International Space Station
ISS/Shuttle Joint Operations Book

ISS-4A

Mission Operations Directorate
Operations Division

November 10, 2000

These procedures are available electronically on the SODF Homepage at http://fitproc.jsc.nasa.gov

National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas
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**ISS/SHUTTLE JOINT OPERATIONS BOOK - 4A**

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10 NOV 00 vii JNT OPS
1. The total USOS loads for Shuttle Arrival should be ≤ 800 Watts.

2. Use the POWERUP column in reverse order to back out of the powerdown.

3. The loads for the major power users are presented below.

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### POWERDOWN

**NOTE**
Depending on the heater configuration, power usage may not decrease after every step.

1. **RS LOAD POWERDOWN**
   TBD (Based on current data, SM and FGB do not require power downs for docking, this will be addressed at the upcoming OPS TIM.)

2. **INHIBITING PMA3 A AND B SHELL HTRS**
   Task: USOS Powerdown/up Pg 1
   3A USOS Powerdown Powerup Display 1
   
   sel PMA3 Htrs
   
   PMA3 – HtrAvailability
   
   sel Htr [X]A where [X] = 1 2 3 4 5
   
   cmd Inhibit
   
   √Htr[X]A Availability – Inh
   
   Repeat

   sel Htr [X]B where [X] = 1 2 3 4 5
   
   cmd Inhibit
   
   √Htr[X]B Availability – Inh
   
   Repeat

### POWERUP

**cmd** Ena Backup

**cmd** Ena Operate
### POWERDOWN

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</tbody>
</table>

#### 4. INHIBITING NODE 1 A AND B HTRS (7 --- 9)

<table>
<thead>
<tr>
<th>Node1Htr79avail</th>
<th>sel Htr [X]A where [X] = 7 8 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd Inhibit</td>
<td>√Htr[X]A Availability – Inh</td>
</tr>
<tr>
<td>Repeat</td>
<td></td>
</tr>
</tbody>
</table>

### POWERUP

<table>
<thead>
<tr>
<th>cmd Ena Backup</th>
<th>cmd Ena Operate</th>
</tr>
</thead>
</table>

---

09 NOV 00
### POWERDOWN

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5. INHIBITING PMA1 A AND B SHELL HTRS</strong></td>
<td><strong>POWERUP</strong></td>
</tr>
<tr>
<td>3A USOS Powerdown Powerup Display 1</td>
<td></td>
</tr>
<tr>
<td>sel PMA1 Htrs</td>
<td></td>
</tr>
<tr>
<td>PMA1 HtrAvailability</td>
<td></td>
</tr>
<tr>
<td>sel Htr [X]A where [X] = 1 3 4 5</td>
<td>cmd Ena Backup</td>
</tr>
<tr>
<td>cmd Inhibit</td>
<td></td>
</tr>
<tr>
<td>√Htr[X]A Availability – Inh</td>
<td></td>
</tr>
<tr>
<td>Repeat</td>
<td></td>
</tr>
<tr>
<td>sel Htr [X]B where [X] = 1 2 3 5</td>
<td>cmd Ena Operate</td>
</tr>
<tr>
<td>cmd Inhibit</td>
<td></td>
</tr>
<tr>
<td>√Htr[X]B Availability – Inh</td>
<td></td>
</tr>
<tr>
<td>Repeat</td>
<td></td>
</tr>
<tr>
<td><strong>6. DISABLING Z1 SPDA HEATERS</strong></td>
<td></td>
</tr>
<tr>
<td>3A USOS Powerdown Powerup Display 1</td>
<td></td>
</tr>
<tr>
<td>‘Pwr Bus Rail Htrs - A’</td>
<td></td>
</tr>
<tr>
<td>cmd Z13B HtrA Inh (√Availability – Inhibit)</td>
<td>cmd Htr A Ena BU</td>
</tr>
<tr>
<td>cmd Z14B HtrA Inh (√Availability – Inhibit)</td>
<td>cmd Htr A Ena BU</td>
</tr>
<tr>
<td>‘Pwr Bus Rail Htrs - B’</td>
<td></td>
</tr>
<tr>
<td>cmd Z13B HtrB Inh (√Availability – Inhibit)</td>
<td>cmd Htr B Ena Opr</td>
</tr>
<tr>
<td>cmd Z14B HtrB Inh (√Availability – Inhibit)</td>
<td>cmd Htr B Ena Opr</td>
</tr>
<tr>
<td><strong>7. DISABLING Z1 EEATCS HEATERS</strong></td>
<td></td>
</tr>
<tr>
<td>‘EEATCS Loop A Non Op Htr1’</td>
<td></td>
</tr>
<tr>
<td>‘RPCM Z13B B’</td>
<td></td>
</tr>
<tr>
<td>cmd RPC 7 – Op (Verify – Op)</td>
<td>cmd RPC 7 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>‘EEATCS Loop B Non Op Htr1’</td>
<td></td>
</tr>
<tr>
<td>‘RPCM Z14B B’</td>
<td></td>
</tr>
<tr>
<td>cmd RPC 7 – Op (Verify – Op)</td>
<td>cmd RPC 7 – Close (Verify – Cl)</td>
</tr>
</tbody>
</table>
### POWERDOWN

<table>
<thead>
<tr>
<th><strong>8. DISABLING Z1 DDCU HEATERS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>‘DDCU Htrs - 1’</td>
</tr>
<tr>
<td>‘RPCM Z14B B’</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 11 – Op (Verify – Op)</td>
</tr>
<tr>
<td>‘RPCM Z13B B’</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 11 – Op (Verify – Op)</td>
</tr>
<tr>
<td>‘DDCU Htrs - 2’</td>
</tr>
<tr>
<td>‘RPCM Z13B B’</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 6 – Op (Verify – Op)</td>
</tr>
<tr>
<td>‘RPCM Z14B B’</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 16 – Op (Verify – Op)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>9. DISABLING PCUs AND HEATERS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>‘PCU 1 and PCU 2 Htr’</td>
</tr>
<tr>
<td>‘RPCM Z13B B’</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 15 – Op (Verify – Op)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 16 – Op (Verify – Op)</td>
</tr>
<tr>
<td>‘PCU 2 and PCU 1 Htr’</td>
</tr>
<tr>
<td>‘RPCM Z14B B’</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 15 – Op (Verify – Op)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 14 – Op (Verify – Op)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>10. DISABLING CMG HEATERS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>‘CMG External Htrs’</td>
</tr>
<tr>
<td>‘RPCM Z13B B’</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 10 – Op (Verify – Op)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 12 – Op (Verify – Op)</td>
</tr>
<tr>
<td>‘CMG External Htrs’</td>
</tr>
<tr>
<td>‘RPCM Z14B B’</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 10 – Op (Verify – Op)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 12 – Op (Verify – Op)</td>
</tr>
</tbody>
</table>

### POWERUP

<table>
<thead>
<tr>
<th><strong>POWERUP</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>cmd</strong> RPC 11 – Close (Verify – Cl)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 11 – Close (Verify – Cl)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 6 – Close (Verify – Cl)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 16 – Close (Verify – Cl)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 15 – Close (Verify – Cl)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 15 – Close (Verify – Cl)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 12 – Close (Verify – Cl)</td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 12 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>POWERDOWN</td>
</tr>
<tr>
<td>------------</td>
</tr>
</tbody>
</table>
| **11. DISABLING S-BAND HEATERS**  
'S-Band Htrs'  
'RPCM Z14B B'
| **cmd** RPC 1 – Op (Verify – Op)  
**cmd** RPC 4 – Op (Verify – Op) |
| **12. TURNING OFF EARLY COMM ANTENNA HEATERS** |
| **CAUTION**  
The Early Comm Antennas may experience hardware damage after several hours without heater power. |
| sel 3A USOS Pwrdn/Pwrup – Display 2  
3A USOS Powerdown Powerup Display 2  
'Early Comm'  
'Port Antenna Htr'
| **cmd** RPC 6 – Op **Execute** (Verify – Op)  
'Stbd Antenna Htr'
| **cmd** RPC 13 – Op **Execute** (Verify – Op)  
\( \sqrt{(RACU 5 \text{ Vout} \times RACU 5 \text{ Iout}) + (RACU 6 \text{ Vout} \times RACU 6 \text{ Iout})} \leq 700 \text{ W} \)  
**cmd** RPC 1 – Close (Verify – Cl)  
**cmd** RPC 4 – Close (Verify – Cl)  
**cmd** RPC 6 – Close **Execute** (Verify – Cl)  
**cmd** RPC 13 – Close **Execute** (Verify – Cl) |
1. **VERIFYING ACS MODING PRE-ARRIVAL CONFIGURATION AND STATUS**

PCS

MCS: ACS Moding

ACS Moding

‘ACS Configuration’

Verify Moding Role Primary, Secondary NCS – Full

**************************************************************************

If Primary(Secondary) NCS Moding Role is not set to Full, then
the following commands should be sent

sel Moding Role

**Moding Role**

**cmd** N1-2(N1-1)

Verify Arm Status Primary(Secondary) NCS – Arm

**cmd** N1-2(N1-1)

Verify Moding Role Primary(Secondary) NCS – Full
Verify Arm Status Primary(Secondary) NCS – Disarm

**************************************************************************

Verify RS Mode Primary, Secondary NCS – Cntl

‘Arrival’

Verify PMA3 Arrival Response SW Primary, Secondary NCS – Inh

2. **ENABLING ACS MODING INDICATOR LIGHTS**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Each of the primary and secondary MDMs command one of the LED units (i.e., two units per PMA, four LEDs per unit).</td>
</tr>
<tr>
<td>2. LED configurations:</td>
</tr>
<tr>
<td>On – Active Attitude Control.</td>
</tr>
<tr>
<td>Flash – Station in Free Drift.</td>
</tr>
<tr>
<td>Off – LED Control Software is inhibited or an MDM loss of comm situation has occurred.</td>
</tr>
</tbody>
</table>

PCS

MCS: ACS Moding

ACS Moding

‘ACS Configuration’

sel LED Control SW

**LED Control SW**

‘Primary NCS’
cmd Enable
√ LED Control SW – Ena
Verify PMA3 LED State – On
‘Secondary NCS’

cmd Enable
√ LED Control SW – Ena
Verify PMA3 LED State – On

3. ENABLING ARRIVAL RESPONSE SOFTWARE FOR ACS MODING

ACS Moding
‘Arrival’

sel PMA3 Arrival Response SW

PMA3 Arrival Response SW
‘Primary NCS’

cmd Enable
Verify Arrival Response SW – Ena
‘Secondary NCS’

cmd Enable
Verify Arrival Response SW – Ena

**********************************************************************************
If Primary(Secondary) NCS Arrival Response SW needs to be inhibited (wave off, etc.), then the following commands should be sent:

sel PMA3 Arrival Response SW

PMA3 Arrival Response SW
‘Primary NCS’(‘Secondary NCS’)

cmd Arm
Verify Arm Status Primary(Secondary) NCS – Arm

cmd Inhibit
Verify Arrival Response SW Primary(Secondary) NCS – Inh
**********************************************************************************
At 170 foot station-keeping, ADCO will prompt Blue/White FCR Flights to this page. At Rendezvous 10 meters (30ft): Blue/White FCR Flights will call “All Quiet.” All Controllers will monitor Shuttle FD and A/G Loops.

### 1. CAPTURE PHASE

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNC</td>
<td>“PCT ARMED”</td>
<td>Shuttle FD</td>
<td></td>
</tr>
<tr>
<td>MMACS</td>
<td>“CONTACT”</td>
<td>Shuttle FD</td>
<td></td>
</tr>
<tr>
<td>Shuttle Crew</td>
<td>“CAPTURE CONFIRMED”</td>
<td>2A/G2</td>
<td>ISS Crew - After 20 seconds, if software has not moded ISS to Free Drift, command ISS to Free Drift.</td>
</tr>
<tr>
<td>MMACS</td>
<td>“MMACS CONFRMS CAPTURE CONFIRMED”</td>
<td>Shuttle FD</td>
<td>SSP GC - Start 60 second wall clock in WFCR &amp; BFCR. RIO - Call <strong>MCC-M</strong> on ISS OPS and inform of Capture. ADCO – Confirm Capture Long and Arrival Event on ISS FD.</td>
</tr>
<tr>
<td>GNC</td>
<td>“SHUTTLE FREE DRIFT”</td>
<td>Shuttle FD</td>
<td></td>
</tr>
</tbody>
</table>

### 2. ISS FREE DRIFT – NOMINAL PATH

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS Crew</td>
<td>“ISS FREE DRIFT”</td>
<td>2A/G2</td>
<td>ADCO/RIO – Confirm INDICATOR on ISS FD.</td>
</tr>
<tr>
<td>ISS FD</td>
<td>“STATION FLIGHT CONFIRM FREE DRIFT”</td>
<td>Shuttle FD</td>
<td>CAPCOM – Table 5 block 1.</td>
</tr>
</tbody>
</table>

### 3. ISS FREE DRIFT – NO CALL FROM ISS CREW

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADCO</td>
<td>“ADCO confirms INDICATOR”</td>
<td>ISS FD</td>
<td>After ADCO confirmation, ISS Flight to wait for RIO call. At NET “Capture Confirmed” + 50 seconds Flight to proceed with status call to Shuttle FD.</td>
</tr>
<tr>
<td>RIO</td>
<td>“MOSCOW CONFIRMS INDICATOR”</td>
<td>ISS FD</td>
<td></td>
</tr>
<tr>
<td>ISS FD</td>
<td>“STATION FLIGHT CONFIRM FREE DRIFT”</td>
<td>Shuttle FD</td>
<td>CAPCOM – Table 5 block 1.</td>
</tr>
</tbody>
</table>

### 4. ISS ACTIVE CONTROL – NO CHANGE AT CAPTURE CONFIRMED + 50 sec

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADCO</td>
<td>“ADCO CONFIRMS ACTIVE CONTROL”</td>
<td>ISS FD</td>
<td>RIO – Call <strong>MCC-M</strong> on ISS OPS for update.</td>
</tr>
<tr>
<td>ISS FD</td>
<td>“STATION FLIGHT CONFIRMS ACTIVE CONTROL”</td>
<td>Shuttle FD</td>
<td>CAPCOM – Table 5 block 2.</td>
</tr>
</tbody>
</table>
### 5. Final Calls to Shuttle Crew – NLT Capture Confirmed + 60 sec

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS FD</td>
<td>“ISS IS FREE DRIFT.”</td>
<td>Shuttle FD</td>
</tr>
<tr>
<td>CAPCOM</td>
<td>“STATION FREE DRIFT CONFIRMED.”</td>
<td>A/G</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS FD</td>
<td>“ISS IS ACTIVE CONTROL.”</td>
<td>Shuttle FD</td>
</tr>
<tr>
<td>CAPCOM</td>
<td>“STATION IN ACTIVE CONTROL, PERFORM FAILED CAPTURE TO UNDOCK.”</td>
<td>A/G</td>
</tr>
</tbody>
</table>
1. **VERIFYING ACS MODING PRE-ARRIVAL CONFIGURATION AND STATUS**

   PCS
   MCS: ACS Moding
   ACS Moding
   ‘ACS Configuration’

   Verify Moding Role Primary, Secondary NCS – Full
   Verify RS Mode Primary, Secondary NCS – Cntl

   √ LED Control SW Primary, Secondary NCS – Ena

   Verify PMA3 LED State Primary, Secondary NCS – On
   ‘Arrival’

   √ PMA3 Arrival Response SW Primary, Secondary NCS – Ena

2. **CAPTURE**

   Orbiter → ISS, “Capture Confirmed.”

   RS Laptop
   CM: СУДН: Main
   СМ: СУДН: Main

   Wait up to 20 seconds for the following indication:
   Verify RS GNC Mode – Indicator

   **************************
   If RS GNC mode does not show Indicator after 20 seconds,
   СМ: ТВМ PROC
   СМ: ТВМ: Procedures

   sel F1_10 “[УВ] OrbiterArrival”

   cmd Execute
   СМ: СУДН :Main

   Verify RS GNC Mode – Indicator

   3. **VERIFYING STATION ACS MODING POST-DOCKING CONFIGURATION**

   PCS
   MCS: ACS Moding
   ACS Moding
   ‘Arrival’

   Verify PMA3 Capture Long Primary, Secondary NCS – X
   Verify Arrival Event Primary, Secondary NCS – X
‘ACS Configuration’

Verify RS Mode Primary,Secondary NCS – Drift
Verify PMA3 LED State Primary,Secondary NCS – Flash

ISS → Orbiter, MCC-H, “ISS is Free Drift.”

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following signals appear at hardmate. Hardmate may take up to 17 minutes to occur after capture.</td>
</tr>
</tbody>
</table>

‘Departure’

Verify PMA3 Interface Sealed Primary,Secondary NCS – X
Verify PMA3 Separation Primary,Secondary NCS – Blank
1. **INHIBITING LED INDICATORS**

PCS

MCS: ACS Moding

ACS Moding

‘ACS Configuration’

sel LED Control SW

LED Control SW

‘Primary NCS’

**cmd Inhibit**

√LED Control SW – Inh

Verify PMA2,PMA3 LED State – Off

‘Secondary NCS’

**cmd Inhibit**

√LED Control SW – Inh

Verify PMA3 LED State – Off

2. **DISABLING ARRIVAL RESPONSE SOFTWARE**

ACS Moding

‘Arrival’

sel PMA3 Arrival Response SW

PMA3 Arrival Response SW

‘Primary NCS’

**cmd Arm**

Verify Arm Status – Arm

**cmd Inhibit**

Verify Arrival Response SW – Inh

Verify Arm Status – Disarm

‘Secondary NCS’

**cmd Arm**

Verify Arm Status – Arm

**cmd Inhibit**

Verify Arrival Response SW – Inh

Verify Arm Status – Disarm
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INGRESS STATION
EXT A/L 1. √ODS Upper Hatch closed
   Equal vlv caps (two) → installed
   Unstrap Centerline Camera Diffuser flex duct from EXT A/L wall.
   Attach flex duct to camera bracket to direct air flow to window.
   If required, tape diffuser open.

AW18A 2. LTG FLOOD 1(3,4) – OFF

MO13Q 3. AIRLK FAN A(B) – OFF

EXT A/L 4. Disconnect airlock flex duct from booster fan muffler, rotate into middeck,
   and secure.

MO13Q 5. AIRLK FAN A(B) – ON
   6. AIRLK 2 – OFF/ON (OFF as required)
   7. TNL ADAPT 1 – OFF/ON (OFF as required)
   8. √Airflow at muffler

Middeck 9. Close Inner Hatch per decal.
   10. Equal vlv (two) – OFF, install caps
1. Notify **MCC**, “Beginning initial Hatch leak checks.”

2. √14.7 CAB REG INLET SYS 1, SYS 2 (two) – CL

   **SM 177 EXTERNAL AIRLOCK**

3. Record A/L-VEST \( \Delta P \): _____ psid.
   Record EXT A/L PRESS: _____ psia.

   **SM 210 NODE 1**

4. Record NODE 1 CAB PRESS: _____ psia.

5. Wait 20 minutes.

   ******************************************************
   If A/L-VEST \( \Delta P \) \leq \) previously recorded - 0.16 psid
   Notify **MCC-H** (possible leakage through Hatches).

   If EXT A/L Press \leq \) previously recorded - 0.16 psia
   Notify **MCC-H** (possible leakage from EXT A/L).

