FLIGHT READINESS STATEMENT
STS-109/ET-112
EXTERNAL TANK PROJECT
PRE-FLIGHT REVIEW

EXTERNAL TANK ET-112/STS-109, AS IDENTIFIED IN THE EXTERNAL TANK PROJECT PRE-FLIGHT REVIEW DATED JANUARY 29, 2002, IS CONSIDERED READY TO SUPPORT FLIGHT UPON ACCEPTABLE DISPOSITION OF OPEN/PLANNED WORK AND/OR OPEN ACTIONS.

N. E. OTTE/MP31

FOR J. BULLMAN/ED10

FOR P. M. MUNAFO/ED30

A. C. ADAMS/QS20

A. A. McCOOL/MP01

FOR P. K. McCONNAUGHEY/ED20

S. D. ROSE/ED40

FOR H. V. McCONNAUGHEY/TD60

J. W. SMELSER/MP31, CHAIRMAN

01/29/2002

Space Shuttle
External Tank

Pre-Flight Review

STS-109/ET-112

112PFR_4250.01/2002

LOCKHEED MARTIN

Agenda

Overview ***Dawn Diecidue***

Prior Mission Performance Summary

- ***STS-108/ET-111***

Current Mission/External Tank Highlights

- ***STS-109/ET-112***

Mass Properties Status

Changes

Senior Management Review NCD: None

Special Topics: None

SRM&QA Assessment

KSC Processing

Verification/Certification

Mission Unique Assessment

Readiness Statement

Appendices

Overview

This review for STS-109/ET-112 includes:

- Items specific to missions STS-109
- First time differences not previously flown and/or reviewed

FRR Series

• ET/SRB Mate Review	11/20/2001
• Michoud Operations President's Review	01/28/2002
• ET Project Pre-Flight Review	01/29/2002
• MMT Simulation	02/13/2002
• Space Shuttle Vehicle FRR	02/14/2002
• Pre-launch Mission Management Team Review	02/26/2002

Prior Mission Performance Summary

STS-108/ET-111, 12/04/2001 Launch Scrubbed Due to Weather Violations

System	***Performance***
• ***OMRSD***	• No ET violations
• ***LCC***	• No ET violations
• ***Instrumentation***	• Nominal performance
• ***MPS***	• Nominal performance
• ***ET Hazardous Gas***	• No ET violations
• ***TPS***	• No issues

Prior Mission Performance Summary

STS-108/ET-111, 12/05/2001 Launch

System	***Performance***
• ***OMRSD***	• No ET violations
• ***LCC***	• No ET violations
• ***Instrumentation***	• Nominal performance
• ***MPS***	• No ET issues
• ***ET Hazardous Gas***	• No ET violations
• ***TPS***	• No issues
• ***ET Disposal***	• Nominal

Prior Mission Performance Summary

STS-108/ET-111, 12/05/2001 Launch

System	***Performance***
• ***Film Review***	• GH2 vent line did not latch on the FSS latching mechanism
• Post Launch	– Vent line impacted the south side of the FSS structure preventing the latch back and caused substantial damage to the structure
	– Pieces of debris (bolts and clevis leg) were found on/in the grating and vent line structure
	– GUCP and 7-inch QD exhibited no damage and the poppet was intact
	– Investigation team findings
	– Review of film showed GUCP separation nominal
	• Pad B Vent Arm retract structure found to be 2 inches off-set (south) compared to Pad A
	• Trend for line to travel further south since incorporation of mods to reduce drop weight and add stiffer flex hose
	• NE wind 90° to vent line (2nd highest recorded)
	– Short term corrective actions have been identified
	• Remove 1-1/4 inch from sheave bracket for more clearance – Complete for Pad A
	• Remove vent line lift bracket (reduce potential for debris)

Prior Mission Performance Summary

STS-108/ET-111, 12/05/2001 Launch

System	***Performance***
• ***Orbiter Tile Damage***	• Lower surface hits forward of the MLG

	STS-108	Average
– Diameter > 1“	5	5
– Total	30	29

• ***Film Review***	• No ET related issues
• Post Landing	– Poor lighting conditions and image resolution

Mission/External Tank Highlights

STS-109/ET-112

Mission	***STS-109***
Launch	***02/28/2002***
• Window	6:48 a.m. – 7:50 a.m. EDT
• Pad	39-A
• Orbiter	Columbia (OV-102)
• Orbital Inclination	28.5 degrees/308 nautical miles
• ET Photo Coverage	• Crew photos from cockpit window • Umbilical well cameras
Mission Objectives	Hubble Space Telescope Servicing Mission
Landing	***KSC, 03/11/2002***
External Tank	***ET-112***
DD250 Acceptance	03/08/2001
Shipped to Launch Site	05/03/2001

Agenda

Overview
Prior Mission Performance Summary
Current Mission/External Tank Highlights

ET-112 Mass Properties ***Rick Spring***

Changes
Senior Management Review NCD: None
Special Topic: None
SRM&QA Assessment
KSC Processing
Verification/Certification
Mission Unique Assessment
Readiness Statement
Appendices

Mass Properties Status

STS-109 / ET-112

ET-112 Weighing

- ET-112 was weighed at MAF on March 6, 2001 using the Weigh Tronix weighing system
  - Predicted Weight 58,350 lbs.
  - As-weighed 58,506 lbs.
  - Delta to Predicted + 156 lbs.

Mission Planning

- MMC-ET-SE40, ET Project - Mass Properties Weight and Balance Report, was submitted March 7, 2001 to support mission planning
  - Coordination with Level II on January 21, 2002 indicates approximately 2,264 lbs. performance margin for STS-109

Agenda

Overview
Prior Mission Performance Summary
Current Mission/External Tank Highlights
Mass Properties Status

Changes

Senior Management Review NCD: None
Special Topic: None
SRM&QA Assessment
KSC Processing
Verification/Certification
Mission Unique Assessment
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Changes

- *Requirement*
  - None

- ***Process***
  - *Qualification of new flex hose liner (B02061)* — *Jimmy Hart*

- *Tooling*
  - New mandrels for LH2 tank circumferential weld tools — *Bill Jones*
  - Use of new LH2 tank ice/frost ramp mold *(H36809-492)* — *Bob Thorner*

- *Configuration*
  - Eliminate LH2 PAL ramp interference (B02074) — *Bob Thorner*
  - Resize LO2 tank ogive foam (B02044A / B)
    - Interim configurations previously presented and/or flown on for ETs 107-110 and ET-111
    - ET-112 configuration is mitigated foam thickness - Included in Appendix A, Minor Changes
  - LO2 Tank dome cap reallocation (J31208) — *Jeff Pilet*
    - Revised dome cap membrane thickness (B02035)
  - Repair LH2 line suspect burst discs (FEC KET-0077) — *Lynn Servay*

Qualification of New Flex Hose Liner (B02061)

