FLIGHT READINESS STATEMENT
STS-66/ET-67 DELTA LEVEL III REVIEW
EXTERNAL TANK PROJECT

EXTERNAL TANK ET67, AS IDENTIFIED IN THE EXTERNAL TANK PROJECT DELTA FLIGHT READINESS REVIEW DATED OCTOBER 5, 1994, IS CONSIDERED READY TO SUPPORT FLIGHT UPON ACCEPTABLE DISPOSITION OF OPEN WORK AND/OR OPEN ACTIONS.

J. RANDALL/EB01

M. PESSIN/EE31

P. SCHUERER/EH01 (actions are complete & acceptable 10/19/94)

for J. EHL/CR01

Pending resolution of feed-thru connector on ET.

FOR J. STRICKLAND/EL01

for J. BLAIR/ED01

for J. MCCARTY/EP01

10/5/94

C. E. SUMNER/SA31, CHAIRMAN

Delta ET Project

STS-66/ET-67 Flight Readiness Review

Agenda

• ***Overview***	***Rick Landers***
• ***Prior Mission Performance Summaries***	
• ***Mission/External Tank Highlights***	
• Changes: No new items	
• Senior Management Review NCDs: No new items	
• SRM&QA Assessment	Frank Ramsey
• KSC Processing	Bill Brandow
• Verification/Certification	Rick Landers
• Mission Unique Assessment	
• Readiness Statement	
• Appendices	
- A: Minor Changes	
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- D: Previously reviewed material	

Overview

- Review covers changes/differences/non-conformances not previously flown and/or reviewed

- This Delta review for STS-66/ET-67 includes:
  - Prior missions' performance summaries
  - Items not previously addressed at the Block 11 ET Project FRR
  - Items specific to mission STS-66
  - Details of previously addressed items are available in appendix

FRR Series	**STS-66/ET-67**
- Block 11(ETs 66-70)	
• ET Project (Baseline)	8/10/94
- Mission Specific Reviews	
• ET/SRB Mate	9/12/94
• Delta ET Project (Baseline)	10/5/94
• Associate Administrator FRR	10/20/94(S)
• Mission Management Team (L-2 Day)	11/1/94(S)

Mission Performance Summaries

System	Performance	
	STS-68/ET-65 Scrub, 8/18/94 (Due to SSME #3 redline exceedance during start sequence)	STS-64/ET-66 Launch, 9/9/94
OMRSD/LCC	No violations	No violations
Instrumentation	No violations	No violations
MPS	Nominal	Nominal
Hazardous Gas	Nominal	Nominal
TPS	Nominal	Nominal
ET Disposal	N/A	Nominal
Orbiter Tile Damage	N/A	Lower surface • >1" = 17 (Average) • Total = 110 (Average)

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MANNED SPACE SYSTEMS

Mission/External Tank Highlights

Mission	**STS-66**
• **Launch**	11/3/94
- Window	11:46 - 13:52 EST
- Pad	B
- Orbiter	Atlantis (OV-104)
- Orbital inclination	57° deg - Insertion at 164 NM
- ET photo coverage	Umbilical well cameras
• **Mission payload**	ATLAS-3 (Atmospheric Laboratory for Applications and Sciences)
• **Landing**	11/14/94
- Time	08:32 EST
- Location	KSC
External Tank	**ET-67**
• **DD250 Acceptance**	5/17/93
- Shipped to launch site	6/08/94

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Changes - List

Description

- **Previously presented at Block 11FRR, 8/10/94** (included in Appendix D)
  - Revise foam dimension build tolerance (B81169)
  - Revise DWV dwell time (B01966)
  - LH2 cable tray TPS (B01948)
- **New items since Block 11 FRR: None**

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SRM&QA Assessment

as of 9/20/94

Item	Status
• **Alerts**	None
• **MRB Assessment**	Complete - No issues/no impact to hazard controls
- MRB NCD Items	592
- PR/MRBs	3
• **Hazard Assessment**	Complete - All hazard reports were re-assessed and hazard controls verified
• **Corrective Action Problem Summary (CAPS)**	Discussed on subsequent charts
- ET-76 LH2 feedline joint 1 leakage (P-074)	
- ET-76 LH2 feedline joint 2 leakage (P-075)	
- "Bulge" in GH2 pressure line bellows convolute (P-076)	

LH2 Feedline Joint 1 Leakage (P-074)

Problem:

- ET-76 LH2 external feedline joint 1 (LH2 external feedline to LH2 tank) leaked at installation

Background:

- Anomaly discovered during dual seal cavity leak check at MAF
  - Seal used at this joint is a RACO (primary) and Creavy (secondary)
  - Trouble shooting revealed no test equipment malfunctions
  - No secondary seal leakage detected when Leak Tec applied to junction of flanges (tank and feedline)
  - The seals were removed and replaced and the joint was successfully re-tested
  - Two (2) flat spots approximately 90° apart were found on the removed RACO seal
  - Sample inspection of twelve (12) RACO seals revealed no indentations or leak paths

Cause:

- Leak resulted from seal damage during installation, handling or supplier fabrication

Corrective Action:

- Crew meetings held with appropriate installation personnel informing them of seal defect and effects of this type anomaly

LH2 Feedline Joint 1 Leakage (P-074)

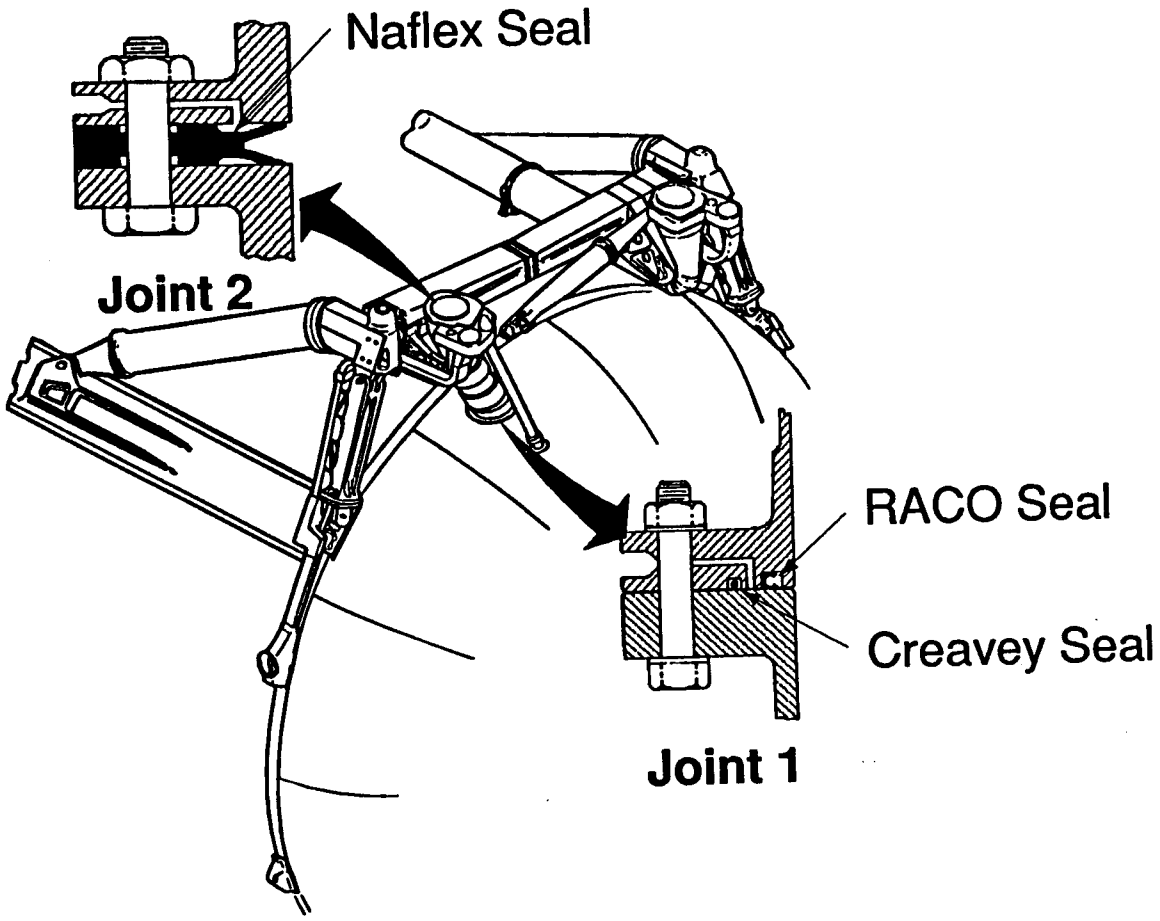
Clearance of Effectivities:

