VEHICLE ENGINEERING

AGENDA

Presenter:

Organization/Date:
Orbiter/10-31-02

ORBITER	**To Be Presented**
FCE	**No Constraints**
GFE	**To Be Presented**
SOFTWARE	**To Be Presented**
FLIGHT READINESS STATEMENT	**To Be Presented**
BACKUP INFORMATION	

STS-113
FLIGHT READINESS REVIEW

OCTOBER 31, 2002

Orbiter

AGENDA

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

- Engineering Readiness Assessment
  - Previous Flight Anomalies — To Be Presented
  - Critical Process Changes — To Be Presented
  - Engineering Requirements Changes — No Constraints
  - Configuration Changes and Certification Status — To Be Presented
  - Mission Kits — No Constraints
  - Safety, Reliability & Quality Assessment — No Constraints
- Special Topics — To Be Presented
  - MPS Feedline Flowliner Update
  - STS-112 ET/Orbiter Aft Attach Shell Assembly Damage

	Presenter:
	Organization/Date: Orbiter/10-31-02

PREVIOUS FLIGHT ANOMALIES

	Presenter:
	Organization/Date: Orbiter/10-31-02

STS-112
IN-FLIGHT ANOMALIES

PREVIOUS IN-FLIGHT ANOMALIES

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

STS-112 (OV-104) In-Flight Anomalies, Previous Shuttle Mission:

- 1 Orbiter in-flight anomaly identified:
  - STS-112-V-01: Primary RCS Thruster L4D Failed Off
  - Details of above presented on following pages

- **All anomalies and problems have been reviewed and none are a constraint to STS-113 flight**
  - One significant problem to be presented as a Ground Ops Special Topic
    - MER-4: System A Pyros Failed to Fire

STS-112-V-01: PRIMARY THRUSTER L4D FAILED OFF

Presenter:
Doug White

Organization/Date:
Orbiter/10-31-02

Observation:

- Thruster L4D failed off just prior ET-SEP during STS-112

Concern:

- Loss of RCS thruster redundancy

Discussion:

- L4D (S/N 229) failed off during first commanded firing
  - Chamber pressure (Pc) reached max value of 16 psia which resulted in deselection by RM
  - Fuel and ox flow was evident by drop in injector temps
  - Low Pc and injector temp drops indicate partial flow on one valve (full flow on the other)
  - Third flight of this thruster since last installation / flushing
    - Sixth flight of fuel valve since overhaul (S/N 708)
    - Twenty-third flight of oxidizer valve (S/N 724)
  - Most likely causes are fuel valve pilot seal extrusion or oxidizer valve contamination
  - Thruster was deselected for remainder of mission

STS-112-V-01: PRIMARY THRUSTER L4D FAILED OFF

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Actions Taken / In Work:

- Reviewed history of OV-105 thrusters
  - No evidence of performance problems on any OV-105 thrusters currently installed
    - Previous GN2 response tests at WSTF were nominal with no indication of marginal performance during response tests
    - No anomalies during last flight, STS-111
- Thruster processing at WSTF and KSC, as well as the current failure risk mitigation procedures continue to be reviewed
  - Thruster process evaluation team is defining tests to determine root cause of fuel valve extrusion
    - Specific operational-type tests
      - Throat plug / GN2 purge
    - Fuel / oxidizer exposure tests
    - Schedule for testing is being developed

STS-112-V-01: PRIMARY THRUSTER L4D FAILED OFF

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Actions Planned:

- Post-flight, L4D will be removed from LP03 and replaced
  - Requires entire manifold R&R to prevent sympathetic failures
- Failed thruster will be sent to WSTF for TT&E
  - TT&E will isolate problem to either the fuel or ox valve

STS-112-V-01: PRIMARY THRUSTER L4D FAILED OFF

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Risk Assessment:

- Failed off/leak thruster is Crit 1R/3
  - Redundant thrusters exist in all firing directions
- Risk mitigation actions are in place to reduce failures
  - Preventative maintenance flushing performed on all primary thrusters at OMM, as well as those used for in-flow replacements
  - Full manifold R&R required for any thruster removal to preclude collateral damage
  - GN2 chamber purge implemented during turnaround operations to reduce propellant vapor build-up
  - Molecular sieve of oxidizer implemented at KSC
- Thruster process evaluation team is evaluating cause of fuel valve extrusion

STS-112-V-01: PRIMARY THRUSTER L4D FAILED OFF

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Acceptable for STS-113 Flight:

- Redundant thrusters exist for each firing direction
- Flight rules exist for failed off thrusters
- Not a safety-of-flight issue
- Risk-mitigation actions in place to reduce failures
- No history of marginal performance on any OV-105 thruster during last GN2 response test at WSTF
- No anomalies on any OV-105 thrusters during last mission

	Presenter:
	Organization/Date: Orbiter/10-31-02

STS-111
IN-FLIGHT ANOMALIES

PREVIOUS IN-FLIGHT ANOMALIES

Presenter:
Doug White

Organization/Date:
Orbiter/10-31-02

STS-111 In-Flight Anomalies, Previous OV-105 Mission:

- Three Orbiter in-flight anomalies identified:
  - STS-111-V-01: Left OME GN2 Regulator Leakage
    - Failed regulator was R&R'd and retested prior to STS-111
    - Regulator performance was nominal during STS-111 and STS-113 OPF flow checkout
  - STS-111-V-02: FES Failure on Primary B Controller
    - Failure isolated to open coil in system B water isolation valve
    - Valve package R&R'd and successfully retested
  - STS-111-V-03: Port Aft PLBD Ready-To-Latch Indication Failed On
    - Switch module R&R'd and successfully retested
  - Detail briefings of the above in backup

All anomalies and problems have been reviewed and none constrain STS-113 flight

	Presenter:
	Organization/Date: Orbiter/10-31-02

CRITICAL PROCESS CHANGES

STS-113 CRITICAL PROCESS CHANGE REVIEW SUMMARY

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Item Reviewed	No. of Items Reviewed	Period or Effectivity Covered	No. Found To Be Critical Process Changes
OMRSD Changes (RCNs)	10	STS-113 Specific & Non-Flight Specific Changes Approved 8/6/02 – 9/19/02	0
OMRSD Waivers & Exceptions	12	STS-113 Specific	0
IDMRD Changes (MCNs)	3	Approved 8/6/02 – 9/19/02	1
IDMRD Waivers & Exceptions	0	Approved 8/6/02 – 9/19/02	0
EDCPs	3	Closed 8/6/02 – 9/19/02	1
Boeing Specifications	16	Released 8/6/02 – 9/19/02	0
Boeing Drawings	141	Released 8/6/02 – 9/19/02	0
Material Review	165	Approved 8/6/02 – 9/19/02	0

- All process changes were reviewed and none constrain STS-113

CRITICAL PROCESS CHANGES

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

IDMRD MCN's:

Fire Extinguisher Container (MCN 3062)

- This MCN resulted from an IDMRD scrub and includes substitution of the USA NSLD ATP for vendor ATP
- Changes made from the vendor ATP to the USA NSLD ATP (RSC-A-0011 Rev. A) are also documented
  - Use of GN2 instead of filtered shop air for checking pressure switch activation & for drying parts
  - Replace freon ultrasonic cleaning with freon rinse to satisfy visual clean requirement
  - Allow decal and lockwire to be solvent wiped instead of freon rinsed
  - After hydrostatic testing apply DOT markings using an ink stamp marking process

CRITICAL PROCESS CHANGES

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Engineering Design Change Proposals (EDCP):

Advanced Air Data Transducer (AADT-005)

- Reduced torque on the bolts that install the AADT to the mount because of previous insert failures in the mounts
  - Torque changed to 35-40 in-lb
  - Torque was 40-50 in-lb
- M&P analysis determined that the 40-50 in-lb fastener installation torque exceeded the recommended value for a 10-32 size insert
- This change will reduce the potential of damage to the mount assembly inserts during installation and removal of the AADT

	Presenter:
	Organization/Date: Orbiter/10-31-02

CONFIGURATION CHANGES AND CERTIFICATION STATUS

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

- Nine modifications implemented during the STS-113 processing flow
  - None of these are first flight modifications for STS-113
  - Total listing of STS-113 modifications and certification details is in backup
  - All modification certification has been processed and approved

	Presenter:
	Organization/Date: Orbiter/10-31-02

SPECIAL TOPICS

SPECIAL TOPICS FOR THE STS-113 FLIGHT READINESS REVIEW

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Topic	Presenter
• MPS Feedline Flowliner Update	Doug White
• STS-112 ET/Orbiter Aft Attach Shell Assembly Damage	Doug White

OV-105 MPS LH2 FEEDLINE FLOWLINER CRACKS

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Observation:

- Inspections of MPS LH2 engine feedline flowliners revealed cracks in the gimbal assembly flowliners near the SSME interface

OV-105 Actions Completed:

- Crack repair welds, post repair NDE, & clean-up of 2 observed OV-105 flowliner cracks are complete
  - E-1 LH2 downstream flowliner
  - E-2 LH2 upstream flowliner
- Polishing of downstream and upstream gimbal flowliner slots is complete
- LH2 feedline NDE inspections
  - Dye penetrant inspection of gimbal yoke to flange weld is complete with no issues
  - X-ray and/or borescope of gimbal bellows and bellows to yoke welds is complete with no issues

OV-105 MPS LH2 FEEDLINE FLOWLINER CRACKS

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

OV-105 Actions Completed: (cont)

- Final assessment of materials property data from MSFC coupon testing data is complete – no issues

Fleet Actions Completed:

- Rationale for clearing remaining hardware (BSTRA joints, bellows to gimbal weld, bellows, and gimbal ring) exposed to fluctuating pressure environment
  - BSTRA joint: Clear with no issues
  - Bellows to gimbal weld: Clear with 0.54 margin of safety (above 1.4 factor of safety) at cryogenic proof pressure
  - Bellows: Clear for 51 missions using conservative analysis technique
  - Gimbal ring: Clear for 100 plus missions
- Teardown and inspection of the LH2 qualification test and MPTA feedlines are complete – no issues

OV-105 MPS LH2 FEEDLINE FLOWLINER CRACKS	Presenter: Doug White
	Organization/Date: Orbiter/10-31-02

Acceptable for STS-113 Flight:

- Based on successfully completed crack repair welds, polishing of LH2 flowliner slots, internal feedline NDE inspections, coupon testing, and feedline analysis, the community has cleared OV-105 for STS-113
- Post STS-112 inspection of OV-104 flowliners is planned, but is not a constraint to STS-113 flight

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE	Presenter: Doug White
	Organization/Date: Orbiter/10-31-02

Observation:

- Post flight inspection of OV-104 ET aft attach shells (salad bowls) revealed indications of damage/material displacement
  - This is in contrast to pre STS-112 conclusion that damage found during shell refurbishment had been caused by the orbiter transporter

Concern:

- Impairment of joint rotation due to damage or material displacement can lead to increase in bending stress in the aft attach bolts

Discussion:

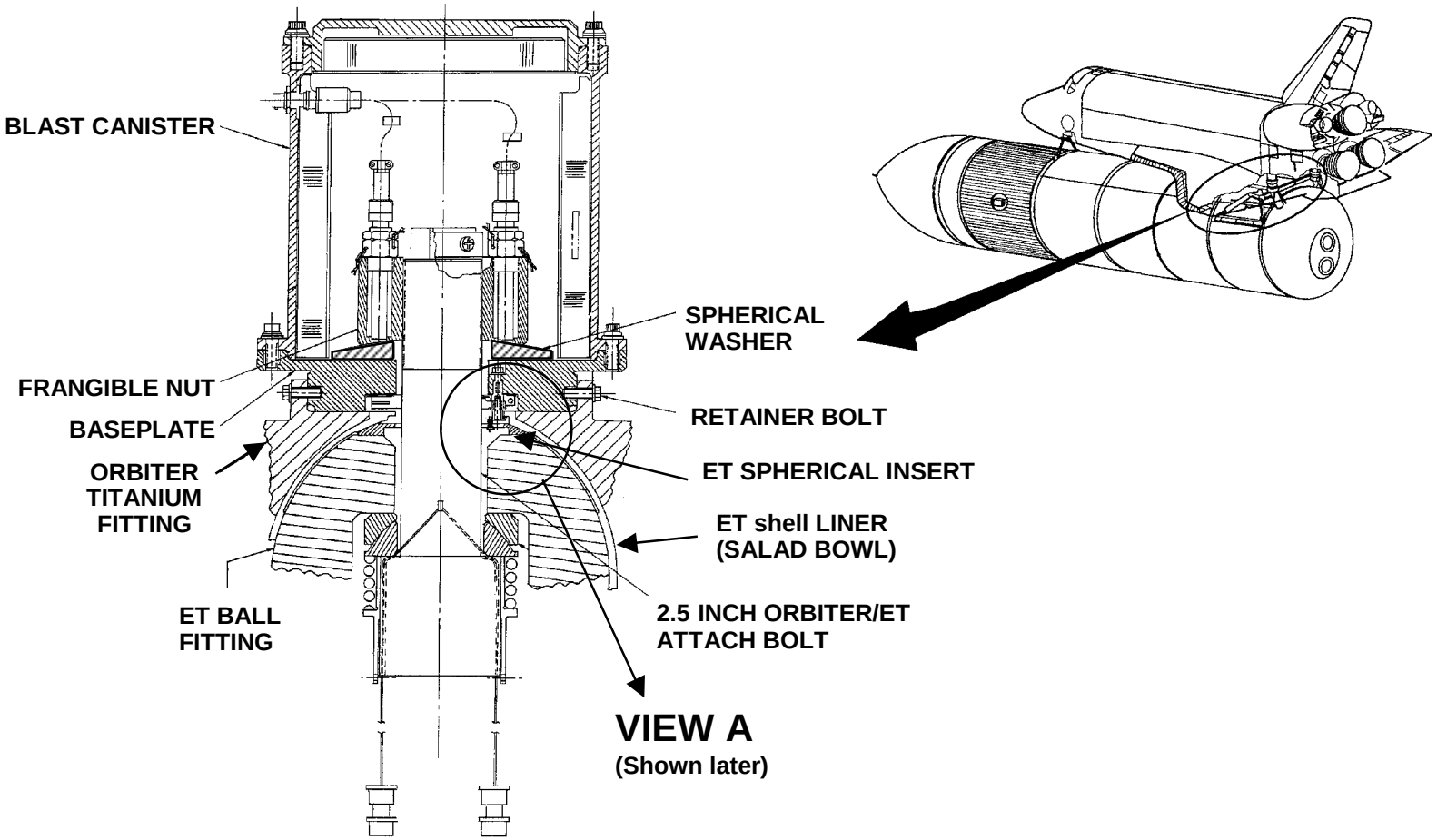
- Purpose of ET shell assembly and ET spherical insert is to provide rotating surfaces for self alignment with the ET monoballs
  - With noted shell damage, analysis with available data could not assure proper joint rotation / function
  - Recommendation made to install new shell assemblies on all vehicles

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Orbiter/ET Aft Attach Flight Mated Configuration



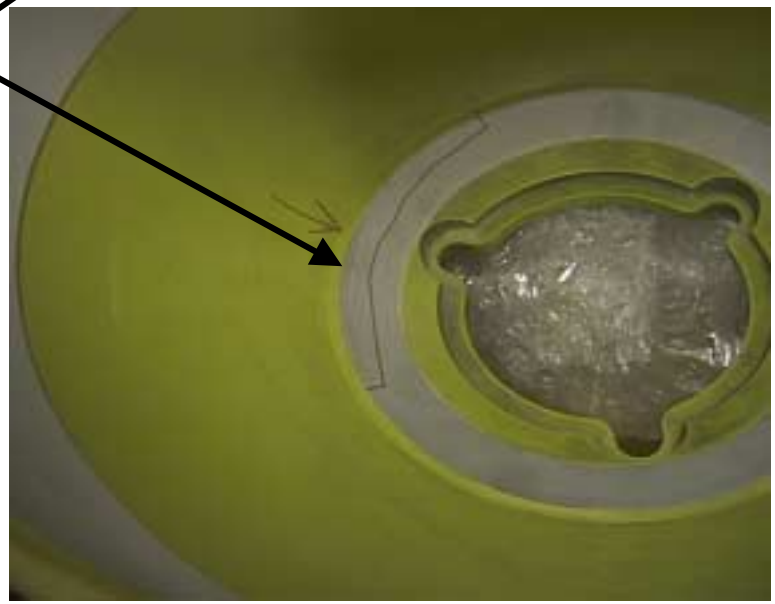
ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

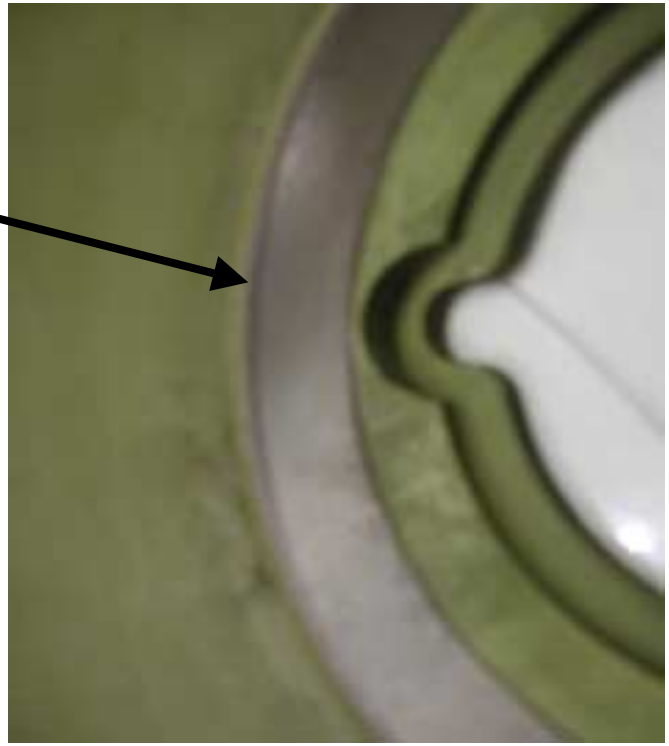
Organization/Date: Orbiter/10-31-02

ET Shell (Salad Bowl) Damage

Area of damage



Example Of Base Material Damage



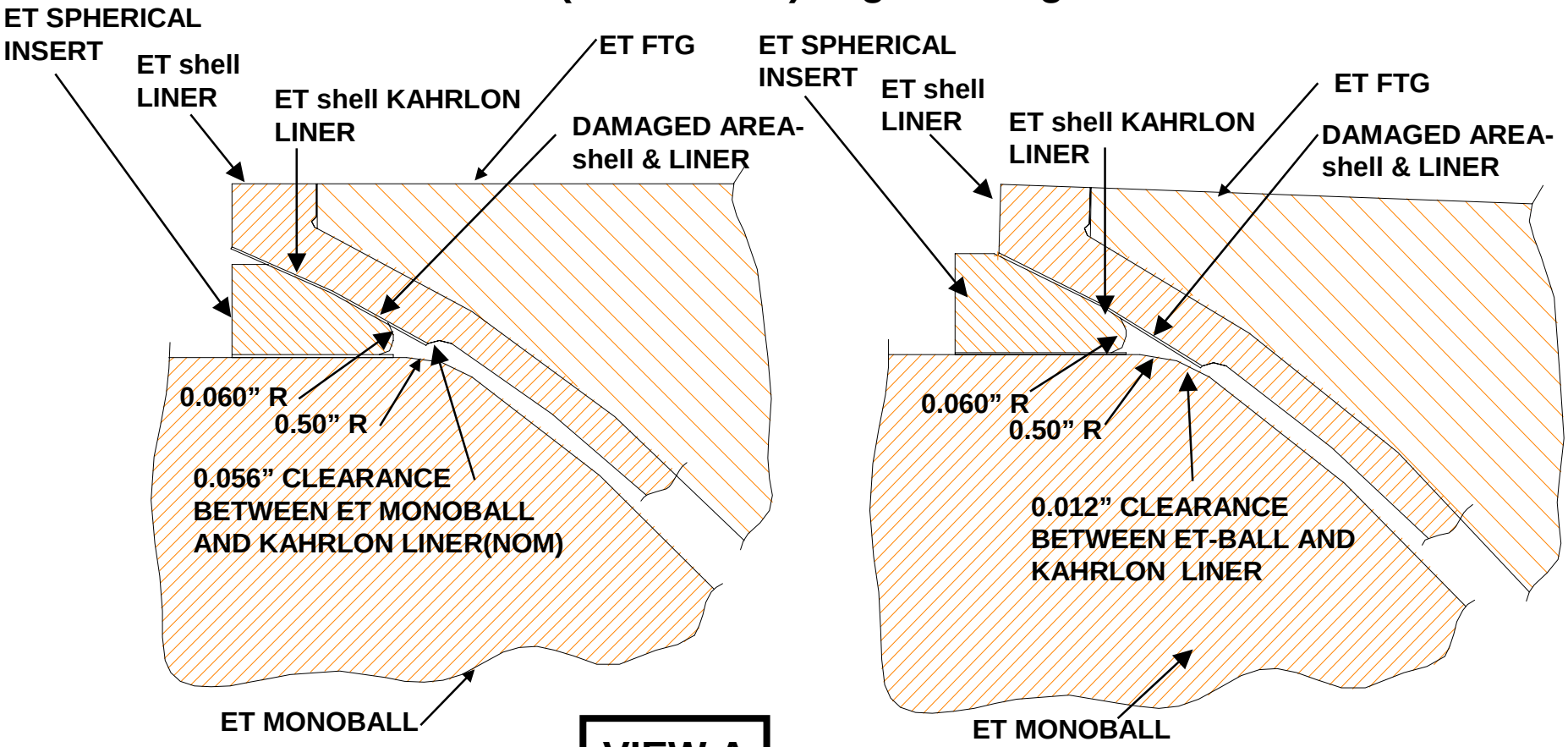
OV-104, Post STS-112

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

ET Shell (Salad Bowl) Flight Configuration



VIEW A

Nominal Position

Max Design Joint Rotation (2 Degrees)

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE	Presenter: Doug White
	Organization/Date: Orbiter/10-31-02

Pre STS-112 Actions Taken:

- Team evaluated possible causes of shell damage:
  - Tool used to install ET shells in orbiter
  - ET mate operation
  - Shell / Kahrlon Liner installation process by Vendor
  - Transfer of orbiter from the OPF to the VAB on the Orbiter Transport System (OTS)
    - Sharp edged circumference of transporter monoballs was considered the most likely cause of ET shell assembly damage
      - Transporter monoball upper circumference edge fabricated with no radius callout (estimated 0.015 R) – should have met Orbiter Vehicle / External Tank ICD-2-12001 requirement of 0.50 R constant edge relief to prevent liner gouging
      - Transporter monoballs reworked to provide adequate radius

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Pre STS-112 Actions Taken: (cont)

- New shell assemblies installed in fleet
  - OV-104 - LH and RH had new shell assemblies installed, inspected prior to ORB-ET mate
  - OV-105 – LH and RH has new shell assemblies installed, inspected prior to ORB-ET mate, not flown.
  - OV-102 - LH and RH has new shell assemblies installed, will be inspected prior to ORB-ET mate, not flown.
  - OV-103 – OMM

Post STS-112 Actions Taken:

- Performed OV-104 post-flight inspection
  - Apparent Damage noted on both LH and RH shell assemblies
    - Consistent with previous damage location
- Availability of spares statused
  - 12 new shell assemblies being fabricated at Palmdale with first pair scheduled for delivery at the end of October

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Actions In Work / Planned:

- PRT evaluating other possible causes
  - Utilizing fault tree and detailed action tracking list
    - 7 Top level branches identified
      - Vendor process
      - OPF processing
      - OPF-VAB transfer process
      - VAB processing
      - VAB-Pad transfer process
      - Pad processing
      - Launch / Ascent / Separation Environments

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE	Presenter: Doug White
	Organization/Date: Orbiter/10-31-02

Actions In Work / Planned: (cont)

- Assembling a flight history table on damaged ET Shells
  - Plan is to correlate which bowls were installed on a given vehicle for a given flight and evaluate against the flight loads
  - Compiling sub-car data to quantify and trend damage of damaged shells
    - Utilize to help determine test cases and worst case damage envelope
    - Damage has been noted on all vehicles, with the earliest damage in 1995 based on flight history

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Serial Number	Number of Flights Since Refurbish	Flight Date Range Since Refurbish	Vehicles Flown	Location @ Length of Defect (Degrees)	Max Depth
EK1893	2	06/98 - 12/01	103, 105	AFT, 360	0.011
FL0067429	3	09/00 - 07/01	104	AFT, 60	0.006
FL0195611	5	10/98 - 03/01	103	AFT, 110	0.008
FL195610	1	06/02	105	AFT, 120	0.010
EK1892	1	08/97	103	AFT, 290	0.019
FL0067428	3	11/97 - 07/99	102	AFT, 110	0.008
EW1826	1	08/97	103	AFT, 130	0.009
EW1825	5	09/97 - 07/01	104	AFT, 110	0.004
MN91555	1	10/02	104 (STS-112)	AFT, 120	0.004*
MN91555	1	10/02	104 (STS-112)	AFT, 120	0.003*

* With Kahrlon liner material

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Actions In Work / Planned: (cont)

- Test program implementation underway
  - Plan is to simulate original (1980) qualification test to determine overall joint coefficient of friction and effect of damaged shell
    - Goal is to characterize attach bolt bending stresses with damaged shell assembly
    - Will use one new shell assembly to establish coefficient of friction baseline
    - Will use worst damaged OV-104, STS-112, shell to determine effect of damage on coefficient of friction
      - OV-104 damage is consistent in damage magnitude, but can only be verified after Kahrlon removal
    - 3-sigma of known damage conditions of shells to provide margin has been established for testing (0.023 inches deep X 360 degrees)
    - Additional test for simulated ORB-ET mate
      - Aft soft mate - torque bolt with vehicle @ 15-45 minute pitch-up angle
      - Rotate joint to simulate fwd mate process
      - Investigate potential of insert misalignment / asymmetrical loading
  - Test plan developed with test readiness review accomplished on 10-27-02 - testing to begin 10-31-02 – Est completion date11-2-02

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Actions In Work / Planned: (cont)

- Stress Analysis – Concurrent with Testing
  - Determine force required to achieve damage to Kahrlon liner/ shell base material
  - Quantify the test results and compare to existing margins
    - Determine damage allowable without exceeding bolt bending margins
  - Review original analysis / assumptions to determine if some conservatism exists
- M&P evaluations
  - Evaluate / perform failure analysis of shells
    - Determine type and quantify material damage condition, inspect for residual material, etc
    - Remove Kahrlon from one of the OV-104 shells for base material inspection – evaluation of second OV-104 shell based on test plan progress and results
  - STS-112 pyro separation hardware sent to NASA JSC for trend evaluation
    - Any out of family findings will be dispositioned by PRT for further M&P / failure analysis by appropriate site

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Actions In Work / Planned: (cont)

- Integration Activities In Work
  - Flight dynamics and separation
    - STS-112 ET separation films have been reviewed
      - No re-contact/ anomalies noted
    - Evaluate joint rotation / loads during ascent phase
      - STS-112 FMA shows max rotations of 0.8 degrees
    - Provide peak load and pitch angle data for heads-up separation
      - STS-112 reconstruction indicates no unexpected forces of the magnitude required to cause damage
      - Determine flight specific loads correlating to the magnitude of damage to each damaged shell
  - Review Orbiter-ET mate operations and physical characteristics
    - PRT to review soft mate / hard mate process
    - Readdress ET monoball physical characteristics
      - Researching build records for ET monoballs

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

Interim Summary and Recommendation:

- Additional testing and analysis is required to determine acceptability of flying with the potential of known, similar shell damage
  - Must envelope with margin all known defects to shell assemblies <u>or</u>
  - Must not appreciably increase overall bolt bending stresses
- Until completion of required testing and analysis, this condition is a constraint to STS-113 launch

	Presenter:
	Organization/Date: Orbiter/10-31-02

GOVERNMENT FURNISHED EQUIPMENT (GFE)

STS-113 RMS - First Flight Modifications

Ken Ruta/MV5

- Arm 201 was upgraded during 2000/2001 and is flying the following hardware for the first time on STS-113:
  - Rebuilt Joints including:
    - Upgraded Motor Modules - new Ceramic Brakes and new Com-scanner assemblies.
    - New design Position Encoders.
  - All modification certification has been processed and approved
- Arm 201 also underwent a Critical Process Change adding maintenance procedures never performed before including:
  - Disassembly of the Arm to remove Joint gearboxes.
  - Removal of all gears, followed by strip of dry lubrication and then gear relubrication.

STS-113 RMS - First Flight Modifications

MCR/Modification	Certification Method	Certification Approval Request	Approval Date	Remarks
CR 1363 - Arm 201-Joint Motor Module upgrade	Test and Analysis	SPAR-RMS-SG.2337 Rev. B	09/01	New Ceramic Brakes and new Com-scanner assemblies added to improve reliability.
CR 1362 - Arm 201-Position Encoder upgrade	Test and Analysis	SPAR-RMS-SG.2124 Rev. H	10/01	Existing Encoders were past their design life of 10 years/100 missions.

	Presenter:
	Organization/Date: Orbiter/10-31-02

SOFTWARE

PROCESS CHANGE FOR STS-113

Presenter:
Patti Thornton
Organization/Date:
Flight Software/10-31-02

Back-up Flight System (BFS) Reconfiguration Performance Testing (Level 8) Eliminated Effective with STS-113

- BFS Level 8 testing has been a verification task performed in the Software Production Facility (SPF) to validate system performance following reconfiguration with mission specific data values for each flight
  - Performed in parallel with Integrated Avionics Verification
  - Separate from performance testing conducted for each new OI
  - Separate from detailed verification testing for non-reconfiguration code/data patches on flight systems
- BFS Level 8 testing is not considered mandatory for flight
  - No discrepancies related to reconfiguration or I-Loads have been identified by BFS Level 8 testing since at least 1987
  - Standard Integrated Avionics Verification testing coverage is provided for BFS engage and listen scenarios

PROCESS CHANGE FOR STS-113

Presenter:
Patti Thornton
Organization/Date:
Flight Software/10-31-02

BFS Level 8 Elimination (cont)

- Not mandatory for flight (cont)
  - Reconfiguration and I-Load patch activities are performed using certified, automated toolsets
  - Rigorous selection and approval processes are in place for reconfiguration data and I-Loads
  - Standard I-Load owner audits are conducted to ensure proper I-Load values were incorporated onto the mass memory for flight
  - Standard SPF systems level reconfiguration health test suite has been expanded effective with STS-113 to include 3 BFS Listen cases

SAIL FACILITY STATUS

Presenter:
Patti Thornton
Organization/Date:
Flight Software/10-31-02

Shuttle Avionics Integration Laboratory (SAIL) Facility Status

- SAIL facility will be down for Cockpit Avionics Upgrade (CAU) related modifications during the STS-113 mission
  - Modifications require major disassembly of panels, wire harnesses and structure in the cockpit, removal of Main Distribution Control Assemblies (necessary for SAIL power up), disconnecting of cables throughout the facility and complete power down for a minimum of 2 months
  - Integrated testing in this configuration is impossible
  - Modifications must be done at this time to meet baselined schedules for CAU
- Availability of the SAIL is not a CoFR requirement
- Any necessary flight support related software verification testing will be performed in the SPF using certified models

	Presenter:
	Organization/Date: Orbiter/10-31-02

FLIGHT READINESS STATEMENT

FLIGHT READINESS EXCEPTION	Presenter: Doug White
	Organization/Date: Orbiter/10-31-02

STS-113 Flight Readiness Open Work Exceptions:

- Resolution of ET/Orbiter aft attach shell assembly damage issue
- Removal and inspection of OV-104 SRB HDP fire 1 wiring

SSVEO is Ready to Fly STS-113

ORBITER
FLIGHT SOFTWARE
FLIGHT CREW
EQUIPMENT

/s/ P. E. Shack
P.E. Shack, Manager
Shuttle Engineering Office

/s/ D. Stamper
D. E. Stamper, TMR
Software

/s/ N. Cerna
N. Cerna, Manager
Flight Crew Equipment Management Office

/s/ P. Petete
P. A. Petete, Acting TMR
Orbiter and Flight Crew Equipment

ORBITER/FLIGHT SOFTWARE

/s/ B. Bemuk
B. I. Bejmuk, Program Director, Orbiter
NASA Systems
The Boeing Company

/s/ J. Wilder
J. Wilder, Associate Program Manager
Orbiter ElementUnited Space Alliance

/s/ T. Peterson
T. F. Peterson, Associate Program Manager
Flight Software Element
United Space Alliance

RMS

/s/ S. Hiason
S. Higson, Program Director, SRMS
McDonald Dettwiler and
Advanced Robotics Limited

/s/ R. Allison
R. Allison, RMS Project Manager

SVS

/s/ L. Beach
L. Beach, Program Manager, SVS
NEPTEC

/s/ D. S. Moyer
D. S. Moyer, SVS Integration Office

FLIGHT CREW EQUIPMENT

/s/ J. Buchli
J.F.Buchli, FCE/EVA Associate
Program Manager
United Space Alliance

