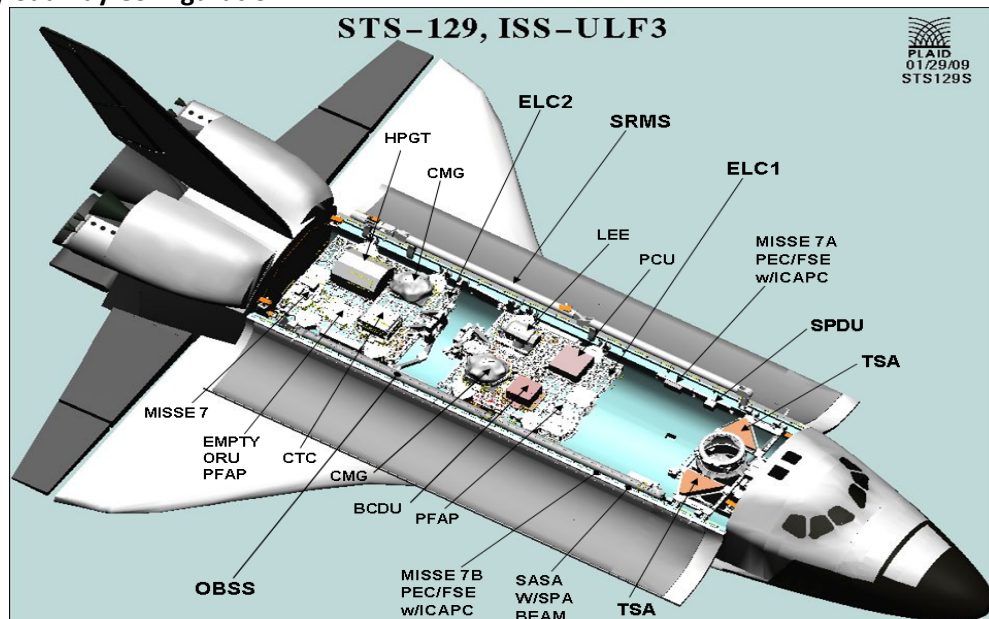


# STS-129/ULF3 Flight Plan Walkthrough

## Generic Items:

- **Launch:** November 16, 2009 @ 19:28:08 GMT (~1:28 pm CST)
- **Orbiter:** OV-104 (Atlantis) non-SSPTS
- **Mission Duration:** 11+1+2
- **Crew:**
  - Shuttle:
    - CDR – Charles “Scorch” Hobaugh
    - PLT- Barry “Butch” Wilmore
    - MS1- Leland Melvin
    - MS2- Randy “Komrade” Bresnik
    - MS3- Mike Foreman
    - MS4- Bobby Satcher
  - ISS Crew:
    - E21 CDR – Frank DeWinne
    - E21 FE1 – Maxim Suraev
    - E21 FE2 – Nicole Stott (dn)
    - E21 FE3 – Roman Romanenko
    - E21 FE4 – Bob Thirsk
    - E21 FE5 – Jeff Williams
- **Payload Bay Configuration:**



- **EVAs:**
  - 3 EVAs scheduled on FDs 4, 6, and 8.
  - All nominal EVAs are performed using the ISS airlock and the campout prebreathe protocol.
  - EVAs 1, 2, and 3 will use LiOH.
  - All EVA tool battery charging is performed using a Battery Stowage Assembly (BSA) charger. BSA charging for REBA, helmet light, and PGT batteries takes ~12 hours while EMU battery charging takes ~20 hours. All non-EMU BSA inits are done on EVA days toward the end of Post EVA with the terms scheduled the following day. EMU battery inits require a 4-hour cool down and thus are scheduled the day after EVAs.
  - The table below lists the EVA crew assignments for all EVAs.

| Task         | EVA 1    | EVA 2    | EVA 3    |
|--------------|----------|----------|----------|
| EV1          | MS3      | MS3      | MS4      |
| EV2          | MS4      | MS2      | MS2      |
| Suit IV      | PLT/FE-2 | PLT/FE-2 | PLT/FE-2 |
| Task IV      | MS2      | MS4      | MS3      |
| P/TV07 Suppt | CDR      | CDR      | CDR      |

- **Pre/Post Sleep Aggregates (based on Final Flight Plan dated 10/20/09):**

| Crew | FD1   | FD2   | FD3   | FD4   | FD5   | FD6   | FD7   | FD8   | FD9   | FD10  | FD11  | FD12  |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| CDR  | 01:35 | 05:30 | 03:20 | 06:05 | 05:15 | 05:05 | 05:00 | 05:35 | 05:25 | 05:05 | 06:00 | 02:20 |
| PLT  | 00:40 | 05:00 | 03:15 | 03:50 | 05:15 | 03:45 | 05:00 | 03:45 | 05:15 | 05:15 | 06:00 | 02:25 |
| MS1  | 01:05 | 05:20 | 03:40 | 05:00 | 05:00 | 05:15 | 05:00 | 05:00 | 05:00 | 05:10 | 05:05 | 02:55 |
| MS2  | 01:20 | 06:00 | 05:35 | 05:50 | 05:00 | 03:10 | 05:00 | 03:10 | 05:15 | 05:15 | 05:55 | 03:00 |
| MS3  | 00:30 | 05:40 | 05:00 | 02:55 | 05:05 | 03:10 | 05:45 | 05:50 | 05:15 | 05:40 | 05:30 | 03:00 |
| MS4  | 00:40 | 05:30 | 05:00 | 03:10 | 05:35 | 05:40 | 05:00 | 03:10 | 05:05 | 05:35 | 06:15 | 02:40 |
| MS5  | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 00:00 | 03:00 | 05:40 | 05:40 | 03:00 |

- **PMCs:** (STS crew) are scheduled in pre-sleep and on the morning of EVAs and performed via A/G. The FD06 pre-sleep PMC is scheduled via OCA to verify NetMeeting operation prior to the PFCs on FD7.
- **Generic Transfer**
  - 34 hrs are required to/from the shuttle middeck. The flight plan currently has **XX:XX** hrs scheduled.
  - Transfer Briefs are scheduled near Pre-sleep on days when transfer is scheduled.
- **Exercise Constraints:**
  - Per our agreement with DO5 (and approval from GJOP), the owner of the activity is responsible for providing inputs to exercise constraints in the timeline. See below for additional details:
    - No words related to exercise constraints will be provided for the Leiderhosen and Daily Summary (all info will be embedded in timeline/OSTPV). Detailed tables will not be submitted.
    - The owner of the activity driving the exercise constraint should review the timeline and verify the constraints are correct.
    - If changes need to be made to the timeline (related to exercise constraints), the owner of the constraint should submit an Internal Note to FAO/OPS PLAN with the change. Also, the owner should add a reference to this IN#### in the OPS PLAN daily roll up FN. FAO/OPS PLAN will ensure that the Summary, Detail, and Exe Notes all have the same words (will work wording depending on length and space avail).
    - Crew will see I bar in Summary, Detail, and MCC band, along with specific words on what activity is driving the constraint. Crew will also see Exercise Constraint in the detail pages underneath the activity name and in the exec note in OSTPV.
    - Questions related to exercise constraints should go to OPS PLAN/FAO as a starting point, since not all constraints are driven by docked loads.
    - ACO will continue to review the timeline and check exercise constraints against docked loads, but primary responsibility for this will be on the discipline creating the constraint.

- See table below for exercise constraints. Also, reference FR ULF3\_C2-74 for more details.