- All ETs cleared - Isolated case
  - ETs 67 thru 75 sucessfully passed acceptance tests
  - ET-76 sucessfully passed acceptance test following replacement of seal
- ATP inspection is a positive screen for this condition

Status:

- Deferred - Pending closure at MSFC

CAPS P-074 and P-075



LH2 Feedline Joint 2 Leakage (P-075)

Problem:

- ET-76 LH2 external feedline joint 2 (LH2 external feedline to disconnect) leaked at installation

Background:

- Anomaly discovered during dual seal cavity leak check at MAF on ET-76
  - The seal used at this joint is a Naflex (Primary and secondary seals in a single unit)
  - Troubleshooting revealed no test equipment malfunctions
  - No secondary seal leakage detected when Leak Tec applied to junctions of the flanges
  - The seal was removed and replaced and the joint was successfully re-tested
  - Inspection of the removed seal showed no discernible discontinuities in the sealing surfaces

Cause:

- Unknown - Root cause of the leak could not be determined

Corrective Action:

- No corrective action for this failure possible

LH2 Feedline Joint 2 Leakage (P-074)

Clearance of Effectivities:

- All ETs cleared - Isolated case
  - ETs 67 thru 75 sucessfully passed acceptance tests
  - ET-76 sucessfully passed acceptance test following replacement of seal
- ATP inspection is a positive screen for this condition

Status:

- Deferred - Pending closure at MSFC

GH2 Pressure Line Bellows Convolute "Bulged"(P-076) 15

Problem:

- While undergoing deflection test, a bellows convolute was detected to be distorted (bulged)

Background:

- Anomaly discovered by visual inspection during ATP at supplier (Arrowhead)
  - "Bulge" found on the first convolute of the first bellows from outlet flange
  - "Bulge" extends in excess of two-third the circumference of convolute
  - Radiographic inspection showed outer two (2) plys expanded outboard and inner ply was collapsed

Cause:

- Moisture entrapped between plies during manufacturing processing flashed to steam resulting in bulging of the bellows convolute during subsequent heat welding
- Controls were not in plce to assure the 15 discrepant bellows were reworked to an acceptable condition.

Corrective Action:

- No processing changes required
  - Anomaly isolated to 15 bellows
  - Arrowhead Products has developed and released a written procedure to assure positive identification, timely segregation and rework of the descrepant hardware

GH2 Pressure Line Bellows Convolute "Bulged" (P-076)$_6$

Clearance of Effectities:

- ET-67 cleared by previous investigation (X-Ray)
- All other ETs cleared
  - Discrepancy isolated to fifteen (15) bellows assemblies
  - None installed on ETs at MAF

Status: Deferred- Pending closure at MSFC

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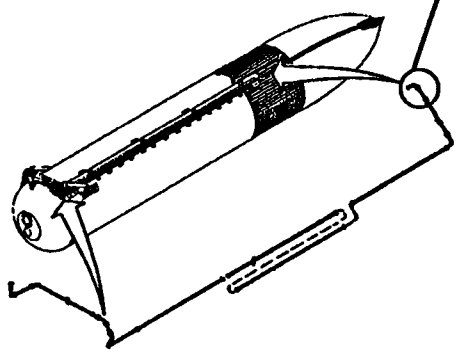
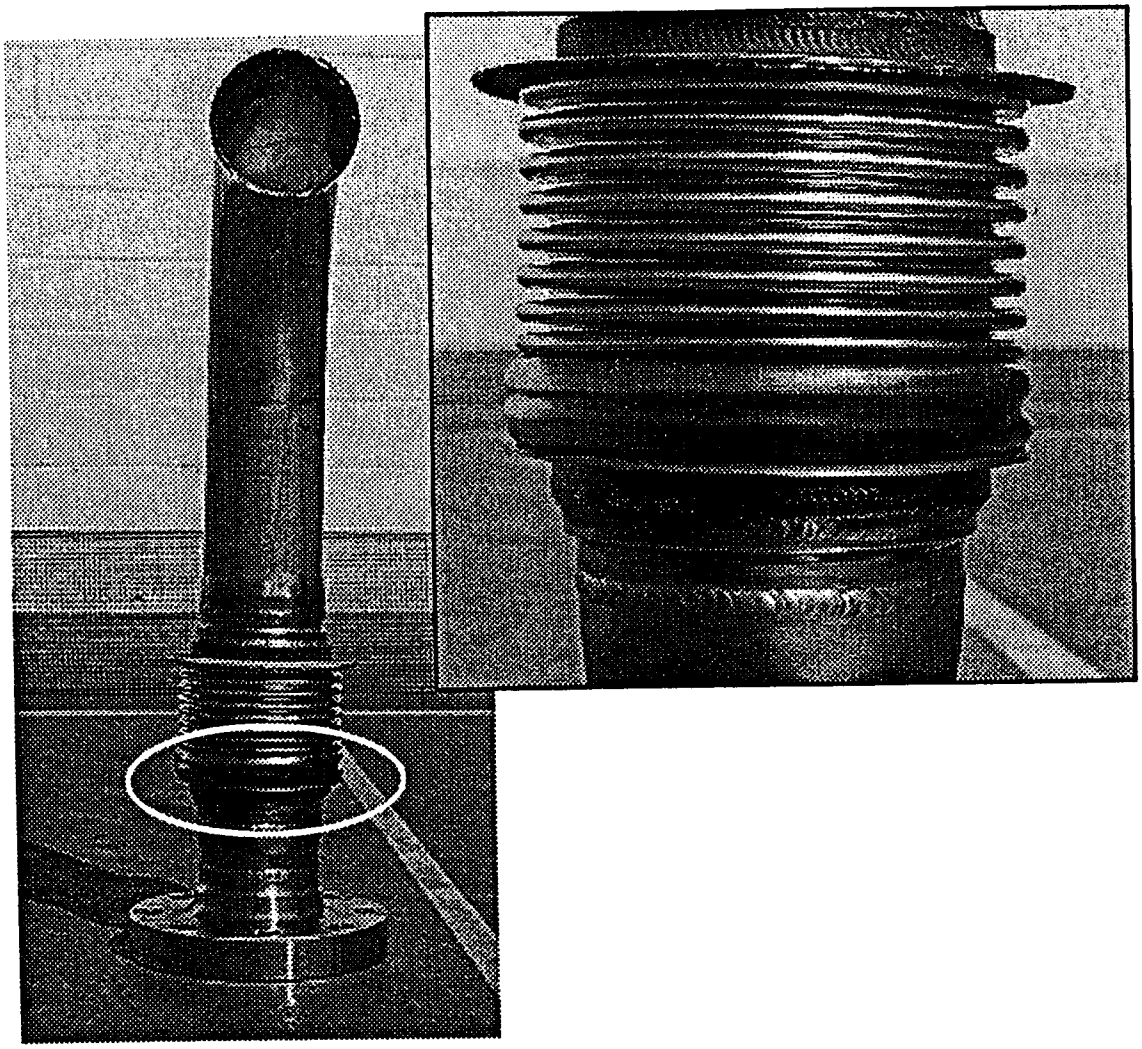
CAPS P-076

