

FLIGHT READINESS STATEMENT
BLOCKS 12 & 13 AND
STS-70/ET-71 AND STS-71/ET-70
Δ EXTERNAL TANK PROJECT REVIEW

EXTERNAL TANKS ET-70 AND ET-71, AS IDENTIFIED IN THE EXTERNAL TANK PROJECT DELTA FLIGHT READINESS REVIEW DATED MAY 3, 1995, ARE CONSIDERED READY TO SUPPORT FLIGHT UPON ACCEPTABLE DISPOSITION OF OPEN WORK AND/OR OPEN ACTIONS.

M.D. Martin
for J. RANDALL/EB01

M. Pessin
M. PESSIN/EE31

P. Schuerer
P. SCHUERER/EH01

M.D. Smiles
For J. EHL/CR01

J. Strickland
for J. STRICKLAND/EL01

J. Blair
for J. BLAIR/ED01

J. McCarthy
J. MCCARTHY/EP01

M.D. Smiles
M. SMILES/CR70

P. V. Counts
P. V. COUNTS/SA31, CHAIRMAN

May 3, 1995

**Space Shuttle
External Tank**

1

**Block 12/13 & STS-70/ET-71 ET Project
STS-71/ET-70 ΔET Project**

Flight Readiness Review



Agenda

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- **Introduction**
- **Prior Mission Summary**
- Overview
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Lou Palermo



Introduction

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- Review covers changes/differences/non-conformances not previously flown
 - Missions STS-63/ET-68 and STS-67/ET-69 performance summaries
 - ET changes for Blocks 12 and 13
 - Mission specific items for STS-70/ET-71 and STS-71/ET-70
 - Separate handout provides assessment for implementation of DOLILU II and Block I SSMEs on STS-70
- Delta reviews for Block 12 and 13 ETs will be scheduled on a mission-by-mission basis and include:
 - List of previously discussed items as applicable to the specific ET
 - Details of previously addressed items will be available in appendix
 - Performance summary of the previous flight
 - New items since previous readiness review
 - Mission specific items
 - Implementation of NCFI 24-57 foam on ET-80 aft dome will be addressed at Delta ET Project review for ET-80

Mission Performance Summary

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<u>System</u>	<u>Performance</u>	
	<u>STS-63/ET-68 (2/3/95)</u>	<u>STS-67/ET-69 (3/2/95)</u>
OMRSD/LCC	No violations	No violations
Instrumentation	Nominal	Nominal
MPS	Nominal	Nominal
Hazardous Gas	No violations	No violations
TPS	Nominal • Small area of topcoat was removed with GO2 vent hood retraction	Nominal
ET disposal	No issues	No issues
Orbiter tile damage	Lower Surface, below average • >1" = 7 • Total = 84	Lower surface, below average • >1" = 11 • Total = 49
Post flight photo review	18" piece of RSS ground checkout cable remained attached for flight *	No issues

* To be presented with Changes, RSS ground checkout tear-away cable (B02006)

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External Tank Overview

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as of 4/26/95

<u>STS</u>	<u>ET</u>	<u>DD250 Date</u>	<u>Ship to KSC</u>	<u>Scheduled Launch Date</u>	<u>Current Location</u>
71	70	2/17/94	11/10/94	6/19/95	KSC
70	71	5/4/94	12/9/94	6/8/95	KSC
69	72	7/1/94	3/9/95	7/20/95	KSC
73	73	10/4/94	4/6/95	9/21/95	KSC
74	74	11/17/94	6/8/95	10/26/95	MAF
72	75	2/3/95	7/13/95	11/30/95	MAF
75	76	3/29/95	7/27/95	2/15/96	MAF
76	77	6/7/95	10/5/95	3/21/96	MAF
77	78	8/4/95	10/26/95	4/25/96	MAF
78	79	10/3/95	11/30/95	6/27/96	MAF
79	80	11/28/95	2/15/96	8/1/96	MAF

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Changes, Documentation/Requirements - List

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<u>Description (Change No.)</u>	<u>Effectivity</u>
• Documentation - GFP LH2 CDF manifold IDD revision (B01948D) * - Periodic CIL update (B01788S)	ET-70 and subs ET Project
• Requirements - KSC work minimization OMRS changes (RCNs KT12079, KT12081, KT12086) *	ET-70 and subs

* Included in Appendix D, Previously presented items
Plain - Included in Appendix A, Minor Changes

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Changes, Configuration - List

<u>Description (Change No.)</u>	<u>Effectivity</u>
- GFP 17" umbilical disconnect revision (B01985) * - Delete aft LO2 feedline bracket heaters (B01937) * - Revise GFP CDF routing in ET Intertank (B01994) * - Remove Intertank sense port shipping protection (B01988A) - Install Hydrogen fire detection paper at MAF (B01997) - Delete AADS connector from LO2 Umbilical (B01142W) - GFP 17" umbilical revision (B01985B) - Enhanced jack pad closeout (B01945B) - RSS ground checkout tear-away cable (B02006) - Generic certification for ET thermal environments (B01959) - LO2 feedline fabrication at MAF (B01953) - Replace Freon TMC for primed surfaces (B01964A) - LH2 aft dome acreage SOFI (B01987)	ET-70 and subs ET-71 and subs ET-75 and subs ET-76 and subs ET-76 and subs ET-77 and subs ET-79 and subs ET-70 and subs ET-70, 72 and subs ET-71 and subs ET-75 and subs ET-79 and subs ET-80 and subs

* Included in Appendix D, Previously presented items
Plain - Included in Appendix A, Minor Changes
Bold - To be presented

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Enhanced Jack Pad Closeout (B01945B)

Background/ Reason:

- STS-58/ET-57 post separation photos showed loss of both ET/Orbiter jack pad TPS closeouts
 - Initiated IFA STS-58-T-01 and CAPS T-066 PF
- Investigation team formed
 - Evaluation attributed failures to poor adhesion and substrate void/cryo pumping
- Extensive development/validation tests performed
- Material/method met test plan acceptance criteria/repeatability requirements

Change:

- Hardware
 - Replaced 4.5" x 4.5" PDL closeouts with four 1.25" PDL foam closeouts on ET jack pad closeouts
 - ETs 70-77
 - Enlarge existing jack pad configuration and spray with BX-250 around dowel pins to create GSE stand-off access holes
 - Modified GSE to incorporate "stand-offs" on ET/Orbiter mating fixture
 - ETs 78 and up: Spray BX-250 foam around dowel pins as part of LH2/Intertank flange closeout at MAF

- Documentation
 - Revise ET CIL and HCS to reflect configuration change

Basis for Certification:

- Stress analysis, PDL FS
 - Was: 1.44
 - Now: > 2.0
- Development/validation tests
 - Cryogenic/bond strength/dissection
- Similarity to previously flown hardware

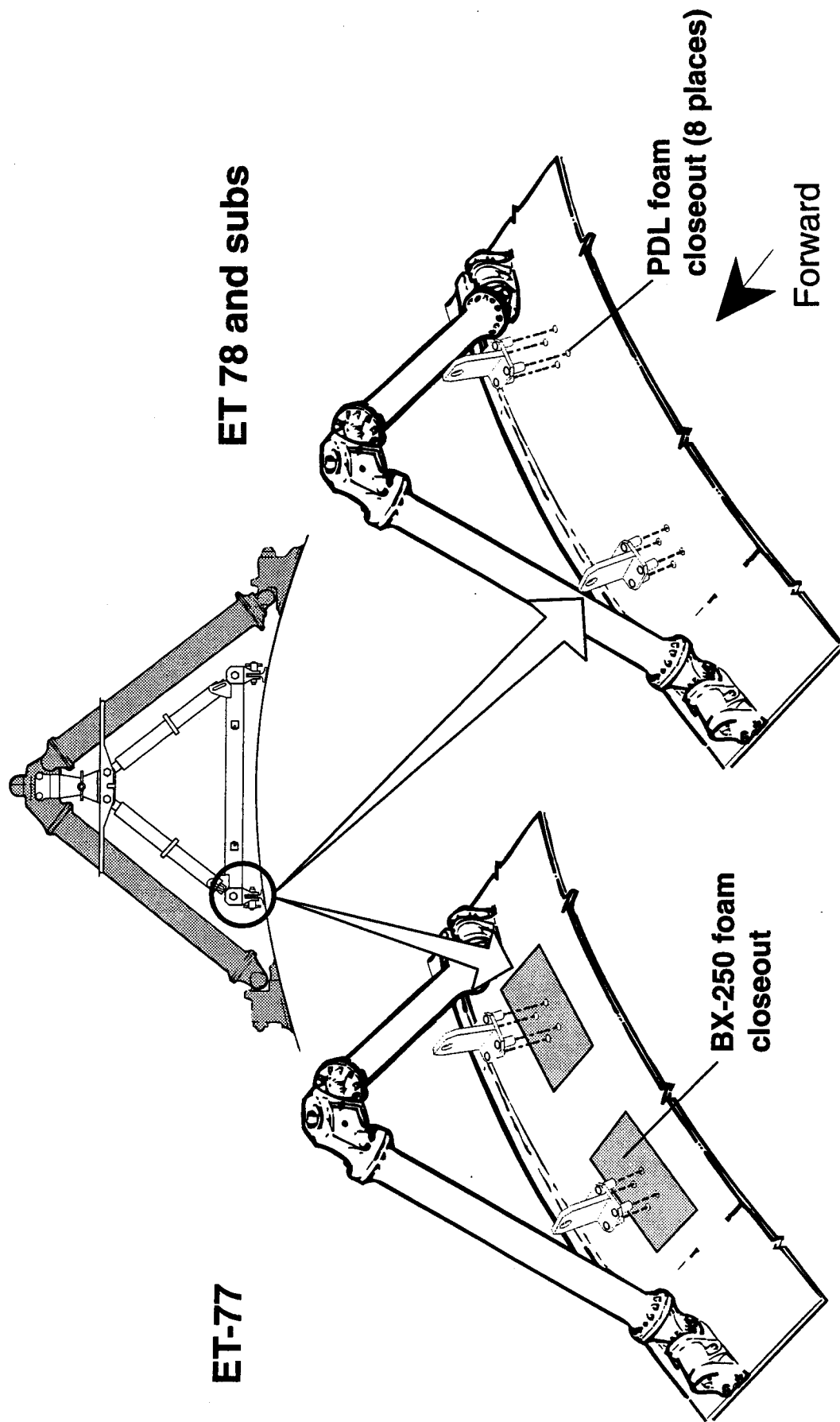
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Enhanced Jack Pad Closeout (B01945B)

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Blk12/13.Pgmker.dd.4/95.4

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RSS Ground Checkout Tear-away Cable (B02006)

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Change:

- Redesign RSS ground checkout tear-away cable for ETs 70, 72 and subs

Background/ Reason:

- Post launch film review revealed approximately 18" piece of ET RSS ground checkout tear-away cable remained attached on ET-68/STS-63
- Review of historical data indicates that the tear-away cable pulled out of the Intertank interface connector on all previous launches and ET-69/STS-67
- Cause of ET-68/STS-63 failure undetermined
- No concerns from a debris, H2 ignition or RF interference standpoint
- Concern related to ESD build up during 1st stage flight which could make the IRD incapable of receiving a destruct command during 2nd stage
 - IRD capability - 25v max.
- Redesign not required on ET-69/STS-67 and ET-71/STS-70 based on accepted risk of RSS not functioning for broad ocean missions
- Range requested design change for high inclination missions

RSS Ground Checkout Tear-away Cable (B02006)

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Background/ Reason:

- Investigation of current design
 - Revealed a high tension load required to separate cable from back of connector
 - GUCP service loop size (4 in. min.) was too large such that tearaway action did not occur within controlled rotation of the GUCP
- Tests performed
 - Simulated GUCP retraction/pull test
 - 3 design options tested - 6 specimens
 - Kellum grip - failed
 - 90° connector and mechanical lanyard - passed
 - 90° connector option selected
 - Minimal impact to KSC processing
 - Reduces significantly the required tension load to separate cable from the connector (20 lbf vs. 110 lbf)
 - GUCP service loop size reduced (2 in. max.) to ensure tearaway action occurs within GUCP initial rotation (23° rotation)
- PRCB S082944 approved design and modification kits on 4/13/95
- Tests performed at MAF validated design solution

Basis for Certification:

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RSS Ground Checkout Tear-away Cable (B02006)

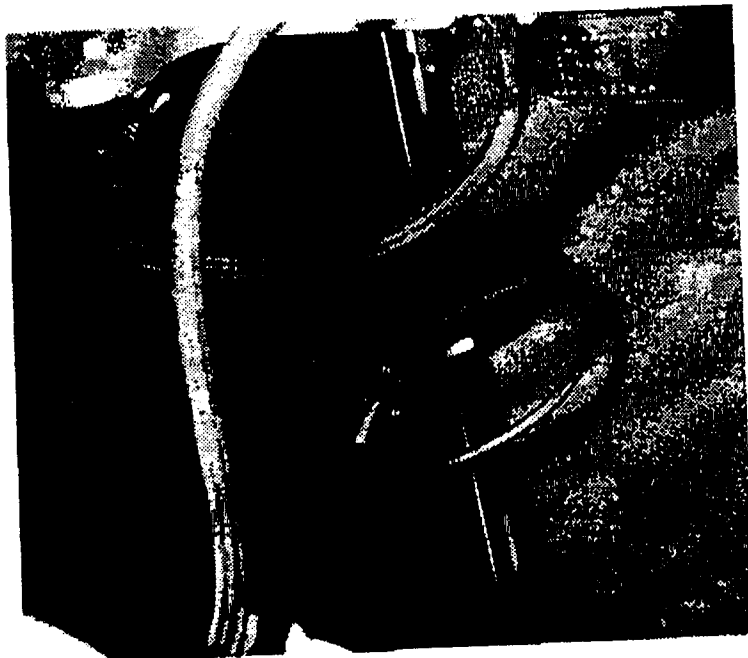
P. 05

MAF/MSR

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05-02-1995 13:25

Prior configuration



ET-70, 72 and subs



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BK12/13.Pgmker.dd.4/95.7

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Generic Cert for ET Thermal Environments (B01959)

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- Basis for Certification:**
- Analysis
 - Thermal
 - Stress: All hardware meets design FS requirements
 - Venting
 - Similarity - TPS materials previously qualified for similar applications

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LO2 Feedline Fabrication at MAF (B01953)

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Change:

- Fabricate LO2 feedline straight sections at MAF

Background/ Reason:

- Supplier of LO2 feedline straight sections through ET-74 no longer in business (Sargent Airtite)
- Make/buy assessment indicated that overall program cost savings would be achieved if hardware was built in-house at MAF

Description:

- Hardware
- No change in flange forging vendor
- Flange machining, assembly welds and acceptance test will be performed at MAF
- Pipe section forming process changed to a 'Roll Extrusion' process
 - Outside diameter controlled
 - Minor increase in line dry weight and propellant weight due to increased inner diameter

Basis for Certification:

- Stress analysis, FS (failure mode - tension and bending)
 - Was: 2.17
 - Now: 2.20
- Successful qualification test of a feedline section fabricated at MAF
 - Acceptance
 - Ultimate load
 - Capability

Alternate Cleaning Solvent for Primed Surfaces

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Change:

- Freon TMC and/or solvent reducer replaced with MEK for manual cleaning of primed surfaces

Background/ Reason:

- 1990 Clean Air Act dictates phase out of Freon TMC due to ozone depletion issue
- EPA targeted elimination of Cyclohexanone (component of solvent reducer) due to toxicity/hazardous substance

Basis for Certification:

- Test program demonstrated successful removal of typical contaminants (silicone, tape residue, oil, Krytox, zinc chromate paste)
- Certification tests in conjunction with TPS alternate blowing agent test program
 - Combined environments
 - PAL ramps
 - Cryoflex

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LH2 Aft Dome Acreage SOFI (B01987)

Change:

- Hardware:
 - Replaced CFC-11 blowing agent in NCFI 22-65 foam material used on ET LH2 aft dome acreage with HCFC-141b blowing agent in NCFI 24-57 foam material

- Documentation:
 - Revised HCS and CIL to reflect new part number

Background/ Reason:

- 1990 Clean Air Act dictates phase out of CFC-11 due to ozone depletion issue

Basis for Certification:

- Development/certification test program
 - Wind tunnel
 - Radiant ablation
 - Combined environments
 - Coupon tests
 - Manufacturing validations

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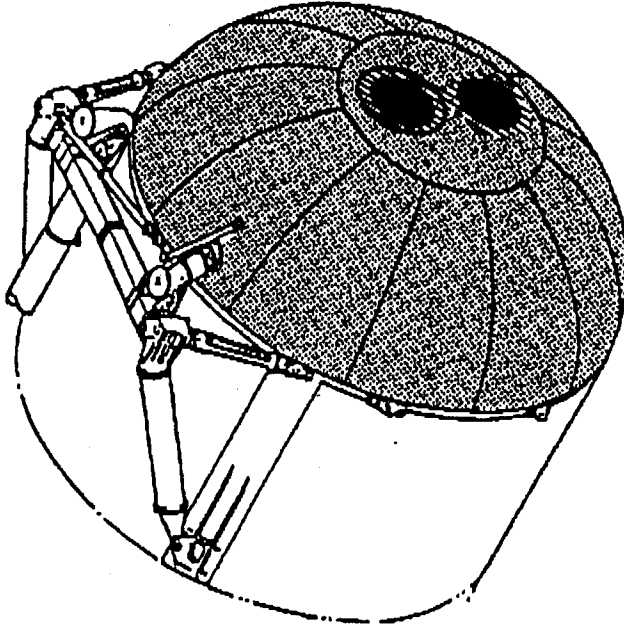
LH2 Aft Dome Acreage SOFI (B01987)

ET-79

- CFC-11 blowing agent in NCFI
22-65 foam

ET-80 and subs

- HCFC-141b blowing agent in NCFI
24-57 foam



LH2 tank aft dome

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Btk12/13.Pgmker.dd.4/95.8

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Mission Highlights

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• FRR Series - ET/SRB Mate - ET Project - Associate Administrator - L-2 Day	<u>STS-70/ET-71</u>	<u>STS-71/ET-70</u>
	4/10/95	3/9/95
	5/3/95	8/10/94
	5/25/95	6/2/95
	6/6/95	6/17/95
• Launch - Window - Pad - Orbiter - Orbital inclination - ET photo coverage	6/8/95	6/19/95
	1020-1250 EDT	1843-1848 EDT
	B	A
	103	104
	28.45° at 160 NM	51.6° at 160 NM
	Crew photos from cockpit window	• Crew photos from cockpit window • Umbilical well cameras
• Mission payload	TDRS-G	Mir rendezvous/docking
• Landing - Time - Location	6/16/95	6/30/95
	0833 EDT	1414 EDT
	KSC	KSC

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SRM&QA Assessment

as of 4/26/95

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Item

- Alerts

Status

None

- MRB Assessment

Complete - No issues/impacts to hazard controls

- Hazard Assessment

Complete - All hazard reports were re-assessed and hazard controls verified

- One new hazard report P.10, "Usage of Isopropyl Alcohol for ET Cleaning and Verification", documents the controls/verifications used to insure LO2 tank/components free of liquid IPA
- Approved by PRCBD S081243A

- Discrepancy Check and Report (DC&R)

- Helium inject tube thermal wrap

(P-95-001)

- ETs 70-73 inspected at KSC - Acceptable
- ETs 74 and 76 - To be worked at MAF
- ET-75 to be inspected by NCD at MAF
- ET-77 inspected at MAF - Acceptable

- Plastic caps inside Intertank

(S-95-002)

- ETs 70 and 71 inspected at KSC - Acceptable
- ETs 72-77 to be inspected

- Corrective Action Problem Summary (CAPS)

None

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KSC Processing - Status

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as of 4/26/95

- **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 Status ***

All within required life through scheduled launch date plus 90 days except

 - Linear Shaped Charge
 - Lot extension test to 6/98 complete
 - Pending approval of certification paper
 - Safe and arm device
 - Shelf life expires 8/95
 - Shelf life extension not planned

* Included in Appendix C

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KSC Processing - Status

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as of 4/26/95

	<u>STS-70/ET-71</u>	<u>STS-71/ET-70</u>
• OMRSD Exceptions/Waivers	0	0
• Changes		
- ET modifications		
• Mod kit *	1	3
• DC&R (Discrepancy Check and Report) *	1	1
• Bldg 45	0	0
• FEC (Field Engineering Change)	0	0
- Software	0	0
• SIM load	5/23/95	5/9/95
• SIM launch	5/3/95	4/19/95

* Included in Appendix C

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Verification/Certification

32

as of 4/26/95

Item

Status

- **NSTS 07700, Volume X Baseline**
 - Revision L, Change 206

No issues - One open item

 - Generic certification for ET thermal environments pending closure of PRCBD 060607, ECD 5/4/95 *
- **Certification documentation**
 - Hardware Certification Sheets (HCS)
 - Certificates of Qualification (COQ)

Complete - No issues
- **Waivers/Deviations**

Complete - No issues

* Previously addressed with Changes, Generic cert for ET thermal environments (B01959)

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Mission Unique Assessment

Revised 5/3/95
34

as of 4/26/95

Category/Item

STS-70/ET-71

STS-71/ET-70

- | | | |
|--|---|----------------------|
| • Vehicle loads | * | Complete - No issues |
| • Thermal assesssment | No longer applicable due to implementation of generic thermal certification * | Complete - No issues |
| • Review of MRB actions using updated loads and environmental data | Complete - No issues | Complete - No issues |
| • MPS Preflight Prediction Package | ECD 5/30/95 * | ECD 6/9/95 |
| * To be discussed in separate handout | | |

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DOLILU II Low Q Impact Assessment for LWT

STS-70/ET-71 ET Project
May 3, 1995

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BLK121713.4220.Addendum.4/95.a

DOLILU II Low Q Impact Assessment for LWT

Background:

- **DOLILU I Processor**
 - Trajectory steering modified by DOL wind data
 - Reduced adverse pitch and yaw effects
 - FRR/FMA are done on nominal trajectory
- **DOLILU II Processor**
 - Modifies thrust as well as steering that affect trajectory
 - No nominal trajectory
 - No FRR/FMA assessments
 - MPS trajectory dispersions must now be stacked rather than RSS'd due to lack of nominal trajectory
- **Cost Reduction Enhancement**
 - Flight specific trajectories generated days before flight will be replaced by building a trajectory hours before flight with L-4 hour winds
 - Trajectory will be within a certification set (DOLILU II) of trajectories covering a wide range of situations previously approved

• Systems

Vddendum.495.b

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DOLILU II Low Q Impact Assessment for LWT

Added 5/3/95
34c

System Impacts:

- **Main Propulsion System (MPS)**
 - Ullage pressure effects of DOLILU II trajectories must be approved
 - Eliminates flight specific ullage pressure predictions for similarly configured flights
 - Four sets of MPS DOLILU II trajectories will eventually exist
 - Low Q for certain LWT flights prior to ISSA
 - All remaining 1995 flights and when Mid Q not needed
 - Trajectories now available
 - Mid Q for other LWT flights prior to ISSA
 - STS-75 and subs as needed
 - Trajectories available in May, 1995
 - LWT flights after 1st ISSA flight
 - Trajectories available July, 1995
 - Performance Enhancement flights (SLWT, Low to High Q)
 - Corrected trajectories available May, 1995 (deleting LSRM/ESRB)
- **Loads**
 - DOLILU I system works with a nominal I-Load
 - DOLILU II is more basic by building the trajectory completely
 - Both systems utilize actual wind versus nominal wind for trajectory construction
 - No nominal I-Load to do an FRR assessment
 - All Rev. M Algorithms will be evaluated DOL
 - Level II complied with request to have all available

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BLK12/13.4220, Addendum 4/95.c

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DOLILU II Low Q Impact Assessment for LWT

System Impacts (continued):

- **Thermal**
 - R/D certification analysis indicated DOLILU II heating less than Generic Certification
 - DOL 1st Stage heating protected by Rule S-9

Change:

- **Main Propulsion System**
 - Insignificant change to LH2 ullage pressure prediction due to flow control valves with sufficient control authority to compensate for trajectory changes
 - LWT LO2 ullage pressure evaluation generic rather than flight specific
 - Trajectory effects on ullage pressure now stacked rather than RSS'd
 - Extreme trajectory cases evaluated for enveloping throttle, atmospheric temperature and acceleration effects
 - Orbiter specific maximum drainback hold time dispersions
 - Updated DOLILU II web action time dispersions (RSS'd values)
- **Loads**
 - FRR/FMA analysis not possible
 - Preflight generated trajectories replaced by trajectory created during prelaunch countdown
 - Utilizes L-4 hour balloon data
 - Minimizes the effects of wind

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DOLILU II Low Q Impact Assessment for LWT

Basis for Certification:

- Main Propulsion System (MPS)
 - STS-70
 - Normal mission flight ullage pressure assessment complete and acceptable (One Block I and two Phase II SSMs)
 - Early RTLS mission to be evaluated by May 3
 - Trajectories available by April 28
 - Generic
 - LO2 ullage pressures meet LWT requirements for all Phase II SSM normal mission DOLILU II Low Q trajectories only with expanded ICD limits
 - S060604A IRN approval required to modify ICD
 - SSP Program accepted loss of margin above 1.4 FS (7% to 6%) on 3/16/95
 - Evaluation of Block I SSMs awaiting autogeneous tag effects of ISP fixes
 - Early RTLS missions to be evaluated by May 3
 - Trajectories available by April 28

DOLILU II Low Q Impact Assessment for LWT

Added 5/3/95
34f

Basis for Certification (cont.):

- Loads
 - Revision M to the ET load indicator equations/algorithms provided for DOLILU II generic trajectory assessment
 - These equations reflect loads cases, incorporated into the design set, covering expanded throttle bucket consistent with DOLILU II
 - Incorporated multiple wind sets
 - Algorithm set has been coded and checked out by R/I/D
 - Equations values match the checkout conditions supplied by Manned Space Systems
 - Test operations demo of STS-70 with a single wind produced algorithm values similar to the nominal trajectory from baseline methodology for critical indicators
 - Shows consistency of new method versus old method
 - R/I generated thousands of trajectories for generic certification of the DOLILU II system
 - Winds for all months
 - Hot and cold SRBs
 - Algorithm E3-104 showed some exceedances
 - Engine knockdown was responsible
 - Modification to knockdown approach eliminated problem
 - Knockdown methodology to be documented in NSTS 08209, Vol III
 - Launch probability for summer months was greater than 85% goal
- Thermal
 - ET heating is less than the generic certification DOL 1st Stage heating

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BLK12/13.4220 Addendum.4/95.1

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DOLILU II Low Q Impact Assessment for LWT

Open Issues:

- **Main Propulsion System (MPS)**
 - Approval of CR S060604A to expand LO2 ullage pressure ICD limits is necessary
 - Scheduled for PRCB 5/9/95
 - Assessment of early RTLS for STS-70
 - Scheduled completion by May 3
 - Completion of LWT LO2 and LH2 ullage pressure assessment for 3 Block I SSME configuration (post STS-70)
- **Loads**
 - None

Conclusions:

- Rev. M algorithms protect the ET
- STS-70 normal mission has been cleared by MPS flight specific assessment
 - MPS early RTLS assessment is scheduled for completion by May 3
- DOLILU II Low Q process is an acceptable method of flying STS with Phase II SSMEs from the ET perspective

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BLK12/13.4220.Addendum.4/95.g

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Added 5/3/95
34h

Block I SSME LO2 Ullage Pressure Assessment for LWT

STS-70/ET-71 ET Project
May 3, 1995

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BLK12/13.4220.Addendum.4/95.h

Block I SSME Ullage Pressure Assessment for LWT

Change:

- Changes from current Phase II SSME hardware configuration:
 - 2-duct powerhead (Phase II was 3-duct)
 - Baffleless main injector
 - Slightly enlarged boundary layer coolant holes
 - Single coil heat exchanger
 - Alternate high pressure oxidizer turbopump

Background/ Reason:

- STS-70 (June 1995) is first flight to use Block I SSME (S/N 2036)
 - Two Phase II SSMEs (S/N 2019 and 2017)
 - Generic LWT LO2 and LH2 ullage pressure impacts uncertain due to recently corrected Block I autogeneous performance data from Rocketdyne, and still to be determined effect of ISP fix

Basis for Certification:

- STS-70 predicted LO2 and LH2 ullage pressures meet ICD requirements
- Generic LWT LO2 and LH2 ullage pressure assessments for 3 Block I SSME configuration complete by mid-August 1995

Manned Space Systems

BLK12/13.4220 Addendum.4/95.1

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Agenda

35

- | | |
|---|--|
| <ul style="list-style-type: none">• Introduction• Prior Mission Summary• Block 12 (ETs 71-75) and Block 13 (ETs 76-80) Items<ul style="list-style-type: none">- Overview- Changes<ul style="list-style-type: none">• Documentation/Requirements• Configuration | Rick Landers |
| <ul style="list-style-type: none">• Mission STS-70/ET-71 Items<ul style="list-style-type: none">- Mission Highlights- SRM&QA Assessment- KSC Processing- Verification/Certification Status- Mission Unique Assessment- Readiness Statement• Appendices<ul style="list-style-type: none">- A: Minor Changes- B: SRM&QA Assessment- C: KSC Processing- D: Previously addressed material | Larry Hartley
Jim Feeley
Gene Horak |
| | Rick Landers
Frank Ramsey
Ken Reaume
Rick Landers |

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BLK12/13.4220.r1.5/95.S1.P35

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ET-71 Readiness Statement

36

**The External Tank, ET-71, is hereby certified
and ready for STS-70 flight pending
completion/closure of open and planned work**

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

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ET-70 Readiness Statement

37

**The External Tank, ET-70, is hereby certified
and ready for STS-71 flight pending
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**Dennis R. Deel
Vice President, External Tank Project
Martin Marietta Manned Space Systems**

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Appendices

38

- **A: Minor Changes**
 - Class I
 - Class II and JS/DCNs
 - Substitutions: None
- **B: SRM&QA Assessment**
 - MRB Assessment Criteria
- **C: KSC Processing**
 - Processing/Planned Work Schedules
 - PR/MRB Summaries
 - Limited Life Components
 - KSC Component Replacement List: None
 - Modification Summary/Status
 - Software Changes: None
- **D: Previously reviewed items**
 - Waivers/Deviations Baseline
 - Changes

Periodic CIL Update (B01788S)

A1

- Change:**
- Annual update to CIL document (MMC-RAO4b)
 - Incorporates editorial/clarification changes
- Reason:**
- Maintain currency of information in CIL
- Basis for Certification:**
- Documentation only

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Remove Intertank Sense Port Protection (B01988A)

A2

Change:

- Remove unnecessary protection for the LH2 tank relief sense port

Background/ Reason:

- Sense port was protected with J476 tape and red streamer
- Protection removed at KSC as part of ET receiving
- Production enhancement
 - Reduces number of red streamers to be accounted for during KSC ET receiving activity
 - Eliminates need to inspect and restore protection during ET storage at MAF

Basis for Certification:

- OMRSD File IV test verifies LH2 tank relief sensing capability prior to flight
 - Flow test during GH2 vent valve checkout

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BI K12/13.4220.r1.5/95.S2.P2

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Install H2 Fire Detection Paper at MAF (B01997)

A3

Change:

- Transfer installation of the hydrogen fire detection paper from KSC to MAF
 - Six locations in vicinity of ET/Orbiter H2 umbilical
 - 8 in. sq. red cross hatched printed polyethylene coated freezer wrap

Background:

- Reduce KSC processing/work activity
 - Installed at KSC since ET-13

Basis for

Certification:

- Similarity to previously flown configuration
 - Flight hardware configuration unchanged

