# FLIGHT READINESS STATEMENT
# STS-76/ET-77 AND STS-77/ET-78
# Δ EXTERNAL TANK PROJECT REVIEW

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**EXTERNAL TANKS ET-77 AND ET-78, AS IDENTIFIED IN THE EXTERNAL TANK PROJECT DELTA FLIGHT READINESS REVIEW DATED FEBRUARY 28, 1996, ARE CONSIDERED READY TO SUPPORT FLIGHT UPON ACCEPTABLE DISPOSITION OF OPEN WORK AND/OR OPEN ACTIONS.**

for J. RANDALL/EB01

for M. PESSIN/EE31

P. SCHUERER/EH01

for J. EHL/CR01

P. V. COUNTS/SA31, CHAIRMAN

for J. STRICKLAND/EL01

J. BLAIR/ED01

J. MCCARTY/ED01

for M. SMILES/CR70

Delta ET Project

# STS-76/ET-77
# STS-77/ET-78
# Flight Readiness Review

LOCKHEED MARTIN

# Agenda



| | |
|---|---|
| • ***Overview*** | ***Rick Landers*** |
| • ***Prior Mission Performance Summary*** | |
| • ***Mission/External Tank Highlights*** | |
| • ***Changes*** | |
| • ***Senior Management Review NCDs*** | Robert Pontiff |
| • SRM&QA Assessment | Terry McKeough |
| • KSC Processing | Blake Hale |
| • Verification/Certification | Rick Landers |
| • Mission Unique Assessment | |
| • Readiness Statement | |
| • Appendices | |
| - A: Minor Changes | |
| - B: SRM&QA Assessment | |
| - C: KSC Processing | |
| - D: Previously reviewed material | |

# Overview



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

- This Delta review for STS-76/ET-77 and STS-77/ET-78 includes:
  - Prior mission performance summary
  - Items not previously addressed at the Blocks 12 and 13 (ETs 71-80) ET Project FRR
  - Items specific to mission STS-76 and STS-77
  - Details of previously addressed items are available in appendix D

| **FRR Series** | **STS-76/ET-77** | **STS-77/ET-78** |
|---|---|---|
| - Block ET Project Review | 5/3/95 | 5/3/95 |
| - Mission Specific Reviews | | |
| • ET/SRB Mate | 1/31/96 | 3/18/96 |
| • Delta ET Project (Baseline) | 2/28/96 | 2/28/96 |
| • Associate Administrator FRR | 3/7/96 | 5/2/96 |
| • Mission Management Team (L-2 Day) | 3/19/96 | 5/14/96 |

# Mission Performance Summary



| System | Performance<br>STS-72/ET-75 (1/11/96) | STS-75/ET-76 (2/22/96) |
|---|---|---|
| **OMRSD/LCC** | No violations | No violations |
| **Instrumentation** | Nominal | Nominal |
| **MPS** | Nominal | Nominal |
| **Hazardous Gas** | Nominal | Nominal |
| **TPS** | One small area (≈1.0" x 0.5") of nose cone topcoat found adhered to GO2 vent seal after hood retraction | Nominal |
| **ET disposal** | Nominal | Nominal |
| **Orbiter tile damage** | Lower surface, below average<br>• >1" = 3<br>• Total = 23 | Not available |
| **Post flight photo review** | • Crew photographs - No issues<br>• Umbilical photographs - No issues | Not available |

# Mission/External Tank Highlights



| **Mission** | **STS-76** | **STS-77** |
|---|---|---|
| • **Launch** | 3/21/96 | 5/16/96 |
| - Window | 03:35 - 03:41 EST | 06:32 - 09:02 EDT |
| - Pad | B | B |
| - Orbiter | Atlantis (OV-104) | Endeavour (OV-105) |
| - Orbital inclination | 51.6° - Insertion at 160NM | 39.0° - Insertion at 153NM |
| - ET photo coverage | • Umbilical well cameras<br>• Crew photos from cockpit window | • Crew photos from cockpit window |
| • **Primary payload** | Third Mir docking (SMM-3) | Spacehab-4 |
| • **Landing** | 3/30/96 | 5/26/96 |
| - Time | 08:05 EST | 06:49 EST |
| - Location | KSC | KSC |
| **External Tank** | **ET-77** | **ET-78** |
| • DD250 Acceptance | 5/24/95 | 7/17/95 |
| • Shipped to launch site | 10/19/95 | 12/7/95 |

# Changes - List



- **Previously presented at Block 12 and 13 FRR, 5/3/95 ***
  - **ET-77**
    - Delete LO2 umbilical AADS connector (B01142W)
  - **ET-78:** None
- **New item since Blocks 12 and 13 FRR**
  - **ET-77**
    - Replace non-locking inserts in forward ET/SRB fitting (B01916)
  - **ET-78:** None

* Included in Appendix D

# Replace Non-locking Inserts in Fwd ET/SRB Fitting 7

**Change:**

- Hardware
  - Replace 4 non-locking inserts which secure the forward SRB bolt catchers with self-locking inserts
  - Eliminate use of Locktite locking compound
- Requirements
  - Revised ICD-2-24001, CIL, and HCSs to reflect change

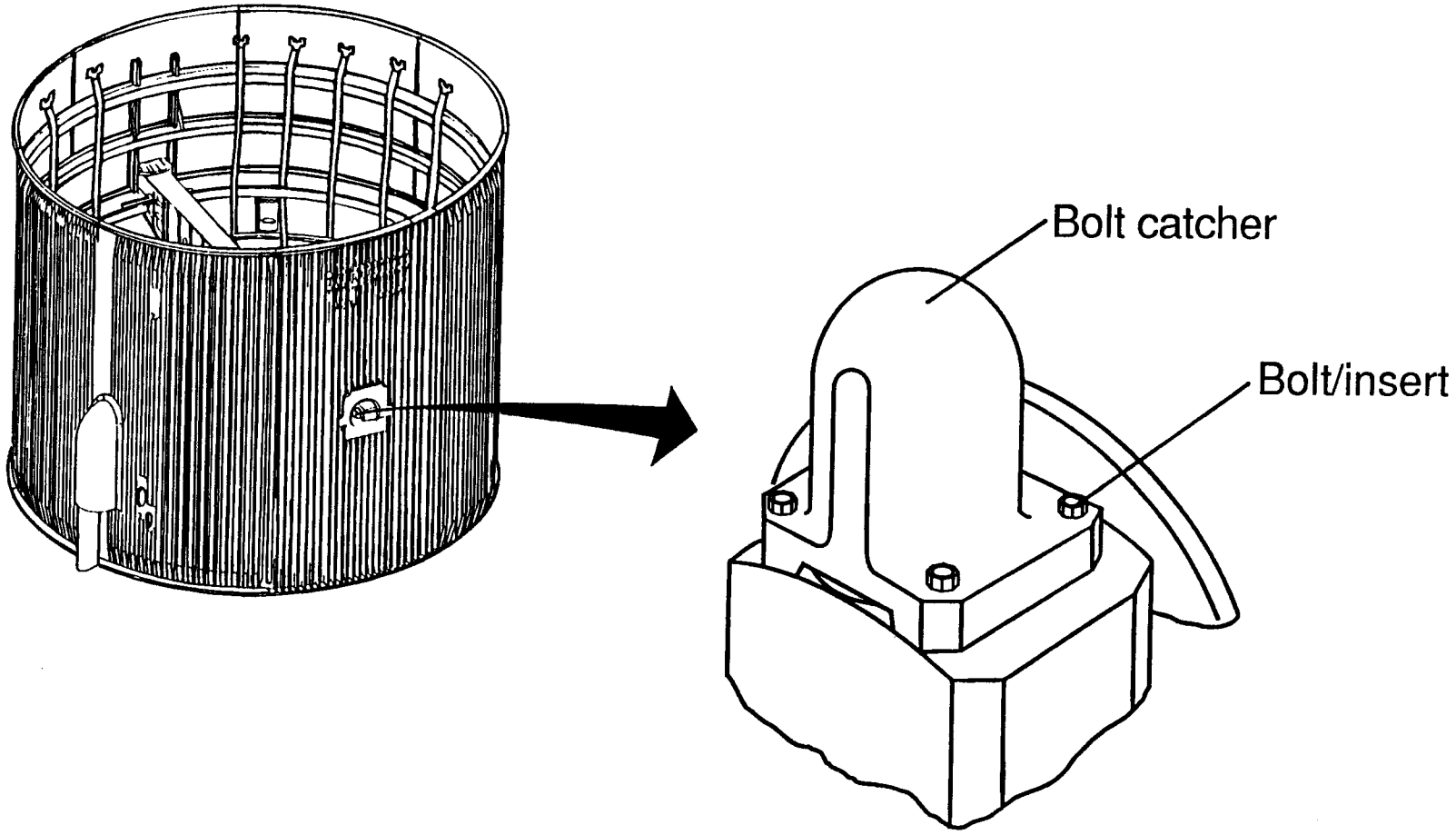
**Background:**

- Non-locking inserts used due to repeated installations early in program
- Current Launch processing has eliminated the need for repeated installations
- Elimination of Locktite enhances hardware processing flow at KSC