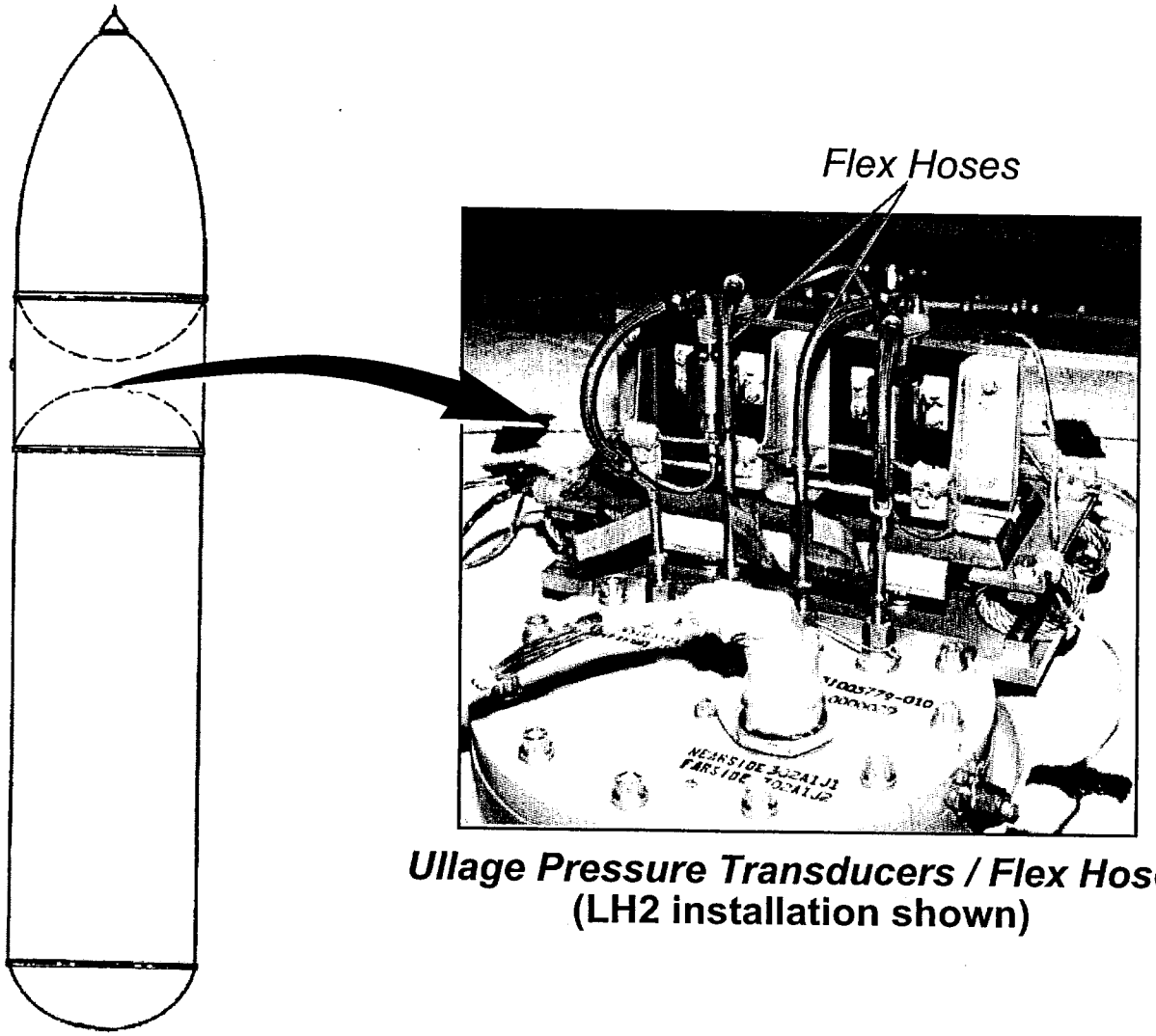
Change

- Supplier of LO2 (32L10) and LH2 (32L8) ullage pressure transducer flexible hoses revised manufacturing process used to fabricate convoluted Teflon line in hoses
  - Was
    - Teflon tube was helically convoluted at RT by putting straight tube over a convoluting mandrel and winding a stainless steel wire around the tube
    - The wire remained in place as the tube was removed from the mandrel and the assembly was placed in the oven and baked to set the convolutes
  - Now
    - Teflon tube is helically convoluted in a heated chamber where a die is used to form the outside diameter
    - The straight tube enters the chamber, is heated, and convoluted by the die

Background / Reason for Change

- Supplier exhausted supply of liner material used for 32L8 and 32L10 hoses
  - Original tooling used to produce hoses no longer available
- 32L8 and 32L10 hoses are identical in diameter and assembly
  - 32L10 hoses, used for LO2 ullage pressure transducers, are cleaned to more stringent requirement

Qualification of New Flex Hose Liner (B02061)



Ullage Pressure Transducers / Flex Hoses
(LH2 installation shown)

Qualification of New Flex Hose Liner (B02061)

Basis for Certification

- No change in material or dimensions
  - Only convoluting process changed
- No change in acceptance tests (leakage, burst and x-ray)
- Test - Random and Sinusoidal Vibration
  - Strength – No sign of damage from impact or fatigue
  - Leak – No degradation in the pressure decay
  - New hoses did not alter the response of the isolation platforms

Changes

- *Requirement*
  - None

- *Process*
  - *Qualification of new flex hose liner (B02061)* — *Jimmy Hart*

- ***Tooling***
  - *New mandrels for LH2 tank circumferential weld tools* — *Bill Jones*
  - *Use of new LH2 tank ice/frost ramp mold (H36809-492)* — *Bob Thorner*

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New Mandrels for LH2 Tank Circumferential Welds

Change

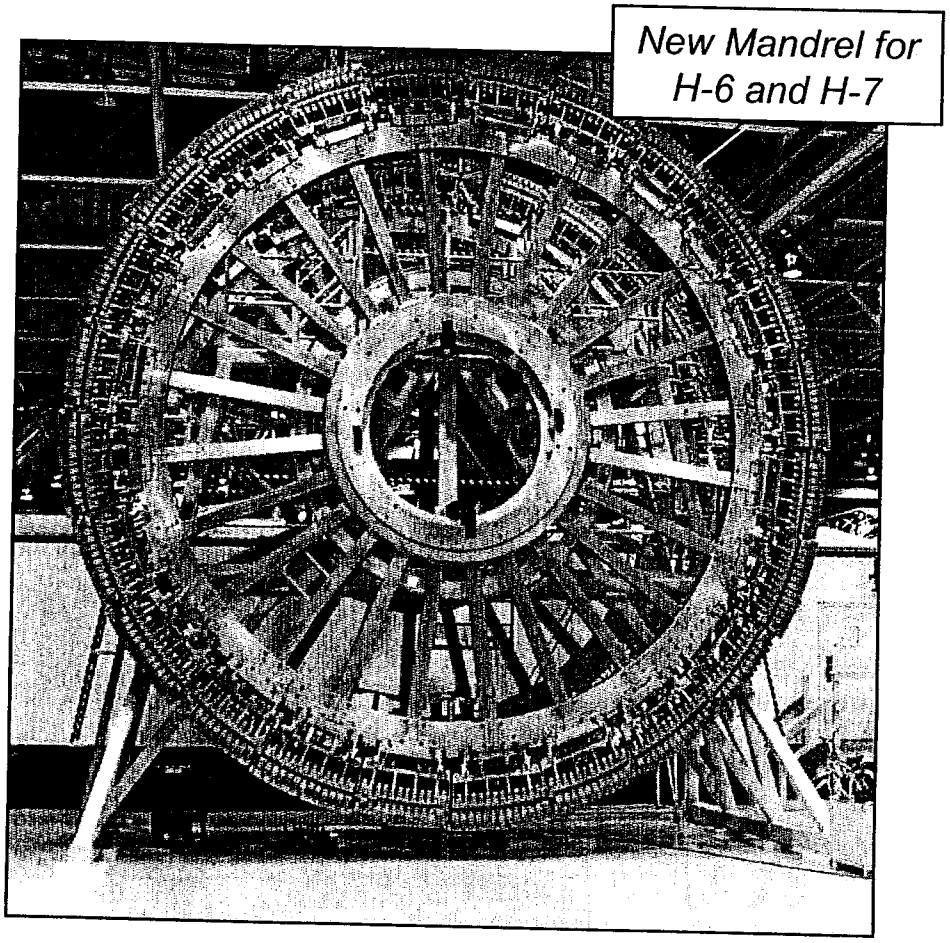
- Replaced one mandrel and added a mandrel on two LH2 tank major weld tools
  - Replaced purge box with static purge chamber
  - Modified tools to accept new weld process flow
    - Was: Welds H1 through H7 were performed on 5019
    - Now: Welds H1 through H5 performed on 5019 and welds H6 and H7 performed on 5068
      - 5069 tool modified to accept 3 barrel tank (shorter assembly)
- No change to weld processes or hardware configuration

