

**STS-110**  
**FLIGHT READINESS REVIEW**

**March 26, 2002**

**Ground Operations**

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# AGENDA

- Shuttle Processing

- Integrated Operations

J. Vevera

- Shuttle Engineering

M. Madden

- Launch and Landing

M. Leinbach

- Summary

D. King  
M. Nappi  
C. Murphy

# PROCESSING DIFFERENCES

**Presenter:**

**J. Vevera**

**Organization/Date:**

**Ground Ops/03-26-02**

## Processing Differences - VAB / Pad

- Planned
  - APU 1/2/3 Confidence Run
  - Late Payload Delivery
  
- Unplanned
  - MMU #1 R&R
  - Orb/SRB Hyd Pump X-Ray
  - EMU Battery Charger R&R
  - MEC #1 R&R
  - Monoball Connector Saver Replacement
  - RH SRB Tilt Hyd Pump R&R
  - E/T Intertank Foam Repair



# SHUTTLE ENGINEERING OVERVIEW

**Presenter:**  
**Mike Madden**  
**Organization/Date:**  
**Ground Ops/03-26-02**

## The following Topics have been reviewed:

- |  |                       |
|--|-----------------------|
| ● Requirements Status – OMRS               | No Issues             |
| ● TOPS Status                              | No Issues             |
| ● LCC/GLS Status                           | To Be Presented       |
| ● Software, SCAN, and Configuration Status | No Issues             |
| ● Vehicle/GSE Modification Status          | No Issues             |
| ● In-Flight Anomaly Status                 | No Issues (in backup) |
| ● Lost Item Problem Reports                | No Issues (in backup) |
| ● Time/Life Cycle                          | No Issues             |
| ● Critical Process Changes                 | No Issues             |
| ● Unexplained Anomalies                    | No Issues             |
| ● Safety, Quality, and Mission Assurance   | No Issues             |
| ● Engineering Topic                        | No Issues             |
| ● Nonstandard Work Summary                 | No Issues (in backup) |

<b>GROUND LAUNCH SEQUENCER</b>	<b>Presenter:</b> <b>Mike Madden</b>
	<b>Organization/Date:</b> <b>Ground Ops/03-26-02</b>

## Ground Launch Sequencer Configuration for STS-110

- GLSD (KLO-82-0071A) Rev 8, Change G, March 2002
- Mask/Bypass/Limit Change List Have Been Reviewed (See Back-up)

### S/W Changes

### Description and Remarks

- |                |  |
|----------------|--|
| ● Housekeeping | OI 29 now handles all housekeeping for the Vent Doors 4/7 OVERRIDE status word. GLS references have been deleted.  |
| ● ET-05        | LCC now allows for biasing of one LH2 Ullage pressure transducer to 48.9 psig before swapping in the spare, GLS was automated for this condition between T-75 and T-10 seconds |

<b>GROUND LAUNCH SEQUENCER</b>	<b>Presenter:</b> <b>Mike Madden</b>
	<b>Organization/Date:</b> <b>Ground Ops/03-26-02</b>

## Ground Launch Sequencer Configuration for STS-110

<b>S/W Changes</b>	<b>Description and Remarks</b>
● Safing	OI 29 provides the addition of a Primary and Secondary Delta Fail Flag for all 3 ME Controller Failures which are now reported to GLS Console during Abort Safing sequences
● INS-02	Upgraded Solid State Modular Memory Unit changes have been incorporated

# IN-FLIGHT ANOMALY STATUS

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- ET Hydrogen Umbilical Retract Anomaly (STS-108)

# IN-FLIGHT ANOMALY STATUS

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- Observation
  - During STS-108 (Pad B), the Hydrogen Vent Arm contacted the Fixed Support Service Structure (FSS) just prior to engaging the primary latching system, causing hardware damage to the vent arm and FSS
    - The vent arm was captured by the secondary capture feature as designed
    - Lifting lug became a debris item
- Concern
  - Potential debris impact with vehicle
  - Damage to Ground Support Equipment

## IN-FLIGHT ANOMALY STATUS (CONT'D)

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- Actions Taken / Fault Tree Analysis
  - 86 Items were reviewed and closed out
    - North Shock Strut higher loading was determined to be the most probable cause (Uneven with South Shock Strut)
    - Decel Cable contact point data indicates a shift to the south after shock struts were changed out for STS-103
      - Average for 5 flights prior to STS-103
        - 6.2 inches south.
      - Average for 5 flights after STS-103 (post shock R/R)
        - 7.9 inches south (1.7 Inches delta to south)
    - Hastelloy Flex Hose Stiffness was tested, found to be less stiff than the 316L Flex Hose (Pad A) and determined not to be a contributing factor
    - Flex Hose Length was also determined not to be a contributing factor

