



# STS-131 SSP Flight Readiness Review

**MS/Travis Robinson**  
**March 10, 2010**



Pre-decisional. Internal Use Only.



Pre-decisional. Internal Use Only.

## Agenda

Presenter	MS/Travis Robinson	
Date	03/10/10	Page 2

- **Systems Engineering & Integration**
  - SE&I FRR Roadmap
  - Flight Preparation Readiness
  - Main Engine Ignition(MEI) Instrumentation Results for STS-130
  - GUCP Pyro Bolt Interface Loads
  - Integrated Debris Risk Summary
  - Integrated In-flight Anomalies (IFAs)
  - Integrated Hazard Report Summary
  - Imagery Status
  - Radar Status
  - Flight Software Readiness
  - Payload and General Support Computer Readiness
  - Non-Standard Open Work Summary
  - Alternate/Dissenting Opinions
  - Certificate of Flight Readiness
  - Launch On Need (LON)

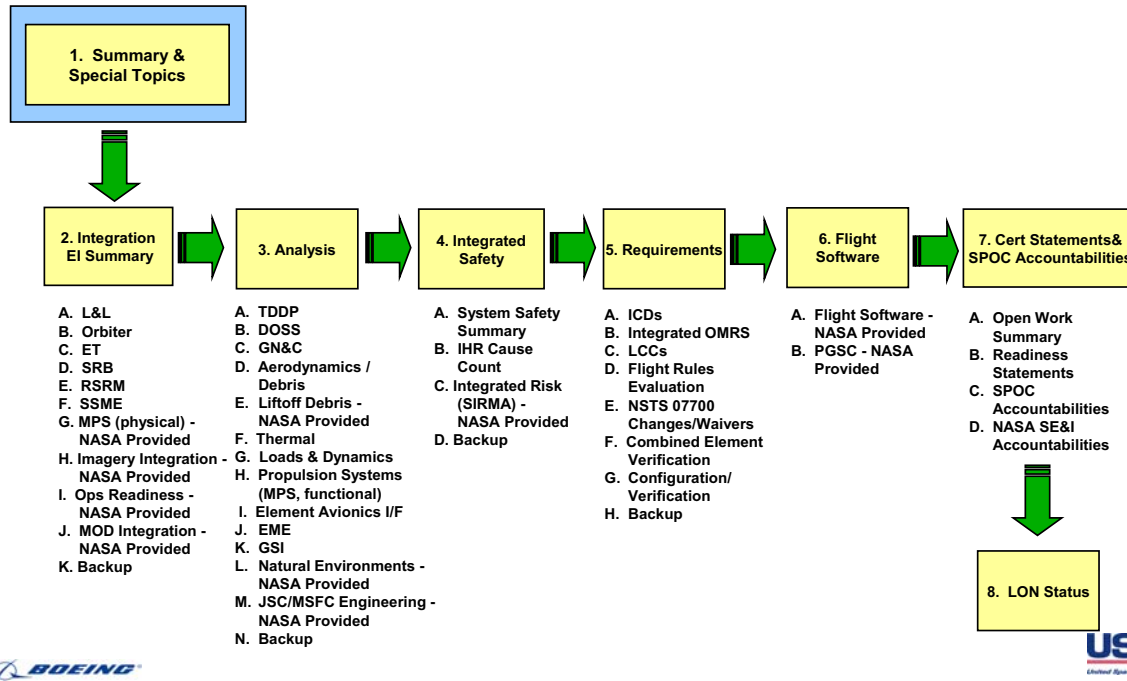




## SE&I FRR Roadmap

Presenter MS/Travis Robinson

Date **03/10/10** Page 3



## Flight Preparation Readiness

Presenter MS/Travis Robinson

Date **03/10/10** Page 4

- **All standard Systems Engineering and Integration flight preparation activities have been completed or are planned. Non-standard open work will be addressed.**
  - System requirements verification
  - Design requirements and induced environment updates; verification of element incorporation
  - Integrated vehicle performance evaluation
  - Real-time mission support preparation and certification of personnel as applicable
  - Review and disposition of waivers, deviations, and exceptions
  - Updates to Integrated Hazards baseline
  - Flight Software verification/Payload and General Support Computer (PGSC) Readiness
  - Review of element requirements changes and verifications for integration impacts





## Main Engine Ignition(MEI) Instrumentation Results for STS-130

Presenter MS/Travis Robinson

Date 03/10/10 Page 5

- **TSM acoustic levels were higher than STS-129 but within the updated design limit for Orbiter base areas – minor poke-outs within ground rules**
- **Base heat shield acoustics were near the high end of OV-102 and OV-103 flight experience but below the updated design level at most frequencies – within ground rules**
- **RCS stinger and vertical tail stinger microphone data processing in work**



## GUCP Pyro Bolt Interface Loads

Presenter MS/Travis Robinson

Date 03/10/10 Page 6

- **STS-119 GH2 Vent leak anomaly prompted a review of interface loads**
- **A recent reassessment of loads has revealed that the GUCP pyro bolt load has increased**
  - 5888 lb versus 5655 lb
- **The current documentation of the GUCP pyro bolt load and accompanying Factor of Safety exception is cumbersome and will be cleaned up as an NFS document change. Changes will be made to the following:**
  - ICD-2-0A002, Space Shuttle Launch Pad & Platform, Figure 3.3-2.1
  - NSTS-07700, Vol. X, Flight and Ground System Specification, Table 3.2.2.1.5.2
  - STS 85-0169, Shuttle Loads Data Book





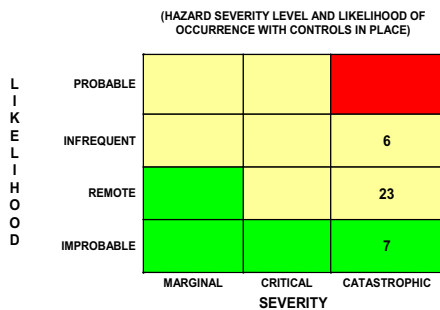
<b>STS-131 SSP FRR</b>	Presenter <b>MS/Doug Drewry</b>	
	Date <b>3/10/10</b>	Page <b>7</b>

