



# **STS-130/ISS-20A MOD Flight Readiness Review**

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***JSC Mission Operations Directorate  
Flight Director Office***

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***January 7, 2010***

# Agenda



- **DA8 COFR Requirements/Endorsements**
  - COFR Requirements/Endorsements Summary
  - New Operations – A/E Topics, Shuttle, ISS, MCC
  - Safety Status Review
  - Flight Rules (Generic Volumes A, B, C, D; STS-130/20A Annex)
  - FDF/ODF/SODF
  - Mission Staffing: Training/Certification/Work Guidelines Compliance
  - Non-Critical Processors/Applications (backup)
  - Emergency Mission Control Center (EMCC)/Backup Control Center (BCC) (backup)
  - Command Procedures (backup)
  - Contingency Shuttle Crew Support/Rescue Flight: STS-130 (LON vehicle) (backup)
  - Flight Techniques & Joint Operations Panels (backup)
  - Level II Actions
- **Standard Open Work (backup)**
- **Non-Standard Open Work**
- **Exceptions**
- **Items of Interest**
- **Flight Readiness Statement**



# DA8 COFR Requirements/Endorsements



REQUIREMENT (STATION)	Flight Director	Program Integration	Ops Safety	SPAN	Team 4									
Non-Crit Processors/Applications	G						G	Ready to Support Flight/Only Standard Open work						
BCC	G				G									
Certified Flight Controllers	G			G	G									
Flight Rules	G													
ODF/SODF	G													
JOP - New Ops	G						Y	Non Standard Open work with expected resolution prior to flight.						
Flight Anomaly Resolution	G			G										
Anomaly - Procedure	G													
Exceptions/Action Items From Prior Readiness Reviews	G	G	G	G	G									
CIL/Hazards	G		Y				R	Open work without expected resolution without assistance, prior to flight, or unavoidable constraint violation.						
No Constraints	G	G												
Level II (Program) Actions	G	G												
Flight/Increment Planning (Mission Requirements)	G													
Exception/Resolution	G	G												
Command Procedures	G							N/A						
Contractor Process Insight		G												





# Ascent/Entry Topics



## Preliminary Launch Window Times for STS-130/20A

KSC Day Window Open	KSC Date	RNDZ Day	ET Photo Umbilical	ET Photo Handheld	Open (EST)	Open (GMT)	In-Plane (GMT)	FD3 Close (GMT)	FD4 Close (GMT)
Sunday	7-Feb	FD3	Dark	Light	4:34:41	9:34:41	9:39:41	9:44:41	
Monday	8-Feb	FD3/FD4	Dark	Light	4:08:59	9:08:59	9:13:59	9:18:59	9:22:13
Tuesday	9-Feb	FD3	Dark	Dark	3:46:28	8:46:28	8:51:28	8:56:28	
Wednesday	10-Feb	FD3/FD4	Dark	Dark	3:20:46	8:20:46	8:25:46	8:30:46	8:34:00
Thursday	11-Feb	FD3	Dark	Dark	2:58:15	7:58:15	8:03:15	8:08:15	
Friday	12-Feb	FD3/FD4	Dark	Dark	2:32:32	7:32:32	7:37:32	7:42:32	7:45:47
Saturday	13-Feb	FD3	Dark	Dark	2:10:01	7:10:01	7:15:01	7:20:01	
Sunday	14-Feb	FD3/FD4	Dark	Dark	1:44:19	6:44:19	6:49:19	6:54:19	6:57:34
Monday	15-Feb	FD3	Dark	Dark	1:21:48	6:21:48	6:26:48	6:31:48	
Tuesday	16-Feb	FD3/FD4	Dark	Dark	0:56:06	5:56:06	6:01:06	6:06:06	6:09:20
Wednesday	17-Feb	FD3	Dark	Dark	0:33:35	5:33:35	5:38:35	5:43:35	
Thursday	18-Feb	FD3/FD4	Dark	Dark	0:07:52	5:07:52	5:12:52	5:17:52	5:21:07

### NOTES:

- 1) Night launch through March 1st.
- 2) FD3/FD4 are days where both a FD3 and a FD4 pane may be utilized to extend the launch window.
- 3) Daylight ET Umbilical lighting occurs between March 5th - March 31st.
- 4) Daylight ET Handheld lighting occurs on Feb 7th-8th and March 7th-31st.
- 5) February 7th and 8th are "Partly Lit" because sunset occurs during the normal ET handheld photo time



**Mission Operations Directorate**  
**Flight Director Office**

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# Ascent/Entry Topics



- **Launch Window Cutouts**
  - Air Force COLA cutout methodology may begin with STS-130.
    - Launch window screened against the entire debris catalog instead of only “mannable” satellites.
    - Impacts to launch window expected to be minimal and should not result in more than ~4 cutouts where launch would be prohibited.
- **Day of Launch ET Loading**
  - Flight Rule updated for verification of ET cryo load when use of loading application (PLOAD) can not be utilized.
    - PLOAD provides the actual ET load on day of launch and when that application is not available the Flight Rule provides the protocol necessary to use prelaunch data to verify an acceptable ET load.
    - Rule is being updated to provide consistency with new Main Propulsion System (MPS) inventory changes recently adopted by the Program and to utilize flight specific ET volume versus a generic value that is currently used.
    - Changes have been reviewed by the Propulsion Systems Integration Group (PSIG) and will be further dispositioned by the System Integration Control Board (SICB) on 1/13.



# Ascent/Entry Topics



- **White Sands Space Harbor (WSSH) Data Restrictions**
  - Radar Tracking data and Weather data from WSSH are now subjected to a new Air Force Information Assurance policy.
    - Data would now be treated as classified.
  - Network Director is aware of the issue and DM and SMG personnel are working this in support of a resolution by STS-130.
    - Radar data issue thought to be resolved but waiting on official Air Force notification.
      - Required per Flight Rules.
    - Weather data impacts include NASA wind towers and surface observation stations around the runway complex.
      - SMG personnel working with NASA WSSH liaison and WSSH meteorological personnel for workarounds,
        - » May have to utilize a RF communication path to obtain tower data.
        - » May have to rely on manual observer for runway wind data.
      - Weather balloon, manual surface observations, and automated surface observations would not be affected.
    - End-to-end test of weather assets including balloon data transmission will be conducted prior to STS-130.



# Ascent/Entry Topics



- **Non Universal I/O Error Update**
  - Flight Rule updated to reflect new protocol for a single non universal I/O error on a flight critical bus.
    - MDM will be turned off or the “string” deassigned after two occurrences.
    - Current Flight Rule covers non universal I/O errors that have bypassed the MDM.
  - Rule change driven from STS-124 prelaunch flow anomaly with a non universal MDM errors resulting in a GPC set split.
- **Edwards Temp Runway**
  - Permanent runway concrete work to begin in mid January which will drive the need for the Temporary Runway for an EDW landing if required.
  - Flight Rules, procedures, and Crew/MCC training have been conducted with use of the Temp Runway.
  - Navigational aids are in place on the Temp Runway.





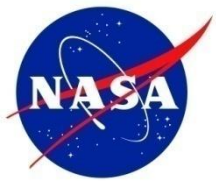
# New Operations: Shuttle EPS Consumables Analysis



- **STS-130 is flying on OV-105 *Endeavour*, which is a SSPTS vehicle**
- **MOD EGIL Team modified consumables analysis method**
  - Previous method used Boeing-provided formulae of Fuel Cell Current vs Voltage to predict power performance w/ SSPTS
  - Previous method caused several “over predictions” of power consumption and subsequently large margins which could have been used for on-orbit task capability or cryo offload for upmass
  - Previous method also caused some “under predictions” of power consumption and some real-time margin loss
  - New analysis method presented to Orbiter Flight Management Office (MO) and approved by Generic JOP / Orbit Flight Techniques Panel for STS-130
- **Using new analysis method, cryo off-load set at 645 lbm, 96 hours pad hold**
  - No unusual orbiter power downs planned
  - Standard Group B Power Down for on-orbit free flight and post docking.