GH2 Pressure Line
Fwd Flex Assembly





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KSC Processing - Status

as of 9/23/94

- **Discrepancy Reports (DRs)/Problem Reports (PRs) Review**
  - All PR/MRB* discrepancies/dispositions similar to previously flown vehicles and are within existing database
  - All MRBs have been reviewed by MAF Reliability for potential SMR

- **Limited Life Component/ET Status ***
  - All within required life through scheduled launch date plus 90 days except S&A device (89 days)

- **OMRSD Exceptions/Waivers:** None

- **Software Changes:** None

- **Changes ***
  - ET modifications

• Mod Kit	0
• DC&R (Discrepancy Check and Report)	0
• Bldg 45	0
• FEC (Field Engineering Change)	1

  - Software

	X
• SIM Load	10/20/94(S)
• SIM Launch	10/17/94(S)

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Verification/Certification - Status

Item	Status
• **NSTS 07700, Volume X Baseline** - Revision L, Change 202	**No constraints**
• **Certification documentation** - Hardware Certification Sheets (HCS) - Certificates of Qualification (COQ) • 81L2 connector certification update	**Complete - No issues** Discussed on subsequent charts
• **Waivers/Deviations**	**Complete - No issues**

81L2 Connector Concern

Issue

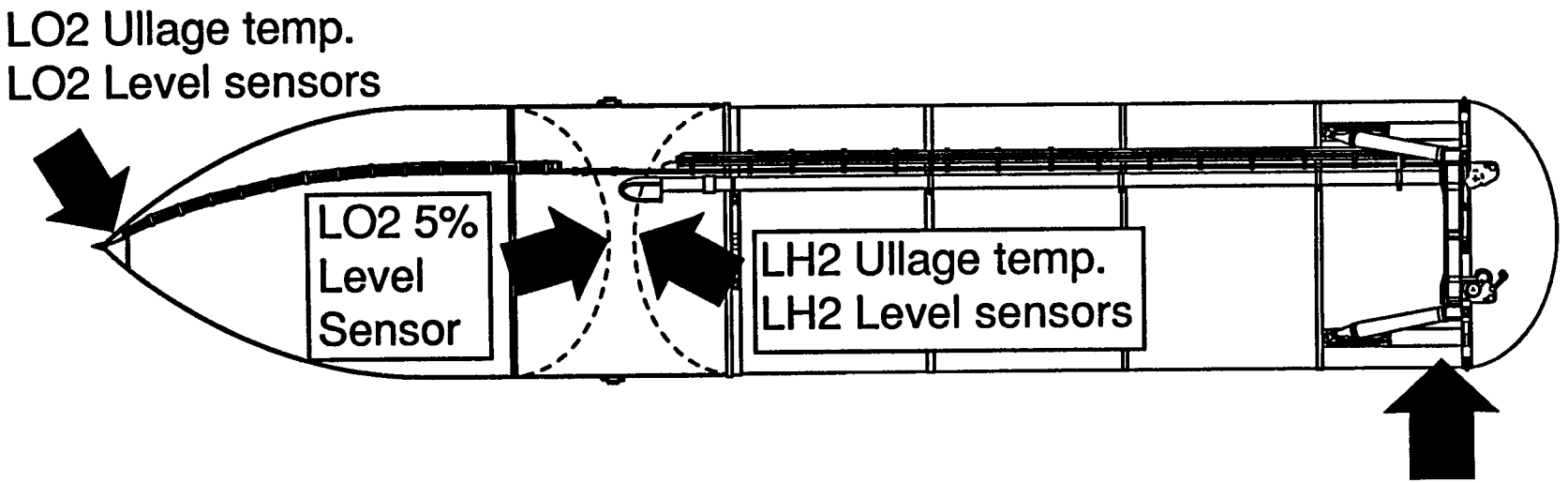
- 81L2 connector not manufactured to the qualified design