| FD  | Event                              | No ARED Exercise | No Un-Isolated Exercise (Erg/Velo/HC-1) | No Exercise | Notes   |
|---|------------------------------------|------------------|---|-------------|---|
| <b>Note: Red boxes indicate the applicable constraint for the Event.</b><br><b>This table is for a high-level, preflight summary only. Constraints are always reflected in the FLT PLN and OSTPV.</b> |                                    |                  |   |             |   |
| 3   | <b>RNDZ/Dock</b>                   |                  |   |             |   |
|   | RS Maneuver to Docking Attitude    |                  |   |             | During RS MNVR to docking attitude  |
|   | Docking                            |                  |   |             | During Docking  |
|   | VRCS to USTO Handover              |                  |   |             | During VRCS to USTO H/O after docking   |
|   | SRMS-UNBERTH-ELC1                  |                  |   |             | First 15 min of Unberth. Crew is GO for Exercise once at HOVER position.                  |
|   | SSRMS-ELC1-GRPL                    |                  |   |             | While both arms are grappled to same payload (ELC1)                                       |
|   | RMS-ELC1-RELEASE                   |                  |   |             |   |
|   | SSRMS-MNVR-INSTALL (step 8)        |                  |   |             | During Last ~5-10 min of SSRMS MNVR To Install and at the Install Position (ELC1-Install) |
|   | ELC1-INSTALL                       |                  |   |             |   |
|   | MT-Translation-WS4                 |                  |   |             | MT Translate executed by MCC-H during crew sleep on FN3.                                  |
| 4   | <b>EVA 1</b>                       |                  |   |             |   |
|   | SASA Install (Z1 WIF11)            |                  |   |             |   |
| 5   | <b>Focused Inspection</b>          |                  |   |             |   |
|   | RMS GRPL OBSS H/O-FI               |                  |   |             | While both arms are grappled to same payload (OBSS)                                       |
|   | SSRMS-OBSS-RLS-FI                  |                  |   |             |   |
|   | FOCUSED INSPECTION                 |                  |   |             | During LCS active imaging   |
|   | SSRMS-OBSS-GRPL H/O                |                  |   |             | While both arms are grappled to same payload (OBSS)                                       |
|   | RMS-OBSS-UNGRPL                    |                  |   |             |   |
|   | MT-Translation-WS2                 |                  |   |             | MT Translate executed by MCC-H during crew sleep on FN5.                                  |
| 6   | <b>EVA 2</b>                       |                  |   |             |   |
|   | SRMS-UNBERTH-ELC2                  |                  |   |             | First 15 min of Unberth. Crew is GO for Exercise once at HOVER position.                  |
|   | SSRMS-ELC2-GRPL                    |                  |   |             | While both arms are grappled to same payload (ELC2)                                       |
|   | RMS-ELC2-RELEASE                   |                  |   |             |   |
|   | SSRMS-MNVR-INSTALL (step 7)        |                  |   |             | During Last ~5-10 min of SSRMS MNVR To Install and at the Install Position (ELC2-Install) |
|   | ELC2-INSTALL                       |                  |   |             |   |
|   | S3 Nadir PAS Deploy                |                  |   |             | During S3 PAS Deploy  |
|   | MT-Translation-WS3                 |                  |   |             | MT Translate executed by MCC-H during crew sleep on FN6.                                  |
| 7   | <b>Off-Duty</b>                    |                  |   |             |   |
|   |                                    |                  |   |             |   |
|   |                                    |                  |   |             |   |
|   |                                    |                  |   |             |   |
| 8   | <b>EVA 3</b>                       |                  |   |             |   |
|   | HPGT Removal/Install               |                  |   |             |   |
|   | S3UI PAS Deploy                    |                  |   |             | During S3UI PAS Deploy  |
|   | MT-Translation-WS4                 |                  |   |             | MT Translate executed by MCC-H during crew sleep on FN8.                                  |
| 9   | <b>Hatch Close</b>                 |                  |   |             |   |
|   | Reboost                            |                  |   |             | If PRCS Reboost, ISS Hardmounted Exercise is prohibited.                                  |
|   | VRCS to USTO Handover              |                  |   |             | During the handover VRCS to USTO post ODS Vestibule Depress                               |
| 10  | <b>Undock</b>                      |                  |   |             |   |
|   | Undocking                          |                  |   |             | During undocking  |
|   | RS Maneuver to +XVV ULF3 Stage TEA |                  |   |             | During the RS maneuver after undocking  |
| ***Note: The following FRs are represented in this constraints matrix: ULF3_C2-74,  |                                    |                  |   |             |   |

- **Maneuvers/Attitude Handovers:**
  - Direct VRCS to MM H/O (Data below from Lead GNC/Kara Pohlkamp):
    - This new attitude control handover will be used on this flight on FD7 and FD9. We will go directly from Orbiter VRCS control to ISS Momentum Management without going through USTO.
    - This attitude control method was DTO'd on STS-118 and STS-120.
    - Handing over directly from VRCS to Momentum Management decreases solar array loading, decreases ISS propellant usage and decreases the time it takes to get to momentum management.
    - Handover will be performed with CMG Desats enabled to ensure a LOAC will not occur if the rates are not as we expect.
    - Handover not certified for direct handover during robotics or EVAs due to constraints with solar array analysis that was performed for this mission. For robotic and EVA activities, we'll follow the standard Orbiter VRCS to USTO to Momentum Management sequence.
    - New method will be used after FD7 water dump and FD9 Reboost.
    - New Handover Sequence:
      - Orbiter will maneuver to TEA (from Water Dump or Reboost)
        - To help reduce attitude errors, UNIV PTG inputs for this maneuver will have decimal places to take into account a more accurate offset between the Orbiter and ISS.
      - Once in attitude, the CMGs will be positioned. When ISS is ready, we'll collapse the Shuttle dead band by going to DAP B13. The timeline callout is "When ISS is GO for dead band collapse, DAP: B13".
      - The dead band collapse will take ~10 minutes. When the rates look good and ISS is ready, Shuttle will go FREE. The timeline callout is "When ISS is GO for att. Control, DAP: FREE". We'll then reload DAP A12 (DAP: A12/FREE/VERN) so we're ready for a LOAC or to takeover attitude control
  - **ODS Leak Check:** Shuttle attitude control is NOT required during the ODS vestibule and PMA2 leak checks. ODS Leak check will be performed on USTO control.
- **IMU Star of Opportunity Aligns** are scheduled daily.
- **Robotics:**
  - Several crewmembers are robotics-certified and have been assigned to specific tasks. CDR, PLT, MS1, MS4 are scheduled for nominal SSRMS ops (CDR and MS4 performs SSRMS ops for Focused Inspection). CDR, PLT, MS1, and MS2 are scheduled for nominal SRMS ops.
  - SRMS is left powered from FD1 through FD10.
  - Manipulator Control Interface Unit (MCIU) filter screen checks are scheduled daily, except on days when standard Filter Cleaning is scheduled. MCIU filter checks should not be scheduled during SRMS ops. Scheduling Filter Cleaning during SRMS ops should not be an issue.
  - See table below for SRMS/SSRMS tasks for this mission.

**Table ULF3-7: Flight ULF3 RMS Tasks**

| RMS Task  | RMS Used | SSRMS Base |             | MT Worksite |
|---|----------|------------|-------------|-------------|
| ELC1 Unberth & Handoff to SSRMS                 | SRMS     | A          | MBS PDGF #1 | 7           |
| ELC1 Installation                               | SSRMS    | A          | MBS PDGF #1 | 7           |
| MT Translation to WS4                           | MT       | A          | MBS PDGF #1 | 4           |
| EVA1 – EVA/EVR SASA Retrieval & Install         | SSRMS    | A          | MBS PDGF #1 | 4           |
| EVA1 – EVA/EVR EE Lube Operations               | SSRMS    | A          | MBS PDGF #1 | 4           |
| SSRMS Walkoff to Node 2 PDGF                    | SSRMS    | B          | Node 2 PDGF | 4           |
| OBSS Unberth & Handoff to SRMS                  | SSRMS    | B          | Node 2 PDGF | 4           |
| Focused Inspection Operations                   | SRMS     | B          | Node 2 PDGF | 4           |
| Maneuver to Focused Inspection Viewing Position | SSRMS    | B          | Node 2 PDGF | 4           |
| OBSS Handoff to SSRMS                           | SRMS     | B          | Node 2 PDGF | 4           |
| OBSS Berthing                                   | SSRMS    | B          | Node 2 PDGF | 4           |
| SSRMS Walkoff to MBS PDGF #1                    | SSRMS    | A          | MBS PDGF #1 | 4           |
| MT Translation to WS2                           | MT       | A          | MBS PDGF #1 | 2           |
| SSRMS Walkoff to MBS PDGF #2                    | SSRMS    | B          | MBS PDGF #2 | 2           |
| ELC2 Unberth & Handoff to SSRMS                 | SRMS     | B          | MBS PDGF #2 | 2           |
| ELC2 Installation                               | SSRMS    | B          | MBS PDGF #2 | 2           |
| SSRMS Walkoff to MBS PDGF #1                    | SSRMS    | A          | MBS PDGF #1 | 2           |
| MT Translation to WS3                           | MT       | A          | MBS PDGF #1 | 3           |
| EVA3 – HPGT Retrieval & Install                 | SSRMS    | A          | MBS PDGF #1 | 3           |

- **General EECOM Notes:**

- A total of 13 CWCs are filled and transferred to ISS. 3 PWRs from ISS will be filled and transferred back to ISS. CWCs and PWRs cannot be filled at the same time since EECOM would not be able to tell how much water is in each. PWR fills cannot occur during supply nozzle dumps. A cue card listing all the water fill requirements is uplinked FD2.
- The water team doesn't want any CWC-I fills for this mission. All CWC fills will be regular.
- Nozzle dumps are scheduled on FD3 (pre-docking), FD7 (docked), FD10 (post undock), and FD11 (EOM-1).
- While on Momentum Management, FES Dumps should not be performed during the following periods.
  - Any time there is a requirement that thrusters are to be inhibited for a planned activity.
  - Within two orbits after momentum management startup unless desats are enabled.
  - Any time there are less than 3 CMGs on line unless desats are enabled.
  - From 2 orbits prior to the start of ELC1/2 Installation through the completion of ELC1/2.
  - NOTE: There's no plans to perform FES dumps during mated operations.
  - Additional FES dump constraints are documented in FR ULF3\_C2-77 (see rule for details).

- **OCA 48Mbps Downlink and SWRDFSH:**

- SWRDFSH allows OCA to downlink at the higher 48Mbps rate vs 2Mbps rate limited by the KFX software. There's no crew interface and should be no impact to the crew.
- In order to take advantage of the 48Mbps downlink, we need the crew to reconfigure the OCA downlink rate (published procedure in ORB OPS C/L).
- High-speed downlink operations (48Mbps) will occur on PAYLOAD MAX channel 3. Crew will set the DTV MUX switch to "BYPFR" and set it back to "ACT" when crew de-configure OCA downlink rate. Note: Using PAYLOAD MAX for OCA prevents DTV and HDTV downlinks.
- Only scheduled to use PAYLOAD MAX on FN2 and FN10 to bring down inspection imagery.
- **PAO Events**
  - All PAO events during the docked timeframe will be performed on ISS and utilize ISS KU assets.
  - The table below list the PAO Events scheduled for this mission.