# STS-131 Debris Risk Summary

**Doug Drewry, MS2**  
**Systems Engineering & Integration Office**  
**Space Shuttle Program Office**



<b>STS-131 Debris Risk Assessment Summary</b>	Presenter <b>MS/Doug Drewry</b>	
	Date <b>3/10/10</b>	Page <b>8</b>



- 6 Infrequent Causes:**
- Liftoff Debris (AD)
  - ET Umbilical Ice (V)
  - Orbiter Putty Repair (AK)
  - T-0 Umbilical Ice (AO)
  - LO2 IFR (I)
  - Intertank acreage (G)

### Debris Risk Assessment, 3/2010

**Six IDBR-01 debris risks remain Infrequent/Catastrophic**

- **Liftoff Debris** is expected to remain at this risk level for the life of the Program due to the diversity of potential Debris sources although rigorous controls have been implemented and continuous vigilance is policy.
- **ET Umbilical Ice**: Accepted Risk; Closely monitored during pre-launch
- **Putty Repair**: Windows zero impact allowable keeps any impact in the “catastrophic” category, forward work may be used to reduce the likelihood to “Remote”.
- **T-0 Umbilical Ice**: Accepted Risk; NSTS 08303 Updated to include 0.1 lbm allowable external ice
- **LOX IFR**: Implemented NDE of all IFR ramps to screen for large voids
- **ET Intertank Foam Loss**: Changed to Infrequent Catastrophic for STS-128
  - Continued Tensile Testing of ET high risk debris areas to mitigate risk





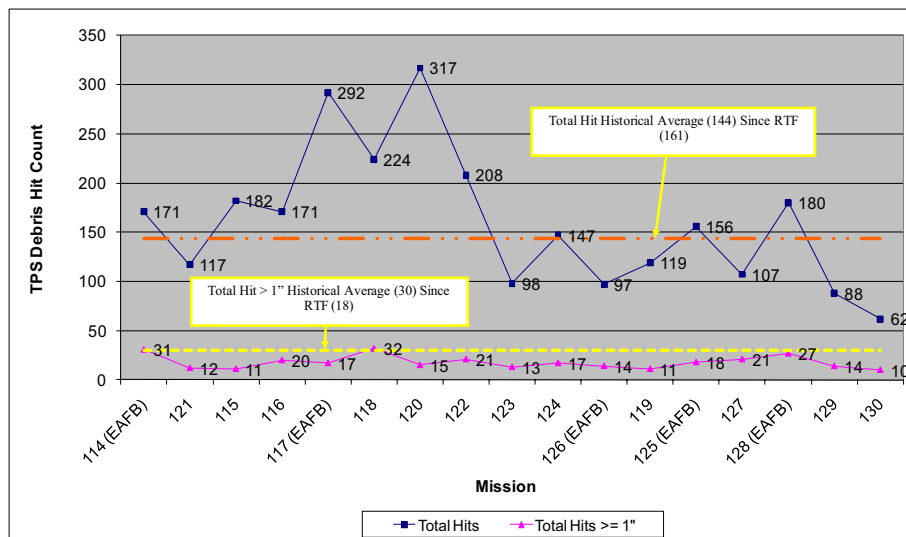
<b>Integrated In Flight Anomalies</b>	
Presenter	<b>MS/Doug Drewry</b>
Date	<b>3/10/10</b> Page <b>9</b>

- **STS-130-I-001 (CoFR Exception) – Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)**
  - Associated Hazard Report: IDBR-01 Cause AD - Infrequent Catastrophic
- **STS-130-I-002 (CoFR Exception) – ET TPS Losses from the Intertank**
  - Associated Hazard Report: IDBR-01 Cause G – Infrequent Catastrophic
    - "Update Acceptance Rationale for Cause G, IT Foam Debris" added to the VTL /Closure expected prior to the STS-132c update.
      - Routine Update: The rationale that exists in Cause G now states the loss of IT foam on STS-127/ET-131 was due to possible contamination on the post-Katrina External Tank. STS-130/ET-134 did not have similar environmental exposure, but did have IT foam losses during flight. The Acceptance rationale needs to be updated to remove any language associated with post-Katrina environments to reflect the actual risk of IT Foam to the program.
  - Actions from MAF TIM 3/4/10 outlined approach for developing PRA to quantify the risk to Special Tile & RCC
- **STS-130-I-003 (CoFR Exception) -Ceramic Insert is Protruding from Window #2 Carrier Panel**
  - 2 ceramic inserts around the windows were identified as protruding. None were liberated. One near window #2 during the flight and one near window #5 post flight. The one near window #2 had defects that should have prompted the part to be removed and replaced prior to STS-130. A follow on detailed inspection identified additional locations that failed the inspection criteria and have since been pull tested and or R&R'd acceptability for flight.
  - A design tolerance study has been conducted to identify locations that are required to be inspected. (Orbiter/PRT)



<b>Orbiter Debris Impact summary STS-130, OV-104</b>	
Presenter	<b>MS/Doug Drewry</b>
Date	<b>3/10/10</b> Page <b>10</b>

- TPS Hits w/damage > 1" = 10 (7 lower surface, 2 L OMS, 1 R OMS, 0 windows) (Total # of Hits = 62)
  - Prior to RTF Average for Lower Surface Hits >1" = 23; Since RTF = 14



**STS-130 elliptical volume Hits>1" = 0.536 in3; RTF Average = 2.637 in3**  
**STS-130 Total elliptical volume ALL Hits = 0.804 in3; RTF Average = 3.811 in3**



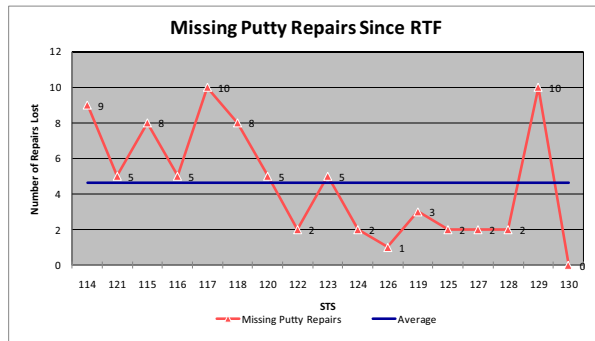


<b>STS-130 Putty Repair Debris Summary</b>	
Presenter	<b>MS/Doug Drewry</b>
Date	<b>3/10/10</b>
	Page <b>11</b>

