



# **STS-132/ISS-ULF4 MOD Flight Readiness Review**

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

***DA8/Tony Ceccacci***

***DA8/Jerry Jason***

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***DA8/Emily Nelson***

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***April 1, 2010***

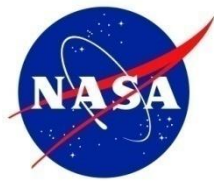
# Agenda



- **DA8 COFR Requirements/Endorsements**
  - COFR Requirements/Endorsements Summary
  - New Operations – A/E Topics, Shuttle, ISS, MCC
  - Safety Status Review (backup)
  - Flight Rules (Generic Volumes A, B, C, D; STS-132/ULF4 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-134 (LON vehicle) (backup)
  - Flight Techniques & Joint Operations Panels (backup)
  - Level II Actions/Shuttle IFAs
- **Standard Open Work (backup)**
- **Non-Standard Open Work**
- **Exceptions**
- **Items of Interest**
- **Flight Readiness Statement**



# DA8 COFR Requirements/Endorsements



REQUIREMENT (SHUTTLE)	FD	PI	Safety	SPAN	SMG	Team 4
Non-Crit Processors/Applications	G				G	
EMCC	G				G	G
Certified Flight Controllers	G			G	G	G
Flight Rules	G					
FDF	G	G				
FTP - New Ops	G					
Flight Anomaly Resolution	Y			G		
Anomaly - Procedure	G					
Exceptions/Action Items From Prior Readiness Reviews	G	G	G	G	G	G
CIL/Hazards	G		G			
No Constraints	G	G				
Level II (Program) Actions	G	G				
Mission Requirements	G					
Exception/Resolution	G	G				
Command Procedures	G					
Flt Prep Process Plan Requirements Met		G				
Contractor Process Insight		G				



Ready to Support Flight/Only Standard Open work



Non Standard Open work with expected resolution prior to flight.



Open work without expected resolution without assistance, prior to flight, or unavoidable constraint violation.



N/A



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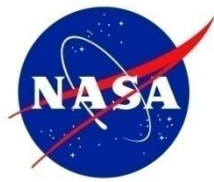
# DA8 COFR Requirements/Endorsements



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	Y					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		G			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									
Contractor Process Insight		G					N/A			



# Ascent/Entry Topics



## Preliminary Launch Window Times for STS-132/ULF4

KSC Day Window Open	KSC Date	RNDZ Day	ET Photo Umbilical	ET Photo Handheld	Open (EDT)	Open (GMT)	In-Plane (GMT)	FD3 Close (GMT)	FD4 Close (GMT)
Friday	14-May	FD3	Light	Light	14:14:59	18:14:59	18:19:59	18:24:59	
Saturday	15-May	FD3/FD4	Light	Light	13:49:16	17:49:16	17:54:16	17:17:03	18:02:26
Sunday	16-May	FD3	Light	Light	13:26:45	17:26:45	17:31:45	17:36:45	
Monday	17-May	FD3/FD4	Light	Light	13:01:02	17:01:02	17:06:02	17:11:02	17:14:13
Tuesday	18-May	FD3	Light	Light	12:38:31	16:38:31	16:43:31	16:48:31	
Wednesday	19-May	FD3/FD4	Light	Light	12:12:48	16:12:48	16:17:48	16:22:48	16:25:59
Thursday	20-May	FD3	Light	Light	11:50:17	15:50:17	15:55:17	16:00:17	
Friday	21-May	FD3/FD4	Light	Light	11:24:34	15:24:34	15:29:34	15:34:34	15:37:45
Saturday	22-May	FD3	Light	Light	11:02:03	15:02:03	15:07:03	15:12:03	
Sunday	23-May	FD3/FD4	Light	Light	10:36:21	14:36:21	14:41:21	14:46:21	14:49:31

### NOTES:

- 1) No mated reboost during STS-131 docked mission
- 2) 3.0 m/s ISS reboost on April 24



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# Ascent/Entry Topics



- **Launch Window Cutouts**

- Air Force COLA cutout methodology will begin with STS-132
- New Air Force process changes:
  - Entire launch window screened against the entire debris catalog instead of only “mannable” satellites.
  - Active satellites will be screened using 8x30x30 km ellipsoid for shuttle only
    - Air Force *considering* screening against debris will use 2.5 km sphere screening
  - Impacts to launch window expected to be minimal and should not result in more than ~4 cutouts where launch would be prohibited
- No changes to MOD processes
  - Continue providing In plane, +15, +30 second launch opportunities for full-up screening
- Waiver process still in development between Launch Integration Mgr and 45'th Space Wing



# Ascent/Entry Topics



- **MORON Runaway Construction (Start: April 12 – Complete: May 1, 2010)**
  - Construction to start on North end of runway (MRN 20 approach) April 12, 2010 (5 to 10 days to complete depending on Wx)
    - Displaced threshold (1000 ft) to support construction results in PAPI and 'Ball Bar' setup for Shuttle Approach to become unavailable
      - Ball Bar Mandatory for TAL Runway support (FR A3-203)
      - PAPI's are HD for daytime landings (FR A3-203)
      - MRN becomes a NO/GO TAL site due to loss of Ball Bar
  - Construction on South end of runaway impacts rollout margin
    - MRN20 approach available (no impacts to PAPI/Ball Bar)
    - Runaway available = 9066 with 1000 ft underrun and 1000 ft overrun (even with displaced threshold on South end)
      - Rollout margin violations for ~ 95% of the cases
- **Edwards Permanent runway will be available for landing operations**
  - Immediately after STS-131 lands, EDW04 MSBLS move will begin
  - FAA certs for MSBLS on May 1 & 2 with backup dates on May 8 & 9
  - Air Force will officially transition from temporary to permanent rwy on May 10



# Spaceflight Meteorology Group



- All forecasters required to support STS-132 meet requirements listed in SMG Training & Certification plan
- GOES-13 replaces GOES-12 as the operational satellite on April 14.
  - GOES-13 data already tested in AWIPS and MIDDs. No issues expected for STS-132.
- System Changes:
  - **AWIPS:** Terminal server and console replacement scheduled after landing of STS-131. This is a “dumb” terminal used for admin and maintenance, not a user workstation. Low risk.
  - **MIDDs:** none

The undersigned certifies that the Spaceflight Meteorology Group is ready to support the STS-132 flight.