FERRY FLIGHT PLANNING

/s/ D. L. McCormack
D. L. McCormack, Ferry Flight Manager

/s/ R. Roe
Ralph R. Roe, Manager
Space Shuttle Vehicle Engineering

	Presenter:
	Organization/Date: Orbiter/10-31-02

BACKUP INFORMATION

	Presenter:
	Organization/Date: Orbiter/10-31-02

PREVIOUS FLIGHT ANOMALIES BACKUP

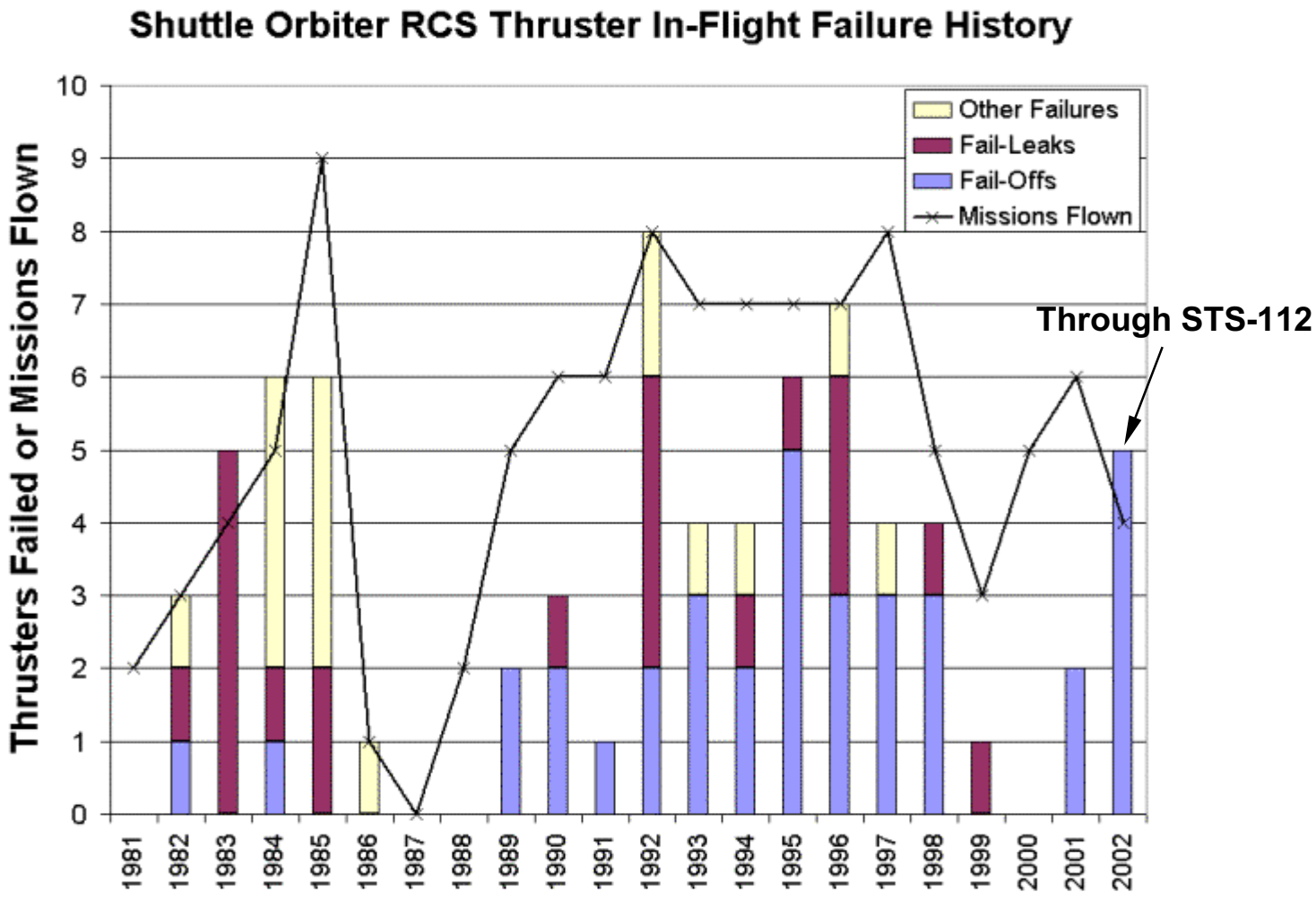
	Presenter:
	Organization/Date: Orbiter/10-31-02

STS-112 IN-FLIGHT ANOMALIES BACKUP

STS-112-V-01: PRIMARY THRUSTER L4D FAILED OFF

Presenter:

Organization/Date:
Orbiter/10-31-02

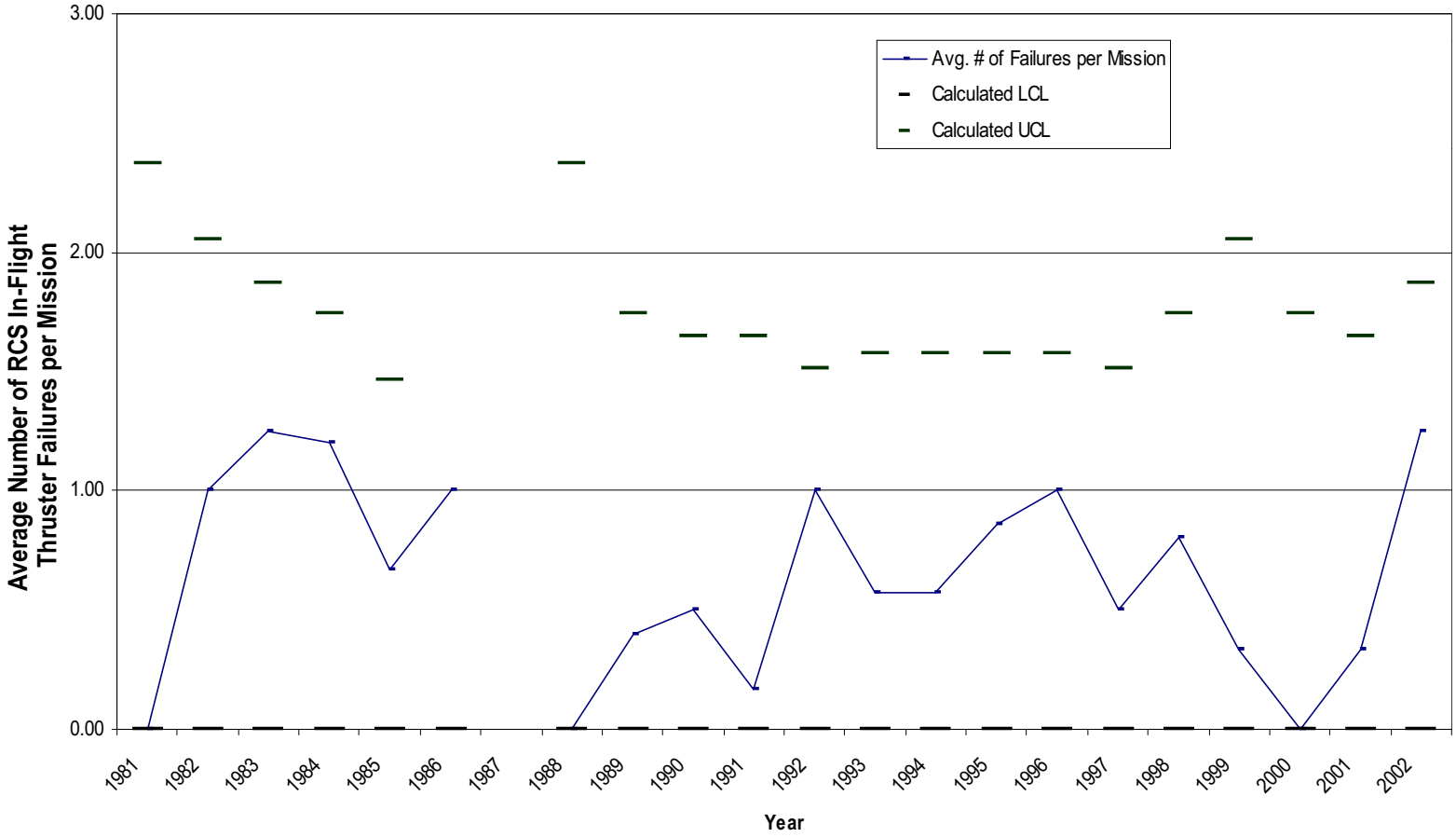


STS-112-V-01: PRIMARY THRUSTER L4D FAILED OFF

Presenter:

Organization/Date:
Orbiter/10-31-02

RCS Thruster Failure History Control Chart
(Variable Sample Size)



	Presenter:
	Organization/Date: Orbiter/10-31-02

STS-111 IN-FLIGHT ANOMALIES BACKUP

STS-111-V-01: OMS ENGINE GN2 REGULATOR LEAKAGE

Presenter:

Organization/Date:
Orbiter/10-31-02

Observation:

- Left OMS engine GN2 regulator exhibited internal leakage after the prelaunch GN2 activation

Concern:

- Loss of ability to operate OMS engine

Discussion:

- OMS engine GN2 regulator (S/N 109) failed to lockup following activation on first launch attempt (30 May 02)
  - Regulator appeared to have locked up at 349 psia
  - Over 30 seconds, leak rate increased to 32 psi/min
  - Leak observed for ~5 min, at this point the GN2 isolation valve was closed before relief device activation
  - The accumulator was vented and depressurized in an attempt to remove suspected transient contamination
  - Regulator performed nominally for remainder of launch attempt
- Regulator re-exhibited leak during 72-hr scrub turnaround

STS-111-V-01: OMS ENGINE GN2 REGULATOR LEAKAGE	Presenter:
	Organization/Date: Orbiter/10-31-02

Actions Taken / In Work:

- Failed regulator was removed and replaced prior to STS-111
  - Performed on pad by KSC personnel
- X-ray / CT scan was performed at KSC
  - No anomalies noted
- Reviewed failure history of GN2 regulator
  - 5 instances of internal leakage, all attributed to contamination
- Failed regulator sent to WSTF for TT&E & F/A
  - Regulator lockup tests performed showed no valve leakage and lockup pressures within specification
  - Valve disassembly TT&E planned for late October

STS-111-V-01: OMS ENGINE GN2 REGULATOR LEAKAGE

Presenter:

Organization/Date:
Orbiter/10-31-02

Risk Assessment:

- GN2 regulator internal leakage is Crit 1R/3
  - May result in loss of GN2 through relief valve
    - Potential loss of mission objectives for excessive loss
    - Still have at least one start if entire high pressure tank relieves overboard
- Flight rules exist for GN2 regulator internal leakage
  - If leak occurs during ascent, GN2 isolation valve will be closed by moving OMS engine switch from ARM/PRESS to ARM
    - Inhibits engine post-burn purge
      - 10 minute off-time required to avoid risk of engine hard start
    - No purge is Crit 1 for some abort cases – inability to restart engine on abort dumps within required time
      - May result in violation of C.G. and tank landing constraints
    - Lack of purge which may result in hard starts documented in CILs as accepted condition
      - Ascent plume heating minimizes the likelihood of a hard start
  - On-orbit, GN2 isolation valve is normally closed
    - Minimizes effect of regulator internal leakage

STS-111-V-01: OMS ENGINE GN2 REGULATOR LEAKAGE	Presenter:
	Organization/Date: Orbiter/10-31-02

Acceptable for STS-113 Flight:

- Failed left OMS engine GN2 regulator was removed, replaced and retested prior to STS-111
- Both OV-105 OMS engine GN2 regulators performed nominally during STS-111 and successfully passed OMRSD checkout during the STS-113 OPF flow
- Flight rules exist for management of leaking regulator
- Relief valve will prevent over-pressurization of downstream components due to internal leakage
  - At least one engine start remains if high pressure GN2 tank vents through the relief valve

STS-111-V-02: FES FAILURE ON PRIMARY B CONTROLLER	Presenter:
	Organization/Date: Orbiter/10-31-02

Observation:

- OV-105 FES failed to come out of standby when operating in the topping mode on the primary B controller at 1:13:22 MET

Concern:

- FES controller is criticality 1R/3
  - One failure away from MDF

Discussion:

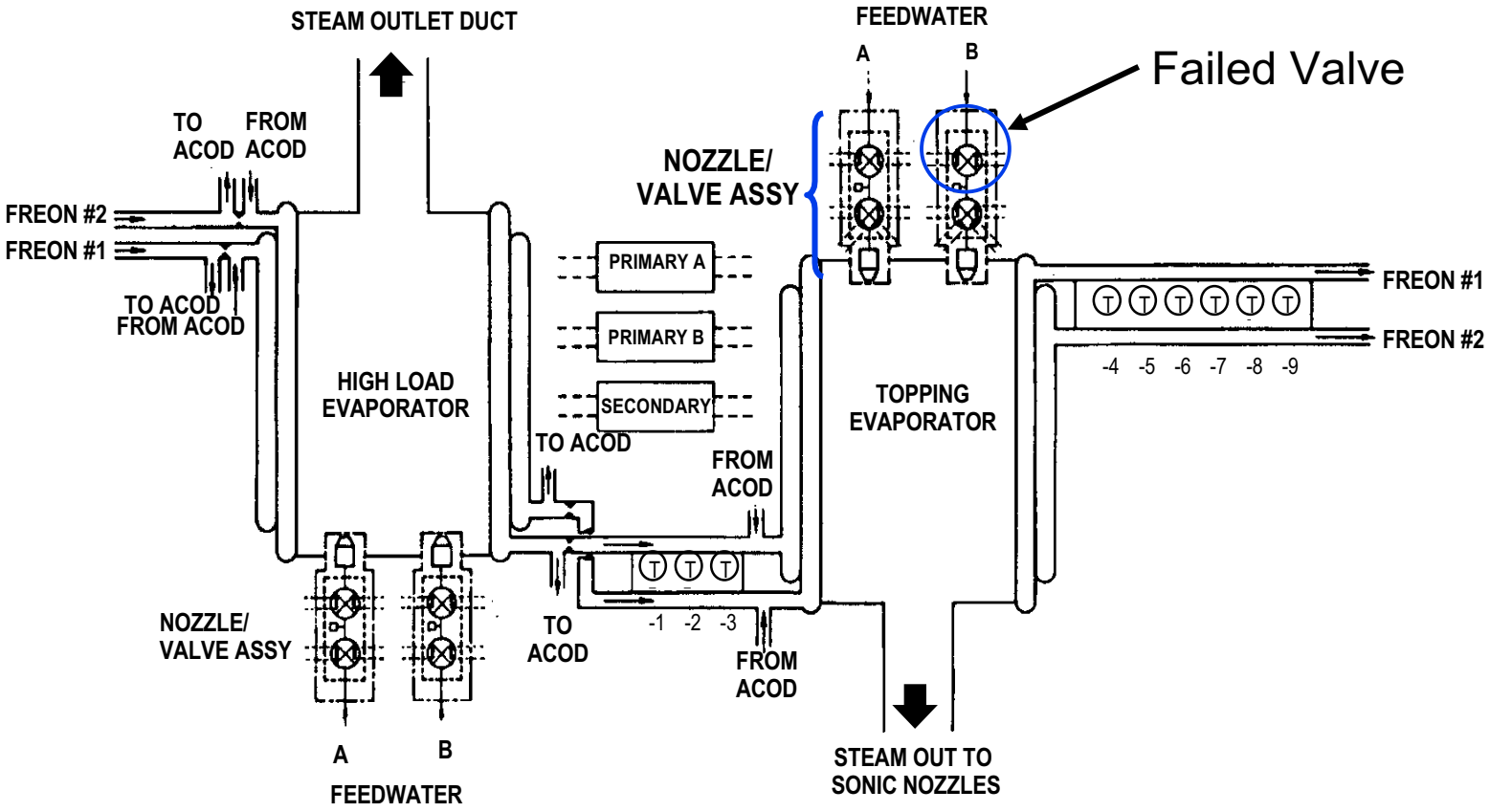
- FES has two cores - high load and topper
- FES high load and topping core required for full up mode during ascent/entry phase because of high heat loads
- FES topper operation supplements cooling performed by radiators on-orbit
- Loss of primary B topping operation equates to loss of full up cooling mode capability for primary B controller

STS-111-V-02: FES FAILURE ON PRIMARY B CONTROLLER

Presenter:

Organization/Date:
Orbiter/10-31-02

FLASH EVAPORATOR SUBSYSTEM



STS-111-V-02: FES FAILURE ON PRIMARY B CONTROLLER

Presenter:

Organization/Date:
Orbiter/10-31-02

Discussion: (cont)

- Two attempts to restart the topper in primary B failed
- Core flush using secondary controller was successful, verified that:
  - Feedline B was not obstructed
  - FES B system isolation valve and pulser valve were mechanically sound
  - Primary A and secondary controllers were good

Actions Taken:

- Fault tree was developed and most probable cause was isolated to the primary B control system
- Post-flight troubleshooting showed the FES water system B isolation valve coil had high resistance
  - Open circuit across isolation valve primary coil
    - Valve has a redundant coil operated via secondary controller
  - Valve assembly was removed and replaced and successfully retested
    - F/A on failed valve in work at vendor

STS-111-V-02: FES FAILURE ON PRIMARY B CONTROLLER

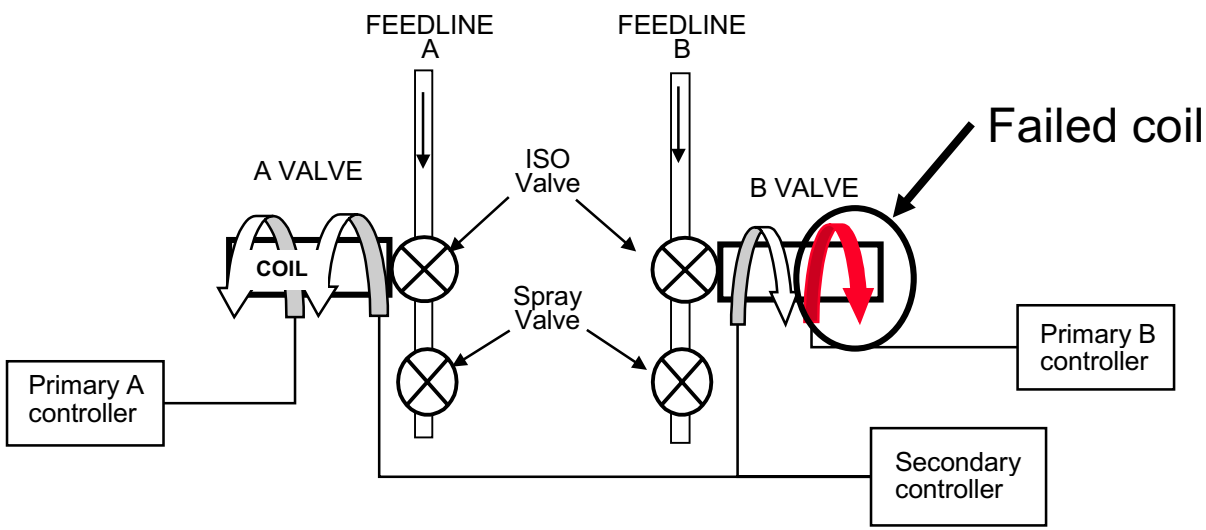
Presenter:

Organization/Date: Orbiter/10-31-02

Action Taken: (cont)

Controller Valve Coil Redundancy

Controller	High load		Topper	
	System A valves	System B valves	System A valves	System B valves
Primary A	✓		✓	
Primary B		✓		✓
Secondary	✓	✓	✓	✓



STS-111-V-02: FES FAILURE ON PRIMARY B CONTROLLER

Presenter:

Organization/Date:
Orbiter/10-31-02

Actions Taken: (cont)

- Failure history of valves:
  - There has been only two FES valve internal failures, including this STS-111 anomaly, in the shuttle program
    - The other was a high load valve failure during ground testing (~1998)

Risk Assessment

- FES valves/controllers are criticality 1R/3
  - Loss of a topping valve leads to loss of associated controller
  - Primary A and B systems are redundant
  - Secondary controller provides entry capability at reduced heat loads
    - Contingency procedures are in place and documented in Flight Rules

STS-111-V-02: FES FAILURE ON PRIMARY B CONTROLLER	Presenter:
	Organization/Date: Orbiter/10-31-02

Acceptable for STS-113 Flight:

- Cause of the STS-111 FES primary system B anomaly was isolated to an open coil in the B system water isolation valve
  - Valve assembly was removed and replaced and successfully retested
- Primary controllers/valves are electrically redundant
  - Secondary controller provides entry capability
- OV-105 satisfied all other File IX in-flight checkout requirements during STS-111
  - Primary A and Secondary system / controller checkouts
    - Included verification of valve function associated with these systems

STS-111-V-03: PAYLOAD BAY DOOR SWITCH MODULE FAILURE DURING DOOR OPENING	Presenter:
	Organization/Date: Orbiter/10-31-02

Observation:

- Three of the payload bay doors (PLBD) ready to latch (RTL) switches on the aft port switch module remained “on” after the port door moved toward the open position following the first and second landing day wave-offs

Concern:

- Switch module RTL indications remaining “on”, requires the PLBD to be closed in manual mode, by the crew, rather than auto mode

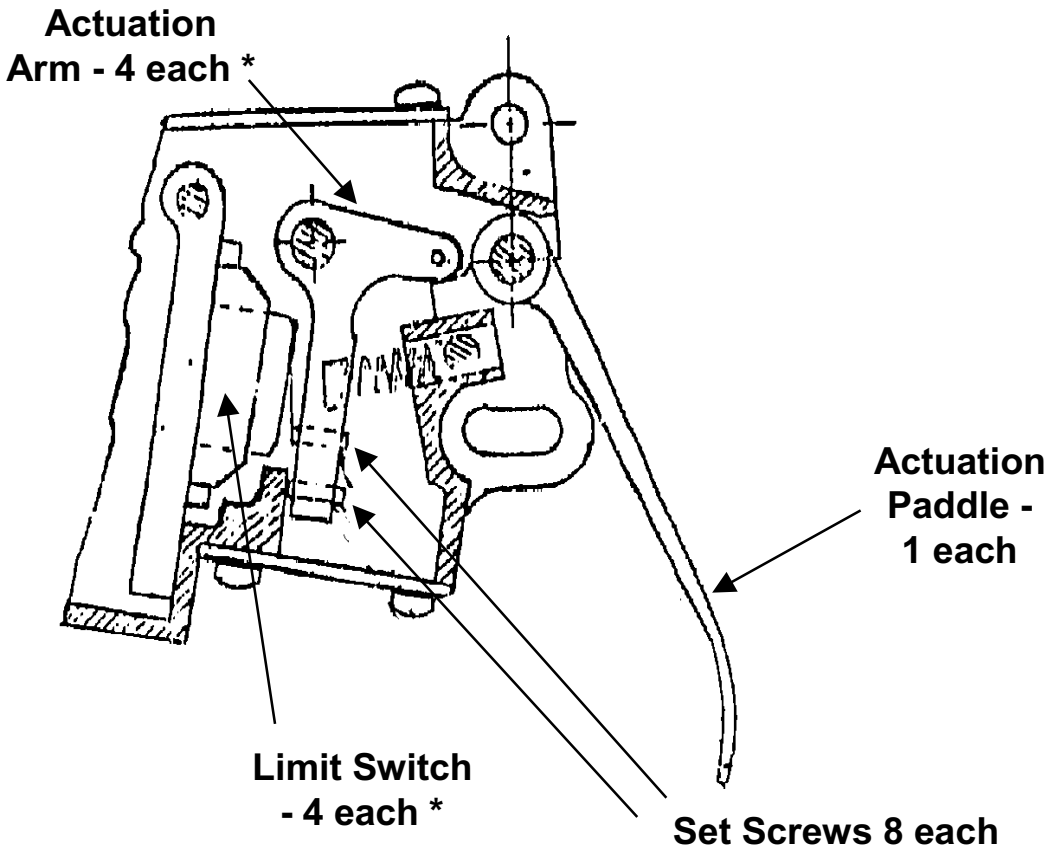
STS-111-V-03: PAYLOAD BAY DOOR SWITCH MODULE FAILURE DURING DOOR OPENING	Presenter:
	Organization/Date: Orbiter/10-31-02

Discussion:

- On first landing wave-off, switches eventually transferred to “off” at approximately 3-1/2 hrs, 6 hours and 9 hours after PLBD opening
- The following day, during the 2nd landing wave-off, the same switches remained “on” in the same port aft switch module
  - Two switches eventually transferred to “off” after approximately 4 hrs, the third transferred after 18 hours
- This anomaly did not affect nominal auto mode PLBD closure for all three cycles during STS-111
- The RTL switches activate the bulkhead actuators, which drive the bulkhead latches to latch the door
  - The switches are actuated by individual “switch levers” that are driven by a single “arm” contacted by the PLBD
  - Two (2) out of three (3) RTL switches in both the forward and aft modules are required before the bulkhead actuators will activate during auto mode