Background/ Discussion

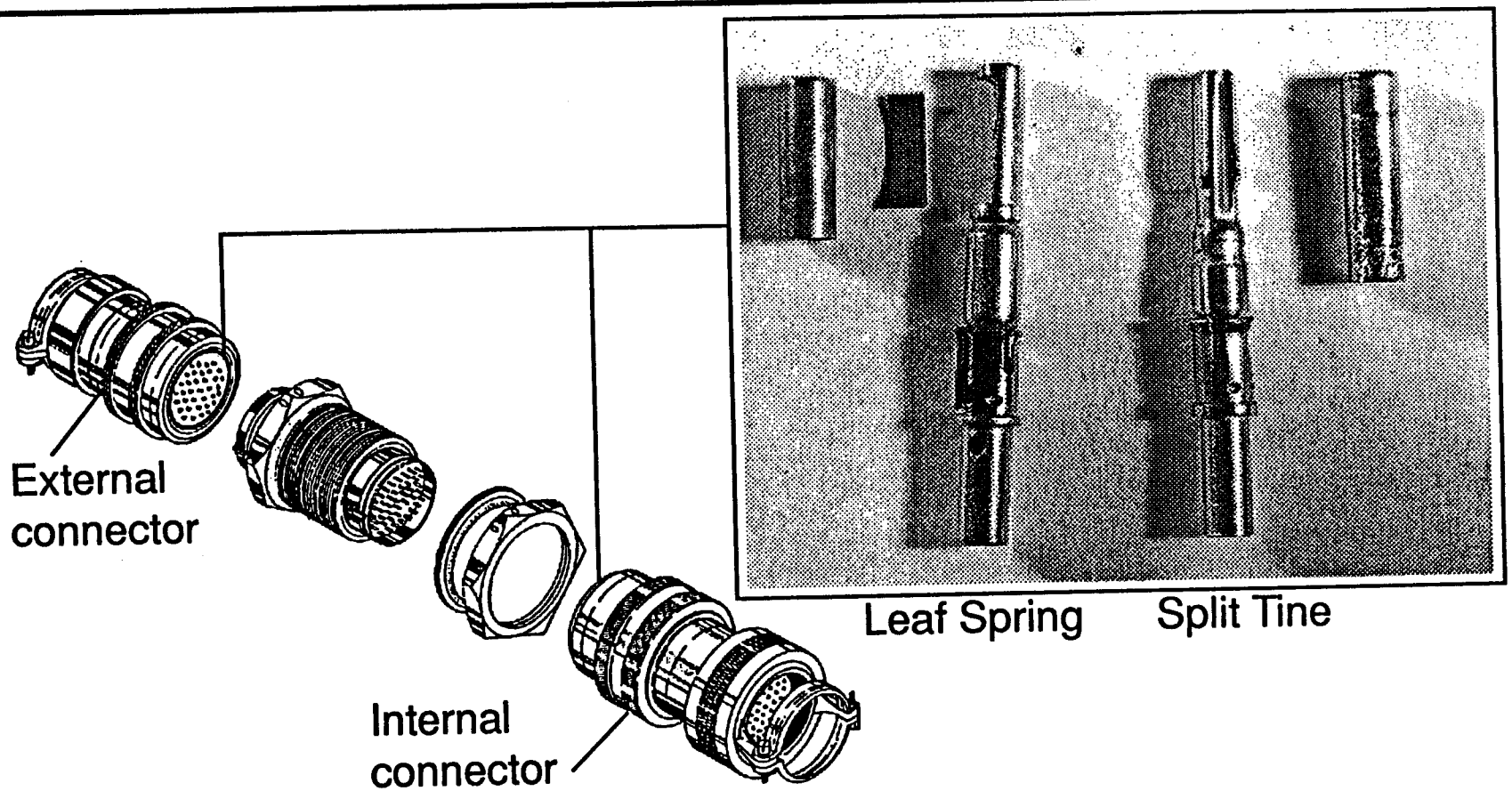
- Vendor connector design changes initiated in 1986
  - MMMSS team assessed changes as minor
    - Contact Socket design
    - Release mechanism wave spring
    - Glass material vitreous seal
  - Delta Qualification not performed
  - Most significant- socket design
- Qualified (-423°F) socket design utilizes leaf spring configuration
  - Spring -Barrel type with leaf spring installed inside for pin retention
    - Spring maintains pin barrel side contact
- Unqualified socket design utilizes 'split tine' configuration
  - Barrel is bifurcated spring at top edge
  - Top edge provides effective choke hold on pin
  - Simpler construction
  - More positive contact between socket & pin
- Qualification of ET 81L2 'split tine' connectors will be by Engineering Analysis & Similarity

81L2 Connector Concern

Feedthru Connection Locatons



81L2 Connector Concern



81L2 Electrical feedthru connector assembly

81L2 Connector Concern

Rationale for Flight:

- 'Split tine' is preferred configuration
- Socket/Pin retention test performed during fabrication
- 'Split Tine' sockets are qualified for use with ET General Purpose 40M connectors (Qualified to -250°F)
- Centaur qualified connector in 1992
  - Qualification loads more severe than ET @ -300°F
- Thermal assessment indicates more grip force between the pin & socket as temperature decreases
- 'Split tine' design has flown potentially on 5 ET's with no anomalies (ET's 61-64,66, STS-59,60,62,64,65,)
  - STS-68/ET-65 Launch scrub & detank
- LH2 ECO depletion sensors only criticality 1 circuit
  - Operational during ascent second stage
  - Engine Cutoff logic looks for 'dry' indications
  - Depletion sensors fail open-'wet'

Status

- COQ Revised -Pending approval at MSFC

Mission Unique Assessment

as of 9/23/94

Category/Item	STS-66/ET-67
• **Vehicle loads**	ECD 10/10/94
• **Thermal assessment** - Ascent - Intact abort and reentry	Complete - No Issues
• **Review of MRB actions using updated loads and environmental data**	ECD 10/10/94
• **MPS Preflight Prediction Package**	ECD 10/24/94

ET-67 Readiness Statement

The External Tank, ET-67 is hereby certified and ready for STS-66 flight pending completion/closure of open and planned work

Jon A. Dutton
Vice President, External Tank Project
Martin Marietta Manned Space Systems

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Appendices

- A: Minor Changes
- B: SRM&QA
- C: KSC Processsing
  - Processing/Planned Work Schedules
  - PR/MRB Summaries
  - OMRSD Exceptions/Waivers: None
  - Limited Life Components
  - KSC Component Replacement List: None
  - Modification Summary/Status
  - Software Changes: None
  - Software Verification/Validation Process
- D: Previously reviewed material
  - Changes
  - SMR NCD's: None
  - Waivers/Deviations

Class I/II or JS/DCN Changes

- Class I/II JS DCN changes that have been reviewed by MSFC S&E Resident Manager's Office
- All Class II STP/STM/Standards changes have been reviewed by MSFC M&P Lab
- These changes are acceptable for flight and summarized in this appendix (presentation not required)
  - Presentation criteria - Selection for presentation based on changes affecting:
    - Processes
    - Configuration
    - Material
    - Alternate Hardware
  - Presentation rejection criteria - All changes that do not affect configuration, material or processes
    - Revise Point of Incorporation
    - Drawing Clarification
    - Non-Flight Hardware Installation/Removal
    - Datum Changes
    - Update Usage/List of Materials (L/M)
    - Drawing Incorporation Errors
    - Manufacturing Aid
    - Drawing Errors
    - Fastener Type/Grip
    - Tolerance Change
    - Productivity
    - Minor changes taken care of by initial release of Class I Change (Same categories as above)

Class I/II or JS/DCN Changes-List

Change No.	Description
TPS	
H34809-766	Implement use of ET Post Build/ Assembly Acceptance Manual in VAB
Electrical	
H34809-843	Input AWS into PDS
H34809-844	Input AWS into PDS
H34809-845	Input AWS into PDS
H34809-854	Input AWS into PDS
Structures	
H34809-910	Add raised pad for serial No. identification on investment castings
H34809-914	Delete primer at assembly level; add to bracket detail level
H34809-923	Clarify sealing requirement on external clip - LO2 welded dome assy
H34809-929	Clarified drawing for hole location callout
H34809-932	Audit finding - Missing Flag Callout -Added Flag Callout

