FLIGHT READINESS STATEMENT
STS-105/ET-110
EXTERNAL TANK PROJECT
PRE-FLIGHT REVIEW

EXTERNAL TANK ET-110/STS-105, AS IDENTIFIED IN THE EXTERNAL TANK PROJECT PRE-FLIGHT REVIEW DATED JUly 24, 2001, IS CONSIDERED READY TO SUPPORT FLIGHT UPON ACCEPTABLE DISPOSITION OF OPEN/PLANNED WORK AND/OR OPEN ACTIONS.

N. E. OTTE/MP31

for J. BULLMAN/ED10

FOR P. M. MUNAFO/ED30

for A. O. GOODSON/QS01

for A. A. McCOOL/MP01

for P. K. McCONNAUGHEY/ED20

S. D. ROSE/ED40

for H. V. McCONNAUGHEY/TD60

J. W. SMELSER/MP31, CHAIRMAN

07/24/2001

Space Shuttle
External Tank

Pre-Flight Review

STS-105/ET-110

LOCKHEED MARTIN

110NASApfr.4250.07/2001

Agenda

Overview

Prior Mission Performance Summary

- ***STS-104/ET-109***

Current Mission/External Tank Highlights

- ***STS-105/ET-110***

Mass Properties Status

Significant Changes: None

Senior Management Review NCDs: None

SRM&QA Assessment

KSC Processing

Verification/Certification

Mission Unique Assessment

Readiness Statement

Appendices

Lynn Servay

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Overview

This review for STS-105/ET-110 includes:

- Items specific to missions STS-105
- First time differences and "out-of-family" non-conformances not previously flown and/or reviewed

FRR Series

• ET/SRB Mate Review	05/17/2001 (Complete)
• ET Project Pre-Flight Review	07/24/2001
• Space Shuttle Vehicle FRR	08/01/2001
• Pre-launch Mission Management Team Review	08/07/2001

Prior Mission Performance Summary

STS-104/ET-109, 07/12/2001 Launch

System	***Performance***
• ***OMRSD***	• OMRSD Waiver WK10123 processed / approved during launch count – Nose cone purge heater output pressure was below that required before turning heater on – Most likely the result of low facility supply pressure and ambient conditions. – Loading continued with no issues – The compartment temperature was within requirement and was not compromised due to the low pressure.
• ***LCC***	• No ET LCC Violations
• ***Instrumentation***	• Nominal Performance
• ***MPS***	• Nominal Performance
• ***ET Hazardous Gas***	• No ET Violations

Prior Mission Performance Summary

STS-104/ET-109, 07/12/2001 Launch

System	***Performance***
• ***TPS***	• No issues
• ***ET Disposal***	• Nominal
• ***Film Review - Post-Launch***	• No ET related issues
• ***Orbiter Tile Damage***	• Foam performance – Pending Orbiter tile damage report – Landing planned 07/24/2001@ 12:42 a.m. EDT
• ***Film Review - Post-Flight***	• Pending film review

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Mission/External Tank Highlights

STS-105/ET-110 (as of 07/16/2001)

Mission	***STS-105***
Launch	***08/09/2001***
• Target time	5:38 p.m. EDT
• Pad	39-A
• Orbiter	Discovery (OV-103)
• Orbital Inclination	51.6 degrees/122 nautical miles
• ET Photo Coverage	• Crew photos from cockpit window • Umbilical well cameras

Primary Payload	• ***ISS 7A.1 MPLM***
	• International Space Station (ISS) Assembly Flight 7A.1
	  • Multi-Purpose Logistics Module (MPLM) Leonardo
	  - U.S. stowage racks and International Standard Payload Racks

Landing	***08/21/2001 KSC***
External Tank	***ET-110***
DD250 Acceptance	07/26/2000
Shipped to Launch Site	11/02/2000

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Agenda

Overview

Prior Mission Performance Summary

Current Mission/External Tank Highlights

ET-110 Mass Properties ***Rick Spring***

Significant Changes: None

Senior Management Review NCDs: None

SRM&QA Assessment

KSC Processing

Verification/Certification

Mission Unique Assessment

Readiness Statement

Appendices

Mass Properties Status

STS-105 / ET-110

Specification Weight = 58,432 lbs.

ET-110 Weighing

- ET-110 was weighed at MAF on July 17, 2000 using the Weigh Tronix weighing system

  - Predicted Weight 58,329 lbs.
  - As-weighed 58,526 lbs.
  - Delta to Predicted +197 lbs.

