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Back-up charts



STS-130 Standard Open Work

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Open Work	ECD
TDDP	
- TDDP-DOL (Supports DOL Products)	01/30/10
- TDDP Change Notice (RSRM L-3 day PMBT Prediction Update)	02/03/10
DOSS	
- L-3 Week Test / TCDT	01/21/10
- L-7 Day SIRB Review	02/01/10
- L-2 Verification Test (Incorporate L-8 Day TDDP & L-3 Day Change Notice)	02/04/10
GN&C	
- Update FRV Results to SIRB	02/01/10
- Normal Prelaunch Configuration & Testing	02/04/10
Loads & Dynamics	
- Final CE Weight & CG Assessment	01/21/10
- Delta L/O FMA	01/15/10
- Normal Prelaunch Configuration & Testing	02/04/10





Pre-decisional. Internal Use Only.

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Open Work	ECD
Flight Rules - Assessment of Late Flight Rule Changes	02/07/10
Software - Update NIRD CCT	L-3 Days
ELVIS - DETTPS Camera/Flash Install & Functional Check - ET LO2 Camera Open Loop MILA Comm Check - Minicam bracket installation/alignment - Cabin Stow of Crew Handheld Cameras - Minicam camera installation/verification - SRB Window Clean & Inspect - SRB Cam End-to-End Test - SRB DAS Install in Fwd Skirt* - SRB Cam Cover Removal, Windows Cleaned - Recharge of ET LO2 Camera Battery* - Cabin Stow of DETTPS Camera IVA Converter Box - ET LO2 Camera Cover Removal / Window Cleaned - SRB Cameras Cover Removal / Windows Cleaned - ET LO2 Camera Open Loop MILA Comm Check - Cabin Stow of Crew Handheld Camera Batteries	VAB Ops S0009 S0009 S0017 S0017 S0008 S0008 S5009 S0007 T1303* L-3 Days T6446† S0007 S0007 DOL



* Prior to ordnance ops, usually at L-1 week
 † Prior to RSS retract, usually at L-1 day



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Open Work	ECD
Ground Cameras - Trackers Towed to Camera Site Locations - Cameras Positioned and Rough Set - Film Loaded and Final Set	L-1 Week L-3 Days L-1 Day
MOD Flight Rules - PCN-1 to the STS-130 flight specific Flight Rules	02/01/10
FSW - Complementary Load Processing - Dump and Compare Processing	L-10 L-5
PGSC - L-14 Late Update Disk - L-14 Cable Testing	01/25/10 01/25/10





DOLILU Block Update		
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- **First flight of modifications to the DOLILU databases for both teams (MOD/Flight Design and SE&I/USA-Boeing)**
- **Changes have negligible impact to DOLILU design and are mostly clean-up items**
 - This establishes a final Shuttle baseline and sync-ups the two Day of Launch databases
 - Updates Day-of-launch (DOL) tools to incorporate Critical Math Models mods
- **Block Update 10.01 content (PRCBD S052550PH)**
 - **SSME Influence Coefficients for approved MPS budget update for STS-129 (PRCBD S084799AV)**
 - Incorporated MPS Inventory/ Influence Coefficients, Flight Derived Dispersions and Roll Maneuver Q-planes updates (negligible effect on trajectory)
 - **CMM 74: Aero Databook SSME Throttling Factor Coefficients Correction (PRCBD S052189GU)**
 - Sign and value discrepancies in some K values (negligible effect on trajectory)



DOLILU Block Update		
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- **CMM 77: Thrust Structure Deformation Model Correction (PRCBD S052189GP)**
 - The SSME 2: yaw coefficient update (negligible effect on trajectory)
- **CMM 172: Transition Aero Correction in data file containing normal force coefficients (PRCBD S052189EQ)**
 - Single data point change in transition region (negligible effect on trajectory)
- **Updated Structural Load Indicator Knockdowns due to the FMODEL6 update (PRCBD S052550PJ)**
 - Changes comes from increased number of baseline motor pairs (no change to Launch Probability)
 - Small changes to Systems Dispersion Knockdowns both positive and negative but all less than 5 percent
- **Integrated System Verification Test (ISVT) completed on 12/04/09**
 - Good comparison between databases and simulations
- **DOLILU databases are verified and ready for the STS-130 launch**