Background / Reason

- Reliability / Producibility
  - Previous mandrel design had purge box that tracked with the torch to maintain a backside shield gas envelope
    - Purge interruptions due to the box resulted in weld defect NCDs
    - New mandrel static purge provides reliable back side shield gas independent of the torch position
  - Mandrel change allows parallel processing of tank barrels
    - Welds H1 through H5 on 5019 tool
    - Welds H6 and H7 on 5068
  - New mandrels have 60% fewer parts than old mandrels

New Mandrels for LH2 Tank Circumferential Welds

T05A5019



T05A5068

112PFR.4250.01/2002

New Mandrels for LH2 Tank Circumferential Welds

Basis for Certification

- Tool Mod Certification
  - Weld Schedule Certification
  - Full Size H2 and H3 Pathfinder Verification

- Flight Hardware Certification – Unchanged from prior vehicles
  - Proof test demonstrates minimum of 111% of design limit load
  - Post-proof inspection (Penetrant and X-ray)

Weld Performance Following Mandrel Change

- Production Cycle Time through the 5019 and 5068
  - Average for four previous tanks = 104 days
  - Average for current tanks = 93 days

- Non-Conformance Documentation
  - Average for four previous tanks = 45 items
  - Average for current tanks = 38 items

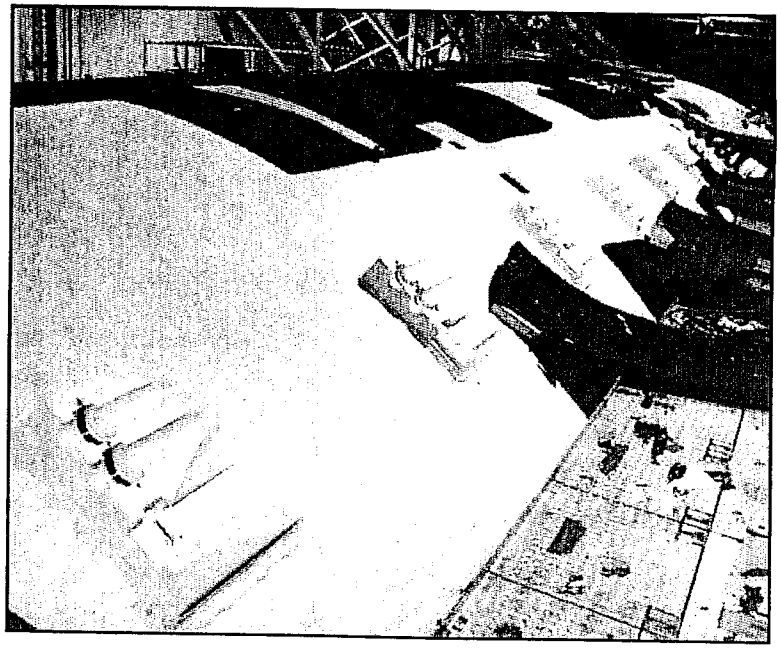
Use of New LH2 Tank Ice/Frost Ramp Mold

Change

- Revised ice/frost foam molds for the closeouts at each of the LH2 tank press. line / cable tray supports
  - Was: Mold used bag with PDL as barrier to retain foam
  - Now: Mold incorporated bladder to retain foam material
- Revised mold drawing to include minor foam dimensional change to accommodate the new mold (H36809-492)

Background / Reason

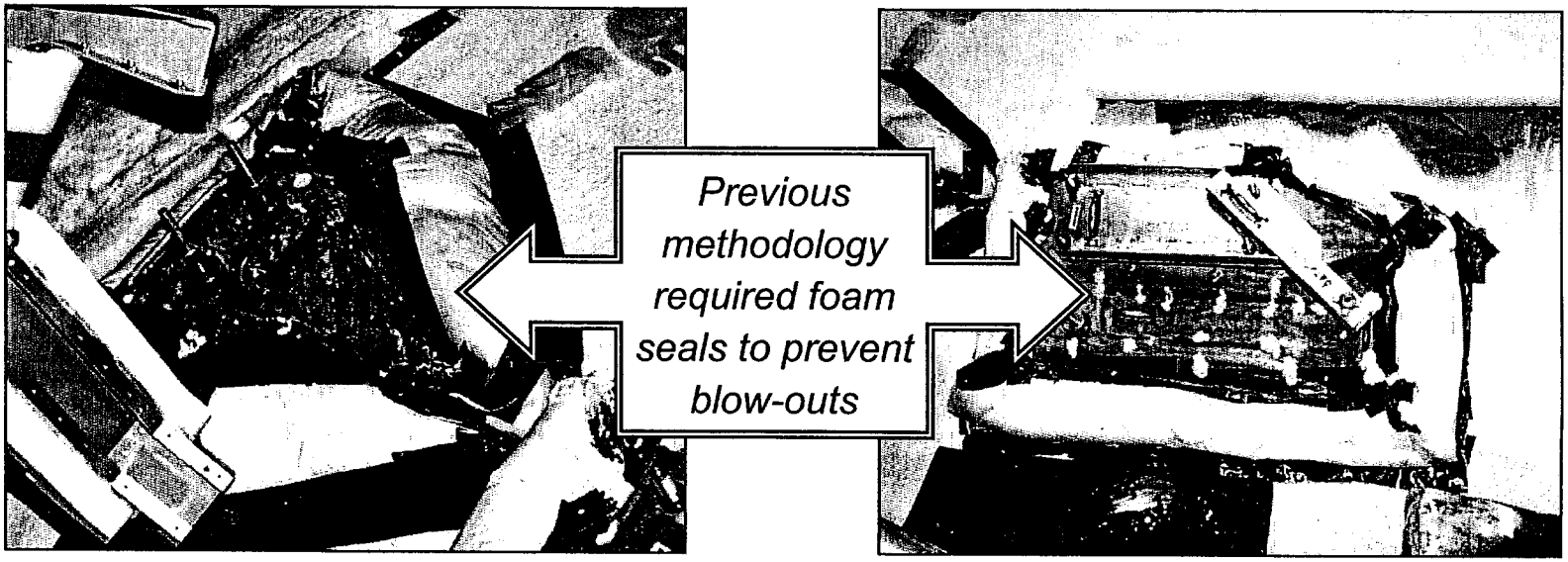
- Producibility change
  - New foam retention seal design reduces acreage foam damage
  - Eliminate rework and non-conformances
    - Average number of ice/frost ramp NCDs for 4 previous ETs = 16
    - Average number of ice/frost ramp NCDs for current tanks = 7.8
      - Saved over 250 labor hours, 24 critical path flow hours, and over $1,000 in material for ET-112