Class I/II or JS/DCN Changes-List

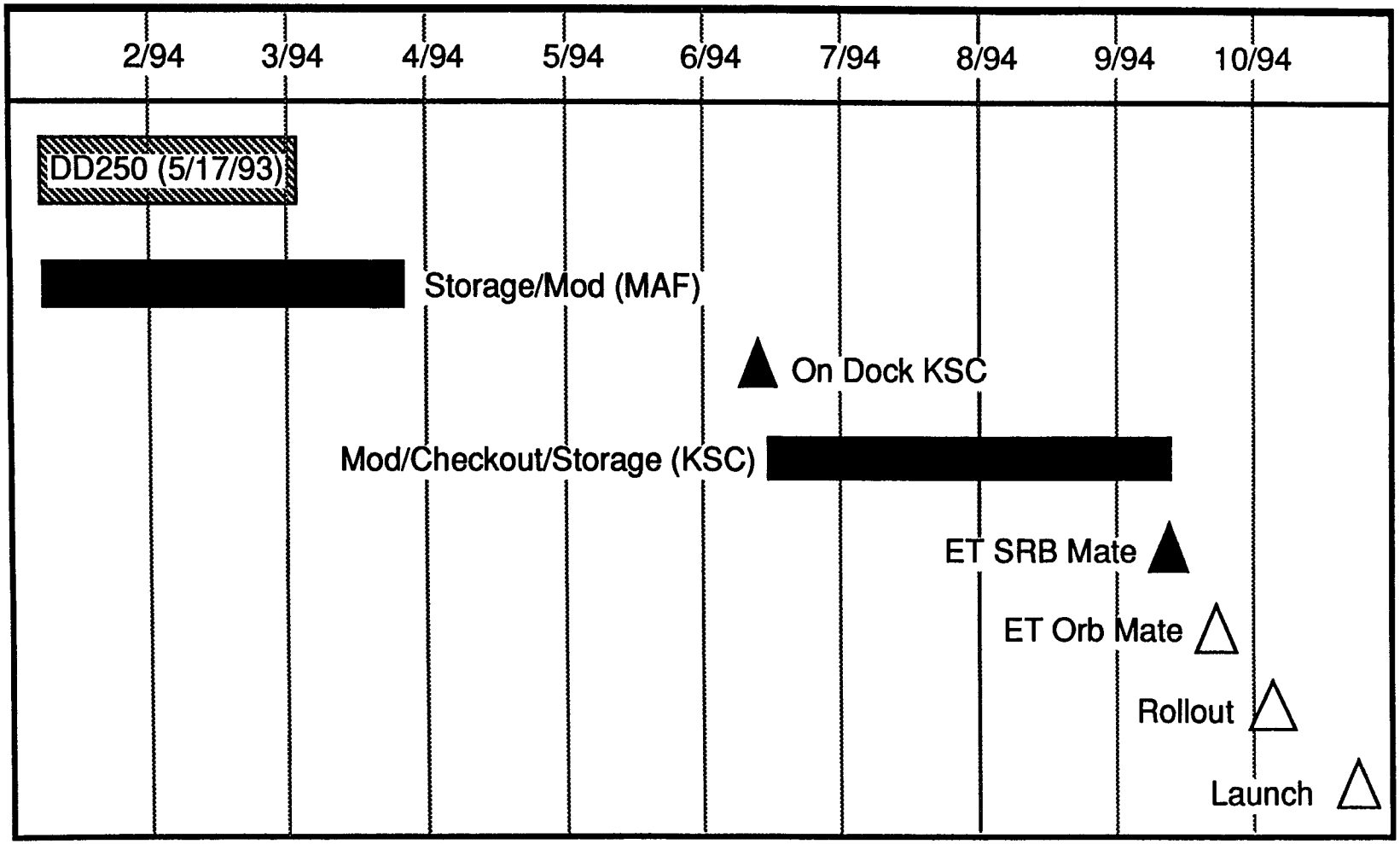
Change No.	Description
Material	
H34809-802	Revise STP 5015- Audit findings & conversion to electronic format
H34809-886	Conversion of STP 5012 to electronic format
H34809-892	Conversion of STP 2024 to electronic format
H34809-925	Revise STP 5015- Audit findings & conversion to electronic format
H34809-926	Revise STM L663(Silicon rubber) Appendix- to add new vendor
H34809-927	Revise STM L663(Silicon rubber) Appendix- to add new vendor
H34809-928	Release material code sheet 11A1 for aluminum 2195
H34809-930	Revised STP 6501 to specify connector torque only when callout on the engineering drawing
H34809-943	Revise K533(Xylene solvent) code sheet to specify specific gravity verification per ASTM D891
H50001-750	Revise STMF144 to allow use of suppler or MMC test equipment/facility to perform tests as specified in STM
H50001-751	Revise STP 6508 to allow seals on pigtail splices and dead ended wires used as spares to be taped to the harness using J463 tape
H50001-753	Conversion of STP 6009 to electronic format

MRB Assessment Criteria

- Assessment of all NCD 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

ET-67 Processing Schedule

C1



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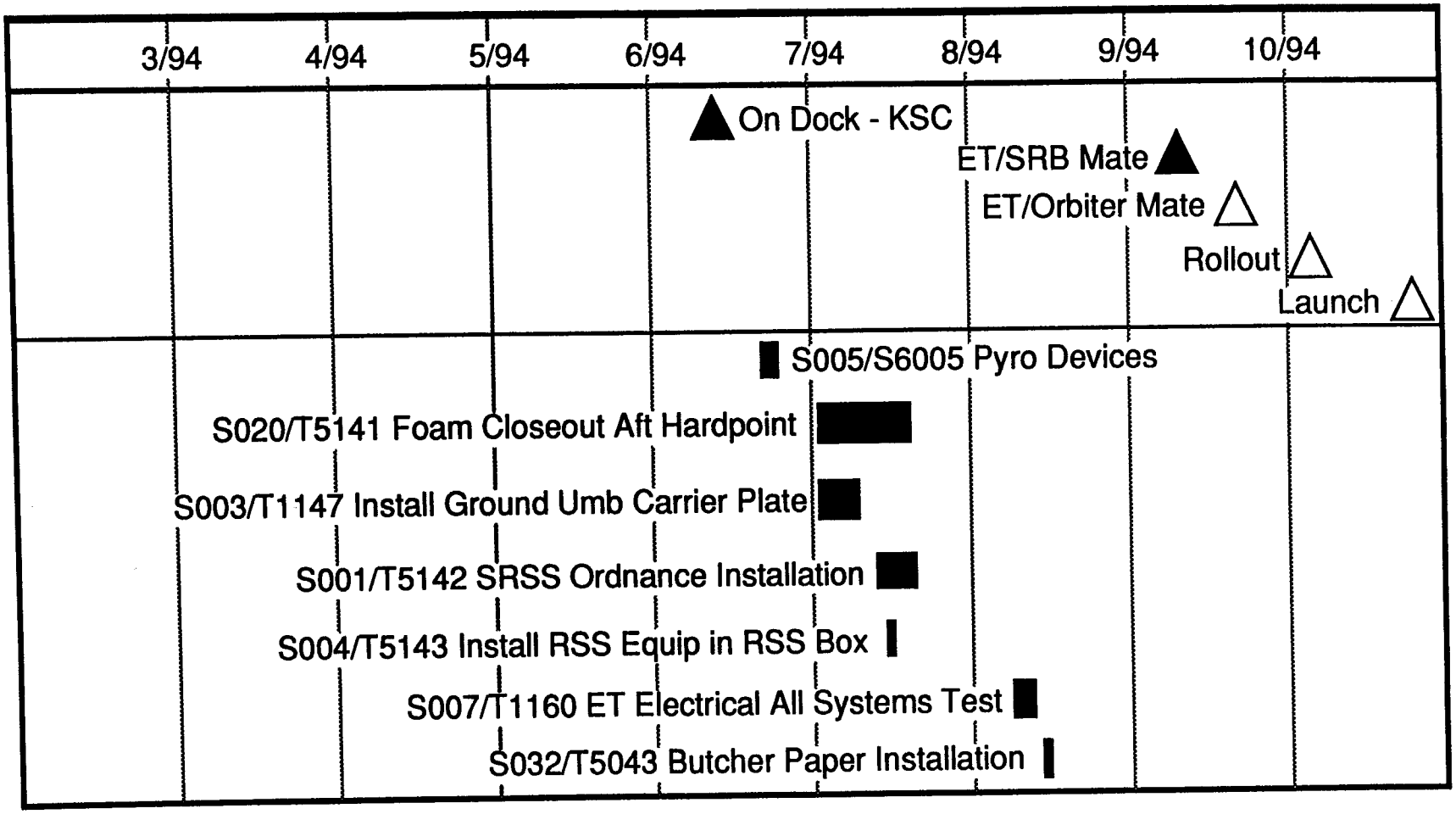
ET-67 Planned Work