/s/ Frank C. Brody

Frank C. Brody

Chief, Spaceflight Meteorology Group

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**Flight Director Office**

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DA8/Sarafin/Nelson/Jones/Jason/Ceccacci 132/ULF4 MOD FRR 04/01/10





# New Operations: Shuttle



- **MRM-1 module operations while in Shuttle:**
  - MRM-1 module activation in payload bay on FD1 immediately after Post Insertion
  - MRM-1 is powered by Orbiter via Remotely Operated Electrical Umbilical (ROEU) via PL PRI and CAB PL bus from FD1 to FD5:
    - Provides MRM-1 power for Terminal Computer Unit (TCU), Thermal Control System (TCS) Cooling Pumps and Cabin Fan/Smoke Detectors
  - MRM-1 Command and Telemetry interface provided through Orbiter via Orbiter Interface Units (OIU) /Payload Signal Processor (PSP) and Payload (PL) MDMs
    - INCO sends commands on behalf of MCC-M while MRM-1 is in payload bay via coordination with ACO and RIO (via approved protocol/process)
  - Crew Interface via SPEC 224 MRM SYSTEMS Display for monitoring during nominal operations and commanding during off-nominal operations
  - Crew switches via Standard Switch Panel (SSP) to support MRM1 Activation and Preparation for Transfer
  - Crew procedures (nominal and contingency) documented in Assembly Ops book



# New Operations: ISS



- **MRM-1 module operations while on SSRMS:**
  - MRM-1 repower on SSRMS will reactivate Terminal Computer Unit (TCU), Thermal Control System (TCS) Cooling Pump and Cabin Fan/Smoke Detector power, all powered via SNTs (different power source than when in payload bay)
  - MRM-1 Automated Docking System (ADS) will be powered up after SSRMS positions the module in the pre-docking position, 150 cm from the docking interface
  - After ADS powerup, the docking probe will be deployed and the MRM-1 docking camera will be powered up (image transmitted via Service Module TV receivers to the RWS Displays)
  - After final interface alignment at 90 cm of docking interface separation, MRM-1 will be translated for final installation
  - Once contact sensors indicate positioning for installation, the MRM-1 TCU will execute an automated docking routine to draw the interfaces together, close hooks and return the docking probe to a fully retracted position



# New Operations: ISS



- **Cupola RWS**

- MRM-1 install and EVA support planned from Cupola RWS in Cupola
- Cupola location of RWS not mandatory, but cupola windows provided enhanced situational awareness for robotics
- Requires drag-throughs for BPSMU, seat restraint system, 2 video monitor cables (SSC video from Node3 to Cupola), 1 SSC cables (for IPV) and one RS Laptop cable
  - 1 IPV SSC cable only required for MRM1 install due to issue with wireless network connection when MRM1 docking video is multi-cast for ground and onboard viewing – not yet approved
  - RS Laptop cable only required for MRM1 install
  - All but IPV and DOUG connections being approved out of board per agreements at 16 FEB 10 SSPCB



# New Operations: ISS Stage Ops



- **Sabatier**

- Sabatier uses H<sub>2</sub> from OGS and CO<sub>2</sub> from CDRA to make H<sub>2</sub>O, which is collected and processed by WPA, and CH<sub>4</sub> which is vented overboard and when operating at a 3-crew level, Sabatier will produce 1000 L/yr of H<sub>2</sub>O
- New regen ECLSS equipment to be flown on 19A and installed in Node 3
  - Requires up to 40 hours of crew time for initial installation
  - Checkout consists of a 5 hour operational run
- NASA committed to launch and provide all operational interfaces required for checkout of the hardware on orbit by May 31, 2010
- New hazard report is in work to document an explosive event concern
- Sabatier will be yellow-tagged until the hazard concern is resolved by engineering, safety and NESC



# 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-132/ISS-ULF4**
  - Volume A (STS), Final, PCN-10 dated 5/21/09
  - Volume B (ISS), Final, PCN-22 dated 2/19/10 (PCN-23 expected 5/4/10)
  - Volume C (Joint), Final, PCN-5 dated 5/18/09
  - Volume D (Soyuz/Progress), Final, PCN-6, dated 5/4/09
- **STS-132/ISS-ULF4 flight rules annex**
  - Final, approved at JPRCB on 3/30/10
  - PCN-1, planned for JPRCB review on 5/3/10
    - Expecting ~25 flight rule CRs (mission priorities, docked loads, exercise constraints, dual docked operation orbiter safing, LTA constraints, etc)



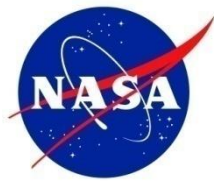
# FDF/ODF/SODF



- **DA8 has participated in FDF/ODF/SODF processes and procedure reviews as required**
- **FDF/ODF will be ready to support STS-132/ISS-ULF4**
- **New procedures are primarily for:**
  - PDRS (MRM-1 grapple, MRM-1 unberth, MRM-1 hand-off, EVA Viewing support for EVAs 1, 2 & 3)
  - GNC (DAP table mods for Draper loads analysis)
  - EVA and Robotics activities
  - Assembly Ops (MRM-1 act, MRM-1 prep for transfer, MRM-1 contingency ops, payload ops)



# Flight Director Mission Staffing



- **STS-132/ISS-ULF4 Flight Directors are certified per Flight Director Certification Guide (DA8-00010), Final, dated May 22, 2009**
- **Additional certified Flight Directors are available to support mission staffing, Team 4, EMCC, and STS-134/LON flight, as required**
- **MOD Work Guidelines are met**
- **Flight-specific certifications are expected to be complete by April 22, 2010**

