



SPACE SHUTTLE PROGRAM
Space Shuttle Program Integration
NASA Johnson Space Center, Houston, Texas



STS-110 Flight Readiness Review

March 26, 2002



Agenda

Presenter

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- • **Program Integration - Flight Manager ***
 - **Key Program Considerations**
 - **Payload & System Safety**
 - **Orbital Debris Status ***
 - **Payload In-Flight Anomalies**
 - **Launch Commit Criteria ***
- **USA Program Integration ***
 - **Special Topic**
 - **Shuttle Certification for Block II SSME**
- **Boeing Integration**
 - **Waivers to Vol X**
- **System Integration TMR**
- **Flight Readiness Statement**

Vanessa Ellerbe

No Issues

No Issues

No Issues

Bob White

No Issues

Lambert Austin

*** Backup Material Included**



Key Program Considerations

Presenter **Vanessa Ellerbe**

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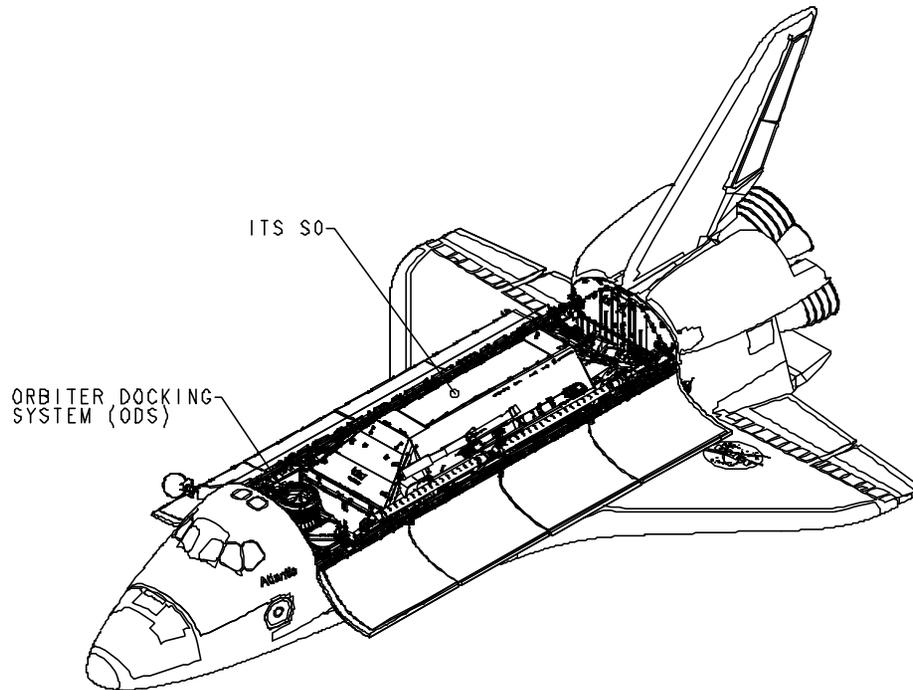
- **Mission Duration (11+0+2) / Pad Hold (+190 Hrs Margin)**
 - DI 122 supports FD3 rendezvous
 - Cryo supports an additional day, if required
- **EVA's from ISS Airlock**
 - 4 scheduled EVA's; FD4, FD6, FD7, FD9
 - Performed by 2 Space Shuttle EVA teams
 - EMU LiOH to support all EVA's
- **Middeck Stowage**
 - Manifest finalized
 - L-10 day BR 3/26/02
 - All ISS Program requirements supported
- **First Flight**
 - Block II SSME cluster
 - OI-29 software
 - Operational DTV
- **Space Shuttle Secondary Payloads**
 - SIMPLEX and RAMBO (Customer DoD)