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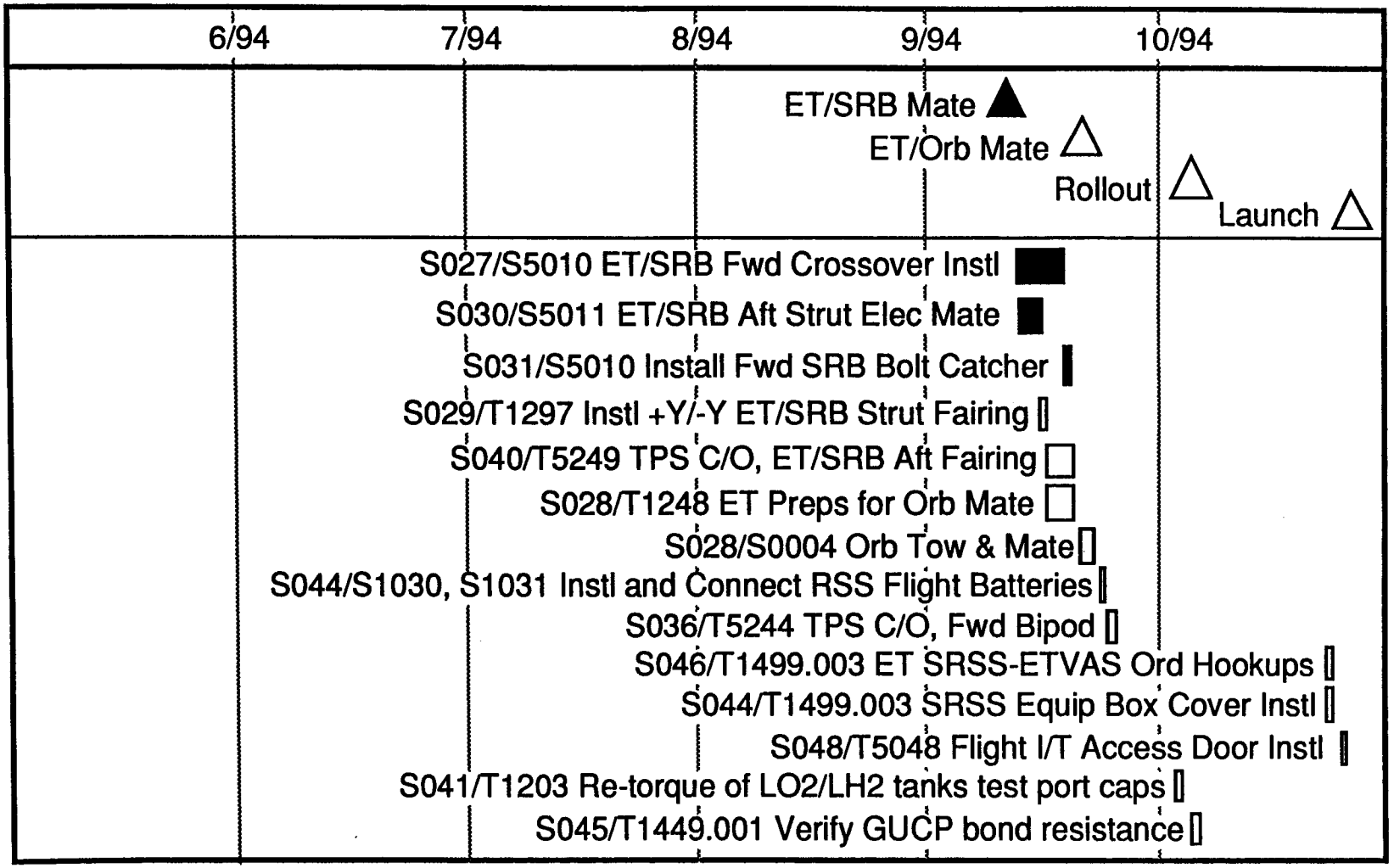
ET-67 Planned Work



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ET-67 DR/PR/OMRSD Waivers/Exceptions - Summary C4

as of 9/23/94

	Discrepancy	Problem	MRB Items		Waivers/Exceptions	
System	Total	Total	**Total**	**Open**	Total	Open
• Electrical	1	1	**1**	**0**	0	0
• Propulsion/ Pneumatics	1	5	**0**	**0**	0	0
• Range Safety	0	0	**0**	**0**	0	0
• Structures	1	11	**1**	**0**	0	0
• Thermal (TPS)	0	4	**1**	**0**	0	0
Total	**3**	**21**	**3**	**0**	**0**	**0**