# New Operations: Shuttle EPS Consumables Analysis (cont)



## • Previous method of Margin Prediction

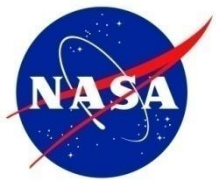
- Boeing delivers FC performance curves that characterize Voltage vs Current for each Fuel Cell.
- Performance curves are a formula of the form  $V = f(I)$  where  $I$  = current.
- Formulas derived using a regression model to fit data points of Voltage and Current from Acceptance Testing and from Flight Data
- FC power levels for cryo loading are predicted using the performance curves
- Typical Fuel Cell Performance Curves:

FCP 1 (S/N 109)	$V = 32.62 - 1.243E-02*(I) + 8.959E-06*(I)^2 - 2.02E-09*(I)^3$
FCP 2 (S/N 107)	$V = 32.54 - 1.303E-02*(I) + 9.572E-06*(I)^2 - 2.67E-09*(I)^3$
FCP 3 (S/N 115)	$V = 32.88 - 1.264E-02*(I) + 8.989E-06*(I)^2 - 2.61E-09*(I)^3$

## • Problems with the previous method

- Prior to STS-119 / ISS-15A (S6 Truss), ISS power for SSPTS allowed FC's to be at the minimum power level (Min KW) intermittently.
- Since installation of S6, more ISS power is available and FC's are at Min KW much of the time.
- Data points on fuel cell behavior relative to Voltage vs Current are limited, thus the FC performance curves do not describe FC behavior power performance well in this regime





# New Operations: Shuttle EPS Consumables Analysis (cont)



- **New Method of Fuel Cell Performance Prediction**
  - Use observed Min KW performance for that fuel cell on previous flight to target baseline Min KW prediction
  - Degredation in FC performance vs Run-time hours is predictable. Scale past Min KW performance with runtime to develop next flight Min KW prediction
  - Run cryo margin analysis using new prediction
  - Although there is possibility of margin loss using new method (under predicting Min KW), new method is still conservative
  - Risk of margin loss with new method greater for flights with multiple launch attempts / slips and, thus, multiple starts / stops on FC's and greater pre-launch runtime
- **Comparison of New & Old Method for STS-130**
  - Boeing Fuel Cell Curves for FC 1 predict a Min KW level 500 W lower than what was observed on previous Flight of this Fuel Cell.
  - For analysis, using previous Flight Data for FC 1 to set Min KW in analysis reduces risk of real-time margin loss.
  - For Fuel Cells 2, 3 the Boeing FC Curves predict a Min KW level within 50 watts of previously observed performance. No adjustment necessary.
  - Using new method mitigated risk of a ~65 lbm real-time margin loss (~10%).
  - Cryo offload set at 645 lbm with high confidence.



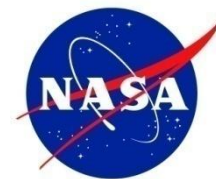
# Shuttle Items of Interest: Orbiter CO2 Management



- **Shuttle LiOH change-out requirements for elevated PPCO2**
  - Modified flight rule 20A\_C2-80 for STS-130/20A
  - PPCO2 will be maintained  $\leq 5.0$  mmHG in the shuttle
  - If level cannot be maintained, additional LiOH changeouts will be scheduled as required
  - An additional (3<sup>rd</sup>) LiOH can changeout is scheduled for the docked day where the 23 ft IMV duct is disconnected and re-routed to Node-3 to support Node-3 outfitting
  - No long term elevated PPCO2 issues are expected based on preflight predicts and planned crew size (total of 11 crew on Shuttle/ISS)
  - Shuttle will use 2 cans from the ISS Contingency Reserve during the mission leaving ISS with their minimum requirement of 20 at the end of the mission (assuming 13 day mission).



# Shuttle Items of Interest: Ascent Performance Margin



- **With emphasis on upmass, APM is near historic low:**
  - Record low APM during ISS assembly was STS-117 / ISS-13A: 1346 lbm absolute in-plane
  - As of 12/30/09, STS-130 / ISS-20A APM is as follows for a Rndz Alt of 185 nmi:
    - 193 lbm IPT Margin at the open of a 5 minute window (Baseline)
      - Equates to 1493 lbm; absolute in-plane launch
      - 193 lbm IPT + 700 lbm DOL + 600 lbm gain for in plane launch with 5-minute window.
  - Current APM is low and there are still outstanding threats
    - Orbiter weight & Node-3 weight still outstanding. Could come in heavier than predicts used in FRR Flight Design Cycle.
    - Late stowage, OMS/RCS propellant loading, colder than predicted SRB propellant temperature, and February winds can further decrease APM.
  - If Orbiter & Node-3 weight reduces APM below 1400 lbs absolute, we will recommend demanifesting cargo to preserve margin.
    - Will present pros/cons to both Programs to enable best risk trade if this scenario exists.



# New Operations: ISS



- **Installation and activation of Node 3**
  - EVA 1 on FD 5 Node 3 installed on Node 1 port, 2 LTA cables connected
    - One cable (J612) is borrowed from Joint A/L
    - Contingency jumper to provide key functionality in the A/L
  - EVA 2 on FD 7 integrates 1<sup>st</sup> channel of Node 3 cooling system into Loop A ETCS
    - Node 3 module is activated by the ground
  - EVA 3 on FD 9 integrates 2<sup>nd</sup> channel of Node 3 cooling system into Loop B ETCS
    - J612 LTA cable disconnected (J602 connected to S0 remains connected as contingency, not used for anything else)
    - Photogrammetry of ammonia lines for PMM clearance (requirements TBD)



# New Operations: ISS



- **Early Ingress**

- Node 3 berthed to ISS on FD 5
- Node 3 systems activated during EVA 2 on FD 7
- Crew will ingress module on FD 6 & 7
  - Use 23' extension duct (nominally routed through Node 2 into orbiter vestibule) during crew day
  - Time will be used to prepare Cupola for relocation and begin get ahead tasks in module (move in ARED and ARS racks, IMV installation)
  - LiOH plan calls for additional LiOH can changeout FD 6 & 7 but not expected to be needed



# New Operations: ISS



- **Cupola relocation and outfitting**
  - Relocated from Node 3 port to Node 3 nadir on FD 8
  - MLI and launch locks removed during EVA 3 on FD 10
  - Shutter checkout during EVA 3
  - Outfitting
    - Integrate cooling system into Node 3 ITCS and activation of heaters (required for MLI removal)
    - Closeout panel install
    - ATU install
    - RWS relocation and installation
  - A fine leak is performed FN 8 so equipment can be moved in on FD 9



# New Operations: ISS

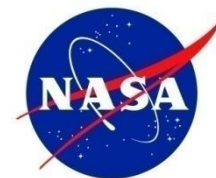


- **PMA3 relocation**

- Pre flight, moved from Node 1 port to Node 2 zenith ( ECD 1/23)
- Analysis on clearance between TRRJ and PMA3 reflector expected 1/8
- Photogrammetry performed on FD 6 using cupola on Node 3 as reference to clear PMA 3
  - Relocation will not be performed without extremely high confidence of clearance
- Relocated from Node 2 zenith to Node 3 port on FD 9
- Confirmation photogrammetry performed on FN9
  - If photogrammetry shows negative clearance, PMA3 will be relocated back to Node 2 zenith
  - Complete analysis and procedures not developed for this case – will be handled real-time
- Heater cables connected during EVA 3 on FD 10
- Repress preferred before orbiter undock to save ISS consumables, but will not be ingressed during the mission
  - Currently does not fit in timeline due to thermal constraints (24<sup>h</sup> thermal hold) prior to repress after relocation – under review







# ISS: Items of Interest



- **Ammonia lines**

- Original design and CDR held Oct 2008 (CR 10560) to support Node 3 relocation and clocking of 90°
- During qual testing in July two lines suffered major failure
- NBL runs fall 2009 indicated routing interference with PMA3 FRGF and PMM
- Redesign initiated
  - New routing with gap spanners pulling lines away from Node 1 nadir
  - Elbows with 90° bend
  - Modification of MLI
- Still concerns with interference with PMA3 even with new routing
  - Decision made to temp stow PMA3 on Node 2 zenith to avoid any risk of interference (CR 12010)
- Third hose (new design) leaked during proof testing of the new lines mid November
- Independent Chief Engineer Review of new design held 12/4
- One line damaged in shipping incident 12/9
- Results of leak indicated concern with welding process received 12/10



# ISS: Items of Interest

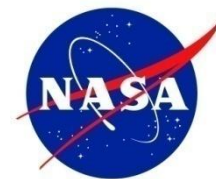


- **Ammonia Lines (continued)**

- Four new lines using methods previously used for ISS assembly begun 12/11
  - New design Hoses have a butt weld in the center with a rigid center of ~10 inches; eliminates the braze feature
- Delta CDR held 12/18
- No significant changes to routing or MLI from previous version
  - Final NBL run 1/12
- Qual unit failure 12/27 – cause under investigation
- Future work:
  - Delivery to Huntsville 1/8
  - Final assembly 1/25
  - Fit check with crew ~1/25
  - Delivery to KSC ~ 1/31
  - Photogrammetry TBD to verify clearance with PMM. No ECD. If requires more than basic EVA crew photography, will be picked up by subsequent flight
  - Lines do not support 120°F shutdown requirement. KAAN cuffs to be installed > 20A (NLT June 23 due to  $\beta$ )



# ISS: Items of Interest



- **Longeron Shadowing**

- On 12/2 in preparation for 19S undock BGA 2A experienced a latch/unlatch failure where the arrays could not be unlatched and returned to autotrack
- To prevent Longeron Shadowing (LS) port SARJ was preemptively parked
- Subsequent, chit 8097 updates flight rule B2-34
  - If receive LS caution and in config per array plan – no action
  - If receive LS caution and not in config per array plan – position SARJ
    - Thrusters are prohibited (desats are ok)
    - Dockings/undockings, module berthings/deberthings, EVA prohibited
- If receive BGA Loss of Comm
  - Act as if received caution and arrays are not per the plan
- Details on cases where thrusters are inhibited being worked with MER, ViPER
  - ECD by SORR
- Forward work:
  - Operations will be out of a 20A specific chit (ECD SORR)
  - Power (ECD 1/23) and GNC analysis (ECD TBD) with new constraints still being worked





