shortened and terminated at the production break
  - New harness sections, routed from the production break to the monoball, allows this portion of the harness to be completely removed from the vehicle during turnaround processing
    - Eliminates damage concerns associated with temporarily stowing the harnesses and provides area access improvement
  - New “gang” wire harness retainer clamps facilitate wire harness removal and reinstallation
  - Three MPS helium lines were locally re-routed to allow room for the production break

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Process Improvement

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19518 APU Air Half Coupling Upgrade	X	X		01-16-276-0018-2453	8/9/01A	• Certification of Orbital Science air half couplings in APU system

- The Orbiter APU air half couplings (AHC's) used to service hydrazine fuel and GN2 have a history of poppet leakage
  - There are a total of six AHC's, three for fuel and three for GN2, one each for the three APU systems
  - The AHC's are located on the aft fuselage sidewall servicing panels AP56-01 and AP56-02
  - The existing design J.C. Carter AHC's have had a total of 72 R&R's since the start of the program
- Replacement of the J.C Carter AHC's requires an extensive amount of activity, including SCAPE ops in a limited work space area of the aft compartment
  - Potential of collateral damage to adjacent area subsystem hardware
  - The AHC has to be removed and sent to the HMF for poppet seal replacement
- Modification replaces the J.C. Carter AHC's with the more reliable Orbital Science AHC's
  - The Orbital Science AHC's are used in the OMS/RCS system and have required only 6 R&R's since return to flight
  - Additionally, the Orbital Science AHC's will eliminate the need for aft compartment scape ops should they require repair
    - The AHC poppet seal can be performed from outside the aft fuselage at the servicing panel without the need for recycling the hardware to the HMF for repair
- Ground side changes associated with the modification include Orbital Science ground half couplings and new scupper assemblies to accommodate the deeper QD

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/03-26-02

OV-104 STS-110 Modifications and Certification

Process Improvement

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19483 Body Flap Fitting Bolt Anti-Spin Retainer	X	X		159-03-350013-001K	4/3/01A	• Aft fuselage structural certification update

- The body flap attach fitting bolts are checked for torque loss after each flight and are re-torqued if bolt torque falls below allowed levels
  - These bolts are preloaded to maintain joint stiffness and prevent joint separation
  - There are four fittings with eight bolts, each attached to the lower aft fuselage
- Each flow, the body flap stub carrier and access panels are removed and the body flap positioned to allow access for personnel and tools to hold the bolt heads in position while the torque checks are performed on the fastener nuts in the aft fuselage
- The modification adds permanent bolt head retainers to the fittings, which restrain the bolts from turning
  - 17 of 32 bolt locations were modified this flow - the remainder will be worked at OMM
  - When completed, will significantly reduce the effort required to perform the torque check task and reduce the risk of access area collateral damage
  - Aft fuselage access only required to perform the torque checks

	Presenter:
	Organization/Date: Orbiter/03-26-02

MISSION KITS
BACKUP

STS-108 MISSION KIT MODIFICATION SUMMARY

Presenter:

Organization/Date:
Orbiter/03-26-02

There Are No First Flight Mission Kit Related Modifications for STS-110

- 6 Mission Kit Related Modifications for STS-110 Previously Flown on Other Vehicles
  - MV0072P Modified GFE Portable Foot Restraint (PFR) - High Strength Bridge Clamp
  - MV0828A External Airlock Stowage Bag Strap Velcro Removed
  - MV0456A New GFE 35mm Umbilical Camera Manifested
  - MV0828A ODS Mission Kit Hardware Affected by Condensate Separation Mod
  - MV0849A STS-110 Mission Unique Lightweight Starboard TSA Cushion
  - MV0886A Micro-SGU