- TPS putty repairs are listed as expected debris in NSTS 60559
- Putty Repair loss is listed in IDBR-01 as cause AK and carried as an Infrequent Catastrophic Risk primarily because Windows have zero capability for impacts
- **There were no Putty repair losses on STS-130**

• **OPO/TPS PRT continues risk reduction steps**

- Allowable Repair filler volume was reduced to limit putty repair masses
- Tile Undercut revised for new repairs
- Process/tooling/Training enhanced
- Tiles with large repairs are being removed in critical areas FWD of the RCC and windows
- Inspections continue (Tactile Test & Minimum gap inspections) and Tiles to be removed are ranked by size/location/repair type
- CHIT's will be initiated and a subset of tiles removed every flow until EOP



<b>STS-130-I-001 Liftoff Debris</b>	
Presenter	<b>MS/Doug Drewry</b>
Date	<b>3/10/10</b>
	Page <b>12</b>

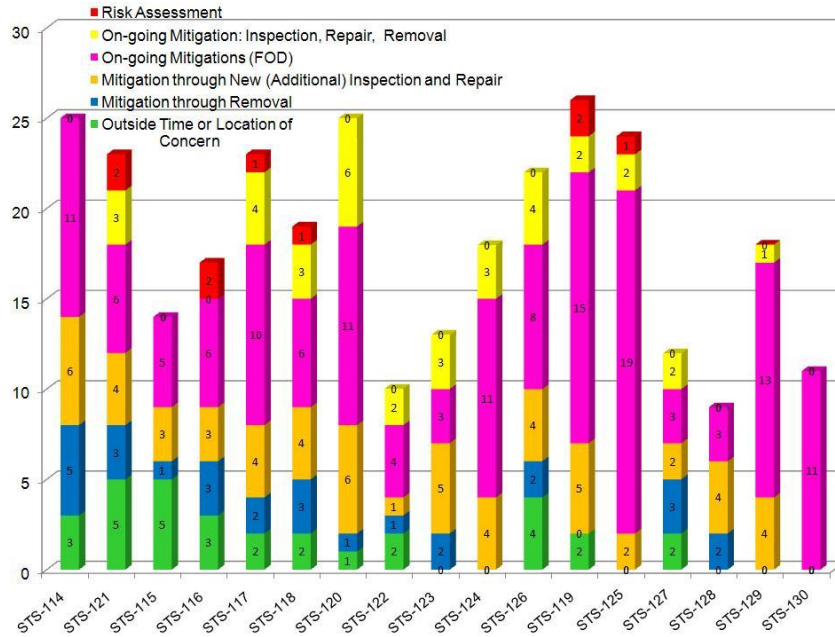
- Several pieces of debris were found on pad post-launch or were captured in imagery observations.
- Liftoff debris risk is currently characterized as infrequent, catastrophic due to significant uncertainties in controls and significant limitations in analysis.
- Debris release has been mitigated for identified potential sources of critical debris by performing repairs and adding inspections for system-level components. Ongoing mitigations include FOD awareness, attrition-based hardware removal, routine inspections and monitoring for facility corrosion.
- Observed STS-130 debris poses no increase in risk.





**Summary of Liftoff Debris Categories**

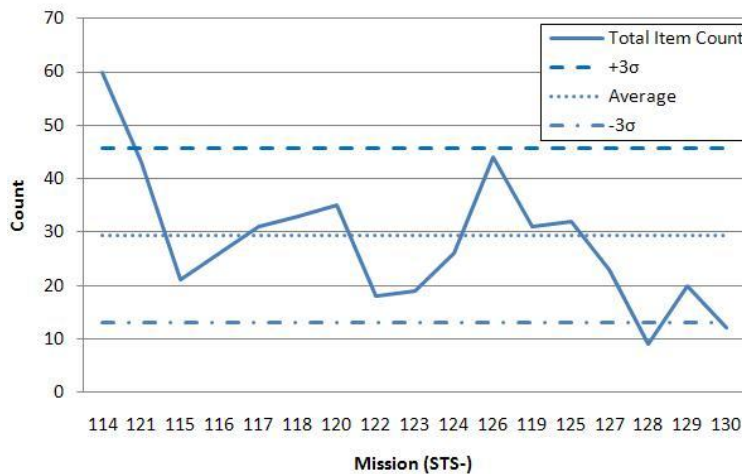
Presenter	MS/Doug Drewry	
Date	3/10/10	Page 13



**STS-114 through STS-130:  
 Liftoff Debris Instance Chronology**

Presenter	MS/Doug Drewry	
Date	3/10/10	Page 14

**Total Item Count Trend**



	Total
+3σ	45.65
μ	29.38
-3σ	13.12
STS-130	12

Baseline established with data from STS-114 through STS-127.

STS-130 debris count is slightly below the IIFA baseline -3σ limit. The very low rust count over the last 3 missions may partially account for the drop below the limit.





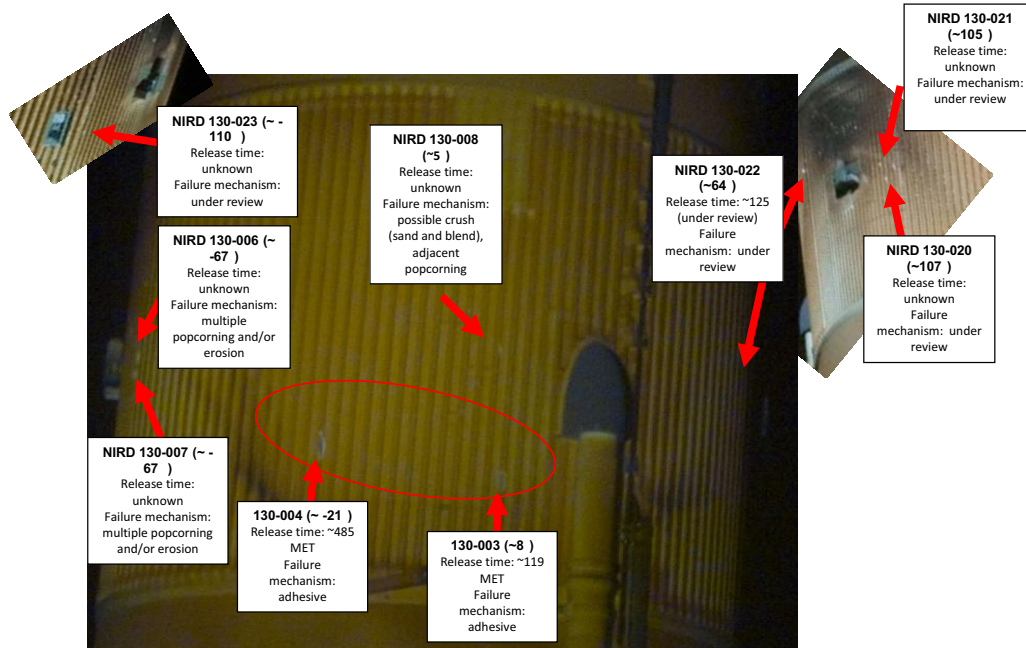
<b>STS-130-I-002 – ET Intertank TPS Losses</b>		
Presenter	MS/Doug Drewry	
Date	3/10/10	Page 15 R1