# ISS: Items of Interest



- **WHC/WCS Plan**

- 20A is taking up DA and installing on FD 4
  - SPRTs still discussing additional hardware and repair options (e.g., external WRS filter)
  - Impact to 20A is TBD and will need to be evaluated
    - Concern with OSO load with additional procedures – would mean deletion of other tasks
    - Timeline impacts TBD
- Anticipate restriction on use to 3 USOS crew members for foreseeable future
- Shuttle crew will generate ~ 83 lbs (~ 1 CWC) of urine above stowage tank limit



# ISS: Items of Interest



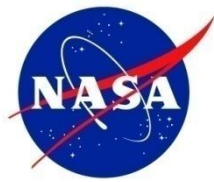
## • WHC/WCS Plan (cont)

- CWC plan still in development. Three different positions on issue:
  - MOD position:
    - Use 1 (or 2) manifested old style “contingency” CWC for shuttle crew urine.
    - Sufficient odor containment expected but not “guaranteed” by engineering.
    - Use 1 on-orbit ISS condensate CWC for STS condensate. Transfer back to ISS.
    - Dump STS urine CWC post undock
  - SSP position:
    - Use new style CWC certified for STS urine containment.
    - Since constraints are ISSP driven, SSP requests ISSP provide 2 new style CWCs (MIP CR)
    - Note: all new style CWCs are on ISS (i.e., no more to manifest)
    - Do not use manifested “contingency” CWC’s in either case because urine collection ops are known and planned
    - If new style ISS CWC’s unavailable, manifest additional old CWC’s for urine
  - ISSP position:
    - Can use either old/new style CWCs for STS urine and condensate but prefers using old style to preserve ISS resource
    - ISS Launch Package does not want additional CWC’s (old or new) to be manifested on STS for urine if not necessary so that ISS preserves remaining STS upmass for ISS H/W needs
    - Acceptable to use new style allocated on ULF-3
- MIP CR will drive discussion and disposition at JMICB (date TBD)

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**Flight Director Office**



# ISS & Shuttle: Items of Interest



- **MCC LAN Switch failure GMT 005 during STS-130/20A Docking Sim**
  - RFCR lost cmd & tlm, BMPSR unaffected
  - WFCR lost timing services and some apps
  - Approx 1 hour for recovery
  - AR 91199
  - Cause linked to IOS software upgrade – backed out from all switches (had not yet been installed on FCR-1).
- **The ISS UHF radio frequency (RF) signal path will be modified by the addition of COTS UHF Communications Unit (CUCU) RF Coupler Assembly between UHF external antennas (P1 & Lab) and the UHF transceivers**
  - Test to be performed after installation to verify UHF functionality
  - Reduced signal strength is expected with the expected establishment of the “Big Loop” reduced from 10k to ~6k.



# Ops Safety Issues



- **Node 3 Ammonia jumpers**

- The existing jumpers had brazing failures during qualification testing and damage during transportation
- ISS Program is rebuilding all of the hoses using a less risky manufacturing process. HR ISS-TCS-0040 is held open to this subject is resolved. (ECD for delivery to KSC for late load is Feb 2).

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- **Node 3 TCS hazard analysis is very late**

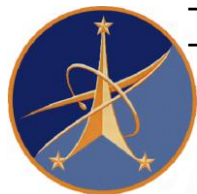
- Concern that new constraints might be identified for startup or shutdown
  - **Greatest risk is associated with HR ISS-TCS-0062 (ECD Jan 11)**
    - HR author believes that new operations constraints are unlikely, but cannot be ruled out until safety assessment is complete
    - The assessment updates are more focused on shutdown rather than startup
  - Lower risk is associated with updates to HR ISS-WRM-139, TCS-1204, TCS-1211 and TCS-0091 (ECD mid Jan)



# OPEN NASA OCADs



- **OSO (14)**
  - Install Hyzod covers
  - Install caps on N3 vents
  - Maint: drain water/turn on heater from Hx when MMOD/MLI covers removed
  - UMS Leak response
  - CBCS touch temp constraints
  - Rack/ORU translation constraints
  - CWD cleanliness constraints
  - RWS U-hook mating interface is IVA no touch area
  - WBCS battery removal after use
- **EVA (4)**
  - EHIP light touch temp constraints
  - Dual lever end effector cannot be used as a tether
  - PWR handling constraints
  - TBA/DLA bagging constraints
- **Crew Systems (2)**
  - TESS HL constraints
- **BME (1)**
  - When supplying supplemental O2 use PFA
- **ECLSS (2)**
  - WBCS MCV Tox 1 containment constraints
  - CWC-I filling constraints
- **PHALCON (1)**
  - Mate/demate constraints
- **PDRS (1)**
  - Adequate camera views for RMS ops



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# Non-Standard Open Work: Safety



- **Mate/Demate (HR Updates in work) (ECD Early Jan)**
- **Resolution of Operations constraints from late TCS Hazard Reports**
  - Plan is to perform safety review Jan 11<sup>th</sup>
  - Any new Ops constraints will be assessed on a case by case basis
    - If not consistent with existing ops and training then worst case effect would be a potential schedule slip to accommodate retraining the crew
    - Program-level coordination/status will continue to occur via both operations and safety channels



# Non-Standard Open Work: Shuttle and ISS



## Shuttle

- White Sands Space Harbor (WSSH) new restriction on data flow for radar tracking and weather data are being worked by the Network Director, Program, DM, and SMG personnel.
  - Estimated resolution for radar tracking is likely this week with official notification by 1/15.
  - Estimated resolution on weather data is 1/15. Workaround will be pursued in parallel to the waiver on data transfer restrictions.

## ISS

- PMA-3 Relocation CBM (two) procedures still in work
  - Requirement was a late add to the mission
- Mission Configuration Test (MCT)
  - Scheduled 1/8 (part 1 completed 1/6 – results TBD)
- Longeron shadowing with new constrains - ECD SORR
- CWC plan - ECD 1/18





# Flight Rules



- **All required generic volume A, B, C, and D flight rules have been developed, reviewed, and approved by the appropriate Flight Techniques Panels, Joint Operations Panels, and the Flight Rules Control Board**
- **The following generic publications are applicable for STS-130/ISS-20A**
  - Volume A (STS), Final, PCN-10 dated 5/21/09
  - Volume B (ISS), Final, PCN-19 dated 12/08/09
  - Volume C (Joint), Final, PCN-5 dated 5/18/09
  - Volume D (Soyuz/Progress), Final, PCN-6, dated 5/4/09
- **STS-130/ISS-20A flight rules annex**
  - Final, approved at JPRCB on 12/4/09
  - PCN-1, planned for JPRCB review on 2/1/10
    - Currently tracking ~26 open flight rule CRs
    - Anticipate ~10 R/T CRs (or PCN-2) prior to launch due to late analysis





# FDF/ODF/SODF



- **DA8 has participated in FDF/ODF/SODF processes and procedure reviews as required**
- **FDF/ODF will be ready to support STS-130/ISS-20A**
- **New US procedures are primarily for:**
  - Robotics (Node 3 install, cupola relocation, PMA3 relocation)
  - ECLSS (transfer of regen racks to Node 3)
  - S&M (module berthings, outfitting of Node 3 and cupola)
  - C&DH, TCS (new Node 3 and cupola systems)



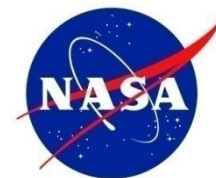
# Flight Director Mission Staffing



- All STS-130/ISS-20A Flight Directors are certified per Flight Director Certification Guide (DA8-00010), Final, dated May 22, 2009
- Additional certified Flight Directors are available to support Team 4, EMCC, and STS-130/LON flight, as required
- MOD Work Guidelines are met
- Flight-specific certifications are expected to be complete by Jan 25, 2010

Shuttle Flight Directors		ISS Flight Directors	
Kwatsi Alibaruho	Lead/Orbit 1	Royce Renfrew	Orbit 1
Gary Horlacher	Orbit 2	Robert Dempsey	Lead/Orbit 2
Chris Edelen	Planning	Michael Lammers	Orbit 3
Norm Knight	Ascent/Entry	Dana Weigel	Team 4





# Level II Actions



- **Two Level II actions are open from STS-128/17A and STS-129/ULF-3:**
  - S070048C: Review Reaction Control System (RCS) Thruster Flight Rules And Procedures Relative To Failed Thruster And Leak Scenarios
    - Community revisited generic Flight Rules A6-60 RCS MANIFOLD CLOSURE CRITERIA, A6-61 RCS MANIFOLD/OMS CROSSFEED LINE REPRESSURIZATION, and A6-158 RCS LEAKING JET MANAGEMENT:
      - Updates to all three rules are complete and will be in place for STS-130 and subs
        - final rationale words awaiting completion of post flight analysis of STS-128 thruster/manifold hardware
  - S070066: Evaluate Flight Rule C2-112 Requirement For Rbar Pitch Maneuver (RPM) And Determine If Any Updates To the Risk Trades Are Required
    - RPM risk trades and current flight rules were revalidated by OFTP (no change required)
      - PRCB direction to accept risk of RPM with one FxD jet failed per side
        - Rule update in work and will be in place for STS-130 (Annex PCN-2) and subs
        - Assumes SSPCB approval which is expected later this month
    - Generic docked orbiter TPS inspection procedures required an update to reflect the current ISS configuration (current published procedure assumes pre-STS-124 config)
      - Updated procedure is in work and will be available for STS-130 and subs