MEI Instrumentation On Orbiter and TSM

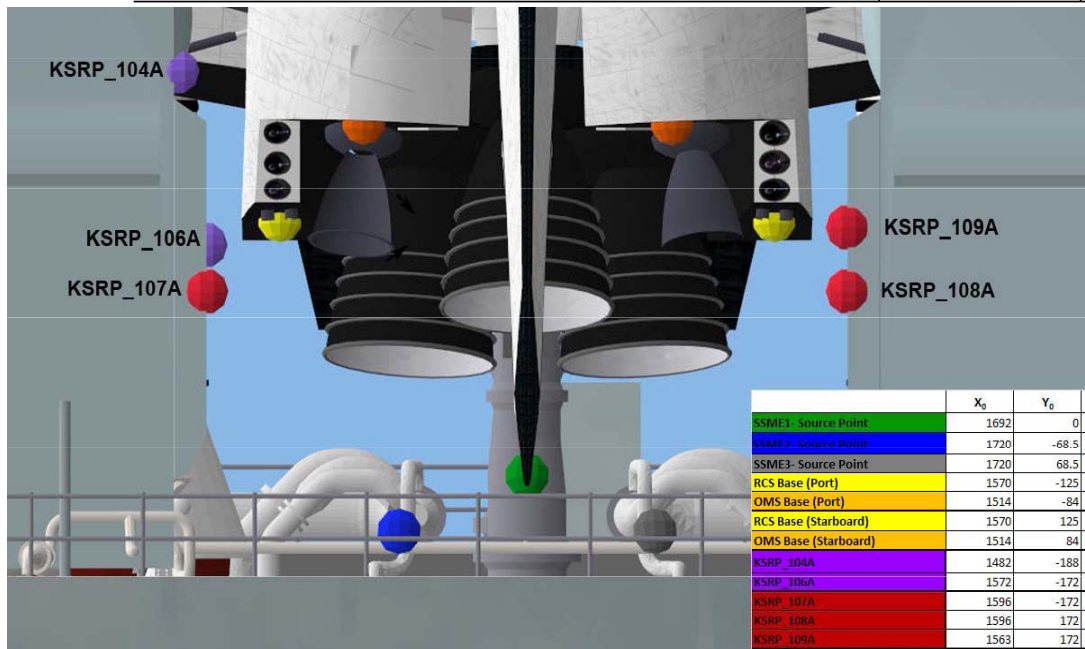
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- **STS-130 MEI TSM Ground Instrumentation Modification**
 - Configuration approved at KSC ERB on 12/04/09
 - 3 sensors on LH2 TSM
 - 2 sensors on LOX TSM
 - Same type of IOP pressure transducers as STS-129
 - Drilling and installation performed in VAB
 - Drilling and tapping of holes completed on 12/10/09
 - Cable installation completed on 12/17/09
 - Transducer installation and testing planned for 01/18/10
 - ECD NLT 01/22/10
 - Procurement of Trig-Tek Microphone Calibrator in work
 - ETA mid Feb 2010 (8 week lead time)
 - Currently borrowing Langley's calibrator until end of Feb 2010