STS-111-V-03: PAYLOAD BAY DOOR SWITCH MODULE FAILURE DURING DOOR OPENING	Presenter:
	Organization/Date: Orbiter/10-31-02

PLBD Switch Module Cross Section



* 3 Ready to Latch Actuation Arms and Limit Switches
1 Closed Actuation Arm and Limit Switch

STS-111-V-03: PAYLOAD BAY DOOR SWITCH MODULE FAILURE DURING DOOR OPENING	Presenter:
	Organization/Date: Orbiter/10-31-02

Actions Taken:

- During post-flight payload bay door opening in the OPF, all three switches transferred to “off” as expected with no delays
- The switch module was inspected on the vehicle for debris/damage - no visible defects/debris
- A small amount of isopropyl alcohol was used to flush the actuation paddle area to free up any debris - no contamination was found
- The switch module was R&R’d and the replacement unit successfully retested
  - TT&E will be performed on the removed unit at NSLD
- Four previous flight anomalies related to switch module RTL indications remaining “on”
  - All anomalies attributed to either:
    - Thermal conditions affecting the operation of the arm or the individual switch levers
    - Marginal switch rigging
  - Switches re-rigged and returned to the field for unrestricted usage

STS-111-V-03: PAYLOAD BAY DOOR SWITCH MODULE FAILURE DURING DOOR OPENING	Presenter:
	Organization/Date: Orbiter/10-31-02

Risk Assessment:

- Failure mode not documented but failure mode considered to be non-critical
  - Worst case, PLBDs would be closed manually
- STS-111 failure was a pre-latch indication, which can be overcome by executing the manual mode door closure procedure

Acceptable for STS-113 Flight:

- The discrepant switch module has been removed and replaced and retested per OMRSD prior to OPF rollout
- Procedure in place to close PLBDs in manual mode for anomalous switch indication
  - On STS-111, if switches had not transferred to “off”, the crew would have closed doors in manual mode

	Presenter:
	Organization/Date: Orbiter/10-31-02

ENGINEERING REQUIREMENTS CHANGES BACKUP

ENGINEERING REQUIREMENTS WAIVERS/DEVIATIONS

Presenter:

Organization/Date:
Orbiter/10-31-02

- **The following NSTS 07700 Volume 3 Exception was processed for STS-113**
  - OV-105 STS-113 will exceed the 3 year time interval defined in NSTS 0770 Volume 3 paragraph 3.2. for the interval between the rollout from last OMDP to roll-in for the next OMDP
    - STS-113 is the 8th flight since the previous OMDP
  - This exception is a one time extension of the time interval between between OV-105 OMDP #1 OPF rollout to the OV-105 OMDP #2 OPF roll-in from 3 years to 5 years to accommodate STS-113
    - Of note, NSTS 07700 Volume III exception previously approved extension of the OV-103 OMDP-3 interval to 4.5 years & 9 flights
  - Updated the Flight Effectivities Table to make the next planned OMDP OPF roll-in read December 2002 (prior to flight 20), was July 01 (prior to flight 20)

	Presenter:
	Organization/Date: Orbiter/10-31-02

CONFIGURATION CHANGES AND CERTIFICATION STATUS BACKUP

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Modifications and Certification

Process Improvements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 17177 Removal of ATCS Ground Cooling Dust Caps from Aft Fuselage				N/A		• Removed the requirement to install dust caps on ground coolant QDs 50V63PD1, PD2 and payload GN2 ground coolant line no. 40 • No technical requirement to re-install the dust caps following demate of the ground coolant QD's during processing • Also eliminates a ferry flight configuration discrepancy

MCR 17177
Dome Heat Shield Bolt Attachment Torque Sequence
				N/A		• Clarifies the installation torque procedure for the dome heat shield bolt halves
						  • Specifies a top to bottom sequence of incremental torque on each dome half to provide proper distribution of bolt torque during installation
						  • Should also help reduce bolt hole galling damage caused by misalignment of dome heat shield and base heat structure mounting holes with the previous torque sequence

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Modifications and Certification

Process Improvements

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 17222 **ET Umbilical Camera Configuration Update** Mission Kit MVO456A				N/A		• Installed the –306 GFE 16mm camera at the LH forward position. • -306 camera configuration corrected an interference problem between the camera housing and Orbiter structure. • All –301 configuration cameras have been recently modified to provide camera manifesting flexibility
MCR 18755 **Mission Specialist 2 Seat 4 Egress Step Launch Configuration Change** Mission Kit MVO226A				N/A		• Changes the seat egress step launch configuration from deployed to stowed based on crew preference for additional clearance • Egress step can be easily deployed if required by the crew should egress through the overhead window be required

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Modifications and Certification

Corrective Action Optional

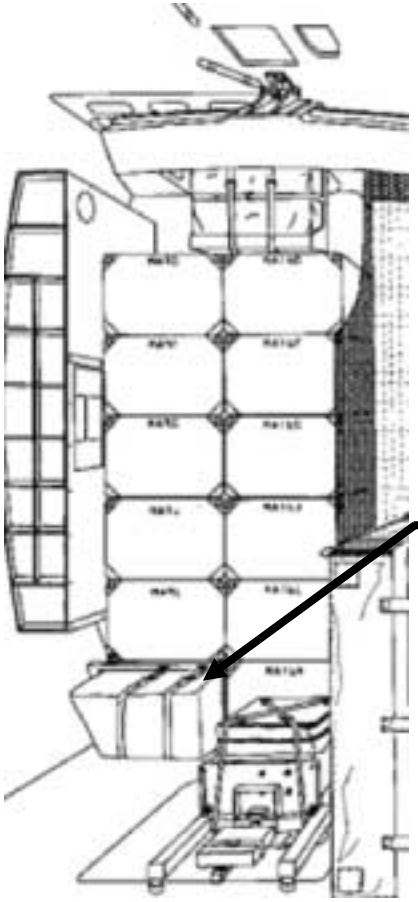
MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 18755 **MA9N Frame Configuration Change** Mission Kit MVO669A		X	X	03-25-000907-001B	7/29/02A	• Crew identified that the MA9N soft stowage bag frame interfered with MA16N locker door • Results in difficulty mounting the stowage bag frame and in opening/closing the locker door • This mod fabricated a new MA9N frame which increased the clearance to the adjacent locker by 3/16” • Additionally, added strengthening braces to the frame assembly to support the bag and eliminate an alignment problem with the installation toggle pin to locker MA9L (above) attach points • See next page
MCR 18755 **Crew Seat Manual Drive Mechanism Hex Cap Retention Mod** Mission Kit MVO225A			X	07-25-39129185-301F	9/26/02A	• Seat manual adjustment mechanism hex caps were recently found to be debonded prior on flight crew seats • Hex caps on all vehicles were rebonded at that time • Mod performed this flow installed a tape/decal to the hex cap to ensure it stays in place for proper operation of manual crew seat adjustment feature • Additionally, procedural changes have been taken to decrease the use of the manual adjustment feature • See following page

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

MCR 18755 MA9N Stowage Modification



VIEW LOOKING AFT - CREW MODULE MIDDECK

MA9N BAG AND FRAME LOCATION

TWO BRACES ADDED TO FRAME

(VIEW LOOKING OUTBOARD STARBOARD SIDE MID-DECK)

INTERFERENCE LOCATION

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

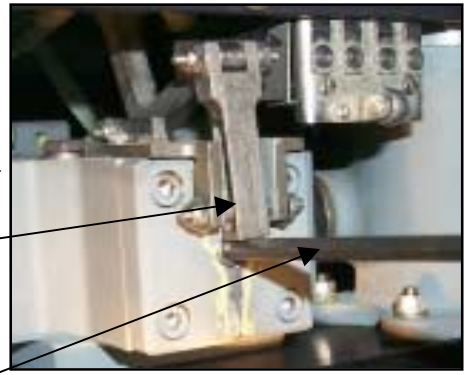
Organization/Date: Orbiter/10-31-02

MCR 18755 Crew Seat Manual Drive Mechanism Hex Cap Retention Mod

CDR/PLT LW Seat (seat back)

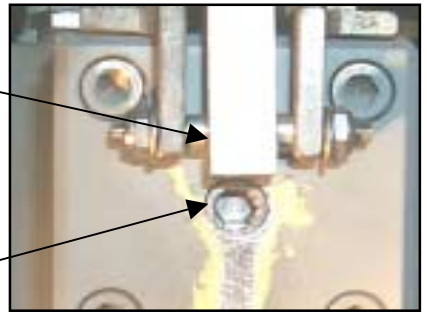
Retractable Cover

IFM Allen Wrench Seat Tool



Manual Vertical Drive Mechanism (Seat Cover Plate Removed)

Retractable Cover



Hex Drive
Tape decal applied over hex drive head

Manual Vertical Drive Mechanism

Manual Vertical Drive Tool Access (Rear of Seat)

Seat Cover Plate

113fpbu.ppt 10/29/02 12:40pm

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 19648 **Aft Fuselage Ballast Shim Retention Mod** Mission Kit MVO573A				N/A		• Laminated shims are installed between ballast slugs and the ballast container covers to provide a snug fit for the ballast slugs • During vehicle inspections following OV-103 flight 29, a laminated shim was found out of position, protruding outside the ballast container • Result of hardware tolerances and installation procedure • Shimming procedure has been improved and fasteners added to the ballast container cover to provide positive retention of the ballast shims
MCR 23070 **ET Cavity Ferry Door Attach Fitting Redesign** Mission Kit MVO074A		X		102-03-355130-001B	1/24/02A	• Recent post-flight and post-ferry flight inspections found fatigue cracking on the ET Cavity ferry door attach point 7 fitting • Modification installs a fitting at the unused attach point 8 location to reduce load and stress levels at attach point 7 • See next page

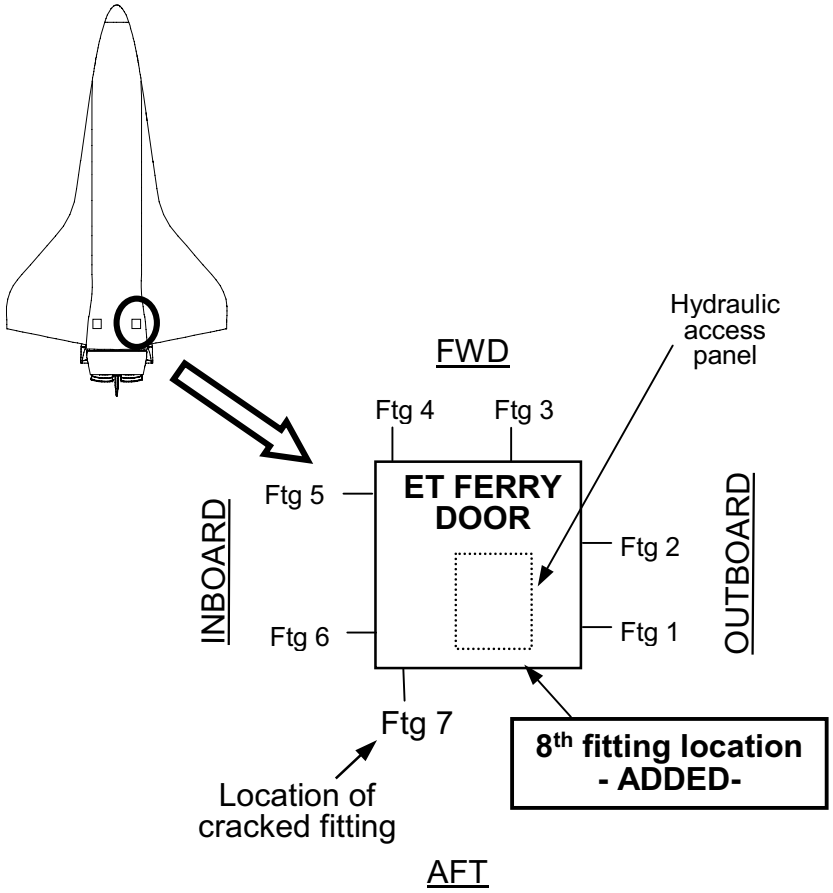
CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