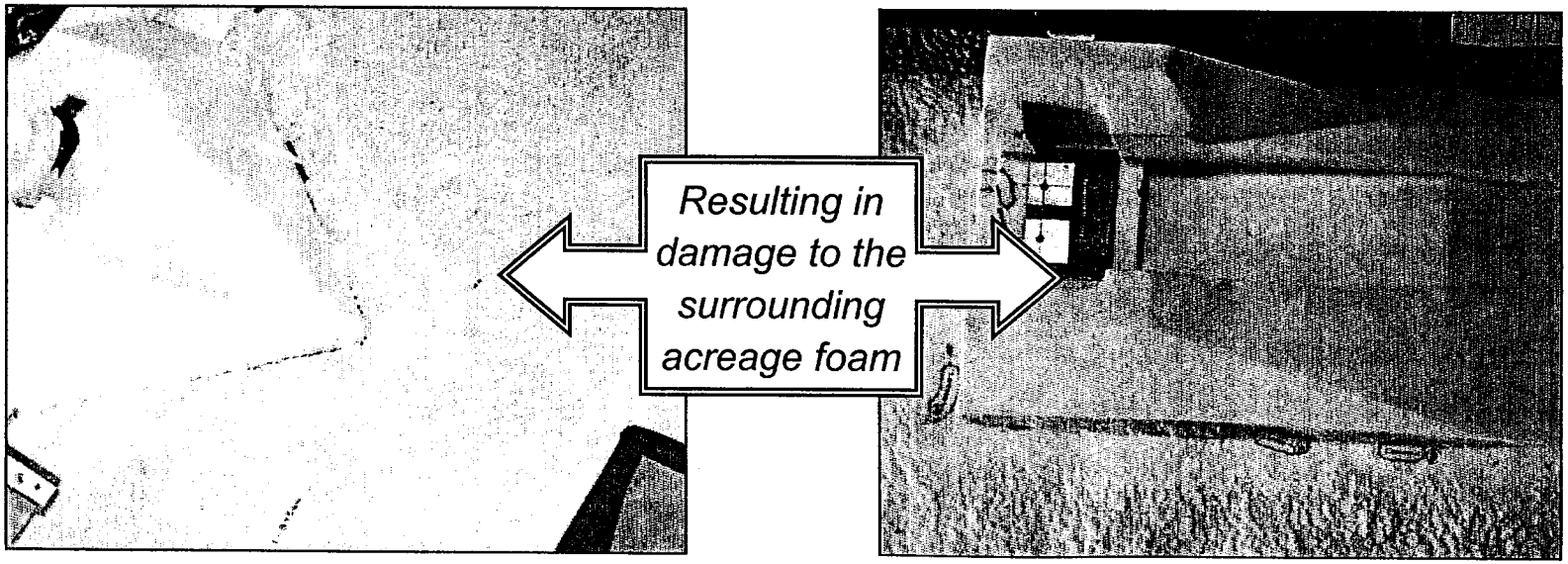
Ice/Frost Ramps

Use of New LH2 Tank Ice/Frost Ramp Mold

Prior Tool - Mold using bag with PDL as barrier to retain foam



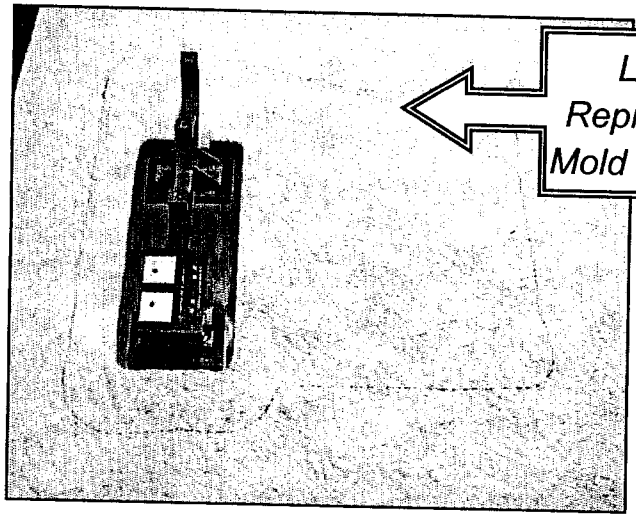
Previous methodology required foam seals to prevent blow-outs



Resulting in damage to the surrounding acreage foam

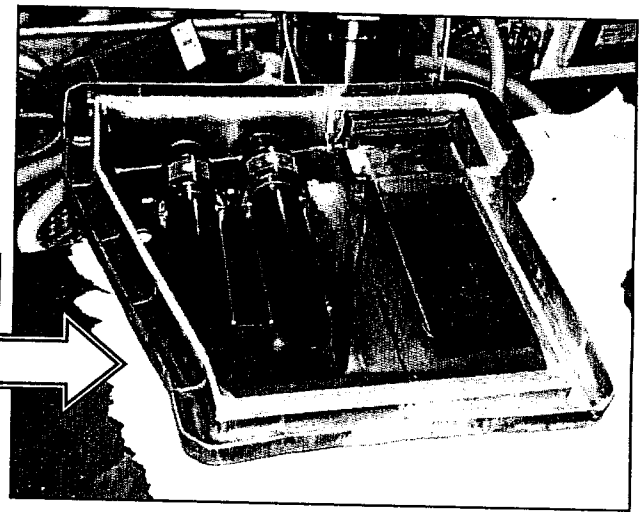
Use of New LH2 Tank Ice/Frost Ramp Mold

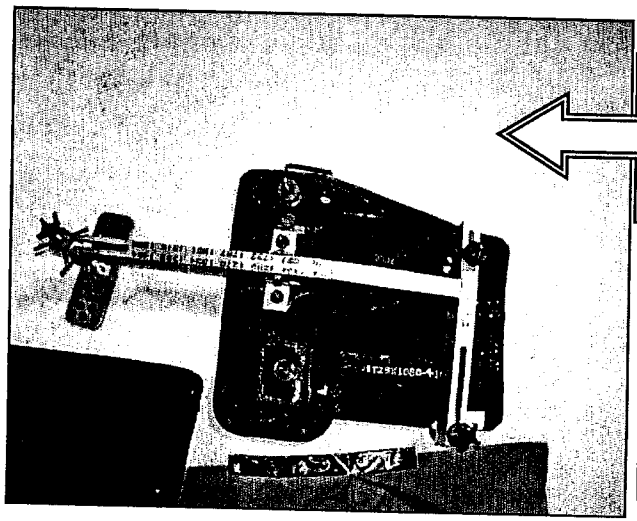
New Tool - Mold incorporated bladder to retain foam material