**Basis for Certification:**

- Stress analysis - Bolt and insert strength remain unchanged
  - Critical FS = 17.7 (tension, bending and shear)
- Bolt retention equal to or greater than installation with Locktite

# Replace Non-locking Inserts in Fwd ET/SRB Fitting 8




**Forward ET/SRB Attach Fitting**

# Agenda



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# Senior Management Review NCDs - List



- **Previously presented at Block 12 and 13 FRR, 5/3/95 ***
  - **ET-77:** None
  - **ET-78:** None
- **New item since Blocks 12 and 13 FRR**
  - **ET-77**
    - LH2 forward dome HFL weld cracks (T125900)
  - **ET-78:** None

# SMR NCD - LH2 Forward Dome HFL Weld Cracks



*T125900*

**Issue:**

- LH2 dome lug fillet welds (HFL-1, -3, -5, and -7) resulted in "suck-back" (weld bead depression) defects during manual TIG weld

**Background:**

- All areas heat repaired from the outside
  - All areas acceptable except HFL-1
  - Pre-proof X-ray showed 0.150" crack in HFL-1 after initial repair
    - Reduced to 0.050" by additional heat repair
- Leak check in Bldg 451 was acceptable
- Post-proof X-ray results:
  - Acceptable welds on HFL-3, -5, and -7
  - Unchanged 0.050" crack on HFL-1
  - Detected additional 0.175" crack on HFL-1

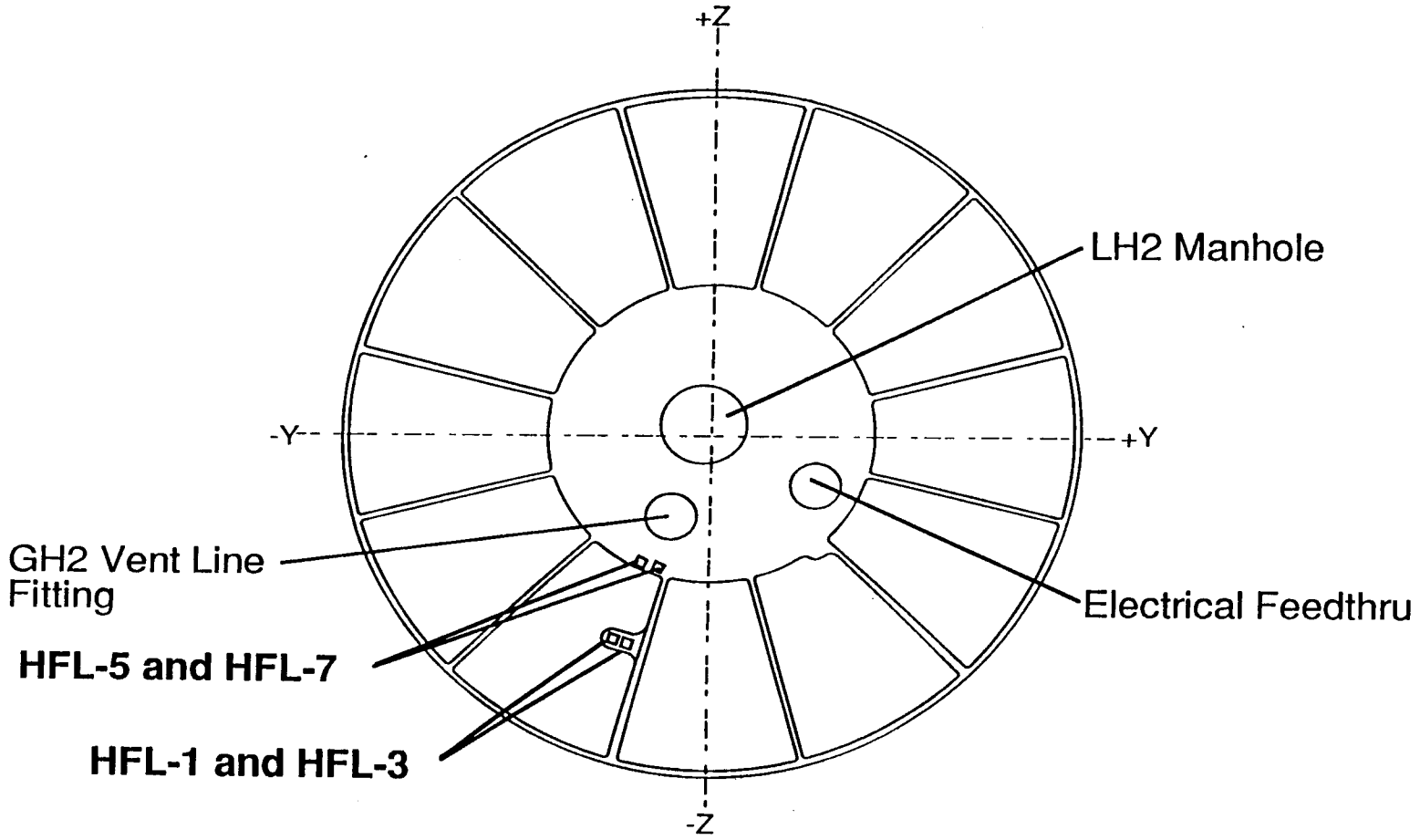
**Cause:**

- Improperly executed manual weld
  - Weld process is extremely operator dependent

# SMR NCD - LH2 Forward Dome HFL Weld Cracks



*T125900*




**LH2 tank forward dome (looking aft)**

# SMR NCD - LH2 Forward Dome HFL Weld Cracks

*T125900*

**Disposition:**

- HFL-1 cracks - Use as is
- Suck back repaired on all welds

**Rationale for Flight:**

- Stress analysis: Critical FS of as welded configuration unaffected
  - Tensile test of test specimens verified that allowables were conservative
- Fracture analysis of detected linear indications in HFL-1: 15 missions to leak, 40 missions to burst for 0.175" defect
  - Conservative flaw size assumptions
  - Conservative stresses applied to growth of crack
  - Flaw size and fatigue life within database
- Visual and penetrant inspection and post-proof leak check acceptable



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# Agenda



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# SRM&QA Assessment



*as of 2/22/96*

| Item | Status | |
|---|---|---|
| | STS-76/ET-77 | STS-77/ET-78 |
| • Alerts | None | None |
| • MRB Assessment | Complete - No issues/no impact to hazard controls | |
| • Hazard Assessment | Complete - All hazard reports were re-assessed and hazard controls verified | |
| • Corrective Action Problem Summary (CAPS) | All CAPS closed - No constraints to launch | |

# Agenda



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# KSC Processing - Status



*as of 2/22/96*

- **Discrepancy Reports (DRs)/Problem Reports (PRs) Review**
  - All PR/MRB discrepancies/dispositions similar to previously flown vehicles and are within existing database
- **Limited Life Component/ET Status**
  - All within required life through scheduled launch date of 3/21/96 plus 90 days except:
    - GUCP pyro bolt expires 5/31/96
      - 4 year shelf life extension scheduled for TBD
- **OMRSD Exceptions/Waivers: None**

| • **Changes** | STS-76/ET-77 | STS-77/ET-78 |
|---|---|---|
| - ET modifications * | | |
| • Mod Kits | 1 | 1 |
| • DC&R (Discrepancy Check and Report) | 0 | 0 |
| • Bldg 45 | 0 | 0 |
| • FEC (Field Engineering Change) | 1 | 0 |
| - OMRSD * | 1 | 0 |
| - Software * | 0 | 0 |
| • SIM Load | 3/8/96 | 4/30/96 |
| • SIM Launch | 3/11/96 | 4/10/96 |