MCR 23070 ET Cavity Ferry Door Attach Fitting Redesign

- Recent post-flight and post-ferry flight inspections found fatigue cracking on the ET Cavity ferry door attach point 7 fitting
  - Possible causes included ferry door installation preload and ferry flight loads
- Modification installs a fitting at the unused attach point 8 location
  - Reduces unsupported span of the ferry door and thereby load & stress levels at attach point 7
  - Also established shimming requirements at fitting locations 7 & 8 to reduce door installation preload



CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Modifications and Certification

Corrective Action Optional

MCR/Modification	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
MCR 23077 Forward Orbiter/ET Attach Fitting Stud Redesign		X		08-45-562001O	10/15/01A	• Recent post-flight inspection of the OV-103 forward ET attach point area revealed a crack in the attach fitting at a machined pocket for one of the multi-piece bearing plate fastener studs • Crack caused by point loading of the stud being reacted by the thin wall of the fitting's machined pocket • Mod replaces the current square stud design to an oval stud to better distribute the reaction forces and eliminate damage to the structure • See next page

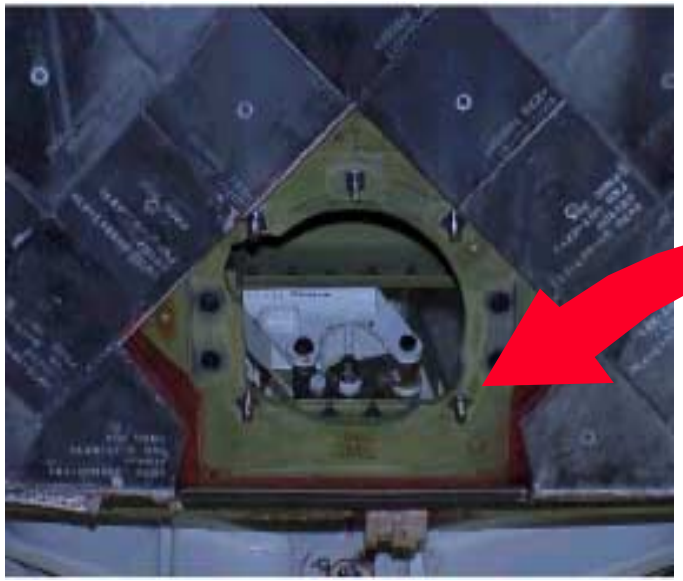
CONFIGURATION CHANGES AND CERTIFICATION STATUS

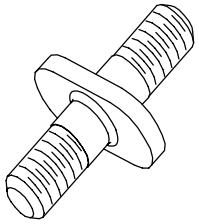
Presenter:

Organization/Date:
Orbiter/10-31-02

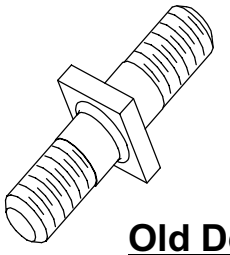
MCR 23077 Forward Orbiter ET Attach Fitting Stud Redesign

- Post-flight inspection of OV-103 following STS-102 found a crack in the attach fitting of the forward ET attach point
  - Current stud design can result in cracking during ground installation
  - Stud redesigned to alleviate concern





New Design
Eliminates stud point loading condition



Old Design

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Certification Updates

Operational Certification Changes

Certification Affected	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Waste Water Dump Line Performance When Dumping Water From CWC and/or PWR	X			04A-23-623000-001E	9/24/02A	• Provides certification for the dumping capability of the supply and waste water dump nozzles when water is dumped from a contingency water container (CWC) and/or a payload water reservoir (PWR) pressurized with cabin pressure only • Originally approved on the basis of a contingency operation • Successful contingency dumps were demonstrated on STS-55, STS-60, STS-104, STS-108 & STS-110 • Video taken on STS-110 also verified an acceptable spray pattern during CWC water dump
Pressurization of the Orbiter/ISS Stack With Nitrogen Through The ODS Transfer Panel		X		06-35-643051-001E	9/24/02A	• Documents certification for pressurization of the Orbiter/ISS stack with nitrogen through the Orbiter Docking System (ODS) transfer panel • The N2 transfer system is protected from a large leak of N2 into the ODS volume by a restrictor • N2 restrictor protects the crew from hypoxia concerns during pressurization

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Certification Updates

Certification Updates

Certification Affected	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
RCS Vernier Thruster Reboost Certification Update		X		24-11-467-0029-0001V	10/28/02A	• Certification update to document config 4 +X/VRCS duty cycles for one hour reboost sessions planned for STS-113
ODS TCS Blanket Certification Update		X	X	48-09-362000-001BM (Submitted 10-16-02)	10/30/02P	• EO to follow change ODS TCS blanket aluminized back cover with a vented beta cloth cover to prevent damage by air flow from external vent port • Certification update required
Coaxial Terminator Certification Effectivity Update		X	X	02-18-413-0045-0001B	10/2/02A	• Certification effectivity update for fleet coverage of the use of coaxial terminator in the UHF ATC transceiver system and in the GPS system combiner • Previous certification had only covered use in the tunnel adapter antenna UHF system • Terminator is a standard part certified for Orbiter use

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Certification Updates

Certification Deviations

Certification Affected	Certification Method			Certification Approval Request No.	Approval Date	Remarks
	Test	Analysis	Similarity			
Main Hydraulic Pump Certification Deviation		X		05D-30-281-0029-0002H	10/28/02A	• Certification deviation for DFL bolts used in main hydraulic pumps 2 & 3 and bolt insert pull-up condition • Inserts were X-rayed post-STS-111 and it was determined that thee was no change to their condition – acceptable to fly STS-113 • Previously processed for STS-111, flight effectivity has been updated to cover STS-113
OMS Engine Fuel Discharge Line Flange Bolt Certification Deviation	X	X		16A-12-621-0009-0001N	10/23/02A	• Certification deviation for MR configuration of higher strength bolts at lowered torque level • Previously processed for STS-111, flight effectivity has been updated to cover STS-113

CONFIGURATION CHANGES AND CERTIFICATION STATUS

Presenter:

Organization/Date:
Orbiter/10-31-02

OV-105 STS-113 Certification Updates

Certification Deviations / QSAs

Certification Affected	Certification Method			Certification Approval Request No.	Approval Date / Status	Remarks
	Test	Analysis	Similarity			
Window Thermal Pane Certification Deviation	X	X		21-07-390001-001L	9/26/02A	• Certification deviation documenting the rationale for accepting the potential of SRB BSM RTV particle impact on the Orbiter thermal window panes 1-6 • Cleared by test and analysis. Particle impact impact testing performed for larger particles (up to 0.25") and impact testing with applied dyna modeling derived scaling factors for smaller (100-850 micron) particles.
				21-07-390001-001L Errata	10/25/02A	• Errata to update OV-105 certified configuration
MPS Flowliner Certification QSA	X	X		01-10-271-0073-0001E (Submitted 10-22-02)	10/30/02P	• QSA to document interim cert updates for MPS feedline environment based on testing and analysis performed to date as part of feedline flowliner crack investigation
Single String GPS MAGR Certification QSA		X	X	01-18-473-0119-0001A	10/25/02A	• QSA certification of the single string GPS MAGR allowing operational use as a backup to TACAN and high-speed C-Band tracking

FIRST USE OF GPS SYSTEM FOR OPERATIONAL REDUNDANCY

Presenter:

Organization/Date:
Orbiter/10-31-02

- New flight rules (A2-301, A3-3, A3-201, A8-X, and A8-1001) approved at the 9/26/02 FRCB allows the use of GPS as an additional level of operational redundancy for:
  - Onboard TACAN LRUs
  - TACAN ground station
  - High-speed ground tracking (C-band)
- GPS system certified for 3-string operational use with the exception of the GPS preamplifier
  - Additional certification required to document operational usage of the single string GPS preamplifier
    - QSA for STS-113, STS-107 and STS-114 has been approved
    - Future CAR/CR update will be processed to cover permanent certification for operational usage
- Single String GPS Preamplifier hardware flown and utilized for flight development testing since 1996
  - 25 flights with no failures observed
  - CAR/CR 01-18-494-822-1017-001 certified the preamplifier for flight test use

	Presenter:
	Organization/Date: Orbiter/10-31-02

MISSION KITS BACKUP

STS-113 MISSION KIT MODIFICATION SUMMARY

Presenter:

Organization/Date:
Orbiter/10-31-02

6 Orbiter Mission Kit Related Modifications For STS-113:

- MVO074A ET Cavity Ferry Door Attach Fitting Redesign
  - Added eight attach fitting for ET umbilical cavity ferry door to eliminate cracking seen on fitting seven due to overload
- MVO225A Crew Seat Manual Drive Mechanism Cap Retention Mod
  - Assures mechanism cap stays in place for proper operation of manual crew seat adjustment feature
- MVO226A Mission Specialist 2 Seat 4 Egress Step Launch Configuration Change
  - Changes the seat egress step launch configuration from deployed to stowed based on crew preference
- MV0669A MA9N Soft Stowage Bag Frame Configuration Change
  - Eliminates interference with adjacent locker

STS-113 MISSION KIT MODIFICATION SUMMARY	Presenter:
	Organization/Date: Orbiter/10-31-02

6 Orbiter Mission Kit Related Modifications For STS-113:

- MVO573A Aft Fuselage Ballast Shim Retention Mod
  - Provides for positive retention of the ballast container cover to ballast slug(s) laminated shims
- MVO456A ET Umbilical Camera Configuration Update
  - Installed –306 GFE 16mm camera at LH forward position – incorporates camera mod allowing use of this camera configuration on any vehicle
- Reference also Configuration Changes and Certification Status backup charts for additional description