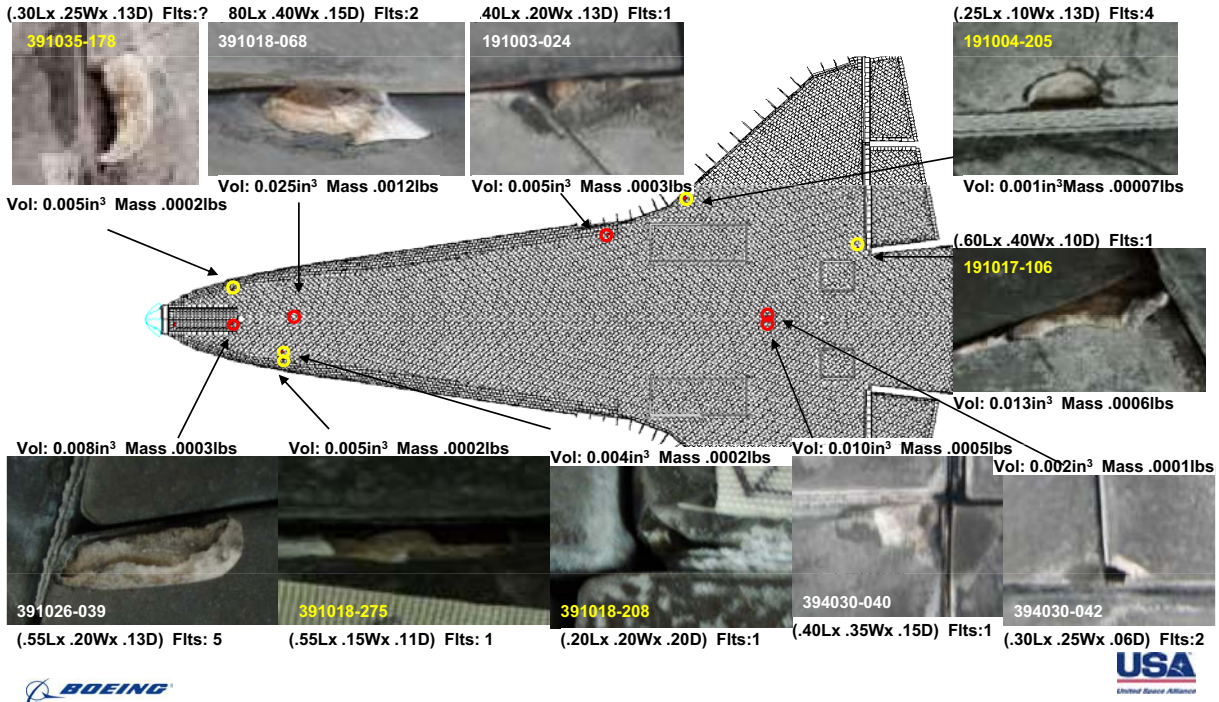
MEI Instrumentation On Orbiter and TSM (Cont'd)

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STS-129 Missing Putty Repairs		Presenter	MS/Doug Drewry
		Date	1/19/10



STS-127-I-004 ET TPS Loss at LO2 IFR 718		Presenter	MS/Doug Drewry
		Date	1/19/10

- **ET/MAF Expanded Informal NDE Process to include prioritized LO2 IFR Ramps**
 - Includes all IFR's thru 553
- **ET/MAF expanded NDE capability in Bldg 420 to include Backscatter & Terahertz techniques**
- **Primary intent behind NDE recommendation at MAF IFR TIM was to "catch" large voids that could result in very large releases during ASTT**
 - SICB approval (10/13/09) of DIG recommended 0.01 lbm as NDE screening criteria
- **Current Engineering tool NDE capability with 90/95% confidence level for detecting smaller voids is acceptable – Certification not required**
 - POD studies show high confidence (90/95) in detecting >~0.5" voids at 8" depth
- **NDE will be performed prior to ET ship**
 - Low risk of very large void/divot based on flight history
 - Predictions are Conservative - There have been no releases of predicted divots to date
 - Probability of performing a repair for predicted divot at 0.01lbm is low
- **Minimizes Impacts to ET processing or schedule deliveries**
- **Accepts risk that if repair is required that it may have to be performed at KSC**
- **NSTS 60559 Vol II updated to document NDE process for LO2 IFRs**