   If NODE PRESS \leq \) previously recorded - 0.02 psia
   Notify **MCC-H** (possible leakage from NODE 1/PMA 3).
   ******************************************************

A6L
1. LT VEST PORT, STBD (two) – OFF
2. LT TRUSS FWD, AFT (two) – OFF

Inner Hatch
3. Equal vlv caps (two) – remove
4. Equal vlv (two) – NORM
5. √Hatch ΔP < 0.2 psid
6. Open Hatch per decal.
7. Equal vlv (two) – OFF, reinstall caps

MO13Q
8. TNL ADAPT 1 – ON/OFF
9. AIRLK 2 – ON/OFF
10. AIRLK FAN A(B) – OFF

Middeck
11. Remove diffuser cap from floor fitting. Stow. Mark stowage location (will be reused).

EXT A/L
12. Unstrap airlock flex duct. Connect to middeck floor fitting and to booster fan muffler inlet.

MO13Q
13. AIRLK FAN A(B) – ON

AW18A
14. As required, LTG FLOOD 1(3,4) – ON
15. √Airflow at top of external airlock halo

EXT A/L
16. Unstrap centerline camera diffuser flex duct from camera bracket. Stow duct along stbd top of EXT A/L wall (in straps).
17. Prior to Centerline Camera removal:
   A7
   VID OUT – MON 1(2)
   VID IN – PL2
   IRIS – CLOSE

   SSP1
   √cb SW PWR 2 (CB4) – cl
   PRI C/L CAM PWR – OFF

18. Remove, stow Centerline Camera.
NOTE

Expect possible dP/dT Klaxon ‘S66 CABIN PRES’ and ‘S66 CABIN PPO2’ alarms during pressurization.

1. ODS Equal vlv (one) → remove cap

NOTE

Cycling of Equal vlv is required to avoid excessive negative delta pressure across the APAS Hatch.

2. ODS Equal vlv (one) → cycle to NORM for 8 seconds, OFF for 30 seconds
   Repeat 10 cycles, then
   ODS Equal vlv (one) → NORM

NOTE

Pressurization will take 15 minutes.

3. When ODS Hatch ΔP < 0.2 psid
   ODS Equal vlv → OFF
   Wait 5 minutes for thermal stabilization.

SM 177 EXTERNAL AIRLOCK

   Wait 30 minutes.

********************************************
If A/L-VEST ΔP ≥ previously recorded + 0.16 psid,
   notify MCC-H (Vestibule/PMA 2 Leak).
********************************************


ODS

6. ODS Equal valve → remove all tape, install Cap Hatch
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TOOLS AND EQUIPMENT REQUIRED:
Unstow, place in tool bag:
- MF28O 10" Adjustable Wrench
- Vol 3B Flashlight
- MF28H Jettison/Stowage Bag
- FDF Kit If required, Sharpie Pen and colored dots (for marking crosshairs)
- WCS Rubber Gloves (one pair)
- Towel
- Stbd Docking Mechanism Accessory Kit
- MD Floor Bag APAS Hatch Tool
  - Cleaning Pads
  - Docking Target Base Plate Cover
  - Docking Target Standoff Cross Bag
  - PMA APAS Hatch Standoff with Velcro Strap
  - 1-1/2" Open End Wrench
  - PMA/ODS Interface Duct
  - APAS Hatch Cover

SETTING UP EXTERNAL AIRLOCK FOR ODS AND PMA INGRESS
1. Relocate Tool Bag and Jettison/Stowage Bag to Ext A/L.
2. If required, temporarily stow EMUs.
3. Equal vlv (one) → remove cap, NORM
   \[ \sqrt{\text{ODS Hatch } \Delta P} \leq 0.2 \text{ psid} \]

ODS VESTIBULE INGRESS
4. Open ODS Hatch per decal.
   Equal vlv (one) – OFF, cap installed

WARNING
Surfaces may be below freezing for a short time after initial ODS hatch opening. Avoid direct contact with vestibule surfaces until VESTIBULE TEMP 1,2 (two) indicate > 40° F (SM 177 EXTERNAL AIRLOCK).

Rotate Centerline Camera Diffuser Duct into vestibule.
Wipe any condensate from vestibule volume and report to MCC-H.
DOCKING EQUIPMENT REMOVAL

ODS 5. For each docking light
Vestibule
Disconnect cables.
Install caps on outlet.
Remove the locking pin.
Remove docking light.
Reinstall locking pin.

6. If required, mark crosshairs with appropriate identification.

7. Remove crosshairs.
   Stow lights and crosshairs in Jettison Stowage Bag.
   Temporarily stow bag in shuttle.

**CAUTION**

When the Standoff Cross is not mounted, it should be in its bag and the Docking Target Base Plate should be covered. The surfaces of these items are very easily scratched, which could impede future dockings.

8. Don Gloves.

9. Remove Docking Target Standoff Cross from Docking Target Base Plate (10" Adjustable Wrench and 1-1/2" Open End Wrench). Temporarily stow jamnut on non-threaded portion of receptacle.

10. Remove Docking Target Standoff Cross.
    Insert Docking Target Standoff Cross into Docking Target Standoff bag. Temporarily stow.

11. Install Docking Target Base Plate Cover.

12. Temporarily stow tools/Gloves.

PMA3 INGRESS OPERATIONS

APAS Hatch

    Insert tool in hatch actuator socket (ensure fully seated).
    Rotate tool 3 --- 4 turns in direction of ‘ОТКР’ (Open) arrow until it clicks.

**********************************************************************
If tool prematurely slips or does not engage
If communication available, check МСС-Н before proceeding.
Select ‘АВАРИЙНОЕ ПОЛОЖИЕ’ (Emergency Position) setting on Hatch Tool.
Reattempt to open Hatch.
**********************************************************************

Remove tool.
Allow Hatch Seals to relax for 3 minutes.
CAUTION
APAS Hatch Seals require 3 minutes to relax before opening Hatch.

Open Hatch.

14. Tether Hatch Tool to hatch handle.
Secure Docking Mechanism Accessory Kit in vestibule.
Secure Hatch in open position to PMA APAS Hatch Standoff.

PMA3 15. APAS EQUAL VLV → CL


17. Coupling ←|→ Cap from PMA3 hard duct


19. Open grille cover.

20. PMA/ODS Interface Duct →|← PMA3 hard duct inlet (Use Coupling.)

MO13Q 21. AIRLK FAN A(B) – OFF

Ext A/L 22. Air Inlet Flex Duct ←|→ Halo

23. PMA/ODS Interface Duct →|← Air Inlet Flex Duct (Use T-handle clamp.)


MO13Q 25. AIRLK FAN A(B) – ON

PMA 26. √Airflow from grille

27. Stow APAS Hatch Cover in PMA.
Secure to Handrail.
ISS TOOLS AND EQUIPMENT REQUIRED (STOWED IN PMA 3)

PMA3
- Docking Target Standoff Cross Bag
- Docking Target Base Plate Cover
- 1-1/2” Open End Wrench
- PMA APAS Cover

ISS TOOLS AND EQUIPMENT REQUIRED

CCCK
- Earplugs (two sets)
- Rubber Gloves (one set)

Kit A
- 10” Adjustable Wrench

NOD1 D4_G1
- Docking Mechanism Accessory Kit
- APAS Hatch Tool
- Cleaning Pads

NOD1 D4_K1
- MPEV Muffler

INGRESS PMA

Node 1 Deck Hatch
1. Node 1 Deck MPEV → uncap
2. Attach MPEV muffler on MPEV snout.
3. Node 1 Deck MPEV → OP
4. Wait 8 minutes or On MCC-H GO, proceed.

MPEV
5. Detach MPEV muffler from MPEV, stow in locker.

Node 1 Deck Hatch
6. Open Node 1 Deck hatch per decal.
   MPEV → CL, cap installed

   WARNING
   Don earplugs prior to and during equalization.
   Doff when no longer required.

7. Don Ear Plugs.

PMA3
8. APAS EQUAL VLV → OP

APAS HATCH OPENING
9. Wait 1 minute or On MCC-H GO, proceed.
10. Open APAS Hatch
    Select ‘РАБОЧЕЕ ПОЛОЖЕНИЕ’ (Working Position) torque setting on APAS Hatch Tool.
Insert tool in hatch socket (ensure fully seated).
Rotate tool 3 --- 4 turns in direction of ‘ОТКР’ (Open) arrow until it clicks.

*****************************************************************
If tool prematurely slips or does not engage
If comm available, check MCC-H before proceeding.
Select ‘РАБОЧЕЕ ПОЛОЖЕНИЕ’ (Emergency Position) setting on Hatch Tool.
Reattempt to open Hatch.
*****************************************************************

Remove tool.
Allow Hatch Seals to relax for 5 minutes.

**CAUTION**
APAS Hatch Seals require 5 minutes to relax before opening Hatch.

Open Hatch.

11. APAS EQUAL VLV → CL

12. Install APAS Hatch Cover (stowed in PMA)
Secure Hatch in open position to PMA APAS Hatch Standoff.

**WARNING**
Surfaces in the ODS vestibule may be below freezing for a short time after initial ODS Hatch opening. Avoid direct contact with vestibule surfaces until SHUTTLE VESTIBULE TEMP 1,2 (two) indicate > 40 degF (SM 177 DM STATUS ODS INTERFACE).

**EQUALIZATION**
13. ISS report to shuttle: “PMA APAS hatch is opened. Go for shuttle equalization with ISS.”

**REMOVE DOCKING EQUIPMENT**

**CAUTION**
When the Standoff Cross is not mounted, it should be in its bag and the Docking Target Base Plate should be covered. The surfaces of these items are very easily scratched, which could impede future dockings.
14. Don gloves.

15. Remove Docking Target Standoff Cross from Docking Target Base Plate. (10" Adjustable Wrench and 1-1/2" Open End Wrench).

Temporarily stow jam nut by continuing to rotate it onto smaller, non-threaded diameter of receptacle.

16. Insert cross into Docking Target Standoff Cross Bag.

17. Install Docking Target Base Plate Cover.

18. Position free end of PMA/ODS Interface Duct Segment new ODS Hatch.

19. **MCC-H** report to ISS and shuttle expected equalization time.

**OPENING ODS HATCH AND VESTIBULE INGRESS**

20. Equal vlv (one) – remove cap, NORM

**SM 66 ENVIRONMENT**

21. When Cabin dP/dT < 0.01, proceed.

22. √ODS Hatch ΔP ≤ 0.2 psid

Open ODS Hatch per decal
Equal vlv (one) - OFF, cap installed

**WARNING**

Surfaces may be below freezing for a short time after initial ODS Hatch opening. Avoid direct contact with vestibule surfaces until SHUTTLE VESTIBULE TEMP 1,2 (two) indicate > 40 degF (SM 177 DM STATUS ODS INTERFACE).

**CONFIGURE DUCTING**

23. AIRLK FAN A(B) – OFF

24. Air Inlet Flex Duct ←|→ Halo

25. Retrieve free end of PMA/ODS duct from vestibule.

26. PMA/ODS Interface Duct →|← Air Inlet Flex Duct (Use T-handle clamp).

27. AIRLK FAN A(B) – ON
<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.</td>
<td>√Airflow from grille</td>
</tr>
<tr>
<td>29.</td>
<td>Node 1 Deck Aft IMV vlv → (deploy handle) OPEN (stow handle)</td>
</tr>
<tr>
<td><strong>NOTE</strong></td>
<td>If necessary, <strong>MCC-H</strong> will command valve to open position to obtain proper open indication.</td>
</tr>
<tr>
<td>30.</td>
<td>Close grille cover.</td>
</tr>
<tr>
<td>31.</td>
<td>Tether hatch tool (temporarily stowed on Shuttle) to hatch handle.</td>
</tr>
</tbody>
</table>
| 32. | Temporarily stow the following in APAS Hatch Cover Bag  
Docking Target Standoff Cross  
1-1/2" Open End Wrench |
| 33. | Stow contents  
10" Adjustable Wrench  
Docking Mechanism Accessory Kit  
APAS Hatch Tool  
Cleaning Pads  
Gloves  
Earplugs  
Towels |
OBJECTIVE:
Install two ground straps between Active CBM (ACBM) Ring and Passive CBM (PCBM) Ring.

LOCATION:
Installed: CBM Vestibule
Stowed: √ Maintenance and Assembly Task Supplement (MATS)

DURATION:
20 minutes

PARTS:
Ground Straps (two) (P/N 683-13477-7)

NOTE
Ground Straps (two) are found in the Vestibule Outfitting Kit (VOK) Cargo Transfer Bag.

MATERIALS:
None

TOOLS REQUIRED:
Mini Maglite
ISS Common IVA Tool Kit:
   Kit D: 3/16” Hex Head, 1/4” Drive
   Kit E: Ratchet 1/4” Drive
   Kit F: 3/8” Socket, 1/4” Drive
   Kit G: (40-200 in-lbs) Trq Wrench, 1/4” Drive
Lid #2: Tablecloth

Equivalent Shuttle Tools:
Flashlight
IFM Tool Kit:
   Drawer 1: Tool Table Cloth
   Drawer 3:
      3/8” Driver Handle
      1/4” to 3/8” Adapter
      3/16” Hex Head, 3/8” Drive
      3/8” Socket, 3/8” Drive
      (30-200 in-lbs) Trq Wrench, 1/4” Drive

REFERENCED PROCEDURE(S):
None
1.102 ACBM TO PCBM GROUND STRAP INSTALLATION
(S&M/4A - ALL/FIN)  Page 2 of 4 pages

Figure 1.- Ground Strap Locations on ACBM (Interior View).

NOTE
Right photo shows PCBM Alignment Guide removed.

Figure 2.- Ground Strap Mounting Brackets on CBM Rings.
LOCATING GROUND STRAP MOUNTING BRACKETS
1. Locate four Ground Strap Mounting Brackets (two on Active CBM Ring and two on Passive CBM Ring).
   Refer to Figure 1,2.

REMOVAL OF ALIGNMENT GUIDES (IF REQUIRED)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of PCBM Alignment Guides is only required to allow access to the Ground Strap Mounting Brackets.</td>
</tr>
</tbody>
</table>

2. If required, remove PCBM Alignment Guides covering Ground Strap Mounting Brackets, loosen fasteners (five per Alignment Guide) (Ratchet 1/4” Drive, 3/8” Socket, 1/4” Drive).
   Temporarily Stow.
   Refer to Figure 3.
INSTALLING GROUND STRAPS

Figure 4.- Ground Strap Installed Across ACBM to PCBM Interface.

NOTE
Ground Straps are installed across ACBM to PCBM interface. To do so, bend Ground Straps to distance required for proper fit, creating area under strap to allow installation of CBM to CBM IVA Seal Kit at later date. Bend should be made as close to ends of straps as possible while maintaining proper fit.

3. Install Ground Straps (two) from ACBM Bracket to PCBM Bracket, bending as necessary. Refer to Figure 4.

4. Tighten fasteners (two per Ground Strap).
   Torque to 90 in-lbs (Ratchet 1/4” Drive, 3/16” Hex Head, (40-200 in-lbs) Trq Wrench, 1/4” Drive).
   Refer to Figure 4.

INSTALLING ALIGNMENT GUIDES (IF REQUIRED)
5. If required, install PCBM Alignment Guides, tighten fasteners (five per Alignment Guide).
   Torque to 85 in-lbs (Ratchet 1/4” Drive, 3/8” Socket, 1/4” Drive, (40-200 in-lbs) Trq Wrench, 1/4” Drive).
   Refer to Figure 3.

6. Inform MCC-H of task completion.

7. √MATS for stowage locations
   Stow tools, equipment.
OBJECTIVE:
Remove CBM Center Disk Cover to allow crew access to vestibule areas.

LOCATION:
Installed: Node 1 Radial Ports
Stowed: √Maintenance and Assembly Task Supplement (MATS)

DURATION:
20 minutes

PARTS:
CBM Center Disk Cover (P/N 683-14575-001) Zenith/Nadir
CBM Center Disk Cover (P/N 683-14575-010) Stbd/Port

MATERIALS:
Gray Tape
Velcro Strips

TOOLS REQUIRED:
Mini Maglite
Portable Fan
ISS Common IVA Tool Kit:
Kit E:
   Ratchet 1/4" Drive
Kit F:
   1/4" Socket, 1/4" Drive
Lid 2:
   Tablecloth

Equivalent Shuttle Tools:
Flashlight
Portable Fan
IFM Tool Kit:
Drawer 1:
   Tool Table Cloth
   General Purpose Tape (1"
Drawer 3:
   4" Ratchet
   1/4" Socket, 1/4" Drive

REFERENCE PROCEDURE(S):
None
REMOVING TENSION TO CENTER DISK COVER

Figure 1.- CBM Center Disk Cover. (IVA side of Zenith/Nadir Cover is shown.)

Figure 2.- Cutaway View of Turnbuckle.
CAUTION

This procedure is performed near hatch seals. Care must be taken to avoid seal damage.

1. Pull out Pull Rings (two each Turnbuckle), then turn 90 degrees and release so that Pull Rings remain out on top of Plungers.
   If Pull Rings do not remain on top of Plungers, restrain Pull Rings on top of Plungers with Gray Tape.
   If required, remove Pull Ring Plungers completely from Turnbuckle (two each Turnbuckle) (Ratchet 1/4” Drive, 1/4” Socket).
   Temporarily Stow. Refer to Figures 1, 2.

2. If on IVA side, loosen Turnbuckles (two) by rotating toward center of Center Disk Cover (20 --- 25 turns).
   If on EVA side, loosen Turnbuckles (two) by rotating away from center of Center Disk Cover (20 --- 25 turns).
   Refer to Figure 3.

3. If Pull Ring Plungers were removed (refer to step 1), reinstall into Turnbuckle (two each Turnbuckle) (Ratchet 1/4” Drive, 1/4” Socket).
   Refer to Figure 2.

REMOVING CENTER DISK COVER FROM MOUNTING BRACKETS

Figure 3.- Loosening Turnbuckles.

Figure 4.- Pulley Restrained by Clevis PIP Pin. (View from IVA Side.)
4. Remove PIP Pins from Clevis Brackets (eight).
   Stow in end of Standoff Bars.
   Refer to Figures 4 --- 6.

5. Push pulleys (eight) into base of Clevis Brackets to release restraints,
   then slide out of Clevis (sliding towards IVA side).
   Refer to Figures 4 --- 6.
6. Remove Standoff Bar PIP Pins (two each Standoff Bar) from restraint location on Standoff Brackets. Insert PIP Pins in stowage location on Standoff Brackets. Refer to Figure 7.

7. Rotate Standoff Bar towards center of Cover. Remove Standoff Bar from Standoff Bracket.

CLOSEOUT

8. Fold cover diagonally so Turnbuckles meet. Fold as small as possible for stowage. Secure cover with Velcro Strips.

9. Inform **MCC-H** of task completion.

10. **MATS** for stowage location of Center Disk Cover
    Stow tools, equipment.
MATED OPERATIONS
NOTE
1. Purpose is to pressurize stack to 14.96 psia from 14.7 psia using orbiter O2 while maintaining ISS O2 concentration below US Segment limit of 24.1 %.

2. O2 repress will be repeated as required to allow adequate mixing and to avoid higher than acceptable O2 concentration in orbiter cabin.

FDA, C/W LIMITS RESET

NOTE
1. CABIN PRESS H/W C/W upper limit is not changed because it is adequate for the target pressures.