Layout Representing Mold Coverage

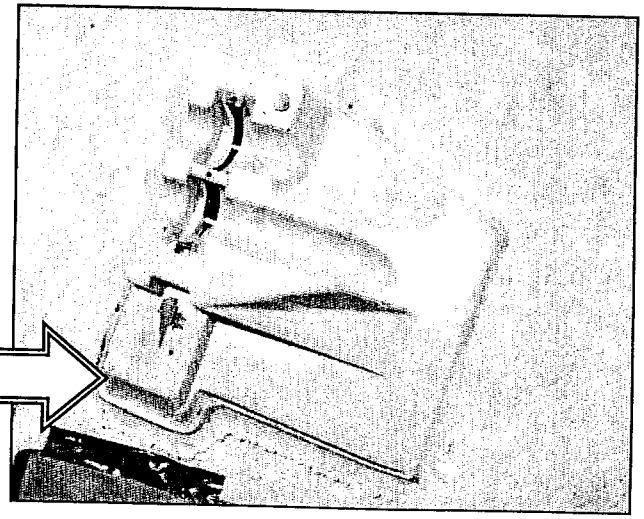
Bladder Tubes are Inserted into Slots



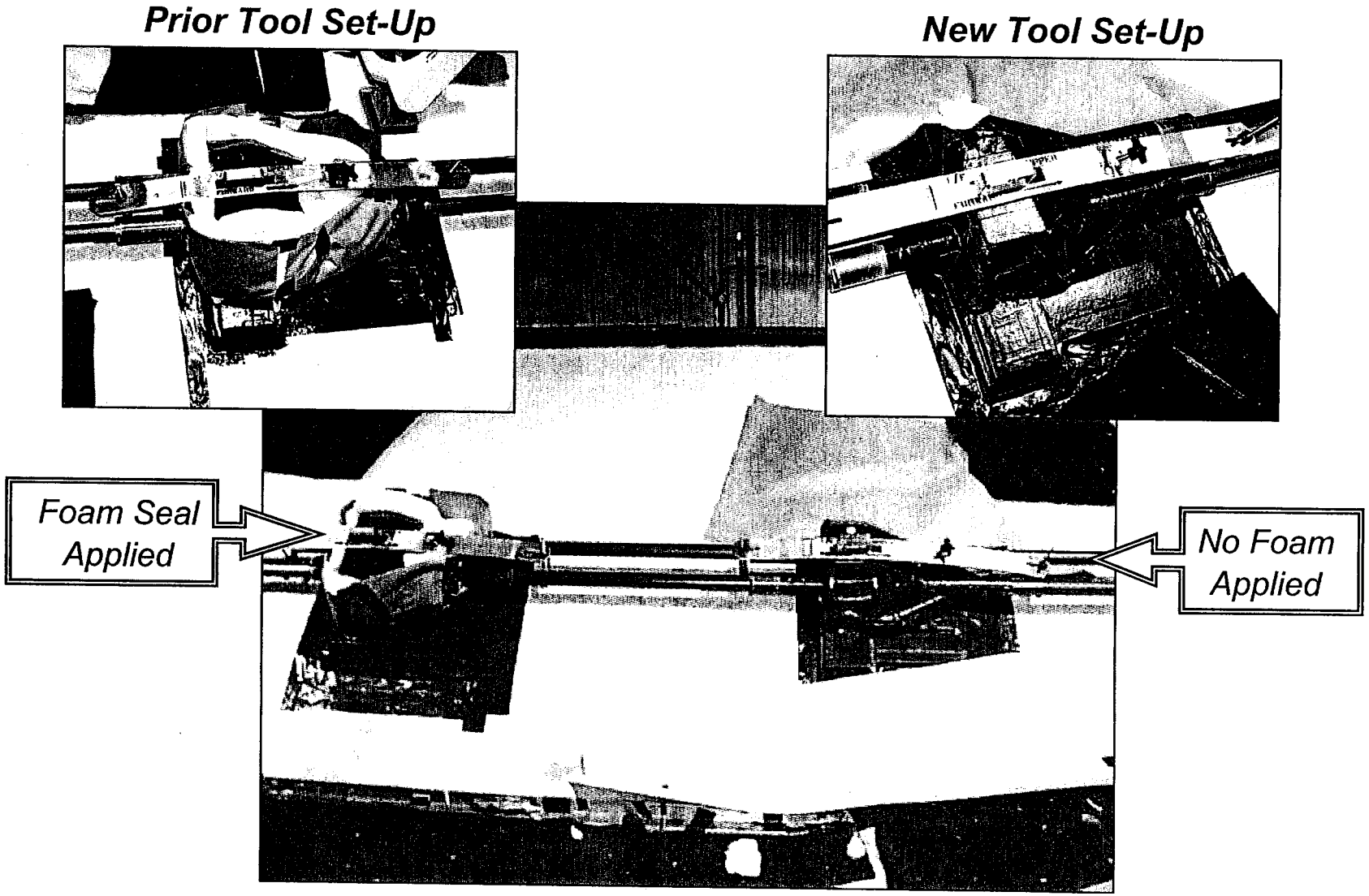


Mold Installed With Hold-Down Footer

High-Quality Final Product After Mold Removal



Use of New LH2 Tank Ice/Frost Ramp Mold



Use of New LH2 Tank Ice/Frost Ramp Mold

Basis for Certification

- Test - Molds were validated per engineering requirements
  - Two successive, successful applications that met bond adhesion, dissection and visual inspection requirements
- Similarity – Ramps using new mold design met existing engineering requirements
  - Verification of Shore "A" 70 hardness requirements
  - Dimension within existing mold schedule
  - No change to surface finish, moldlines or airloads

Changes

- *Requirement*
  - None

- *Process*
  - *Qualification of new flex hose liner (B02061)* — *Jimmy Hart*

- *Tooling*
  - New mandrels for LH2 tank circumferential weld tools — *Bill Jones*
  - Use of new LH2 tank ice/frost ramp mold — *Bob Thorner*

- ***Configuration***
  - Eliminate Potential LH2 PAL ramp interference (B02074) — *Bob Thorner*
  - Resize LO2 tank ogive foam (B02044A / B)
    - Interim configurations previously presented and/or flown on for ETs 107-110 and ET-111
    - ET-112 configuration is mitigated foam thickness - Included in Appendix A, Minor Changes
  - LO2 Tank dome cap reallocation (J31208) — *Jeff Pilet*
    - Revised dome cap membrane thickness (B02035)
  - Repair LH2 line suspect burst discs (FEC KET-0077) — *Lynn Servay*

Eliminate Potential LH2 PAL Ramp Interference (B02074)

Change

- Revised angular build dimension (and length) of the LH2 PAL ramp at Sta 1528 to preclude potential interference with ice/frost ramp

Background / Reason

- New mold used for ice/frost ramps on LH2 tank
  - Mold developed to reduce acreage foam damage during mold removal
  - New mold produced ramps built to high side of the dimensional tolerance
    - Identified a potential condition wherein the LH2 PAL ramp if applied to current dimensional requirements could overlay onto the forward surface of the ice/frost ramp at Sta 1528
    - Potential for interference existed since ET-1

Documentation Impact

- Revised ICD to eliminate potential interference

Basis for Certification

- Analysis - LH2 PAL ramp angular dimension change certified by aero analysis
  - No change to airload methodology

LO2 Tank Dome Cap Reallocation (J31208/B02035)

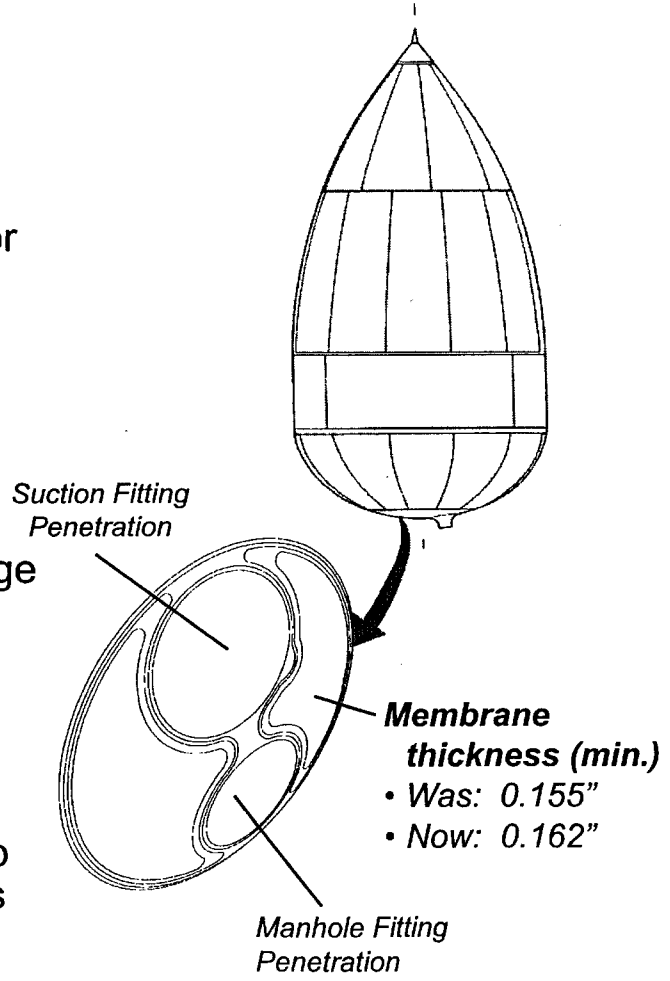
Change

- Reallocated ET-115 (as-planned) LO2 tank dome cap to ET-112 LO2 tank aft dome (as-built)
  - ET-112 dome cap needed for ET-102 due to welding issues with ET-102 as-planned dome
  - Dome cap acreage membrane thickness increased for ET-115 and subs (+8 lbs)
    - Basic cap design configuration is unchanged (i.e. material, weld land widths, weld land thickness)