* Included in Appendix C

# Agenda



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# Verification/Certification



***as of 2/22/96***

| Item | Status |
|---|---|
| • **NSTS 07700, Volume X Baseline**<br>- Revision L, Change 218 | **No constraints** |
| • **Certification documentation**<br>- Hardware Certification Sheets (HCS)<br>• S140B/S162B, Non-locking inserts in forward ET/SRB fittings (B01916) *<br>- Certificates of Qualification (COQ)<br>• No changes | **Approved - No issues** |
| • **Waivers/Deviations** | **Complete - No issues** |

* Previously presented with Changes

# Mission Unique Assessment



*as of 2/22/96*

| Category/Item | STS-76/ET-77 | STS-77/ET-78 |
|---|---|---|
| • **Review of MRB actions using updated loads** | Complete - No issues | Complete - No issues |
| • **MPS Preflight Prediction Package** | ECD 3/11/96 | ECD 5/6/96 |

# Agenda



| | |
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| • Mission/External Tank Highlights | |
| • Changes | |
| • Senior Management Review NCDs: None | |
| • SRM&QA Assessment | Terry McKeough |
| • KSC Processing | Blake Hale |
| • Verification/Certification | Rick Landers |
| • Mission Unique Assessment | |
| • ***Readiness Statement*** | |
| • Appendices | |
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# ET-77 Readiness Statement



**The External Tank, ET-77 is hereby certified and ready for STS-76 flight pending completion/closure of open and planned work**

Dennis R. Deel
Vice President, External Tank Project
Lockheed Martin Manned Space Systems

# ET-78 Readiness Statement



**The External Tank, ET-78 is hereby certified and ready for STS-77 flight pending completion/closure of open and planned work**

Dennis R. Deel
Vice President, External Tank Project
Lockheed Martin Manned Space Systems

# Appendices



- **A: Minor Changes**
- **B: SRM&QA Assessment**
  - NCD Assessment Criteria
  - Corrective Action Problem Summary (CAPS)
- **C: KSC Processing**
  - Processing/Planned Work Schedules
  - PR/MRB Summaries
  - OMRSD Exceptions/Waivers: None
  - OMRSD Changes (RCNs)
  - Limited Life Components
  - Modification Summary/Status
  - Software Changes: None
- **D: Previously reviewed material**
  - Waivers/Deviations

# Class II or JS/DCN Changes



- Class I/II JS/DCN changes that have been reviewed by MSFC Resident 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 | Effectivity |
|---|---|---|
| **Electrical/RSS** | | |
| B01994-900 | Delete two spacers underneath CDF clamps in Intertank | ET-77 and subs |
| H35809-028 | Revise drawing note callout in electrical connector termination data | ET-78 and subs |
| H35809-043 | Revise dimension locating scrim cloth electrical cable supports | ET-77 and subs |
| **Propulsion** | | |
| H34809-954 | Add flatness requirement on top of LO2 transducer mounting plate | ET-77 and subs |
| H34809-996 | Revise serial number location on GO2/GH2 pressure line Barrymounts | ET-78 and subs |
| H35809-114 | Clarify GH2 vent installation end rod alignment requirement | ET-78 and subs |

# Class I/II or JS/DCN Changes - List



| Change No. | Description | Effectivity |
|---|---|---|
| **Structures** | | |
| H50001-726 | Add flagnote to clarify datum locations of SRB beam fitting corner plates | ET-78 and subs |
| **Systems** | | |
| H35809-137 | Correct item callouts on ET Protection requirements drawing | ET-77 and subs |
| **TPS** | | |
| H34809-959 | Add dimension for vertical/SRB fairing ablator installation detail | ET-78 and subs |

# Class I/II or JS/DCN Changes - List, Materials



| Change No. | Document | Description |
|---|---|---|
| H35809-252 | STP 1006 | Delete aging practices from STP and require adding aging practice to certification sheet |
| H35809-310 | L1A2 | Revise spray requirements for receiving acceptance spray to be "shingle spray" instead of flat passes |
| H35809-320 | M358 | Revise addendum to allow 24 month shelf life with unlimited 12 month extensions |
| H35809-320 | M473 | Revise addendum to allow 12 month shelf life with one 3 month extension |
| H35809-320 | M495 | Revise addendum to allow 3 month shelf life at 50-80°F or 12 month at 36-46°F |
| H35809-320 | M660 | Revise addendum to allow 9 month shelf life |
| H35809-320 | M667 | Revise addendum to allow 12 month shelf life |

# Class I/II or JS/DCN Changes - List, Materials



| Change No. | Document | Description |
|---|---|---|
| H35809-324 | STP 1506 | Change density range in specification from 16-19 pounds per cubic foot to 15-19 pounds per cubic foot |
| H35809-329 | STP 6506 | Clarify number and configuration of samples required for training & certification and clarify instructions in case failures occur and retest allowances |
| H35809-330 | Y933 | Revise STM to revise/eliminate particle size distribution requirement and general update |
| H35809-330 | Y934 | Revise STM to revise/eliminate particle size distribution requirement, delete NVR requirement, and general update |
| H35809-330 | Y936 | Revise STM to revise/eliminate particle size distribution requirement, delete NVR requirement, and general update |
| H35809-330 | Y981 | Revise STM for general update |
| H35809-342 | STP 2014 | Eliminate installation counts and rely on torque control requirements to ensure insert integrity |

# Class I/II or JS/DCN Changes - List, Materials



| Change No. | Document | Description |
|---|---|---|
| H35809-350 | 11A1 | 1) Add T8A4 temper to code sheet-identify as 11A1Q<br>2) Add ALCOA to procurement information<br>3) Delete note cross referencing Reynolds temper designations with Lockheed Martin |
| H35809-370 | 6509 | Clarify conflicting product and fabrication requirements on shrink tube dimension and engineering update to remove redundant requirements |
| H35809-371 | Y936 | Revise source appendix to add Richmond Products and delete Scientific Enterprises, Advanced Purification Systems and Coventry Manufacturing Co. |
| H35809-381 | L1A1 | Revise to change section 3.7.3.4 to fabricate 8 specimens and 3.7.5.1 & 3.7.5.2 to test 4 specimens each |
| H35809-405 | 2012 | 1) Revise par 3.3.1.4 to allow die marks<br>2) Update document to Lockheed Martin letterhead and callouts |
| H35809-428 | E659 | Revise E659 code addendum to eliminate flammability qualification test requirement from document |
| H35809-428 | E741 | Revise E741 code addendum to eliminate flammability qualification test requirement from document |