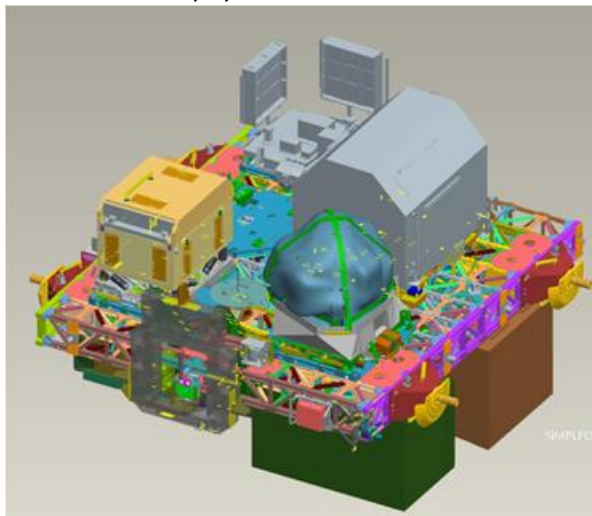
| Flight Day | Crew           | Event                            |
|------------|----------------|----------------------------------|
| FD05       | CDR, PLT       |                                  |
| FD05       | CDR, MS1, MS4  |                                  |
| FD07       | PLT, MS1, FE-2 | Tennessee Tech Educational Event |
| FD07       | MS1, MS4, FE-2 |                                  |
| FD09       | All            | Crew Conference                  |
| FD11       | All            |                                  |

- **Crew Requested Activities**
  - Crew Choice Downlinks - not hard scheduled in the timeline. We'll uplink a crew choice downlink msg with KU times during pre sleep every day. Crew choice will be downlinked via HD. **Note:** Must be scheduled over TDRS East or West. Also, need to make sure ISS is not using HD.
  - MS1/Leland Melvin may call down with a video for us to downlink. The video is for the "Richmond Game" on Nov. 21st. PAO informed him that he'll have to downlink on FD2 to give them time to turn it around.
  - MS2/Randy Bresnik may call down with words (or something) on the birth of his daughter (maybe...don't know for sure). His wife is expecting and is due Nov. 20th.
  - MS4/Bobby Satcher is flying an "All Star Jersey" (east of one side, west on other) and he may have a video for us to downlink sometime during the flight.
  - On Thanksgiving day (Nov. 26th or Nov. 25th), the crew may request to downlink a "Happy Thanksgiving Day" message.
- **ELC 1 and ELC2 (Expressed Logistics Carrier):**
  - **ELC 1 (See Figure 1 below)**
    - Flown in shuttle bays 5-8
    - Transferred to P3 lower Unpressurized Cargo Carrier Attachment System (UCCAS)
    - Carrying:
      - Ammonia Tank Assembly (ATA) #1
      - Flight Releasable Attachment Mechanism (FRAM) ORUs
      - Control Moment Gyro (CMG) #1
      - Nitrogen Tank Assembly (NTA) #1
      - Pump Module (PM) #4
      - SSRMS Latching End Effector (LEE)
      - Plasma Contactor Unit (PCU)
      - Two empty Payload Passive FRAMs (PFRAM)
  - **Note:** ELC 1 taken out of payload bay first. If ELC1 Unberth is unsuccessful, ELC2 will remain in the PLB due to orbiter entry CG constraints and anytime deorbit requirements. [Ref. ULF3\_C2-82]



**Figure 1: ELC1**

- **ELC2 (See Figure 2 below)**
  - Flown up in shuttle bays 10-13
  - Transferred to S3 upper outboard PAS
  - Carrying:
    - Directed mounted High Pressure Gas Tank (HPGT)
    - Flight Releasable Attachment Mechanism (FRAM) ORUs:
    - Mobile Transporter/Trailing Umbilical System (MT/TUS) Reel Assembly (RA)
    - CMG #2
    - NTA #2
    - PM #3
    - Cargo Transport Carrier (CTC) containing:
      - 7 Type V RPCMs
      - 1 Type II RPCMs
    - 1 empty Payload PFRAM and 1 empty PFRAM
    - MISSE-7 attach hardware/adaptor plates and one empty FRAM for future payload use

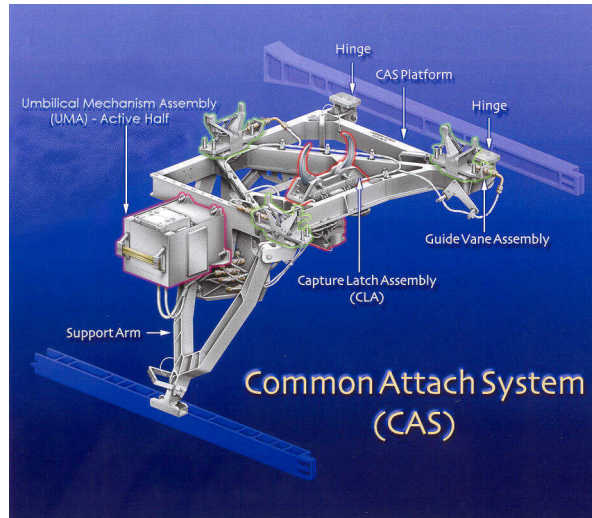


**Figure 2: ELC2**

- **CAS (Common Attach System)**
  - The Common Attach System (CAS) is used on ISS to support ELC1 and ELC2 by providing a remotely operated mating and structural attachment point with connections for power, data, and High Rate Data Link (HRDL). There are two

types of CAS: the Unpressurized Cargo Carrier Attachment System (UCCAS) and the Payload Attachment System (PAS).

- A total of six CAS sites are available, with two UCCAS sites on the Port 3 (P3) Integrated Truss Segment (ITS) and four PAS sites on the Starboard 3 (S3) ITS. The UCCAS and PAS are identical except that the UCCAS contain a redundant Integrated Motor Controller Assembly (IMCA) for both the Capture Latch Assembly (CLA) and Umbilical Mechanism Assembly (UMA).



- **Secondary/Transfer Payloads:**

- **NLP (National Lab Pathfinder) Vaccine-6**

- NLP is an un-powered payload, flown in a single Middeck locker.
- NLP-Vaccine-6 includes 8 Group Activation Packs (GAP) that are stowed at ambient temperature

- **NLP (Cells-2)**

- NLP-Cells-2 includes 16 Group Activation Packs (GAP) that are incubated at 37 deg C inside CGBA-2 in the middeck.
- CGBA-2 will be powered prior to launch and remain powered through landing except when accessed for NLP-Cells-2 operations.
- CGBA-2 has a nominal power draw of 65 Watts, with peaks of 130W for up to an hour following CGBA-2 access for NLP-Cells-2 operations.
- CGBA-2 status checks are included in the Middeck Status Check section.
- Power interruptions must be limited to 30 minutes.

| NLP GAP Activity |                 |                |                   |               |                |                    |                     |          |
|------------------|-----------------|----------------|-------------------|---------------|----------------|--------------------|---------------------|----------|
| FD               | Ambient (MA16D) |                |                   | CGBA (MF71E)  |                |                    |                     | Duration |
|                  | Activate GAPS   | Terminate GAPS | Move GAPS to CGBA | Activate GAPS | Terminate GAPS | Move GAPS to MA16D | Change Temp to (°C) |          |
| 2                | A-H             |                |                   |               |                |                    |                     | 00:15    |
| 4                |                 | A-H            | A-H               | 5-8           |                | 5-8, 13-16         |                     | 00:30    |
| 9                | 15-16           |                |                   |               |                |                    |                     | 00:10    |
| 10               |                 | 5-8, 15-16     | 5-8, 13-16        | 1-4, 9-14     |                | A-H                | 37                  | 00:35    |
| 11               |                 |                |                   |               | 3-4, 11-14     |                    | 6                   | 00:20    |

- **ABRS (Advanced Biological Research Facility)**
  - Plant Science
    - Two plant growth chambers
    - APEX-Cambium (CSA) and TAGES (NASA) experiments
  - ABRs is powered in the Middeck from launch to transfer
  - When ABRs is powered up on ISS during the transfer procedure, it is powered up in ascent mode. ABRs cannot be powered in ascent mode for more than 30 minutes on ISS; the XFER & P/U activity should be followed immediately by the ISS INIT ACTIVATION activity if possible.
  - A twice daily status check for ABRs/APEX-Cambium in the Middeck is included in the Middeck Status Check.
  - Power interruptions must be limited to 30 minutes when ABRs is in middeck.
  - Transferred on FD5 (MS1/FE-4). Due to the timing between ground commanding and the initial power up, it's critical to make sure ABRs is in the correct configuration within 30 min of powering it up on ISS. If this does not happen, the unit will overheat very quickly and degrade science.
  - If the front panel status LED is illuminated amber while ABRs is on shuttle, the crew must place ABRs in a science safe mode. The crew must perform ABRs Safing procedure found in ASSY OPS book. This procedure has the crew take a PGSC off the network and connect (using a RJ45 cable) the PGSC to ABRs. The crew will then launch the ABRs application and "safe" the experiment. This procedure should take ~10-15 min to execute.
  - On FD5, MS1 will retrieve an ABRs sample stowed in the GLACIER. Sample is needed before FE-4/Thirsk performs ABRs experiment on FD6.
- **GLACIER**
  - Glacier is a double Middeck Locker freezer used in conjunction with other ISS/middeck experiments. The primary function of Glacier is to provide cryogenic preservation of samples from experiment on-orbit. Glacier is designed to support experiments that require thermal control between +4° and -160° C.
  - Glacier will launch unpowered in the Middeck, and be powered up at least two days prior to sample insertion. Glacier is powered up on FD7 from the Middeck Utility Panel (MUP).
  - Power interruptions must be limited to 120 minutes when samples are inside -95C Glacier.
  - Glacier twice daily status checks while on Shuttle are included in the Middeck Status Check section. The desired separation of the status checks are 8 to 12 hours.
  - MS1 and MS3 are trained for Glacier.
  - The following table outlines the Glacier activities required for this mission.