Shuttle Flight Directors		ISS Flight Directors	
Michael Sarafin	Lead/Orbit 1	Holly Ridings	Orbit 1
J. Chris Edelen	Orbit 2	Emily Nelson	Lead/Orbit 2
Ginger Kerrick	Planning	Scott Stover*	Orbit 3
Richard Jones	Ascent		
Tony Ceccacci	Entry	Jerry Jason	Increment Lead

- \* - Pending ISS Hot Seat Console Ops and Certification Paperwork (ECD is 4/30/10)



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# Level II Actions and Exceptions



- **Level II Actions:**            **None**
- **Exceptions:**                **None**





# Non-Standard Open Work: STS



- **IFA STS-129-D-001 Unexpected Release of HPGT from ELC2**
  - High Pressure Gas Tank (HPGT) was released from ELC before EVA crewpersons were in place, ready to receive the ORU
    - Procedure incorrectly assumed “locked” configuration of 5<sup>th</sup> latch was sufficient; however this assumption was true only at the ISS Airlock (HPGT final destination) and not for the ELC interface
    - A mechanical (dowel) soft dock interface was used for HPGT interface
  - MOD has assessed the STS-132/ULF4 EVA operations and the following soft dock features are planned for use during EVA operations:
    - SGAnt Boom to ICC-VLD (ball detent)
    - EOTP to ICC-VLD (magnetic soft dock)
    - EOTP to SPDM (magnetic soft dock)
    - Battery to ICC-VLD (ball detent)
    - Battery to Truss (ball detent)
  - Procedures ensure all EVA ORUs and hardware are fully secured before being untethered.
  - STS-132/ULF4 one-flight disposition estimated completed date is 4/22/10.



# Non-Standard Open Work: Dual Docked Operations



- **Soyuz 21S**
  - Undock from SM Aft: June 2, 2010
- **Soyuz 23S**
  - Launch: June 15, 2010
  - Docking to SM Aft: June 17, 2010
- **ISS indirect handover period between 21S undock and 23S docking**
  - Results in 3 ISS crew (1 US crew) available during this period
    - Tracy Caldwell-Dyson is ISS Suit IV for EVA ops and SSRMS operator
  - Some ISS utilization/science may be lost due to limited ISS crew time
- **Dual Docked Operations Occurs for:**
  - Shuttle launch from June 9 through June 12 (DDO with 23S Docking)
  - +1 docked extension day not available prelaunch with 12+0 day mission due to cryo margin – and ISS program requirements to schedule Utilization payload ops
- **STS-132/ULF4 Launch Season:**
  - May 14 - May 22, 2010
  - June 3 - June 8, 2010
  - June 10 - June 12, 2010

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# Non-Standard Open Work: Dual Docked Operations (cont)



- **Unique SRMS/OBSS safing trajectory coordinated with Orbiter Project Office to protect OBSS sensors and SRMS cameras**
  - Procedure will be uplinked to crew if required
  - Orbiter payload bay camera & star tracker doors also require safing measures
- **Attitude Control and Solar Array Plan**
  - Options to be worked for attitude mnvr to Soyuz docking attitude (ECD L-2 weeks)
    - Shuttle VRCS attitude mnvr + Russian thruster attitude hold
      - Shuttle propellant not specifically budgeted for this
      - May be difficult to find a common solar array position that supports Shuttle VRCS, Russian attitude hold and KURS constraints
    - Russian attitude mnvr and attitude hold



# Non-Standard Open Work: Dual Docked Operations (cont)

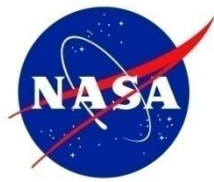


- **Forward Work**

- Solar array plan and powerdown requirements once SACM is received (L- 2 weeks)
- Specific detailed timeline will be worked after launch to the specific flight day DDO opportunity
  - Nominal mission sleep schedule (Ascending landing) supports 23S Soyuz docking
  - Loss of some CAT 3 mission content (ISS Utilization payload ops, etc), depending on DDO timing relative to docked Shuttle mission
- Flight rules targeted for PCN-1
  - Orbiter systems safing requirements for DDO
  - Docked loads constraint tables for DDO



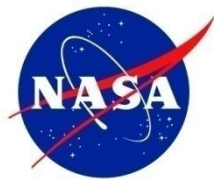
# Non-Standard Open Work: ISS



- **Joint Station Local Area Network (JSL) and Video Streaming Workstation upgrades**
  - In order to route all desired views to a Robotic Workstation (RWS) in the Cupola, new hardware must be installed, configured and checked out prior to flight
  - JSL extension provides wireless network capability in Node3 and the Cupola for SSC use
  - Video Streaming Workstation eliminates the need for 2 drag-thrus from Node2 to the Cupola for additional video views from Shuttle assets (still drag thru from Node3 to Cupola)
- **MRM-1 Stowage: module will arrive filled with USOS stowage that must be unpacked by 27 JUN 10 in order to MRM-1 to be outfitted for the 23S relocation**
  - ~64 Cargo Transfer Bag Equivalents do not have approved locations for unstow from MRM1
  - ISSP currently negotiating additional stowage allocations in JEM and FGB
  - MRM-1 ingress and unstow not planned until ULF4 stage
- **Stowage plan for PDGF (IVA)**
  - Plan in work (ECD 4/15)



# Non-Standard Open Work: ISS



## MRM-1:

- **Ground segment teams continue to work issues with routing MRM-1 data to MCC-M**
  - During ground testing with SAIL and an MRM-1 simulation, MCC-M has not received all MRM-1 telemetry expected while the module is powered in the payload bay
  - Ground segment experts in both control centers continue to work the issue
  - MCC-M receives enough telemetry to confirm nominal operations, but the more detailed telemetry needed for troubleshooting failures is not reliably available
- **Allowable MRM-1 probe length for module return to payload bay**
  - MRM-1 cannot be returned to the payload bay if the docking probe is fully deployed
  - Analysis is on-going to establish the allowable docking probe length for return of MRM-1 to the payload bay
- **MCC-M commanding requirements during nominal installation**
  - RSC-E indicated in a telecon on 30 MAR 10 that a problem in MRM-1 software may require MCC-M commanding after module power up on SSRMS before proceeding in the installation activity; details of this new requirement will be worked through future telecons