# MRB 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

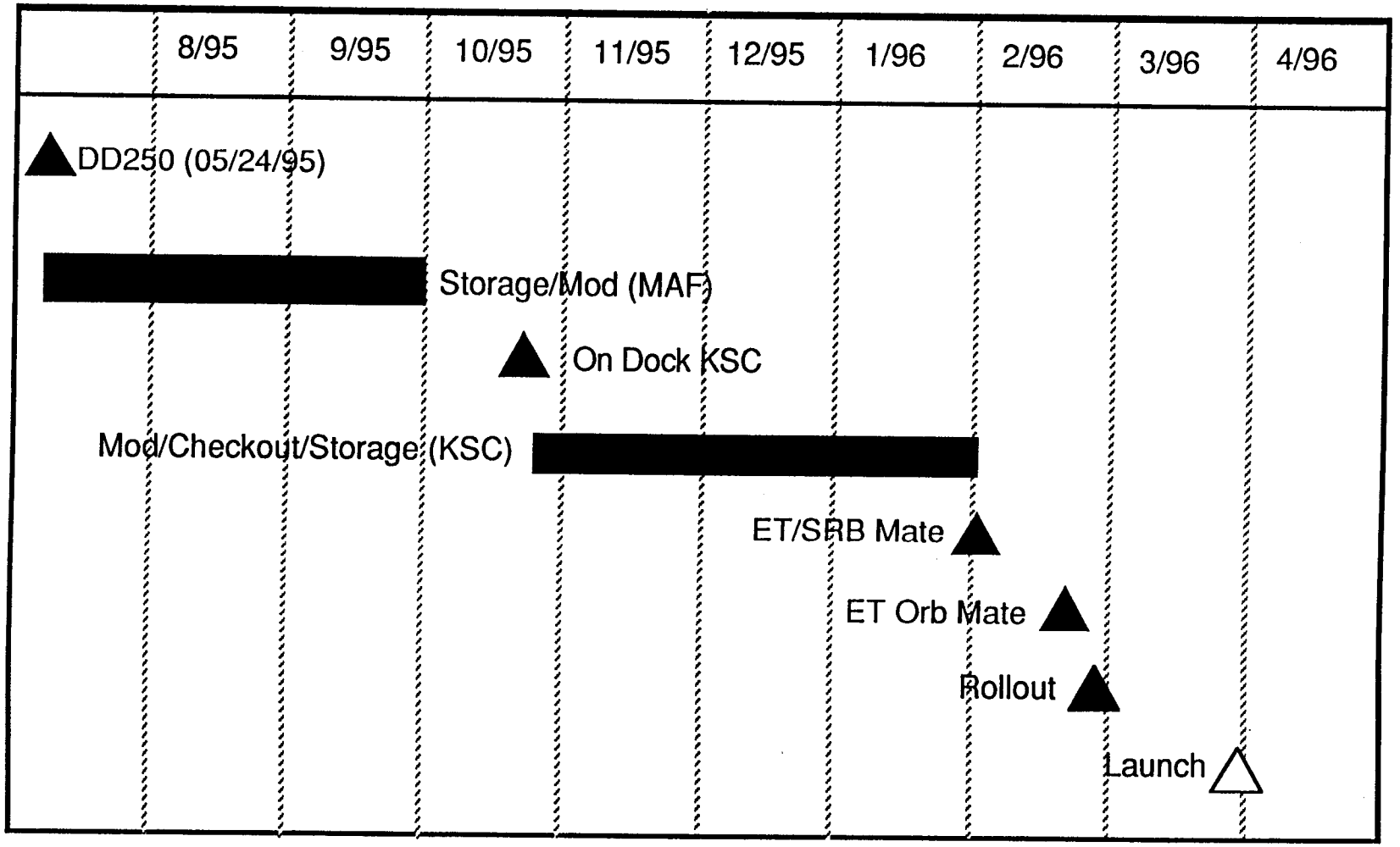
# Corrective Action Problem Summary (CAPS)



| Item | Vehicle Clearance | Status |
|---|---|---|
| P-079, Two joints on ET-82 helium inject line failed "bubble" leak check | • All completed ETs cleared<br>• All completed ETs passed ATP<br>• Proof test demonstrated ultimate margins were achieved | • CAPS closed at MAF<br>- Pending MSFC closure |
| P-080, weld leak on GO2 pressure line during ATP at supplier | • All ETs cleared<br>• ATP designed to catch this type of failure | • CAPS closed at MAF<br>- Pending MSFC closure |

# ET-77 Processing Schedule

C1

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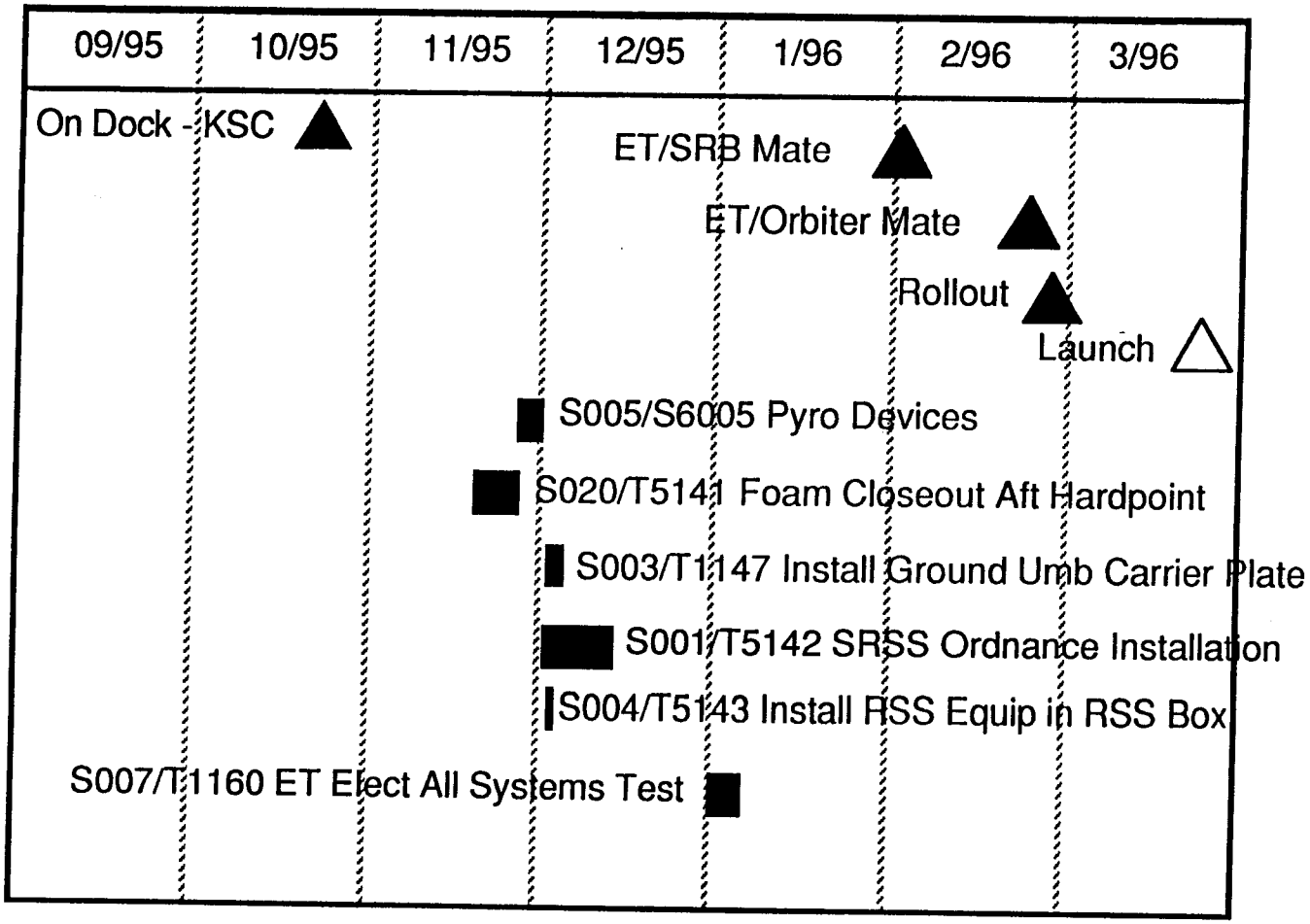
ET77/78ΔP.2/96.S4.1