## IN-FLIGHT ANOMALY STATUS (CONT'D)

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

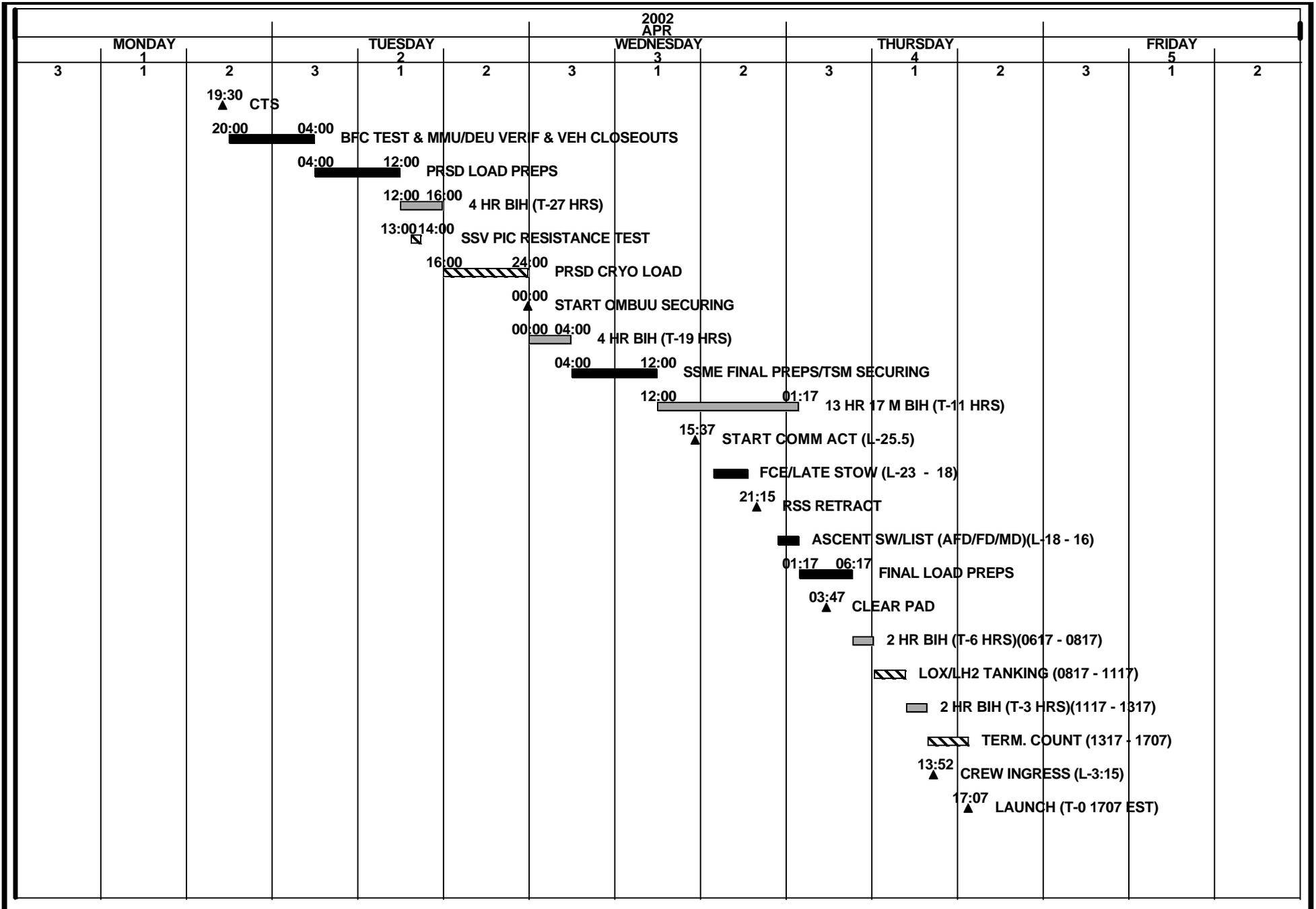
- Flight Rationale
  - Provided  $\frac{3}{4}$ " additional clearance on south side of deceleration cable structure beyond STS-108 contact point by removing  $1 \frac{1}{4}$  inches of material
  - Removed vent line lifting bracket, eliminating debris source during STS-108 anomaly
  - Pivot arm shocks have been load tested for nominal operation
  - All damaged hardware has been repaired and returned to print condition