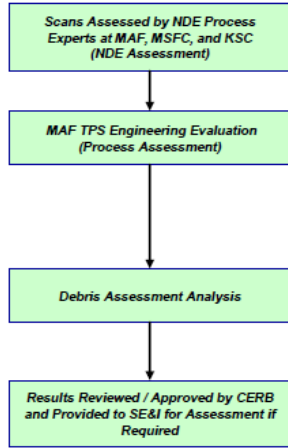




Document Process for Assessment of TPS NDE Observations

NDE Observation Assessment Approach

- Informal process developed by the ET Project and the SE&I directorate
- Implemented through the Debris Integration Group (DIG)
- Results of the assessment are reported at the appropriate milestone review in the COFR process



- POD studies show high confidence (90/95) in detecting >~0.5" voids at 8" depth
- Indications > 0.9" x 0.4" are reported and provided for assessment
- Indications with spacing <0.4" are combined as single observations
- Process assessment performed to evaluate observations against known processing characteristic, part geometry and dissection data (RTF and V&V)
- Void-type indications sized & characterized as slot or cylinder based on aspect ratio of two largest dimensions
- Sizes compared to process performance data (RTF and verification and validation dissection data)
- Relative indication depth within ramp determined based on hardware configuration and experience with dissection data (distance to free surface)
- Conservative empirically derived divot / no-divot methodology used to assess release potential
- Maximum expected divot mass determined by placing defect at critical depth for divoting within specified depth range
- Mass calculated assuming conservative shape (conical frustum) with maximum material density
- Potential divot mass >NDE Screening Mass (0.01 lbm) provided to SE&I for Risk Assessment
 - SE&I will perform DTA/PRA for the specific location and potential divot identified
 - The ET Project will identify a repair option to mitigate the risk and identify risks associated with doing the candidate repair
- Data will be presented to the SSP Manager (thru SICB, Noon Board, or PRCB as appropriate) to consider with flight history on divot predictions in deciding whether to Repair or Use as Is.