Mission Planning

- MMC-ET-SE40, ET Project - Mass Properties Weight and Balance Report, was submitted July 18, 2000 to support mission planning
- Coordination with Level II on July 10, 2001 indicates approximately 1,656 lbs. performance margin for STS-105

Agenda

Overview

Prior Mission Performance Summary

Current Mission/External Tank Highlights

Mass Properties Status

Significant Changes: None

Senior Management Review NCDs: None

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

KSC Processing

Verification/Certification

Mission Unique Assessment

Readiness Statement

Appendices

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SRM&QA Assessment

as of 07/19/2001

Item	***Status***
• ***ALERTS***	• None Open
• ***MRB Assessment***	• Complete - No issues/no impact to hazard controls
• ***Hazard Assessment***	• Complete - All hazard reports were re-assessed and hazard controls verified
• ***CIL Retention Rationale***	• Complete - No issues/no impact to CIL retention rationale
• ***Corrective Action Problem Summary (CAPS)***	
• S-083, Post proof NDE concerns	• ET-110 cleared – Pending implementation of corrective action
• S-085, Sanded/shaved Al 2195 welds	• ET-110 cleared - Rationale accepted at PRCB, 12/04/2000 – Submitted to MSFC for closure 7/19/2001
• S-086 LH2 Tank Tooling Pin Impact - ET-115 Senior Management Review	• ET -110 cleared - Isolated Case
• S-087 LH2 ET-117 Orthogrib Rib Cracks	• ET-110 cleared - Isolated Incident; • Fleet clearance presented at STS-104/ET-109 FRR
• P-095 LH2 Recirculation Line ATP Failure	• ET-110 cleared - • Passed the Acceptance Test Procedure (ATP)

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Agenda

Overview

Prior Mission Performance Summary

Current Mission/External Tank Highlights

Mass Properties Status

Significant Changes: None

Senior Management Review NCDs: None

SRM&QA Assessment

KSC Processing ***Scott Otto***

Verification/Certification

Mission Unique Assessment

Readiness Statement

Appendices

KSC Processing

as of 07/16/2001

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

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

Limited Life Component/ET Status

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

OMRSD Exceptions/Waivers

- None

KSC Processing - Status

as of 07/16/2001

Changes

- ET modifications
  - Mod Kits 0
  - DC&R 0
  - Bldg 45 0
  - FEC 1 Intertank thrust panel foam venting
  - OMRSD/LCC 0
  - Facility 0
  - Software 0

SIM Launch (S0044) *06/25/01*
SIM Load (S0056) *07/17/01*

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Agenda

Overview

Prior Mission Performance Summary

Current Mission/External Tank Highlights

Mass Properties Status

Significant Changes: None

Senior Management Review NCDs: None

SRM&QA Assessment

KSC Processing

Verification/Certification Readiness Statement — ***Lynn Servay***

Appendices

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

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Verification/Certification

as of 07/16/2001

Item	Status
NSTS 07700, Volume X, Book 1, Baseline	
• Revision M, Change 272	• Complete - No issues
Certification Documentation	
• Certificates of Qualification (COQ)	• No new items
• Hardware Certification Sheets (HCS)	• No new items
Deviations/Waivers	• No new items Note: ET-110 is last tank with waiver against 95% launch probability requirement due to low foam thickness on LO2 tank ogive (NSTS 07700, Volume X, Book 1, Waiver 682)

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Mission Unique Assessment

as of 07/16/2001

	STS-105/ET-110
Review of MRB actions using updated loads	No new loads or environments requiring assessment have been identified at this time
MPS Preflight Prediction Package	ECD 07/30/2001

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Readiness Statement

The External Tank, ET-110, is certified and ready for STS-105 flight pending completion/closure of open and planned work

Appendices

A: Minor Changes

B: SRM&QA Assessment

- NCD Assessment Criteria

C: KSC Processing

- PR/MRB Summaries
- OMRSD Exceptions/Waivers
- Modification Summaries/Status
- Limited Life Component Status
- OMRSD Changes (RCNs): None
- Software Changes: None
- Facility Modifications: None

D: Level II Waivers/Level III Deviations

Change Presentation Criteria

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

Minor Change – Configuration

Change	Description	Basis for Certification
Revise Weld Acceptance Manual (B02044-006)	Clarification of weld inspection criteria. – Added LO2 Tank ogive surface inspection criteria for O2 weld to SLWT Weld Acceptance Manual	Similarity – Documented and previously used Quality Control inspection method
Primer Touch-Up on GFE Part (B02054-001)	Producibility change to allow primer touch-up on GFE Bolt Catcher per STP 3003, not to exceed 3 sq. in.	Similarity - Primer touch-up previously performed and accepted per NCD