2. PPO2 limits are inhibited to avoid nuisance alarms.

3. O2 is limit-sensed by O2 concentration.

1. Contact MCC-H for uplink of B/U C/W and SM ALERT limit resets via TMBU, if desired.

<table>
<thead>
<tr>
<th>B/U C&amp;W</th>
<th>PARAM ID</th>
<th>ENA/INH</th>
<th>HI EU</th>
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<tr>
<td>CABIN PRESS</td>
<td>0612405</td>
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<td>PPO2 A</td>
<td>0612511</td>
<td>INH</td>
<td></td>
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<tr>
<td>PPO2 B</td>
<td>0612513</td>
<td>INH</td>
<td></td>
</tr>
<tr>
<td>H2O LOOP 1 ICH OUT T</td>
<td>0612724</td>
<td>INH</td>
<td></td>
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<tr>
<td>H2O LOOP 2 ICH OUT T</td>
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<td>INH</td>
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<table>
<thead>
<tr>
<th>H/W C&amp;W</th>
<th>CHANNEL</th>
<th>ENA/INH</th>
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<tr>
<td>PPO2 A</td>
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<td>INH</td>
</tr>
<tr>
<td>PPO2 B</td>
<td>44</td>
<td>INH</td>
</tr>
</tbody>
</table>

2. √MCC-H for repress Cryo configuration

Node 1
3. √PPRV caps installed on port, stbd Hatches

O2 REPRESS INITIATION

OCAC
4. Perform OCAC filter cleaning
   OCAC PWR → OFF

C5
5. DIRECT O2 vlv – OP

6. When ‘S78 O2 CONC’ or ‘S66 CABIN PRESS’ or ‘S210 NODE 1 CAB PRESS’ message
   DIRECT O2 vlv – CL
7. **MCC-H** may ask for another cycle.  
Wait for O2 to mix and O2 concentration to stabilize.

On call from **MCC-H**  
Repeat steps 5 --- 7.

**OCAC** 8. OCAC PWR → ON

9. √**MCC-H** for post-repress cryo configuration
NOTE
Station crew is primary for performing ISS steps. If necessary, commands to the ISS may be sent by MCC-M or the orbiter crew (via aft flight deck).

1. VERIFYING ORBITER NOT IN CONTROL

C3
√DAP: A/FREE/VERN(ALT)

GNC 20 DAP CONFIG

√DAP A12, B12 loaded

Orbiter ⇒ ISS, MCC-H, “Orbiter ready to begin controlling attitude of Mated Stack.”

2. CONFIGURING ISS TO FREE DRIFT

2.1 Commanding via ISS Crew or MCC-M

If commanding ISS to Free Drift via RS laptop or MCC-M

RS Laptop

CM: TBM PROC

CM:TBM:Procedures

sel F1_37 Transition to Indicator

Cancel combined propulsion system operations

cmd Execute

CM: СУДН: Main

CM: СУДН: Main

Verify RS GNC Mode – Indicator

ISS(MCC-M) ⇒ orbiter, MCC-H, “ISS is in Free Drift.”

2.2 Commanding via Shuttle AFD

If commanding ISS to Free Drift via the shuttle AFD

PCS

SM: MCS: 4A SM MCS Moding

4A SM MCS Moding

Verify RS GNC Mode – Thrusters

cmd 4A SM Mode Transition Enable

‘SM To Indicator Mode’

cmd SM To Indicator

Verify RS GNC Mode – Indicator

Orbiter ⇒ ISS(MCC-H), “ISS is in Free Drift.”
ПЕРЕДАЧА УПРАВЛЕНИЯ ОРИЕНТАЦИЕЙ С ШАТТЛА НА ДВИГАТЕЛИ ОРИЕНТАЦИИ РС
(JNT OPS/4A/FIN B/MULTI) Страница 1 из 2

<table>
<thead>
<tr>
<th>Лаптоп РС</th>
<th>1. ПРОВЕРКА, ЧТО МКС НЕ УПРАВЛЯЕТ ОРИЕНТАЦИЕЙ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>СМ: СУДН: Основной</td>
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<tr>
<td></td>
<td>СМ: СУДН: Основной</td>
</tr>
<tr>
<td></td>
<td>Проверить RS GNC Mode – Indicator (Режим СУДН РС – Индикаторный)</td>
</tr>
</tbody>
</table>

2. ПОДГОТОВКА СУДН РС К ПРИНЯТИЮ УПРАВЛЕНИЯ ОРИЕНТАЦИЕЙ (ВЫПОЛНЯЕТСЯ ЦУП-М)

ЦУП-М подготовить РС для передачи управления, путем выдачи команд согласно проверенной наземной процедуре.

- F1_17 УВ для задания BRO (расход на ориентацию; требуется значение BRO)
- F1_40 Выбор коллапторов и ДО для ориентации (требуется ввод ряда значений)
- УВ для выбора соответствующего режима управления ориентацией РС

ЦУП-М ⇒ МКС, ЦУП-Х “Российский сегмент готов к передаче управления”.

3. ПЕРЕВОД ШАТТЛА В СВОБОДНЫЙ ДРЕЙФ

СЗ(A6) DAP: FREE

Шаттл ⇒ МКС, ЦУП-Х “Шаттл находится в свободном дрейфе”.

4. ПРИНЯТИЕ УПРАВЛЕНИЯ ОРИЕНТАЦИЕЙ МКС

4.1 ВЫДАЧА КОМАНД ЭКИПАЖЕМ МКС ИЛИ ЦУП-М

Если команда на перевод МКС в режим управления ориентацией осуществляется экипажем МКС или ЦУП-М

- СМ: TBM PROC
- СМ: TBM: Procedures

выбрать F1_16 Перевод СУДН в активное управление на ДО

cmd Execute

- СМ: СУДН: Основной
- СМ: СУДН: Основной

Проверить RS GNC Mode – Thruster Only (Режим СУДН РС – только на ДО)

МКС(ЦУП-М) ⇒ Шаттл, ЦУП-Х “МКС приняла управление ориентацией”.
3. **ASSUMING CONTROL WITH ORBITER**

If ALT DAP required

- **O14:** PRI RJD DRIVER, LOGIC (sixteen) – ON
- **O15, O16:F**

If required attitude per Flight Plan is LVLH

DAP – A/LVLH/VERN(ALT)

If required attitude per Flight Plan is Inertial

DAP – A/INRTL/VERN(ALT)

[**GNC UNIV PTG**]

When rates are damped < 0.1 deg/sec/axis

DAP – A/AUTO/VERN(ALT)

Shuttle ⇒ ISS, **MCC-H**, “Shuttle has established attitude control.”
4.2 Выдача команд с кормового отсека летной папулы Шаттла

<table>
<thead>
<tr>
<th>ПРИМЕЧАНИЕ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Обратной связи команды SM Mode Transition Enable (Разрешить смену режима CM) нет. С момента выдачи команды отправляется 60-секундное окно, во время которого может быть выдана команда на принятие управления орентацией. Если это не выполнено, команда Transition Enable (Разрешить смену режима) должна быть выдана снова.</td>
</tr>
</tbody>
</table>

ДвоиУ3-Х относительно опорной системы координат управления CM

<table>
<thead>
<tr>
<th>PCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM: MCS: 4A SM MCS Moding</td>
</tr>
<tr>
<td>4A SM MCS Moding</td>
</tr>
</tbody>
</table>

cmd 4A SM Mode Transition Enable (Разрешить смену режима CM для полёта 4A)

'SM Take Control' (Приятие управления CM)

cmd LVLH(Inertial)(XPOP) (poУ3-Х)

Проверить RS GNC Mode – Thrusters (Режим СУДН РС – Управление на ДО) Проверить RS Reference Frame – Curr OSK(Curr Intrl Att)(XPOP) (Опорная система координат РС – Текущая OSK(Текущая Инерциальная орентация)(XPOP))

Шаттл ➔ MKS(ЦУП-Х) "MKC приняла управление ориентацией связи".

5. ВОЗВРАЩЕНИЕ ШАТТЛА В ШТАНТУЮ КОНФИГУРАЦИЮ

Если ALT DAP (режим ALT цифрового автопилота), вернуться к отключению питания Группы В.

| О14, | PRI RJD DRIVER, LOGIC (штатный) ➔ OFF (Откл) |
| О15, | RJDA-1A L2/R2 MANF DRIVER ➔ ON (кл) |
| О16: | F |
NOTE
Station crew is primary for performing ISS steps. If necessary, commands to the ISS may be sent by MCC-M or the shuttle crew (via aft flight deck).

1. **VERIFYING ISS NOT IN CONTROL**

   **RS Laptop**
   
   CМ: СУДН: Main
   
   Verify RS GNC Mode – Indicator

2. **PREPARING RS СУДН TO TAKE CONTROL (VIA MCC-M)**

   **MCC-M** will prepare the RS for handover by issuing the following commands per verified ground procedure.

   - F1, 17 Set BRO (Attitude control prop consumption limit; requires BRO value)
   - F1, 40 Manifolds and ДО for Attitude Control, Select (requires multiple inputs)
   - [УВ] for selection of proper RS Attitude Mode

   **MCC-M ⇒ ISS, MCC-H**, “Russian Segment ready for handover.”

3. **PLACING ORBITER INTO FREE DRIFT**

   **C3(A6)**
   
   DAP: FREE
   
   Shuttle ⇒ ISS, MCC-H, “Orbiter is in Free Drift.”

4. **ASSUMING ATTITUDE CONTROL WITH ISS**

   **4.1 Commanding via ISS Crew or MCC-M**

   If commanding ISS to attitude control via ISS crew or MCC-M
   
   **RS Laptop**
   
   CM: TBM PROC
   
   sel F1, 16 Motion Control and Navigation System transition to active control mode using thrusters

   cmd Execute

   CМ: СУДН: Main
   
   Verify RS GNC Mode – Thruster Only

   **ISS(MCC-M) ⇒ orbiter, MCC-H**, “ISS has assumed attitude control.”
ПЕРЕДАЧА УПРАВЛЕНИЯ ОРИЕНТАЦИЕЙ С ШАТТЛА НА ДВИГАТЕЛИ ОРИЕНТАЦИИ РС
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ПРИМЕЧАНИЕ
Экипаж станции является основным по выполнению шагов процедуры для МКС. При необходимости команды на МКС могут выдаваться ЦУП-М или экипажем Шаттла (с кормового отсека летной палубы).

1. ПРОВЕРКА, ЧТО МКС НЕ УПРАВЛЯЕТ ОРИЕНТАЦИЕЙ

Лаптоп PC

CM: СУДН: Основной
CM: СУДН: Основной

Проверить RS GNC Mode – Indicator (Режим СУДН РС – Индикаторный)

2. ПОДГОТОВКА СУДН РС К ПРИНЯТИЮ УПРАВЛЕНИЯ ОРИЕНТАЦИЕЙ (ВЫПОЛНЯЕТСЯ ЦУП-М)

ЦУП-М

ЦУП-М готовит PC для передачи управления, путем выдачи команд согласно проверенной наземной процедуре.

F1_17 УБ для задания BRO (расход на ориентацию; требуется значение BRO)
F1_40 Выбор коллапторов и ДО для ориентации (требуется ввод ряда значений)
УВ для выбора соответствующего режима управления ориентацией РС

ЦУП-М ⇒ МКС, ЦУП-Х "Российский сегмент готов к передаче управления".

3. ПЕРЕВОД ШАТТЛА В СВОБОДНЫЙ ДРЕЙФ

Лаптоп PC

СЗ(A6)

DAP: FREE

Шаттл ⇒ МКС, ЦУП-Х "Шаттл находится в свободном дрейфе".

4. ПРИНЯТИЕ УПРАВЛЕНИЯ ОРИЕНТАЦИЕЙ МКС

4.1 ВЫДАЧА УПРАВЛЕНИЯ ОРИЕНТАЦИЕЙ

Если команда на перевод МКС в режим управления ориентацией осуществляется экипажем МКС или ЦУП-М

Лаптоп PC

CM: TBM PROC
CM: TBM: Procedures

выбрать F1_16 Перевод СУДН в активное управление на ДО

cmd Execute

CM: СУДН: Основной
CM: СУДН: Основной

Проверить RS GNC Mode – Thruster Only (Режим СУДН РС – только на ДО)

МКС(ЦУП-М) ⇒ Шаттл, ЦУП-Х "МКС приняла управление ориентацией".
4.2 Commanding via Shuttle AFD

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no feedback for SM Mode Transition Enable command. Once this command is sent, a 60-second window opens during which the take control command can be sent. If not, the Transition Enable command must be sent again.</td>
</tr>
</tbody>
</table>

√MCC-H for SM control reference frame

PCS
SM: MCS: 4A SM MCS Moding
4A SM MCS Moding

\textbf{cmd} 4A SM Mode Transition Enable

'SM Take Control'

\textbf{cmd} LVLH(Inertial)(XPOP) (per MCC-H instruction)

Verify RS GNC Mode – Thrusters
Verify RS Reference Frame – Curr OSK(Curr Inrtl Att)(XPOP)

Orbiter ⇒ ISS(MCC-H), “ISS has assumed attitude control of the Mated Stack.”

5. RETURNING ORBITER TO NOMINAL CONFIGURATION
If ALT DAP, return to Group B Powerdown.

O14, PRI RJD DRIVER, LOGIC (sixteen) – OFF
O15, RJDA-1A L2/R2 MANF DRIVER – ON
O16:F
4.2 Выдача команд с кормового отсека летной папулы Шаттla

**ПРИМЕЧАНИЕ**
Обратной связи команды SM Mode Transition Enable (Разрешить смену режима CM) нет. С момента выдачи команды открывается 60-секундное окно, во время которого может быть выдана команда на принятие управляния ориентацией. Если это не выполнено, команда Transition Enable (Разрешить смену режима) должна быть выдана снова.

Дно УЗ-X относительно опорной системы координат управления CM

**PCS**
SM: MCS: 4A SM MCS Moding
4A SM MCS Moding

**cmd** 4A SM Mode Transition Enable (Разрешить смену режима CM для полета 4A)

' SM Take Control' (Приятие управления CM)

**cmd** LVLH(Inertial)(XPOP) (по УЗ-X)

Проверить RS GNC Mode – Thrusters (Режим СУДН PC – Управление на ДО)
Проверить RS Reference Frame – Curr OSK(Curr Infl Att)(XPOP) (Опорная система координат PC –Текущая OCK(Текущая Инерциальная ориентация)(XPOP))

Шаттл ⇒ MKC(ЦУП-X) “MKC приняла управление ориентацией связи”.

5. ВОЗВРАЩЕНИЕ ШАТТЛА В ШТАТНУЮ КОНФИГУРАЦИЮ
Если ALT DAP (режим ALT цифрового автопилота), вернуться к отключению питания Группы В.

O14, PRI RJD DRIVER, LOGIC (шестнадцать) – OFF (Откл)
O15, RJDA-1A L2/R2 MANF DRIVER – ON (Бкл)
O16:F
This Page Intentionally Blank
OBJECTIVE:
Install CBM Center Disk Cover to restore thermal and meteoroid debris protection to the Node 1 Radial Port.

LOCATION:
Installed: Node 1 Radial Ports
Stowed: √Maintenance and Assembly Task Supplement (MATS)

DURATION:
20 minutes

PARTS:
CBM Center Disk Cover (P/N 683-14575-001) Nadir/Zenith
CBM Center Disk Cover (P/N 683-14575-010) Stbd/Port

MATERIALS:
Gray Tape

TOOLS REQUIRED:
Mini Maglite
Portable Fan
ISS Common IVA Tool Kit:
  Kit E:
    Ratchet 1/4" Drive
  Kit F:
    1/4" Socket, 1/4" Drive
Lid 2:
  Tablecloth

Equivalent Shuttle Tools:
Flashlight
Portable Fan
IFM Tool Kit:
  Drawer 1:
    Tool Table Cloth
    General Purpose Tape (1")
  Drawer 3:
    4" Ratchet
    1/4" Socket, 1/4" Drive

REFERENCE PROCEDURE(S):
None
INSTALLING CENTER DISK COVER ONTO MOUNTING BRACKETS

CAUTION
This procedure is performed near hatch seals. Care must be taken to avoid seal damage.

1. Remove Center Disk Cover from stowage. Slide Cover into vestibule before unfolding for installation.

2. Unfold Cover, Standoff Bars toward Controller Panel Assemblies (CPAs). Refer to Figure 1.

Figure 1.- CBM Center Disk Cover. (IVA side of Zenith/Nadir Cover is shown.)
3. Slide Standoff Bar Hooks (two each Standoff Bar) into Standoff Bracket. Rotate Standoff Bar away from center of Center Disk Cover. Refer to Figure 2.

4. Remove Standoff Bar PIP Pins (two each Standoff Bar) from stowage location on Standoff Brackets. Insert PIP Pins in restraint location on Standoff Brackets. Refer to Figure 2.

Figure 2.- Side View of Standoff Bar Installed in Standoff Bracket.

Figure 3.- Clevis PIP Pin Stowed in End of Standoff Bar. (View from IVA Side.)
5. Slide Pulley Restraints (eight) into Clevis Bracket until pulley snaps into place (sliding towards EVA side).
   Refer to Figures 3 --- 5.

6. Remove Clevis PIP Pins (eight) from stowage location at end of Standoff Bars.
   Insert PIP Pins in Clevis Brackets.
   Refer to Figures 3 --- 5.
7. Pull out Pull Rings (two each Turnbuckle), then turn 90 degrees and release so that Pull Rings remain out on top of Plungers. If Pull Rings do not remain on top of Plungers, restrain Pull Rings on top of Plungers with Gray Tape.

If required, remove Pull Ring Plungers completely from turnbuckle (two each Turnbuckle) (Ratchet 1/4" Drive, 1/4" Socket). Temporarily stow. Refer to Figure 6.
8. If on IVA side, tighten Turnbuckles (two) by rotating away from center of Center Disk Cover (20 --- 25 turns, shaking every 5 turns until cable is taut).

If on EVA side, tighten Turnbuckles (two) by rotating toward center of Center Disk Cover (20 --- 25 turns, shaking every 5 turns until cable is taut).
Refer to Figure 7.

9. If required, remove securing tape on Pull Rings.
Rotate Pull Rings so Plungers fall back into place.

If Pull Ring Plungers were removed (refer to Step 7), reinstall into Turnbuckle (two each Turnbuckle) (Ratchet 1/4" Drive, 1/4" Socket).
Refer to Figure 6.

CLOSEOUT

10. Inform MCC-H of task completion.

11. Stow tools, equipment.
EGRESS PMA3

1. Verify all Equipment Bags and returning items removed from PMA3
   - 10" Adjustable Wrench
   - 1-1/2" Open End Wrench
   - Rubber Gloves
   - Towel
   - Flashlight

MO13Q 2. ARLK/TNL FAN A(B) – OFF

Ext A/L 3. PMA/ODS Interface Duct Segment ←|→ Air Inlet Flex Duct
   (Stow free end of PMA/ODS Interface Duct into PMA3.)

4. Air Inlet Flex Duct →|← Halo (Use T-handle Clamp.)

MO13Q 5. ARLK/TNL FAN A(B) – ON

Ext A/L 6. √Airflow at halo

PMA3 7. Wipe any visible condensation from PMA3 and report any condensation to MCC-H.
   Clean hatch seals with Cleaning Pads from Docking Mechanism Accessory Kit.

8. Don Gloves.

9. Remove Docking Target Base Plate Cover from Docking Target Base Plate.

10. Remove Docking Target Standoff Cross from Standoff Cross Bag.

   **NOTE**
   Ensure key on Standoff Cross shaft is aligned with keyway on mating receptacle, and insert shaft until collar bottoms out on receptacle surface.

11. Insert Docking Target Standoff Cross into keyed receptacle on Docking Target Base Plate until shaft collar bottoms out.

   **NOTE**
   When all mating parts are correctly assembled, a groove on the Docking Target Standoff Cross shaft should be visible above hexagonal capnut (not recessed).

12. Ensure jamnut is positioned onto smaller, non-threaded diameter of Docking Target Base Plate receptacle.
    Rotate capnut ↗, and tighten very firmly onto receptacle (10" Adjustable Wrench).
    Thread jamnut onto receptacle, rotating ↘, until contact with capnut shoulder occurs.
While maintaining a \( \leftarrow \) torque on capnut, firmly tighten jamnut \( \rightarrow \) against capnut (1-1/2" Open End Wrench).