Hydrogen Vent Arm has been Tested, Validated and is ready to support STS-110

# STS-110 / OV-104 Launch Countdown Summary

OPR: J. Spaulding (1-9306)

18MAR02 15:07



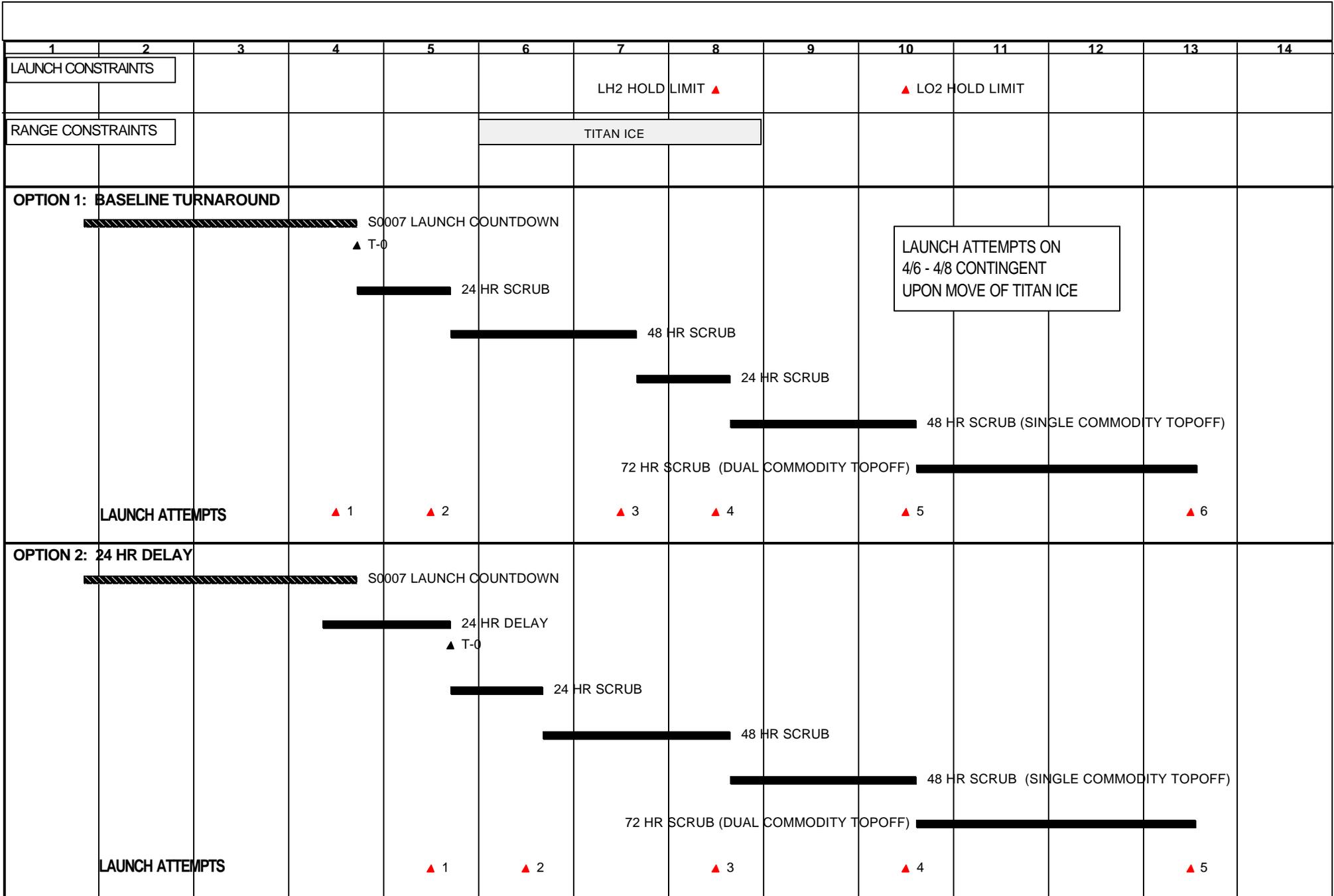
NOTE:  
Actual scrub turnaround timelines will be determined  
realtime based on specific conditions encountered.