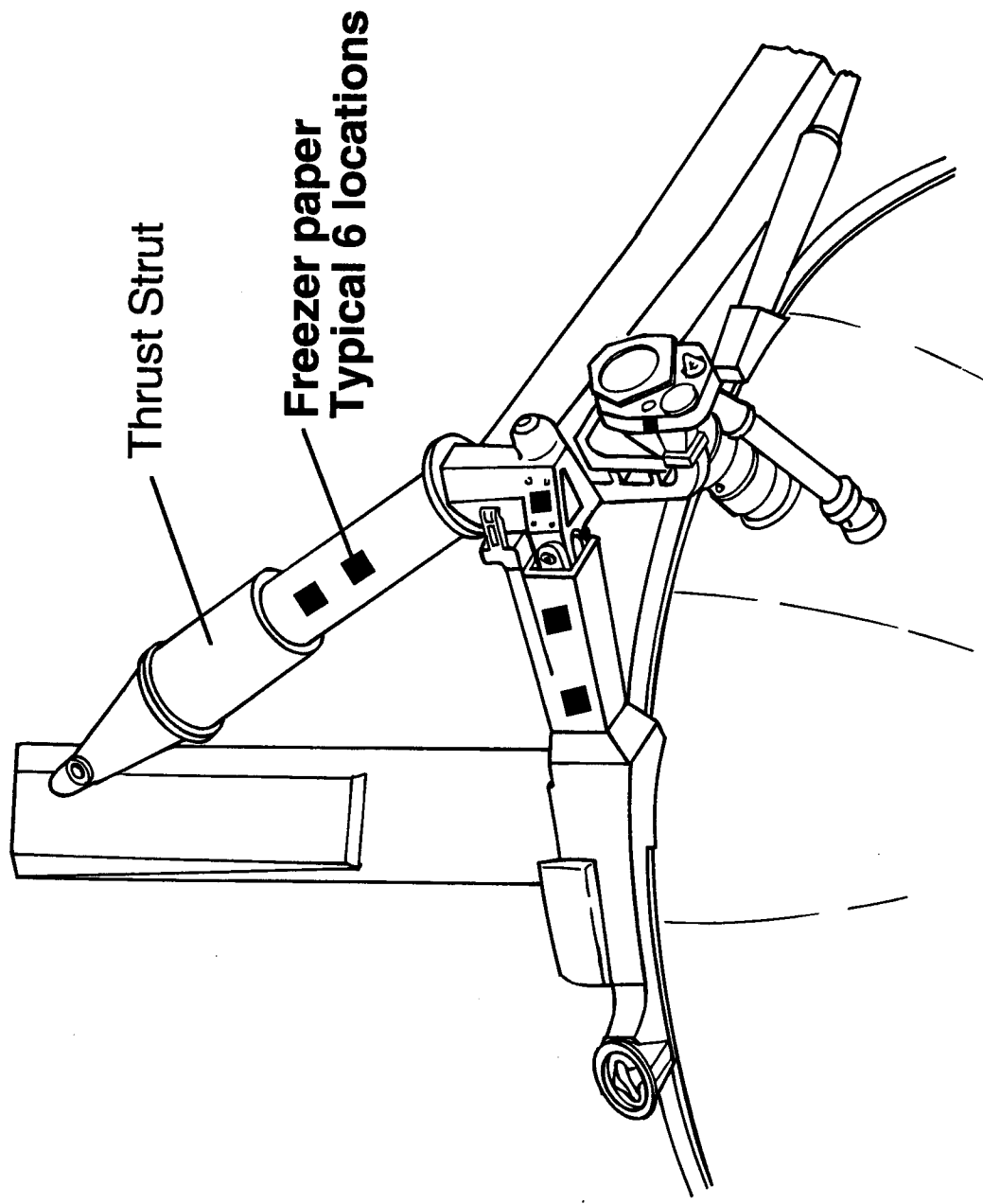
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Install H2 Fire Detection Paper at MAF (B01997)

A4



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BI K12/13.4220.11.5/95.S2.P4

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Delete AADS connector from LO2 Umbilical (B01142W)^{A5}

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

GFP Umbilical Disconnect Revision (B01985B)

A6

Description:

- Update ET drawing to reflect revised GFP umbilical part numbers

Background/ Reason:

- RI revised part numbers for LO2 and LH2 umbilicals for ET-79 and up
 - Follower arm bearing revised
 - Aero fairing rework - Plug unused instrumentation wire hole

Basis for Certification:

- Similarity - Function of umbilical unchanged

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Class II or JS/DCN Changes

A7

- 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)

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Class I/II or JS/DCN Changes - List

A8

<u>Change No.</u>	<u>Description</u>	<u>Effectivity</u>
Electrical		
H34809-954	Remove flatness requirement LO2 transducer mounting plate	ET 77 and up
H34809-958	Issue freeze order - LO2 transducer mounting plate	ET 77 and up
Structural		
H34809-812	Delete wet tape test requirement on LH2 feedline flange	ET 71 and up
H34809-946	Remove flag note	ET 75 and up
H35809-046	Revise true position symbol to clarify datum "A" tolerance	ET 75 and up
H35809-068	Change cleaning requirement to solvent wipe per STP5002	ET 75 and up
H35809-106	Define chemical film location requirement	ET 75 and up
Systems		
H34809-912	Revise CIL implementation drawing	ET 71 and up
H34809-913	Revise CIL implementation Drawing	ET 71 and up
H34809-947	Added in-process rework criteria and instructions for flange lapping	ET Project
H34809-953	- Leak test pressure lowered to comply with Safety requirement - Electronic transfer of document	ET Project
H35809-007	Revise ET Acceptance Manual for exposed adhesive, tapered edge for STP 1516 rework, criteria and rework for alum structures and allow J144a tape to repair damaged protective coating	ET Project
H50001-747	Update CIL for alternate TPS processes	ET 71 and up

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BI K12/13.4220.r1.5/95.S2.P8

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Class I/II or JS/DCN Changes - List

A9

<u>Change No</u>	<u>Description</u>	<u>Effectivity</u>
Thermal		
H34809-786	• Add ICD 2-12001 callout • Trim dimension on aft side of crossbeam	ET 71 and up
H34809-828	Eliminate TPS interference at Station 1129 feedline support	ET 71 and up
H34809-890	Add hard dimension to foam trim	ET 76 and up
H34809-903	Relocate dimension origins	ET 71 and up
H34809-916	Revise thickness dimension	ET 71 and up
H34809-944	Add bondline for two step spray foam operation	ET 75 and up
H34809-955	Exempt epoxy primer touch up, LO2 feedline support base fitting	ET 71 and up
H34809-957	Clarify ablator coverage over lockwires	ET 71 and up
H34809-970	Revise the forward bipod foam ramp	ET 76 and up
H35809-020	Extend trim in TPS to provide clearance for GO2 pressure line flange	ET 76 and up
H35809-033	Revise LH2 PAL ramp height dimension	ET 71 and up
H35809-044	LO2 cable tray fairing remove wording specific to bonding operations	ET 71 and up
H50001-740	Add option for SLA application and ICD 2-12001 requirement	ET 71 and up
H50001-741	Revise dimensional errors	ET 71 and up

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

A10

<u>Change No</u>	<u>Document</u>	<u>Description</u>
H34809-925	STP 6502	Clarify figures 8 and 10b
H34809-926	L663	Revise source appendix to add new vendor
H34809-927	L664	Revise source appendix to add new vendor
H34809-930	STP 6501	Add torquing requirements for coaxial connectors
H34809-938	Y981, Y933, Y934, Y936	Revise code sheets and STM to allow IPA, TCE, or PCA for NVR test
H34809-943	K533	Revise to perform specific gravity test per ASTM D891 instead of ASTM D3505 or D4502 as referenced in ASTM D843
H34809-939	STP 2010	Revise to lower the proof test values specified for Type III staked bearings
H34809-966	STP 3001	Revise to Rev G to allow manual Iridite application solution concentration and times to be the same as the immersion solution concentration and times
H34809-979	STP 7501	Add statement to specification to allow engineering drawing to deviate from specification requirements, incorporate amendments and general update of specification
H34809-980	STP 1518	Allow kitted material to be stored for 30 days in controlled area instead of 7 days
H34809-983	STP 1503	• Revise Paragraph 3.4.3.6 to allow engineering drawing to specify final trim after specified cure time • Delete requirements for tensile test on test panel when plug pull is performed on part
H34809-984	STP 6502	Revise/clarify Figure 12b to delete inner layer of shrink sleeving when protecting glass fiber sleeving ends

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BLK12/13.4220.r1.5/95.S2.P10

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

A11

<u>Change No</u>	<u>Document</u>	<u>Description</u>
H34809-997	Y476	Create new code for Y476C and update electronic format and remove no longer required notations
H35809-013	STP 5501	Add Paragraph 4.4.3.5 to allow exemption from X-Ray within 1/2" of weld when specified on engineering drawing and to specify 1/2" requirement in 4.4.3
H35809-040	STP 5501	- Correct referenced paragraph numbers - Clarify weld inspection and acceptance requirements - Add reference to Standard Procedure for calibration of equipment - Delete reference to proof test - Incorporate NSRA 4111-186 - Editorial updates
H35809-042	26L2	Clarify visual differences between passivated and cad plated bolts
H35809-055	33L3	Revise standard to reflect MS 21076 Rev H
H35809-056	36L8, 36L9	Revise AVL to add new vendor
H35809-059	STM H176	Define allowed shelf life from Date Of Manufacture
H35809-072	25L10	Revise AVL to add new vendor
H35809-073	STP 5008	- Add safety approval for DAS' to paragraph 1.1 & 1.2 - Add normalize NVR data to paragraph 4.4.3.3 - Clarify size definition for small parts for NVR test in para. 4.2.2.1 and 4.4.1.1
H35809-074	45L8/45L9	Revise AVL to add new vendor
H35809-079	K329	Revise shelf life on code sheet (Rev 4) and addendum (Rev 2) to be 6 months from date of shipment
H35809-101	STM H178	- Clarify requirements for suppliers and for fabrication - Modify safety requirements paragraph

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

A12

<u>Change No</u>	<u>Document</u>	<u>Description</u>
H35809-102	STP 7524	Revise to clarify requirements for fabrication and acceptance
H35809-103	Y1A2	Delete requirement for receiving inspection tests
H35809-110	STP 7532	Make backup material when drilling optional and define allowable dimensions for setback
H35809-133	Y441	Add Air Co Gas and Tri-gas to source appendix
H45001-410	26L24	Revise upper temperature limit for fastener
H45001-411	32L10	Add Titeflex Corp to Approved Vendor List (Rev 1)
H45001-412	34L4/34L5/ 34L6/34L7	Revise standards drawing
H45001-413	33L7	Add SPS Technologies to AVL and remove other vendors (Rev 6)
H45001-414	60L1	Release AVL60L1 with Chicago Car Seal Co. as approved vendor
H50001-750	STM F144	Revise STM F144 to allow any suitable facility to perform any specified test
H50001-751	STP 6508	Add paragraph to wrap sealed pigtail splices and dead ended wires with J463 tape
H50001-753	STP6009	- Delete unused material (MMSJ465A) - Update to boilerplate - Incorporate outstanding amendments
H50001-754	STP 6001	- Clarify test method callout per PAC 3541-2609 - Update to boilerplate
H50001-757	STP 2001	- Incorporate Amendments 26 & 27 - Allow shop to cut rivets to length - Prohibit punched holes in Al-Li alloy

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MRB Assessment Criteria

B1

- Assessment of all MRB NCD Items
 - Adequacy of technical dispositions
 - Completeness of required repair/retest
 - First time occurrences/SMR
 - Verification of margin of safety assessment/documentated
 - Review of impact to hazards
 - Engineering review for impact to loads