13. Stow the following equipment in PMA:
   - Docking Mechanism Accessory Kit (minus Hatch Tool)
   - Docking Target Base Plate Cover
   - Docking Target Standoff Cross Bag
   - 1-1/2" Open End Wrench

14. Stow tools and equipment in shuttle:
   - Rubber Gloves
   - 10" Adjustable Wrench
   - Towel

ODS 15. Close PMA3 APAS Hatch.
   Disconnect Hatch from PMA APAS Hatch Standoff.
   Secure Hatch Standoff to PMA Handrail.
   Close Hatch.
   Select ‘РАБОЧЕЕ ПОЛОЖЕНИЕ’ (Working Position) torque setting on APAS Hatch Tool.
   Insert Hatch Tool in hatch socket (ensure fully seated).
   Rotate Hatch Tool 3 --- 4 turns in direction of ‘ЗАТП’ (Close) arrow until it clicks.

**************************************************************************

If tool prematurely slips or does not engage
   If comm available, check МСС-H before proceeding.
   Select ‘АВАРИЙНОЕ ПОЛОЖЕНИЕ’ (Emergency Position) setting on Hatch Tool.
   Reattempt to close Hatch.
**************************************************************************

16. √APAS EQUAL VLV – Op

ODS 17. Close ODS Hatch per decal.

Hatch 18. √Equal vlv (two) – OFF, caps installed

Ext A/L 19. If required, reinstall EMUs on AAPs.

20. Temporarily stow APAS Hatch Tool for transfer during nominal ingress.
ISS TOOLS AND EQUIPMENT REQUIRED

- Rubber Gloves
- Kit A 10" Adjustable Wrench
- Docking Mechanism Accessory Kit
  - APAS Hatch Tool
  - Cleaning Pads
  - APAS Hatch Cover
  - Docking Target Standoff Cross Bag
  - Docking Target Base Plate Cover
- 1-1/2" Open End Wrench

CONFIGURING DUCTING

1. Open grille cover.
2. Node 1 Deck Aft(Lab Fwd Stbd) IMV vlv → (deploy handle) CLOSE
   (stow handle)
3. AIRLK FAN A(B) – OFF
4. Ext A/L PMA/ODS Interface Duct Segment ←|→ Air Inlet Flex Duct
5. PMA Stow free end of PMA/ODS Interface Duct Segment into PMA.
6. Ext A/L Air Inlet Flex Duct →|← Halo (Use T-handle clamp.)
7. MO13Q AIRLK FAN A(B) – ON
   √Airflow at halo
8. ODS Vestibule Install crosshairs per markings.
9. For each docking light, remove the locking pin, install docking light
   perpendicular to ODS shell, and reinstall the locking pin.
   Reconnect cables.
10. Don Gloves for handling of Docking Target.
11. Disconnect Hatch from PMA APAS Hatch Standoff.
    Secure Hatch Standoff to PMA Handrail with Velcro.
    Remove APAS Hatch Cover.
    Stow cover in APAS Hatch Cover Bag.
12. Remove Docking Target Base Plate Cover from Target Base Plate. Stow cover in APAS Hatch Cover Bag.


**NOTE**
Ensure key on Standoff Cross shaft is aligned with keyway on mating receptacle, and insert shaft until collar bottoms out on receptacle surface.

14. Insert Docking Target Standoff Cross into keyed receptacle on Docking Target Base Plate until shaft collar bottoms out.

**NOTE**
When all mating parts are correctly assembled, a groove on docking target Standoff Cross shaft should be visible above capnut (not recessed).

15. Ensure jamnut is positioned onto smaller, non-threaded diameter of Docking Target Base Plate receptacle.

Rotate capnut and tighten very firmly onto receptacle (10" Adjustable Wrench).

Thread jamnut onto receptacle, rotating until contact with capnut occurs.
While maintaining a torque on capnut, firmly tighten jamnut against capnut (1-1/2" Open End Wrench).


**ODS HATCH CLOSURE**

ODS Hatch

17. Close ODS Hatch per decal.

18. √EQUAL VLV (two) – OFF, capped

**APAS HATCH CLOSURE**

PMA


Select ‘РАБОЧЕЕ ПОЛОЖЕНИЕ’ (Working Position) torque setting on Hatch Tool.
Insert tool in hatch socket (ensure fully seated).
Rotate tool 3 --- 4 turns in direction of ‘3AKP’ (Close) arrow until tool clicks.
PMA

20. √APAS EQUAL VLV – CL

WARNING

PMA remains unventilated and should not be considered a habitable module. Restrict activity in PMA to stowage only.

CLOSING NODE 1 DECK HATCH

Node 1 21. Close Node 1 Deck (Lab Fwd) Hatch per decal.
Deck √MPEV → CL, capped
(Lab Fwd)
1. √ODS Hatch closed

2. √ODS Hatch Equal vlv (two) – OFF, caps installed

A6L 3. √cb ESS 1BC(2CA) SYS PWR CNTL SYS 1(2) – cl

4. √SYS PWR MNA(MNB) – ctr (tb-ON)

5. cb ESS 1BC(2CA) DEP SYS 1(2) VENT ISOL – cl

6. cb MNA(B) DEP SYS 1(2) VENT – cl

7. VEST DEP VLV SYS 1(SYS 2) VENT ISOL – OP (tb-OP)

8. VEST DEP VLV SYS 1(SYS 2) VENT – OP (tb–OP)
   Wait 15 minutes.

9. VEST DEP VLV SYS 1(SYS 2) VENT – CL (tb–CL)

NOTE
MCC-H will perform ODS Hatch, and PMA 3 APAS Hatch leak check overnight.
1. Once P6 is activated, the ISS power generation capability is such that an ISS powerdown will not be required unless the absolute solar beta angle $\geq 50^\circ$.

For absolute solar beta angle $\geq 50^\circ$, the total ISS powerdown required is 600 Watts (~200 from the RS and ~400 from the USOS).

2. Use the POWERUP column in reverse order to back out of the powerdown.

3. The loads for the major power users are presented below.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>dc Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMA3 Shell Heaters</td>
<td>0 W predicted</td>
</tr>
<tr>
<td>Node 1 Shell Heaters</td>
<td>0 W predicted</td>
</tr>
<tr>
<td></td>
<td>Total for String B 1284 W</td>
</tr>
<tr>
<td>PMA1 Shell Heaters</td>
<td>40 W predicted</td>
</tr>
<tr>
<td></td>
<td>Total for String B 272 W</td>
</tr>
<tr>
<td>SPDA Rail Heaters</td>
<td>120 W</td>
</tr>
<tr>
<td>Z1 EEATCS Heaters</td>
<td>TBD W</td>
</tr>
<tr>
<td>Z1 DDCU Heaters</td>
<td>200 W</td>
</tr>
<tr>
<td>PCUs and Heaters</td>
<td>124 W</td>
</tr>
<tr>
<td>CMG Heaters</td>
<td>400 W</td>
</tr>
<tr>
<td>KU-Band and S-Band Heaters</td>
<td>610 W</td>
</tr>
</tbody>
</table>

Early Comm

<table>
<thead>
<tr>
<th>Transmitter On</th>
<th>Low Rate</th>
<th>High Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1RS1 C</td>
<td>19 W</td>
<td>147 W</td>
</tr>
<tr>
<td>Port Antenna Power (5)</td>
<td>70 W</td>
<td>70 W</td>
</tr>
<tr>
<td>Port Antenna Heater (6)</td>
<td>65 W</td>
<td>19 W</td>
</tr>
<tr>
<td>Stbd Antenna Power (12)</td>
<td>70 W</td>
<td>70 W</td>
</tr>
<tr>
<td>Stbd Antenna Heater (13)</td>
<td>54 W</td>
<td>54 W</td>
</tr>
<tr>
<td>XCVR Power (5)</td>
<td>23 W</td>
<td>23 W</td>
</tr>
<tr>
<td>RFPDB Power (11)</td>
<td>12 W</td>
<td>51 W</td>
</tr>
</tbody>
</table>

MDM N1-1

<table>
<thead>
<tr>
<th>Mode</th>
<th>Wattage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Mode</td>
<td>67 W</td>
</tr>
<tr>
<td>Secondary Mode</td>
<td>67 W</td>
</tr>
<tr>
<td>Diagnostic Mode</td>
<td>37 W</td>
</tr>
</tbody>
</table>

MDM N1-2

<table>
<thead>
<tr>
<th>Mode</th>
<th>Wattage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Mode</td>
<td>67 W</td>
</tr>
<tr>
<td>Secondary Mode</td>
<td>67 W</td>
</tr>
<tr>
<td>Diagnostic Mode</td>
<td>37 W</td>
</tr>
</tbody>
</table>
## POWERDOWN

### NOTE
Depending on the heater configuration, power usage may not decrease after every step.

1. **POWERDOWN REQUIREMENT VERIFICATION**
   - If absolute solar beta angle < 50° (no powerdown required) >>

2. **RS LOAD POWERDOWN**
   - TBD (Based on current data, SM and FGB total powerdown will be 200 W.)

3. **INHIBITING PMA3 A AND B SHELL HTRS**
   - **Task:** USOS Powerdown/up Pg 1
   - **3A USOS Powerdown Powerup Display 1**

   **sel PMA3 Htrs**

   **PMA3 – HtrAvailability**

   **sel Htr [X]A** where [X] = 1 2 3 4 5

   **cmd Inhibit**

   \(\sqrt{\text{Htr[X]A Availability – Inh}}\)

   Repeat

   **sel Htr [X]B** where [X] = 1 2 3 4 5

   **cmd Inhibit**

   \(\sqrt{\text{Htr[X]B Availability – Inh}}\)

   Repeat

## POWERUP

**cmd Ena Backup**

**cmd Ena Operate**
### POWERDOWN

<table>
<thead>
<tr>
<th>4. INHIBITING NODE 1 A AND B HTRS (1 --- 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A USOS Powerdown Powerup Display 1</td>
</tr>
<tr>
<td>sel Node 1 Htrs 1 --- 6</td>
</tr>
<tr>
<td>Node1Htr16avail</td>
</tr>
<tr>
<td>sel Htr [X]A   where [X] = [1, 2, 3, 4, 5, 6]</td>
</tr>
<tr>
<td><strong>cmd</strong> Inhibit</td>
</tr>
<tr>
<td>√Htr[X]A Availability – Inh</td>
</tr>
<tr>
<td>Repeat</td>
</tr>
<tr>
<td>sel Htr [X]B   where [X] = [1, 2, 3, 4, 5, 6]</td>
</tr>
<tr>
<td><strong>cmd</strong> Inhibit</td>
</tr>
<tr>
<td>√Htr[X]B Availability – Inh</td>
</tr>
<tr>
<td>Repeat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. INHIBITING NODE 1 A AND B HTRS (7 --- 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A USOS Powerdown Powerup Display 1</td>
</tr>
<tr>
<td>sel Node 1 Htrs 7 --- 9</td>
</tr>
<tr>
<td>Node1Htr79avail</td>
</tr>
<tr>
<td>sel Htr [X]A   where [X] = [7, 8, 9]</td>
</tr>
<tr>
<td><strong>cmd</strong> Inhibit</td>
</tr>
<tr>
<td>√Htr[X]A Availability – Inh</td>
</tr>
<tr>
<td>Repeat</td>
</tr>
<tr>
<td>sel Htr [X]B   where [X] = [7, 8, 9]</td>
</tr>
<tr>
<td><strong>cmd</strong> Inh</td>
</tr>
<tr>
<td>√Htr[X]B Availability – Inh</td>
</tr>
<tr>
<td>Repeat</td>
</tr>
</tbody>
</table>

### POWERUP

<table>
<thead>
<tr>
<th>cmd Ena Backup</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd Ena Operate</td>
</tr>
</tbody>
</table>

09 NOV 00
### POWERDOWN

6. **INHIBITING PMA1 A AND B SHELL HTRS**

   **3A USOS Powerdown Powerup Display 1**

   - `sel PMA1 Htrs`
   - `PMA1 HtrAvailability`
   - `sel Htr [X]A  where [X] = 1 3 4 5`
     - **cmd** Inhibit
     - `√Htr[X]A Availability – Inh`
   - Repeat
   - `sel Htr [X]B  where [X] = 1 2 3 5`
     - **cmd** Inhibit
     - `√Htr[X]B Availability – Inh`
   - Repeat

7. **DISABLING Z1 SPDA HEATERS**

   **3A USOS Powerdown Powerup Display 1**

   - `'Pwr Bus Rail Htrs - A'`
     - **cmd** Z13B HtrA Inh (`√Availability – Inhibit`)
     - **cmd** Z14B HtrA Inh (`√Availability – Inhibit`)
   - `'Pwr Bus Rail Htrs - B'`
     - **cmd** Z13B HtrB Inh (`√Availability – Inhibit`)
     - **cmd** Z14B HtrB Inh (`√Availability – Inhibit`)

8. **DISABLING Z1 EEATCS HEATERS**

   - `'EEATCS Loop A Non Op Htr1’`
     - `'RPCM Z13B B’`
     - **cmd** RPC 7 – Op (Verify – Op)
   - `'EEATCS Loop B Non Op Htr1’`
     - `'RPCM Z14B B’`
     - **cmd** RPC 7 – Op (Verify – Op)

### POWERUP

- **cmd** Ena Backup
- **cmd** Ena Operate
- **cmd** Htr A Ena BU
- **cmd** Htr A Ena BU
- **cmd** Htr B Ena Opr
- **cmd** Htr B Ena Opr
- **cmd** RPC 7 – Close (Verify – Cl)
- **cmd** RPC 7 – Close (Verify – Cl)
<table>
<thead>
<tr>
<th>POWERDOWN</th>
<th>POWERUP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>9. DISABLING Z1 DDCU HEATERS</strong>&lt;br&gt;‘DDCU Htrs - 1’&lt;br&gt;‘RPCM Z14B B’&lt;br&gt;&lt;br&gt;<strong>cmd</strong> RPC 11 – Op (Verify – Op)&lt;br&gt;‘RPCM Z13B B’&lt;br&gt;&lt;br&gt;<strong>cmd</strong> RPC 11 – Op (Verify – Op)&lt;br&gt;‘DDCU Htrs - 2’&lt;br&gt;‘RPCM Z13B B’&lt;br&gt;&lt;br&gt;<strong>cmd</strong> RPC 6 – Op (Verify – Op)&lt;br&gt;‘RPCM Z14B B’&lt;br&gt;&lt;br&gt;<strong>cmd</strong> RPC 16 – Op (Verify – Op)</td>
<td><strong>cmd</strong> RPC 11 – Close&lt;br&gt;(Verify – Cl)&lt;br&gt;&lt;br&gt;<strong>cmd</strong> RPC 11 – Close&lt;br&gt;(Verify – Cl)&lt;br&gt;&lt;br&gt;<strong>cmd</strong> RPC 6 – Close&lt;br&gt;(Verify – Cl)&lt;br&gt;&lt;br&gt;<strong>cmd</strong> RPC 16 – Close&lt;br&gt;(Verify – Cl)</td>
</tr>
</tbody>
</table>
1. **VERIFYING ACS Moding ROLE CONFIGURATION**

PCS

MCS: ACS Moding

ACS Moding

‘ACS Configuration’

Verify Moding Role Primary,Secondary NCS – Full

********************************************************************

If Primary(Secondary) NCS Moding Role is not set to Full, then the following commands should be sent:

**set Moding Role**

**cmd** N1-2(N1-1) – Arm

Verify Arm Status Primary(Secondary) NCS – Arm

**cmd** N1-2(N1-1) – Full

Verify Moding Role Primary(Secondary) NCS – Full

Verify Arm Status Primary(Secondary) NCS – Disarm

********************************************************************

2. **VERIFYING RUSSIAN SEGMENT MODE STATUS**

‘ACS Configuration’

Verify RS Mode Primary,Secondary NCS – Drift

3. **VERIFYING DEPARTURE EVENT STATUS AND CONFIGURATION**

‘Departure’

Verify PMA3 Interface Sealed Primary,Secondary NCS – X

Verify PMA3 Separation Primary,Secondary NCS – Blank

Verify Departure Event Primary,Secondary NCS – Blank

4. **PENDING BACK OFF TIMER SET FOR ORBITER DEPARTURE**

**NOTE**

Pending Back Off Timer of 250 seconds allows the Orbiter to reach a safe distance prior to ISS resuming active attitude control.

PCS

MCS: ACS Moding

ACS Moding

‘Departure’

**set** Pending Back Off Time

**Pending Back Off Time**
‘Primary NCS’

input Time: 250 (seconds)

**cmd** Accept Time

Verify Pending Back Off Time: 250 (seconds)
Verify Arm Status – Arm

**cmd** Incorporate Pending Back Off Time

Verify Back Off Time: 250 (seconds)
Verify Arm Status – Disarm

‘Secondary NCS’

input Time: 250 (seconds)

**cmd** Accept Time

Verify Pending Back Off Time: 250 (seconds)
Verify Arm Status – Arm

**cmd** Incorporate Pending Back Off Time

Verify Back Off Time: 250 (seconds)
Verify Arm Status – Disarm

******************************************************************
If, before incorporating this time, the Pending Back Off Time needs to be canceled or configured later, disarm the current Pending Back Off Time as follows

sel Pending Back Off Time

*Pending Back Off Time*

‘Primary NCS’(‘Secondary NCS’)

**cmd** Disarm

Verify Arm Status – Disarm

******************************************************************

5. **ENABLING APAS LED LIGHTING**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each of the primary and secondary MDMs command one of the LED units (i.e., two units per PMA, four LEDs per unit). LED configurations: On – Active Attitude Control, Flash - Station in Drift, Off - LED Control SW is Inhibited or an MDM loss of comm situation has occurred.</td>
</tr>
</tbody>
</table>
PCS: ACS Moding
ACS Moding
‘ACS Configuration’

sel LED Control SW

LED Control SW

‘Primary NCS’

**cmd** Enable

Verify LED Control SW – Ena
Verify PMA3 LED State – Flash

‘Secondary NCS’

**cmd** Enable

Verify LED Control SW – Ena
Verify PMA3 LED State – Flash

6. **CREW VERIFICATION OF LED STATE**

   **MCC-H**
   
   At a convenient time, get visual verification by orbiter crew that LED indicators are Flashing (orbiter overhead windows).

7. **ENABLING DEPARTURE EVENT MONITORING FOR ACS Moding**

PCS

MCS: ACS Moding
ACS Moding
‘Departure’

sel PMA3 Departure Response SW

PMA3 Departure Response SW

‘Primary NCS’

**cmd** Arm

Verify Arm Status – Arm

**cmd** Enable

Verify Departure Response SW – Ena
Verify Arm Status – Disarm

‘Secondary NCS’

**cmd** Arm
Verify Arm Status – Arm

**cmd** Enable

Verify Departure Response SW – Ena
Verify Arm Status – Disarm

8. **VERIFYING DEPARTURE EVENT SOFTWARE STATUS**

ACS Moding

‘Departure’

Verify Departure Event Primary, Secondary NCS – blank

*******************************************************************

**CAUTION**

If the Primary(Secondary) Time Since Separation is observed to be incrementing any time prior to planned departure, ISS may take attitude control after 250 seconds. IMMEDIATE ACTION IS REQUIRED.

*******************************************************************

If the Primary(Secondary) Time Since Separation is observed to be incrementing any time prior to planned departure

sel Moding Role

**Moding Role**

**cmd** N1-2(N1-1) – Arm

Verify Arm Status Primary(Secondary) NCS – Arm

**cmd** N1-2(N1-1) – Off

Verify Moding Role Primary(Secondary) NCS – Off
Verify Arm Status Primary(Secondary) NCS – Disarm

*******************************************************************
1. **VERIFYING ISS SYSTEMS HAVE BEEN POWERED DOWN**

MCC-H that {2.505 ISS POWERDOWN AND RECOVERY FOR SHUTTLE ARRIVAL (DEPARTURE)} has been completed.