# STS-110

## LAUNCH COUNTDOWN TURNAROUND OPTIONS

OPR: J. Spaulding 1-9306

22MAR02 08:19



# LANDING OPERATIONS STATUS

**Presenter:**

**Mike Leinbach**

**Organization/Date:**

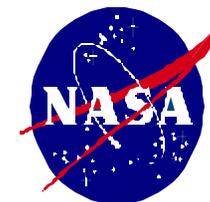
**Launch & Landing/03-26-02**

- **Launch Support**
  - ❖ **RTLS:** KSC
  - ❖ **TAL:**
    - Zaragoza (Prime)      Deploy at L-7 days, Mar 28, 2002
    - Moron (Alt)              Deploy at L-7 days, Mar 28, 2002
    - Ben Guerir (Alt)        Deploy at L-9 days, Mar 26, 2002
  - ❖ **AOA:**
    - KSC (Prime)
    - WSSH (Alt)              Deploy at L-2 days, Apr 2, 2002
- **Mission Support**
  - ❖ KSC (Prime EOM)
  - ❖ DFRC/EDW              Deploy at L-2 days, Apr 2, 2002
  - ❖ WSSH
- **Site Status**
  - ❖ No issues.





Kennedy Space Center  
Shuttle Processing Team



STS-110 Readiness Statement

*This is to certify that appropriate CoFR items from NSTS-08117 Appendices H and Q, Flight Preparation Process Plan, have been reviewed and dispositioned. Subject to completion of planned work and resolution of any identified constraints, KSC Shuttle Processing and Supporting Organizations are ready to support Launch Operations.*

**S/J. G. Presnell, Jr. for**

Charlie W. Murphy  
APM, Integrated Logistics,  
USA.

**S/M. J. Nappi for**

Andrew A. Allen  
APM, Ground Operations,  
USA.

**S/David A. King**

David A. King  
Director of Shuttle Processing,  
NASA



**STS-110**  
**FLIGHT READINESS REVIEW**

**BACKUP**

**March 26, 2002**

**Ground Operations**

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# UNEXPLAINED ANOMALIES

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- Closed -
  - IPR-110V-0006 ODS Hooks 2 & 8 Closed Indication  
Toggling OFF Unexpectedly
  
- Open – Pending Closure
  - IPR-110V-0005 APU #2 Gas Generator Bed Temp  
and Gear Box Pressure Anomaly

**UNEXPLAINED ANOMALIES  
ODS HOOKS 2 & 8 CLOSED INDICATION  
TOGGLING OFF****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Observation
  - ODS Hooks #8 Closed Indication came ON as expected during the STS-104 Docking operation, but toggled to OFF 3 seconds later
    - The measurement was OFF for 109 seconds, and then it came back on
    - ODS Hooks #2 also had a 1 second drop out in the same time period
- Concerns
  - Unconfirmed status of individual ODS Hook positions

**UNEXPLAINED ANOMALIES  
ODS HOOKS 2 & 8 CLOSED INDICATION  
TOGGLING OFF (CONT'D)****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Discussion
  - Individual Hooks Closed sensors were added as an ISS upgrade, were not present for MIR Flights
  - Toggling of this type of measurement has not been observed in the “Post Hooks Closed” time frame for the 4 flights on OV-104 since installation
  - Toggling during Hooks operations has been observed on STS-97, STS-98, and STS–106 and during Ground processing for STS-110
  - Hook linear advance and group hook closed indications for each motor group operated nominally
    - These measurements provide some redundancy to individual hook closed indications

**UNEXPLAINED ANOMALIES  
ODS HOOKS 2 & 8 CLOSED INDICATION  
TOGGLING OFF (CONT'D)****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Actions Taken
  - Troubleshooting included Hooks Cycles and Visual and Borescope Inspections
    - No anomalies noted

**UNEXPLAINED ANOMALIES  
ODS HOOKS 2 & 8 CLOSED INDICATION  
TOGGLING OFF (CONT'D)****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Possible Causes
  - Open Circuit – break in the copper path between connectors, sensor micro switches, and/or MDM's
    - Highly Unlikely – 2 independent copper path failures would be required to fail both #2 and #8 Hooks Indications
  - Faulty MDM
    - Highly Unlikely - 2 independent MDM channel failures would be required to fail both #2 and #8 Hooks Indications
  - Marginally rigged micro switches sensitive to thermal conditions and/or flight loads may contribute to temporary loss of these indications