| Activity                             | Flight Day | Crew     | Duration | Scheduling Info   |
|--------------------------------------|------------|----------|----------|---|
| <i>Shuttle Crew Activities</i>       |            |          |          |   |
| GLACIER SAMPLE RETRIEVE              | 5          | MS1      | 00:20    | Schedule prior to ABRs Harvest activities on FD5 on FE-4/Thirsk. One of the ABRs Samples was stowed in GLACIER and must be retrieved before FD6. Crew performs step 1 of GLACIER UNPACK AND STOW procedure.                     |
| GLACIER POWERUP                      | 7          | MS1      | 00:10    | Schedule powerup ~48hrs prior to Sample Transfer to GLACIER. Crew performs step 2 of GLACIER UNPACK AND STOW procedure  |
| GLACIER STS SET POINT                | 8          | MS1      | 00:10    | Schedule at least 24hrs prior to sample insertion.  |
| GLACIER RECORD QUICK DIAGNOSTIC DATA | 9          | MS1      | 00:05    | Schedule 1 hour prior to MELFI/GLACIER SAMPLE TRANSFER to check and record health and status of specific temperature data prior to sample insertion. The FD9 morning GLACIER STATUS CHECK will be replaced with this procedure. |
| SAMPLE TRANSFER REVIEW               | 9          | MS1/FE-5 | 00:15    | Schedule prior to MELFI/GLACIER SAMPLE TRANSFER to review transfer procedure.   |
| MELFI/GLACIER SAMPLE TRANSFER        | 9          | MS1/FE-5 | 00:30    | Schedule after RAD SILK experiment is transferred to MELFI. RAD SILK MELFI transfer is currently scheduled on FD8 (ISS CDR).  |

|                                      |   |     |       |  |
|--------------------------------------|---|-----|-------|--|
| GLACIER RECORD QUICK DIAGNOSTIC DATA | 9 | MS1 | 00:05 | Schedule 1 hour after MELFI/GLACIER SAMPLE TRANSFER to check and record health and status of specific temperature data after sample insertion.   |
| GLACIER PHOTO/VIDEO                  | 8 | MS1 | 00:15 | Schedule one performance after powerup and prior to sample insertion. Crew takes video and photo of GLACIER in the middeck prior to any sample insertions to verify on-orbit configuration.  |
| GLACIER PHOTO/VIDEO                  | 9 | PLT | 00:15 | Schedule during any crew-tended GLACIER activity in the middeck. Another crewmember takes video and/or Photo of another crewmember performing an activity at the GLACIER (sample insertion/removal, status checks, etc.). Both video and photos are desired. |

- **MDS (Mouse Drawer System)**
  - Returned on STS-129/ULF3 (Launched on STS-128/17A)
  - Contains 6 mice
  - Transfer to shuttle on FD9 (MS1/FE-2)
  - Power down and transfer must immediately follow MDS-FAC-DECONFIGURE on ISS on FD9. **Must be scheduled within 48 to 24 hours of hatch closure. Requires S-Band for last 10min for voice ; KU-Band for realtime video downlink is highly desired for the first 40min. S-Band for voice for first 40min is highly desired.**
  - Daily status checks to verify health of system and mice. Crew will slide out MDS to check on mice. MS1 and MS5 (FE-2) are trained for MDS.
- **Spinal Elongation**
  - A minimum of 1 session per subject is required as late as possible during docked ops to ensure that maximal spinal elongation has occurred. Schedule data collection sessions back to back for all participating subjects. All spinal activities need to occur on the same crew day.
  - Spinal Elongation measurements should not be taken within one hour after countermeasures (Penguin Suit, EVA, weight lifting, ARED, IRED, TVIS, etc)
  - The latest possible time we could schedule Spinal is on FD5. Also, this mission is not waiting for OCA to downlink the Spinal setup image prior to Spinal operations. This was a crew request to not wait for PI approval.
- **CERISE (JAXA)**
  - This experiment examines RNA interference under microgravity environments and evaluates effects of microgravity on *phosphorylation* proteins and signal transduction concerning muscle fiber formation using *C.elegans*. (hmm! Okay, I completely understand what this experiment is all about...)
  - Crew time
    - 40 minutes/1 ISS – Observation & insert into MELFI
    - 220 minutes/1 ISS – Installation & activation, retrieve
    - 170 minutes/1 ISS – Retrieve & deactivation (stage)
  - Must be transferred before CERISE ops on FD4.
- **On Orbit SDBI's, ESA Questionnaires, DTO's, SDTO's:**
  - **SBDI 1634 (Sleep Short):** PLT and MS4 are scheduled to complete sleep logs at wake-up. The subjects wear Actiwatch activity monitors (watches) throughout the mission.
  - **SBDI 1900 (Integrated Immune):** MS2 and MS4 are scheduled for the saliva samples and blood draws. They provide liquid saliva samples at wake-up every other day starting FD02. Also on FD2 and EOM-1, dry saliva samples are scheduled at wakeup, w/u+30 min, w/u+6hrs, w/u+10hrs, and just prior to sleep. The participants also provide a blood sample on EOM-1. FE-2 (dn) is also scheduled for a similar Integrated Immune experiment. MS1 draws all blood samples, and all samples return on the Shuttle.

|               |             |             |             |             |             |             |             |             |             |             |             |             |
|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>SDBI's</b> | <b>FD01</b> | <b>FD02</b> | <b>FD03</b> | <b>FD04</b> | <b>FD05</b> | <b>FD06</b> | <b>FD07</b> | <b>FD08</b> | <b>FD09</b> | <b>FD10</b> | <b>FD11</b> | <b>FD12</b> |
|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|

|              |     |        |   |   |     |   |     |   |     |   |   |       |      |
|--------------|-----|--------|---|---|-----|---|-----|---|-----|---|---|-------|------|
| SDBI<br>1634 | CDR |        | X | X | X   | X | X   | X | X   | X | X | X     | X    |
|              | PLT |        |   | X | EVA | X | EVA | X | EVA | X | X | X     | X    |
|              | MS1 |        | X | X | X   | X | X   | X | X   | X | X | X     | X    |
|              | MS2 |        | X | X | X   | X | EVA | X | EVA | X | X | X     | X    |
|              | MS4 |        | X | X | EVA | X | X   | X | EVA | X | X | X     | X    |
|              | MS5 |        |   |   |     |   |     |   |     | X | X | X     |      |
| SDBI<br>1900 | MS2 |        | D | L |     | L |     | L |     | L |   | L+D+B |      |
|              | MS4 | Unstow | D | L |     | L |     | L |     | L |   | L+D+B | Stow |
|              | MS5 |        |   |   |     |   |     |   |     |   |   | L+D+B |      |

X=Scheduled; L=Liquid Saliva; D=Dry Saliva; B=Blood Sample

**Red** = Couldn't schedule without violating PSA Aggregates. Note: If time becomes available real-time, please add.

- **DTO 696 (GRAB SAMPLE CONTAINER (GSC) REDESIGN FOR SHUTTLE)**
  - DTO 696 will assist in the development of new hardware to verify air within the Orbiter. The data on air quality is needed to allow assessment of health risks to the crew, allow trending of the vehicle atmosphere for constituents of concern, provide data to assess life support system performance and identify potential new compounds that may be introduced into the vehicle atmosphere from operations. Post-flight analysis provides insight into habitable volume air quality which has been analyzed since early Shuttle missions.
  - On the last flight day, MS3 will unstow equipment, take air samples using the current GSC and take two additional samples using the new GSC.
  - Instructions for use of canister are labeled directly on the GSC.
- **Payload of Opportunities:**
  - **MAUI:** Primary goal is to better understand and model the interaction between spacecraft plumes and the upper atmosphere utilizing telescopes. Observe a sequence of Shuttle PRCS and VRCS burns from AMOS ground site telescopes at various angles-of-attack (AOA)
    - Four PRCS burns at 0°, 45°, 90° and 180° AOA
    - Three VRCS burns at 0°, 45° and 90° AOA
  - **SIMPLEX:** Studies exhaust interactions with the ionosphere utilizing Shuttle OMS burns and collecting data with ground radars & radio telescopes.
    - Data has been collected on 11 past missions. There's minimal science requirements remaining, they include:
      - Arecibo – 1 Day Burn (Prefer Ram directed burn)
      - Millstone Hill – 1 Night Burn (Prefer Ram directed burn)
      - *Kwajalein or Jicamarca – 1 90° Out-of-Plane Burn either day or night (Not mandatory)*
    - Secondary SIMPLEX Science objectives may be captured passively from Alice Springs or Very Large Array
  - **SEITE:** Investigates plasma turbulence utilizing Shuttle OMS burns and collecting data with satellite sensors. Minimum Science objective is to collect data from one Day burn and one Night burn (burns can be on different flights)
    - Perform an OMS burn during a conjunction with a SEITE satellite defined to occur when the satellite is within 300 km range of the Shuttle.
      - C/NOFS (SSC# 32765, Intl. Designator 08017A, 13° inclination)
      - STPSat-1 (SSC# 30775, Intl. Designator 07006D, 35° inclination)
  - **RAMBO-2:** The RAMBO-2 experiment uses two STSS satellites; STSS-1 and STSS-2, to acquire stereo views of Shuttle exhaust plumes providing 3-Dimensional (3-D) information on plume morphology. The STSS satellites are in the same orbit separated at a distance to acquire the 3-D data. Each satellite is equipped with an infrared system consisting of three main components: a wide-view acquisition sensor, a narrow-view tracking sensor, and a signal and data processor subsystem.