**NOTE**

Procedure to be completed for both channels. Total Time to complete procedure = 1 hour.

2. **VERIFYING COMM WITH BGA CONTROLLER**

PCS

P6: EPS: BGA 4B(2B)

BGA 4B(2B)

'ECU 4B(2B)'

Verify Integ Cnt - <incrementing>

3. **VERIFYING ECU PWR SUPPLY TEMPS AND VOLTAGE STATUS**

Verify SAW PS Temp, °C: -45 --- 54

Verify BGA PS Temp, °C: -45 --- 54

Voltage, V: 115 --- 125

4. **RECORDING PRESENT BGA STATUS**

BGA 4B(2B)

'BGA 4B(2B)'

Record data.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Ch 4B(2B) Mode, Primary PVCU</td>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>BGA Mode, Primary PVCU</td>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>Actual Angle, deg</td>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>Actual Angle Rate, deg/s</td>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>Motor State</td>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>Motor Velocity, deg/s</td>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>Motor Current, A</td>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>Latch 1 Pin Status</td>
<td>_________</td>
<td>_________</td>
</tr>
<tr>
<td>Latch 2 Pin Status</td>
<td>_________</td>
<td>_________</td>
</tr>
</tbody>
</table>

Copy recorded values for BGA 2B into column titled “INITIAL” in step 13.1.

Copy recorded values for BGA 4B into column titled “INITIAL” in step 13.2.
5. **VERIFYING BGA MOD**
   If the BGA Mode is “Safe/Lock”, “Manual Free”, “Null”, or “Blind” check with **MCC-H** before proceeding. (Safe/Lock to Safe/Lock mode transitions are not possible.)

6. **VERIFYING BLIND MODE IMPLEMENTATION TIME AND BGA ANGLE**
   √**MCC-H** for Blind Mode implementation time and BGA angle.
   
<table>
<thead>
<tr>
<th>Record</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directed Position, Time After LOC</td>
<td>Time After LOC</td>
<td>Time After LOC</td>
</tr>
<tr>
<td>________sec</td>
<td>________sec</td>
<td></td>
</tr>
<tr>
<td>(Protect for second Dock/Undock attempt + 15 minutes, 270 minutes max)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   | Directed Position, Cmded Angle | Cmded Angle |
   | ________deg | ________deg |
   | (Optimal power generation position) |
   | ________deg | ________deg |
   | (0 to 360) |

   Copy Time After LOC and Cmded Angle values into steps 7 and 8.

7. **SETTING BGA BLIND MODE TO DIRECTED POSTION FOR PRIMARY MDM**
   
   sel Blind Modes
   **BGA 4B(2B) Blind Modes**
   ‘Primary PVCU’
   ‘Directed Position’

   input LOC Timer: 1

<table>
<thead>
<tr>
<th>input Time After LOC</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>________sec</td>
<td>________sec</td>
<td></td>
</tr>
<tr>
<td>(From step 6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>input Cmded Angle</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>________deg</td>
<td>________deg</td>
<td></td>
</tr>
<tr>
<td>(From step 6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   **cmd Arm**
   **cmd Set**

   Verify Preselected Blind Mode - Directed Position
   Verify Actual LOC Timer - Implement

<table>
<thead>
<tr>
<th>Verify Preselected Time After LOC</th>
<th>Verify Preselected Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>________sec</td>
<td>________sec</td>
</tr>
<tr>
<td>(From step 6)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verify Preselected Parameter</th>
<th>Verify Preselected Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>________deg</td>
<td>________deg</td>
</tr>
<tr>
<td>(From step 6)</td>
<td>(From step 6)</td>
</tr>
</tbody>
</table>
8. SETTING BGA BLIND MODE TO DIRECTED POSTION FOR BACK-UP MDM

‘Backup PVCU’
‘Directed Position’

input LOC Timer: 1

<table>
<thead>
<tr>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______ sec or _______ sec</td>
<td>_______ sec or _______ sec</td>
</tr>
</tbody>
</table>

input Time After LOC: _______ sec or _______ sec
input Cmded Angle: _______ deg or _______ deg

(From step 6) (From step 6)

**cmd** Arm
**cmd** Set

Verify Preselected Blind Mode - Directed Position
Verify Actual LOC Timer - Implement

<table>
<thead>
<tr>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______ sec or _______ sec</td>
<td>_______ sec or _______ sec</td>
</tr>
</tbody>
</table>

Verify Preselected Time After LOC: _______ sec or _______ sec
Verify Preselected Parameter: _______ deg or _______ deg

(From step 6) (From step 6)

9. SETTING BGA CONTINGENCY CONTROL TO ANGLE HOLD

BGA 4B(2B)
‘BGA 4B(2B)’

sel Contingency Control

BGA 4B(2B) Contingency Control
‘Angle Hold’

**cmd** Arm
**cmd** Set

**NOTE**
SPN 15635 (PR 15635) BGA 2B and BGA 4B Contingency Control parameter static and indicates “Angle Hold” (Fixed for 5A and subsequent flights).

Verify Contingency Control - Angle Hold
10. **VERIFYING BGA CONTINGENCY MODE**
   Confirm Contingency Control status with MCC-H when time permits; continue procedure.

   **NOTE**
   Repeat steps 2 ---10 for the opposite BGA before proceeding.

11. **VERIFYING NEW BGA FEATHER ANGLE AND LATCH SELECTION**
   \( \text{MCC-H} \) for BGA feather angle and appropriate anti-rotation latch. If MCC-H not available use the following table.

   **Record**
<table>
<thead>
<tr>
<th>Cmded Angle: (0 to 360)</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>deg</td>
<td>deg</td>
<td>deg</td>
<td>deg</td>
</tr>
<tr>
<td>Flight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BGA 2B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BGA 4B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td>N/A</td>
<td>N/A</td>
<td>258.75 (1)</td>
<td>101.25 (1)</td>
</tr>
<tr>
<td>Progress 3</td>
<td>219.375 (1)</td>
<td>140.625 (1)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>5A</td>
<td>270 (1)</td>
<td>90 (1)</td>
<td>258.75 (1)</td>
<td>101.25 (1)</td>
</tr>
<tr>
<td>Progress 4</td>
<td>219.375 (1)</td>
<td>140.625 (1)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>5A.1</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>6A</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>Soyuz 2</td>
<td>219.375 (1)</td>
<td>140.625 (1)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>7A</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>4R</td>
<td>219.375 (1)</td>
<td>140.625 (1)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>7A.1</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>UF1</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>8A</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>UF2</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>9A</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>11A</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
<tr>
<td>9A.1</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
<td>149.063 (2)</td>
<td>210.937 (2)</td>
</tr>
</tbody>
</table>

   Copy BGA 2B Cmded Angle and Latch values into step 12, into column titled “FINAL” in step 13.1 and step 14.

   Copy BGA 4B Cmded Angle and Latch values into step 12, into column titled “FINAL” in step 13.2 and step 14.
12. CONFIGURING BGA MODE TO DIRECTED POSITION

**NOTE**
In order to save time, one BGA can be commanded to Directed Position Mode while the other is still in transition. Analysis has shown that perturbations due to additive torque disturbance are minimal.

BGA 4B(2B)
‘BGA 4B(2B)’

If PV Ch 4B(2B) Mode, Primary PVCU - Non-Solar Tracking
(Fully Commanded) (Contingency/Safe)

sel BGA Modes

BGA 4B(2B) Modes
‘Directed Position’

input Cmded Angle: _______deg or _______deg
(From step 11) (From step 11)

**cmd** Arm
**cmd** Set

Verify BGA Mode - Directed Position
BGA 4B(2B)
‘BGA 4B(2B)’

**NOTE**
SPN 17198 (PR 17198) Cmded Angle parameter contains a positive bias and can be as much as 1 deg greater than the value issued during commanding. This bias does not affect the Actual Angle parameter.

BGA 2B
BGA 4B
Verify Cmded Angle: _______deg (± 1.0) or _______deg (± 1.0)
(From step 11) (From step 11)

If PV Ch 4B(2B) Mode, Primary PVCU - Autonomous

sel Channel Targeted Modes

BGA 4B(2B) Ch Targeted Modes

<table>
<thead>
<tr>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
</table>
| input Cmded Angle: ______ deg or ______ deg (From step 11) | ______ deg or ______ deg (From step 11) |}

**cmd Set**

Verify Ch 4B(2B) Mode - Non-Solar Tracking
Verify BGA Mode - Directed Position

**NOTE**

SPN 17198 (PR 17198) Cmded Angle parameter contains a positive bias and can be as much as 1 deg greater than the value issued during commanding. This bias does not affect the Actual Angle parameter.

<table>
<thead>
<tr>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
</table>
| Verify Cmded Angle: ______ deg (± 1.0) or ______ deg (± 1.0) (From step 11) | ______ deg (± 1.0) or ______ deg (± 1.0) (From step 11) |}

**NOTE**

Repeat steps 11 through 12 for the opposite BGA before proceeding.

13. **VERIFYING BGA TRANSITION TO DIRECTED POSITION MODE AND CMDED ANGLE**

**NOTE**

It can take up to 30 minutes if one of the anti-rotation latches is engaged (15 minutes to unlatch pin and 15 minutes to complete the rotation).

13.1 **Verify BGA 2B Transition to Directed Position Mode and Cmded Angle.**

PCS
P6: EPS: BGA 2B
[BGA 2B]
‘BGA 2B’
13.2 Verify BGA 4B Transition to Directed Position Mode andCmded Angle.

PCS P6: EPS: BGA 4B
BGA 4B 'BGA 4B'

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial</th>
<th>Transition</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGA Actual Angle, deg</td>
<td>(From step 4)</td>
<td>&lt;Approaching Target Angle&gt;</td>
<td>± 0.5)</td>
</tr>
<tr>
<td>BGA Error Angle, deg</td>
<td>N/A</td>
<td>&lt;Decreasing&gt;</td>
<td>0.000 (± 1.0)</td>
</tr>
<tr>
<td>BGA Actual Angle Rate, deg/s</td>
<td>(From step 4)</td>
<td>+0.07 --- +0.28 or</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.07 --- -0.28</td>
<td></td>
</tr>
<tr>
<td>Divergence Indicator</td>
<td>&lt;Blank&gt;</td>
<td>&lt;Blank&gt;</td>
<td>&lt;Blank&gt;</td>
</tr>
<tr>
<td>BGA Motor State</td>
<td>(From step 4)</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>BGA Motor Velocity, deg/s</td>
<td>(From step 4)</td>
<td>+0.07 --- +0.28 or</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.07 --- -0.28</td>
<td></td>
</tr>
<tr>
<td>BGA Motor Current, A</td>
<td>(From step 4)</td>
<td>0.10 --- 0.70 (± 0.4)</td>
<td>0.10 (± 0.4)</td>
</tr>
<tr>
<td>Latch 1 Pin Status</td>
<td>(From step 4)</td>
<td>Unlatched</td>
<td>Unlatched</td>
</tr>
<tr>
<td>Latch 2 Pin Status</td>
<td>(From step 4)</td>
<td>Unlatched</td>
<td>Unlatched</td>
</tr>
</tbody>
</table>
14. CONFIGURING BGA MODE TO SAFE/LOCK (AS NECESSARY)

**NOTE**
In order to save time, one BGA can be commanded to Safe/Lock Mode while the other is still in transition. Analysis has shown that perturbations due to additive torque disturbance are minimal.

**BGA 4B(2B)**

`BGA 4B(2B)`

sel BGA Modes

**BGA 4B(2B) Modes**

`Safe/Lock`

input Cmded Angle = __________deg or __________deg
input Latch Select = __________ or __________

(From step 11) (From step 11)

**cmd Arm**

**cmd Set**

Verify BGA Mode - Safe/Lock

**BGA 4B(2B)**

`BGA 4B(2B)`

**NOTE**

SPN 17198 (PR 17198) Cmded Angle parameter contains a positive bias and can be as much as 1 deg greater than the value issued during commanding. This bias does not affect the Actual Angle parameter.

Verify Cmded Angle = __________deg (± 1.0) or __________deg (± 1.0)

(From step 11) (From step 11)

**NOTE**
Repeat step 14 for the opposite BGA before proceeding.
15. **VERIFYING BGA LATCH SEQUENCE COMPLETE (AS NECESSARY)**

**NOTE**

BGA Latch Sequence Duration takes 8.5 minutes (average) from the point at which the BGA is within 1 deg of the commanded angle to start of column A in the latch sequence. This time delay allows time to dampen any remaining motor perturbations before driving the latch mechanism. It takes 11 minutes (average) to complete columns A through D of the latch sequence. TOTAL TIME = 19.5 minutes at ambient temperature for each BGA.

### 15.1 Verifying BGA 2B Latch Sequence Complete

**PCS**
P6: EPS: BGA 2B

**BGA 2B**

‘BGA 2B’

Verify the appropriate anti-rotation latch is “Latched.”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial (~8.5 min)</th>
<th>Column A: (~4 min) Voltage/Current On</th>
<th>Column B: (~1 min) Active Actuator Indication</th>
<th>Column C: (~6 min) Inactive Actuator Indication</th>
<th>Column D: Latched Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGA Latch 1(2) Pin Status</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Latched</td>
</tr>
<tr>
<td>BGA Latch 1(2) Actuator</td>
<td>Inactive</td>
<td>Inactive</td>
<td>Active</td>
<td>Inactive</td>
<td>Inactive</td>
</tr>
<tr>
<td>BGA Latch 1(2) Current, A</td>
<td>Off Scale Low</td>
<td>~1.25 Off Scale Low</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
</tr>
<tr>
<td>BGA Latch 1(2) Voltage, V</td>
<td>0.0 – 0.1</td>
<td>~15 Off Scale Low</td>
<td>0.0 – 0.1</td>
<td>0.0 – 0.1</td>
<td>0.0 – 0.1</td>
</tr>
<tr>
<td>BGA Latch 1(2) Abort</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>BGA Motor State</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF*</td>
</tr>
</tbody>
</table>

*Initial = BGA within 1 deg of commanded angle

* Just after column D in the BGA latch sequence, the motor will turn off indicating the BGA has completed its latch sequence.

** Actual angle may be slightly different than commanded, due to final pin alignment. (± 0.3 deg).
15.2 Verifying BGA 4B Latch Sequence Complete

PCS

P6: EPS: BGA 4B

Verify the appropriate anti-rotation latch is “Latched.”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial (~8.5 min)</th>
<th>Column A: (~4 min Voltage/Current On)</th>
<th>Column B: (~1 min Active Actuator Indication)</th>
<th>Column C: (~6 min Inactive Actuator Indication)</th>
<th>Column D: Latched Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGA Latch 1(2) Pin Status</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Latched</td>
</tr>
<tr>
<td>BGA Latch 1(2) Actuator</td>
<td>Inactive</td>
<td>Inactive</td>
<td>Active</td>
<td>Inactive</td>
<td>Inactive</td>
</tr>
<tr>
<td>BGA Latch 1(2) Current, A</td>
<td>Off Scale Low</td>
<td>~1.25</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
</tr>
<tr>
<td>BGA Latch 1(2) Voltage, V</td>
<td>0.0 – 0.1</td>
<td>~15</td>
<td>0.0 – 0.1</td>
<td>0.0 – 0.1</td>
<td>0.0 – 0.1</td>
</tr>
<tr>
<td>BGA Latch 1(2) Abort</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>BGA Motor State</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF*</td>
</tr>
</tbody>
</table>

Initial = BGA within 1 deg of commanded angle

* Just after step D in the BGA latch sequence, the motor will turn off indicating the BGA has completed its latch sequence.

** Actual angle may be slightly different than commanded, due to final pin alignment. (± 0.3 deg).

If Actuator time-out occurs or Latch 1(2) Abort = “X”, √MCC-H.

If Latch 1(2) Pin Status = “Unlatched” after 20 minutes, √MCC-H.
1. **VERIFYING ACS MODING SOFTWARE CONFIGURATION**

PCS

MCS: ACS Moding

'ACS Moding’

Verify PMA3 Interface Sealed Primary, Secondary NCS — X

Verify PMA3 Separation Primary, Secondary NCS — blank

Verify PMA3 Departure Response SW Primary, Secondary NCS — Ena

Verify Back Off Time Primary, Secondary NCS: 250 (seconds)

Verify Time Since Separation Primary, Secondary NCS: 0

Verify Departure Event Primary, Secondary NCS — blank

**************************************************************************

**CAUTION**

If the Primary(Secondary) Time Since Separation is observed to be incrementing any time prior to planned departure, ISS may take attitude control after 250 seconds. IMMEDIATE ACTION IS REQUIRED.

If the Primary(Secondary) Time Since Separation is observed to be incrementing any time prior to planned departure

sel Moding Role

[Moding Role]

**cmd** N1-2(N1-1) – Arm

Verify Arm Status Primary(Secondary) NCS – Arm

**cmd** N1-2(N1-1) – Off

Verify Moding Role Primary(Secondary) NCS – Off

Verify Arm Status Primary(Secondary) NCS – Disarm

Wait for the orbiter call of Separation, then

If Primary moding role has been commanded off, perform only step 2 before exiting this procedure.

If Secondary moding role has been commanded off, perform the remaining steps of this procedure.

**************************************************************************

2. **COMMANDING ISS TO ATTITUDE HOLD FOR DEPARTURE**

Orbiter ⇒ ISS, “Range 30 feet.”

RS Laptop

CM: TBM PROC

[CM:TBM:Procedures]

sel F1_11 “[YB] OrbiterDeparture”

**cmd** Execute

ISS ⇒ orbiter, “Station is in Attitude Hold.”
3. MONITORING NCS SEPARATION SIGNALS, VERIFICATION OF ORBITER DEPARTURE AND POST SEPARATION LED MODE CHANGE

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For flights prior to onboard crew, orbiter monitoring of Station telemetry is discontinued when Orbiter OIU is disconnected.</td>
</tr>
<tr>
<td>2. The Time Since Separation counter is initiated when Separation is true (X) and Interface Sealed is false (Blank).</td>
</tr>
<tr>
<td>3. The Departure Event is set when the Time Since Separation equals the set Back Off Time. When the SM receives the Departure Event signal, it will resume active attitude control.</td>
</tr>
</tbody>
</table>

‘Departure’

Verify PMA3 Interface Sealed Primary,Secondary NCS – blank
Verify PMA3 Separation Primary,Secondary NCS – X
Verify Time Since Separation Primary,Secondary NCS – (Increasing)

When Time Since Separation equals Back Off Time
Verify Departure Event Primary,Secondary NCS – X

PCS
MCS: ACS Moding

‘ACS Configuration’

Verify RS Mode Primary,Secondary NCS – Cntl
Verify PMA3 LED State Primary,Secondary NCS – On

ISS ⇒ orbiter, “Station in Thrusters, holding Current Attitude.”
1. **INHIBITING ACS MODING INDICATOR LIGHTS**

   PCS
   MCS: ACS Moding
   ✣ ACS Moding
   ‘ACS Configuration’
   sel LED Control SW
   ✣ LED Control SW
   ‘Primary NCS’

   **cmd** Inhibit
   ✓ LED Control SW – Inh
   Verify PMA3 LED State – Off
   ‘Secondary NCS’

   **cmd** Inhibit
   ✓ LED Control SW – Inh
   Verify PMA3 LED State – Off

2. **INHIBITING DEPARTURE RESPONSE**

   ACS Moding
   ‘Departure’
   sel PMA3 Departure Response SW
   ✣ PMA3 Departure Response SW
   ‘Primary NCS’

   **cmd** Inhibit
   Verify Departure Response SW – Inh
   Verify Arm Status – Disarm
   ‘Secondary NCS’

   **cmd** Inhibit
   Verify Departure Response SW – Inh
   Verify Arm Status – Disarm

   ACS Moding
   ‘Departure’

   Verify Departure Event Primary,Secondary NCS – Blank
VHF RADIO SETTINGS
- AM/FM (Modulation) – FM
- PCV (Encryption) – PT (clear)
- PWR (Power) – MED

CHANGE AND STORE CHANNEL SETTINGS
- CH [0-9] – RCV frequency settings
- Modify [AM/FM], [PCV], [PWR], as required.
- Enter first 6 digits of RCV frequency.
- R/T – XMIT frequency (flashing TX)
- Enter first 6 digits of XMIT frequency.
- STO

ARIU KEYING
- J1 VOX key to VHF radio
- J2 XMIT PTT key to VHF radio

EXCL MIR XMIT
- BPSMU/ARIU headset can key VHF radio.
- ATUs are listen only.