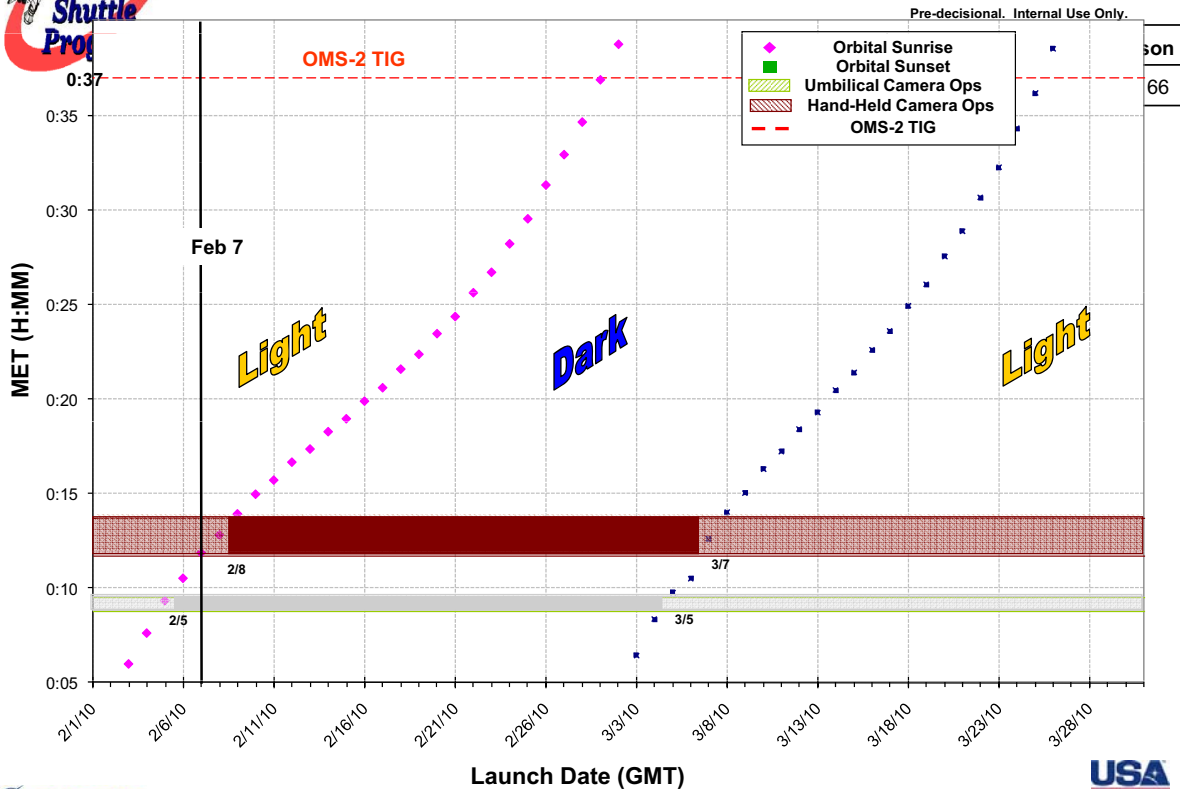
10-07-2009



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Lighting Predicts





Lighting Predicts (cont.)

Presenter	MS3/Brenda Eliason	
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Launch Date (2010 GMT)	Launch	Umbilical Ops (8:46 - 9:30 MET)	Hand-Held Ops (11:43 - 13:43 MET)	Pitch-Up Maneuver
Feb 01 - Feb 04	DARK	DAYLIGHT	DAYLIGHT	Yes
Feb 05	DARK	Partly DAYLIGHT	DAYLIGHT	
Feb 06	DARK	DARK	DAYLIGHT	
Feb 07 - Feb 08	DARK	DARK	Partly DAYLIGHT	
Feb 09 - Mar 03	DARK	DARK	DARK	No
Mar 04	DAYLIGHT	DARK	DARK	
Mar 05 - Mar 06	DAYLIGHT	DAYLIGHT	DARK	
Mar 07	DAYLIGHT	DAYLIGHT	Partly DAYLIGHT	Yes
Mar 08 - Mar 31	DAYLIGHT	DAYLIGHT	DAYLIGHT	



Integrated In Flight Anomalies (IIFAs)

Presenter	MS3/B. Eliason	
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IFA Number : Title Description	STS-130 Status and Rationale
<p>•STS-129-I-001: Unexpected Debris/Expected Debris Exceeding Mass Allowable Prior to Pad Clearance (Liftoff Debris)</p> <p>•Multiple pieces of debris were found on pad post-launch that include corrosion, liberated pad hardware, and foreign object debris or were captured in imagery observations</p>	<ul style="list-style-type: none"> • Risk Assessment indicates that given the proposed mitigations, observed debris poses no appreciable increase in risk. • 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 (e.g. MLP FIREX nozzles around the SSME Exhaust Hole; ETVAS cooling spray nozzles and plumbing; OIS electrical connector Dust Caps; and GVA hood knurled fasteners). Ongoing mitigations include FOD awareness, attrition-based hardware removal, routine inspections and monitoring for facility corrosion. <p>•Status - Dispositioned</p>





Integrated In Flight Anomalies (IIFAs)

Presenter **MS3/B. Eliason**
 Date **01/19/10** Page **69**

IFA Number : Title Description	STS-130 Status and Rationale
<p>▪STS-129-I-002: Single Transient SRB I/O Error at Liftoff</p> <p>▪During STS-129 liftoff, an SRB I/O error occurred on MDM LL2 (one of the two left SRB MDMs) via Launch Data Bus (LDB) 2.</p> <p>▪Following the single transient error, SRB I/O operated nominally through SRB Separation.</p>	<p>•From investigation, a single transient I/O error would be caused by the coincident timing of the disconnect of T-0 umbilical removing electrical power from the Data Bus Isolation Amplifier (DBIA) causing a short, less than 28 microsecond, noise burst on the LDB2. If the noise burst collides with a simultaneous transmission on the bus, an I/O error is recorded.</p> <p>•DPS system is designed to accommodate single I/O error. Nominal removal of the T-0 umbilical can generate only a single I/O error.</p> <p>•There is no effect on flight control or other flight systems, as the data is not used by the GPCs.</p> <p>•Status – Dispositioned</p>