# Shuttle: Items of Interest



- **Non-SSPTS Mission**

- OV-104/Atlantis does not have SSPTS capability
- ~102 hours of pad hold capability (H2 limited), assuming 12+0+2 day mission
- Pad hold margin allows 4 launch attempts over 5 days (based only on cryo)
- On-time launch results in ~20 hours of on-orbit margin (O2 limited) above 12+0 mission
- Standard Group B Power Down assumed for on-orbit free flight and post docking



# Shuttle: Items of Interest



- **12+0 Day Timeline Management (per Annex Flight Rule ULF4\_C2-19)**
  - With 12+0 day mission, there is no pre-flight mission extension capability
    - Driven by ISSPO requirement to schedule Utilization Payload Ops (CAT 3)
  - To accommodate contingencies, the IVA time schedule for FD9 will be re-allocated to another point in the mission, as required for the following:
    - Additional docked Focused Inspection (FI) time - (above 1.2 hour preflight reserve)
    - Use as required to accomplish CAT1 IVA objectives (Dual Docked Operations)
    - Add a contingency EVA day, if required, to accomplish CAT 1 EVA objectives
    - Add a contingency EVA day, if required, to accomplish CAT 2 EVA objectives
    - Use as required to accomplish CAT2 IVA (including robotic/MRM-1) objectives





# Shuttle: Items of Interest

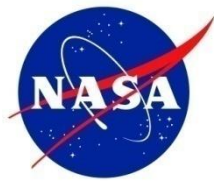


- **Shuttle LiOH Management**

- Annex flight rule ULF4\_C2-79 requires  $\text{PPCO}_2$  levels  $\leq 5.0$  mmHg, factoring in available ISS resources (same rule as last ~4 flights)
- Nominal plan – with 6 ISS crew for 12+0+2 day duration, expect to use 9 cans from ISS stockpile
  - Expect to leave ISS stockpile  $\geq 30$  cans, including 12 cans flying up in US cargo allocation within MRM-1 module
  - Assumes CDRA operating in NOD3, no LAB CDRA available, & nominal STS-131/19A
- Worst case plan = Same as nominal plan (slip to June results in 3 ISS crew, LAB CDRA recovery possible if increase mission priority to perform bed R&R)
- Placeholder in timeline on FD7 to perform mated supply water/condensate dump to support CWC & PWR condensate fill/processing plan
- Highly confident nominal mission will allow deletion of FD7 mated dump



# Shuttle: Items of Interest



- **Shuttle Waste Management**

- Urine/waste water dumps not allowed during mated operations
- Plan for 4 Shuttle crew members to use ISS WHC during docked mission - to reduce Shuttle waste tank input and support ISS regen water processing
- Crew/Ground Plan: Shuttle waste tank tracking chart will be uplinked to crew on FD4
  - For nominal mission do not expect to offload waste tank into CWC
  - Worst case – may require offload of waste tank into 1 CWC (due to ISS WHC/Regen ECLSS failure, etc)
  - Waste tank dump targeted for morning of FD11 (Late Inspection Day) followed by CWC dump (only if required)

- **Shuttle Water Management**

- Placeholder in timeline on FD7 to perform mated supply water/condensate dump to support CWC & PWR condensate fill/processing plan
- Highly confident nominal mission will allow deletion of FD7 mated dump



# Joint Shuttle/ISS: Item of Interest



- **MRM-1 Robotic Installation Sequence:**
  - MRM-1 will be powered down after SRMS grapple and prior to unberth from payload bay
  - SRMS will unberth MRM-1 and present it to SSRMS at hand-off position for SSRMS grapple
  - MRM-1 will be reactivated on SSRMS
  - SRMS will ungrapple and maneuver to viewing install position
  - SSRMS will maneuver MRM-1 to install position
  - MRM-1 docking probe will be deployed and docking camera will be activated
  - SSRMS will install MRM-1 on FGB Nadir docking port using probe and drogue mechanism



# ISS: Items of Interest



- **Longeron Shadowing**
  - Solar Array Wing 2A considered degraded since the December 2009 BGA latch failure/longeron shadowing event
  - Longeron Shadowing plans are being determined on an event-by-event basis and documented via CHIT
  - ULF4 constraints are in work for event-specific contingency responses to longeron shadowing cautions (ECD L- 2 weeks)
  - Considered part of Standard Open Work



# ISS: Items of Interest



- **Battery R&R (EVAs 2-3)**
  - 4B batteries being R&Red are much more lightly loaded than the 2B batteries R&Red on STS-127/2JA
    - May 14<sup>th</sup> Beta range is good for power generation so powerdowns in this period are very light
    - A slip to the July window will cause more significant powerdowns, but still lighter than what's been seen in the past.
  - Battery torque broken on ICC-VLD batteries during EVA1
    - ICC-VLD return is not allowed once battery torque is broken
  - Four (4) batteries swapped on EVA 2
    - Batteries A-D to be swapped for 1-4
      - Order and placement of batteries required to support within VLA analysis of ICC-VLD
  - Remaining two (2) batteries swapped during EVA 3
    - PDGF retrieval will be sacrificed (PDGF round tripped) if required to complete battery R&R per priorities



# ISS: Items of Interest



- **MSS Ground Controlled Operations**

- FN3 - MT translation from WS4 to WS6, then SSRMS walk-off to MBS PDGF 3 and maneuver to EVA1 support position
  - Required to support EVA1 (SGAnt & EOTP install)
- FN4 – SSRMS maneuver away from EVA1 support position and walk-off to LAB PDGF
  - Required to support MRM-1 hand-off/installation, OBSS hand-off
- FN5 – SSRMS walk-off to MBS PDGF 3, then MT translate from WS6 to WS8
  - Required to support to support EVA2/EVA3 battery R&R ops
- FN8 – MT translate from WS 8 to WS6, then SSRMS walk-off to LAB, and MT translate from WS6 to WS4
  - Required to support ICC-VLD2 return to payload bay