Background

- SSP (Level II) requested External Tank certification to higher maximum LO2 tank ullage pressure operating range (expansion of ICD requirements)
  - ICD pressure increase required to allow the Orbiter fleet to use any combination of spare GO2 fixed orifices beginning at ET-115

- Certification to the higher pressures required increases to the LO2 proof test pressures, barrel membrane thickness and dome cap membrane thickness
  - Barrel design and proof pressure changes to be implemented (as planned) and presented at ET-115 readiness reviews



LO2 Tank Dome Cap Reallocation (J31208/B02035)

Basis for Certification

- Similarity
  - Basic dome cap design configuration is unchanged from previous design
    - Only change is increase in membrane thickness

- Test
  - Proof test demonstrates a minimum of 120% of design limit load

- Analysis
  - Stress analysis shows improved Factors of Safety for redesigned cap implemented at ET-112
    - Proof and flight pressure requirements are unchanged at ET-112

	Was	***Now***	***Required***	***Failure Mode***
Proof	1.00	1.05	1.00	Yield Strength
Flight	1.53	1.60	1.26	Ultimate Strength

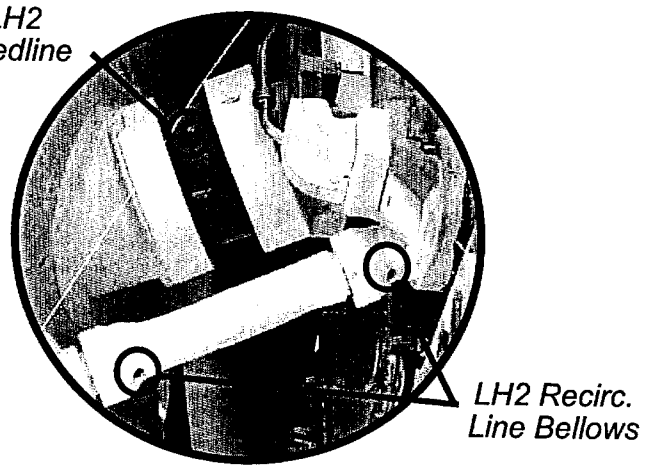
Repair Suspect LH2 Line Burst Discs (FEC KET-0077)

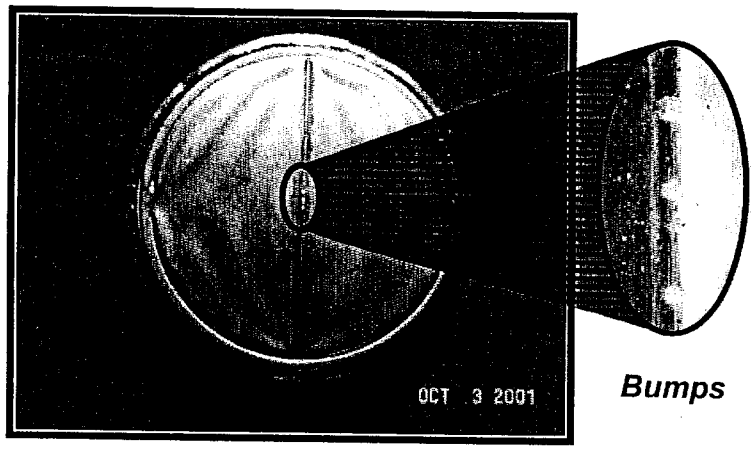
Change

- Implement a repair on suspect burst discs to prevent suspect leakage

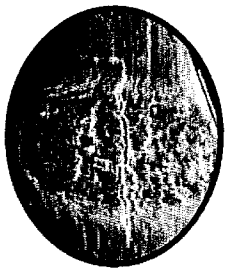
Background

- Burst disc is a safety feature on jacketed lines to prevent hardware damage due to annulus over-pressure
  - Three burst discs are installed on each ET
- During a supplier ATP burst discs leaked
  - Leakage at microscopic cracks observed on the part during failure analysis
  - Cracking observed only on small "bumps" in the center of the disc





Bumps



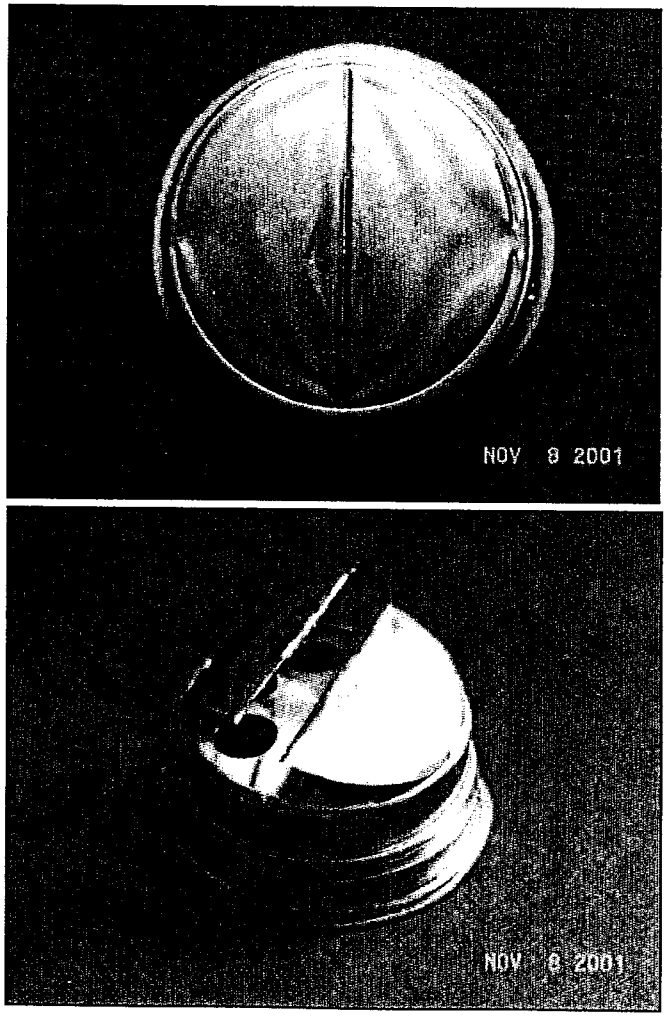
Typical Crack
Approx. 0.008" in length

112PFR.4250.01/2002

Repair Suspect LH2 Line Burst Discs (FEC KET-0077)

Repair Method Verification

- Cleaning and application methods were validated on available burst disc assemblies
  - Performed through burst disc shield
- Repaired a total of 17 burst discs per established procedure
  - All repairs witnessed/verified by quality representative
  - Six discs had known leakage
  - Eleven had no leaks
- Performed 13 simulated operational cycles on each of the 17 discs
  - Demonstrated the ability of repair to eliminate / prevent leakage on hardware
  - No leakage was detected during testing
- Verified burst pressure all discs
  - All burst within ATP requirement of 35±15 psid



Repair Suspect LH2 Line Burst Discs (FEC KET-0077)

Basis for Certification

- Test
  - Method to repair remaining suspect burst discs using Conathane primer developed and validated
    - Repair prevents leakage of burst disc during operations
    - All materials are approved for use on ET flight hardware
    - Testing demonstrated that Conathane repair does not affect the burst pressure of the disc