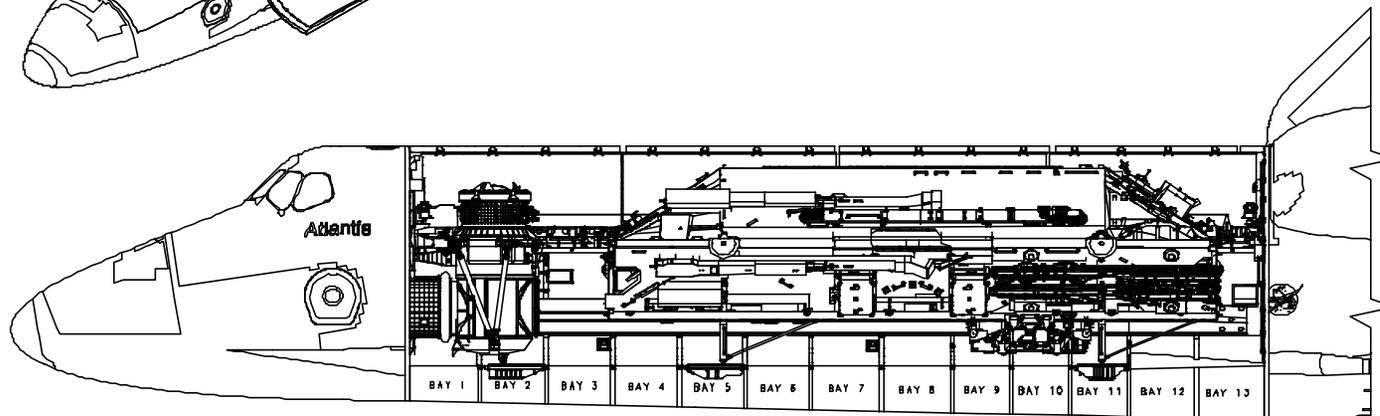
Payload Bay Configuration With S0 Installed

Presenter **Vanessa Ellerbe**

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PAYLOAD BAY PAYLOADS:
 ITS S0 Integrated Truss Segment S0
 ODS Orbiter Docking System



ODS

INTEGRATED TRUSS SEGMENT S0 (ITS S0)



Clearance Assessment Results

Presenter **Vanessa Ellerbe**

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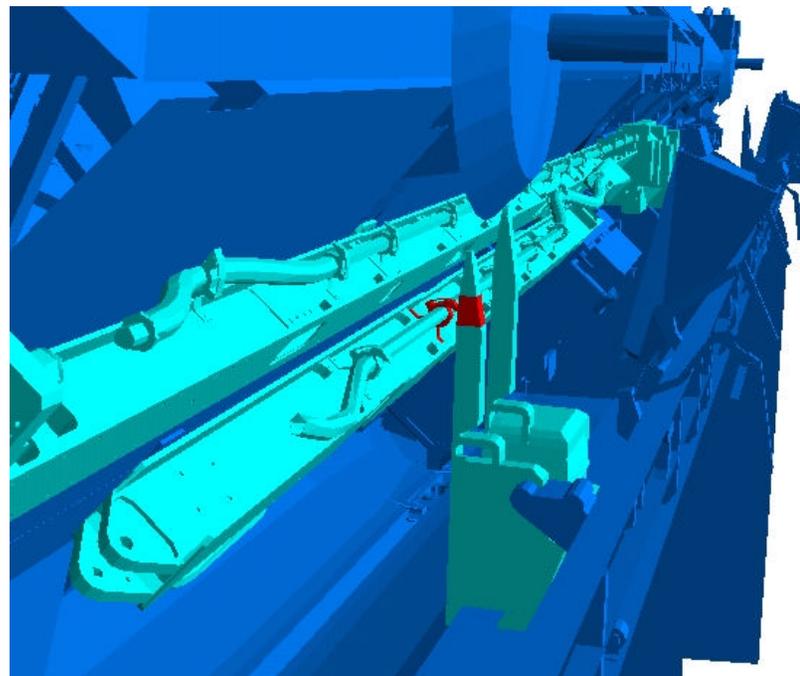
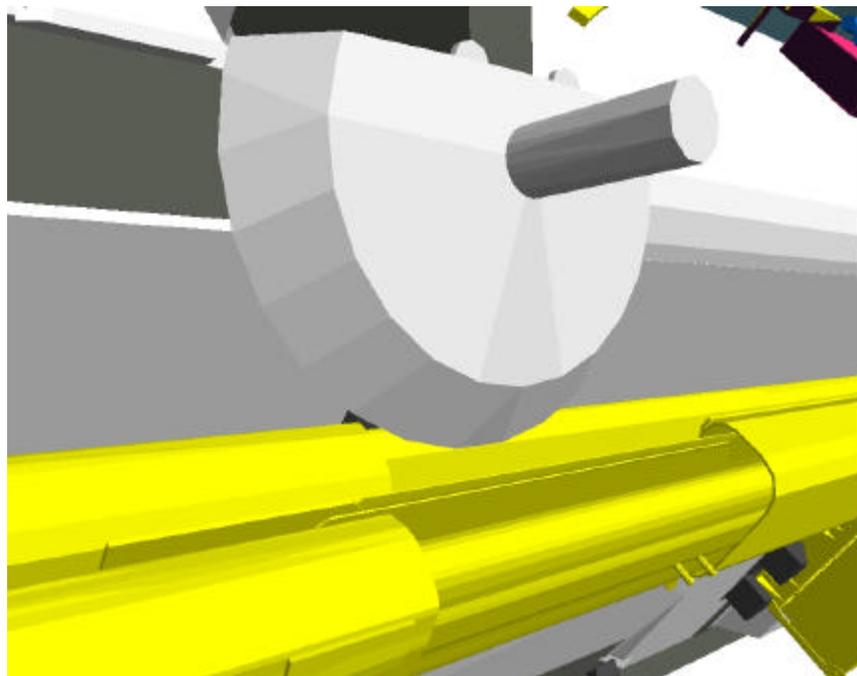
- **Payload Bay Dynamic Clearance**
 - One potential contact
 - S0 segment-to-segment fluid jumper MLI blanket to orbiter MPM MLI blanket
 - Not an issue – no structure-to-structure contact
- **Unberthing / Reberthing Clearance**
 - One potential contact
 - S0 starboard fluid umbilical to orbiter forward port V-guide
 - Crew VR Lab assessment complete
 - Visual cues are adequate
 - No contact expected
 - Structural contact analysis complete
 - Will not result in damage to primary structure