DISABLE MIR XMIT
- ARIU is listen only – no key

EVA
- Both BPSMU/ARIU headset and ATU key VHF radio.

FREQUENCIES
1 - Shuttle/ISS (RNDZ) Half Duplex
2 - Shuttle/ISS (Docked) Half Duplex
3 - Shuttle/ISS/Soyuz Simplex
4 - Shuttle/Soyuz/Joint EVA Half Duplex
5 - Contingency VHF-2 Half Duplex

XMIT | RCV
--- | ---
139.2125 (medium power) | 143.625
139.2125 (low power) | 143.625
121.75 (medium power) | 121.75
143.825 (medium power) | 139.2125
121.75 (medium power) | 130.1625
WARNING
Do not operate VHF radio in HI power. Exceeds allowable cabin radiation levels and can damage antenna.

VHF ISS antenna cavity

CDR ATU CONFIG
PWR AUD
A/G 1 OFF
A/G 2 T/R vol 5 +
A/A OFF
ICOM A OFF
ICOM B OFF
MODE PTT/PTT

14' VHF Radio Comm Cable (pre-routed)

Attenuator

ML85E
J12 S2

20' VHF DC Pwr Cable (pre-routed)

VHFAntenna Cable

(coiled at L17)

20' VHF Antenna Cable

(coiled at L17)

4' VHF ARIU/ATU Cable (pre-routed)

4' VHF ARIU/ATU Cable (pre-routed)

4' Audio/Video I/F Cable

42' Audio/Video I/F Cable

BPSMU/ODS Adapter

BPSMU

ARIU

EXCL MIR
DISABLE
EVA

J1
J3

J2

VOL SQ

REMOTE

AUDI0

20' Audio/Video I/F Cable

BPSMU/S2
Config 1.- Anytime Hatches Closed (Rndz, EVA, Undock, Flyaround).

1. May be used when over Russian ground sites.
2. Early comm used for video-teleconferencing (backup to A/G2 and TV from Shuttle via MCC-H during EVAs)

VOSKHOD – SM audio system.
CP 2 – SM Comm Panel 2 – slaves config of FGB CH1/USOS RSA1.
IMCU – Intermodule Communications Unit.
FGB Audio – FGB Audio Center.
RAKU – Russian Audio Interface Unit.
ABC – Audio Bus Controller.
IAC – Internal Audio Controller.
ATU 1(2) – Audio Terminal Unit.
Config 2.- Docked with Hatches Open.

1. May be used when over Russian ground sites.
2. Early comm used for video-teleconferencing (backup to A/G 2 via MCC-H)
1. **STOWAGE**
   Unstow:
   - VHF Radio
   - ARIU
   - VHF ARIU/Radio Cable 4'
   - VHF ISS Antenna Cavity (Window Shade)
   - Antenna Adapter Plate (W6/W1) (Window Shade)
   - BPSMU
   - BPSMU/ODS Adapter
   - Audio/Video I/F Cable 42'
   - Audio/Video I/F Cable 4'
   Pre-routed cables:
   - VHF Antenna Cable 20' with Attenuator
   - VHF Radio DC Power Cable 20'
   - VHF Radio Headset Extension Cable 14'
   - VHF ARIU/ATU Cable 4'

2. **ANTENNA INSTALLATION**
   W6(W1) Remove Window Shade.
   - Assemble VHF ISS Antenna Cavity to Antenna Adapter Plate.
   - Connect VHF Antenna Cable with Attenuator on ISS Antenna Cavity.
   - Install Antenna Assembly in window.
   **NOTE**
   1. Place antenna cavity fastener loops over all eight metal tabs before closing fasteners.
   2. Do not touch circuitry inside cavity.
   3. Antenna must be flush against window to form ground plane using orbiter.

3. **RADIO/ARIU SETUP**
   VHF Radio √Power – Off (vol)
   L5 √CDR COMM CCU PWR – OFF
   - Connect VHF Radio Comm Cable to CCU.
   ML85E √SW2 – OFF
   √VHF Radio DC Power Cable to outlet (J12)
Connect VHF Radio DC Power Cable to VHF Radio (J1).
Connect VHF ARIU/Radio Cable to ARIU (J3).
Connect VHF ARIU/Radio to VHF Radio (AUDIO).
Connect VHF ARIU/ATU Cable to ARIU (J1).
Connect BPSMU/ODS Adapter to ARIU (J2).
Connect 4’ Audio/Video I/F Cable to BPSMU/ODS Adapter.
Connect 42’ Audio/Video I/F Cable to 4’ Audio/Video I/F Cable.
Connect BPSMU to 42’ Audio/Video I/F Cable.
Connect VHF Antenna Cable to VHF Radio (ANT).

4. RADIO AND AUDIO SYSTEM CONFIGURATION

O5
AUD PWR – AUD
A/G2 – T/R
All others – OFF
VOL A/G 2, as required (5 minimum)
XMIT/ICOM MODE – PTT/PTT

L5
CDR COMM CCU PWR – ON

ARIU
XMIT sw – EVA

ML85E
SW2 – ON

VHF Radio
Power – On (vol)
Volume, Squelch, as required

5. CHANNEL SELECTION CHECK

NOTE
Channel check is done in reverse order so default 1 is selected at the end of the check.

Keypad
Press [CH] 1-5

Channel 5: Contingency VHF-2 Half Duplex
√XMIT: 121.75 MHz (medium power)
√RCV: 130.1625 MHz

Channel 4: Shuttle/Soyuz/Joint EVA (Half Duplex)
√XMIT: 143.625 MHz (medium power)
√RCV: 139.2125 MHz

Channel 3: Shuttle/ISS/Soyuz simplex

Channel 2: Shuttle/ISS (Docked) Half Duplex
√XMIT: 139.2125 MHz (low power)
√RCV: 143.625 MHz
Channel 1: Shuttle/ISS (RNDZ) Half Duplex

\[\text{\(\sqrt{\text{xmit}}\): 139.2125 MHz (medium power)}\]
\[\text{\(\sqrt{\text{rcv}}\): 143.625 MHz}\]

6. **VHF RADIO SETTINGS CHECK**

**NOTE**

If radio channels settings not correct, use VHF Cue Card to reprogram settings.

Verify VHF radio settings

\[\sqrt{\text{AM/FM (Modulation)}} – \text{FM}\]
\[\sqrt{\text{PCV (Encryption)}} – \text{PT (clear)}\]
\[\sqrt{\text{PWR (Power)}} – \text{MED(LO), as required}\]

**WARNING**

Do not operate VHF Radio in \(\text{HI}\) power which exceeds maximum allowable radiation levels inside cabin and antenna can be damaged.
VHF TRANSCEIVER POWERUP AND CHECKOUT

1. Power radio → On
   SQUELCH → Full ccw (for VOL adjust)
   VOL → as required (midrange)
   SQUELCH → as required

   If speaker is required
   MODE → Press
   SPKR → Press

   √SPKR Annunciator Symbol – “SPKR”

   To disable speaker
   Repeat steps.
   Verify SPKR Annunciator Symbol – blank

2. Panel Illumination adjust
   LAMP – Press and release
   Repeat for desired back lighting.

   NOTE
   1. Channel 2 is recommended post docking.
   2. If ISS experiences trouble hearing shuttle, switch to Channel 1 and notify MCC.

3. Channel Selection
   CH – Press
   SELECT: 1, 2, 3, 4, 5

   Channel 1: Shuttle/ISS (RNDZ) Half Duplex
   XMIT: 139.2125 MHz (medium power)
   RCV: 143.625 MHz

   Channel 2: Shuttle/ISS (Docked) Half Duplex
   XMIT: 139.2125 MHz (low power)
   RCV: 143.625 MHz

   Channel 3: Shuttle/ISS/Soyuz simplex
   XMIT/RCV: 121.75 MHz (medium power)

   Channel 4: Shuttle/Soyuz/Joint EVA Half Duplex
   XMIT: 143.625 MHz (medium power)
   RCV: 139.2125 MHz
Channel 5: Contingency VHF-2 Half Duplex

XMIT: 121.75 MHz (medium power)
RCV: 130.1625 MHz

4. ISS crew configures communication system in preparation for communications with shuttle.
1. **UNSTOWING EPCS LAPTOP**

   - ML60J EPCS Laptop (two)
   - ML60J DC Power Supply Adapter Cable 10’ (two)
   - ML60J 1553 PC Card w/Adapter Cable 22in
   - ML60J ORB DC Power Cable 6’ (one)
   - ML60J ORB DC Power Cable 10’ (one)
   - ML60J ORB 1553 Data Cable 8’ (two)
   - ML60J RS/ORB DC Power Supply (28V → 20V) (two)

2. **VERIFYING POWER OFF**

   - √ PCS1,2 28VDC PWR SPLY – Off

   For DC UTIL PWR outlet availability, refer to {UTILITY OUTLET PLUG-IN PLAN ORBIT CONFIGURATION} (FDF, REF DATA FS, UTIL PWR).

   - A15 √ DC UTIL PWR MNC – Off (J2)
   - L12/A3 √ PDIP DC PWR 2 – OFF

3. **MAKING PCS POWER AND DATA CABLE CONNECTIONS**

   - Connect the 22-inch Adapter Cable to the 1553 PC Card for both PCSs. Insert 1553 PC Card into either PCS PCMCIA slot for both PCSs.

   - Connect both DC Power Supply Adapter Cable 10’ to PCS1,2 and to the 28VDC power supply outlets (J2).

   - A15 Connect PCS1 DC Power Supply Adapter Cable 10’ to MNC DC UTIL power outlet (J2) and to 28VDC power supply outlet (J1).

   - L12/A3 Connect PCS2 ORB DC Power Cable 6’ to PDIP DC Power 2 outlet (J3) and to 28VDC power supply outlet (J1).

   - Connect PCS1 ORB 1553 Data Cable 8’ to the N1-1 (J103) outlet and to the 1553 PC Card w/Adapter Cable 22in.

   - Connect PCS2 ORB 1553 Data Cable 8’ to the N1-2 (J107) outlet and to 1553 PC Card w/Adapter Cable 22in.

4. **TURNING ON EPCS LAPTOP**

   - A15 DC UTIL PWR MNC – ON (J2)

   - Pwr Sply PCS1 28VDC PWR SPLY – On (Lt On)

   - L12/A3 PDIP DC PWR 2 – ON

   - Pwr Sply PCS2 28VDC PWR SPLY – On (Lt On)

   - PCS EPCS 1,2 Laptop Power – On
5. **CONNECTING EPCS TO MDM DATA (IF MDMs ARE UP AND RUNNING)**

PCS2

After boot up, when taskbar appears at bottom of display

- sel Arrow directly above PCS logo (as required)
- sel Start/Restart PCS CDS (as required)

**NOTE**

1. A popup window will appear if the internal positive time is > 60 seconds different from the RS time. If this window appears, ‘Use RS Time’ should be selected.

2. A popup window may appear saying that the CW Server failed to start and it will be retried every 15 seconds. ‘OK’ should be selected to remove it.

- sel Icon to open PCSCDS Main Control Panel Window (as required)

√Status Box is green and ‘CONNECTED’ is displayed in the PCSCDS Main Control Panel Window (as required)

Iconify PCSCDS Main Control Panel Window.

************************************************************
If Status Box is not green, select ‘Connect to MDM’ button if the MDMs are on.
************************************************************

**NOTE**

1. PCS connection to MDM is indicated by green in the Status Box and ‘CONNECTED’ message displayed in the PCSCDS Main Control Panel Window only when the associated Node MDM is up and running as the Primary MDM.

2. If MDMs are not up and running and step 5 is executed, expect a PCS ‘CW SERVER ERROR’ and ‘CDS SIGNON FAIL’ messages.

After connection to the MDMs, if the PCS displays the message ‘THE MDM CONNECTION HAS FAILED’, open the PCSCDS Main Control Panel Window and select ‘Connect to MDM’ button to reconnect.

If no joy, close all displays and anything iconified.
Repeat step 5.

If still no joy, perform {LOSS OF PCS TELEMETRY}, all (SODF: ISS MAL: C&DH), then:
6. CONFIGURING PCS FOR DISPLAYS (AS REQUIRED)

**NOTE**
After PCSCDS has been selected, wait 30 seconds before starting CDDF displays.

sel Arrow above PCS logo
sel Start PCS CDDF display

After approximately 1 minute, √'INCREMENT 4A HOME PAGE' is displayed.

********************************************************************
If GMT <static> or telemetry fields in Caution & Warning Tool Bar are cyan, go to {PCS RECONNECT} (SODF: ISS OPS: C&DH).
********************************************************************

Displays may now be selected as desired.

Inform MCC-H when complete.
Figure 1.- AFD EPCS Configuration.

**NOTE**
The 1553 Data Cable I/Fs with a 22-inch pigtail connector (Ch A and B) connects to the 1553 Card that inserts into the PC Card PCMCIA upper slot in the EPCS.
1. **POWERING DOWN EPCS**

   Close all display windows.

   Disconnect CDS from MDM.

   Close CDS Window.

   At the taskbar on bottom of display
   sel EXIT

   On ‘Logout Confirmation’ window
   sel OK

   When ‘**Type any key to continue**’,
   EPCS 1,2 Laptop Power \(\rightarrow\) Off

   PCS1,2 28VDC PWR SPLY \(\rightarrow\) Off (Lt Off)

   A15  DC UTIL PWR MNC – OFF (J2)

   L12/A3  PDIP DC PWR 2 – OFF

2. **DISCONNECTING EPCS POWER AND DATA CABLE**

   L12/A3  Disconnect both ORB 1553 Data Cable 8’ from N1-1 (J103) and N1-2 (J107) and from the 1553 PC Card w/Adapter Cable 22in.

   Disconnect both the ORB DC Power Cable 6’ and the ORB DC Power Cable 10’ from the RS/ORB DC Power Supply (28V \(\rightarrow\) 20V) (J1) and the ORB DC outlets.

   Disconnect both the DC Power Supply Adapter Cable 10’ from the PCS DC Power outlet and the RS/ORB DC Power Supply (28V \(\rightarrow\) 20V) (J2).

3. **STOWING EPCS LAPTOP**

   EPCS Laptop (two)

   DC Power Supply Adapter Cable 10’ (two)

   1553 PC Card w/Adapter Cable 22in (two)

   ORB DC Power Cable 6’ (one)

   ORB DC Power Cable 10’ (one)

   ORB 1553 Data Cable 8’ (two)

   RS/ORB DC Power Supply (28V \(\rightarrow\) 20V) (two)
2.304 PCS LOG FILE SAVE

PCS 1. CDS LOGS DUMP
If PCSCDS Main Control Panel is an icon, double-click the ‘cds_ui’ icon to restore it.

PCSCDS MAIN CONTROL PANEL

sel File
sel Update Log Files

2. SAVE LOGS
sel Arrow directly above PCS logo
sel Save Logs

PCS save logs

Disregard text.
Press enter.

NOTE
1. The format to use for naming the directory is:
   [userinitials] logs [flight day]

2. Use a different directory name each time you save the logs. If the logs need to be saved more than once in a flight day, append the directory name with an underscore and a number starting at “1” and increment each time that the logs are saved that day. An example directory name would be:
   abclogs07_2

Enter directory name.
Press enter.

Verify message – Save logs completed
Press enter.

PCS 3. VERIFYING THE LOGS HAVE BEEN SAVED
Right-click anywhere on empty desktop space.

sel Programs
sel Terminal…

Type ‘cd <directory name>’.
Type ‘ls -l’.

Verify Runtime_files/ and logs/ are in the directory.

Close terminal window.

4. Inform MCC-H with the directory name.
1. **PERFORMING PCS LOG FILES SAVE**
   Perform [2.304  PCS LOG FILE SAVE], all (SODF: POC: NOMINAL: PCS) as needed, then:

2. **RUNNING COPY LOGS TO FLOPPY UTILITY**
   sel Arrow directly above PCS logo
   sel Copy PCS logs to floppy

   Press Enter.

   **NOTE**
   If action fails, the following will be displayed:
   
   If no disk in drive, insert diskette, try again.
   If no floppy drive attached, shutdown, attach floppy drive, and reboot.
   If floppy drive is attached after boot up, shutdown and reboot.
   If floppy drive not seated properly, shutdown, re-seat, and reboot.

   Input directory name from list of available directories listed in the Terminal Window.

   sel OK

   Verify Copy logs to floppy complete.

   Press Enter.

   Manually Eject Floppy Disk.
1. **CDDF AND CDS SHUTDOWN**
   
   Close all display windows.
   Disconnect CDS from MDM.
   Close CDS window.

2. **CONNECTING PCS TO MDM DATA**
   
   sel Arrow directly above PCS logo
   sel Start/Restart PCS CDS

   If popup window appears asking what time source to use
   
   On EPCS
   sel RS Time

   On PCS
   sel MDM Time

   **NOTE**
   
   A pop-up window may appear saying that the CW Server failed to start and it will be retried every 15 seconds.

   sel Icon to open PCSCDS Main Control Panel Window

   √ Status Box is green and ‘**Connected**’ is displayed in the PCSCDS Main Control Panel Window

   Iconify PCSCDS Main Control Panel Window.

3. **PCS FOR DISPLAYS CONFIGURATION**
   
   sel Arrow above PCS logo
   sel Start PCS CDDF display

   After approximately 1 minute, √‘**Increment xA Home Page**’ is displayed.

   Displays may now be selected as desired.
1. OPENING SNAPSHOT WINDOW
Move the pointer to an open area on the desktop.
Press the right mouse button.

- sel Programs
- sel Snapshot…

2. TAKING SNAPSHOT
NOTE
You must have the window that you wish
to snapshot open and uncovered.

- Snapshot V3.X

- sel box next to ‘Hide Window During Capture’
- sel Snap

NOTE
When you click on the window, the Snapshot
Window will disappear for 8 --- 16 seconds.

Click on the window you want to take a snapshot of.

3. SAVING SNAPSHOT
NOTE
The image file will be saved in the
/export/home/PCSUser directory.

- Snapshot V3.X

- sel View…
- Image Tool V3.X File: Untitled

- sel File
- sel Save As…

- Image Tool: Save As
- ‘File Format’

- sel Sun Raster
- sel GIF

Save As…
Type over ‘Untitled1’ with the name that you wish to call the image
followed by ‘.gif’.
NOTE
There will be a pop-up window with the message ‘Saving to the GIF file format may result in a loss of data. Do you want to continue?’ The difference is negligible and can be ignored.

sel Save
sel Yes

Close the display and Snapshot application.

4. RETRIEVING AND VIEWING THE IMAGE
Right-click on any empty space on the desktop.

sel Programs
sel Image Viewer
sel File
sel Open…
sel <the desired file>
sel OK

Close Image View - Palette window.
MALFUNCTION
Radio frequency interference may cause a temporary loss of the VHF link. Reattempt contact for several minutes prior to declaring a failure.

Focus troubleshooting Shuttle VHF first since it is not permanent H/W and requires significant configuration.