	Presenter:
	Organization/Date: Orbiter/10-31-02

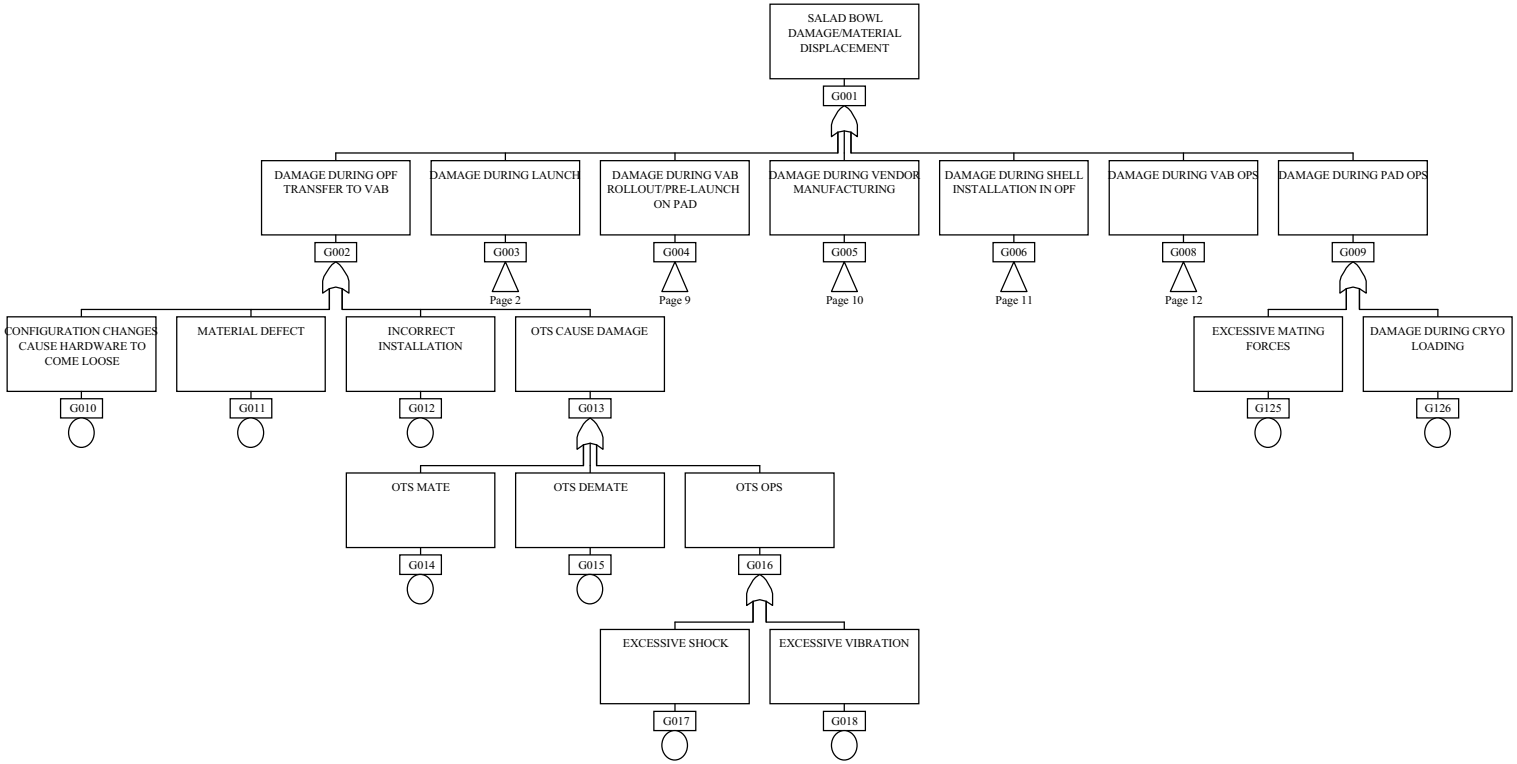
SPECIAL TOPICS BACKUP

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter:

Organization/Date:
Orbiter/10-31-02

TOP LEVEL FAULT TREE



ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE	Presenter: Doug White
	Organization/Date: Orbiter/10-31-02

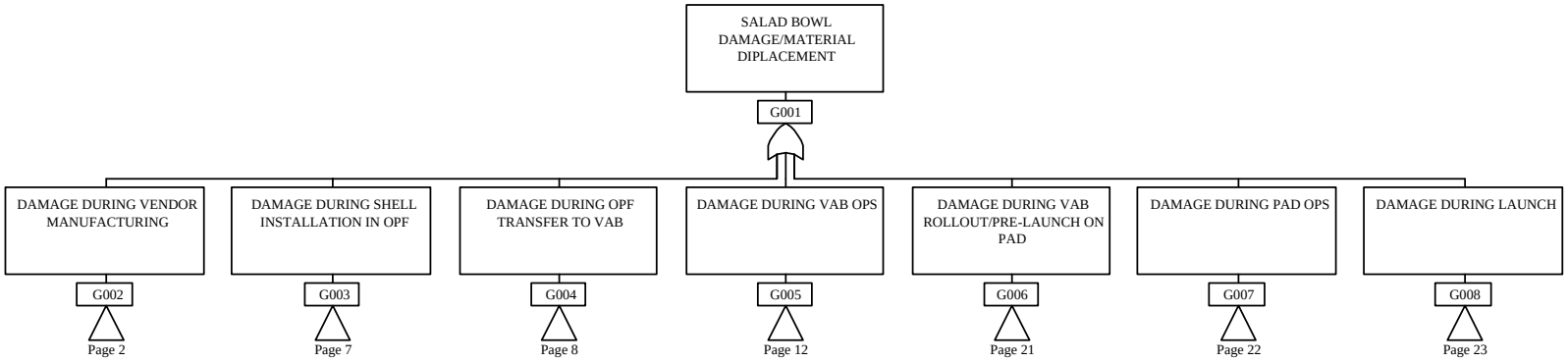
BACKUP

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter: Doug White

Organization/Date: Orbiter/10-31-02

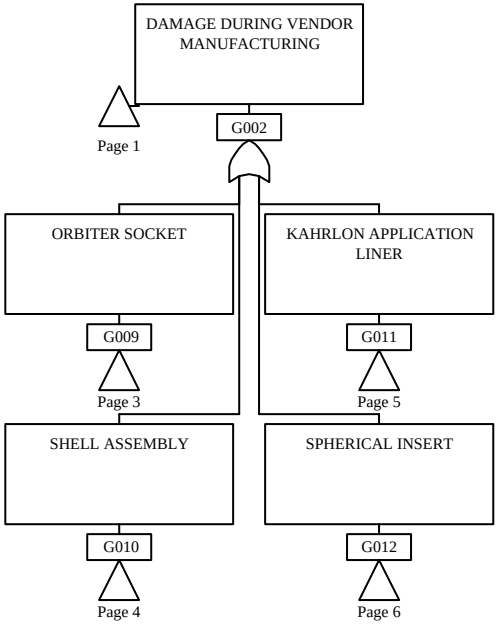
TOP LEVEL FAULT TREE



ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

Presenter:
Doug White

Organization/Date:
Orbiter/10-31-02



ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

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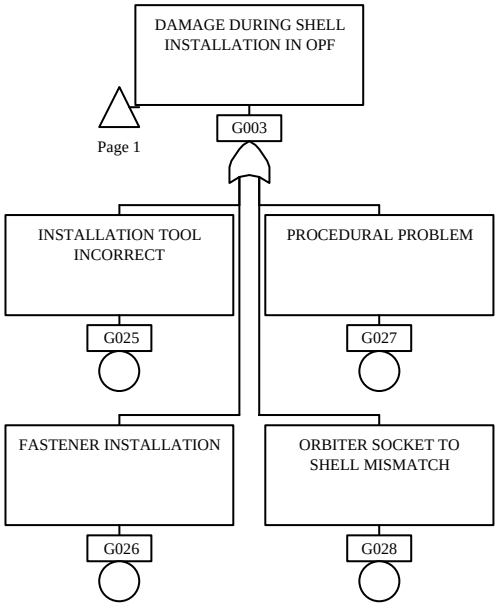
Organization/Date:
Orbiter/10-31-02



ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

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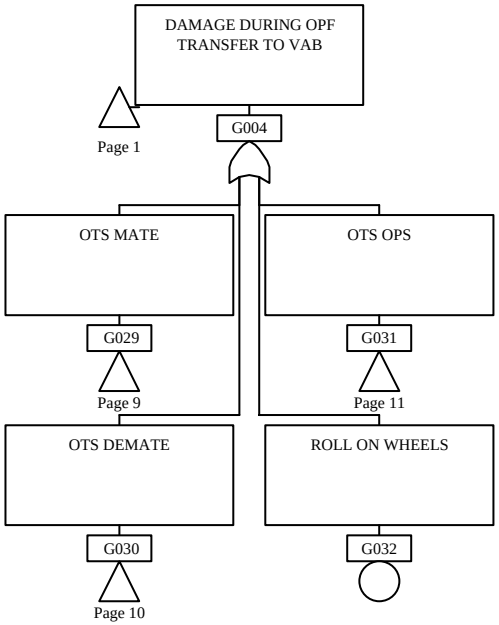

ORBITER/ET AFT ATTACH SHELL ASSEMBLY DAMAGE

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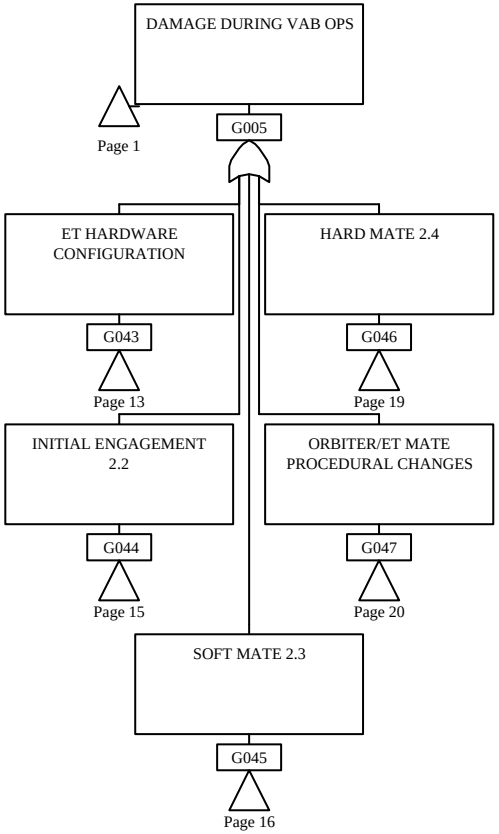

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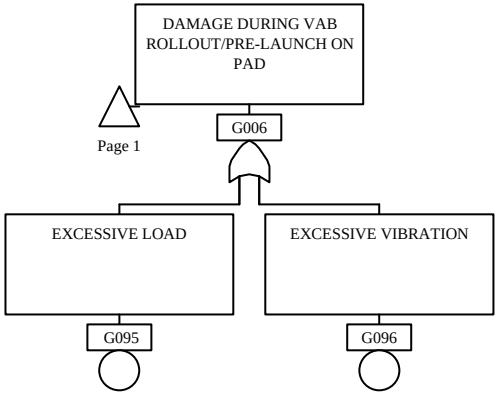

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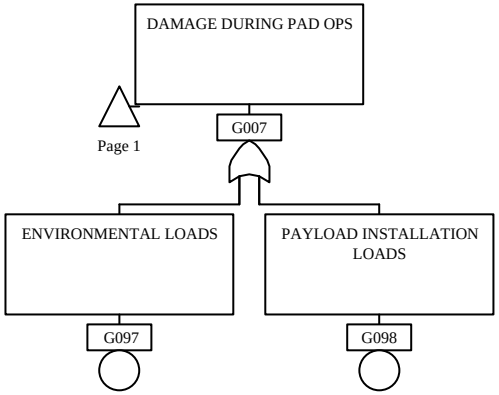

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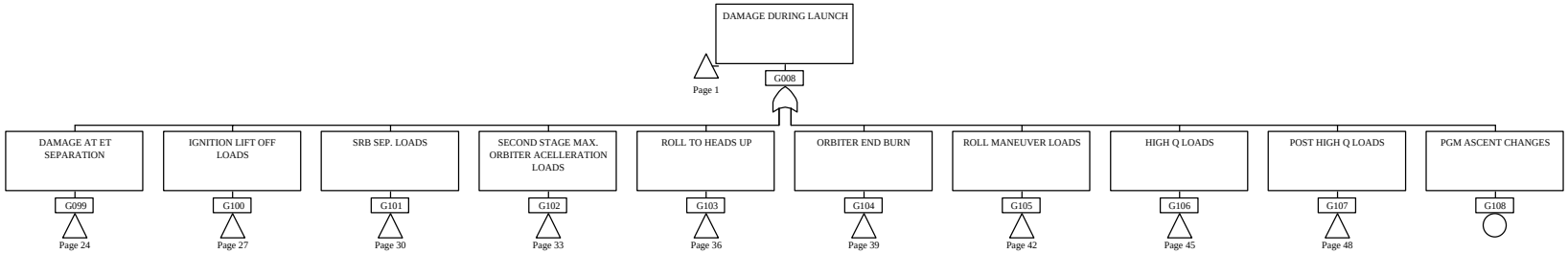
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Orbiter/10-31-02