**BACKGROUND**

- **STS-127 experienced significant foam loss across the Intertank**
  - Investigation initiated a review of tank processing history and possible causes
  - Review identified contamination prior to foam application as the probable cause
  
- **Plug pulls were implemented as a process check to ensure no gross contamination issues prior to STS-128**
  - STS-128 had no foam losses from +Z side of Intertank
  - Crew Hand Held imagery was not available for –Z side of Intertank
  - SRB video at separation provided limited views but no observed –Z losses
- **Plug pulls were continued as a process check for STS-129**
  - STS-129 had eight foam losses from –Z area with unknown times of release
  - Good DETTPS Umbilical imagery showed no +Z Intertank foam losses
  
- **Additional plug pulls were added prior to STS-130 to sample platform access areas in addition to the high risk areas**
  
- **STS-130 experienced two +Z Intertank foam losses**
  - Currently tracking 21 observations of missing TPS on STS-130/ET-134 Intertank
  - 2 Areas on +Z were determined to be adhesive failures similar to STS-127/ET-131 losses
    - One occurred during ASTT (+Z losses observed at 119 sec and 485 sec MET)
  - Conditional PRA done for the STS-130 Intertank foam release during ASTT
    - 1/10,000 for Special Tile
    - 1/10,000 for RCC



<b>STS-130 Intertank TPS Losses (<math>\phi</math>: <math>\pm</math> 110deg)</b>		
Presenter	MS/Doug Drewry	
Date	3/10/10	Page 16





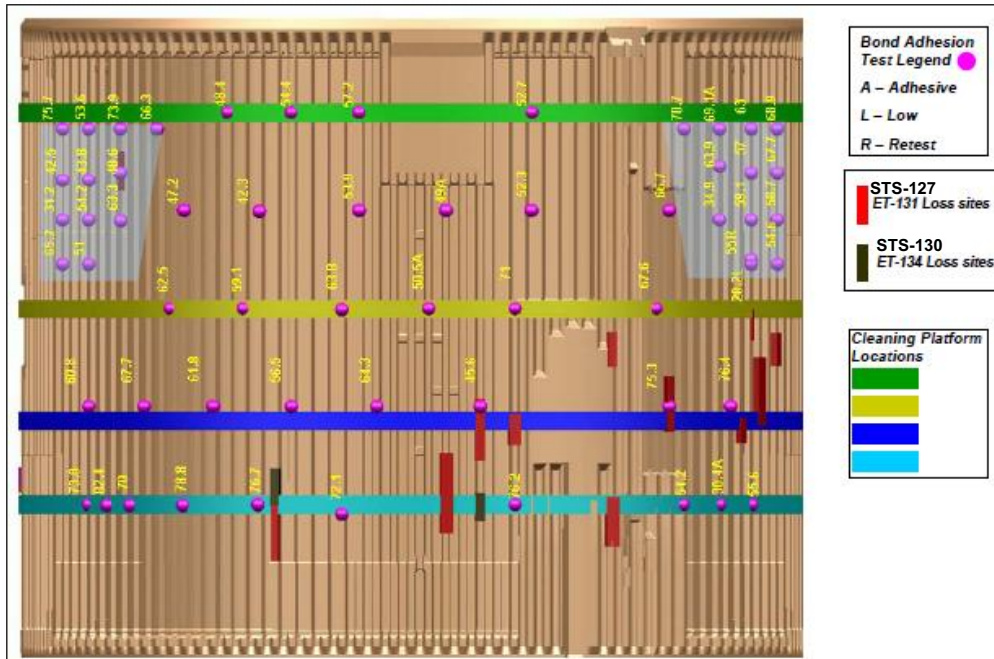


**STS-127/130 +Z Intertank Losses  
 with STS-130/ET-134 Plug Pull Locations**

Presenter **MS/Doug Drewry**

Date **3/10/10**

Page **17**



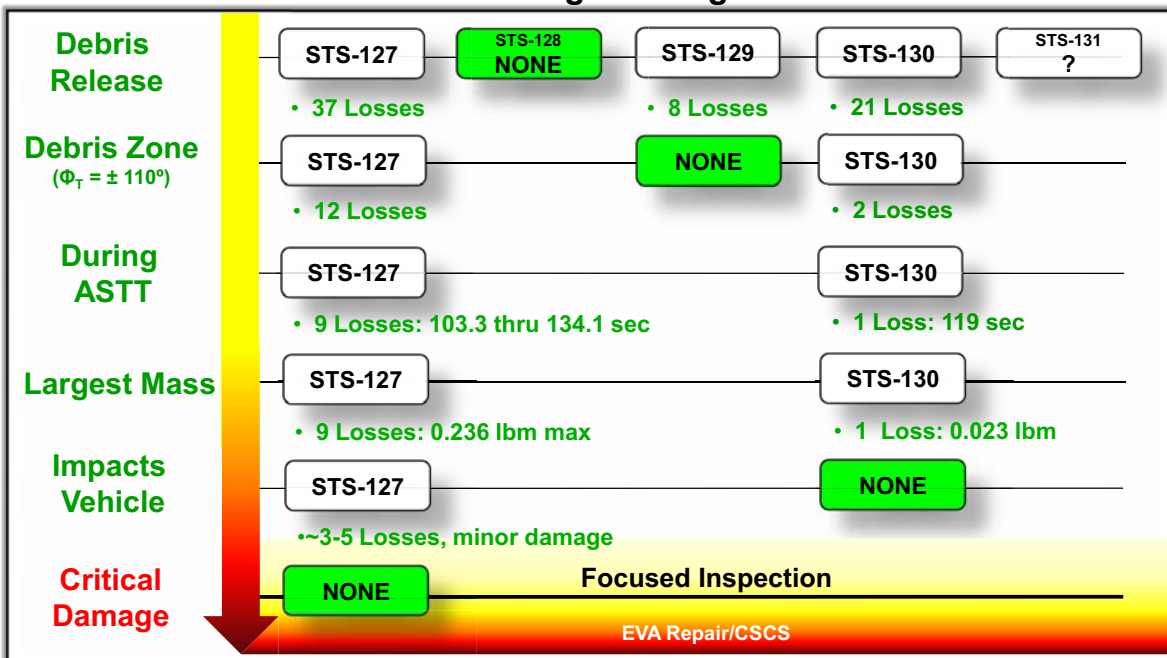
**Flight Comparison / Likelihood Assessment**