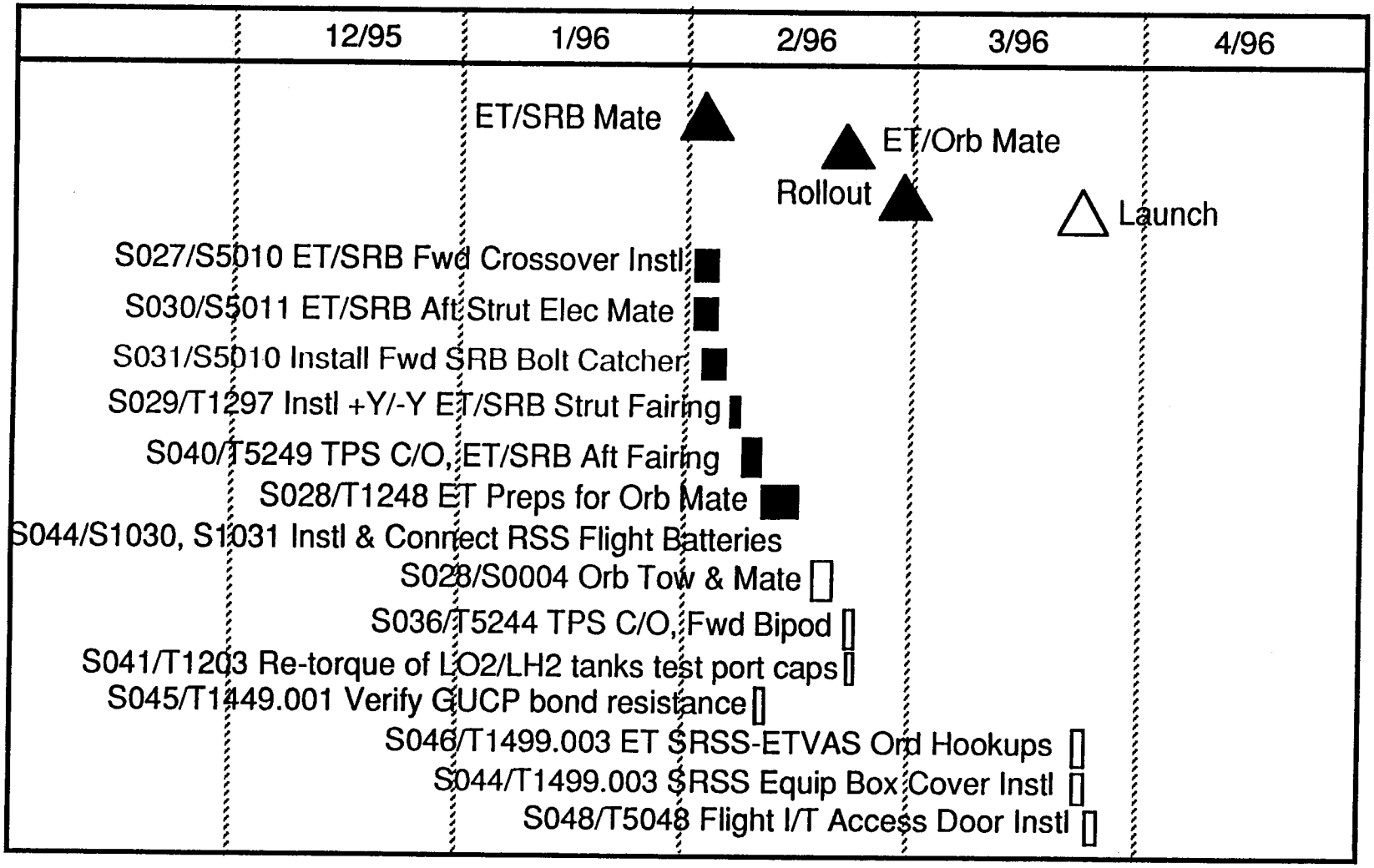
# ET-77 Planned Work





# ET-77 Planned Work

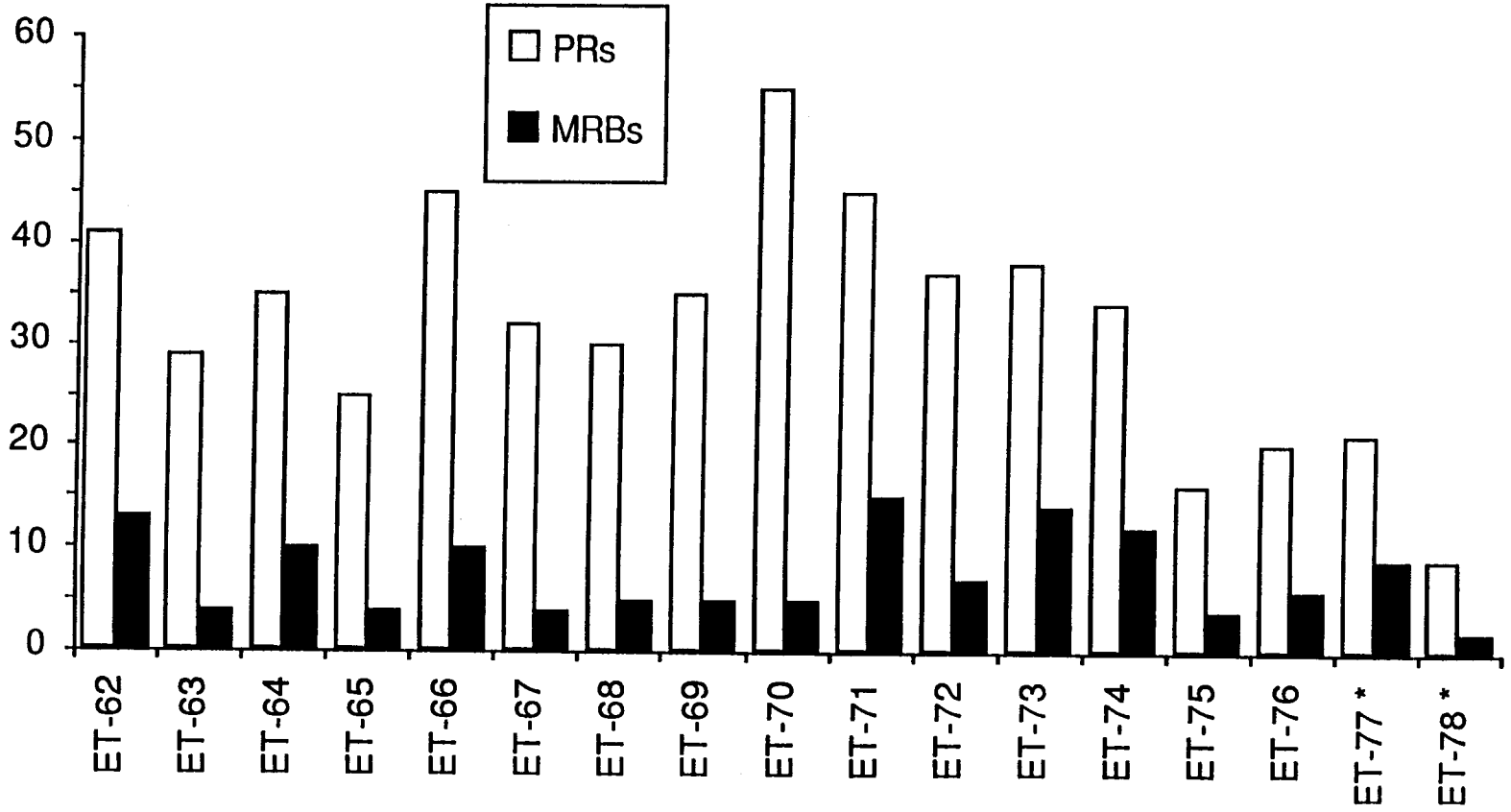




# PR/MRB History (1994 - 1996)



***as of 2/22/96***

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# ET-77 DR/PR/OMRSD Waiver/Exception-Summary C5

*as of 2/22/96*

| | Discrepancy Problem | | MRB Items * | | Waivers/Exceptions | |
|---|---|---|---|---|---|---|
| System | Total | Total | Total | Open | Total | Open |
| • Electrical | 0 | 0 | 0 | 0 | 0 | 0 |
| • Propulsion/ Pneumatics | 0 | 5 | 1 | 0 | 0 | 0 |
| • Range Safety | 0 | 0 | 0 | 0 | 0 | 0 |
| • Structures | 2 | 7 | 3 | 0 | 0 | 0 |
| • Thermal (TPS) | 0 | 9 | 5 | 0 | 0 | 0 |
| **Total** | **2** | **21** | **9** | **0** | **0** | **0** |