- **RAMBO-2 will not be performed during the November launch of STS-129 due to the delayed launch of STSS demonstrator satellite (Launched Sept 25th). The checkout and other activities will not be complete prior to STS-129.**
- **Passive Thermal Requirements for November Launch:**

| EOM Thermal Conditioning PTC Requirement |     |       |       |       |
|--|-----|-------|-------|-------|
| Launch                                   | EOM | EOM+1 | EOM+2 | EOM+3 |
| 11/14                                    | NO  | NO    | NO    | NO    |
| 11/15                                    | NO  | NO    | NO    | YES   |
| 11/16                                    | NO  | NO    | YES   | YES   |
| 11/17                                    | NO  | YES   | YES   | YES   |
| 11/18                                    | YES | YES   | YES   | YES   |
| 11/19                                    | YES | YES   | YES   | YES   |
| 11/20                                    | YES | YES   | YES   | YES   |

#### **FD01 (Ascent, Post Insertion, Setups)**

- **Following Post Insertion (PI)** the standard FD1 activities are scheduled: Aft Controller Checkout, NC1 OMS burn, Group B Power down, Elevon Park, APU Reconfig, GIRA Install, OCAC Setup, Shuttle Emergency Eyewash (SEE) Setup and Tissue Equivalent Proportional Counter (TEPC) Power On. SEE Setup must occur after GIRA Install.
- **RMS:** RMS On-Orbit Init, RMS Pwrup, and RMS Checkout are performed to prepare for FD2 surveys. RMS Pwrup and Checkout must be de-conflicted with the OMS burn. The RMS is parked in pre-cradle overnight (not powered down).
- **PGSC Setup** is performed per the nominal usage chart and a late update will be performed from the ground. All PGSCs and hardware are expected to be set up on FD1 (no additional time is scheduled on FD2). WLES is activated.
- **Ascent Imagery:** ET handheld photos and ET umbilical well photos are downloaded to a PGSC for OCA downlink. The umbilical well photos are downloaded twice per the procedure. ET video is downlink over Ku.
- **Photo/TV:** P/TV01 is the general setup of camera equipment for the mission. The first few steps of the setup procedure are required prior to playing back the ET video. Steps 1-9 are the minimum requirement for inspection.
- **SDBIs:** Actiwatch activity monitors (watches) are donned for SDBI 1634 and Saliva kit is unstowed in preparation for saliva samples on FD2 for SDBI 1900.
- **Transfer Payloads:** Daily middeck status checks are performed for ABRS and CGBA.
- **Bleed Orifice** is installed. This activity was permanently removed from the Pre-sleep procedure and should be hard scheduled on FD1.

#### **FD02 (Inspections, EMU Checkout, RNDZ Prep)**

**RNDZ Burns:** NC2 and NC3 rendezvous burns are planned to allow adequate time for OBSS surveys.

##### **TPS Surveys:**

- All RCC is inspected during the OBSS Starboard Wing, Nose Cap, and Port Wing surveys. The two wing surveys also cover most of areas of the crew cabin. The OMS pod is inspected using a handheld camera to take pictures from the aft flight deck windows.
- The OBSS survey procedures incorporate the use of supplemental IDC images during LDRI scans, thus reducing the likelihood of needing Focused Inspection. The starboard wing survey is scheduled for **1:55**, the nose cap for **0:50**, and the port wing for **2:15**. The OBSS unberth procedure incorporates the LDRI 3D calibration and the starboard survey the flat field calibration. **(Note: Updated Survey durations for STBD and PORT to include OMS POD and T-0 Umbilical survey)**

- o Three crewmembers are required continuously during the surveys, two for SRMS/OBSS ops and one to operate situational awareness cameras and sensors. Only two crewmembers are required during unberthing and berthing operations (non-laser ops).
- o Scans of the entire starboard wing are not easily performed, or are impossible to perform while docked, and so are scheduled first. The surveys are scheduled to continue through the night passes, but the crew may elect to pause if the night time visuals are not sufficient.
- o The LDRI survey attitude requires no sun within a +/-15° field of view (FOV) of the laser bore-sight. Additionally, no sun can be within a 10° half-cone directly behind the instrument; however it is highly desired to keep the sun at a 90° half cone behind the instrument as long as it's not directly behind.
- o The IDC requires no sun within a 10° half cone of the FOV and any infringement will result in the IDC instrument being powered off. The IDC line-of-sight is calibrated to align with the LDRI line-of-sight during scans.
- o Real-time Ku is desired (not required) during the LDRI 3D calibration in OBSS unberth. Each surface scan requires as much real-time Ku as possible to downlink DTV using TDRS E or W (not TDRS Z).
- o Inertial attitudes are scheduled to maximize Ku and to optimize LDRI lighting. Specifically, the wing attitudes put the sun on the wing in the X-Y plane ~60° from the nose, and the nose cap attitude puts the sun on the nose pitched down 30° to avoid sun in the crew's eyes. All maneuvers are scheduled to occur during RMS/OBSS repositioning. If maneuvers are required during the survey, scanning will be paused. VERN/ALT attitude hold is acceptable for LDRI. DAP A14 is loaded per the Unberth procedure and is used throughout the surveys. The attitude maneuvers are choreographed so to not conflict with OBSS/DAP constraints. The maneuver to nose cap is performed during a 10-minute gap between the starboard wing and nose cap surveys. This is because nose jets are inhibited and ALT/tail-only is selected almost immediately into the nose cap survey. The maneuver to port survey is scheduled 10 minutes into the procedure. This is because free drift is selected in step 3.
- o Any video not obtained real-time is downlinked after all surveys are complete. INCO provides LOS times in order to help the crew cue the tapes. A dedicated comm maneuver is scheduled to provide sufficient Ku downlink time. Note that TDRS E or W must be used as TDRS Z does not have the capability for DTV and cannot be used to downlink critical damage video.
- o IDC images obtained during the survey are downlinked via OCA.
- o P/TV08 is set up for the OMS Pod Survey. The OMS pod survey requires daylight, and either -ZLV (Earthshine setting) or -ZSI (Sunlit setting). Note that there is a 3-hour maximum -ZSI limit while undocked.
- o The OBSS berth procedure leaves the SRMS in pre-cradle where it is parked overnight.
- **SRMS:** After OBSS Berth, the SSRMS will grapple ELC1 in preparation for ELC1 install on FD3. This was a crew request to perform this way.
- **W4 Mini-cam Video Downlink:** Video of the window 4 mini-cam will be downlinked as soon as practical. Background: Three mini-cam views have been requested for this flight. The first is the general in cabin camera at window 9 location looking forward during ascent. The second is a program request to set up a mini-cam in window 4 looking forward at the External Tank. The third is looking forward through the pilot's HUD during descent. The FRD request to provide the capability to record and downlink mini-cam video of Window 4 viewing the external tank as time allows.
- **EVA Preps:** Two EMUs are checked out and the EMUs and other EVA tools are prepared for transfer to ISS.
- **Rendezvous Prep Activities:** Centerline Camera Install and ODS Ring Extension cannot occur during OBSS surveys due to a camera view constraint and is thus scheduled after OBSS Berth. Centerline Camera Install must occur before ODS Ring Extension. RNDZ Tools Checkout must be decoupled with the surveys because the surveys require RSAD and DOUG on the PGSCs while the RNDZ Tools Checkout requires RPOP.
- **EECOM:**