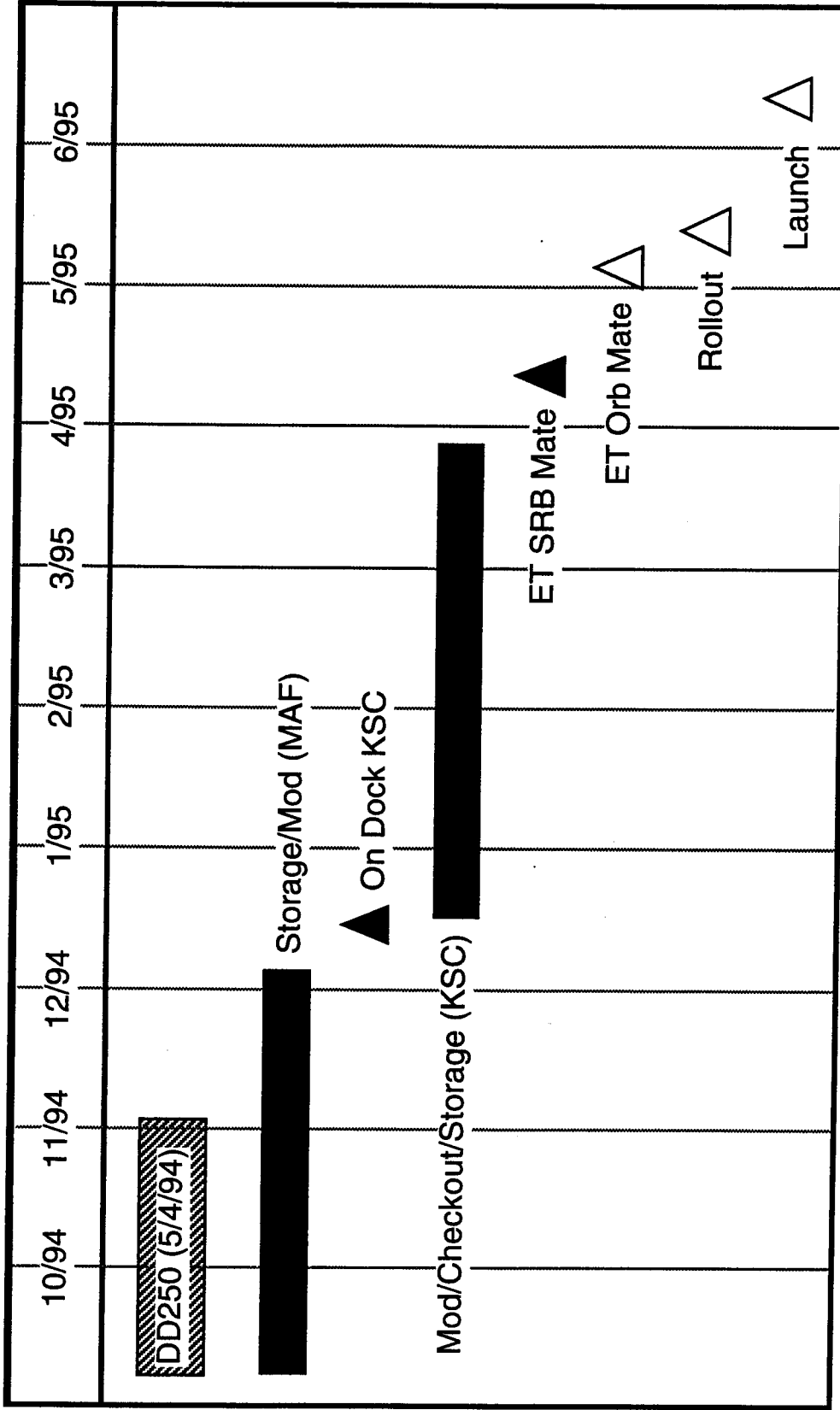
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ET-71 Processing Schedule

C1



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PI K12/13.4220.r1.5/95.S4.P1

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02

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BLK12/13.4220.r.l.5/95.S4.P2

ET-71 Planned Work

C3

2/95	3/95	4/95	5/95	6/95
		ET/SRB Mate ▲	ET/Orb Mate ▲	△ Launch
S027/S5010 ET/SRB Fwd Crossover Instl			Rollout	
S030/S5011 ET/SRB Aft Strut Elec Mate				
S031/S5010 Install Fwd SRB Bolt Catcher				
S029/T1297 Instl + Y/-Y ET/SRB Strut Fairing				
S040/T5249 TPS C/O, ET/SRB Aft Fairing				
S028/T1248 ET Preps for Orb Mate				
S044/S1030, S1031 Instl & Connect RSS Flight Batteries				
S041/T1203 Re-torque of LO2/LH2 tanks test port caps				
S045/T1449.001 Verify GUCP bond resistance				
S046/T1499.003 ET SRSS-ETVAS Ord Hookups				
S044/T1499.003 SRSS Equip Box Cover Instl				
S048/T5048 Flight I/T Access Door Instl				

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P' 12/13.4220.1.5/95.S4.P3

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ET-71 DR/PR/OMRSD Waivers/Exceptions - Summary ^{C4}

as of 4/26/95

<u>System</u>	<u>Discrepancy</u>		<u>Problem</u>		<u>MRB Items</u>		<u>Waivers/Exceptions</u>	
	<u>Total</u>	<u>Total</u>	<u>Total</u>	<u>Open</u>	<u>Total</u>	<u>Open</u>	<u>Total</u>	<u>Open</u>
• Electrical	1	0	0	0	0	0	0	0
• Propulsion/ Pneumatics	0	7	3	0	0	0	0	0
• Range Safety	0	1	0	0	0	0	0	0
• Structures	4	0	1	0	0	0	0	0
• Thermal (TPS)	3	9	0	0	0	0	0	0
Total	8	17	4	0	0	0	0	0

MANNED SPACE SYSTEMS

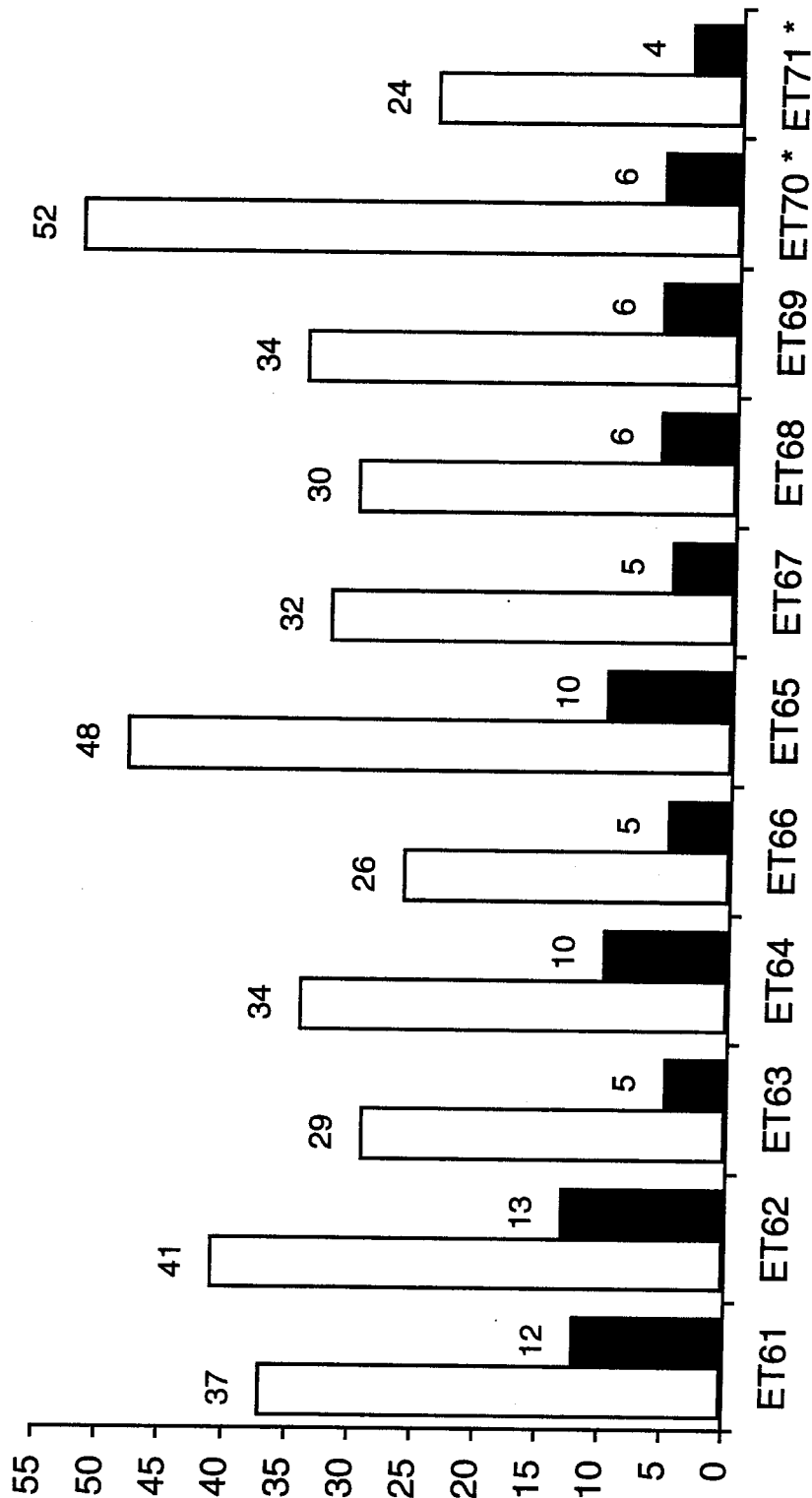
BLK12/13.4220.r1.5/95.S4.P4

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PR/MRB History

C5

(1994 - 1995)

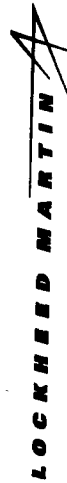


* Incomplete data

☐ Total PRs
☐ Total MRBs

MANNED SPACE SYSTEMS

BI K12/13.4220.r1.5/95.S4.P5



ET-71 PR/MRBs - Summary

C6

<u>PR No./Status</u>	<u>Title/Description</u>	<u>Disposition</u>
Propulsion PET-71-FP-0002	4" disconnect is too low	• Use as is • Acceptable per PRCBD S052922JJR1
PET-71-FP-0005 Closed	LO2 Pressure transducer mass simulator not cleaned to STP 5008 requirements • Particulate sampling indicated 2 particles greater than 1000 microns • Allowable is 0 particles greater than 1000 mircons	• Use as is • Sampling of 20 pressure transducers indicated the NVR was less than allowable 1 mg/sq ft • LO2 clean flex hose contains 25 micron final filter
PET-71-FP-0007 Pending	Inspect helium inject tube assembly (Ref DC&R P-95-001)	• Use as is • Inspection complete
Structures		
PET-71-ST-0003 Closed	Raised metal on yoke swivel	• Removed raised metal that was previously accepted • MRB documents configuration change

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BLK12/13.4220.r1.5/95.S4.P6

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ET-71 Limited Life Components

C7

Cycle Sensitive

<u>Description</u>	<u>Part No.</u>	<u>Serial No.</u>	<u>Limit</u>	<u>Required</u>	<u>Remaining</u>
LH2 Manhole Cover Assy	80914081488 -019	00000195	100	1	100
LO2 Tank Mechanical Assy	80912002000 -019	00000066	100	1	100
LH2 Tank Mechanical Assy	80914002000 -009	00000064	100	1	100
LO2 Manhole Cover Assy	80911001205 -010	00000167	100	1	100
LO2 Fwd Ogive Cover Plate	80911001207 -029	00000203	100	1	100
LH2 Manhole Cover Assy (Aft Dome)	80911001444 -010	00000354 00000355	100 100	1 1	100 100