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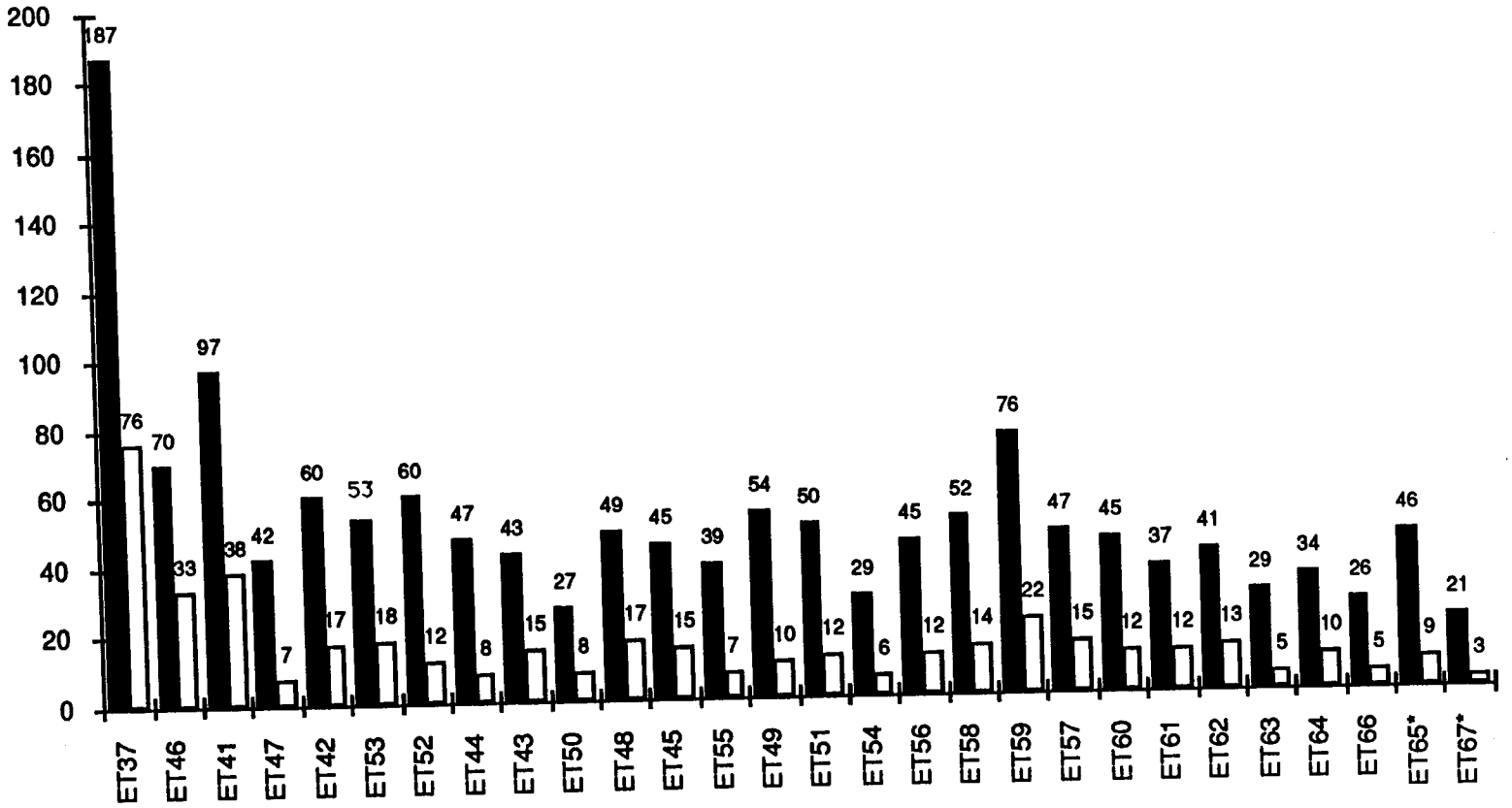
ET-67 PR/MRBs - Summary

PR No./Status	Title/Description	Disposition
Electrical		
PET-67-EL-0001 Closed	LH2 ullage transducer number 3 has chaffed wire 2" to 3" from transducer	• Use as repaired • Wrap area with Kapton tape
Structures		
PET-67-ST-0009 Closed	Conathane & crest adhesive stored outside temperature requirements	• Use as is
Thermal		
PET-67-TS-0001 Closed	Excessive trim of BX-250 aft hardpoint closeout	• Use as repaired • Repair both areas with BX-250

PR/MRB History (1991 - Present)



* Incomplete data

■ Total PRs
□ Total MRBs

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MANNED SPACE SYSTEMS

ET-67 Limited Life Components

Cycle Sensitive

Description	Part No.	Serial No.	Limit	Required	Remaining
LH2 Manhole Cover Assy	80914081488 -019	00000190	100	2	100
LO2 Mechanical Assy	80912002000 -019	00000060	100	1	100
LH2 Mechanical Assy	80914002000 -009	00000060	100	2	100
LO2 Manhole Cover Assy	80911001205 -010	00000159	100	1	100
LO2 Fwd Ogive Cover Plate	80911001207 -029	00000196	100	1	100
LH2 Manhole Cover Assy (Aft Dome)	80911001444 -010	00000347 00000349	100 100	2 2	100 100

ET-67 Limited Life Components

Age Sensitive

Description	Part No.	Serial No.	Limit	Initiation	Expiration
External Tank	80901000000 -230	00000060	6 Yrs	1/93	1/99
RSS Battery A	10406-0133 -801	---	2 Yrs 90 Days		
RSS Battery B	10406-0133 -801	---	2 Yrs 90 Days		

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MANNED SPACE SYSTEMS

ET-67 Limited Life Components

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

Description	Part No.	Lot No.	Serial No.	Latest Retest	Expiration
Confined Detonating Fuse	10315-0002				
	-825	AAB	303	1/92	3/96**
	-826	AAB	256	1/92	3/96**
	-827	AAB	214	1/92	3/96**
	-828	AAB	170	1/92	3/96**
	-831	AAB	446	1/92	3/96**
Confined Detonating Fuse Manifold	10312-0002-803	AAT	2002121	4/92	7-Yr, 3/95*
		AAT	2002122	4/92	7-Yr, 3/95*
Safe & Arm Device	10311-0001-803	AAH	2000421	9/92	1/95***
NSD	SEB26100094	JHR	0008	8/92	8/96
	-201	JHR	0010	8/92	8/96

* Old sub-assy mfg date of 3/89
** Old sub-assy mfg date of 3/86
*** Old sub-assy mfg date of 1/85

ET-67 Limited Life Components

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

Description	Part No.	Lot No.	Serial No.	Latest Retest	Expiration
Separator Assy GUCP	PD500020 -059	AAF	0000813	5/92	4-Yr, 5/96
Cartridge Assy	PD500020 -030	AAF AAF	69947 69948	5/92 5/92	4-Yr, 5/96 4-Yr, 5/96
Linear Shaped Charge	PD500016 -050	AAJ	0001569	2/91	4-Yr, 6/95

MARTIN MARIETTA
MANNED SPACE SYSTEMS

ET-67 Modification Summary

No.	Description	Status
FEC KET-0028	Inspect and relocate CDF Assembly in ET Intertank	Closed

KSC Software Revision Verification/Validation Process C12

- Software changes identified and approved by Technical Review Panel (TRP)
- Code changed and de-bugged against propellant loading model
  - Desk top review performed by MMC Software/Project Engineer
- Software Verification Procedures (SVP) revised by System Engineers
- Software Verification Process
  - Desk top review performed by SPC Quality Engineer
  - Automated "was/is" program listing produced and verified
  - Revised software loaded into simulation firing room
  - Software Verification Procedures (SVPs) performed to test changed code against propellant loading model*

*LO2/LH2 Main Propulsion System Models
- High fidelity
- Reflects system dynamics
- Provides simulation for:
  - Application software
  - De-bug/verification
  - Engineering training
  - Propellant loading

KSC Software Revision Verification/Validation Process C13

- Revised software
  - Used for
    - S0044, Simulated launch
    - S0056, Simulated load (Shuttle Propellant Load Countdown Simulation)
      - LO2/LH2 software all executing concurrently
      - Nominal and contingency operations simulated
      - Provides end-to-end software verification
  - Loaded into operational firing room for hardware use