- The CWC condensate bag is installed prior to the simo dump on FD3 (crew request). To verify that the water from the hum seps are going into the condensate bag and not into the Lower Electronic Box (LEB), CDR performs a hum Sep check in Post sleep on FD3.
- **Transfer:** MS4 performs as much Transfer Prep as possible.
- **Generic Activities:** CRYO O2 Sensor Ck, Water Spray Boiler (WSB) Controller Swap, FC Manual Purge, FC Monitoring, B POD Heater Reconfig, Ergometer Setup, and Filter Cleaning are performed. FCMS ops must be decoupled with SRMS ops and RNDZ Tools Checkout due to PGSC limitations.
- **On Orbit SDBI's, DTO's, SDTO's:**
  - **SDBI:** 1634 sleep log is recorded at wake up for all subjects. 1900 dry saliva's are scheduled on MS2 and MS4.
- **Secondary/Transfer Payloads:**
  - **NLP:** MS4 activates Vaccine-6 GAPS A-H.
  - Daily middeck status checks are performed for ABRS and CGBA (twice daily).
- **OCA 48Mbps Downlink:** Crew will configure onboard OCA for 48Mbps downlink. This will allow OCA to bring down inspection images much faster.
- **Maneuvers:** Prior to crew sleep, the CDR future loads the maneuver for the FD3 waste water dump. The maneuver starts just after crew wakeup on FD3.
- **Sleep Shift:** No sleep shift today

### **FD3 – RNDZ/Docking**

- **OCA 48Mbps Downlink:** Crew will de-configure from 48Mbps to 2Mbps downlink during post sleep timeframe.
- **RNDZ:** The shuttle rendezvous' with the ISS. When the shuttle is on the RBAR at 600 feet from ISS, it performs the RBAR Pitch Maneuver (RPM) to allow the ISS crewmembers to photograph the belly of the shuttle and crew cabin areas to inspect for tile damage. The pictures are downlinked via ISS OCA with 800mm images having higher priority than the 400mm images.
- **Ingress:** After docking and APDS hard mate, leak checks are performed on the PMA and ODS, the ODS is prepared for ingress including removal of the centerline camera and installation of ducting, and hatches are opened. A short welcome occurs and then a safety briefing is given to the shuttle crewmembers.
- **RPM Image Card Transfer to STS:** If ISS OCA is not powered up by hatch opening or ISS Ku is not expected to be available for a long time AND if Shuttle is expected to have Ku, a real time call will be made to transfer the RPM image card over to the shuttle KFX machine for downlink. It is highly desired to get the images downlinked as soon as possible.
- **ISS RPM Photography:**
  - Headset cables are configured to extend S/G1 (listen only) from FGB ПГО to SM during shuttle docking and undocking.
  - Photo/TV hardware configuration is verified to be setup correctly and new/fully charged batteries are installed for the RPM documentation.
  - ISS CDR will setup a camcorder to video crewmembers performing RPM photography, followed by FE-1 setting up timers for the bottom side photographic shooting window. Upon Orbiter RPM initiation, FE-1 will activate timers indicating beginning and end of the bottom side photography window.
  - Positioned at SM windows 6 and 8 as required for RPM documentation, CDR will perform the 800mm photography while FE-2 performs the 400mm photography.
  - RPM images will be transferred to the designated 800mm and 400mm folders for downlink. 800mm images should be transferred first.
  - At completion of RPM documentation, CDR will deactivate the RPM camera configuration.
- **Maneuvers:**
  - Once hard mate is complete, the shuttle maneuvers the stack to a biased -XLV -ZVV (ISS -XVV) (TEA) attitude with the nominal docked DAP of A12. ISS takes over attitude control and maintains it during most of the docked timeframe using Control Moment Gyros (CMGs).

- We will not utilize the new attitude handover (VRCS to Momentum Management) sequence on FD3. Flight Directors didn't feel comfortable performing on FD3 and potentially risk impacting ELC1 Install operations later in the day.
- For Nov. 16th launch, we're in the worst case possible for Solar Array optimization and momentum management start up time. We cannot get into Momentum Management until 30 after ELC1 Unberth. Per the Lead ISS Flight Director, we'll stick with the currently timeline as much as possible (and not move ELC1 Unberth 30 min later). We will manage the momentum real-time.
- **Comm:**
  - The OIU is activated during RNDZ and will remain on until post undock.
  - SSOR is activated during RNDZ and will be used for docked A/G comm. Hardline ICOM is setup for STS/ISS comm.
- **EECOM:**
  - A waste dump is scheduled to start soon after crew wakeup when the future loaded maneuver is complete. This dump is done as late as possible prior to docking to minimize docked water dumps.
  - CWC#1 is filled and transferred to ISS.
  - N2 Transfer is setup and initiated
  - STS O2 is configured for EVA prebreathe
- **PGSCs:**
  - Post docking, the PGSC network is reconfigured from the RNDZ configuration to the robotic configuration in preparation for ELC1 Unberth and Install.
  - The aft flight deck PCS is also setup. AFT FD PCS will be transferred to ISS on FD9.
- **Photo/TV:** P/TV02 is used for approach and docking. Post docking, P/TV04 is set up for ISS ingress video and P/TV05 is set up for ISS internal operations (Configuring the BPSMU and RWS). Do not schedule P/TV04 before or during ODS Volume Prep for Ingress (there's a green jumper conflict). A video playback of docking is also scheduled. P/TV06 is set up for Robotic Operations.
- **EVA Prep:**
  - Prior to docking, the EMUs are removed from the orbiter airlock to facilitate ISS access after docking.
  - Post hatch open, crewmembers begin transferring EMUs to ISS. REBAs are installed in the EMUs, and the REBAs are checked out.
  - The equipment lock is prepared and the tools are configured for the EVA. Per 126 lessons learned, we've schedule a 30 min "EVA Tool Audit" on the task IV and both EVA crewmembers following the EVA Tool Config.
  - Most crewmembers are timelined for an hour procedure review. Due to ELC1 ops, we're unable to schedule all crewmembers for a procedure review.
  - MS3(EV1) and MS4(EV2) perform EVA campout procedures in presleep with FE-2(IV) assisting until hatch closure. They initiate a mask prebreathe, finish tool config, and depress the A/L to 10.2 psi. The EV crewmembers sleep in the A/L overnight.
- **ELC 1 Install:**
  - SRMS performs ELC1 Unberth and Handoff to SSRMS
  - SSRMS MNVRs to ELC1 Install Position
  - CAS operators (PLT, FE-2) send commands to install ELC1
  - After ELC1 is installed, GNC need the crew to perform a Control Accel update.
  - Overnight, ROBO will release ELC1 and perform a MT translate to WS4
- **Transfer:** Minimum transfer is performed today. The SODF is transferred to ISS, there's a Crew Transfer Bag (CTB) that needs to be transferred prior to "CERISE Transfer" scheduled later in the day.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - **SDBIs:** 1634 sleep log is recorded at wake up on available subjects. 1900 liquid saliva samples scheduled on available crewmembers.
  - Daily middeck status checks are performed for ABRS and CGBA (twice daily).
- **Sleep Shift:** No sleep shift today

## **FD04 - EVA 1 (SASA Install)**

**Big Picture and EVA 1 Overview:** Today is the first EVA. The crew will install the SASA onto Z1 and apply heater power. SASA is currently on the sidewall of the PLB. After SASA install, EV1 will route the SGANT Cable for ULF4. He will also install an NH3 Bracket and reposition the FGB LAN connector on N1 and tie down the MMOD shield in preparation for 20A. EV2 will be busy lubricating the POA LEE snares and JEM RMS LEE snares.

- **Assignments:**
  - MS3 (Foreman): EV1; MS4 (Satcher): EV2
  - PLT (Wilmore): suit IV; MS2 (Bresnik): task IV
- **EVA duration** is 6:30. LiOH is used.
- **EVA Prep/Campout protocol:** ~35 minutes following campout crew wakeup and at least 8:40 since 10.2 depress was completed the night before, the airlock is re-pressurized to 14.7 psi and the hatch is opened. The EV crewmembers have 40 minutes while wearing their quick-don masks for a hygiene break and to gather breakfast. The EVs and suit IVs (two) ingress the airlock, close the hatch, and depress the airlock to 10.2 psi. The EVs then doff the O2 masks, don the EMUs, and purge the EMUs with pure O2. The airlock is repressed to 14.7 psi and the IVs exit. The EVs then perform a 60-minute in-suit prebreathe followed by crew lock hatch closing and depress. Finally, the EVs perform Post Depressurization where they disconnect from the Service and Cooling Umbilical (SCU), which marks the start of the PET clock. The depress pump depresses the crew lock down 3 psi after which the crew lock valves are opened to vacuum. Once depress is complete, the EVs egress the crew lock and begin EVA setup.
- **EVA 1 Tasks:**
  - Transfer S-Band Antenna and Support Assembly (SASA) to Z1 location and apply heater and operation power and connect 1553
  - Route SGANT cable – for ULF4
  - Remove Node 1 handrail 0111 and replace with NH3 line routing bracket – for 20A
  - Reposition FGB LAN connector on Node 1 and tie down C2-02 MMOD shield – for 20A
  - Lubricate the POA snares
  - Lubricate the JEM RMS snares
- **Robotics:** MS2/Leland and PLT/Wilmore will be assisting in the EVA for the entire duration of the EVA. After the EVA, the SSRMS will grapple N2 PDGF in preparation for focused inspection activities on FD5 (if required). Overnight, the ground (ROBO) will release PDGF1.
  - After the JRMS Lube EVA task, the current plan has ISS CDR stow the JRMS and deactivate. MS4 has expressed an interest in performing this task (He traveled to JAPAN to get JRMS training). JAXA has agreed to reschedule JRMS stow activities to FD5 if focused inspection is not required. On FD4, once we hear FI is not required, Ops Plan will perform all the coordination required to get JRMS stow activities aborted from the FD4 timeline and rescheduled to FD5.
- **Post EVA activities:** After the EVs are back in the airlock, they perform Pre-Repress connecting to SCUs, close the EVA hatch, and repress the crew lock to 14.7 psi. Post EVA procedures include water recharge. Photos of the gloves are scheduled at the start of Post EVA. BSA EVA tool battery charging is initiated. The Post EVA Conference is scheduled on FD4 because there's no time on FD5. If time opens up, please reschedule conference to FD5. EVA prefers to have conference the day after EVA 1 and 2.
- **EECOM:** 2 CWC fills are performed and CWC Condensate Change out is scheduled as late in the day as possible.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - **SDBIs:** 1634 sleep log is recorded at wake up on available crewmembers.
  - **NLP:** Vaccine-6 GAPs A-H are terminated 48hrs (+/- 3hrs) after activation. After termination, GAPs A-H are moved to the CGBA and Cells-2 GAPs 5-8, 13-16 are moved from CGBA to MA16D.
  - Daily middeck status checks are performed for ABRS and CGBA (twice daily).
- **Sleep Shift:** Crew is going to bed 30 min early, so the day is shortened by 30 min. Shift is to support shuttle landing at KSC.