# ISS: Items of Interest



- **MRM-1 docking probe removal in the event of probe retraction failure**
  - In the event MRM-1 cannot be installed and the docking probe cannot be sufficiently retracted, EVA removal of the docking system will be required to return the module to the payload bay.
  - This contingency case requires multiple failures in a specific and brief period of time; due to this very low likelihood of occurrence, FOR decision was to establish a contingency plan to determine feasibility of execution but not complete all programmatic analysis required to COFR the activity
  - Plan to put 2 EV crewmembers in APFR/PFR on the Shuttle sill and have SRMS present the module to them for removal of 17 bolts and disconnection (or sever) of three power/data cables
  - Necessary EVA tools flying on Progress 37 to allow for EVA removal of an MRM-1 docking probe that is failed in a deployed state
  - EV crew members trained on flight hardware (1 g) at RSC-E facility in Moscow
  - Preliminary PDRS, SSRMS and EVA procedures have been developed and will be submitted in real-time as required



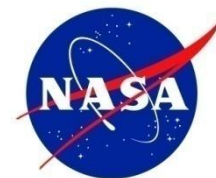
# Flight Readiness Statement



- 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-132/ISS-ULF4 mission and ISS-ULF4 stage
- All standard/non-standard open work will be closed out or have a closure plan prior to SSP FRR (4/28/10) with no exceptions
- ISSP SORR will be conducted on 4/22/10; closeout for non-standard open work will be reported to ISSP prior to SOMD Level 1 FRR (5/5/10)







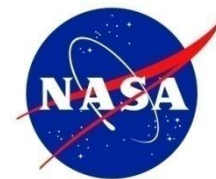
# BACKUP



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# ISS Open Hazard Reports



**RSCE-0003-MRM1** Depressurization of MRM1 pressurized compartment due to impact by a micrometeoroid or orbital debris. (ECD 4/13/10)

**ISS-EVA-0301-ULF4** EVA Crewmember Collision (ECD 3/30/10)

**ISS-MCH-0109-ULF4** Inability to gain/maintain structural integrity using attachment mechanisms (ECD 4/13/10)

**ISS-COL-1002-MRM1** ISS Collision (ECD 3/30/10)

**ISS-C&T-1101-AC** Personnel Injury or Damage to Equipment Due to Excessive Non-Ionizing Radiation from Transmitter Antenna Systems. (ECD 4/13/10)

**ISS-M&P-0003-MRM1** Release of Hazardous Materials into the Orbiter Payload Bay (ECD 4/13/10)

**ISS-STR-0108-MRM1** Structural Failure Due to Launch, Return, Landing, and On-orbit Loads (ECD 4/13/10)





# ISS Open NCRs



**NCR-ISS-193 (ULF4) Lack of Failure Tolerance during Orbital Replaceable Unit (ORU)/Hardware Removal and Replacement (R&R) Operations Due to Failure of Mechanical Interfaces (ECD 4/13/10)**



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DA8/Sarafin/Nelson/Jones/Jason/Ceccacci 132/ULF4 MOD FRR 04/01/10 35

# Payload Open Hazard Reports



- **STS**
  - none
- **ISS**
  - JAXA EPO-5 Phase III, ECD: TBD
  - JAXA Ferulate Phase III, ECD: 04/09/10
  - JAXA Fish Scales Phase III, ECD: 04/21/10
  - JAXA Hydro Tropi 2 Phase III, ECD: 04/08/10



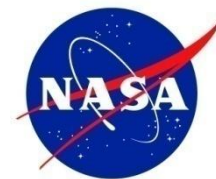
# Open NASA OCADs



- **CATO (3)**
  - EVA RF Keep out zone
  - KU Antenna Mask constraints
- **EVA (4)**
  - SPDM EOTP exposed sharp edge constraints
  - EDF removal options
  - EVA backup for SPDM EOTB BJU
  - 85 foot tether stowage constraints
- **Robo (3)**
  - Docking is prohibited when EOTF is in the service position
  - SPDM EOTP mate demate constraints
  - SPDM constraints for holding the EOTF SPU



# Non-Critical Processors/Applications



- **No changes to Flight Director MCC software applications for STS-132/ISS-ULF4**



# EMCC/BCC



- **No changes to EMCC procedures from STS-131/19A plan**
  - Personnel are identified to support EMCC, if required
- **Backup Control Center (BCC)**
  - BCC-HOSC is prime for BCC/BAT.
  - Facilities and personnel are readying to support.
  - Checkout occurred and included all Partner Control Centers.
    - March 31, 2010 included HOSC, POIC, JAXA, ESA and MCC-M



# Command Procedures



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





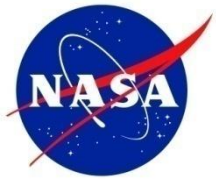
# CSCS Support/LON



- 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-132 Ascent/Entry Team will support STS-134/LON mission
- Personnel are available to support orbit operations as required



# Remaining STS-132/ULF4 Integrated Sims



- **Ascent/Entry**

- 4/12: FDO/BSE
- 4/20: D/O Prep
- 4/23: TCDT w/ KSC
- 4/28: Ascent #3
- 4/30: Post Insertion (with MCC-M tied in)
- 5/4: Entry #3
- 5/10: Ascent #4

- **Orbit**

- None

- **ISS**

- 5/6: Ground-only simulation with MCC-M





# STS-132/ULF-4 JOPs



- **STS-132/ULF4 JOP #1 – 07/7/09**
- **STS-132/ULF4 JOP #2– 09/09/09**
- **STS-132/ULF4 JOP #3– 12/01/09**
- **STS-132/ULF4 JOP #4– 12/04/09**
- **STS-132/ULF4 JOP #5– 01/11/10**
- **STS-132/ULF4 JOP #6– 02/01/10**
- **STS-132/ULF4 JOP #7– 02/25/10**
- **STS-132/ULF4 JOP #8 – 03/29/10**



# Ascent/Entry Topics



- **Edwards Temp Runway**

- Permanent runway concrete work to began 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.