- Repair presented to and approved by PRCB *11/19/2001 (S061766)*
  - Repair on STS-109/ET-112 complete

Agenda

Overview
Prior Mission Performance Summary
Current Mission/External Tank Highlights
Mass Properties Status
Changes: No significant items
Senior Management Review NCD
Special Topic: None

SRM&QA Assessment ***Terry McKeough***

KSC Processing
Verification/Certification
Mission Unique Assessment
Readiness Statement
Appendices

SRM&QA Assessment

as of 01/23/2002

Item	***Status***
• ***ALERTS***	• None
• ***MRB Assessment***	• Complete - No issues/no impact to hazard controls
• ***Hazard Assessment***	• Complete - All hazard reports were re-assessed and hazard controls verified
• ***CIL Retention Rationale***	• Complete - No issues/no impact to CIL retention rationale
• ***Corrective Action Problem Summary (CAPS)***	
• S-087, ET-117 LH2 tank orthogrid rib cracks	• ET-112 Cleared – Closure submitted to MSFC, 11/26/01

Agenda

Overview
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Special Topic: None
SRM&QA Assessment

KSC Processing — *Brian Knipfing*

Verification/Certification
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KSC Processing

as of 01/23/2002

Discrepancy Reports (DRs)/Problem Reports (PRs) Review

- PR/MRB discrepancies/dispositions similar to previously flown vehicles
  - All KSC/MRBs have been reviewed by MAF Reliability for potential SMR
  - No items were elevated to the SMR

Limited Life Component/ET Status

- All within required life through scheduled launch date plus 90 days except for pyrotechnic device installed in the GUCP separator assembly
  - Pyrotechnic device expired 4 year lot certification on January 27, 2002
    - Lot re-certification test complete in December 2001 – Pending paper closure

OMRSD Exceptions/Waivers

- None

KSC Processing - Status

as of 01/23/2002

Changes

- ET modifications

– Mod Kits	0	
– DC&R	0	
– Bldg 45	0	
– FEC	1	Repair suspect LH2 line burst discs (KET-0077) *
– OMRSD	2	HGDS 2000 Mods (KT15701 and KT15702)
– LCC	1	HGDS 2000 Mods (1078R01)
– Facility	1	HGDS 2000 Mods
– Software	0	

SIM Launch (S0044) *Complete 01/18/2002*

SIM Load (S0056) *02/05/2002*

* *Previously presented with Changes*

OMRSD, LCC and Facility Changes - HGDS 2000 Mods

RCN KT15701/KT15702 and LCN 1078 R01

Change

- Replace existing Prime and BU HGDS (Hazardous Gas Detection Systems) with the new HGDS 2000 on MLPs
  - New system consists of two turbo pumped mass spectrometers and a common sample delivery system
    - Designed to provide improved qualitative and quantitative gas content data for various areas of the Orbiter, ET and Umbilicals
    - New equipment has higher flow rates, quicker response time, higher resolution and higher reliability
  - Eliminates references to MSIDs (Measurement/Stimulation Identifications) in OMRSD/LCC
    - Required update to MAF and HOSC data displays
- No changes to Haz Gas limits

Background

- New system designed and manufactured by a joint NASA / Contractor team to replace existing systems

Rationale for Acceptance

- Successfully prototyped and running in parallel with the existing systems for the four previous launches
  - MAF and HOSC have validated the display mods – No issues

Agenda

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Special Topic: None
SRM&QA Assessment
KSC Processing

Verification/Certification Readiness Statement

Dawn Diecidue

Appendices

- A: Minor Changes
- B: SRM&QA Assessment
- C: KSC Processing
- D: Level II Waivers/Level III Deviations
- E: Previously Presented Items

Verification/Certification

as of 01/23/2002

Item	***Status***
NSTS 07700, Volume X, Book 1, Baseline	
• Revision M, Change 280	**Complete - No issues**
Certification Documentation	
• Certificates of Qualification (COQ)	**No new items**
• Hardware Certification Sheets (HCS)	**Complete - No issues**
– Revise flexible hose liner process (B02061)	
• E007F, LH2 Ullage Pressure Transducer Installation	
– Revise LH2 tank PAL ramp configuration (B02074)	
• T503V, Ice/Frost Foam (PDL-1034)	
• T504V, Closeout Foams (SS-1171)	
• T507V, Closeout Foams (BX-250)	
– Revision to LO2 tank ogive foam thickness (B02044B)	
• T501N, Acreage Foam	
• T503M, Ice/Frost Foam (PDL-1034)	
Deviations/Waivers	**No new items**

Mission Unique Assessment

as of 01/23/2002

Review of MRB actions using updated loads

MPS Preflight Prediction Package

STS-109/ET-112

No new loads or environments requiring assessment have been identified at this time

ECD 02/18/2002

Readiness Statement

The External Tank, ET-112, is certified and ready for STS-109 flight pending completion/closure of open and planned work

Appendices

A: Minor Changes

B: SRM&QA Assessment

- NCD Assessment Criteria

C: KSC Processing

- PR/MRB Summaries
- ET-112 Modification Status
- Limited Life Component Status
- OMRSD Exceptions/Waivers: None
- Software Changes: None

D: Level II Waivers/Level III Deviations

Appendices

A: Minor Changes

B: SRM&QA Assessment

- NCD Assessment Criteria

C: KSC Processing

- PR/MRB Summaries
- ET-112 Modification Status
- Limited Life Component Status
- OMRSD Exceptions/Waivers: None
- Software Changes: None

D: Level II Waivers/Level III Deviations

Minor Changes

- Changes for Presentation
  - *Type I Documentation*
  - *Requirements*
  - *Configuration* (affects part interchangeability)
  - *Materials* (requires SE16 revision)
  - *Technical Changes to Processes* (STPs)
- Changes for inclusion in Appendix
  - *Minor configuration* (affects part interchangeability)
  - *Minor updates* - Does not affect part interchangeability, materials or processes
    - Revise point of incorporation
    - Drawing clarification
    - Non-flight hardware installation/removal
    - Datum changes
    - Update usage/List of Materials
    - Drawing incorporation errors
    - Manufacturing aid
    - Drawing errors
    - Fastener type/grip
    - Producibility
- Update vendor list
    - Laboratory test procedures
    - Materials
- All Class I and Class II changes have been reviewed by the MSFC Resident Office
- All Class II STP/STM/Standard/Code sheet changes have been submitted to the MSFC Materials, Processes and Manufacturing Department for concurrence

Resize LO2 Tank Ogive Foam Thickness (B02044A B)

Change

- Resized foam thickness on LO2 tank ogive (B02044A / B)
  - Decreased minimum net sprayed foam thickness on the +Z LO2 tank

Background

- Analysis showed that thick foam on the +Z LO2 tank adjacent to Station 536 O2 weld could crack during tanking as a product of a negative contour deviation
  - Foam thickness reduced for tanks with potential condition (ETs 102, 107-110)
  - Reduced foam thickness caused violation of NSTS 07700, Vol. X 95% launch probability requirement
- Foam thickness increased for single effectivity (ET-111) until mitigation plan was developed
  - ET-111 verified to have no contour deviations

Reason

- Reliability
  - Adequate foam thickness to eliminate waiver to NSTS 07700, Vol. X

Documentation Impact

- Revised EIS to reflect weight impact of -9 lbs
- Revised HCS to reflect new part numbers
- Revised ICD to reflect new foam configuration

Basis for Certification

- Analysis
  - Thermal:
    - No increase to design ascent temperatures/FS unchanged
    - 95% launch probability maintained with decreased foam configuration
    - Reentry requirements maintained
  - Propulsion: LO2 mass requirement maintained
    - Negligible impact due to heat load change
  - Aero: No impact to aero waviness requirement