# Exceptions



- **None**



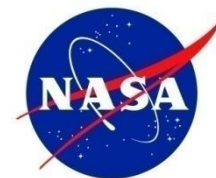
# Flight Readiness Statement



- **Pending completion of all standard and non-standard open work, the Flight Director Office and Space Flight Meteorology Group are ready to support the STS-130/ISS-20A mission and ISS-20A stage**
- **All standard/non-standard open work will be closed out or have a closure plan prior to SSP FRR (1/20/10) with no exceptions**
- **ISSP SORR will be conducted on 1/14/10; closeout for non-standard open work will be reported to ISSP prior to SOMD Level 1 FRR (1/27/10)**







# BACKUP



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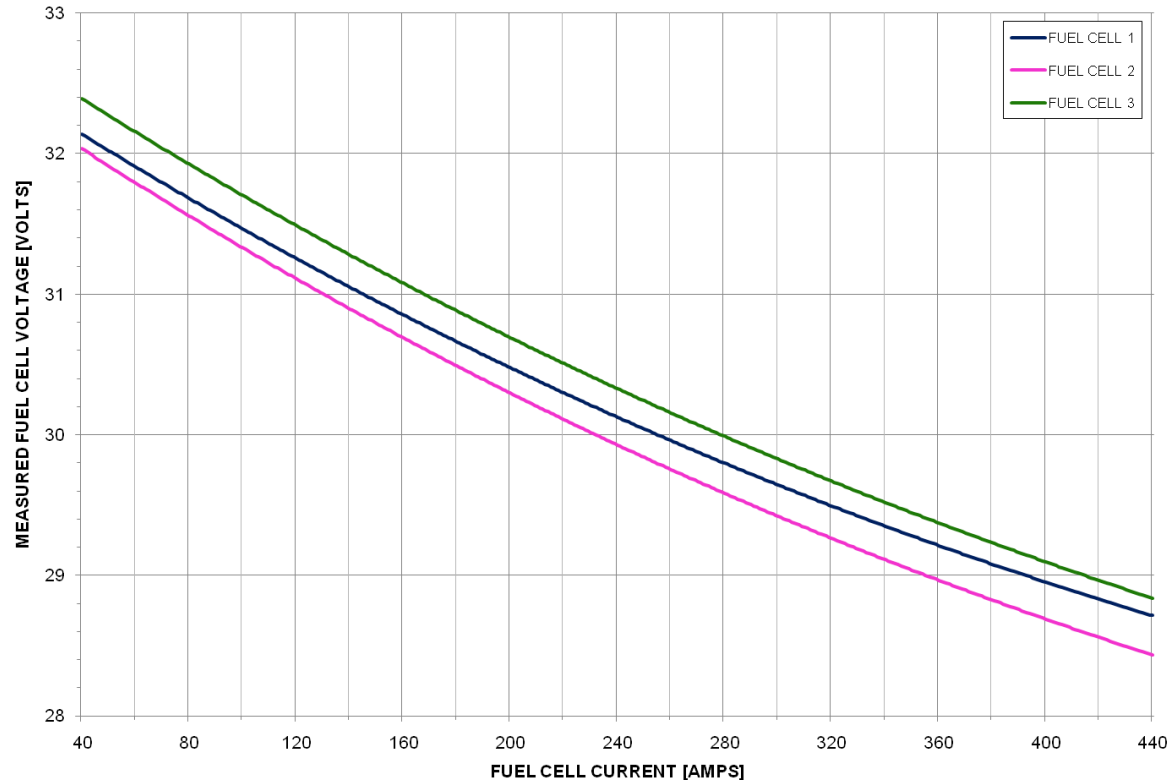
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# FC Performance Curves



OV-103 / STS-128  
Predicted Fuel Cell Performance

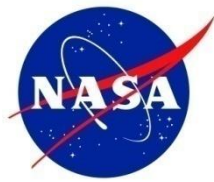


FCP 1 (S/N 109)	$V = 32.62 - 1.243E-02*(I) + 8.959E-06*(I)^2 - 2.02E-09*(I)^3$
FCP 2 (S/N 107)	$V = 32.54 - 1.303E-02*(I) + 9.572E-06*(I)^2 - 2.67E-09*(I)^3$
FCP 3 (S/N 115)	$V = 32.88 - 1.264E-02*(I) + 8.989E-06*(I)^2 - 2.61E-09*(I)^3$

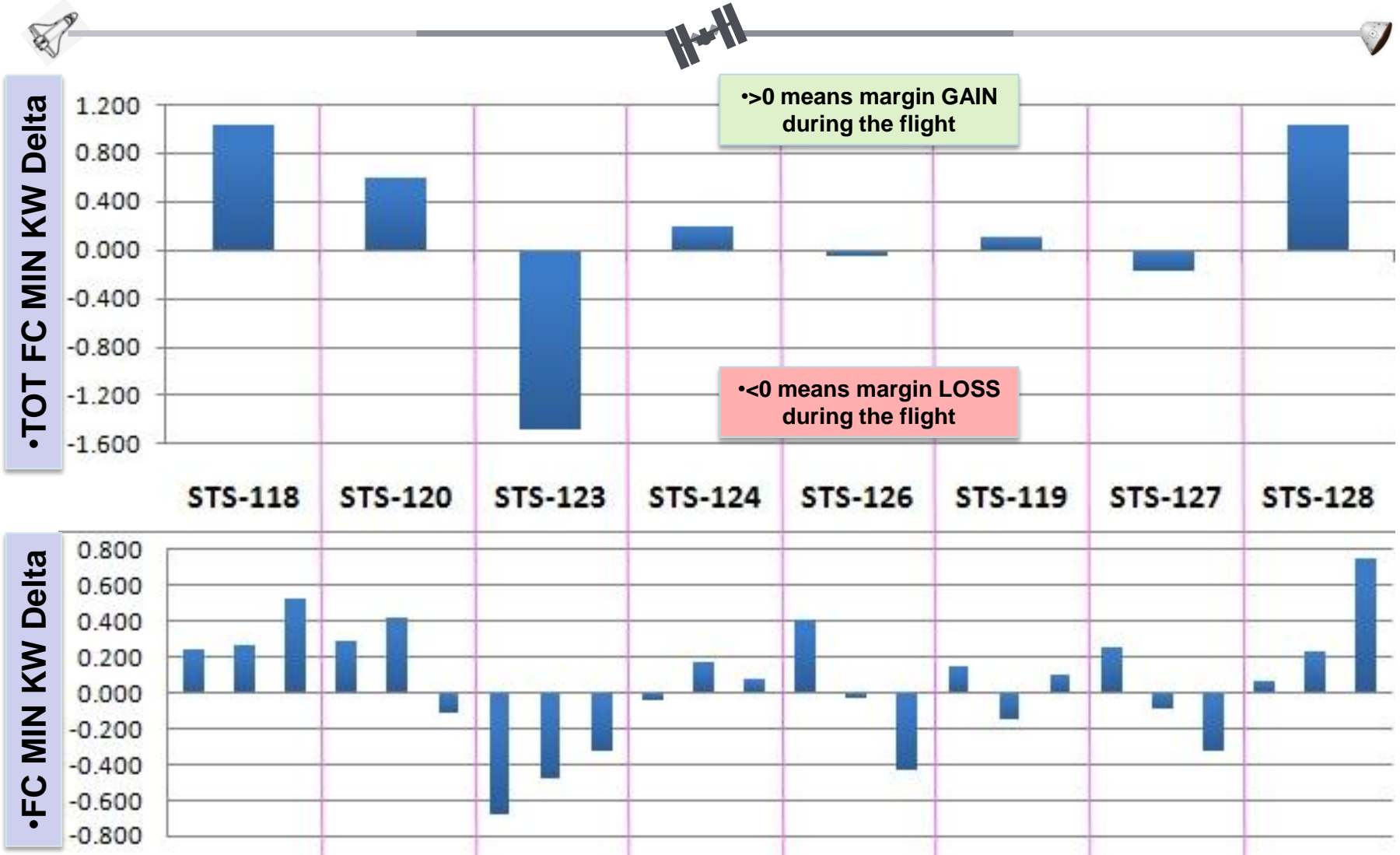
- **FC Curves illustrate the relationship between voltage (V) and current (I)**
  - Power = V \* I
- **Not all FCs are equal**
  - Performance varies from FC to FC and decreases from flight to flight



# FC MIN Delta on Flights to Date



•Difference between FC MIN Prediction and Actual (kW)



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# Comparison with Past Flights



•Difference between FC MIN Prediction and Actual (kW)