- **Launch Window Cutouts**

- Air Force COLA cutout methodology may begin with STS-131.
  - 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.



# Focused Inspection Timeline



Assumption: Launch on Fri, May 14, 2010 @ 134/18:14:59 GMT, 13:14 am CDT

Focused Inspection Mtg:  
Sunday @ 4:00 pm CDT

Docking: Sunday 10:23 am CDT  
1/21:09 MET

	MET	12	13	14	15	16	17	18	19	20	21	22	23	02/0	1	2	3	4	5	6	7	8	9	10	11	12	
FD03	STS	Sleep	Pst Slp	ISS RNDZ										Dock	Hatch	Hello	EVA Xfers/Prep. ICC Unbrth/Instl POA	EVA1 Rvw	Pre Sleep/EVA PB		Sleep						
	ISS	Sleep	Pst Slp	DPC																Pre Sleep	Sleep						
	ORB ATT	-ZLV -XVV	Dump	RNDZ										BIAS -XLV -ZVV													
		Water Dump^		NH^ NC4^		Ti^		Dock 1/21:09^		MT Xlate WS4-6, SSRMS W/O MBS PDGF3, LAB Ris																	
	MET	12	13	14	15	16	17	18	19	20	21	22	23	03/0	1	2	3	4	5	6	7	8	9	10	11	12	
FD04	STS	Sleep	Pst Slp	EVA Prep/Cmpout										EVA 1-SGANT/SGANT Boom Instl, EOTP			Pst EVA	Pre Sleep		Sleep							
	ISS	Sleep	Pst Slp											SSRMS EVA Support				Pre Sleep		Sleep							
	ORB ATT											BIAS -XLV -ZVV															
												SSRMS W/O LAB, PDGF3 Ris															
	MET	12	13	14	15	16	17	18	19	20	21	22	23	04/0	1	2	3	4	5	6	7	8	9	10	11	12	
FD05	STS	Sleep	Post Sleep	SRMS/SSRMS MRM-1 Unbrth/Dk, EVA2 Prep										Meal	OBSS H/O, FI Rvw		FI	EVA2 Rvw	Pre Sleep/EVA PB		Sleep						
	ISS	Sleep	Pst Slp	D												Xfer			D	Pre Sleep		Sleep					
	ORB ATT											BIAS -XLV -ZVV															
												SSRMS W/O MBS PDGF3, LAB Ris, MT Xlate WS6-8															



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# Standard Open Work



- **STS-132/ISS-ULF4 Flight Rules Annex**
  - Final: approved at JPRCB on 3/30/10
  - PCN-1: targeted for JPRCB on 5/3/10
- **FDF/SODF**
  - Final crew review 5/4/10
  - Final errata, L-1 days
- **Training**
  - Complete STS-132 Ascent/Entry simulations (L-6 days)
  - Complete Flight Director flight specific certifications (ECD 4/22/10)
- **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)
  - Longeron Shadowing Response
- **Finalize Docked Stowage Plan**
  - Plan being coordinated with ESA and JAXA
- **Complete “Road To” Items and Prepack**
  - SSRMS Walkoff to Lab PDGF
  - SPDM relocation to MBS



# STS-132/ULF4 Overview Timeline



## STS-132/ULF4 Overview Timeline (12+0+2) Launch May 14, 2010 (GMT 134/18:14:59)

UPDATED 24 FEB 2010

MET		00/0												01/0												02/0												03/0																							
FD	Activity	12	13	14	15	16	17	18	19	20	21	22	23	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
FD01	STS													ASC	Post Insertion	P/TV01 / PGSC S/U	RMS C/O	Pre Sleep	Sleep																																										
	ORB ATT																									-ZLV -XVW																																			
		NC1^																																																											
FD02	STS	Sleep		Post Sleep		OBSS Unbrth/Srvy-Stbd, Nose				Meal	OBSS Survey Port	OBSS Berth	RNDZ Tools C/O	Pre Sleep		Sleep																																													
	ORB ATT	-ZLV -XVW				EMU C/O & Xfer Prep				Inspection Attitudes						-ZLV -XVW																																													
		NC2^												NC3^																																															
FD03	STS	Sleep		Pst Slp	ISS RNDZ				Dock	Hatch	Hello	EVA Xfers/Prep, ICC Unbrth/Instl POA		EVA1 Rvw	Pre Sleep/EVA PB		Sleep																																												
	ORB ATT	-ZLV -XVW		Dump	RNDZ								Pre Sleep		Sleep																																														
		Water Dump^				NH^ NC4^				TI^		Dock 1/21:09^		MT Xlate WS4-6, SSRMS W/O MBS PDGF3, LAB RIs																																															
FD04	STS	Sleep		Pst Slp	EVA Prep/Cmpout				EVA 1-SGANT/SGANT Boom Instl, EOTP				Pst EVA	Pre Sleep		Sleep																																													
	ORB ATT	-ZLV -XVW		EVA Prep/Cmpout				SSRMS EVA Support						Pre Sleep		Sleep																																													
		BIAS -XLV -ZVW																																																											
		SSRMS W/O LAB, PDGF3 RIs																																																											

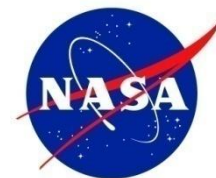


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# STS-132/ULF4 Overview Timeline



	MET	12	13	14	15	16	17	18	19	20	21	22	23	04/0	1	2	3	4	5	6	7	8	9	10	11	12	
FD05	STS	Sleep	Post Sleep	SRMS/SSRMS MRM-1 Unbrth/Dk, EVA2 Prep										Meal	OBSS H/O, FI Rvw	FI	EVA2	Pre Sleep/EVA PB		Sleep							
	ISS	Sleep	Pst Slp	D													Xfer	Rvw	D	Pre Sleep	Sleep						
	ORB ATT															BIAS -XLV -ZVV											