Nominal Config: SHUTTLE
ISS antenna cavity and 25' antenna cable with attenuator installed VHF radio CH 1(2) selected.
ARIU J1 connected to CDR ATU via 14' pre-routed VHF radio comm cable and 4' ARIU Audio/Pwr cable. CDR ATU A/G2 (A/G1) T/R, all else OFF.
ARIU J3 connected to VHF radio audio via 4' Radio/ARIU cable. BPSMU, 42' audio/video I/F cable, and 4' audio/video I/F cable w/ODS adapter installed at ARIU J2 input connector.

ISS VHF 1 A/G voice config from any SM comm panel.
SHUTTLE/ISS VHF COMM MAL

14 Shuttle
• Readjust squelch setting to just above noise.
• Reattempt contact.
Contact successful?

Yes

17 Continue nominal operations.

No

18 Shuttle
• Stuck key (mutes rcvr!)
TX displayed on radio LCD when audio loop not keyed?

Yes

19 Problem isolated to Shuttle H/W. BPSMU, ATU, ARIU, or VHF radio problem.

No

20 Shuttle
• Radio being keyed and txr transmitting on radio LCD
• Go to meter mode on radio [mode (6), pwr (8)].
• Key audio loop and perform test count.
TX (and approx 5 bars for MED pwr) displayed on radio LCD while counting?

No

21 Problem isolated to Shuttle H/W. BPSMU, ATU, ARIU, or VHF radio problem.

Yes

22 Shuttle
Perform following steps as time permits, reattempting contact after each step:
• Cycle PTT several times.
• Check or swap out BPSMU.
• Replace BPSMU with VLHS/HIU plugged into ARIU.
• ARIU switch to EXCL MIR XMIT.
• ARIU switch to XMIT DIS.
• Use radio handset or swap out ARIU.
• Power cycle VHF radio.
• Swap out VHF radio.
• Swap out each interface cable.

MCC

23 Shuttle
• Internal pwr supply status
While still in meter mode:
• Press [R/T] to display PS1 (~500).
• Press [R/T] to display PS2 (~120).
• Press [R/T] to display PS3 (~500).
• Press [R/T] to display PS4 (~120).
• Press [R/T] to display PS5 (~240).
• Press [R/T] to display PS6 (~700).
• Press [R/T] to return to signal strength meter.
• Exit meter mode [mode (6), pwr (8)].
All pwr supplies as expected?

No

24 Shuttle VHF radio problem.

Yes

25 Shuttle
• MCC
• Swap out radio.
VHF 2 frequency set interferes with CONUS air traffic control. VHF 2 use over CONUS restricted to emergency situations only.

Shuttle VHF 2:
- XMIT = 121.75
- RCV = 130.1625

ISS VHF 2:
- XMIT = 130.167
- RCV = 121.75

Perform following steps as time permits, reattempting contact after each step:
- Power cycle VHF radio.
- Check or swap out BPSMU.
- Use radio handset or swap out ARIU.

Shuttle and ISS:
- Attempt contact via VHF 2 frequency set.
  - Verify not over CONUS.
  - MCC to verify other ship configuring for VHF 2 comm

Shuttle:
- Select CH 5 on VHF radio.
  - MCC

ISS:
- Configure comm panel for VHF 2.
  - MCC

Shuttle or ISS:
- Reattempt contact.
  - MCC

Contact successful?
Yes
- Reattempt contact.

No

Shuttle and ISS:
- Return to VHF 1 frequency set.
  - MCC

Shuttle:
- Select CH 1(2) on VHF radio.
  - MCC

ISS:
- Configure comm panel for VHF 1.
  - MCC

Contact successful?
Yes
- Reattempt contact.

No
- Return to VHF 1 frequency set.
1. **POWERING DOWN EPCS/PCS**  
   Close all display windows.

   If PCS does not accept inputs from the keyboard or mouse, go to step 2.

   Disconnect CDS from MDM.

   Close CDS window.

   At the taskbar on bottom of display
   sel EXIT

   On Logout Confirmation window
   sel OK

   Wait for *Type any key to continue* message to appear.

2. **TURNING OFF POWER**  
   PCS Thinkpad pwr sw \(\rightarrow\) Off

   Wait 10 seconds.

3. **TURNING ON POWER**  
   PCS Thinkpad pwr sw \(\rightarrow\) On

4. **CONNECTING EPCS/PCS TO MDM DATA**  
   PCS2  
   After bootup, when taskbar appears at bottom of display
   sel Arrow directly above PCS logo
   sel Start/Restart PCS CDS
   sel Icon to open PCSDCS Main Control Panel Window

   \(\sqrt{\text{Status Box is green and 'Connected' is displayed in the PCSCDSS}}\)

   Main Control Panel Window

   Iconify PCSCDSS Main Control Panel Window.

5. **CONFIGURING PCS FOR DISPLAYS**  
   sel Arrow above PCS logo
   sel Start PCS CDDF display

   After approximately 1 minute, \(\sqrt{'Increment xA Home Page'}}\) is displayed.

   Displays may now be selected as desired.
If GMT - <static> or telemetry fields in Caution & Warning toolbar are cyan, go to \{2.306 PCS RECONNECT\}, all (SODF: POC: NOMINAL: PCS).

Display may now be selected as desired.
1. Determine crew location.
   Russian Segment
   Shuttle AFT Flight Deck

2. Reconnect to MDM
   - Wait 10 minutes before reconnecting.
   - On PCS connected to N1-2
   - PCS CDS Main Control panel Window
   - sel 'Connect to MDM' icon
   - Is MDM connected status box green?

3. Check Retry Counter
   Node 1: CDH: MDM N1-1
   Secondary NCS MDM Node 1
   - 'Software Control'
   - sel MDM Utilities
   - sel 'Auto Retry Counter'
   - Is Auto Retry Counter greater than 0?


6. Reconnect to Other MDM
   - On PCS connected to N1-1
   - PCS CDS Main Control panel Window
   - sel 'Connect to MDM' icon
   - Is MDM connected status box green?

7. Notify MCC.

8. Notify MCC.

9. Notify MCC.

10. Reconfigure OIU for Ground and MCDS Telemetry
    - SM 212 OIU
    - BUS 4 BC – ITEM 15 EXEC
    - BUS 3 RT – ITEM 10 EXEC
    - Change OIU N1 Phys Dev to N1-1 – ITEM 18 +4 EXEC
    - Reload OIU FORMAT 2 – ITEM 1 +2 EXEC

11. Notify MCC.

If N1-2 has failed, N1-1 will automatically take over as primary.

Waiting 10 minutes will allow the system to stabilize and NCS Auto Retry to complete if it has executed.
Loss of power should be handled by applicable shuttle procedure.

Shuttle crew is limited to data available on MCDS displays.

Loss of power

by applicable shuttle procedure.

Shuttle crew is limited to data available on MCDS displays.

Check Cable

• MDM data cable and power connections at PDIP for PCS 2
• 1553 cable connection and card seating at PCMCIA card for PCS 2

Are cables properly connected and 1553 card properly seated?

Yes 17

No

Reconnect

• Reconnect PCS Cables.

Was 1553 Card removed or unseated?

No

Yes

Perform (PCS REBOOT)
(SODF: ISS OPS: POC).

Then:

15

• sel ‘Connect to MDM’ icon

Is MDM connected status box green?

Yes 16

Loose data or 1553 card unseated.

No

12

Swap PCSs

• Reconnect other PCS to N1-2 at PDIP Panel
• sel ‘Connect to MDM’ icon

Is MDM connected status box green?

No 18

Possible PDIP Failure on N1-2 UB Orb PCR.

Yes

19

PCS-2 failure.

Continue operations on other PCS with good MDM connection.
 expect the following caution ‘N1-1 Detected RT Fail N1-2 – PMA1’.

If the Telemetry Sink Bus fails, the Primary Node 1 MDM will transition itself to Standby and wait longer than normal in order to allow the Secondary MDM to transition to Primary.

Expect the following caution ‘N1-1 Detected RT Fail N1-2 – PMA1’.

If the Telemetry Sink Bus fails, the Primary Node 1 MDM will transition itself to Standby and wait longer than normal in order to allow the Secondary MDM to transition to Primary.
If N1-2 MDM fails, expect C&W message on Russian C&W panel and Russian laptop.

Waiting 10 minutes will allow the system to stabilize and NCS Auto Retry to complete if it has executed.

This will take away station data while swapping.
1. These tools are needed for removing the latch in an emergency.

2. Egress path required so crewmembers are not isolated from escape vehicle.

WARNING
If crew will be isolated from their return vehicle, they must have a 1/4" racket, 4" ext, and 1/2" socket.

Is there access to the Ribbed (EVA) side of Hatch?

If domed (IVA) side, translate through hatch to EVA side.

Is translation possible?

Is hatch closure possible without isolating crew from return vehicle?

Visually check Hatch for debris which may prevent actuation.

- Tension Rods
- Latches
- Sliders
- Pinion Gear
- Drive Mechanism
- PIP Pins
- Rotating ring

Refer to Figure 3.

Are there any debris or contamination present on the Hatch?

Clear the mechanisms of debris.
8
- Visually check Hatch for bent or broken parts.
  • Tension Rods
  • Latches
  • Sliders
  • Pinion Gear
  • Drive Mechanism
  • PIP Pins
  • Refer to Figure 1.

Are there any broken or bent parts?

9
- Attempt to cycle Hatch.
  Does Hatch cycle freely?

10
- Yes
  - MCC

11
- Tape & Disconnect Tension Rod by removing PIP Pin Wrap.
- Restrain the disconnected tension rod with Gray Tape.
- Refer to Figure 2.

12
- Cycle latch by hand looking for jams in mechanism.
  Was the jam found?

13
- Yes
  - Are all eight tension rods disconnected?

14
- No
  - Attempt to cycle the Hatch Crank.
  Does Hatch Crank cycle freely?

15
- Yes
  - Are all eight tension rods disconnected?

16
- No
  - MCC

17
- Open Hatch Prep
  • Reinstall non-failed tension rods.

18
- Attempt to cycle the Hatch Crank.
  Does Hatch Crank cycle freely?

19
- Yes
  - Inform MCC of completion and failed ORU.
  - Return to nominal operations.
Figure 1.- Duct tape.

Figure 2.- Tension Rod restrained.

Figure 3.- Hatch overview.
OBJECTIVE: Shuttle crew will pinpoint and repair pressure leaks in PMA3.

LOCATION: PMA3

DURATION: Situation dependent

PARTS: None

MATERIALS: None

TOOLS REQUIRED:
- APDS/APAS Hatch Tool
- Docking Target Base Plate Cover
- Docking Target Standoff Cross Bag
- Flashlight (two)
- Shuttle IFM Tool Kit:
  - Locker Drawer 1: IFM Leak Repair Kit
  - General Purpose Tape, 2"
  - Locker Drawer 3:
    - 5/32” Ball Tip Hex Head Driver, 1/4” Drive
    - 4” Ratchet Wrench, 1/4” Drive
    - 7/16” Deep Socket
    - 1/4” Torque Wrench (20-300 in-lbs)

REFERENCED PROCEDURES:
- EARLY PMA3 INGRESS
- EARLY PMA3 EGRESS

PMA3 INGRESS
1. √ MCC-H, “Go to Ingress PMA3.”

2. MCC-H Report maximum duration for PMA3 Ingress.

3. Perform [EARLY PMA3 INGRESS], steps 14 --- 27 (SODF: JOINT OPS: | INGRESS STATION), then:
MO13Q  4. AIRLK FAN A(B) → OFF

5. Listen for leak.

6. AIRLK FAN A(B) → ON

**WARNING**

If AIRLK FAN A(B) needs to be subsequently turned off to listen for leak, notify **MCC-H**. Ingress duration will be further limited if PMA3 ventilation inadequate.

---

**Figure 1.** Module and CBM Seals, Cross Section.

---

**Figure 2.** PMA 2/3 Instrumentation Cable Passthroughs. PMA 2/3 Looking Toward APAS Hatch (closeout removed). Ref. Photograph S98-14923.
PMA3 LEAK PINPOINT AND REPAIR

PMA3 LEAK ISOLATION

NOTE

1. Crew visual, aural, and tactile senses must be used to locate leak source (looking for debris/damage, listening for leak, and feeling around seals and connectors for air leak).

2. Once leak is pinpointed, proceed to step 8 (Leak Repair).

7. Search for leaks in PMA3.
   If leak is found, proceed to step 13, Leak Repair.
   Search for leaks across Node 1 to PMA interface.
   Refer to Figure 1.

   Remove avionics closeout, hex fasteners (twelve) (4" Ratchet, 5/32" Ball Tip Hex Head, 1/4" Drive).

   Check for leaks at instrumentation cable passthroughs J20, J21, J22.
   Refer to Figure 2.

LEAK REPAIR

8. If leak found
   √MCC-H before initiating repair

   If leak through IMV Valve flange
   Retighten V-band coupling to 35 in-lbs (7/16" Deep Socket, 1/4" Torque Wrench).

   If leak due to puncture in surface area
   Patch hole with Dux Seal from IFM Leak Repair Kit.
   Cover patch with All Purpose Tape.

   If leak through connector or seal
   Use Valve Foam Applicator from IFM Leak Repair Kit, following decal instructions.

9. Tighten remaining closeout fasteners

PMA3 EGRESS (LEAK NOT FOUND OR IRREPARABLE)

10. Report to MCC-H, “Leak not found” or “leak irreparable.”

MO13Q

11. AIRLK FAN A(B) → OFF

12. Remove tools and equipment from PMA3.

EMERGENCY RESPONSE
TMAX DETERMINATION

ORBITER + ISS ATMOSPHERE TO 9.5 PSIA NOMOGRAPH

Orbiter + ISS (4A stage - all compartments)

BASIS:
O2 Flow: on/off at 50 lb/hr after 10 min, with ppO2 > 2.2 psi, %O2
Total Volume = 10660 ft³
NOTE

1. This Expedited undocking should be used for the following failures
   Non-isolatable prop leak (shuttle)
   Cabin leak (shuttle)
   Loss of cooling (two cabin fans, water coolant loops, Freon coolant loops (shuttle))

2. Entrance to this procedure based on Cabin Leak or Loss of Cooling scenario assumes that this
   procedure will be worked concurrently with the associated FDF ORB PKT and ENTRY PKT
   powerdown.

3. At least 20 minutes are required to perform mandatory activities through physical separation. An
   additional 45 minutes required for ANY ATTITUDE SEPARATION, or an additional 18 minutes
   required for SHUTTLE EMERGENCY SEPARATION (to OMS TIG).

4. A highly desirable step is listed as step 4a. This step should be performed as time permits.
### ISS CREW

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>ISS report to shuttle, “JEUS in progress.”</td>
</tr>
</tbody>
</table>
| 2a.  | ISOLATE VEHICLES  
Return to home vehicle.  
If required by Shuttle CDR, perform JOINT EMERGENCY EGRESS cue card, steps 3 --- 10 |
| 3a.  | If ISS controlling stack, mode ISS to free drift and handover attitude control from ISS to shuttle  
Perform Russian steps to mode from Thrusters to Indicator.  
Verify RS GNC Mode – Indicator  
ISS(MCC-H) ⇒ shuttle, “ISS is in Free Drift.”  

**NOTE**  
The following step should be completed as time is available. |
| 4a.  | INHIBITING RT FDIR  
Node 1: C&DH: Primary N1 MDM: UB ORB  
N1-2(1): RT Status  
UB ORB N1_2(1). RT Status  

\[ \text{cmd 08 OIU Inhibit FDIR} \text{ Execute} \]  
Verify 08 OIU RT FDIR Status – Inh |

### SHUTTLE MS

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b.</td>
<td>Shuttle report to ISS, “JEUS in progress.”</td>
</tr>
</tbody>
</table>
| 2b.  | ISOLATE VEHICLES  
Perform JOINT EMERGENCY EGRESS cue card, then: |
| 3b.  | Perform ISS SAFING (DFD, ORB PKT, PL PWRDN) as required, then MS reports to CDR “Pre-Undock ISS Safing complete.” |
| 4b.  | PERFORMING APMC DEACT  
L12U  
APCU 1,2 CONV – OFF  
\[ \text{\checkmark CONV tb – bp} \]  
\[ \text{\checkmark OUTPUT tb – bp} \]  
\[ \text{OUTPUT – OFF} \] |