* Included in Appendix C

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ET77/78ΔP.2/96.S4.5

# E 77 PR/MRBs - Summary Prop/Pneumatics



| PR No./Status | Title/Description | Disposition |
|---|---|---|
| PET-77-FP- 0002<br>Item #1<br>Closed | Inboard pivot of the LH2 umbilical roller arm assy is contacting the roller arm assy housing | Use as repaired<br>• Roller arm housing was reworked by filing and alodine application to provide clearance |
| PET-77-FP-0002<br>Item #1<br>Closed | Two nicks with raised metal in the bore of the LH2 17" disconnect<br>• Located at the 6 and 9 o'clock position | Use as repaired<br>• Raised metal removed and alodine applied to area |

| PR No./Status | Title/Description | Disposition |
|---|---|---|
| PET-77-ST-0003<br>Item #1<br>Closed | • Two gouges on bipod strut assy clevis end (about halfway out on clevis)<br>• Verification of part thickness not feasible | Use as is<br>• No raised metal found<br>• No crack like indications |
| PET-77-ST-0003<br>Item #2<br>Closed | Scratch on bipod strut clevis<br>• Defect measures 0.010" D with raised metal 0.006"<br>• Verification of part thickness not feasible | Use as is<br>• Raised metal removed and defect edges blended<br>• No crack like indications |
| PET-77-ST-0006<br>Closed | Two gouges on the ET/Orbiter yoke assy<br>• Defect measures 0.020" D with no raised metal<br>• Verification of part thickness not feasible | Use as is<br>• No raised metal found<br>• No crack like indications |
| PET-77-ST-0007<br>Closed | Missing primer on lower right hand side of Ground Umbilical Carrier Panel<br>• Scratch 0.25" L x 0.001" W | Use as is<br>• Small area of missing primer is covered by GUCP reducing potential for corrosion |



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# E 77 PR/MRBs - Summary Thermal



| PR No./Status | Title/Description | Disposition |
|---|---|---|
| PET-77-TS-0001<br>Closed | -Y GO2 vent seal alignment grid letters are faded | • Use as repaired<br>- Lumocolor 317 currently used was replaced with epoxy ink<br>- Epoxy ink is currently used for all part markings on the tank |
| PET-77-TS- 0004<br>Closed | Suspect air pocket (subsurface void) on ice frost ramp located at Sta 1657<br>• Trimmed off raised foam, subsurface voids found | • Use as repaired<br>- Voids repaired using PDL<br>- Additional bondline will not alter thermal performance |

# ET 77 PR/MRBs - Summary Thermal



| PR No./Status | Title/Description | Disposition |
|---|---|---|
| PET-77-TS-0007<br>Closed | Void in fire barrier sealant of LH2 umbilical test port closeout<br>• Defect measures 0.125" diameter | Use as is<br>• Area of missing fire barrier is small and localized<br>• Existing TPS will provide sufficient thermal protection<br>• Area not a debris concern |
| PET-77-TS-0008<br>Closed | Voids in -Y aft fairing TPS closeout<br>• Defects measure<br>- 2.31 x 0.375" x 0.5"<br>- 1.5" x 1.0" x 0.5" | Use as repaired<br>• Voids repaired using PDL<br>• Additional bondlines will not affect thermal performance of closeout<br>• Repair of these areas not a debris or ice/frost concern |
| PET-77-TS-0009<br>Closed | Crushed/cracked foam in -Y bipod spindle clevis PDL foam closeout<br>• Defect is located on aft side of clevis<br>• Measures 0.6"L x 0.06" W x 0.1" D | Use as is<br>• No loose material - Not a debris concern<br>• Crack terminates at clevis fitting and additional propagation not expected |

## LH2 Flapper Valve Postion

**Problem:**

- During attempted removal of the stop plate from the LH2 17" disconnect cover plate the technician felt the load of the disconnect roller against the stop plate indicating the valve was attempting to close

**Trouble Shooting Performed:**

- Torque checks and visual inspections were performed and indicated that the valve was operating properly
  - Parker-Hannifin reperformed the angle and tip load with no anomalies

**Rationale:**

- Stand alone inspections/measurements performed by Parker-Hannifin personnel (the vendor) before and after the incident indicated the disconnect is without any visible abnormalities or inspection/ measurement anomalies
- OMRSDs associated with open/closure torques were re-satisfied and are acceptable
- Post ET/Orbiter mate positive control of the ET 17" disconnect flapper valve is maintained by the Orbiter actuator leakage and the opened position latch lock
  - Additionally, the over center position of the flapper causes fluid flow to hold the valve in the open position

# ET-77 Limited Life Components

C

*Cycle Sensitive*

| Description | Part No. | Serial No. | Limit | Required | Remaining |
|---|---|---|---|---|---|
| LH2 Manhole Cover Assy | 80914081488-019 | 00098290 | 100 | 1 | 100 |
| LO2 Tank Mechanical Assy | 80912002000-019 | 00088620 | 100 | 1 | 100 |
| LH2 Tank Mechanical Assy | 80914002000-009 | 00079380 | 100 | 1 | 100 |
| LO2 Manhole Cover Assy | 80911001205-010 | 00169780 | 100 | 1 | 100 |
| LO2 Fwd Ogive Cover Plate | 80911001207-029 | 00077240 | 100 | 1 | 100 |
| LH2 Manhole Cover Assy (Aft Dome) | 80911001444-010 | 00110010 | 100 | 1 | 100 |
| | | 00074350 | 100 | 1 | 100 |

# ET 77 Limited Life Components

C

## *Age Sensitive*

| Description | Part No. | Serial No. | Limit | Initiation | Expiration |
|---|---|---|---|---|---|
| External Tank | 80901000000-270 | 00000070 | 6 Yrs | 5/95 | 5/2001 |
| RSS Battery A | 10406-0133-801 | 2000191 | 2 Yrs<br>90 Days | 5/95<br>2/16/96 | 5/97<br>5/16/96 |
| RSS Battery B | 10406-0133-801 | 2000190 | 2 Yrs<br>90 Days | 5/95<br>2/16/96 | 5/97<br>5/16/96 |

## *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 | 315 | 2/96 | 2/97 |
| | -826 | AAB | 268 | 2/96 | 2/97 |
| | -827 | AAB | 225 | 2/96 | 2/97 |
| | -828 | AAB | 181 | 2/96 | 2/97 |
| | -831 | AAB | 456 | 2/96 | 2/97 |
| Confined Detonating Fuse Manifold | 10312-0001-107 | AAT | 2002300 | 11/94 | 3/98 |
| | 10312-0001-107 | AAT | 2002301 | 11/94 | 3/98 |
| Safe & Arm Device | 10311-0001-803 | AAH | 2000405 | 11/95 | 8/96 |

## *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 |
|---|---|---|---|---|---|
| NSD | SEB26100094 -201 | JHT | 00279<br>00280 | TBD<br>TBD | 8/98<br>8/98 |
| Separator Assy GUCP | PD500020-059 | AAF | 0000833 | 5/92 | 5/96* |
| Cartridge Assy | PD500020-030 | AAF<br>AAF | 69998<br>69999 | 5/92<br>5/92 | 5/96*<br>5/96* |
| Linear Shaped Charge | PD500016-050 | AAJ | 0001772 | 6/95 | 6/98 |