Presenter **MS/Doug Drewry**

Date **3/10/10**

Page **18**

**Path to Critical Damage vs. Flight Performance**





<b>ET Intertank TPS Losses Factors effecting Risk Assessment</b>		
Presenter	MS/Doug Drewry	
Date	3/10/10	Page 19

- **IDBR-01, Cause G documents Intertank foam debris**
  - "External Debris Impact to SSV During Ascent Due to ET Foam – NCFI 24-124 located on the Intertank Acreage"
  - Cause Upgraded to Infrequent/Catastrophic following STS-127 (Tracking VTL item to update Cause G removing references to Katrina as a cause – STS-132)
- **DIG assessment identifies a 20 to 30 second window of risk during ascent**
  - ET physics model indicates heating is likely insufficient prior to 100 sec to cause liberation
  - DTA and Orbiter damage capability demonstrates risk diminishes after 120 seconds
- **Relatively short window of exposure & several events are required to line up to result in critical damage**
  - IT Debris release,
  - Release from a critical debris zone,
  - Within ASTT,
  - Debris large enough to cause critical damage,
  - Debris Impacts vehicle
  - Impact angle and orientation of debris as it impacts also effect level of damage
- **Debris concern is limited to Foam loss on +Z side of Intertank**
  - Majority of +Z losses have been on lower half of the Intertank (i.e., lower risk areas)



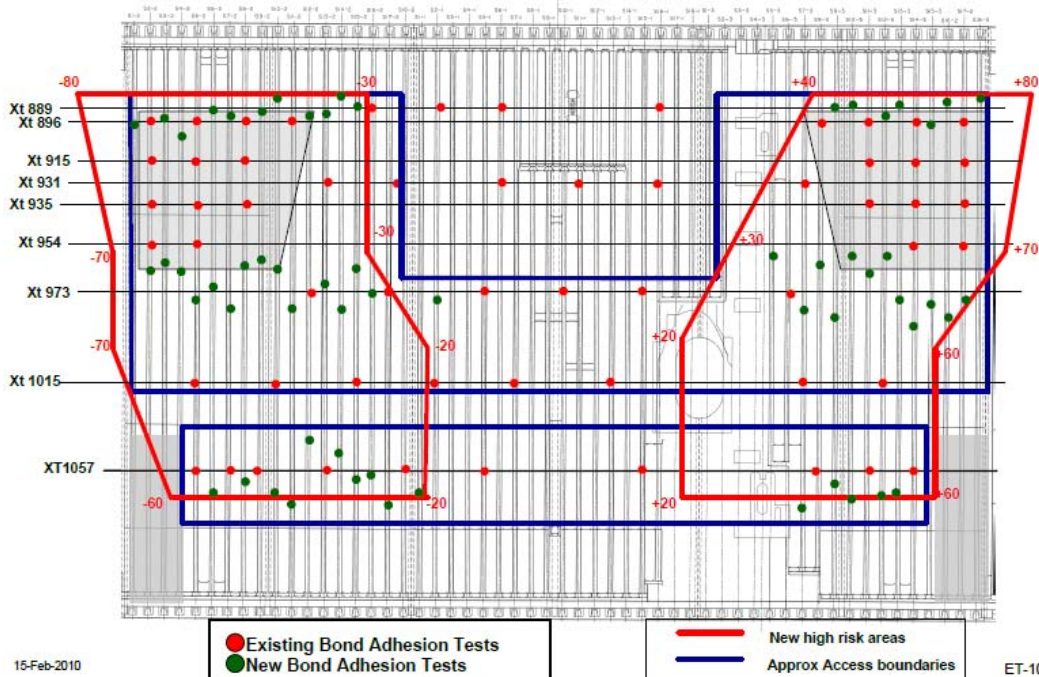
<b>ET Intertank TPS Losses STS-131 Flight Rationale</b>		
Presenter	MS/Doug Drewry	
Date	3/10/10	Page 20

- **Intertank debris has improved significantly since STS-127, but flight history suggests random debris losses from this area will remain a SSP risk.**
- **ET process controls such as certification of cleaning processes, personnel, and spray processes provide confidence in overall TPS foam application and integrity.**
- **Plug pulls provide confidence that a wide-spread process/contamination issue does not exist and provide additional assurance that weak bond issues do not exist in the high risk areas (critical debris zones)**
  - This rationale recognizes that plug pull tests are not controls and do not prevent foam loss but it does increase confidence in tested areas.
- **Additional Plug Pulls done for STS-131/ET-135 in work platform areas where most losses have occurred**
  - ET-135 is the last tank using platform cleaning
- **Imagery demonstrates that debris can liberate as a single piece, however flight evidence and testing show debris is likely to breakup into smaller pieces**
  - Smaller foam pieces decrease the likelihood for critical damage to RCC
  - Breakup increases tile impact risk but smaller pieces decrease the potential for critical damage





<b>STS-131/ET-135 Plug Pull Locations</b>	
Presenter	MS/Doug Drewry
Date	3/10/10
	Page 21