MANNED SPACE SYSTEMS

BI K12/13.4220.r1.5/95.S4.P7

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ET-71 Limited Life Components

C8

Age Sensitive

<u>Description</u>	<u>Part No.</u>	<u>Serial No.</u>	<u>Limit</u>	<u>Initiation</u>	<u>Expiration</u>
External Tank	80901000000 -269	000000064	6 Yrs	5/94	5/2000
RSS Battery A	10406-0133 -801	---	2 Yrs 90 Days		
RSS Battery B	10406-0133 -801	---	2 Yrs 90 Days		

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BLK12/13.4220.r1.5/95.S4.P8

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ET-71 Limited Life Components

C9

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

<u>Description</u>	<u>Part No.</u>	<u>Lot No.</u>	<u>Serial No.</u>	<u>Latest Retest</u>	<u>Expiration</u>
Confined Detonating Fuse	10315-0002				
	-825	AAB	309	1/93	3/96**
	-826	AAB	262	1/93	3/96**
	-827	AAB	218	1/93	3/96**
	-828	AAB	175	1/93	3/96**
	-831	AAB	450	1/93	3/96**
Confined Detonating Fuse Manifold	10312-0001				
	-106	AAT	2002025	11/94	3/98*
	-107	AAT	2002065	11/94	3/98*
Safe & Arm Device	10311-0001-803	AAG	1000374	6/91	8/95***
NSD	SEB26100094	JHR	0620	8/92	8/96
	-201	JHS	0132	7/92	7/96

- * Oldest sub-assy mfg date of 3/90
- ** Oldest sub-assy mfg date of 8/86
- *** Oldest sub-assy mfg date of 6/91
- Shelf life extension not planned

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P9

LOCKHEED MARTIN 

ET-71 Limited Life Components

C10

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

<u>Description</u>	<u>Part No.</u>	<u>Lot No.</u>	<u>Serial No.</u>	<u>Latest Retest</u>	<u>Expiration</u>
Separator Assy GUCP	PD500020 -059	AAF	0000821	5/92	5/96
Cartridge Assy	PD500020 -030	AAF AAF	69968 69969	5/92 5/92	5/96 5/96
Linear Shaped Charge	PD500016 -050	AAJ	0001573	6/91	6/95 *

* Lot extension to 6/98 complete - Pending approval of certification paper

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P10

LOCKHEED MARTIN 

ET-71 Modification Summary

C11

<u>No.</u>	<u>Description</u>	<u>Status</u>
Mod Kit		
B489/B01945B	Enhanced jack pad closeout process at KSC	• BX-250 trim complete • Remaining closeout to be completed after Orbiter mate
DC&R		
P-95-001	Inspect helium inject tube assembly	• Measurements complete • MRB to use as is in work

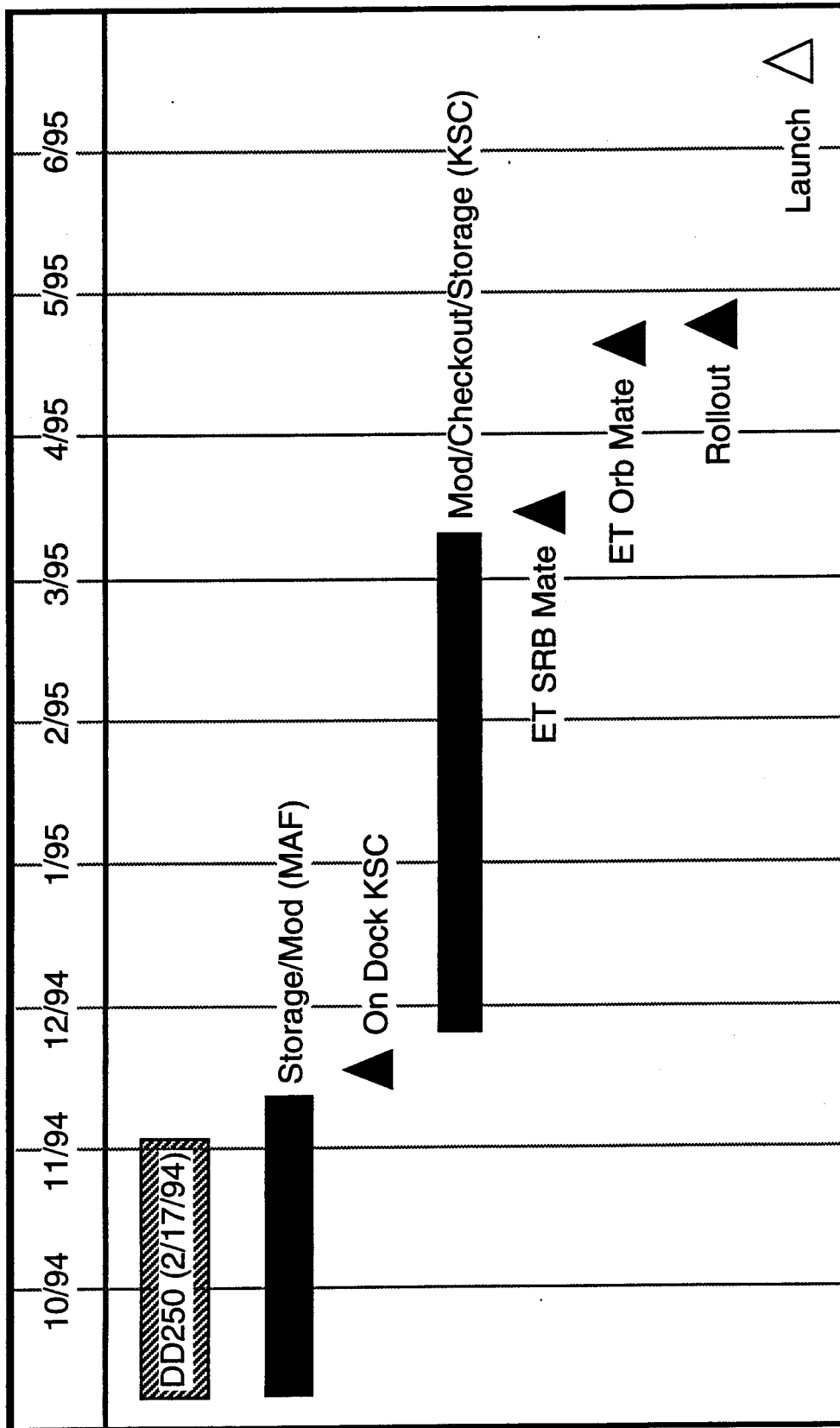
MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P11

LOCKHEED MARTIN 

ET-70 Processing Schedule

C12



ET-70 Planned Work

C13

11/94	12/94	1/95	2/95	3/95	4/95	5/95	6/95
		▲ On Dock - KSC			ET/SRB Mate ▲		
					ET/Orbiter Mate ▲	Rollout ▲	Launch △
				■ S005/S6005 Pyro Devices			
				■ S020/T5141 Foam Closeout Aft Hardpoint			
				■ S003/T1147 Install Ground Umb Carrier Plate			
				■ S001/T5142 SRSS Ordnance Installation			
				■ S004/T5143 Install RSS Equip in RSS Box			
				■ S007/ET70-EL-002 ET Elect All Systems Test			
				■ S032/T5043 Butcher Paper Installation			

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P13

LOCKHEED MARTIN 

ET-70 Planned Work

C14

2/95	3/95	4/95	5/95	6/95
	ET/SRB Mate ▲	ET/Orb Mate ▲ Rollout ▲		Launch △
S040/T5249 TPS C/O, ET/SRB Aft Fairing ■ S028/T1248 ET Preps for Orb Mate ■ S044/S1030, S1031 Instl & Connect RSS Flight Batteries ■ S041/T1203 Re-torque of LO2/LH2 tanks test port caps ■ S045/T1449.001 Verify GUCP bond resistance ■		S027/S5010 ET/SRB Fwd Crossover Instl ■ S030/S5011 ET/SRB Aft Strut Elec Mate ■ S031/S5010 Install Fwd SRB Bolt Catcher ■ S029/T1297 Instl +Y/-Y ET/SRB Strut Fairing ■		
		S046/T1499.003 ET SRSS-ETVAS Ord Hookups □ S044/T1499.003 SRSS Equip Box Cover Instl □ S048/T5048 Flight I/T Access Door Instl □		

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P14

LOCKHEED MARTIN 

ET-70 DR/PR/OMRSD Waivers/Exceptions - Summary C15

as of 4/26/95

<u>System</u>	<u>Discrepancy</u>		<u>Problem</u>		<u>MRB Items</u>		<u>Waivers/Exceptions</u>	
	<u>Total</u>		<u>Total</u>		<u>Total</u>	<u>Open</u>	<u>Total</u>	<u>Open</u>
• Electrical	0		3		0	0	0	0
• Propulsion/ Pneumatics	1		14		4	0	0	0
• Range Safety	0		0		0	0	0	0
• Structures	4		10		1	0	0	0
• Thermal (TPS)	2		25		1	0	0	0
Total	6		52		6	0	0	0

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P15

LOCKHEED MARTIN 

ET-70 PR/MRBs - Summary

C16

<u>PR No./Status</u>	<u>Title/Description</u>	<u>Disposition</u>
Propulsion		
PET-70-FP-0001 Closed	Third clamp from GUCP on GHe line has cracked primer and bent bracket	• Use as is - Clip bent only with no cracks - LH2 vent valve sense port tube assembly not bent
PET-70-FP-0003 Closed	LH2 4" disconnect assembly has gouge/no raised metal on mating surface	• Use as is - Gouge is located between the primary and secondary seal surface
PET-70-FP-0014 Closed	LO2 pressure transducer mass simulator is not cleaned to STP 5008 requirements • Particulate sampling indicated 2 particles greater than 1000 microns • Allowable is 0 particles greater than 1000 microns	• Use as is - Sampling of 20 pressure transducers indicated the NVR was less than allowable 1 mg / sq ft - LO2 clean flex hose contains 25 micron final filter
PET-70-FP-0015 Open	Suspect helium inject tube thermal wrapping	• Use as is - Adequate layers of thermal material exist - No thermal concern due to aero heating

MANNED SPACE SYSTEMS

BLK12/13.4220.r.5/95.S4.P16

LOCKHEED MARTIN 

ET-70 PR/MRBs - Summary

C17

<u>PR No./Status</u>	<u>Title/Description</u>	<u>Disposition</u>
TPS		
PET-70-TS-0012 Closed	Damaged/cracked SLA on the +Y crossbeam to thrust strut fairing	• Repair with STP1510 Type handpack
Structures		
PET-70-ST-0013 Closed	RTV missing from bolt on electrical Disconnect (EO4)	• Use as is - Corrosion not a concern after S0004 - Three of four bond jumper fasteners are intact providing lightning current paths