Minor Changes

Change No.	Discipline	Description	Effectivity
H35809-025	Structural	Drawing Error - Corrected drawings using fasteners with 100 degree countersunk heads to call out STP2003.	ET-110 & Up
H36809-405	Structural	Update Use of Material - Alternate lubricant, N363A, added for installation of rubber, air flow restricting dams in cable trays; N363B is no longer available, and alternate is in use at KSC	ET-110 & Up
H36809-429	Mechanical	Drawing Error - Aft interface cable tray harness washer installation was revised to change a note from field of the drawing from "2 reqd" to "As reqd". The note on field of the drawing contradicted a flag note that controls the washer usage by specifying "As reqd" instead of any quantity. Prior built Ets 96-109 were TCO'd by MPP which had washer usage "as required".	ET-110 & Up
H36809-346	TPS	Drawing Clarification - Clarified foam venting views; orientation views were contradictory to sectional views in drawing field	ET-110 & Up
H36809-387	TPS	Drawing Error - Corrected nosecone closeout drawing by removing dimensions that contradicted a flag note for the J482A tape placement. A new section was created to show another view of tape configuration	ET-110 & Up
H36809-421	TPS	Producibility - Revised SRB PAL ramp to remove the optional closeout associated with a wedge of foam in the cable tray corner to enhance SS-1171 closeout. Wedge of foam not required for BX-250 spray. The optional SS-1171 foam closeout for this configuration was never used on flight hardware.	ET-110 & Up
H50001-813	TPS	Drawing Clarification - Clarified dimensional requirements for the ablator configuration on SRB aft cable tray assembly. Removed the FLUSH +/- .06 in Zone 4/D on Sheet 16, and added in Zone 4/B ".25 REF TYP" to the optional hand pack ablator covering the cable tray side	ET-110 & Up

Minor Changes

Change No.	Discipline	Description	Effectivity
H36809-428	Systems	Producibility - Revise ET weighing requirements to incorporate process improvements at MAF - added a weighing system uncertainty to the requirements (+/- 126 lbs); deleted shim requirements vs. pedestals; revised ambient condition requirement and environments stabilization; incorporated graphic updates; improved alignment definition.	ET-110 & Up

Minor Changes – STD/STM/STP/AVL

Change No.	Document	Description
B02047-005	809-3600 Mil Spec Alternate Document	Periodic revision of the book form drawing to update list of inactive/cancelled Mil Specs and equivalent superceding documents
H36809-477	STP5510 Friction Plug Welding	Incorporated changes from independent assessment. Updated document to add proof test to qualification requirements, revise tapered hole dimensions, require measurement of tapered hole's minor diameter, require separate hole-in-plate equipment check, and allow unlimited number of multi-plug stitching.
H36809-524	26L30 Fastener	Producibility - Revised standard to specify that maximum thread diameter shall be a minimum of 0.001 less than actual shank diameter prior to adding self locking feature.
	AVL Updates	
H36809-526	26L20 Bolt	Updated standard part AVLs to reflect current supplier data – Removed suppliers no longer in business, no longer manufacturing part, or no longer approved to manufacture part. – Updated supplier name or address, revised CAGE code, or added/changed supplier part number – Added new suppliers
H36809-527	33L6 Nut	
H36809-528	26L2 Ext Wrenching Bolt	
H36809-530	26L33 Fastener	
H36809-563	34L1 Insert Screw Thread	
	34L10 Insert	
	34L2 Insert	
H36809-606	26L17 Full Thread Bolt	
H36809-647	26L2 Ext Wrenching Bolt	
H36809-648	26L3 Bolt	
H36809-649	26L4 Bolt	

Minor Changes – STD/STM/STP/AVL

Change No.	Document	Description
H36809-529	32L2 Flexible Metallic Hose Assy	Producibility - Revised standard to permit the manufacturer's use of silver plated coupling nuts to avoid contamination problems during the cleaning process. Silver plate finish shall be per AMS2410.
H36809-555	26L10, 26L9 - Blind Bolt Groups STP2020	Revised documents to reflect new procurement specification (NASM8975) to prevent procurement of parts made to obsolete versions of MIL-F-8975. The changes reflect those made by the military to some of the installed dimensions, and were made to eliminate excessive shaving of flush head parts after installation. There were not changes in physical properties. The change to the STP eliminated inspection of installed parts to obsolete dimensions.
H36809-572	K719 Epoxy-Polyamide Primer	Updated material code sheet source appendix to reflect change in vendor name address and manufacturing location
H36809-578	EQTP1006 Fingerprint Testing	Established engineering test procedure for receiving acceptance of cryogenic adhesives
H36809-593	32L2 Flexible Metallic Hose Assy	Revised standard to reflect manufacturing of hose assemblies with either bare/passivated or lubricated male end fitting thread. On previous revision of standard, silver plating should not have been specified for male end of the hose.
H36809-607	34L3 Floating Screw Thread Insert	Revised standard to reflect current drawing. Supplier uses 302 corrosion resistant steel for retaining the nut element, whereas the old standard specified 304.