**UNEXPLAINED ANOMALIES  
ODS HOOKS 2 & 8 CLOSED INDICATION  
TOGGLING OFF (CONT'D)****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Most Probable Cause
  - Marginally rigged micro switches sensitive to thermal conditions and/or flight loads may contribute to temporary loss of these indications
- Risk Assessment
  - No risk to Flight and Crew's safety or Mission success

**UNEXPLAINED ANOMALIES  
ODS HOOKS 2 & 8 CLOSED INDICATION  
TOGGLING OFF (CONT'D)****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Flight Rationale
  - Each of the 12 Hooks contains one closed position sensor that provides telemetry data concerning the position of the individual hook
    - Indications are instrumentation only
  - Primary latching system provides sufficient redundancy to verify nominal hook operations
  - Anomaly has no impact on ODS operations, capabilities, mission success, of safety

**UNEXPLAINED ANOMALIES (CONT'D)  
APU 2 GAS GEN'R BED TEMP AND  
GEAR BOX GN2 PRESS ANOMALY****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Observation
  - APU 2 Gas Generator Bed Temp and Gearbox GN2 pressure went to lower limit when controller power was removed
    - Measurements should have remained powered up because the Gas Generator Heaters were on via the cockpit switch
- Concerns
  - Loss of instrumentation when only the Heater SW is on and the Controller is powered off

**UNEXPLAINED ANOMALIES (CONT'D)  
APU 2 GAS GEN'R BED TEMP AND  
GEAR BOX GN2 PRESS ANOMALY****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Discussion
  - Loss of these two measurements with heater power on has not been observed before
  - No Failures of the APU Controller have been observed since it was upgraded to the MC201-0001-1005 digital controller
  
- Actions Taken
  - Initial troubleshooting included installing break-out-boxes and performing resistance checks to look for open circuits
    - Found open circuits
  - Troubleshooting was repeated and no anomalies were found
    - Suspecting that the technician did not perform the test correctly
  - Troubleshooting the system returned it to normal operation

**UNEXPLAINED ANOMALIES (CONT'D)  
APU 2 GAS GEN'R BED TEMP AND  
GEAR BOX GN2 PRESS ANOMALY****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Actions Taken (Cont'd)
  - 3 Wire runs were removed and replaced with new wiring
    - These 3 runs could have caused the observed anomaly
  
- Actions in Work
  - Failure Analysis of the removed wire segments was performed
    - Results did not find any wire discrepancies or discontinuities

**UNEXPLAINED ANOMALIES (CONT'D)  
APU 2 GAS GEN'R BED TEMP AND  
GEAR BOX GN2 PRESS ANOMALY****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Causes
  - Possible Causes
    - Open Circuit - caused by a recessed pin in a connector, or a broken wire
    - Broken Wire - Removed and replaced 3 circuits
      - Failure Analysis was performed on these wire segments
      - No anomalies were identified
  - Most Probable Cause
    - Recessed Pin in a connector which was reseated during troubleshooting efforts

**UNEXPLAINED ANOMALIES (CONT'D)  
APU 2 GAS GEN'R BED TEMP AND  
GEAR BOX GN2 PRESS ANOMALY****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02**

- Flight Rationale
  - A full controller test using the Controller Checkout Unit was performed with no anomalies noted
  - The anomaly has not repeated itself since the break-out-boxes and the suspect wires were replaced
  - If the problem reappears in flight, the Controller can be turned on to power the instrumentation signal conditioner
  
- Risk Assessment
  - No risk to Flight and Crew's safety or Mission success

# LOST ITEM PROBLEM REPORTS

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

## Lost Items Not Found (7 Total)

### Summary/Conclusion for all LAF PR's

- A thorough search of each area was unsuccessful in finding/retrieving the lost items
- System Engineering evaluations have concluded no adverse effect on Orbiter system operations

## Crew Module

- PR -LAF-4-25-0514: Screw is missing from side of HUD #1. Detected while working OEL-215. Screw retaining hardware is not present inside HUD.  
(P/N MS5195730B)
  - Weight: 1.12 grams
  - Size: 0.63 in. long
  - Location: Crew Module

## LOST ITEM PROBLEM REPORTS

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

### Crew Module (Cont'd)

- PR-LAF-4-25-0520: Retention tie strap (V606-650648-029) on the SORG water lines is not installed
  - Weight: 8 grams
  - Size: 0.25 in. x 19 in. long
  - Location: Unknown
  