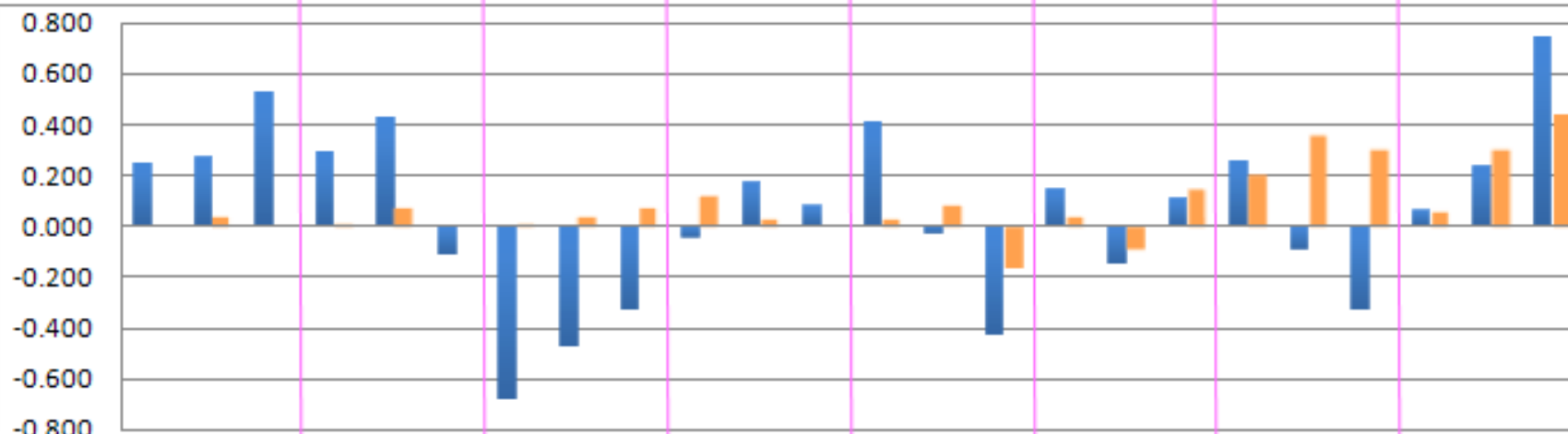
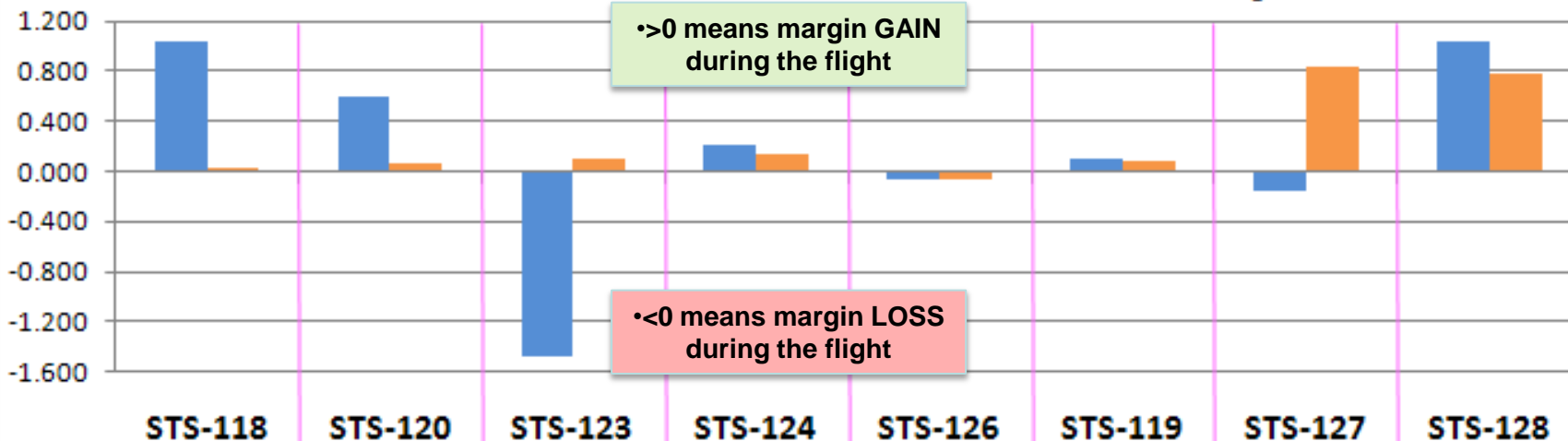
•TOT FC MIN KW Delta

•FC MIN KW Delta

■ Old Method with Verbatim FCs  
■ New Method Using Historical FC MIN KW

•>0 means margin GAIN during the flight

•<0 means margin LOSS during the flight



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# Next SSPTS Flight: STS-130



- **Evaluation of official FC Curves for STS-130**

- FC1 MIN KW is 500 W lower than where best available data predicts it will be
  - Change to FC MIN KW is needed to reduce risk of margin loss during the flight
- FC2 and 3 are within 50 W of best available data
  - No change needed

- **500 W underprediction could result in ~65 lbm O2 negative impact to the flight**

- ***Note: STS-130 FRR Products used the best available data for FC MIN KW prediction and are not underpredicted***

	Using FC Curves Verbatim	New Method using Historical FC MIN KW data
FC1 MIN KW	1.600	2.100
FC2 MIN KW	2.469	2.469
FC3 MIN KW	2.149	2.149
TOTAL FC MIN KW	6.218	6.718



# Spaceflight Meteorology Group



- All forecasters required to support STS-130 meet requirements listed in SMG Training & Certification plan.
- White Sands weather data issues
  - Due to new DoD security policy, wind tower data now considered classified.
  - SMG working to restore access to this data.
- System Changes:
  - **AWIPS:**
    - Build 9.2 first week of Jan 2010: no significant impacts, bug fixes only.
  - **MIDS:**
    - Configuration change to accommodate EDW wind towers moving back to temporary runway locations.
    - Update to Meteosat (European) satellite ingestor software to address intermittent missing images.

The undersigned certifies that the Spaceflight Meteorology Group is ready to support the STS-130 flight.

/s/ Frank C. Brody

Frank C. Brody

Chief, Spaceflight Meteorology Group

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# Weather Systems Status



System	Explanation	Risk	Impact
AWIPS Build 9.2	Routine software update to AWIPS. Completed by SMG - first week of January 2010.	Low	Minor bug fixes.
MIDDS	Configuration change to accommodate EDW wind towers moving back to temporary runway locations. Implemented by FDOC with JET.	None	EDW tower data will be decoded and stored in MIDDS with new latitude and longitude values.
MIDDS	Update to Meteosat (European) satellite ingestor software. Implemented by FDOC with JET.	Low	Potential fix to intermittent missing images.
Model Cluster (CF1)	FDOC updated operating system on cluster prior to STS-129. SMG installed WRF-EMS Version 3.0 weather model and Point Forecast Software prior to STS-129. Only TAL WRF model runs were available for STS-129.	Low	TAL, KSC, and EDW WRF model runs should be available for STS-130. Data may not be in AWIPS due to bandwidth issues between MIDDS and AWIPS.



# White Sands Data Issues

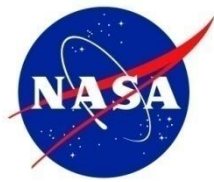


- On December 9 SMG was notified that due to WSMR Information Assurance policy that all data on the WSMR Test Support Network (TSN) was now “classified” data and would no longer be sent to external customers.
- WSMR Met Branch stopped all data transmission received from the TSN at the Met Branch building.
- There are negative impacts (see next slide) upon meteorological observations received at JSC/SMG for Space Shuttle AOA, PLS and EOM landing support.





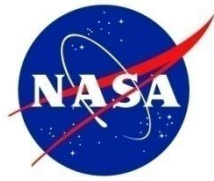
# SMG Data Impacts/ White Sands Landing Posture



- **Worst case scenario – data not restored**
  - **Data we HAVE**
    - Weather balloon and manual surface observations.
      - Balloon data used by entry trajectory and weather.
      - Manual surface observation for weather GO vs NOGO observed conditions.
    - Automated surface observations.
      - Reports ceiling, visibility, winds, weather, T, TD, altimeter.
      - Does not always report peak winds.
  - **Data we do NOT have**
    - 3 NASA funded towers at WSSH
      - Data is communicated via the TSN.
      - Tower at approach end of the runway typically used as surface wind for approach and landing.
    - Majority of WSMR Surface Automated Mesoscale Station (SAMS).
      - SAMS stations are scattered throughout the test range and provide valuable input to forecasts and analyses.
      - Tower 4 located near the intersection of WSSH RWY22 and RWY17.



# Mitigation



- **SMG provided WSMR liaison to NASA with list of PRD items no longer being met.**
- **SMG working with WSMR Met Branch and other WSMR personnel for possible workarounds.**
  - NASA towers at WSSH may revert to less reliable RF communication path between WSSH and WSMR Met Branch.
- **End-to-end test of balloon data transmission is recommended prior to STS-130.**



# EMCC/BCC



- **No changes to EMCC procedures since STS-128/17A**
  - Personnel are identified to support EMCC, if required
- **Backup Control Center (BCC)**
  - BCC-HOSC is prime for BCC/BAT.
  - Facilities and personnel are ready to support.
  - Checkout occurred and included all Partner Control Centers.
    - June 1, 2009 included HOSC, POIC, JAXA, ESA.
    - July 8, 2009 included MCC-M.
    - BCC updates now provide cmd/tlm connectivity to MCC-M, COL-CC and SSIPC.