Minor Changes – STD/STM/STP/AVL

Change No.	Document	Description
H36809-608	54L5 Vibration Isolator	Corrected drawing error - the illustration had a quantity of two inserts specified, but four inserts are actually used. No change to physical parts.
H36809-619	E300 TFE Insulated Electrical Cable	Update the material code sheet source appendix to reflect manufacturer's name change
H36809-623	EQTP1005 Fingerprint Test Epoxy Primer	Established fingerprint testing for receiving acceptance of epoxy primer MMSK719
H36809-624	33L6 Slotted Hex Nut	Revised bearing surface finish from 16 to 63; changed across-corner dimension of the hexagon to a reference dimension; added "typical" to the across flats dimension.
J31218-002, H36809-659	80900000041 ET Protection Requirements	Revised drawing to remove flown effectivities and to reflect ET Model identification
J31218-039	PD4800175 Flexible Oxidizer Feedline	Revised document as required to replace LWT numbers with ET Model identification

NCD Assessment Criteria

Assessment of all MRB Items

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

ET-110 DR/PR/OMRSD Waiver/Exceptions

as of 07/16/2001

System	Discrepancy	Problem	MRB Items	Exceptions/ Waivers
• Electrical	0	0	0	0
• Propulsion/ Pneumatics	0	0	0	0
• Structures	2	4	0	0
• Thermal (TPS)	1	7	1	0
Total	3	11	1	0

ET-110 PR/MRBs

as of 07/16/2001

PR No./Status	Title/Description	Disposition
ET-110-TS-0004	• Void in +Z splice plate closeout	• MR approved to process edges and repair with PDL

ET-110 KSC Modification Summary/Status

as of 07/16/2001

Item	***Title***	***Status***
• ***Field Engineering Changes***		
– FEC KET-0071	Intertank +Z stringer area foam venting	Work complete

ET-110 Limited Life Components

Cycle Sensitive

Description	Part No.	Serial No.	Limit	Required	Remaining
LH2 Manhole Cover Assy	80914081488-509	0000864300	14	2	14
LO2 Tank Mechanical Assy	80912002000-500	0000913600	14	2	14
LH2 Tank Mechanical Assy	80914002000-509	0000919250	14	2	14
LO2 Manhole Cover Assy	80911001205-509	0000902600	14	2	14
LO2 Fwd Ogive Cover Plate	80911001207-509	0000887140	14	2	14
LH2 Manhole Cover Assy -Aft	80911001444-509	0000887150	14	2	14

ET-110 Limited Life Components

Age Sensitive

Description	Part No.	Serial No.	Limit	Initiation	Expiration
External Tank	80901010000-509	00000103	6 Yrs	07/2000	07/2006

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

Description	Part No.	Lot No.	Serial No.	DLAT* / Retest	Expiration
Separator Assy GUCP	PD5000020-059	AAH	0001167	01/27/1998	01/2002
Cartridge Assy	PD5000020-030	AAH	0001349	01/27/1998	01/2002
Cartridge Assy	PD5000020-030	AAH	0001352	01/27/1998	01/2002

** Destructive Lot Acceptance Test*

Level II Waivers - Baseline

Document / Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700, Volume V, Information Management Requirements				
Generic part name, type, common designation, and part manufacturer H4 code are not required for EEE parts status print out	PRCBD S000127B 06/28/88	Table C.5 Item 2SR-10	6	ETs 49 & up
Data required in limited life status report is supplied in acceptance data package	PRCBD S000127B 06/28/88	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	PRCBD S000127B 06/28/88	Table C.6 Item 2SR-7	10	ETs 49 & up

Level II Waivers - Baseline

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

Level II Waivers - Baseline

Document / Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700, Volume X, Book 1, Space Shuttle Flight and Ground System Specification, Requirements				
Launch Probability	PRCBD S071290R1 04/10/00	3.2.1.2.14.1	682	ETs 102, 107 - 110
Applicability of Space Shuttle Manned Spacecraft Criteria and Standards (NSTS 08080-1)	PRCBD S061451 08/08/00	Table 2.0	683	ET-96 & up
NSTS 07700-10-MVP-01, Shuttle Master Verification Plan - Volume I, General Approach and Guidelines				
Environmental acceptance of ET components	PRCBD S002130H 03/07/89	3.7.1	13	ETs 23, 27-29, 31 & up

Level II Waivers - Baseline

Document / Requirement	Authority	Paragraph	Waiver No.	Effectivity
SL-E-0001 - Specification Electromagnetic Compatibility Requirement				
Wire marking is not applicable to ET	PRCBD S040732K 09/27/89	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 feet on ground half of GUCA	PRCBD S087020L 08/17/88	3.4.2.1	21	ETs 23, 27-29, 31 & up