	Presenter:
	Organization/Date: Orbiter/03-26-02

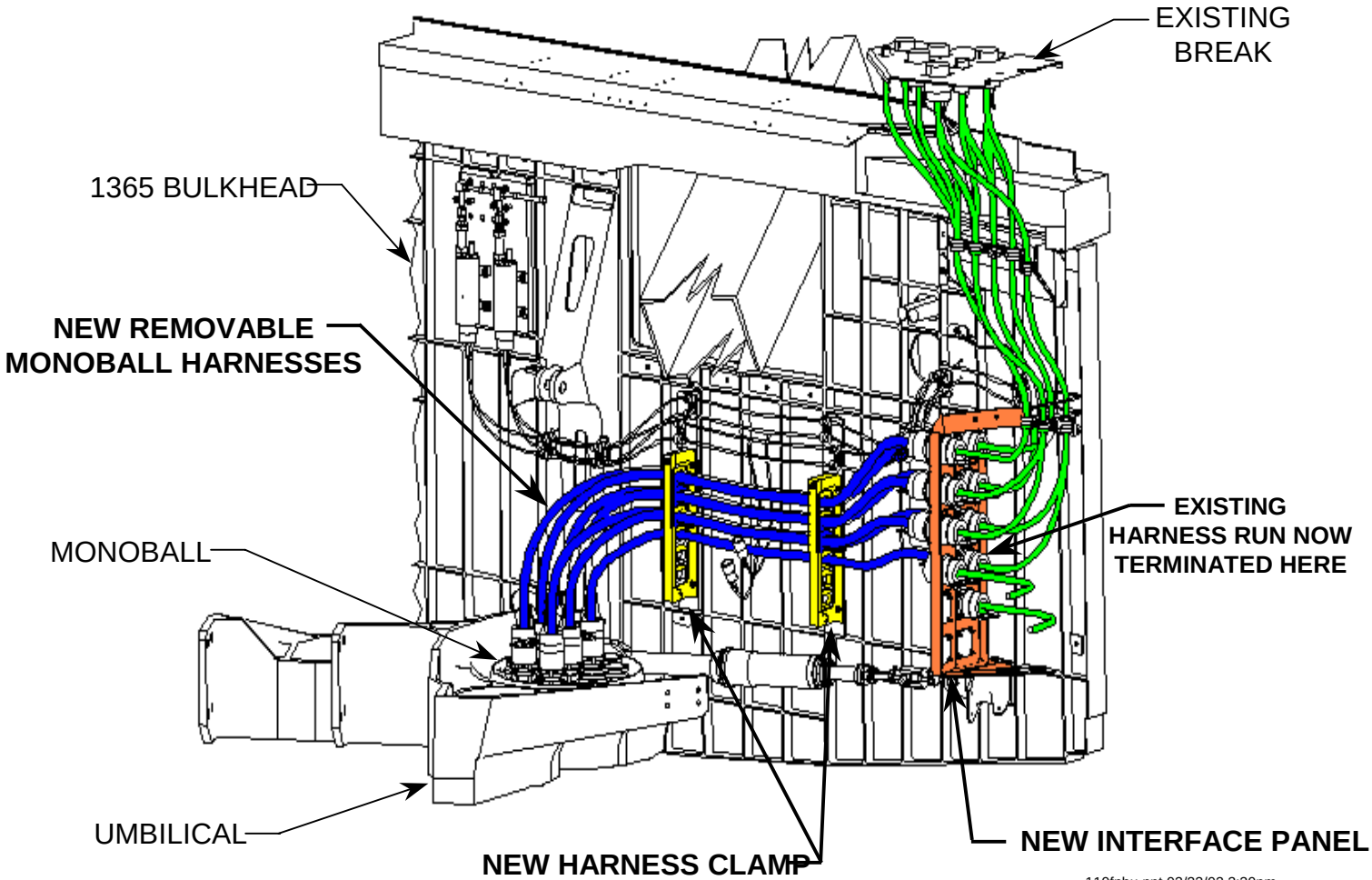
Special Topic Back-Up

CONNECTOR SAVER CONCERN

Presenter:

Organization/Date:
Orbiter/03-26-02

MONOBALL PRODUCTION BREAK HARDWARE



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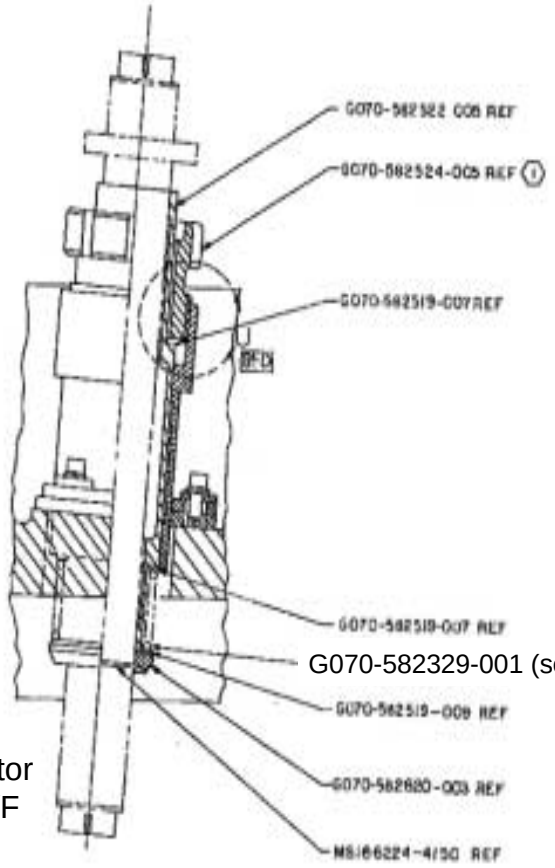
CONNECTOR SAVER CONCERN

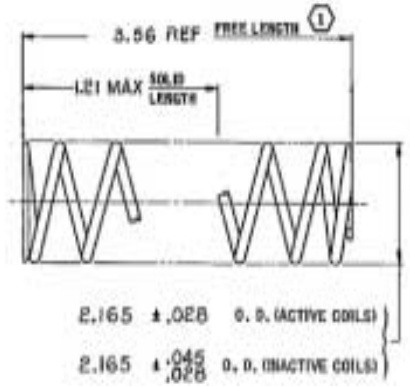
Presenter:

Organization/Date:
Orbiter/03-26-02

GW70-580517 - Umbilical Carrier Plate Connector (TYP)



Connector Saver I/F



View A – Electrical Connector Spring

	Presenter: Patti Thornton
	Organization/Date: Flight Software/03-26-02

SOFTWARE BACK-UP

STS-110 I-LOAD PATCHES

Presenter:
Patti Thornton
Organization/Date:
Flight Software/03-26-02

Two Sets of I-Load Patches were Approved for STS-110

- Patches for CRs 92718, 92719 and 92724A were approved by the SASCB on 10/22/01and released to the field on 11/01/01
  - PRCB authorization for flight occurred on 11/01/01
- Patches for CR 92746 were approved by the SASCB on 02/14/02 and released to the field on 02/26/02
  - PRCB authorization for flight occurred on 03/07/02

STS-110 I-LOAD PATCHES

Presenter:
Patti Thornton
Organization/Date:
Flight Software/03-26-02

CR 92719 - STS-110 MPS Pressure Anomaly and Vernier Leak Limit Patches (PASS and BFS)

- Addresses the MPS LH2 manifold pressure rise observed on STS-104
  - Delays LH2 pre-valve closures and increases MPS dump time delay by 2 seconds each
  - Results in 2 second extension to ET/Orbiter mated coast
- Extends new OI-29 TAL Alpha/Beta automated mated coast maneuver as a result of increased mated coast time, improving TAL hit margins
- Restores Vernier Injector temperature leak limits to previous flight values
  - Range had been expanded in support of hardware mod which is no longer planned

STS-110 I-LOAD PATCHES

Presenter:
Patti Thornton
Organization/Date:
Flight Software/03-26-02

CR 92724A - STS-110 Ascent/Entry GN&C I-Load Patches (PASS and BFS)

- Updates ascent guidance and sequencing I-Loads due to addition of a full OMS load and nominal OMS assist

CR 92718 - STS-110 On-Orbit Flight Control Patch (PASS)

- Updates on-orbit flight control I-Loads due to ISS/Orbiter mass property changes and SSRMS operations definition
- Uses new OI-29 Reboost staggered Primary RCS jet firings to reduce structural loads

CR 92746 - STS-110 On-Orbit Flight Control Patch 2 (PASS)

- Updates on-orbit flight control mass acceleration I-Loads due to ISS/Orbiter mass property changes associated with Soyuz docked node change
  - Prevents excessive jet firings and inefficient prop usage

STS-110 DATA PATCHES

Presenter:
Patti Thornton
Organization/Date:
Flight Software/03-26-02

DR 111690 - Improper Indexing Causes Activation/ Deactivation of Wrong SM Processes (PASS)

- 8 Halfword data patch restores KSC's ability to inhibit normal hardware output commanding during Ground Check-Out (GCO) mode processing due to an error introduced on OI-29
  - Patch restores the hardware output process table entries to their original (OI-28) locations
  - Precludes impacts at KSC during PL processing

Patch Developed Per Full Standard Processes and Released to the Field on 01/07/02

- Patch installed at KSC for use in all GCO mode processing
- Patch fully verified in SPF and SAIL
- PRCB authorized patch for flight on 03/07/02

STS-110 DATA PATCHES

Presenter:
Patti Thornton
Organization/Date:
Flight Software/03-26-02

DR 111625 - Incorrect Branching When Blanking ITEMS 50-68 on DAP CONFIG (PASS)

- 1 Halfword data patch corrects an on-orbit flight control display anomaly introduced on OI-29 potentially resulting in illegible data in one field when data in other fields is blank
  - Patch updates the count of halfwords to be skipped when blanking data on the display to account for OI-29 changes
  - Precludes the need for crew workarounds to avoid confusion

Patch Developed Per Full Standard Processes and Released to the Field on 02/07/02

- Patch installed and in use in SMS
- Patch fully verified in SPF and SAIL
- PRCB authorized patch for flight on 03/07/02

STS-110 CODE PATCH

Presenter:
Patti Thornton
Organization/Date:
Flight Software/03-26-02

DR 110884 - Unexpected FTS of GPC 3 Following Induced FTS of GPC 2 (PASS)

- Simple 8 halfword code patch removes a latent design exposure to a second sync failure and/or inconsistent GPC commanding following a Fail-to-Sync (FTS)
  - Precludes any downstream effects if a FTS occurs in a specific timing line-up with active I/O by ensuring inconsistent input data is marked in error prior to use by applications code
- Problem identified prior to STS-109 and waived for flight
  - Additional exposure exists on OI-29 due to new capabilities

Patch Developed Per Full Standard Processes and Released to the Field on 03/01/02

- Patch installed in all OI-29 SMS training loads
- Patch fully verified in SPF and SAIL
- PRCB authorized patch for flight on 03/07/02