Integrated In Flight Anomalies (IIFAs)

Presenter **MS3/B. Eliason**
 Date **01/19/10** Page **70**

IFA Number : Title Description	STS-130 Status and Rationale
<p>▪STS-129-I-003: ET TPS Losses on –Z Intertank</p> <p>▪Crew hand held camera imagery for ET-133 (STS-129) revealed eight thermal protection system (TPS) losses on the –Z side of the External Tank (ET) Intertank (IT).</p> <p>▪The timing of release was indeterminate since ascent imagery of the –Z side of the ET was limited.</p> <p>▪All of the losses were located outside of the critical debris zone and therefore did not pose a threat to the orbiter.</p>	<p>•The proximate cause appears to be low bond adhesion of the TPS due to contamination.</p> <p>•The ET-133 (STS-129) losses were similar to those on ET-131 (STS-127) in that they also appeared to correlate with the location of the Michoud Assembly Facility (MAF) platforms used to clean the IT. The correlation was particularly noticeable for both ET-131 and ET-133 on the –Z side at the Xt-1057 platform level.</p> <p>• However, in the absence of a root cause or a conclusive correlation to tank processing, the ET will need to be cleared for each flight based on the bond adhesion tests conducted.</p> <p>•Bond Adhesion tests were performed on ET-134 (STS-130) and the results give some indication that there may be no gross TPS bond adhesion issues in the high-risk areas or at the +Z Xt-1057 level.</p> <p>•Status – Dispositioned</p>





Integrated In Flight Anomalies (IIFAs)

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<u>IFA Number : Title</u> Description	STS-130 Status and Rationale
<p>▪STS-129-I-004: RH SRB Froth Pak Cracks Near GN2 Purge Line</p> <p>▪A crack in the right hand SRB Froth Pak foam near the GN2 Purge line was observed.</p> <p>▪The ascent imagery was reviewed and it appears that the foam was still intact up to 66 seconds MET.</p>	<p>•The investigation concluded that movement of a shop aid resulted in separation of the shop aid halves and allowed foam expansion into the GN2 purge probe area.</p> <p>•As a corrective action, position jacks were implemented to ensure the shop aid remains in place during foaming operations and reference marks were created to provide visual verification that the shop aid remains in place during foaming operations and assists in post-foaming inspections.</p> <p>•Additionally, Vaseline application to the shop aid seams has been implemented to mitigate foam intrusion and a tool has been designed to physically verify proper clearance between the foam and the GN2 purge probe.</p> <p>•For STS-130, the foam application with the enhanced shop aids and verifications will be performed no earlier than 1/18/10. Engineering presence is required during those foaming operations.</p> <p>•Status - Dispositioned</p>



Integrated In Flight Anomalies (IIFAs)

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<u>IFA Number : Title</u> Description	STS-130 Status and Rationale
<p>▪STS-128-I-001: LH2 PV-12 Inboard Fill and Drain valve did not indicate closed when commanded</p> <p>•On 8/26 launch attempt, during transition to reduced fast fill, LH2 inboard fill & drain valve (PV12) position indicator did not indicate closed when valve was commanded closed. Violation of LCC MPS-04</p> <p>•After ET de-tank, valve was cycled in ambient temperature conditions & closed indications were received</p> <p>•On 08/28/09 launch attempt, valve-closed indication was received</p>	<p>▪Failure investigation to date shows no evidence of a systemic issue.</p> <p>•Of all the possible failure causes, system contamination is the only integrated cause that has been identified.</p> <p>▪Root cause determination in work. However, the anomaly will be closed as unexplained with the most likely cause as contamination.</p> <p>▪Retaining the current LCC protection ensures the Fill and Drain valves are closed (in the appropriate configuration) for launch, which mitigates the hazard risks associated with this IIFA.</p> <p>•Status - Dispositioned</p>





Integrated In Flight Anomalies (IIFAs)