<b>ET Intertank TPS Losses STS-131 Flight Rationale (Continued)</b>	
Presenter	MS/Doug Drewry
Date	3/10/10
	Page 22 R1

- **Intertank Risk assessments:**
  - Loss Mass has been generally overestimated by EPAT and Imagery
  - Foam losses on -Z side of Intertank are not good indications for potential loss on the +Z side
    - Foam on +Z side is vented and thicker than -Z Intertank foam
  - MSFC Hot Gas Facility testing has shown our predicted Break-Up model is likely conservative
  - Flight observations indicate we have overestimated the pop-off velocity in our modeling which effects transport and influences a higher RCC risk
  - Damage models assumed worst case orientations for debris impactors
    - Not realistic with tumbling pieces of foam, many possible orientations
    - Only a fraction of the pieces will impact at the most critical locations AND angles of impact.
  - STS-127 actual damage was very minor compared to what model predictions estimated.
- **Qualitative assessment indicates the overall likelihood of experiencing catastrophic damage is probably remote, However due to uncertainties it continues to be carried as an Infrequent/Catastrophic risk.**
  - Debris TIM at MAF March 4, 2010 to determine if a realistic PRA to quantify the SSP risk could be developed.
    - Currently developing PRA for Special Tile and RCC

**STS-131 Risk is acceptable based on Qualitative Assessment and confidence gained by bond adhesion test performed in critical zone**





# STS-131 SSP Flight Readiness Review

## Integrated Hazard Report and Integrated In-flight Anomalies Summary

MS3/JJ Hill  
 March 10, 2010



Pre-decisional. Internal Use Only.



Pre-decisional. Internal Use Only.

### Integrated Hazard Report Changes Since STS-130

Presenter	MS3/J. Hill	
Date	03/10/10	Page 24

- **IMPS-01 Contamination in the Integrated MPS H2 System**
  - Change Request S050425JW (Baseline Revision H)
    - Add ORBI 306 “Fire/Explosion In The Orbiter Aft Compartment Caused By MPS Propellant Leakage/Component Rupture” as a Control to IMPS-01-C
    - Delete Open Work IMPS-01-OW-005 within IMPS-01-C
      - Action to MV: Implement design controls to reduce the hazard likelihood for flow control valve (FCV) poppet failures.
      - Update required to ORBI-311 prior to STS-131 (Action S050425JGR4 with 3/25/10 ECD)
    - Update References
    - Update Background content
    - Change Flight Effectivity to STS-131 through STS-999
  - No change in overall risk classification: ACCEPTED RISK





**Integrated Hazard Report Changes  
 Since STS-130**

Presenter	MS3/J. Hill	
Date	03/10/10	Page 25

- **IMPS-05, Over Pressurization of the Integrated MPS H2 System**
  - Change Request S050425JY (Baseline Revision H)
    - Delete Open Work IMPS-05-OW-013 within IMPS-05-Q
      - Action to MV: Implement design controls to reduce the hazard likelihood for flow control valve (FCV) poppet failures. (This action is also captured in IMPS-01-OW-005 and should be reported to the SICB)
      - Update required to ORBI-311 prior to STS-131 (Action S050425JGR4 with 3/25/10 ECD)
    - Update references
    - Change Flight Effectivity to STS-131 through STS-999
  - Overall risk classification downgraded to previous classification (due to open work closure): **CONTROLLED**



**Integrated In-flight Anomalies(IFAs) Summary**  
**CoFR Exceptions**

Presenter	MS3/J. Hill	
Date	03/10/10	Page 26

- **STS-130-I-001 “Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)”**
  - Status – ECD 3/9/10
- **STS-130-I-002 “ET TPS Losses from the Intertank”**
  - Status – ECD 3/23/10
- **STS-130-I-003 “Ceramic Insert is Protruding from Window #2 Carrier Panel”**
  - Status – ECD 3/9/10





Pre-decisional. Internal Use Only.

Presenter **MS3/J. Hill**

Date **03/10/10** Page **27**

### Integrated Hazard Risk Matrix

Likelihood	Probable			
	Infrequent	2		12 (13)
	Remote	2	2	130 (131)
	Improbable	11	11	268
		Marginal	Critical	Catastrophic
		<b>Severity</b>		

**Risk Summary**  
 22 of 38 IHR's are classified as Controlled Risk  
 16 of 38 IHR's are classified as Accepted Risk  
 \* Previous Flight

Pre-decisional. Internal use Only.

Hazard Report #	Integrated Hazard Titles	Controlled Risk				Accepted Risk				Total				
		Controlled Risk	remote-marginal	improbable-marginal	improbable-catastrophic	Accepted Risk	probable-marginal	infrequent-marginal	remote-catastrophic					
<b>"Accepted Risk" Hazard Reports</b>														
IDBR-01	Ascent Debris Impact to SSV	7			7	29			23	6				
ICOM-01	Adverse Effects due to Intentional RF Environment	2			2	1			1					
IEME-01	Adverse Electromagnetic Effects (EME)	0			0	18			18					
IGNC-01	Ascent Trajectory Event Anomaly	13			13	1			1	1				
IMEO-01	Hazardous Environment in the Aft Compartment	0			0	4		1	3					
IMPS-01	Contamination in the Integrated MPS H2 System	0			0	1		1						
IMPS-02	Contamination in the Integrated MPS O2 System	0			0	1		1						
IMPS-03	Improper IMPS configuration during SSME Operation	11			11	3		3						
IMPS-04	Off-Nominal Purges	4			4	6		1						
IMPS-09	Hazardous Environment due to H2 External to SSV	17	1	1	19	45	1	1	42	1				
INEV-01	Exposure to Natural Environment Exceeds Capability of the Space Shuttle SSV Elements	1	1		2	1	1	1	3					
ISPR-04	SRB Hold Down Post (HDP) System Malfunction	3			3	1		1						
ISPR-05	SRB Umbilical System Malfunction	3			3	1		1						
ITHM-01	Exposure to Thermal Environment Exceed Capability of SSV	15	1	5	21	3	1	1	4					
IVLD-01	Exposure to Induced Environments Exceed Structural Capability of SSV	22			22	26			26					
ILIT-01	Adverse Effects of Lightning	0			0	6			6					
<b>Accepted Risk Distribution Totals</b>		(see next page)				147	0	2	3	130	0	0	12	0



Pre-decisional. Internal Use Only.