SSRMS W/O MBS PDGF3, LAB Ris, MT Xlate WS6-8

	MET	12	13	14	15	16	17	18	19	20	21	22	23	05/0	1	2	3	4	5	6	7	8	9	10	11	12
FD06	STS	Sleep	Pst Slp	EVA Prep/Cmpout			EVA 2-4 P6 Batt R&R						Pst EVA	Pre Sleep		Sleep										
	ISS	Sleep	Pst Slp	DPC	ICC Rmv POA	SSRMS EVA Support						Pst EVA	Pre Sleep	Sleep												
	ORB ATT															BIAS -XLV -ZVV										

	MET	12	13	14	15	16	17	18	19	20	21	22	23	06/0	1	2	3	4	5	6	7	8	9	10	11	12
FD07	STS	Slp	Post Sleep		EVA3 Prep/Xfer						Meal	Joint Off Duty (4 hr), PFCs				EVA3	Pre Sleep/EVA PB		Sleep							
	ISS	Slp	Pst Slp	DPC	MRM-1 Lk Ck/Air Smpl									Rvw	D	Pre Sleep	Sleep									
	ORB ATT	BIAS -XLV -ZVV			Water Dump														BIAS -XLV -ZVV							

Water Dump^

	MET	12	13	14	15	16	17	18	19	20	21	22	23	07/0	1	2	3	4	5	6	7	8	9	10	11	12
FD08	STS	Slp	Pst Slp	EVA Prep/Cmpout			EVA 3-2 P6 Batt R&R, PDGF3 Rlct						Pst EVA	Pre Sleep		Sleep										
	ISS	Slp	Pst Slp	DPC	SSRMS EVA Support						ICC to POA	Pre Sleep	Sleep													
	ORB ATT															BIAS -XLV -ZVV										

MT Xlate WS8-6, SSRMS W/O LAB, PDGF3 Ris, MT Xlate WS6-4

	MET	12	13	14	15	16	17	18	19	20	21	22	23	08/0	1	2	3	4	5	6	7	8	9	10	11	12
FD09	STS	S	Post Sleep		SSRMS ICC Brth PLB, SPINAL, MDDK & EVA Xfers						Meal	MDDK	Joint Off Duty (2:45 hr)		Pre Sleep		Sleep							P		
	ISS	S	Pst Slp	DPC								Xfer			Pre Sleep	Sleep							P			
	ORB ATT															BIAS -XLV -ZVV										



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# STS-132/ULF4 Overview Timeline



	MET	12	13	14	15	16	17	18	19	20	21	22	23	09/0	1	2	3	4	5	6	7	8	9	10	11	12
FD10	STS	Pst Slp		O2/N2 Xfer T/D	RNDZ Tool,CL Cam	Crew Conf/ Photo	Meal	Hatch CIs & Leak Ck	Mnvr Undk/ UNDOCK	Flyaround/ Sep	Pre Sleep			Sleep										P		
	ISS	PS	D		DCB Pack						Pre Sleep			Sleep										P		
	ORB ATT	BIAS -XLV -ZVV										UNDK/FLYAROUND/SEP			-ZLV -XVV											

Undk 8/22:16^

	MET	12	13	14	15	16	17	18	19	20	21	22	23	10/0	1	2	3	4	5	6	7	8	9	10	11	12
FD11	STS	Post Sleep		Dump	OBSS Unbrth/Srvy-Stbd, Nose				Meal	OBSS Survey Port	OBSS Berth	Pre Sleep			Sleep										P	
	ORB ATT	-ZLV -XVV		Dump	Post ISS EVA Ops				Cabin Stow							-ZLV -XVV										

^Waste Dump

	MET	12	13	14	15	16	17	18	19	20	21	22	23	11/0	1	2	3	4	5	6	7	8	9	10	11	12	
FD12	STS	Post Sleep		FCS C/O, RCS HF	D/O Brief, Cabin Stow				Meal	Cabin Stow, L-1 Comm Cks, Water Dumps				Pre Sleep			Sleep										P
	ORB ATT	-ZLV -XVV										Dump			-ZLV -XVV												

Water Dump^

	MET	12	13	14	15	16	17	18	19	20	21	22	23	12/0	1	2	3	4	5	6	7	8	9	10	11	12
FD13	STS	Post Sleep		IMU	D/O PREP				LDG																	
	ORB ATT	-ZLV -XVV		IMU	-XSI	COMM		Entry																		

KSC D/O TIG -11/18:41^

KSC Landing 11/19:47^



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# Generic Soyuz Docking Timeline



PET	-3:30	-3:00	-2:00	-1:00	0:00	1:00	2:00	3:00	4:00								
ISS CDR (Kotev)	POSTSLEEP	DPC	MPEG2 C/O	POSTSLEEP	HAM & WIND	PW	CTTC CFG	ISS-TK-RNDZ-MON (Soyuz Appr. Monitoring)	CTTC DCFG	PAO S/U	PAO	SAFETY BRIEF	MEAL				
FE-5 (Noguchi)	POSTSLEEP	DPC		POSTSLEEP		PW		EXERCISE		EXERCISE	PAO	PAO	SAFETY BRIEF	MEAL			
FE-6 (Creamer)	POSTSLEEP	DPC		POSTSLEEP		PW	P/TV CNFG	BPTK-TE		BPTK-TE	P/TV RMV	PAO S/U	PAO	PAO	RWS CBL	SAFETY BRIEF	MEAL
FE-1 (Skvortsov)	TK-22-БД-OPER (Soyuz Operations)						Soyuz Leak Check				PAO	PAO	CLIMP INSTL	SAFETY BRIEF	MEAL		
FE-2 (Caldwell)	TK-22-БД-OPER (Soyuz Operations)						Soyuz Leak Check				PAO	PAO		SAFETY BRIEF	MEAL		
FE-3 (Kornienko)	TK-22-БД-OPER (Soyuz Operations)						Soyuz Leak Check				PAO	PAO		SAFETY BRIEF	MEAL		
STS CREW (ALL)					SHUTTLE SAFING						SHUTTLE RECONFIG		PAO	PAO	SAFETY BRIEF	MEAL	