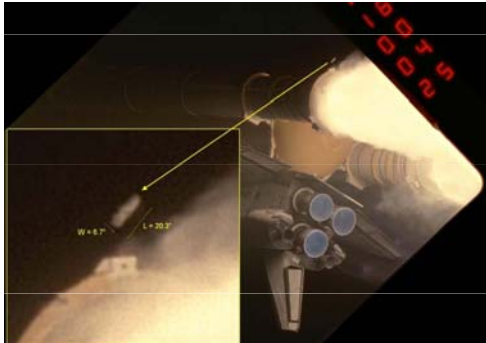
Presenter **MS3/B. Eliason**
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IFA Number : Title Description	STS-130 Status and Rationale
<p>▪STS-128-I-002: Ice External to the LH2 T-0 Umbilical</p> <ul style="list-style-type: none"> On 8/25 launch attempt, ice buildup was observed on –Z side of LH2 T-0 Umbilical, bridging over to Orbiter TPS. LCC ICE-01 waiver LW-114 approved. On 8/28 launch attempt, ice observed bridging from the T-0 plate to Orbiter. LCC ICE-01 waiver LW-116 approved. 	<ul style="list-style-type: none"> Ice/frost build-up outside peripheral seal on LH2 T-0 Umbilical seen on 3 flights since STS-126 NSTS 08303 has been updated with acceptable definition of Ice/frost buildup on Orbiter at this interface Umbilical seals inspected & verified integrity The DTA results indicate credible transport to aft locations of orbiter downstream of T-0 umbilicals Previous improvements to assist in detecting ice near umbilical or damage caused by ice liberation: <ul style="list-style-type: none"> KSC Final Inspection Team (FIT) to use telescopic camera & heightened awareness during inspections KSC IAT to expedite T-0 imagery review to reduce review time by ~1 day JSC MOD implemented on-orbit inspections of aft fuselage and OMS pod area STS-130 improvements include increased seal inspections and mitigations to reduce water intrusion Status – Dispositioned



Integrated In Flight Anomalies (IIFAs)

Presenter **MS3/B. Eliason**
 Date **01/19/10** Page **74**

IFA Number : Title Description	STS-130 Status and Rationale
<p>▪STS-128-I-005: Debris Observed Near RH SRB Aft Skirt HDP #4 Foot</p> <ul style="list-style-type: none"> Debris appears to be flexible fabric-like material, 68"x11", max of 2.29 lb Origination point not observed in videos 	<ul style="list-style-type: none"> SRB aft skirt viton coated nylon assemblies are the only credible source for this debris. Viton is an expected debris source, but this debris exceeds the 0.3 lbm allowable. Initial Debris Transport Analysis (DTA) indicates potential for Viton to impact to other elements. Added new cause, IDBR-01-AP "External Debris Impact to SSV due to SRB Viton Coated Nylon during ascent" to capture potential transport Status – Dispositioned





Integrated In Flight Anomalies (IIFAs)

Presenter **MS3/B. Eliason**
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<u>IFA Number : Title</u> Description	STS-130 Status and Rationale
<ul style="list-style-type: none"> ▪ STS-127-I-003: LH2 Leak at ET Ground Umbilical Carrier Plate (GUCP) ▪ During first two launch attempts of ET-131/STS-127, hydrogen leak detectors 23 and 25 located at the ET/GUCP interface observed leakage exceeding Launch Commit Criteria (LCC) Haz-09 limit of 40,000 ppm, resulting in launch scrubs 	<ul style="list-style-type: none"> ▪ Failure also seen on STS-119 ▪ Changes implemented as a result of STS-119 and STS-127 failures <ul style="list-style-type: none"> ▪ Consistent method of flight seal inspection developed & put into place at MAF & KSC to ensure damaged seal could not be utilized ▪ Concentricity tool & tighter tolerance guide pins were developed to aid installation of the GUCP ▪ Two design changes implemented: washers added to GUCP feet to prevent lateral movement during external loading of hardware; and a 2-piece flight seal is to be used, which has greater resiliency & provides additional capability to compensate for misalignment. Both changes will be used for remainder of flights ▪ Safety risk is mitigated through Leak Detectors 23 and 25 that monitor this interface for any hydrogen leaks ▪ Status - Dispositioned