Minor Changes

Change No.	Discipline	Description
H36809-317	TPS	Corrected minor Intertank foam machining drawing differences with Cell "L" machining program
H36809-367	Structure	Revise method for stowing purge line flex hose in nose cone compartment. STP for stowing electrical wire harnesses incorrectly called out on drawing
H36809-350	Structure	Lower allowable stresses require that peaking and mismatch limits be revised for OB1-4 welds. OB welds are considered "at risk" therefore requiring post proof x-ray for the full length of the weld
H36809-382	Electrical	Added note to allow gap of .005" max between flat faying surfaces of the LO2 aft sensor mast. Build tolerances of the mast surfaces can violate STP 2014. Gap is acceptable due to low loads
H36809-395	Structure	Added shim requirement to clip mounted on crossbeam to prevent fastener shanking due to machining mismatch on support fitting
H36809-401	Propulsion	Drawing correction - Revised cleaning spec notes for GH2 vent valve actuation and sense line assemblies. Assemblies specified different types and classes of cleaning specs. MPP correctly specified type and class
H36809-408	Structure	Revised weld inspection requirements to clarify start / stop locations of the O1 weld and post proof radiographic inspection angle criteria – Previously flown vehicles reviewed and dispositioned by TSB and FCB
H36809-505	TPS	Remove requirement contradiction from LO2 PAL ramp. Note 3 gives a test core spacing which differs from drawing field dimensions
H36809-562	Structures	Revise ET Vent Area drawing to correct drawing numbers called out in error
H50001-817	TPS	Added note to drawing to designate that the fairing assembly has areas designated as a future TPS closeout at a subsequent assembly

Minor Changes

Change No.	Discipline	Description
H50001-820	TPS	Revised Post Build Acceptance Criteria (MAF and KSC) to show acceptable SOFI defects on the LH2 barrel foam that fall below minimum foam thickness and around LH2 ice/frost ramps and LO2 feedline support closeouts
J31218-000	Structures	LWT to ET number conversion

Minor Changes – STD/STM/STP/AVL

Change No.	Document	Description
H36809-627	74L4 STD	Revise minimum lead wire length on the LH2 sensor to ensure consistent splice location and to enhance LH2 aft dome during sensor installation. Inconsistency was caused by the introduction of the shock mount design for SLWT. Previous version of the STD provided for a minimum of 36 inch lead wire, some sensors were longer (longer allowed by spec since it only called out a minimum).
H36809-601	STP 1510 App STP 1522	Revise witness panel size from 6" x 12" to 4" x 12" – Provides more representative area for material testing
H36809-680	809-3501	▪ Added an AVL list with current suppliers ▪ Replaced FED-STD-751 with ASTM D 6193 ▪ Deleted extraneous references to ASTM D 6193
H36809-696	MCS App K255	Revise material code sheet appendix to Turco Products to Henkel Surface Technologies
H36809-702 H36809-703 H36809-733	MCS App F144 MCS App F250 MCS App F145	Replace Chemplast, Inc with St –Gobain Performance Plastics
H36809-716	MCS H1A1 and App	Replace Burlington Glass Fabric with BGF Industries
H36809-720	MCS App Y933	Replace Clean Room Products with KNF Clean Room Products. Add new vendor – Richmond Technology, Inc.

NCD Assessment Criteria

Assessment of all MRB Items

- Adequacy of technical dispositions
- Completeness of required repair/retest
- First time occurrences/SMR
- Verification of margin of safety assessment/documented
- Review of impact to hazards
- Engineering review for impact to loads
- Engineering review for reduced extrusion to plate weld allowables

ET-112 DR/PR/OMRSD Waiver/Exceptions

as of 01/23/2002

System	Discrepancy	Problem	MRB Items	Exceptions/ Waivers
• Electrical	1	0	0	0
• Propulsion/ Pneumatics	0	0	0	0
• Structures	0	4	0	0
• Thermal (TPS)	2	10	3	0
Total	3	14	3	0

ET-112 PR/MRBs

as of 01/23/2002

PR No./Status	Title/Description	Disposition
ET-112-TS-0004	Five areas on the +Y thrust panel circumferential rib tops were noted to be inadvertently vented at MAF	MRB approved to use as is • Previous test data which indicates venting at this location does no harm
ET-112-TS-0008	Hygrothermograph failed during cure on aft fairing TPS closeouts – Missing data	MRB approved to use as is • TPS closeout cure met all engineering requirements
ET-112-TS-0009	Voids in forward peripheral TPS closeout on –Y aft fairing	MRB approved to use as repaired • Repair with PDL created additional bondline • Additional bondline will not affect closeout peformance

ET-112 KSC Modification Summary & Status

as of 01/23/2002

Item	Title	Status
FEC KET-0077	LH2 feedline/recirculation line burst disc repair	Complete – 12/03/2001

ET-112 Limited Life Components

Cycle Sensitive

Description	Part No.	Serial No.	Limit	Required	Remaining
LH2 Manhole Cover Assy	80914081488-509	0000986250	14	2	14
LO2 Tank Mechanical Assy	80912002000-500	0000979730	14	2	14
LH2 Tank Mechanical Assy	80914002000-509	0001045570	14	2	14
LO2 Manhole Cover Assy	80911001205-509	0000986160	14	2	14
LO2 Fwd Ogive Cover Plate	80911001207-509	0000987500	14	2	14
LH2 Manhole Cover Assy -Aft	80911001444-509	0000986220	14	2	14

ET-112 Limited Life Components

Age Sensitive

Description	Part No.	Serial No.	Limit	Initiation	Expiration
External Tank	80901010000-509	00000105	6 Yrs	03/2001	03/2007

Age Sensitive Pyrotechnics - 10 Years Life/Requires Lot Verification Tests After 4 and 7 Years

Description	Part No.	Lot No.	Serial No.	DLAT*/Retest	Expiration
Separator Assy GUCP	PD5000020-059	AAH	0001174	12/18/2001 **	12/18/2004
Cartridge Assy	PD5000020-030	AAH	0001365	12/18/2001 **	12/18/2004
Cartridge Assy	PD5000020-030	AAH	0001366	12/18/2001 **	12/18/2004

** Destructive Lot Acceptance Test*
*** Pending paper closure*

Level II Waivers - Baseline

Document / Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700, Volume X, Book 1, Space Shuttle Flight and Ground System Specification, Requirements				
Electrical bonding	PRCBD S040732M 09/09/88	3.6.14	378	ETs 23, 27-29, 31 & up
Soldering, circuit boards, and connectors	PRCBD S040732M 09/09/88	3.6.15.1.1	379	ETs 23, 27-29, 31 & up
PD7400106 circuit boards	PRCBD S040732M 09/09/88	3.6.15.2.1	382	ETs 23, 27-29, 31 & up
Pressure transducer circuit boards	PRCBD S040732M 09/09/88	3.6.15.2.1	383	ETs 23, 27-29, 31 & up

Level II Waivers - Baseline

Document / Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700, Volume X, Book 1, Space Shuttle Flight and Ground System Specification, Requirements				
Applicability of Space Shuttle Manned Spacecraft Criteria and Standards (NSTS 08080-1)	PRCBD S061451 08/08/00	Table 2.0	683	ET-96 & up
NSTS 07700-10-MVP-01, Shuttle Master Verification Plan - Volume I, General Approach and Guidelines				
Environmental acceptance of ET components	PRCBD S002130H 03/07/89	3.7.1	13	ETs 23, 27-29, 31 & up
SW-E-0002 - Ground Support Equipment General Design Requirements				
Factor of safety applied to yield for feet on ground half of GUCA	PRCBD S087020L 08/17/88	3.4.2.1	21	ETs 23, 27-29, 31 & up