- PR-LAF-4-25-0522: A sleeve bolt (ME128-0066-4004) and retaining ring (ME128-0037-0004) is missing from Panel R9
  - Weight: 11.3 grams
  - Size: 0.5 in. x 1.25 in. x 1 in.
  - Location: Crew Module – Panel R9 Area

# LOST ITEM PROBLEM REPORTS

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

## Midbody

- PR-LAF-4-25-0506: Pin missing from shackle under the 13-1 LH PLB platform
  - Weight: 45 Grams
  - Size: 0.5 in. x 2 in. long
  - Location: Midbody - Not believed to be in the ship
    - Pin has been missing for an undetermined amount of time (More than 1 OPF Flow)
      - Suspect PR also taken against OV-103 in OPF Bay 2
    - Pin may have fallen onto OPEN L/H PLBD
    - Detailed Radiator Inspection performed before PLBD Closure which identifies micro-meteorite impacts would have found PIN or related Damage
      - None Identified
    - Conclusion - Highly unlikely the PIN is in the Orbiter

**LOST ITEM PROBLEM REPORTS****Presenter:****Mike Madden****Organization/Date:****Ground Ops/03-26-02****Midbody (Cont'd)**

- PR-LAF-4-25-0509: Personnel dropped a hair clip over the Wing Box while removing the 1307 PLB Curtain
  - Weight: <1 gram
  - Size: 2.25 in. long x 0.25 in
  - Location: All pieces except one prong were recovered. Hair clip prong approximate size 2.25" x .25", material is plastic, brown in color

## LOST ITEM PROBLEM REPORTS

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

### Midbody (Cont'd)

- PR -LAF-4-25-0517: V544-366180-001 Spacer was detected missing while working TCS-4-25-1824
  - Weight: 12.8 grams
  - Size: 1 in. x 8.25 in. long
  - Location: Xo 1090 R/H Side

### Aft

- PR- LAF-4-25-0507: Lost a safety cable Ferrule size .032" (Bergen tool S/N C003-339)
  - Weight: 0.2 gram
  - Size: 0.1 in. x 0.15 in.
  - Location: Ferrule on safety cable did not completely crimp and fell behind Bay 5 L/H upper wire tray. Unable to locate ferrule in upper part after 15 minutes search

## FUEL CELL RUNTIME

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- Fuel Cell (FC) Runtime Contingency
  - Present Runtime Hours
    - FC1 s/n 106      1304
    - FC2 s/n 108      1621
    - FC3 s/n 120      973
  - Planned Runtime Usage - 342 hours
    - 11+0 day mission + 2 weather contingency + 30 FC start/landing
  - Available Contingency Runtime
    - FC1    954 hours
    - FC2    637 hours
    - FC3    1285 hours

# IN-FLIGHT ANOMALY STATUS

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- ET Hydrogen Umbilical Retract Anomaly (STS-108)

# IN-FLIGHT ANOMALY STATUS

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- Observation
  - During STS-108 (Pad B), the Hydrogen Vent Arm contacted the Fixed Support Service Structure (FSS) just prior to engaging the primary latching system, causing hardware damage to the vent arm and FSS
    - The vent arm was captured by the secondary capture feature as designed
    - Lifting lug became a debris item
- Concern
  - Potential debris impact with vehicle
  - Damage to Ground Support Equipment

# IN-FLIGHT ANOMALY STATUS (CONT'D)

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**



**Vent Arm Prior to Lift and Mate**



**Pivot Arm Shocks**

## IN-FLIGHT ANOMALY STATUS (CONT'D)

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- Actions Taken / Fault Tree Analysis
  - 86 Items were reviewed and closed out
    - North Shock Strut higher loading was determined to be the most probable cause (Uneven with South Shock Strut)
    - Flex Hose Stiffness was tested and determined not to be a factor

## IN-FLIGHT ANOMALY STATUS (CONT'D)

**Presenter:**

**Mike Madden**

**Organization/Date:**

**Ground Ops/03-26-02**

- Flight Rationale
  - Provided  $\frac{3}{4}$ " additional clearance on south side of deceleration cable structure beyond STS-108 contact point
  - Removed vent line lifting bracket, eliminating debris source during STS-108 anomaly
  - Pivot arm shocks have been load tested for nominal operation
  - All damaged hardware has been repaired and returned to print condition

Hydrogen Vent Arm has been Tested, Validated and is ready to support STS-110