* 4 year shelf life extension planned

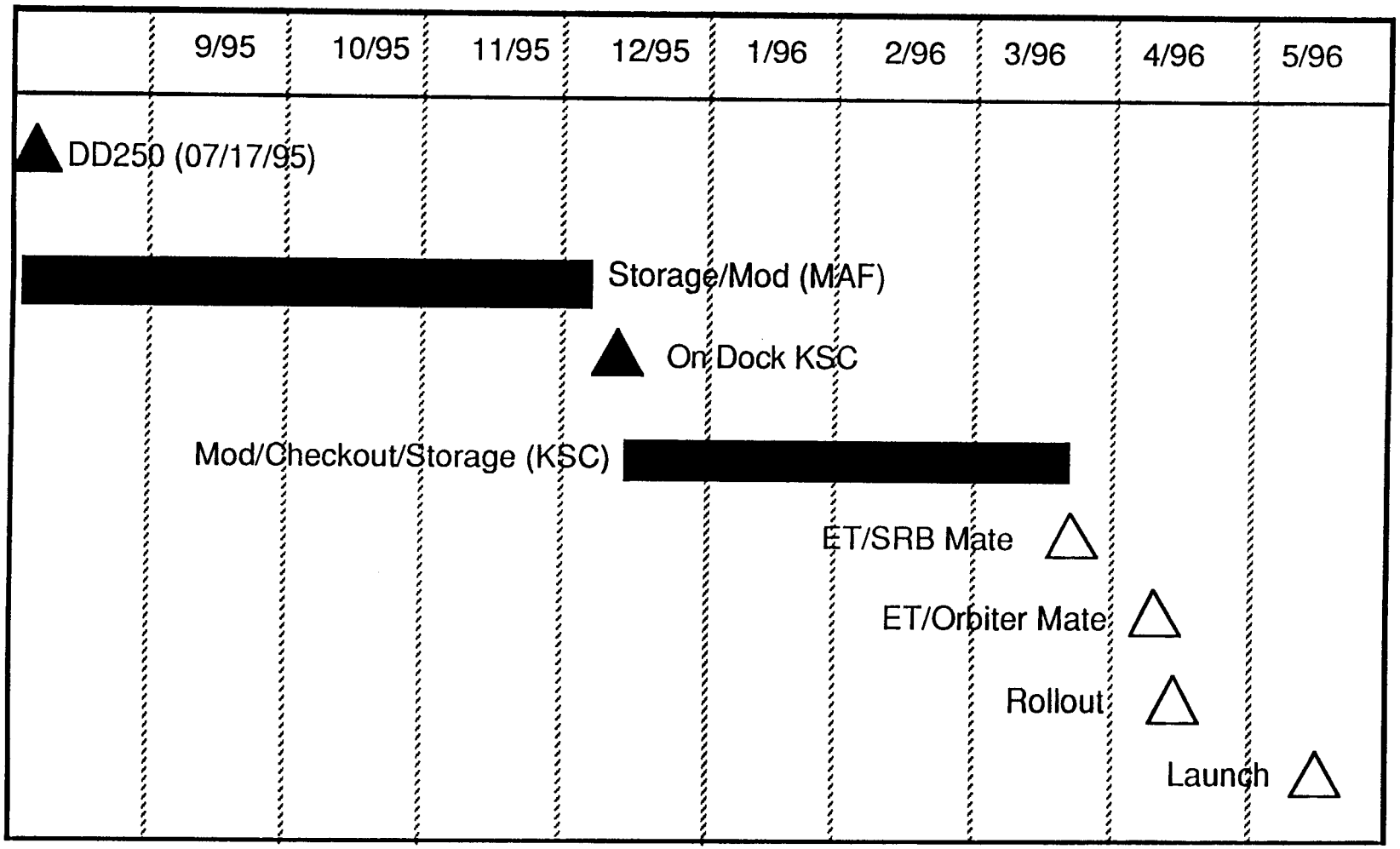
| No. | Description | Status |
|---|---|---|
| **Mod Kits** | | |
| E141/B02009 | Electrical bonding of the Integrated Receiver/Decoded (IRD) | Closed |
| **FEC** | | |
| KET-0029 | Third hardpoint primer application | Closed |

# C RSD Change, File IV

C

| Description | Reason | Rationale for Change |
| --- | --- | --- |
| • Delete visual inspection of safety wire securing OI feedthru connector on the LO2 aft dome during receiving inspection operations (RCN KT12655M) | • ET processing efficiency improvement - NASA requirements reduction team requested all STS elements evaluate existing requirements for duplicate and/or no value inspections at KSC | • Connector is inspected at MAF prior to shipment to KSC<br>• No planned work in vicinity of connector<br>• No history of failure |

# ET 78 Processing Schedu

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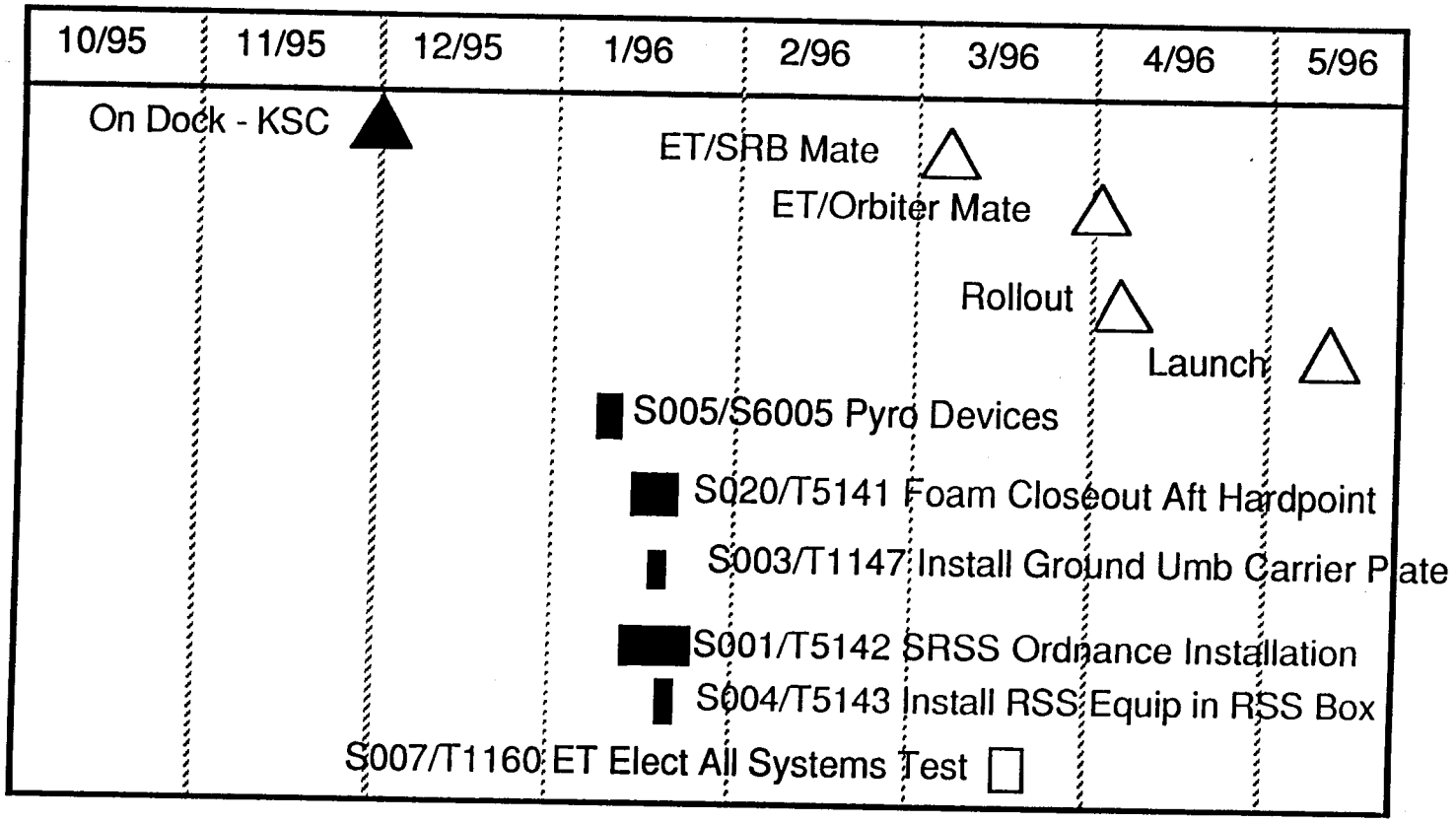
*Manned Space Systems*