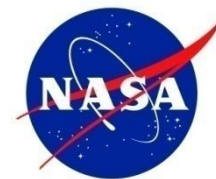
# Command Procedures



- **Personnel are prepared and ready to execute the command procedures as documented per MOD Command Policy/Flight Rules**



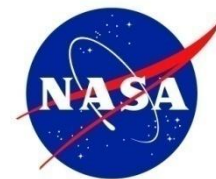
# Non-Critical Processors/Applications



- **No changes to Flight Director MCC software applications for STS-130/ ISS-20A**



# ISS OPEN HAZARD REPORTS



**STD-ISP-0001** Integrated Support Platform. (ECD 1/11/10)

**ISS-TCS-0062** Heat Exchanger (HX) ammonia/water interface failure due to water freezing in the HX core. (ECD 1/11/10)

**ISS-WRM-139** ISS Water Recovery System (WRS) Water Leakage Resulting in Equipment Damage and/or Personal Illness (ECD 1/18/10)

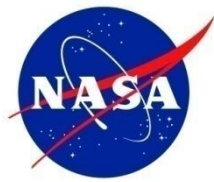
**ISS-TCS-1204** Loss of ISS Element or Critical and Non-Critical Hardware Due to Thermal Extremes. (ECD 1/11/10)

**ISS-TCS-0091** Leakage or Failure of the Internal Thermal Control System (ITCS). (ECD 1/18/10)

**ISS-TCS-1211** New (ECD 1/18/10)



# ISS OPEN NCRs



**NCR-ISS-193 (20A) Lack of Failure Tolerance during Orbital Replaceable Unit (ORU)/Hardware Removal and Replacement (R&R) Operations Due to Failure of Mechanical Interfaces.**

**NCR-ISS-218 (Rev. B) Ungrounded Floating Connector Interfaces (P).**

**NCR-ISS-229\_20A US Lab Integrated Acoustic Non-Compliance.**

**NCR-NODE3-Acoustics-01 Node 3 Integrated Acoustic Non-Compliance.**

**NCR-NASDA-RMS-15 Potential Sharp Edges on the Snare Cable Rod End Insert of JEMRMS End Effector**

**NCR-ISS-222 WPA Jumper Hose Proof Test Factor of Safety**

**NCR-ISS-223 Contingency Water Container (CWC), Payload Water Reservoir (PWR), and ACTEX Interface to the WRS Rack 1**

**NCR-ISS-228 Seal Failure Tolerance of the Antimicrobial Applicator (AmiA) During Installation Procedure to the JEM Internal Thermal Control System (ITCS)**

**NCR-WHC-001 Inability of crew to hear C&W during Waste Collection System (ACY) operation**

**NCR-TBD covering the protruding components of the Robotic Workstation (RWS) Crew Chair**

**Assembly foot rest into the Node3 Passive Common Berthing Mechanism (PCBM) hatchway,**

**NCR-TBD flight specific drag-throughs (chit 7870)**

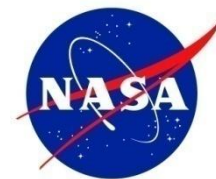


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# PAYLOAD OPEN HAZARD REPORTS



- **STS**
  - none
- **ISS**
  - JAXA NEXE Phase III, ECD: 01/05/10
  - NLP Cells-3 (US) Phase III, ECD: 01/10/10
  - NLP Vaccine-7 (US) Phase III, ECD: 01/08/10





# CSCS Support/LON



- Contingency Shuttle Crew Support (CSCS) /Rescue Flight Resource Book is located at [http://mod.jsc.nasa.gov/da8/rules/CSCS\\_Rescue\\_Flight\\_Resource\\_Book/cover.htm](http://mod.jsc.nasa.gov/da8/rules/CSCS_Rescue_Flight_Resource_Book/cover.htm)
- STS-130 Ascent/Entry Team will support STS-130/LON mission
- Personnel are available to support Orbit Operations as required



# Remaining STS-130/20A Integrated Simulations



- **Ascent/Entry**
  - 1/7: Post Insertion
  - 1/13: Ascent #3
  - 1/21: TCDT w/ KSC
  - 1/29: Entry #3
  - 2/1: Ascent #4
- **Orbit**
  - None
- **ISS**
  - None



# Ascent/Entry Flight Techniques Panel



- **Ascent/Entry Flight Techniques Panel (A/E FTPs) was held with topics supporting STS-130/20A**
  - A/E FTP #253
    - Single Non Universal I/O Error Updates



# Ascent/Entry FTP #253

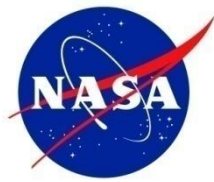


- **Single NON-Universal I/O Error Action**

- During the STS-124 pre launch flow, Atlantis experienced two GPCs failing to sync.
  - The cause was traced to a failing diode within MDM FA2.
  - Failed GPCs was preceded by a single non-universal detected I/O error by GPC 4.
- Concern that a similar failure during flight could result in a GPC set split and/or BFS engage.
- Orbiter Project imposed mitigation steps for suspect diodes.
- Current Flight Rules cover Non Universal I/O errors that “bypass” but not for single occurrences.
  - Two sequential occurrences result in a bypass.
- AEFTP concluded that action would not be taken until the second indication occurs.
  - Single non universal I/O errors can occur for different reasons with different results (i.e. single event upset that results in no impact).
  - Action includes de-assigning FA/FF MDM input/output which has impact on other active systems.



# IP Integration



- **STS-130/ISS-20A Briefings to Russian Teams**
  - ECD of L-1 Week
- **STS-130/20A Telecon w/ ESA on 12/03/09**
  - Reviewed procedures for Node 3 activation and Loop A/B integration including contingency swap
- **STS-130/20A Telecon w/ JAXA on 12/03/09**
  - Reviewed procedures for Node 3 activation and Loop A/B integration including contingency swap



# Standard Open Work



- **STS-130/ISS-20A Flight Rules Annex**
  - Final: approved at JPRCB on 12/4/09
  - PCN-1: targeted for JPRCB on 02/01/10
- **FDF/SODF**
  - Final crew review 1/22/10
  - Final errata, L-2 days
- **Training**
  - Complete STS-130/ISS-20A Ascent/Entry simulations (L-6 days)
  - Complete Flight Director flight specific certifications (ECD 1/25/10)
- **INDEPENDENT SAFETY VERIFICATION REVIEW**
  - SHUTTLE ISVR REPORT (ECD: L-2 wk)
  - ISS ISVR REPORT (ECD: L-2 wk)



# Standard Open Work



- **Water transfer plan and Pressure profile**
  - Complete coordination with MCC-M (ECD L- 8 days)
- **Finalize solar array constraints and power profile plan for docked mission**
  - SACM (L-2 weeks)
  - Power Analysis (ECD L-2 weeks)
- **Complete “Road To” Items and Prepack**
  - PMA 3 relocation from N1p to N2z (1/23)
  - A/L contingency jumper installation (1/20)
  - RPM Training, begins week of 1/4
  - Prepack the week of 1/18
  - Standard EVA and A/L prep items start the week of 1/18



# Increment 22 Overview



- **Major activities for Increment 22:**
  - 21S Stage
    - RS EVA#24 (1/14)
    - 20S Relocate (SM Aft → MRM2 Zen) (1/20)
    - 36P dock
    - SIGI R4 updates
    - PMA 3 Relocate, ESP3 Relocate
    - STS-130/20A prep and joint ops
  - 20A Stage
    - T2 Relocate (NOD2 → NOD3), JEMRMS SFA ACO
    - ZSR, CQ3 installs and STS-131/19A prep
    - 20S Undock (3/18)