Presenter **MS3/J. Hill**

Date **03/10/10** Page **28**

### Integrated Hazard Risk Matrix

<b>"Controlled Risk" Hazard Reports</b>															
Hazard Report #	Integrated Hazard Titles	Controlled Risk	remote-marginal	improbable-marginal	improbable-catastrophic	Accepted Risk	probable-marginal	infrequent-marginal	remote-catastrophic	Total					
IARO-01	Aerodynamics Environment not per Specified Design	1			1	0				1					
IEPD-01	Inability to Power Critical Functions	8			3	5				13					
IFSI-01	ET/SRB System Interface Failure	6			6	0				6					
IFSI-02	ET/Orbiter System Interface Failure	10			10	0				10					
IFSI-03	SSME/Orbiter System Interface Failure	14			14	0				14					
IFSI-04	Outer Mold Line Configuration Error	3			3	0				3					
IFSW-01	Flight Software Generic Problems can cause loss of vehicle command and control	1			1	0				1					
IFSW-02	Erroneous Inputs to Flight Software can cause loss of vehicle command and control	9			9	0				9					
IMEO-02	Malfunction of Integrated Hydraulic System (Systems 1, 2 and 3)	4			4	0				4					
IMEO-03	SSME Nozzle/OMS Pod/ Body Flap Interference	2			2	0				2					
IMPS-05	Over pressurization of the Integrated MPS H2 System	7			7	0				7					
IMPS-06	Under pressurization of the Integrated MPS H2 System	7			7	0				7					
IMPS-07	Over pressurization of the Integrated MPS O2 System	7			7	0				7					
IMPS-08	Under pressurization of the Integrated MPS O2 System	7			7	0				7					
IMPS-12	Excessive O2 from ET/Orbiter/SSME External to SSV	7			7	0				7					
IMPS-15	LO2 Geyser Event during Cryo Loading	8			8	0				8					
IMPS-16	Loss of MPS He System	4			4	0				4					
IMPS-17	Inadvertent SSME Shutdown	3			3	0				3					
IPYR-01	Pyrotechnic System Malfunction	11			11	0				11					
ISPR-02	ET Vent Arm System (ETVAS) Umbilical System Malfunction	14			14	0				14					
ISPR-03	Tail Service Mast (TSM) T-0 Umbilical System Malfunction	40	5	6	29	0				75					
IVLD-02	System Instability Results In Structural Failure of SSV	13			13	0				13					
<b>Controlled Risk Distribution Totals</b>		292	2	11	11	268	147	0	2	3	130	0	0	12	0





**Integrated Hazard Risk Matrix Count  
 Decrease**

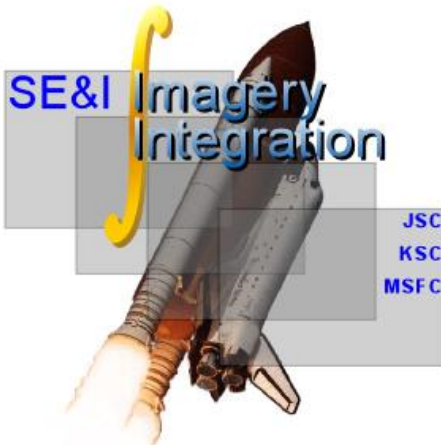
Presenter	MS3/J. Hill	
Date	03/10/10	Page 29

- Infrequent Catastrophic  
 One (IMPS-01-C - Deletion of Flow Control Valve Open Work)
- Remote Catastrophic  
 One (IMPS-05-Q - Deletion of Flow Control Valve Open Work)



**STS-131  
 SSP Flight Readiness Review**

March 10, 2010



**MS3/David Melendrez**





**Imagery Hardware**  
**Vehicle Cameras (ELVIS)**

Presenter	MS3/David Melendrez	
Date	3/10/10	Page 32

**ET LO2 Feedline Camera (ET-135)**

- Camera system installed and on schedule with nominal checkouts
- **Ready to support. No open issues.**

**Ground Network & TV**

- Nominal ISS trajectory ground station coverage
- **Ready to support. No open issues.**

**SRB Cameras (BI-142)**

- Hardware installation and closeouts on schedule with nominal checkouts
- **Ready to support. No open issues.**

**Digital ET TPS (DETTPS) Umbilical Well Still Camera**

- Camera configured for daylight settings through Apr 8
- Camera and flash functional test in VAB on 2/27 successful
- Flash memory card:
  - Camera appears to be using #2 flash memory card (#1 should be prime) - most likely due to corrupt card in slot 1
  - Loss of redundancy for availability of memory cards (only one is used)
  - Camera operating well on card 2
  - Minor procedural change for crew
- **Ready to support. No open issues.**

<b>DETTPS Camera Settings</b>
• Daylight:
• f/8, ISO 100, 1/250
• Bracketing: 0EV=f/8, +1EV= f/5.6
• Night
• f/2.8, ISO 200, 1/250
• Bracketing 0EV=f/2.8, +1EV= f/2.0

**Crew Handheld High Definition (HD) Video Camera**

- STS-130 HD downlink issue is believed to be related to a problem with ch2 on the Mux
- Mux ch2 in OV103 was used successfully on STS-128 for HD video
- Plan for STS-131 is to use ch2 with ch1 available as backup
- **Ready to support. No open issues.**



**Imagery Hardware**  
**Vehicle Cameras (non-ELVIS)**

Presenter	MS3/David Melendrez	
Date	3/10/10	Page 33

**Orbiter MiniCam**

- STS-130 performance of camera in pilot's Window 4 was very good
- Daylight exposure issues observed on STS-129 will be addressed on STS-131 and subs:
  - Use fixed shutter speed (1/1000)
  - Auto gain OFF to avoid over-exposing tank against dark sky
- STS-131 FRD includes requirement for crew downlink as time allows (currently in the Flight Plan at the end of FD2, after OBSS surveys)
- **Ready to support. No open issues.**