Note: Unless indicated, both SPC and MMC/LSS personnel are involved in all operations

Revise Foam Dimensional Build Tolerances (B81169) D1

Change:

- Revised ICD to reflect increased ET insulation flushness tolerances adjacent to Orbiter umbilical tie bolt installation clearance envelope
- Add ICD requirements to MAF drawing for bipod strut jack pad TPS trims

Reason:

- Productivity enhancement - Eliminated tight dimensional tolerance requirements on the ET insulation configuration
- Maintain ET/GSE interface control documentation

Basis for Certification:

- Tolerance increase within TPS process parameters of subsequent KSC closeouts
- Documentation only

GFP LH2 CDF Manifold IDD Revision (B01948D)

D2

Change:

- Revise documentation of schematic diagrams and orientation of reference designators to reflect correct integration into the ET Range Safety System
  - Revise CDF installation drawing 80921021109-029

Reason:

- Documentation change
  - MSFC revision to the Interface Definition Document (IDD 10A01202)
  - Revised location of permanently capped port on GFP CDF manifold to port #2
  - Revise MMMSS installation drawing to correct schematic diagram connections and orient reference designators to correct location
  - GFP hardware was received with correct port #2 permanently capped

Basis for Certification:

- Similarity

Revise DWV Dwell Time (B01966)

Change:

- Revise MAF acceptance test requirements for DWV minimum dwell time parameter from 100 milliseconds to 2 seconds (B01966)

Background/ Reason:

- Dielectric Withstanding Voltage (DWV) test provides confidence that there are no inherent defects in wire insulation
- Test procedures and equipment reused and verified
- ETs flown after 5/92 successfully passed DWV with 2 seconds dwell time

Basis for Certification:

- Previously discussed as Special Topic (CAPS E-148B) on STS-46/ET-48 (6/18/92)
- 100 millisecond test was an acceptable test
- Increased dwell time makes ET DWV testing compatible with other Shuttle Projects

LH2 Cable Tray TPS (B01948)

Change:

- Hardware
  - Replaced MA25S ablator with SLA 561 on LH2 cable tray segments, cable tray covers and cable tray gap closures (3 each)
    - Reduced TPS thickness
    - Eliminated adhesive bonding of MA25S panels
- Requirements
  - Update CIL to limit effectivity for MA25S use for affected cable trays and gap closures

Background:

- MA25S ablator no longer required due to LH2 tank LSC (Linear Shaped Charge) deletion (STS-50/ET-50, 6/25/92)
  - Previously used to protect LSC from thermal environments
- SLA 561 used on all other LH2 cable tray segments, cable tray covers and cable tray gap closures

Basis for Certification:

- Similarity to previously flown hardware
- Thermal and stress analysis
  - Temperature unchanged
  - Cable tray flange margins slightly reduced due to increased dynamic loads during max Q
    - FS was: 2.84
    - FS now: 2.63

Level II Waivers - Baseline

Document/ Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700 Vol. V - Information Management Requirements				
Generic part name, type, common designation, and part manufacturer H4 code are not required for EEE parts status printout	S00127B 6/28/88	Table C.5 Item 2SR-10	6	ETs 49 & up
Data required in limited life status report is supplied in acceptance data package	S00127B 6/28/88	Table C.6 Item 2SR-7	8	ETs 49 & up
Requirement to deliver element pressure vessel historical data to EPO will remain at contractor facility	S00127B 6/28/88	Table C.6 Item 2SR-7	10	ETs 49 & up

Level II Waivers - Baseline

Document/ Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700 Vol. X - Space Shuttle Flight and Ground System Specification , Book 1 Requirements				
Electrical wiring of redundant systems NSTS 08080-1, 20A/4B	S40732G 6/18/88	Table 2.0	362	ETs 23, 27-29, 31 & up
Electrical bonding per MIL-B-5087B (2)	S040732M 9/9/88	3.6.14	378	ETs 23, 27-29, 31 & up
Soldering, circuit boards & connectors	S040732M 9/9/88	3.6.15.1.1	379	ETs 23, 27-29, 31 & up
PD7400106 circuit boards	S040732M 9/9/88	3.6.15.2.1	382	ETs 23, 27-29, 31 & up
PCM MUX and pressure transducer circuit boards	S040732M 9/9/88	3.6.15.2.1	383	ETs 23, 27-29, 31 & up
Range safety system compliance with AFETRM 127-1 and SAMTECM 127-1	S94934 9/10/88	3.5.4.12	388	ETs 28 & up

Level II Waivers - Baseline

Document/ Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700 Vol. X - Space Shuttle Flight and Ground System Specification , Book 1 Requirements				
CIL fail safe and redundancy requirements	S040201E 4/3/87	3.5.1.1.1 Thru 3.5.1.1.3	401	ETs 23, 27-29, 31 & up
2058 Frame, Bearing Stress	S40793H, H-R1 11/22/88	3.2.2.1.5.2	452	ETs 23, 27-29, 31 & up
Soldering of electrical connectors	S094779C 2/21/91	3.6.15.1.1	573	ETs 37, 41 & up

Level II Waivers - Baseline

Document/ Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 08060, Rev. F - System Pyrotechnic Specification				
Design pyrotechnics for reliability - No redundant tumble valve	S003422E 6/24/88	3.1	60	ETs 23, 27-29, 31 & up
Use 40M36298 connectors	S040732F 6/24/88	3.4.1	61	ETs 23,27-29, 31 & up
Epoxy to separate dissimilar metals on LSCs	S040732F 6/24/88	3.5.8	62	ETs 23, 27-29, 31 & up
Circuit resistance check not required after connector mate in tumble system	S040732F 6/24/88	7.3	63	ETs 23, 27-29, 31 & up
Prevent adverse effects of common mode currents	S040732F 6/24/88	8.2.1	64	ETs 23, 27-29, 31 & up

Level II Waivers - Baseline

Document/ Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 08060, Rev. F - System Pyrotechnic Specification				
Fire circuit wiring shall be routed separately	S040732F 6/24/88	8.2.3	65	ETs 23, 27-29, 31 & up
NSTS 07700-10-MVP-01 - Shuttle Master Verification Plan				
Environmental acceptance of ET components	S002130H 3/7/89	3.7.1	13	ETs 23, 27-29, 31 & up
NSTS 08123, Rev. B - Certification of Flexible Hoses and Bellows				
LH2 feedline bellows	S0052023G-R1 8/2/91	1.2	3	ETs 42 - 45, 47 & up

Level II Waivers - Baseline

Document/ Requirement	Authority	Paragraph	Waiver No.	Effectivity
SL-E-0001 - Specification Electromagnetic Compatibility Requirement				
Wire marking is not applicable to the ET	S40732K 9/27/88	3.2.5	3	ETs 23, 27-29, 31 & up
SW-E-0002 - Ground Support Equipment General Design Requirements				
Factor of safety applied to yield for GUCP leg	S87020L 8/17/88	3.4.2.1	21	ETs 23, 27-29, 31 & up