Integrated In Flight Anomalies (IIFAs)

Presenter **MS3/B. Eliason**
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<u>IFA Number : Title</u> Description	STS-130 Status and Rationale
<ul style="list-style-type: none"> ▪ STS-127-I-004: ET TPS Loss at LO2 IFR 718 ▪ Divot seen on the LO2 Ice/Frost ramp (IFR) @ XT718 aft inboard corner. Estimated ~ 0.044 lbm ▪ TPS debris was also observed from same ramp station on STS-125 	<p>After STS-127, SE&I changed the risk classification from "Remote, Catastrophic" to "Infrequent, Catastrophic" due to uncertainties in physics modeling of release mechanisms</p> <ul style="list-style-type: none"> ▪ Based on the results of a TIM held on this topic, the following improvements were implemented <ul style="list-style-type: none"> • Increase level of NDE to include all horizontally poured LO2 IFRs • Audit design/process for improvements to reduce debris potential ▪ ET Project performed NDE for STS-130/ET-134 IFRs with acceptable results ▪ NSTS-60559, Volume II has been updated to document the ET Project's NDE process. ▪ IDBR-01 has been updated to reflect NSTS-60559 update. ▪ Status - Dispositioned





Integrated In Flight Anomalies (IIFAs)

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IFA Number : Title Description	STS-130 Status and Rationale
<ul style="list-style-type: none"> ▪STS-127-I-007: Layer of MCC-1 Missing on Aft Skirt Acreage ▪During STS-127 Post-flight assessment of SRB hardware, one incident of Marshall Convergent Coating (MCC-1) loss on LH Aft Skirt and two incidences of MCC-1 loss on RH Aft Skirt) were discovered 	<ul style="list-style-type: none"> •MCC-1 is not expected to liberate during ascent or post SRB Separation. It is classified as unexpected debris •All three liberations occurred in a recovery error overlap area, where spray application was interrupted and re-initiated. •Spray process interruptions due to mechanical problems or controlled parameter tolerance violations is most likely cause •For STS-129 through STS-131, the hardware does not have any overlap recovery areas and are not prone to the same failures as occurred on STS-127 •Status - Dispositioned



Integrated In Flight Anomalies (IIFAs)

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IFA Number : Title Description	STS-130 Status and Rationale
<ul style="list-style-type: none"> ▪STS-126-I-004: MPS GH2 Pressure Flow Control Valve open with no command ▪During 2nd stage, there was uncommanded drop in SSME #2 hydrogen outlet pressure. Data was indicative of flow control valve (FCV) #2 not fully cycling to high flow position. Valves #1 & 3 compensated, no performance impact ▪Post-flight inspection revealed an FCV hardware failure, with approximately 1/4 of the engine #2 FCV's poppet head missing. This resulted in the pressure drop seen in flight data 	<ul style="list-style-type: none"> ▪Poppet failures could cause ET venting causing a flammable atmosphere outside the ET, or poppet debris could puncture a line causing an explosive atmosphere in the aft compartment. The increase in risk due to these hazards has been documented in previous IIFA closures on this topic and accepted by the SSP ▪Improved eddy current techniques and acceptance criteria have enhanced the ability to recognize & track growth in crack indications. This reduces the risk of a poppet piece liberating in one flight ▪STS-130 poppets inspected to ensure no cracks present, using improved inspection capabilities ▪Orbiter Project presented FCV closure to the 1/07/10 PRCB and has closed the open work in IMPS-01 and IMPS-05 ▪IMPS-01 and IMPS-05 will be updated prior to STS-131 •Status - Dispositioned





STS-130 SYSTEM LEVEL WAIVERS

Presenter	USA/John Magley	
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- No changes or waivers to NSTS 07700 Vol X impacting software for STS-130
- No new software-induced waivers to NSTS 07700 Vol X