S0 Fluid Umbilical at Orbiter V-guide

Presenter **Vanessa Ellerbe**

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Payload and System Safety

Presenter **Vanessa Ellerbe**

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- **Integrated Experiment Hazards Assessment – Complete**
- **Toxicology Process**
 - **Verification 1: Complete**
 - **Verification 2: Standard open work for late load items**
- **Payload Safety Review Process – Complete**
- **One Non-compliance Report (NCR) – Approved**
 - **Biomass Production System Pinch Point Hazard (Integrated ISS Express Rack Issue)**
 - **Payload hardware labeled and crew trained**



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No Issues
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Lambert Austin
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SPECIAL TOPIC - SHUTTLE CERTIFICATION FOR BLOCK II SSME	Presenter: Bob White
	Organization/Date: Program Integ/03-26-2002

- **Systems Integration Initially Assessed the Shuttle Certification Environments for Blk II SSME Implementation**
 - Mixed cluster (STS-104 and STS-108)
 - Full cluster (STS-110 and subs)
- **Certification Impacts Were Identified For the Following Areas:**
 - ET ullage pressure
 - MPS pressurization was impacted because of changes to the SSME tags that resulted in minor (~0.1 psi) expansions of the ICD ullage pressure
 - Pre-launch loads
 - Blk II SSME start-up thrust profile changed due to increased spin-up rate required to overcome the higher inertia of Pratt HPFTP - increased excitation of vehicle dynamics

**SPECIAL TOPIC - SHUTTLE
CERTIFICATION FOR BLOCK II SSME****Presenter:**

Bob White

Organization/Date:

Program Integ/03-26-2002

- **Certification Was Also Impacted As a Result of STS-104 First Block II Flight Observations**
 - Higher than expected post-MECO LH₂ manifold pressure was observed
 - Caused by LH₂ boiling in sealed MPS system with higher heat rates flowing into a smaller pump fluid volume than with Block IIA
 - Revision to post-MECO Blk II thermal / pressurization model required
 - To mitigate post MECO pressure rise a 2-second delay in LH₂ prevalue closure was approved for flight
 - Pre-flight predictions of the post-MECO performance with 2-second delay and with new thermal model was verified by STS-108 and STS-109 post-flight analyses
 - STS-110 mission-specific certification for 2-second increase in mated-coast completed
 - ET / Orbiter separation systems certification analysis has demonstrated positive clearances for mated coast extension
 - Ascent heating environments updated for mated coast extension