DOCK  
(typically ~3.5 to 4 hours after crew wake)

HATCH OPEN

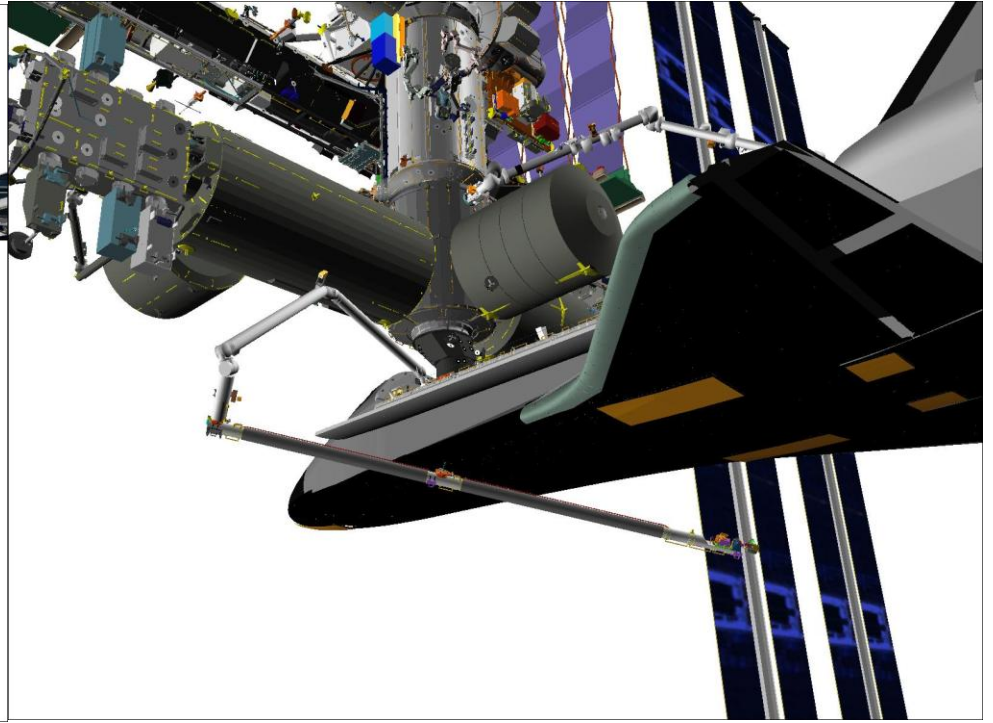
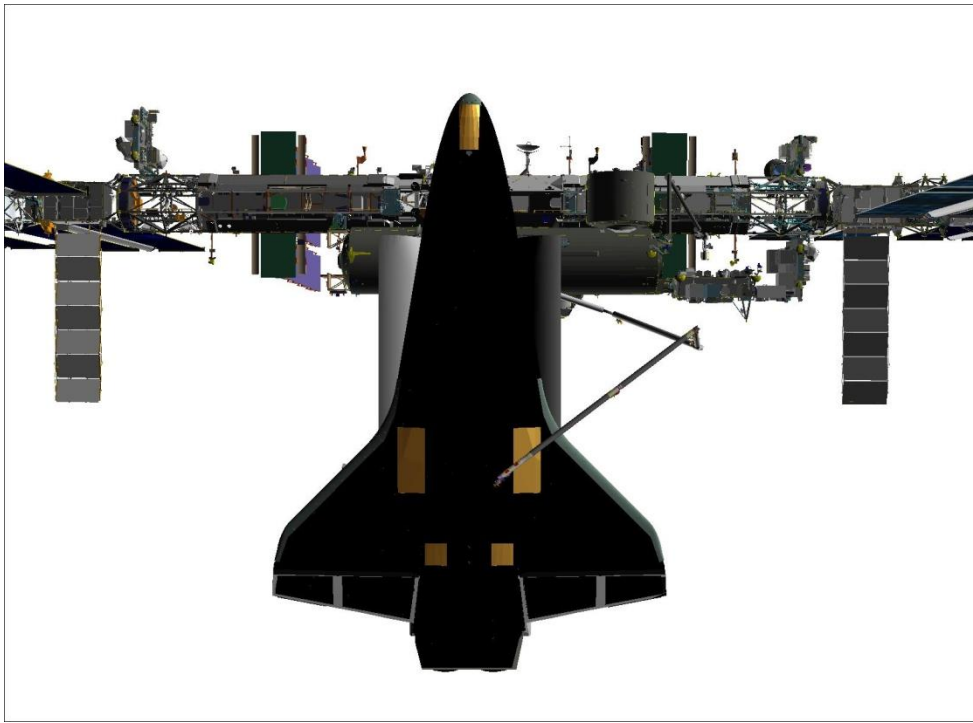
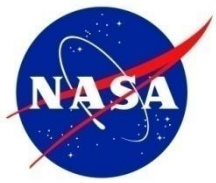
5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	
SAFETY HANDOVER	EXERCISE, ROUTINE MAINTENANCE, POST DOCK CLOSEOUT, ETC			PREP WORK	DPC	PRESLEEP		SLEEP...	
SAFETY HANDOVER				EXERCISE	PREP WORK	DPC	PRESLEEP		SLEEP...
SAFETY HANDOVER	SODF BOOK U/D		EXERCISE		PREP WORK	DPC	PRESLEEP		SLEEP...
SAFETY HANDOVER	SOYUZ POST-DOCK, CRITICAL PAYLOAD TRANSFER, ETC				PREP WORK	DPC	PRESLEEP		SLEEP...
SAFETY HANDOVER					PREP WORK	DPC	PRESLEEP		SLEEP...
SAFETY HANDOVER	SOYUZ POST-DOCK, SUIT DRYING, CRITICAL PAYLOAD TRANSFER, ETC				PREP WORK	DPC	PRESLEEP		SLEEP...



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# SRMS/OBSS Safing for Dual Docked Operations



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