## **FD05 - Focused Inspection (placeholder)**

**Big Picture:** This day is our focused inspection placeholder. We have 3 hours of FI scheduled on CDR, PLT, and MS1. Prior to FI, the SSRMS will unberth the OBSS and handoff to the SRMS. After FI, the SRMS maneuvers to the OBSS handoff position and the SSRMS grapples OBSS and Berth in the PLB. The SSRMS grapples PDGF#1 in preparation for MT translate during pre sleep. Lastly, the SRMS grapples ELC2 in preparation for ELC2 Install on FD6. Overnight, the ground (ROBO) will release Node 2 PDGF, translate MT to WS2 then walk off to PDGF2 in preparation for ELC2 Install the next day.

- **Contingency Plan (No FI):** This day will be EVA2 prep and transfer day. Due to ELC2 thermal constraints, ELC2 will not be moved up to FD5 (it will remain on EVA2 day, FD6). ELC2 grapple will be performed sometime before pre sleep.

### **Focused Inspection (FI):**

- FI will be required if imagery results from FD2 inspections and RPM photos indicate suspect TPS. If no FI is required, the OBSS is left in the PLB until after undock.
  - A sensor is selected based on the inspection areas targeted and the type of images needed, although LCS is considered highest priority. LCS/IDC images are downlinked via OCA and LDRI/ITVC video requires live downlink or playback via TDRS E or W (no TDRZ).
  - LCS has no sun constraints.
  - Three crewmembers are required for the survey. The crewmembers review the procedures using DOUG, maneuver SSRMS to a viewing support position, and perform focused inspection. A 3-hour FI placeholder is timed.
- **EECOM/ECLSS:**
    - 2 CWCs fill scheduled and transferred to ISS. LiOH Swap is scheduled on MS2 (swapping LiOH cans with ISS).
- ### **EVA Preps:**
- BSA EVA tool battery charging is terminated and BSA EMU battery charging is initiated. This is required prior to EMU Swap.
  - EMUs are swapped so that MS4's EMU is removed from the A/L and MS2's EMU is placed in the airlock.
  - All crewmembers are timed for an hour procedure review.
  - MS1(EV1) and FE-2(EV3) perform EVA campout procedures in presleep with MS4(IV) assisting until hatch closure. They initiate a mask prebreathe, finish tool config, and depress the A/L to 10.2 psi. The EV crewmembers sleep in the A/L overnight.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
    - **SDBIs:** 1634 sleep log is recorded at wake up for all subjects. 1900 liquid saliva samples scheduled on available crewmembers.
    - **SPINAL:** The Spinal Standing height and Spinal (CDRs seat) are performed on all crew including FE-5. FE-2 is trained to assist with measurements and is scheduled to assist with 3 of our crewmembers. She's also scheduled to stow the hardware after ops are complete. FYI. CDR requested during FOR to schedule the Spinal Setup on a shuttle crewmember (not Nicole).
    - **ABRS:** ABRs filter is change out prior to transfer to ISS. Filter is installed prior to transfer to maintain a safe return configuration. During the filter change out procedure, door fasteners are removed.
    - **GLACIER Sample Retrieve:** ABRs Samples (KFTs) were placed in GLACIER prior to launch and is required before ABRs activities on FD6. MS1 is scheduled to go into GLACIER, remove the samples, and transfer to ISS. Sample retrieval was initially planned to be transferred on FD7 before we powered up GLACIER.
    - Daily middeck status checks are performed for ABRs and CGBA (CGBA twice daily, only once for ABRs).
  - **Sleep Shift:** Crew is going to bed 30 min early, so the day is shortened by 30 min. Shift is to support shuttle landing at KSC.

## **FD06 - EVA 2 (MISSE 7A/7B Install)**

**EVA 2 Overview:** The day will be started off with Scorch, Leland, Frank, Nicole, and Jeff installing ELC2. Next, the EV crew (Randy & Mike), with Bobby's IVA support, will be installing GATOR, deploying S3 Nadir PAS, relocating FPMU/VSSA, and installing WETA. No robotics support is needed for EVA2. Scorch will be photo documenting the EVA.

### **Assignments:**

- MS3 (Foreman): EV1; MS2 (Bresnik): EV3
- PLT (Wilmore): suit IV; MS4 (Satcher): task IV
- **EVA duration** is 6:30. LiOH is used.
- **EVA Prep/Campout protocol**: see FD5
- **EVA 2 Tasks:**
  - Install GATOR / AIS / ARISS antenna's on Columbus
  - Relocate FPMU and Stanchion from CP2 on S1, to CP6 on P1
  - Deploy S3LO CAS site for ESP-3 relocation
  - Install WETA # 3 at CP1 on S3
- **Robotics:** No Robotics will be needed for EVA2.
  - **SRMS Ops:** Prior to EVA2, Scorch and Leland will use SRMS to unberth ELC2 and hand it off to Frank and Jeff on SSRMS.
  - After the SRMS releases ELC2, robotics operations need to pause for ~20min to allow the CMGs to settle. ADCO predicts that we're really close to LOAC. After 20min, we pick back up with the SRMS MNVR to ELC2 viewing position. Leland is scheduled to perform the SSRMS OCAS (Handoff cleanup steps....no arm movement) during the 20min pause.
  - After the EVA, the SRMS mnvrs to pre cradle position and remains there until FD10 Late Inspection.
  - **SSRMS Ops:** Jeff and Leland will maneuver ELC2 to install position with SSRMS, where Nicole and Leland will mate to PAS-1. After ELC1 is installed, Butch and Leland will grapple MBS1 (walk off required to support EVA 3 on FD8). Later in the day, Butch and Leland will Release MBS2 to complete the walk off. **Note: There's a flight rule (don't know the number though... ) that prohibits SSRMS operations during PAS Deploys.**
- **EECOM:**
  - 2 CWCs are filled and transferred to ISS.
  - Before pre sleep, CDR perform "Dump Equipment Gather" in preparation for the FD7 water dump.
- **MMACS:**
  - PRLAs are closed late in the day.
- **PMC via OCA:** performed tonight in preparation for FD7 PFC's.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - **SDBIs:** 1634 sleep log is recorded at wake up for all subjects.
  - Daily middeck status checks are performed for CGBA.
- **Sleep Shift:** Crew is going to bed 30 min early, so the day is shortened by 30 min. Shift is to support shuttle landing at KSC.

## **FD07 - Off-Duty (4hrs)**

**Big Picture:** Crew is scheduled for 4-hours of off-duty in the morning.

- **PFC's:** Private Family Conferences are scheduled during crew off-duty.
- **EECOM/ECLSS:**
  - One Condensate bag dump is scheduled in the afternoon and one PWR dump is scheduled.
  - Two CWCs are filled and transferred to ISS.
  - The condensate CWC bag is changed out
- **Generic Transfer:**

- FE-4 and MS1 will transfer CUCU from Middeck and Install in ISS. Cable routing, activation and checkout will be performed sometime in the early part of 2010, the exact schedule is in work.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - Glacier is powered on in preparation for sample transfer on FD9. Glacier needs to be powered on for at least 48hrs prior to sample insertion.
  - **SDBIs:** 1634 sleep log is recorded at wake up for all subjects.
  - Daily middeck status checks are performed for CGBA and Glacier.
- **Sleep Shift:** Crew is going to bed 30 min early, so the day is shortened by 30 min. Shift is to support shuttle landing at KSC.

#### **FD08 - EVA 3 (HPGT Install)**

**EVA 3 Overview:** EV crew (Randy & Bobby), with Mike's IVA support, will be transferring HPGT from ELC2 to ISS Airlock with assistance from SSRMS. EV crew will also be installing MISSE 7 on ELC2 and deploying S3 Zenith Inboard PAS. Butch and Leland will be operating the SSRMS for the EVA. Scorch will be photo documenting the EVA.