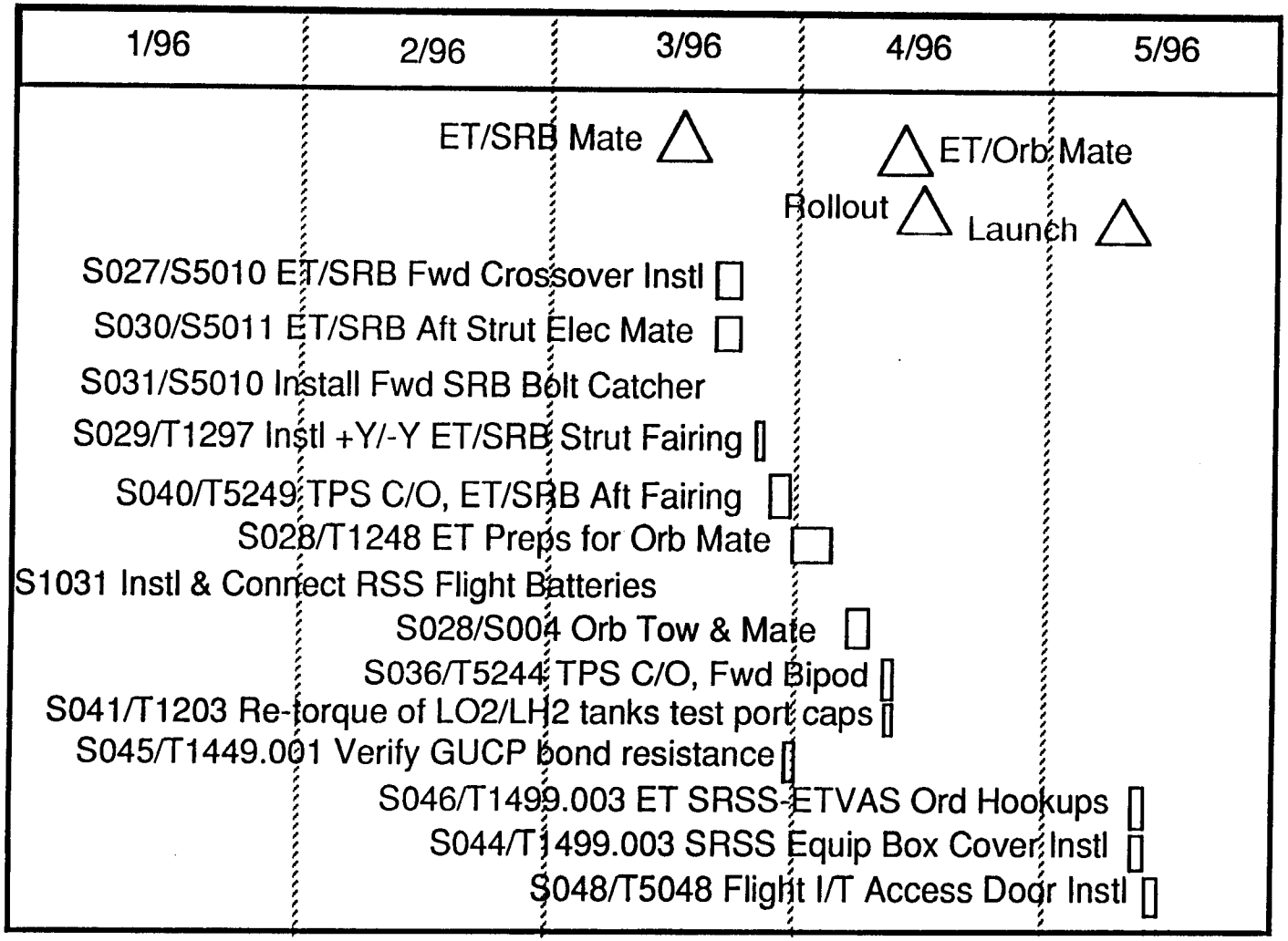
# ET 78 Planned Work

C1



# E 78 Planned Work



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*Manned Space Systems*

# ET 78 DR/PR/OMRSD Waiver/Exception-Summary

*as of 2/22/96*

| System | Discrepancy Problem Total | Discrepancy Problem Total | MRB Items Total | MRB Items Open | Waivers/Exceptions Total | Waivers/Exceptions Open |
|---|---|---|---|---|---|---|
| • Electrical | 0 | 0 | **0** | **0** | 0 | 0 |
| • Propulsion/ Pneumatics | 1 | 0 | **0** | **0** | 0 | 0 |
| • Range Safety | 0 | 0 | **0** | **0** | 0 | 0 |
| • Structures | 0 | 3 | **0** | **0** | 0 | 0 |
| • Thermal (TPS) | 1 | 6 | **2** | **1** | 0 | 0 |
| **Total** | **2** | **9** | **2** | **0** | **0** | **0** |

# ET-78 PR/MRBs - Summary

| PR No./Status | Title/Description | Disposition |
|---|---|---|
| **Thermal** | | |
| PET-78-TS-0004<br>Closed | Area of mold/mildew adjacent to 2-inch valve poppet on LH2 umbilical | • Use as repaired<br>- Solvent wipe with freon/IPA<br>- Accept remaining residue |
| PET-78-TS-0007<br>Open | Three areas of undersprayed BX-250 in aft hardpoint closeout area | • Use as is<br>- Defects are localized and marginally violate minimum thickness requirement<br>- Ice/frost requirements maintained |

# ET-78 Limited Life Components

## *Cycle Sensitive*

| Description | Part No. | Serial No. | Limit | Required | Remaining |
|---|---|---|---|---|---|
| LH2 Manhole Cover Assy | 80914081488-019 | 000123410 | 100 | 1 | 100 |
| LO2 Tank Mechanical Assy | 80912002000-019 | 000111540 | 100 | 1 | 100 |
| LH2 Tank Mechanical Assy | 80914002000-009 | 000100070 | 100 | 1 | 100 |
| LO2 Manhole Cover Assy | 80911001205-010 | 000192910 | 100 | 1 | 100 |
| LO2 Fwd Ogive Cover Plate | 80911001207-029 | 000124870 | 100 | 1 | 100 |
| LH2 Manhole Cover Assy (Aft Dome) | 80911001444-010 | 000095010<br>000131860 | 100<br>100 | 1<br>1 | 100<br>100 |

## *Age Sensitive*

| Description | Part No. | Serial No. | Limit | Initiation | Expiration |
|---|---|---|---|---|---|
| External Tank | 80901000000-270 | 00000071 | 6 Yrs | 7/95 | 7/2001 |
| RSS Battery A | 10406-0133-801 | TBD | 2 Yrs 90 Days | TBD | TBD |
| RSS Battery B | 10406-0133-801 | TBD | 2 Yrs 90 Days | TBD | TBD |

## *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 | 317 | 2/96 | 2/99 * |
| | -826 | AAB | 269 | 2/96 | 2/99 * |
| | -827 | AAB | 226 | 2/96 | 2/99 * |
| | -828 | AAB | 460 | 2/96 | 2/99 * |
| | -831 | AAB | 457 | 2/96 | 2/99 * |
| Confined Detonating Fuse Manifold | 10312-0001-107 | AAW | 2002302 | 7/93 | 7/97 |
| | 10312-0001-107 | AAW | 2002303 | 7/93 | 7/97 |
| Safe & Arm Device | 10311-0001-803 | AAH | 2000438 | 11/95 | 8/96 |

* 10 year shelf life extension complete - Pending receipt of certification paper

***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 |
|---|---|---|---|---|---|
| NSD | SEB26100094 -201 | JHT | 00091 | TBD | 8/98 |
| | | | 00092 | TBD | 8/98 |
| Separator Assy GUCP | PD500020-059 | AAF | 0000835 | 5/92 | 5/96* |
| Cartridge Assy | PD500020-030 | AAF | 70002 | 5/92 | 5/96* |
| | | AAF | 70003 | 5/92 | 5/96* |
| Linear Shaped Charge | PD500016-050 | AAJ | 0001773 | 6/95 | 6/98 |

* 4 year shelf life extension planned for TBD

| No. | Description | Status |
|---|---|---|
| E142/B02009 | Electrical bonding of the Integrated Receiver/Decoded (IRD) | Closed |

# Delete LO2 Umbilical AAD Connector (B01142W) D1

**Change:**

- Delete unused connector from the LO2 umbilical

**Reason:**

- Connector no longer used
  - Ascent Air Data System removed from ET
- Orbiter mating connector removed (IRN 0478- ICD-2-12001)

**Basis for Certification:**

- Inspection - Connector not installed

| 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 |

| 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 |

| 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 |

| 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 |

| 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 |

| 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 |