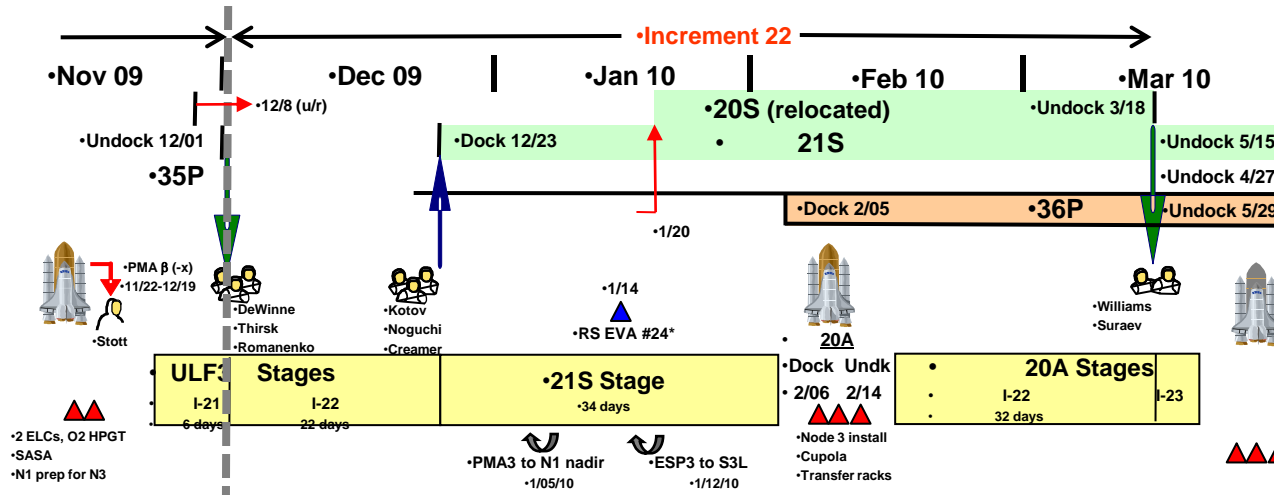


# Increment 22 Preview

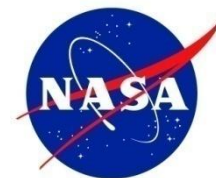


- 20S Crew:
- (Docked to SM Aft/MRM2)
  - ISS CDR: Jeff Williams
  - ISS FE-1: Maxime Suraev

- 21S Crew:
- (Docked to FGB)
  - ISS FE-4: Oleg Kotov (Inc 23 CDR)
  - ISS FE-5: Soichi Noguchi
  - ISS FE-6: T.J. Creamer



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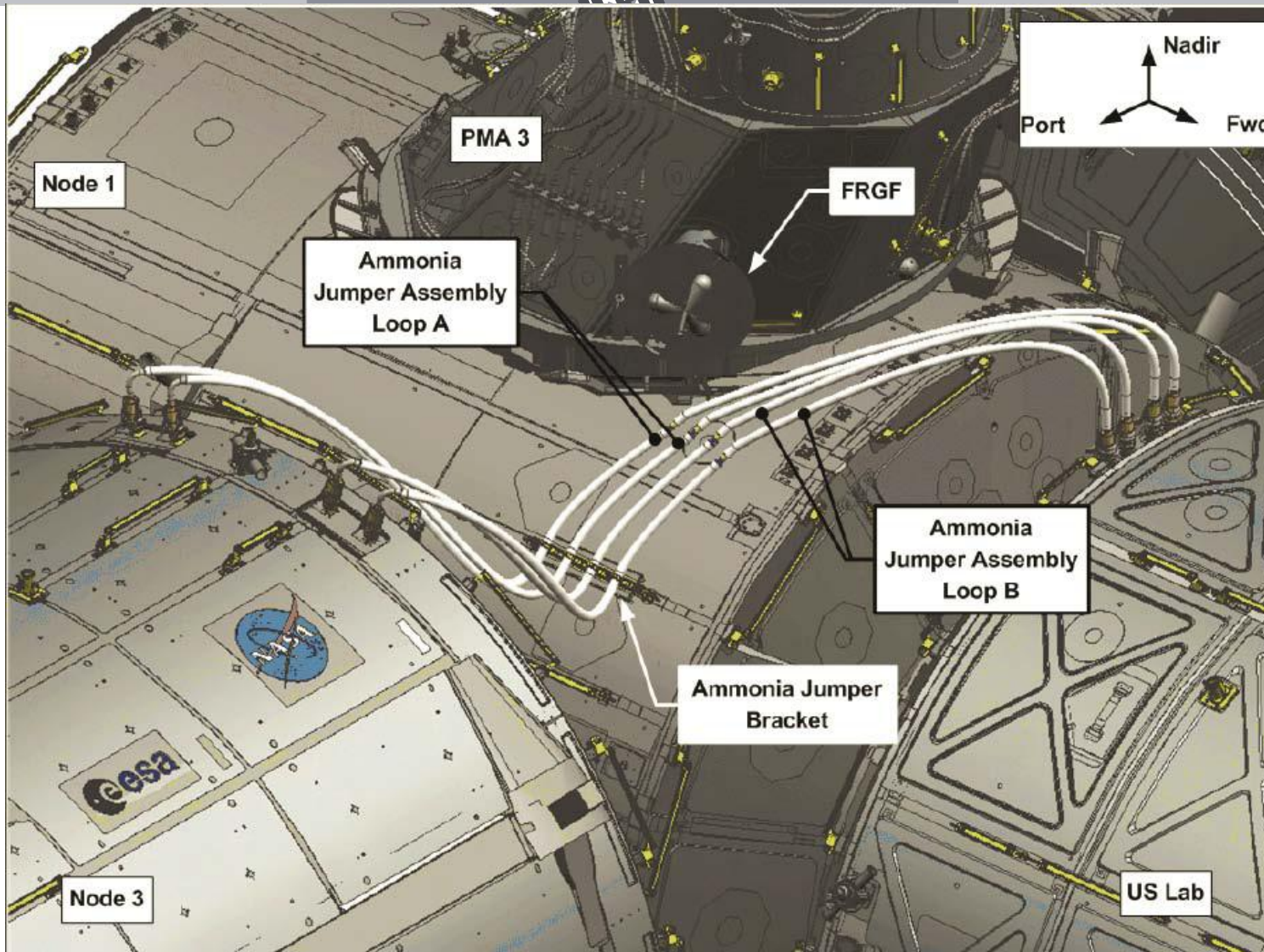
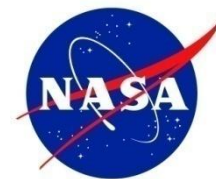
# SPAN Staffing



- ISS SPAN Support: Staffing provided by USA CAF Personnel
- ISS SPAN Systems: Staffing provided by DI plus support from DA8 and DA7 if required
- SSP SPAN Systems: Staffing provided by DS plus support from DA8 and DA7 if required
- SPAN DO: Staffing provided by DO
- SPAN DM: Staffing provided by DM
- SPAN DX: Staffing provided by DX
- SPAN Managers: Staffing provided by DM, DO, DX. Additional ad hoc support from DA8, DA7, DS, and DI



# Original Ammonia Line Routing



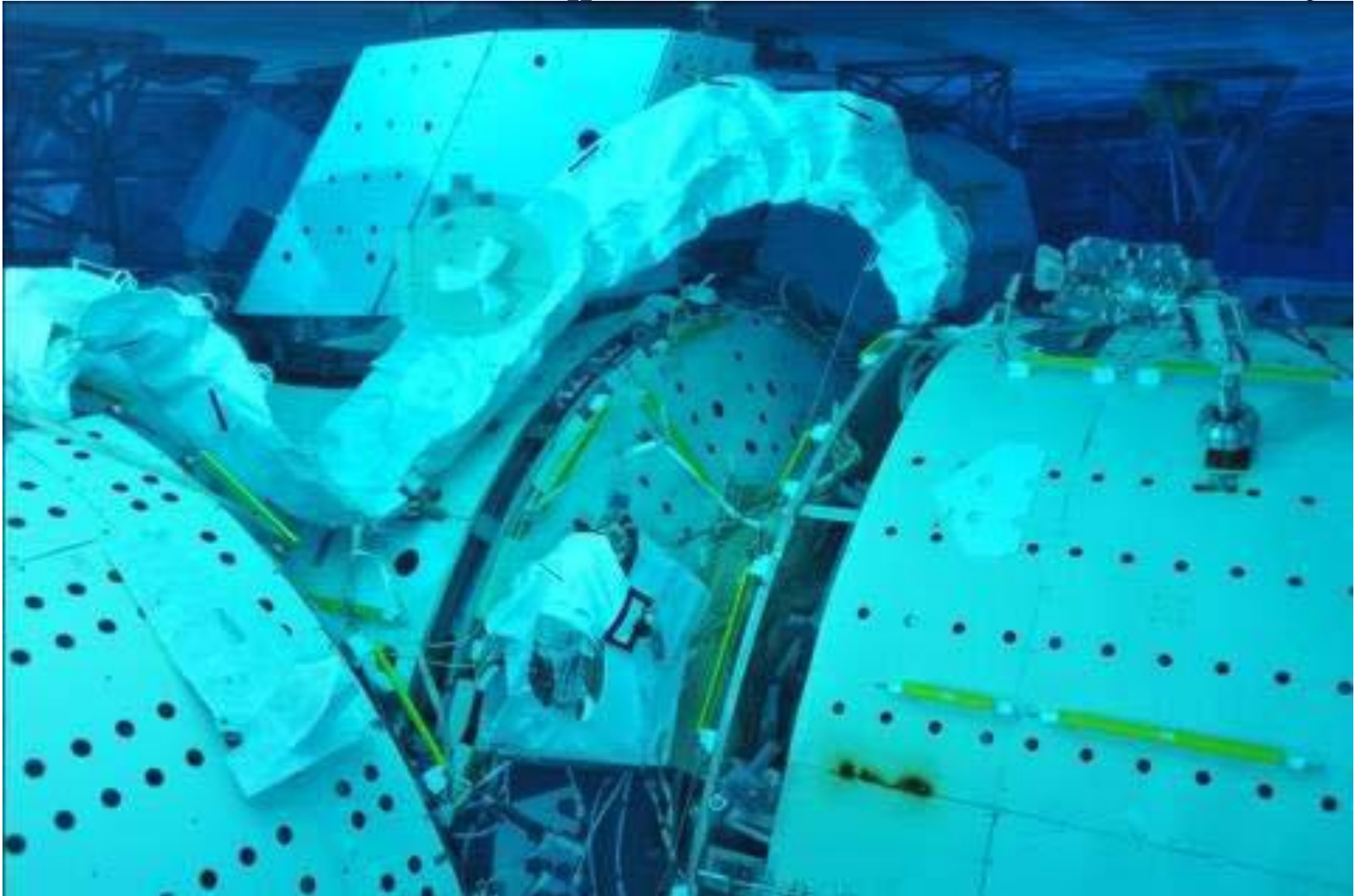
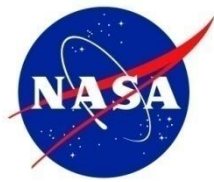
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# Original Routing NBL Test