**Flight Certification Updates are Complete for 3 Block II
SSMEs and Systems Integration Is Ready for Flight**



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- **Program Integration - Flight Manager ***

Vanessa Ellerbe

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No Issues

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- **USA Program Integration ***

Bob White

- **Special Topic**
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No Issues

- **Waivers to Vol X**

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Lambert Austin

- **Flight Readiness Statement**

*** Backup Material Included**



STS-110 NASA System Integration TMR Flight Readiness

Presenter	Lambert Austin, Jr.	
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- **Insight, audit and surveillance requirements complete**
- **No out-of-family problems have been identified for impact to safety of flight, or planned flight operations**
- **Approved Program requirements changes have been implemented and verified**
 - **ICD, OMRS, LCC**
 - **Vehicle configuration**
 - **DOSS configuration**
 - **NSTS 07700, Volume X**
 - **Joint requirements**
- **All Joint Shuttle / International Space Station on-orbit Systems Integration analyses have been completed and compatibility verified for STS-110-8A baseline mission**
- **System Integration is ready for flight pending the completion of remaining open work**



STS-110 NASA Systems Integration TMR Boeing Relocation Status

Presenter	Lambert Austin, Jr.	
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- **Joint NASA / USA / Boeing Process in Place to Manage Relocation Activities While Continuing Contracted Tasks for Flight Operations, New Capability Development, and Anomaly Resolution**
 - Functional Transition Plans
 - Individual Training Plans
 - Joint Transition Management Plan
 - Out-of-Family Criteria Established
 - NASA Approval for Transition Complete
- **Relocation Progress and Metrics are Stated as Part of the CoFR Process and Monthly Joint NASA / USA / Boeing Reviews**
 - Skill Retention Status
 - Contracted Products Status
 - Risk Mitigation Status
- **Current Transition Risk Assessment**
 - 95+% of Personnel Still Available at Boeing-Huntington Beach
 - 30+% of Personnel Committed to Relocate
 - Risk = Yellow
 - Currently Available Skills Meet All Contract Requirements
 - No Flight Product Delivery or Quality Issues Identified for STS-110



Systems Integration CoFR Status

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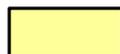
- **Systems Integration Transition Process has been assessed for impacts to the near term CoFR process**

STS-110	STS-111	STS-107	STS-112	STS-113	STS-114
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- **Yellow rating due to single string MPS post flight processing**
 - STS-111, 107, 112, & 113
- **Yellow rating due to single string GN&C / Nav**
 - STS-112, 113



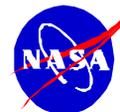
Green: Primary and backup personnel in place to produce the required products



Yellow: Single string exists to produce the required products



Red: Neither primary or backup personnel in place for required products



STS-110 Flight Readiness Statement

Presenter

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**THIS CERTIFIES THAT ALL MISSION REQUIREMENTS HAVE BEEN MET AND
SPACE SHUTTLE INTEGRATION IS READY FOR FLIGHT, PENDING COMPLETION
OF THE DEFINED OPEN WORK**

/s/ Lambert D. Austin, Jr.

**L. D. AUSTIN, JR., MANAGER
SPACE SHUTTLE SYSTEMS INTEGRATION**

/s/ Michele A. Brekke

**M. A. BREKKE, MANAGER
SPACE SHUTTLE CUSTOMER AND
FLIGHT INTEGRATION**

/s/ Fred R. Hinson

**H. N. HAMMOND, ASSOC. PROG. MGR
PROGRAM INTEGRATION
UNITED SPACE ALLIANCE**

/s/ Axel M. Larsen

**A. M. LARSEN, MANAGER
PAYLOAD SAFETY**

/s/ Richard N. Richards

**R. N. RICHARDS, PROGRAM DIRECTOR
SHUTTLE & SPACE STATION INTEGRATION
BOEING HUMAN SPACE FLIGHT &
EXPLORATION**

/s/ R. L. Segert

**R. L. SEGERT, MANAGER
SPACE SHUTTLE KSC INTEGRATION**

/s/ Vanessa Ellerbe

**V. S. ELLERBE, FLIGHT MANAGER
SPACE SHUTTLE PROGRAM INTEGRATION**



SPACE SHUTTLE PROGRAM
Space Shuttle Program Integration
NASA Johnson Space Center, Houston, Texas