**Imagery Hardware**  
*Ground and Airborne*

Presenter	MS3/David Melendrez	
Date	3/10/10	Page 34

**Ground Cameras**

- Cameras configured nominally per Launch & Landing PRD
- **Ready to support.**

**Airborne Cameras**

- HYTHIRM scheduled to support BLT DTO
- **Ready to support. No open issues.**

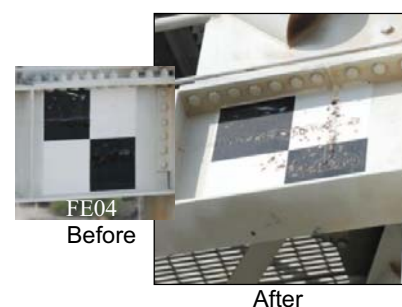
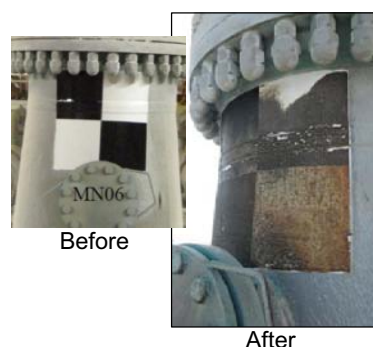
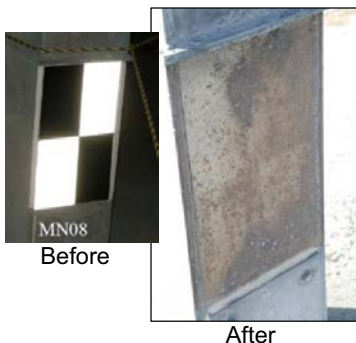


**Photo Targets**

Presenter	MS3/David Melendrez	
Date	3/10/10	Page 35

- Prior to STS-130 Launch:
  - FE01 (295' level) removed due to delamination, most likely due to installation on irregular surface
  - FE03 (235' level) and FE07 (175' level) also on irregular surfaces were inspected and both appeared nominal
- Post STS-130 Launch:
  - All FSS targets performed well except FE04 (235' level) - heating effects (see below)
  - Several MLP targets had been burned or significantly degraded (see below), as expected
  - No targets were observed liberating or contributing to liftoff debris environment
- All 19 targets (MLP and FSS combined) will be in place (repaired/replaced as necessary) for STS-131
- Study underway to compare physical performance of each target (MLP and FSS) and usefulness of targets for photogrammetric analyses
- **Ready to support. No open issues.**

(see Backup for locations of targets FE01, 03, 04, and 07)





**Lighting Predicts, April 5 – April 30**

Presenter	MS3/David Melendrez	
Date	3/10/10	Page 36

**Launch**

- Apr 5 – Apr 30: **DARK**

**ET Sep Imagery**

- Apr 5 – Apr 8: **DAYLIGHT**
- Apr 9 – Apr 30: **DARK**

**Handheld ET (post-pitcharound) Imagery**

- Apr 5 – Apr 11: **DAYLIGHT**
- Apr 12 – Apr 13: **DAYLIGHT, Non-Optimal**
- Apr 14 – Apr 30: **DARK**

**Post ET-Sep Mnvrs**

- Apr 5 – Apr 13: **Nominal +X, Nominal Pitch**
- Apr 14 – Apr 30: **Nominal +X\*\*, No Pitch**

\*\*For launch dates of Apr 14<sup>th</sup> – Apr 30<sup>th</sup> : MOD may execute modified +X (20sec) vs. the nominal (11 sec) burn

MOD, SE&I Agreements for Crew HH ET Photography

1. Pitch mnvr for handheld ET photography will not be attempted if nominal photography time is dark.
2. Pitch mnvr will not be performed "late"
3. Pitch mnvr and ET handheld photography will not be attempted on LON mission



**CoFR Products & Readiness**

Presenter	MS3/David Melendrez	
Date	3/10/10	Page 37

STS-131 Imagery Readiness Review was held with the IATs and hardware teams on 2/12/10.

Area of Responsibility	Statement	Status
Operations Integration Plan	NSTS 60540, Operations Integration Plan, Rev B approved at 06/27/06 SICB. End-to-end readiness level of hardware, procedures, tools, and facilities have been assessed to ensure Open Work and issues will be resolved prior to flight.	Ready
Engineering Image Analysis Products, Training, and Staffing	Imagery engineering analysis, and "I-Squared" SE&I personnel and tools are ready to support STS-131.	Ready
Imagery Laboratory Readiness	Imagery labs at JSC, KSC, and MSFC have the required capabilities and configurations to support anticipated and unexpected analysis.	Ready
Camera Hardware Readiness	All ground and vehicle requirements for imagery and other data collection assets have been implemented for flight and associated operational readiness has been demonstrated.	Ready





# STS-131 SSP Flight Readiness Review Radar Status

**MS/Joe Hamilton**



Pre-decisional. Internal Use Only.



Pre-decisional. Internal Use Only.

## **Debris Radar Configuration for STS-131:**

Presenter	MS/J.A. Hamilton	
Date	3/10/10	Page 39

- **STS-131 NDR Configuration:**
  - 1 MCR C-band radar
  - 2 NASA X-band radars
    - NASA #1 on SRB vessel *Liberty Star*
    - NASA #2 on *Runnymede-Class* ARMY LCU
- Operational SRB tracking, following ASTT, by both X-bd radars
- No planned changes in operations from STS-129
- The Navy NMIS radars will be at the MCR site, but powered off during the NASA radar mission.
- NDR Readiness will be reviewed on 03/12/10.





## **NDR Issues During STS-130:**

Presenter	MS/J.A. Hamilton	
Date	3/10/10	Page 40

### **NDR-C1 Radar:**

Problem: Minor noise problem prevented the use of Phase Compensation Tables (PCTs) which are intended to improve data quality (Same status since STS-125).

Resolution: unresolved.

### **NDRX-3 Radar:**

Problem: None.

### **NDRX-4 Radar:**

Problem: Radar ranging did not work while tracking SRB, post ASTT.

Resolution: Under evaluation.



## **Readiness for STS-131:**

Presenter	MS/J.A. Hamilton	
Date	3/10/10	Page 41

- **Team Readiness**
  - Complete, both ascent and analysis teams ready
- **Facility Readiness**
  - Complete
- **Radar Readiness**
  - NDR-C1 – GREEN
  - NDR-X3 - GREEN
  - NDR-X4 - GREEN