- **Assignments:**
  - MS4 (Satcher): EV2; MS2 (Bresnik): EV3
  - PLT (Wilmore): suit IV; MS3 (Foreman): task IV
- **EVA duration** is 6:30. LiOH is used.
- **EVA Prep/Campout protocol:** see FD5
- **EVA 3 Tasks:**
  - Transfer and install spare HPGT (O<sub>2</sub>) from ELC2 to ISS Airlock
  - Install, activate, and checkout MISSE PECs 7A and 7B onto ELC2
  - Deploy S3UI CAS site for ULF6 / AMS
- **Post EVA:** see FD5
- **Robotics:** Butch and Leland will use SSRMS to grapple the HPGT and transfer it to the Airlock for Installation.
- **EECOM/ECLSS:**
  - 2 CWC bags are filled and transferred to ISS.
  - 2 hour N2 repress scheduled on CDR.
  - 3 PWR bags are filled and transferred to ISS.
- **Photo/TV:** P/TV08 External Survey is performed over daylight to document the external ISS structure.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - Glacier is powered on in preparation for sample transfer on FD9. Glacier needs to be powered on for at least 48hrs prior to sample insertion.
  - **SDBIs:** 1634 sleep log is recorded at wake up for all subjects.
  - Daily middeck status checks are performed for CGBA and Glacier.
- **Sleep Shift:** Crew is going to bed 30 min early, so the day is shortened by 30 min. Shift is to support shuttle landing at KSC.

#### **FD09 - Transfer, Off-Duty, Hatch Close**

**Big Picture:** Randy, Mike, and Bobby will spend their morning on post-EVA reconfigs. Both ISS and STS crews will spend most of the day preparing and transferring items to STS in prep for hatch close at the end of the day. The last crew conference/crew photo will be prior to Meal followed by 2hr of off-duty for the shuttle crew. The farewell ceremony is scheduled in the evening right before Hatch Close.

- **Reboost:** A 1-hr reboost placeholder is scheduled. It's very likely that the reboost will be performed during the mission.
- **PGSC Operations:**
  - The shuttle AFD PCS is deactivated and transferred to ISS.
  - RNDZ Tools checkout is scheduled after hatch closure.

- **Post EVA Reconfig and Xfer:** Procedure includes steps to reconfigure EMUs for transfer, reconfig EMU systems transfer bag for transfer, prepares ISS EMUs for undock, and transfers and stows necessary EVA hardware. On FD8, FE-5 reconfigures one of our EMUs for return. It was reconfigured on FD8 to allow time for ISS crew to perform the BCM R&R and checkout of the new battery. The BCM R&R cannot occur at the same time as Post EVA Reconfig and Transfer.
- **EECOM/ECLSS:**
  - Last 2 CWCs are filled and transferred to ISS.
  - The condensate bag is changed out.
  - O2 equipment is torn down.
- **BCM R&R:** Bob and Jeff will be conducting BCM Battery R&R and Checkout. If checkout is successful, the old Tox4 battery will be returned on shuttle.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - **GLACIER:**
    - 1-hour prior to sample transfer to Glacier, MS1 will check the temperature in Glacier to make sure it's ready for samples.
    - Samples are transferred to Glacier from MELFI
    - 1-hour after sample transfer, the temperature is checked again to determine if desired temperature is being maintained. If not, crew will perform another check 30min later. If the temperature cannot be maintained, we may transfer samples back to MELFI on ISS.
  - **MDS:**
    - Mice are transferred to shuttle for return. There's some concern about getting all the bolts engaged in locker. If there's issue on-orbit, we may have to return the mice to ISS or come up with another method to bring mice home (i.e. strap down in middeck floor).
  - **DCB** (Double Cold bag) experiment samples are packed and transferred for return on shuttle as late as possible prior to hatch closure. Two ISS crew are scheduled for packing with a DCB procedure review prior.
  - **SDBIs:** 1634 sleep log is recorded at wake up for all subjects.
  - Daily middeck status checks are performed for CGBA and Glacier.
  - **NLP:** Cells-2 GAPs 15-16 are activated.
- **Post Farewell:**
  - Hatches are closed between ISS and Shuttle followed by a hatch leak check.
  - Shuttle attitude control is NOT required during the ODS vestibule and PMA2 leak checks. The ODS Leak check will be performed on USTO control.
  - The centerline camera is installed, P/TV03 is setup for undocking imagery, and PCS is activated.

**Sleep Shift:** Crew is going to bed 30 min early, so the day is shortened by 30 min. Shift is to support shuttle landing at KSC.

#### **FD10 - Undock/Flyaround and Late Inspection:**

- **Pre-undock:** The -Z star tracker is turned on, Group B power up is performed and the orbiter takes attitude control and maneuvers to the undock attitude.
- **Post Sep Burn activities:** Group B power down is performed, the SSOR and OIU are deactivated, the EMUs are reinstalled in the airlock, the condensate CWC bag is torn down, the undock video is played back, P/TV03 deact is performed to remove the centerline camera, and the PGSC network is reconfigured from the RNDZ setup to the RMS setup.
- The comm string 1 checkout is scheduled. A 24 hour check of comm string 1 is scheduled. System will be reconfigured back to comm string 2 at the end of the checkout period (FD14).
- **EECOM/ECLSS:** A waste dump is performed prior to late inspection.
- **Late inspection:** The RCC inspection procedures and scheduling are identical to FD2 except for the following deltas:
  - The starboard wing survey is scheduled for 1:30, the nose cap for 0:50 (same as FD2), and the port wing for 1:45.
  - The LDRI 3D calibration in unberth is not performed.

- IDC supplemental imagery is not performed.
  - Surveys of the crew cabin areas are not performed during the wing surveys.
- **EVA Stow:** Post ISS EVA Entry Prep & EVA Stow are scheduled.
- **OCA 48Mbps Downlink:** Crew will configure onboard OCA for 48Mbps downlink.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - **SDBIs:** 1634 sleep log is recorded at wake up for all subjects.
  - **NLP:** Cells-2 GAPs 7-8, 15-16 are terminated. After termination, GAPs 7-8, 13-16 are moved to the CGBA and Vaccine-6 GAPs A-H are moved from CGBA to MA16D. Also, the temperature is changed to 37 degrees C.
  - Daily middeck status checks are performed for CGBA and Glacier.
- **Sleep Shift:** No additional sleep shift required. Crew sleep is lined up to support landing at KSC on EOM.

#### **FD11 - FCS c/o, RCS HF, Cabin Stow (EOM-1)**

- **Nominal EOM-1 activities:** FCS Checkout with WSB heater activation and filter cleaning prior; RCS Hotfire; D/O Briefing; Cabin Stow, Ergometer Stow. MS2 is scheduled for P/TV ops during FCS Checkout .
- **OCA 48Mbps Downlink:** Crew will de-configure onboard OCA from 48Mbps to 2Mbps downlink. During the day, if OCA is overwhelmed with images to downlink, we may decide to have the crew configure back to 48Mbps. Please coordinate with INCO first because this takes away DTV/HDTV capability.
- **Unique EOM-1 activities:**
  - Launch Entry Suit Fit Check and Recumbent Seat Kit Install is performed for FE-2(dn). This should be performed after ergometer stow due to spatial concerns.

#### **Comm activities:**

- L-1 comm checks are scheduled for a prime MLA and a prime DFR pass.
- The MADS instrumentation is activated in preparation for entry.
- Entry video is setup. Schedule after PAO event due to a conflict with the PAO event.
- Comm string 1 checkout is complete and the system is reconfigured back to comm string 2.
- Ku Band stow is scheduled as late as possible.

**EECOM/ECLSS:** A simo dump is performed followed by one CWC bag dumps.

#### **PGSCs:**

- PILOT ops is performed after RCS Hotfire.
- WLES is deactivated from the backup machine prior to PILOT ops because that machine is used for PILOT and cannot have other applications running in the back ground. The prime WLES machine is deactivated as late as possible.
- The printer is stowed and all the PGSC hardware is stowed late in the day.

**PAO Event:** Final event for all crewmembers. This is currently scheduled to occur using standard def, not HD.

- **OA:** For Nov. 17th launch, we may have to perform OA to bring in earlier KSC opportunity.
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - **SDBIs:** 1634 sleep log is recorded at wake up for all subjects. For 1900, MS2, MS4 and FE-2(dn) collects a liquid saliva sample at wakeup and a series of dry saliva samples at wakeup, w/u+30 min, w/u+6hrs, w/u+10hrs, and just prior to sleep. Final stow of the kit is performed. MS2, MS4, and FE-2 provides a blood samples while MS1 draws the blood.
  - **NLP:** Cells-2 GAPs 3-4, 11-14 are terminated. After termination, GAPs 5-6 are moved to the CGBA. Also, the temperature is changed to 6 degrees C.
  - Daily middeck status checks are performed for CGBA and Glacier.
- **Sleep Shift:** No additional sleep shift required. Crew sleep is lined up to support landing at KSC on EOM.

### **FD12 - Deorbit and Entry**

- **Nominal EOM activities:** Group B power up, IMU align & verification, maneuver to a -XSI thermal conditioning, GIRA & OCAC stow, TEPC power down, air sample collection, MADS enable
- **Secondary Payloads/SDBIs/DTOs/SDTOs:**
  - Actiwatch activity monitors (watches) are doffed for SDBI 1634.
  - Daily middeck status checks are performed for CGBA and Glacier.
  - DTO-696 Air Sample performed. MS3/Mike Foreman requested we add the locker locations of the canisters in the detailed timeline.
- **Deorbit Prep, Entry, Landing at KSC**