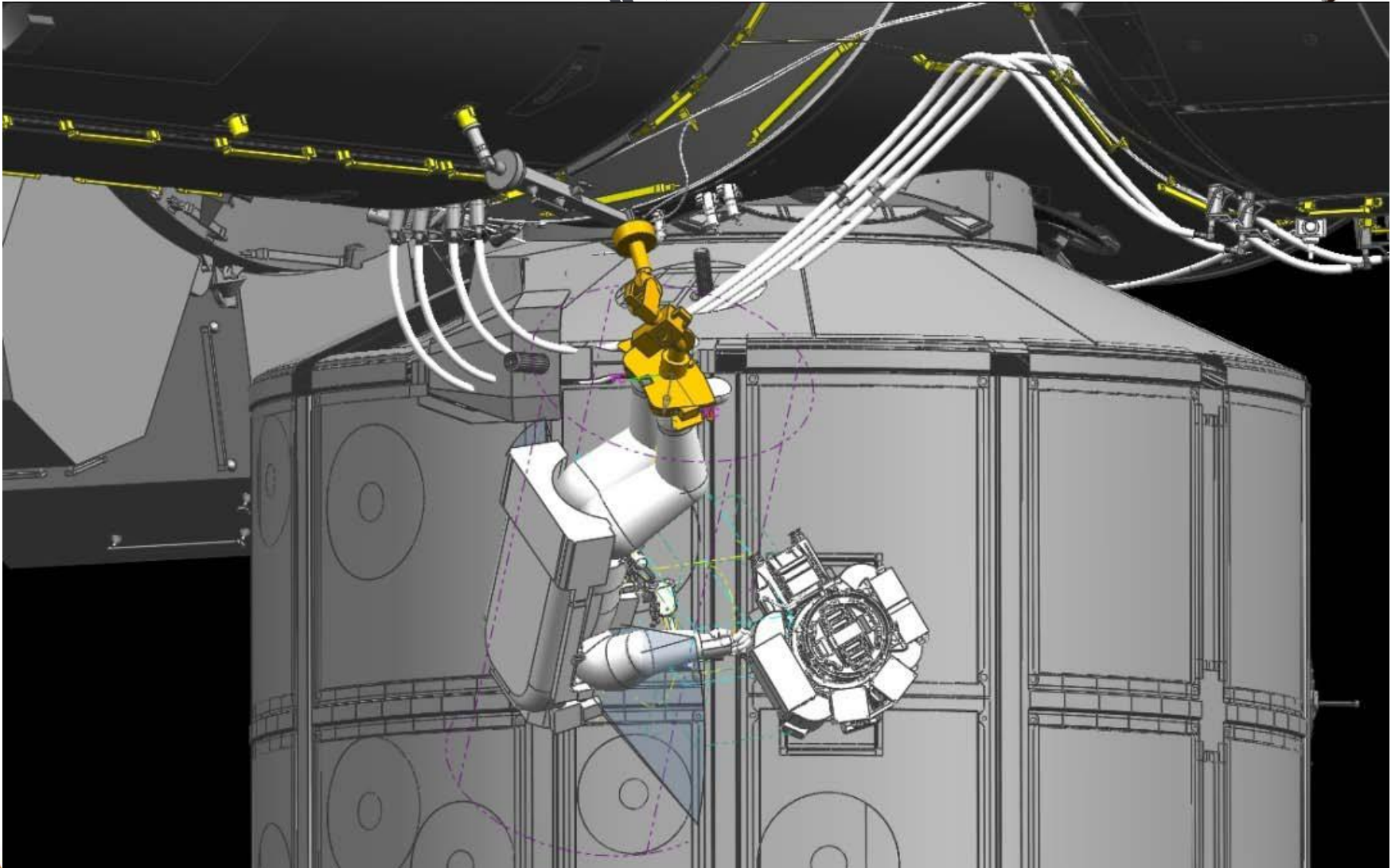
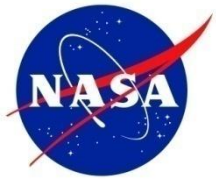
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# Ammonia Line PMM Interference



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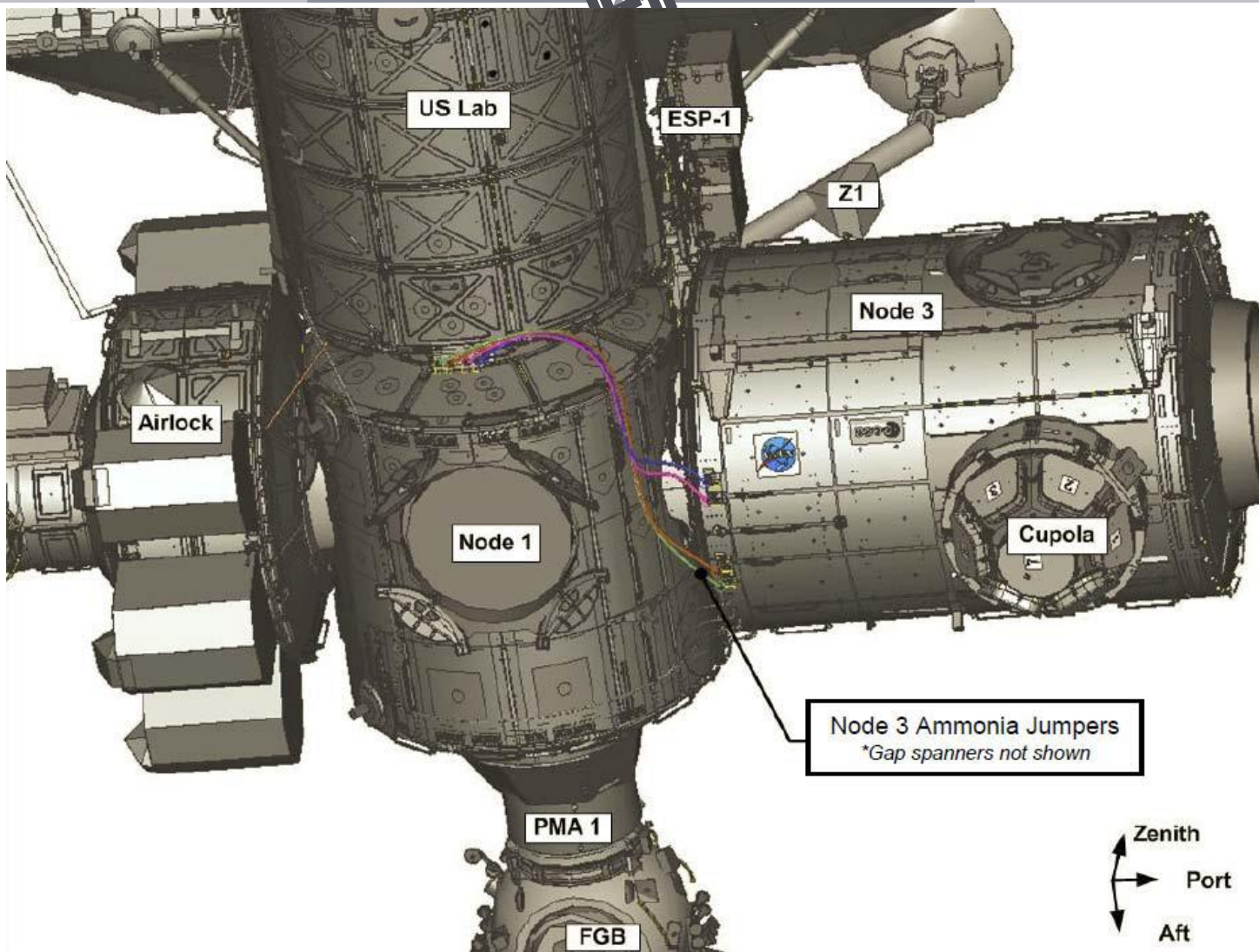
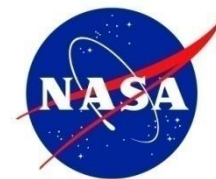
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# Ammonia Line New Routing



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