MANNED SPACE SYSTEMS

BI K12/13.4220.r1.5/95.S4.P17

LOCKHEED MARTIN 

ET-70 Limited Life Components

C18

Cycle Sensitive

<u>Description</u>	<u>Part No.</u>	<u>Serial No.</u>	<u>Limit</u>	<u>Required</u>	<u>Remaining</u>
LH2 Manhole Cover Assy	80914081488 -019	00000194	100	1	100
LO2 Tank Mechanical Assy	80912002000 -019	00000063	100	1	100
LH2 Tank Mechanical Assy	80914002000 -009	00000063	100	1	100
LO2 Manhole Cover Assy	80911001205 -010	00000165	100	1	100
LO2 Fwd Ogive Cover Plate	80911001207 -029	00000201	100	1	100
LH2 Manhole Cover Assy (Aft Dome)	80911001444 -010	00000352 00000353	100 100	1 1	100 100

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P18

LOCKHEED MARTIN



ET-70 Limited Life Components

C19

Age Sensitive

<u>Description</u>	<u>Part No.</u>	<u>Serial No.</u>	<u>Limit</u>	<u>Initiation</u>	<u>Expiration</u>
External Tank	80901000000 -269	000000063	6 Yrs	2/94	2/2000
RSS Battery A	10406-0133 -801	---	2 Yrs 90 Days		
RSS Battery B	10406-0133 -801	---	2 Yrs 90 Days		

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P19

LOCKHEED MARTIN 

ET-70 Limited Life Components

C20

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

<u>Description</u>	<u>Part No.</u>	<u>Lot No.</u>	<u>Serial No.</u>	<u>Latest Retest</u>	<u>Expiration</u>
Confined Detonating Fuse	10315-0002				
	-825	AAB	306	1/93	3/96**
	-826	AAB	260	1/93	3/96**
	-827	AAB	217	1/93	3/96**
	-828	AAB	174	1/93	3/96**
	-831	AAB	449	1/93	3/96**
Confined Detonating Fuse Manifold	10312-0001				
	-106	AAT	2002024	11/94	3/98*
	-107	AAT	2002064	11/94	3/98*
Safe & Arm Device	10311-0001-803	AAG	1000370	6/91	8/95***
NSD	SEB26100094 -201	JHR	0618	8/92	8/96
		JHR	0619	8/92	8/96

- * Oldest sub-assy mfg date of 3/90
- ** Oldest sub-assy mfg date of 8/86
- *** Oldest sub-assy mfg date of 6/91
- Shelf life extension not planned

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P20

LOCKHEED MARTIN 

ET-70 Limited Life Components

C21

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

<u>Description</u>	<u>Part No.</u>	<u>Lot No.</u>	<u>Serial No.</u>	<u>Latest Retest</u>	<u>Expiration</u>
Separator Assy GUCP	PD500020 -059	AAF	0000819	5/92	5/96
Cartridge Assy	PD500020 -030	AAF AAF	69962 69964	5/92 5/92	5/96 5/96
Linear Shaped Charge	PD500016 -050	AAJ	0001572	6/91	6/95

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P21

LOCKHEED MARTIN 

ET-70 Modification Summary

C22

<u>No.</u>	<u>Description</u>	<u>Status</u>
Mod Kit		
B488/B01945B	Enhanced jack pad closeout process	Work complete
E127/B02006	RSS ground checkout cable assembly modification	Work complete
E137/B02006E	GUCP drawing modification	• Documentation change only • Pending paper closure
DC&R		
P-95-001	Inspect helium inject tube assembly	• Measurements complete • MRB to use as is processed

MANNED SPACE SYSTEMS

BLK12/13.4220.r1.5/95.S4.P22

LOCKHEED MARTIN 

GFP LH2 CDF Manifold IDD Revision (B01948D)

D1

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

Manned Space Systems

BLK12/13.4220.r1.5/95.S5.P1

LOCKHEED MARTIN 

OMRS Work Minimization RCNs

D2

Change:

- Three RCNs revised/deleted redundant OMRSD File IV ET stand alone checkout requirements
 - RCN KT12081B revised five requirements to inspect only in the event that the areas are accessed during ET processing at KSC and modify ET weighing operations
 - RCN KT12079C deleted thirteen redundant ET stand alone pneumatic tests and revised six
 - RCN KT12086B deleted five redundant ET stand alone electrical tests and revised three

Reason:

- Minimize KSC effort required to process ET

Basis for Certification:

- Tests/inspections of hardware performed at MAF as part of ET acceptance
- Review of File IV inspection/test result history since return to flight revealed no significant anomalies found at KSC
- Subsequent OMRSD File II tests or LCC adequately screen for failures

Manned Space Systems

BLK12/13.4220.r1.5/95.S5.P2

LOCKHEED MARTIN



GFP 17" Umbilical Disconnect Revision (B01985)

D3

Change:

- Revised height setting tolerances for LO2/LH2 2" and 4" disconnects
 - Was: 0.0" to 0.010"
 - Now: 0.005" to 0.010"

Background:

- Umbilical supplied as GFP
 - Improved sealing margin of disconnect

Basis for Certification:

- Similarity - New height settings within certified tolerances

Delete Aft LO2 Feedline Bracket Heaters (B01937)

D4

Change:

- Delete aft LO2 feedline bracket heaters
 - LCC changed to allow up to 100 sq. in. of ice formation on LO2 feedline brackets
 - OMRS changed for STS-45 to delete heater test, checkout and activation at KSC (Previously presented at STS-45/ET-44 Delta ET Project FRR, 2/21/92)
 - MAF test and checkout requirements (TM04) revised ET 64 and up to eliminate testing of heaters and associated cabling (Previously presented at Block 11 ET Project FRR, 8/10/94)

Reason:

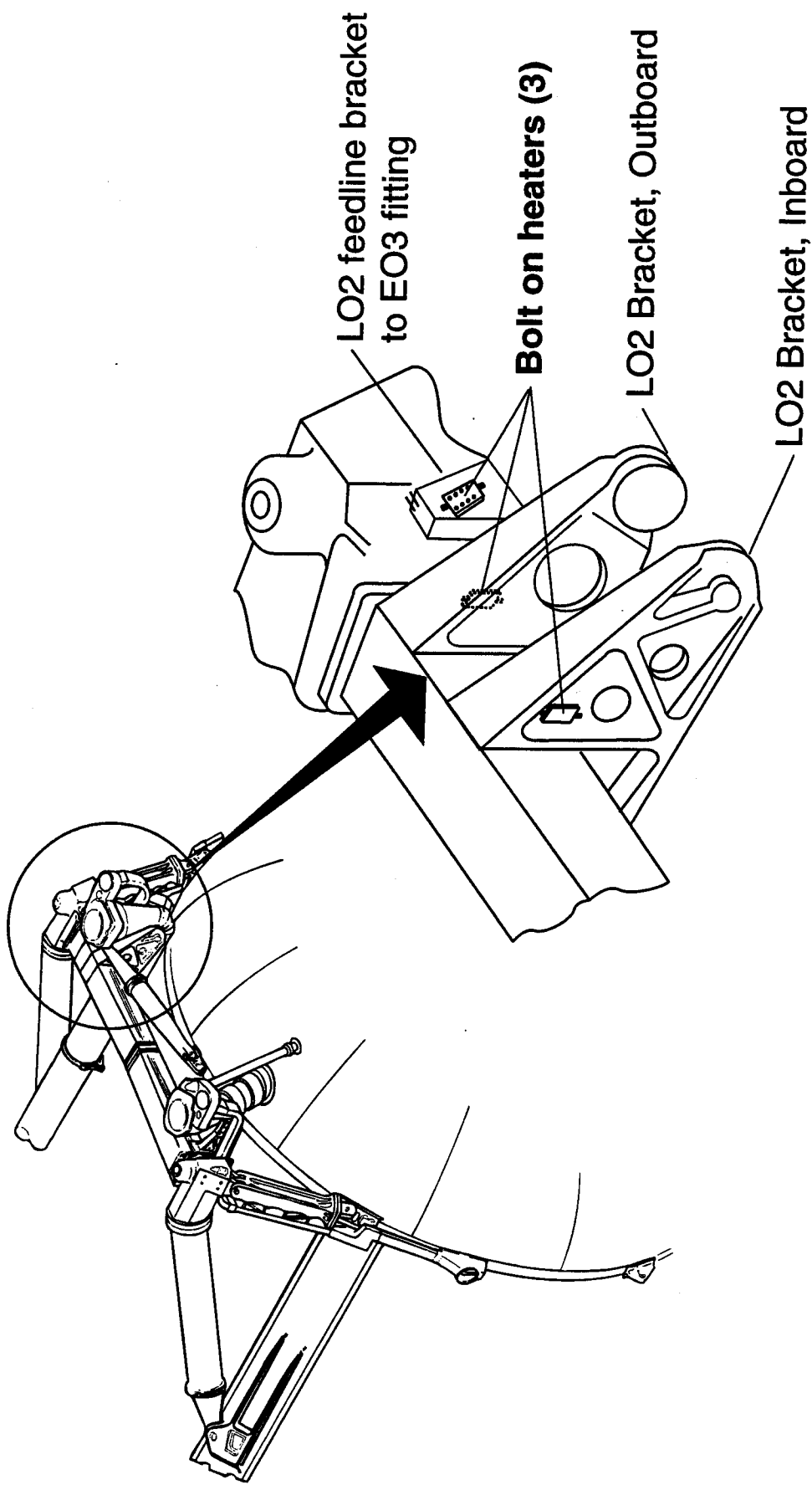
- Thermal analysis indicates that worst case ice formation with unheated aft LO2 feedline brackets would be 61.3 sq. in.
 - Heaters and associated cabling no longer required

Basis for Certification:

- Thermal analysis - Ice/frost formation in this area is within acceptable limits

Delete Aft LO2 Feedline Bracket Heaters (B01937)

D5



Manned Space Systems

Blk12/13.Pgmker.dd.4/95.5

LOCKHEED MARTIN

Revise GFP CDF Routing in Intertank (B01994)

D6

- Change:**
- Add requirement to inspect and reposition CDF to ensure no Intertank purge line contact or direct gas impingement possible
- Background/
Reason:**
- CDF COQ cites functional testing after heating to +350°F for 30 minutes
 - Auto detonation limit is >400°F
 - ET installations potentially heated by purge gas during cryo operations
 - Maximum observed conditions from 6 flows (STS-58 thru 62 and STS-65)
 - +270°F for 6 hours
 - +285°F for 30 minutes
 - Confidence test performed @ KSC 6/17/94
 - 4 sections of CDF baked at +285°F for 7 hours
 - All sections fired successfully
 - IDD waiver approved for ETs 64 thru 67
 - CDF usage in environments > 250°F requires delta qualification test

Manned Space Systems

BLK12/13.4220.r1.5/95.S5.P6

LOCKHEED MARTIN



Revise GFP CDF Routing in Intertank (B01994)