STS-110 Flight Readiness Review

Backup Charts



Unberth / Reberth Clearance Results

Presenter	Vanessa Ellerbe	
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Priority Contacts (2" and 1° with less than 1" clearance)

Class 1

<u>S0 Hardware</u>	<u>Orbiter Hardware</u>	<u>Clearance (in)</u>	<u>Resolution</u>
Starboard Fluid Umbilicals	Forward Port V-guides	0.34	Contact Analysis Complete - Non-issue

Class 2

<u>S0 Hardware</u>	<u>Orbiter Hardware</u>	<u>Clearance (in)</u>	<u>Resolution</u>
MBSU 1A1B*	Port Fluid Line Longeron	0.80	Contact determined not to be a physical possibility; scuff plate prevents contact - Non-issue
MBSU 3A3B*	Starboard Fluid Line Longeron	0.80	

Note: Payload constrained to 3 inches along Y-axis when berthed.

Potential Contacts (3" and 2° with less than 1" clearance)

Class 1

<u>S0 Hardware</u>	<u>Orbiter Hardware</u>	<u>Clearance (in)</u>	<u>Resolution</u>
Starboard Avionics Umbilicals	MPM	Contact	Tether Restrained - Non-issue



STS-110 Orbital Debris Status

Presenter **Vanessa Ellerbe**

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- **Orbital Debris / Micrometeoroid Risk Is Acceptable**

<u>Criteria</u>	<u>Risk</u>	<u>Guideline</u>
Critical Penetration	1 in 360	1 in 200
Radiator Tube Penetration	1 in 314	1 in 61
Window Replacements	56%	N/A



Approved Mandatory Launch Commit Criteria for STS-110

Presenter	Vanessa Ellerbe	
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- **STS-110 Minimum Equipment List (MEL) Mission Dependent (LCN 1091)**
- **MEDS LCC Update for Detail BITE (LCN 1090)**
 - Rewrites table of MEDS status word exceptions for OI-29 to include new Detail BITE which will allow for continuation of the count for some exceptions associated with status word 2
- **RSRM Field Joint Limit Change (LCN 1092)**
 - Recently provided O-ring resiliency data results in LCC minimum temperature increase to 86 degrees F ensuring a safety factor in excess of 2.0 for O-ring seal tracking



Approved Non-Mandatory Launch Commit Criteria for STS-110

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- **ECL-10 Update (LCN 1063)**
 - Revises Requirement for Av Bay Cabin Fan Delta Pressures to prevent the 10 degree delta limit from being in effect when primary measurements are being used
- **ADTA BCE Bypass Update (LCN 1093)**
 - Rewrites Redline Derivation and Consequences of Exceeding Redlines to delete references to sideslip Beta since there is no direct correlation between loss of a single ADTA input and sensitivity of Beta calculations
- **Updates to EPDC and GNC MIT for OI-29 (LCN 1089)**
 - Updates the Measurement Information Table for Orbiter Control Bus RPC anomaly to state that if an RPC indicates off a System Management alarm will be initiated.

USA PROGRAM INTEGRATION FLIGHT PREPARATION PROCESS

Presenter:

Bob White

Organization/Date:

Program Integ/03-26-2002

- **All the Systems and Cargo Integration flight preparation activities have been completed except for planned open work – no issues identified**
- **Completed tasks include:**
 - Verification of compliance with generically certified requirements
 - Mission specific analyses
 - Documentation of vehicle and cargo requirements
 - Reconfiguration / installation of Payload Integration hardware
 - Payload bay clearance assessment

Program Integration Is Ready to Support Flight