D7

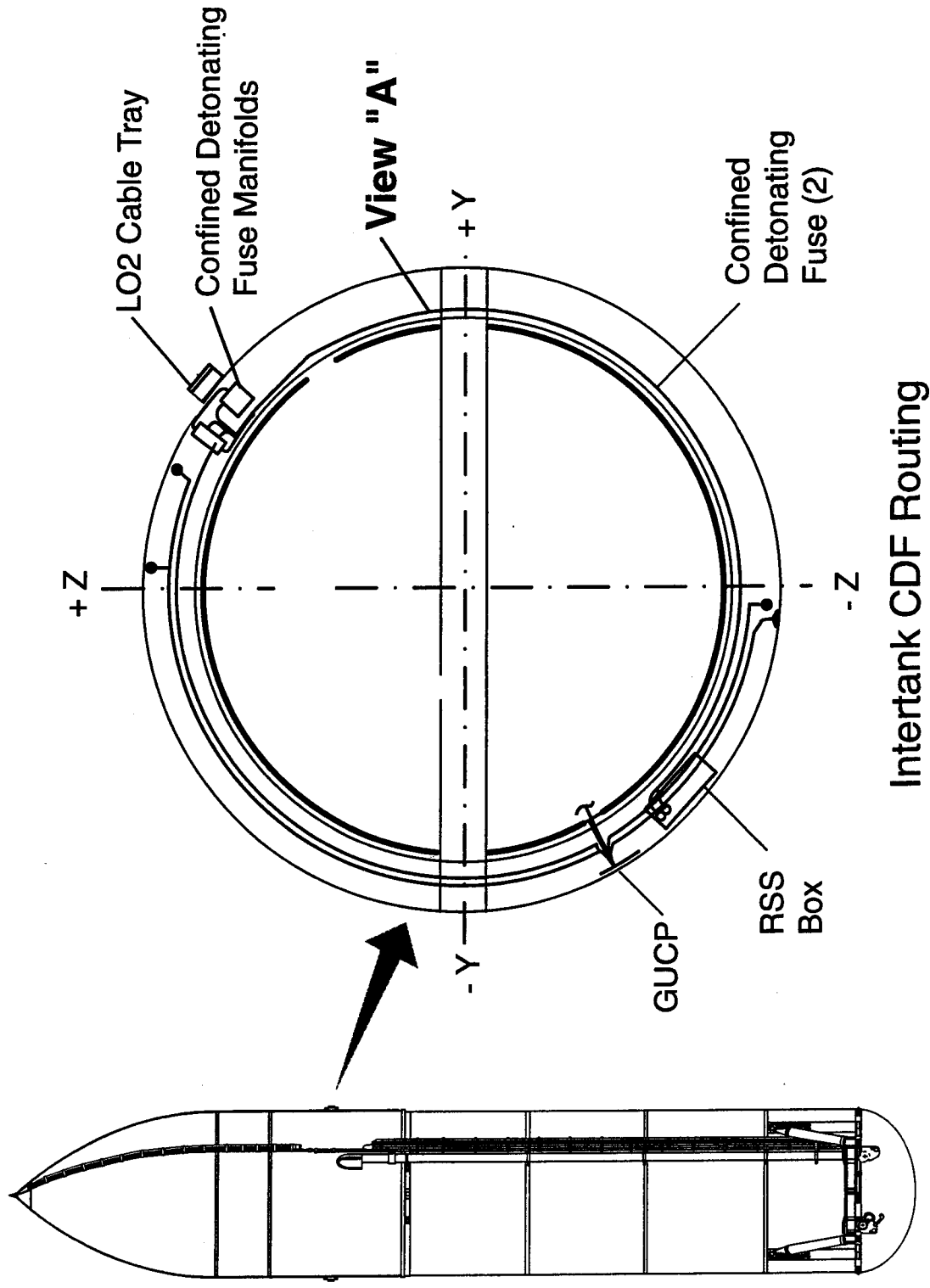
Basis for

Certification:

- ETs 64 and 65
 - Procedural control of purge gas temperature ensures CDF will not be heated above test demonstrated values
 - Maximum Intertank purge outlet temperature +268°F
 - CDF temperature ≈240°F
- ETs 66 thru 74
 - Reposition CDF away from purge manifold
 - 0.25" minimum clearance from line contact
 - Gas impingement from flow orifice: 1.00" diameter x 2.00" length (cone of influence)
- ET 75 and subs
 - Add additional clamps to ensure CDF is positioned to not contact purge manifold
- Thermal and vibration delta qualification test performed on CDF at 250°F for 4 mission cycles
 - All specimens fired successfully

Revise GFP CDF Routing in Intertank (B01994)

D8



Manned Space Systems

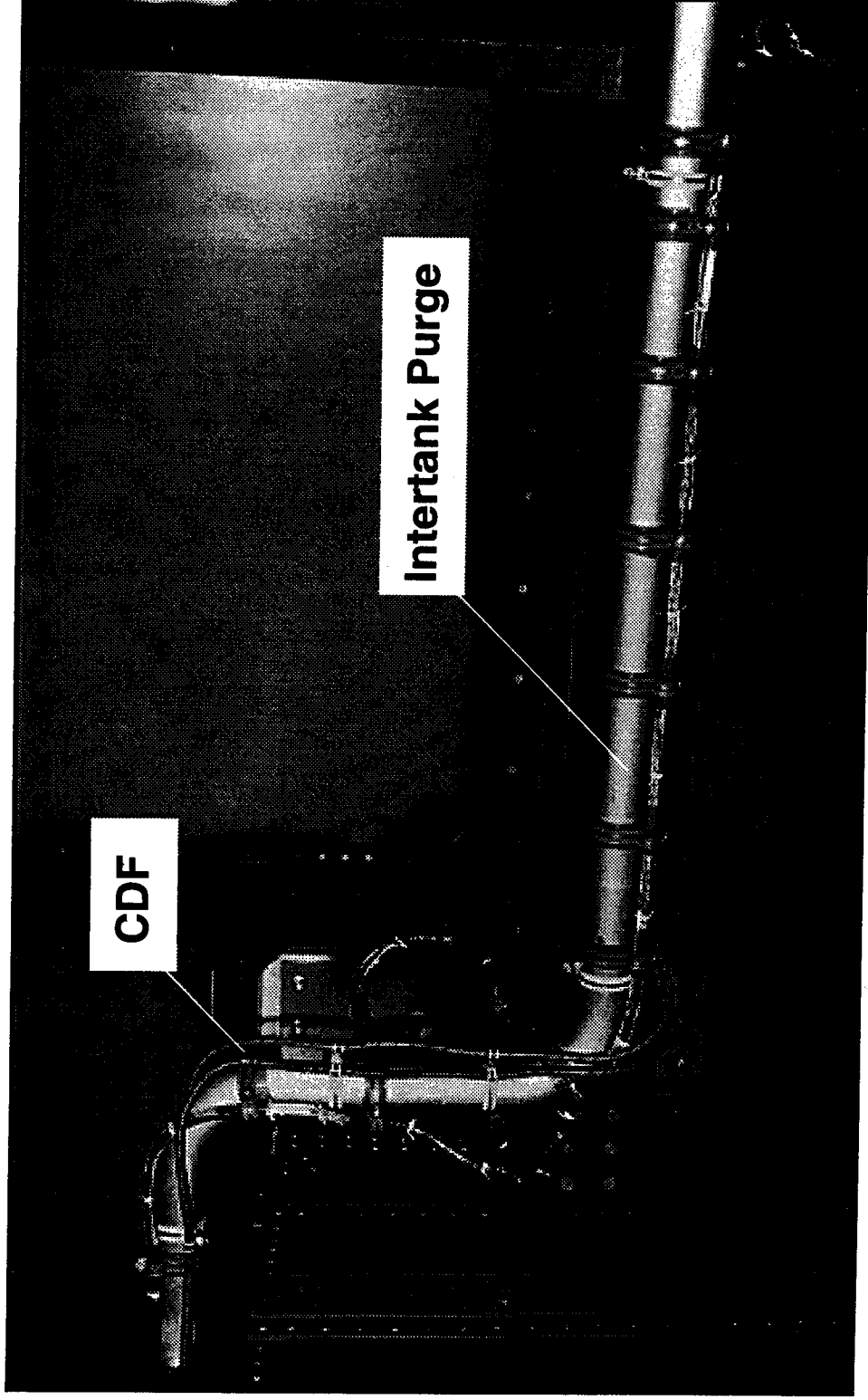
Blk12/13.Pgmker.dd.4/95.1

LOCKHEED MARTIN

Revise GFP CDF Routing in Intertank (B01994)

D9

View "A"



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Blk12/13.Pgmker.dd.4/95.2

LOCKHEED MARTIN

Level II Waivers - Baseline

D10

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 and 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 and 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 and up

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BLK12/13.4220.r1.5/95.S5.P10

LOCKHEED MARTIN



Level II Waivers - Baseline

D11

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 and up
Electrical bonding per MIL- B-5087B (2)	S040732M 9/9/88	3.6.14	378	ETs 23, 27-29, 31 and up
Soldering, circuit boards & connectors	S040732M 9/9/88	3.6.15.1.1	379	ETs 23, 27-29, 31 and up
PD7400106 circuit boards	S040732M 9/9/88	3.6.15.2.1	382	ETs 23, 27-29, 31 and up
PCM MUX and pressure transducer circuit boards	S040732M 9/9/88	3.6.15.2.1	383	ETs 23, 27-29, 31 and up
Range safety system compliance with AFETRM 127-1 and SAMTECM 127-1	S94934 9/10/88	3.5.4.12	388	ETs 23, 27-29, 31 and up

Manned Space Systems

BLK12/13.4220.r1.5/95.S5.P11

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Level II Waivers - Baseline

D12

<u>Document/ Requirement</u>	<u>Authority</u>	<u>Paragraph</u>	<u>Waiver No.</u>	<u>Effectivity</u>
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 and up
Soldering of electrical connectors	S094779C 2/21/91	3.6.15.1.1	573	ETs 37, 41 and up

Manned Space Systems

BLK12/13.4220.r1.5/95.S5.P12

LOCKHEED MARTIN 

Level II Waivers - Baseline

D13

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

Manned Space Systems

BLK12/13.4220.r1.5/95.S5.P13

LOCKHEED MARTIN 

Level II Waivers - Baseline

D14

<u>Document/ Requirement</u>	<u>Authority</u>	<u>Paragraph</u>	<u>Waiver No.</u>	<u>Effectivity</u>
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 and 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 and 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, and up

Manned Space Systems

BLK12/13.4220.r1.5/95.S5.P14

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Level II Waivers - Baseline

D15

<u>Document/ Requirement</u>	<u>Authority</u>	<u>Paragraph</u>	<u>Waiver No.</u>	<u>Effectivity</u>
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 and 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 and up

Manned Space Systems

BLK12/13.4220.r1.5/95.S5.P15

LOCKHEED MARTIN 

Level III Deviations - Baseline

D16

<u>Document/Requirement</u>	<u>Paragraph</u>	<u>DAR No.</u>	<u>Effectivity</u>
Ultimate and yield factors of safety below required requirement for pressurized lines less than 1.5" dia • Actual: 1.37 and 1.01 • Requirement: 1.5 and 1.25	3.2.1.5.2.2	219	ETs 66 and 71 thru 75