### SHUTTLE CDR/PLT

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1c.</td>
<td>Shuttle report to ISS, “JEUS in progress.”</td>
</tr>
</tbody>
</table>
| 2c.  | ISOLATE VEHICLES  
All crew return to home vehicle.  
\[ \checkmark \] Only Shuttle crew on Shuttle  
Give, “Go for Hatch closure.”  
If required, give “Go to perform Utilize ISS Atmosphere.” |
| 3c.  | PREPARING FOR UNDOCKING  
O14.  
Pri RJD DRIVER, LOGIC (sixteen) – ON  
O15.  
O16:F  
O14,  
L, AFT DDU cbs (four) – cl  
O15,  
O16:E |
| 4c.  | If ISS controlling stack, handover attitude control from ISS to shuttle  
On “ISS in free drift” call from ISS, DAP as required. |
| 5c.  | If P6 jettison and on “Go” from RMS operator  
MNVR  
\[ \text{TG = 2} \]  
\[ \text{BV = 2} \]  
\[ \text{OM = blank} \]  
A/AUTO/ALT Init TRK |
| 6c.  | When sharing ISS atmosphere cplt, give, “Go for Vestibule depress.”  
Hold until “GO for vestibule depress” from CDR.  
After Hatch closure complete, CDR give “GO to depress vestibule.” |
<table>
<thead>
<tr>
<th>ISS CREW</th>
<th>SHUTTLE MS</th>
<th>SHUTTLE CDR/PLT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5b. DEPRESSURIZING SHUTTLE VESTIBULE A6L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>√cb ESS 1BC SYS PWR CNTL SYS 1 – cb ESS 2CA SYS PWR CNTL SYS 2 – cb ESS 1BC DEP SYS 1 VENT ISOL – cb ESS 2CA DEP SYS 2 VENT ISOL – cb ESS MNA DEP SYS 1 VENT – cb ESS MNB DEP SYS 2 VENT – SYS PWR SYS 1, SYS2 tb (two) – ON VEST DEP VLV SYS 1(2) VENT ISOL (two) – OP (tb – OP) VEST DP VLV SYS 1(2) VENT (two) – OP (tb – OP)</td>
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<tr>
<td></td>
<td>6b. ODS PREPARATION FOR UNDOCKING</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If required, perform PMA-3 HOOKS OPEN (FDF, RNDZ, APDS). Perform DOCKING MECHANISM PWRUP (FDF, RNDZ, APDS). If Airlock Pressure &lt; 8.0 PSIA If time permits, terminate EVA and repress airlock. If time not available, expect hooks motor drive to fail during drive operation. Perform UNDOCKING PREP (FDF, RNDZ, APDS).</td>
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<td></td>
<td>7c. GNC_23_RCS</td>
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<tr>
<td></td>
<td>Reselect manually deselected jets.</td>
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<tr>
<td></td>
<td>8c. FLT CNTLR PWRUP</td>
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<tr>
<td></td>
<td>GNC_25_RM_ORBIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SW RM INH – ITEM 16 (*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A6U FLT CNTLR PWR – ON</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CRT SW RM INH – ITEM 16 (*)</td>
<td></td>
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<tr>
<td></td>
<td>9c. CONFIGURING DAP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If P6 jettison, verify stack maneuver cplt before continuing GNC_UNIV_PTG Rates &lt; 0.1 °/sec</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A6U DAP: FREE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GNC_20_DAP_CONFIG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If performing Any Attitude Sep CONFIG DAP A,B to A9,B9 If performing Shuttle Emergency Separation CONFIG DAP A,B to A7,B7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>√DAP A CNTL ACC – ITEM 28 +0 EXEC √DAP B CNTL ACC – ITEM 48 +0 EXEC</td>
<td></td>
</tr>
<tr>
<td><strong>SHUTTLE MS</strong></td>
<td><strong>SHUTTLE CDR/PLT</strong></td>
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<tr>
<td>----------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>Hold until given “GO to undock” From CDR.</td>
<td>CDR give MS &quot;GO for Command Undocking.”</td>
<td></td>
</tr>
<tr>
<td><strong>A7L</strong> 7b. <strong>COMMAND UNDOCKING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After DAP configured, and <strong>On MCC GO</strong> (if Comm),</td>
<td>10c. If OMS TIG &lt; 1 hour</td>
<td></td>
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<tr>
<td>------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td>If HOOKS 1(2) OP lt failed ON</td>
<td>Go to SHUTTLE EMERGENCY SEPARATION (FDF,</td>
<td></td>
</tr>
<tr>
<td>APDS PWR A ds - OFF</td>
<td>RENDEZVOUS, CONTINGENCY OPS).</td>
<td></td>
</tr>
<tr>
<td>√ A ds, failed its off</td>
<td>If OMS TIG &gt; 1 hour</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td><strong>pb APDS CIRC PROT OFF – push (√lt on)</strong></td>
<td>Unstow HHL.</td>
<td></td>
</tr>
<tr>
<td><strong>CRT</strong></td>
<td>Go to ANY ATTITUDE SEPARATION (FDF, RENDEZVOUS,</td>
<td></td>
</tr>
<tr>
<td>√ HOOKS 1, HOOKS 2 CL lt (two) – off</td>
<td>CONTINGENCY OPS).</td>
<td></td>
</tr>
<tr>
<td>√ HOOKS 1, HOOKS 2 POS &lt; 92 % and decrease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If P6 jettison in progress and after hooks are driving, perform P6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNGRAPPLE (FDF, PDRS, NOM P6 OPS).</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CRT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If HOOKS 1(2) appear to stop before reaching end-of-travel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(HOOKS 1(2) POS &gt; 4 % and not decrease), allow for single</td>
<td></td>
<td></td>
</tr>
<tr>
<td>motor drive time (~4:40) before performing pnl A7L pwr cycle.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>-2:20</strong> 8b. <strong>pb UNDOCKING – push</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>√ HOOKS 1, HOOKS 2 CL lt (two) – off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If P6 jettison in progress and after hooks are driving, perform P6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNGRAPPLE (FDF, PDRS, NOM P6 OPS).</td>
<td></td>
<td></td>
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<tr>
<td><strong>-1:30</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A7L</strong> 9b. <strong>√ INTERF SEALED lt – off</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>√ RDY to HK lt – off (HOOKS 1, HOOKS 2 POS ~30 %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>0:00</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>10b. √ HOOKS 1, HOOKS 2 OP Its (two) – on</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CRT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>√ HOOKS 1, HOOKS 2 POS = 4 %</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>√ UNDOCK COMPLETE lt – on</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>+2:20</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If HOOKS 1(2) fail to open (confirmed by no physical separation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>p PB WRR OFF – push</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRE PYROS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A6L</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYRO PWR MN A, MN C (two) – ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A7L</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYROS Ap, Bp, Cp (three) – ON (√lts on)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>pb PYRO CIRC PROT OFF – push (√lts on)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACT HOOKS FIRING – push</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After Separation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>pb PYRO CIRC PROT ON – push (√OFF lt off)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYROS Ap, Bp, Cp (three) – OFF (√lts off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A6L</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYRO PWR MN A, MN C (two) – OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>+2:20</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If HOOKS 1(2) fail to open (confirmed by no physical separation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>p PB WRR OFF – push</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRE PYROS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A6L</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYRO PWR MN A, MN C (two) – ON</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A7L</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYROS Ap, Bp, Cp (three) – ON (√lts on)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>pb PYRO CIRC PROT OFF – push (√lts on)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACT HOOKS FIRING – push</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After Separation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>pb PYRO CIRC PROT ON – push (√OFF lt off)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYROS Ap, Bp, Cp (three) – OFF (√lts off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A6L</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYRO PWR MN A, MN C (two) – OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SHUTTLE MS</strong></td>
<td><strong>SHUTTLE CDR/PLT</strong></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td>11b. POST UNDOCKING&lt;br&gt;A7L pb PWR OFF – push&lt;br&gt;STATUS 1t (eighteen) – off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12b. Go to DOCKING MECHANISM PWRDN (FDF, RNDZ, APDS).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13b. If required, perform PL SAFING (FDF, ORB PKT, PL PWRDN).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CUE CARD
This cue card is executed as part of the toxic spill, fire/smoke, cabin leak or loss of cooling powerdown procedures.

**EGRESS TO HOME VEHICLE**
1. If required, all crew return to home vehicle, unstow and don masks.

M013Q 2. \( \sqrt{\text{Airlk Fan A(B) - OFF}} \)

**HATCH CLOSURE PREP**

PMA 4. Stow PMA/ODS duct on PMA handrail.
   Stow ODS air inlet duct in A/L.

5. Disconnect Hatch from Standoff, stow standoff on handrail.

APAS 6. Remove and securely stow covers for Hatch, Docking Target Baseplate.

7. Install Standoff Cross (by hand if no time available).

**HATCH CLOSURES**
8. On CDR call, “Go for Hatch closure.”

Node 1 Deck 9. Node 1 Deck Aft(Lab Fwd Stbd, Fwd Port) IMV vlv (one, two) → (deploy handle) CLOSE (stow handle)

10. Close Node 1 Deck(Lab Fwd) hatch per decal.
   \( \sqrt{\text{MPEV - CL}} \)

APAS  Close APAS Hatch using tool.
   \( \sqrt{\text{APAS MPEV - CL}} \)

ODS 11. Close ODS Hatch per decal.
   \( \sqrt{\text{EQUAL VLVS (two) - OFF, caps installed}} \)

12. Report to ISS, **MCC**, “ODS and APAS Hatches closed.”

**UTILIZING ISS ATMOSPHERE FOR SHUTTLE LEAK**
On shuttle CDR request to use ISS atmosphere
UTILIZE ISS ATMOSPHERE
(JNT OPS/4A/FIN B)

UTILIZING ATMOSPHERE
On Shuttle CDR request to use ISS atmosphere

Node 1 Deck (Lab Fwd)
1. Node 1 Deck Aft (Lab Fwd) MPEV → OP
2. Open Node 1 Deck (Lab Fwd) Hatch per decal.

PMA3(2)
3. APAS Hatch MPEV → OP
   Report to STS, MCC, “APAS MPEV open.”

ODS Hatch
4. ODS HATCH Equal vlv (two) → EMER

**CAUTION**
Minimum allowable ISS Pressure is 490 mmHg (9.5 mmHg).

PCS
5. NODE 1: ECLSS or
   Lab ECLSS
   [PO]
   [PO]
   Russian Manometer [MB]

   When ISS total pressure < 495 mmHg (9.57 psia), terminate flow to shuttle.

PMA3(2)
6. APAS Hatch MPEV → CL
   Report to STS, MCC, “APAS MPEV closed.”

ODS Hatch
7. ODS HATCH Equal vlv (two) → OFF, caps installed
   Report to ISS, MCC, “ODS Hatch Equalization vlvs closed.”

Node 1 Deck (Lab Fwd)
8. Close Node 1 Deck (Lab Fwd) Hatch per decal.
   Node 1 Deck Aft (Lab Fwd) MPEV → CL

9. Node 1 Deck Aft (Lab Fwds (two)) IMV vlvs → CL
Proximity Operations (Approach)

**Flight 4A + Rbar approach**

- **All times are approximate**

1. **Station attitude** (0,0,0) YPR
2. **Orbiter Docking attitude** (180,0,0) YPR

**NOTE**

1. All times based on nominal atmosphere.
2. Russian segment array feathering angles for the FGB and SM respectively are 247.5 and 202.5 degrees. US P6 arrays feathering angle is 90 deg for 4B and 270 deg for 2B.
3. Orbiter burns are in NORMZ outside of 1000 ft, LOWZ from 1000 ft to 75 ft, and NORMZ inside of 75 ft.

- **Begin Pre-heat of NI**
  - Shell Heaters @ Dock - 360 (~4 hours of pre-heat)** Analysis Required to determine pre-heat time**

- **ISS Begin MNVR to docking attitude** (0,0,0) YPR (25 min to complete)

- **ISS Config for prox ops:**
  1. Change HTR setup - end pre-heat
  2. **Analysis Required to determine pre-heat time**

- **ISS in Docking Attitude**

- **Feather and lock RS Arrays (See Note 2)**
  - **(8-10 min)**
  - Orient Solar arrays for sun-tracking (8-10 min)

- **Daily Orbit 3**

**Proximity Operations (Approach)**

09 NOV 00
PROXIMITY OPERATIONS
(JNT OPS/4A/FIN B) Page 2 of 2 pages

Flight 4A Proximity Operations (Departure)

**NOTE**
1. Constraints are in bold.
2. US arrays feathered to 100 deg for 4B and 260 deg for 2B. FGB arrays feathered to 247.5 deg. SM arrays feathered to 202.5 deg.
3. Orbiter burns in NORMZ for initial separation and LOWZ for remainder of separation Prox Ops.

09 NOV 00
## Shuttle Arrival

<table>
<thead>
<tr>
<th>Time to Dock</th>
<th>ISS Activity</th>
<th>Shuttle Activity</th>
<th>Constraint</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-480</td>
<td>SM and FGB batteries to FULL CHARGE mode and inhibit battery cycling (8 SM and 6 FGB batteries).</td>
<td>Need for this to occur 5 revs before docking.</td>
<td>RS FGB &amp; SM CMD</td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>Uplink and verify attitude cyclogram.</td>
<td>Verify Early Comm in Low Data Rate mode for cmd/tlm.</td>
<td>Verify VHF comm with shuttle.</td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>Perform last basis correction before docking if needed.</td>
<td>No later than GO for Ti.</td>
<td>Verify VHF comm with ISS.</td>
<td></td>
</tr>
<tr>
<td>D-214</td>
<td>Prepare ISS systems for LVLH power levels (as required).</td>
<td>RS to US Pwr X-fer Flight Rules.</td>
<td>ISS System Powerdown Prior to Arrival (SODF)</td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>MCC-M verifies ISS energy reserves are sufficient (SM Batteries at &gt; tbd A-hrs and FGB Batteries at &gt; tbd).</td>
<td>1. Batteries in full charge mode, 2. Battery Cycling mode-off. (Believe the limit)</td>
<td>RS Procedure</td>
<td></td>
</tr>
<tr>
<td>D-183</td>
<td>MCC-M GO for Ti Burn.</td>
<td>Ti-30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-153</td>
<td>ISS GO for Ti Burn.</td>
<td>Ti-30</td>
<td>~ Ti - 15</td>
<td></td>
</tr>
<tr>
<td>D-150 (Ti+3)</td>
<td>Initiate ISS maneuver to LVLH and to docking attitude (0,0,0).</td>
<td></td>
<td>RNDZ OMS BURN (FDF: RENDEZVOUS, CONTINGENCY OPS)</td>
<td></td>
</tr>
<tr>
<td>D-128</td>
<td>SM Navigation Light and Onboard Lights ON.</td>
<td>Will turn on after first sunset following Ti. Cyclogram will turn off at sunrise and turn on at sunset until dock.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-125 (Ti+28)</td>
<td>Verify ISS in LVLH (0,0,0) for docking and SM navigation light ON.</td>
<td>NLT first sunset after Ti.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Docking Mechanism Pwrup &amp; Prep</td>
<td>Two-hour power on constraint begins with Docking Mechanism Prep.</td>
<td>DOCKING MECHANISM PWRUP, DOCKING MECHANISM PREP</td>
<td></td>
</tr>
</tbody>
</table>
## SHUTTLE ARRIVAL

<table>
<thead>
<tr>
<th>Time to Dock</th>
<th>ISS Activity</th>
<th>Shuttle Activity</th>
<th>Constraint</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-61</td>
<td>Orbiter to LOWZ at 1000’</td>
<td>1000’</td>
<td>Callout from RNDZ Timeline. All RNDZ procedures from 2000 ft/post-MC4 are summarized in STS-4A Approach (RNDZ, CUE CARD).</td>
<td></td>
</tr>
<tr>
<td>D-53</td>
<td>Orbiter mnvr to minus XVV attitude.</td>
<td>Tail forward attitude reqd for docking.</td>
<td>TAIL FWD MNVR (RENNDEVOUS, RENDEVOUS TIMELINE)</td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>Perform Config ISS for Arrival.</td>
<td></td>
<td>ACS Pre-Arrival Moding: This can be performed at D-60 SODF: ISS System Powerdown Prior to Arrival (cont.) ISS Configure for docking.</td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>Verify ISS Non-essential Load reductions complete.</td>
<td></td>
<td>SODF: ISS System Powerdown Prior to Arrival (verify procedure complete).</td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>Load FDIR Limits PPL.</td>
<td>Temporary loss of ACS moding if N1-2 MDM fails.</td>
<td>CONFIGURE C&amp;DH FOR DOCKING</td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>MCC-M verifies ISS energy reserves are sufficient (SM Batteries at &gt; tbd A-hrs and FGB Batteries at &gt; tbd).</td>
<td></td>
<td>RS Procedure</td>
<td></td>
</tr>
<tr>
<td>D-50</td>
<td>Position and Lock ISS SAWs (SM@initial position 1 and sun zones 6(port) and 12(stbd) ; FGB @initial position 1 and sun zone 4(both arrays)).</td>
<td>ISS is now power negative and may remain in this configuration for 3 orbits max. Must be complete prior to D-32 min.</td>
<td>RS Procedure</td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>Verify OIU and Orbiter PL Comm Config.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>EPCS Setup</td>
<td></td>
<td>EPCS SETUP</td>
<td></td>
</tr>
<tr>
<td>D-35</td>
<td>Verify ISS Systems Go/NoGo for docking.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-tbd</td>
<td>ISS GO for docking.</td>
<td></td>
<td>NLT D-35</td>
<td></td>
</tr>
<tr>
<td>D-32</td>
<td>Orbiter at 170’ GO for docking</td>
<td></td>
<td>INITIATE APPROACH (RNDZ, RNDZ TIMELINE)</td>
<td></td>
</tr>
<tr>
<td>(Ti+121)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-23</td>
<td>Orbiter to NORMZ at 75’</td>
<td>75’</td>
<td>Called from STS-4A APPROACH (RENNDEVOUS, CUE CARD).</td>
<td></td>
</tr>
</tbody>
</table>
## ARRIVAL TIMELINE

**(JNT OPS/4A/FIN B)**

<table>
<thead>
<tr>
<th>Time to Dock</th>
<th>ISS Activity</th>
<th>Shuttle Activity</th>
<th>Constraint</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D-11</strong></td>
<td></td>
<td><strong>Stationkeep at 30 ft for docking alignment</strong></td>
<td></td>
<td><strong>30 FT STATIONKEEPING (RNDZ, RNDZ TIMELINE)</strong></td>
</tr>
<tr>
<td><strong>D-6</strong></td>
<td></td>
<td><strong>Resume approach</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>D-0 (Ti+153)</strong></td>
<td><strong>At Shuttle call of &quot;Capture Confirmed&quot; ISS crew sends command resulting in SM MCS mode to INDICATOR. Verify ISS MCS Modes to FREE. ISS Call, &quot;ISS is Free Drift.&quot;</strong></td>
<td><strong>Verify Capture and Orbiter in FREE. Call &quot;Capture Confirmed&quot; to ISS.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>D + 10</strong></td>
<td><strong>Docking sequence complete.</strong></td>
<td></td>
<td></td>
<td><strong>DOCKING SEQUENCE CC</strong></td>
</tr>
<tr>
<td><strong>D + 14</strong></td>
<td><strong>Docking Mechanism Powerdown.</strong></td>
<td></td>
<td></td>
<td><strong>DOCKING MECHANISM PWRDN</strong></td>
</tr>
<tr>
<td><strong>D+20</strong></td>
<td><strong>Verify Hard Mate.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>(Ti+174 to 184)</strong></td>
<td><strong>When HARD MATE confirmed, GO for ISS SAW repositioning.</strong></td>
<td><strong>When Hard Mate confirmed, GO for maneuver to XPOP.</strong></td>
<td><strong>May not want to perform leak check during any maneuvers or jet firings.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>D+60</strong></td>
<td><strong>MCC-M confirms battery charging based on ECS telemetry.</strong></td>
<td></td>
<td></td>
<td><strong>Tim Verification</strong></td>
</tr>
<tr>
<td><strong>D + 90</strong></td>
<td><strong>Shuttle crew performs DTO 257.</strong></td>
<td></td>
<td></td>
<td><strong>ACS POST ARRIVAL MODING</strong></td>
</tr>
<tr>
<td><strong>D+130</strong></td>
<td><strong>Disable NCS arrival moding and LEDs.</strong></td>
<td></td>
<td></td>
<td><strong>ACS POST ARRIVAL MODING</strong></td>
</tr>
<tr>
<td><strong>D+200</strong></td>
<td><strong>MCC-M confirms battery SOC has recovered and is GO for ISS systems powerup.</strong></td>
<td></td>
<td></td>
<td><strong>ISS SYS POWERUP POST ARRIVAL</strong></td>
</tr>
</tbody>
</table>
### DEPARTURE TIMELINE

(JNT OPS/4A/FIN B)  

#### SHUTTLE DEPARTURE

<table>
<thead>
<tr>
<th>Time to Undock</th>
<th>ISS Activity</th>
<th>Shuttle Activity</th>
<th>Constraint</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-120</td>
<td>Uplink and verify attitude cyclogram &amp; mass properties.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perform Config ISS for Departure.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verify ISS Non-essential Load reductions complete, as required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCC</td>
<td>MCC verifies ISS energy reserves are sufficient ( SM Batteries at &gt;tbd A-hrs and FGB Batteries &gt;tbd A-hrs) Currently the only agreement we have gotten with the Russians, 1.Batteries in full charge mode, 2.Battery Cycling mode-off.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If SM controlling stack attitude, handover control to Orbiter for undocking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-92</td>
<td>Position and Lock ISS RS SA (SM@initial position 1 and sun zones 6 (port) and 12 (stbd); FGB @initial position 1 and sun zone 4 (both arrays))</td>
<td>Then initiate ISS maneuver to LVLH and to undocking attitude (0,0,0)</td>
<td>RS: Russian Cmd procedure</td>
<td></td>
</tr>
<tr>
<td>U-90</td>
<td>ISS in undocking attitude (0,0,0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-82</td>
<td>ACS Pre-Departure Moding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-75</td>
<td>Inhibit OIU FDIR</td>
<td></td>
<td>Configure C&amp;DH for UNDOCKING</td>
<td></td>
</tr>
<tr>
<td>U-15</td>
<td>Position and Lock ISS US SAWs (4B beta @100 deg and 28 beta @260 deg)</td>
<td>US: SODF P6 SAW Feather for Arrival/Departure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-13</td>
<td>Verify ISS Systems Go/NoGo for Undocking.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-3</td>
<td>Verify Orbiter in FREE</td>
<td></td>
<td>UNDOCKING OPERATIONS (RNDZ, UNDOCKING/SEP TIMELINE)</td>
<td></td>
</tr>
<tr>
<td>U-0</td>
<td>Undock</td>
<td>Undock - &quot;Upon separation, begin sep pulses in NORMZ</td>
<td>UNDOCKING OPERATIONS (RNDZ, UNDOCKING/SEP TIMELINE)</td>
<td></td>
</tr>
<tr>
<td>U+1</td>
<td>At Shuttle call &quot;Range 30 ft,&quot; ISS commands RS MCS to active control.</td>
<td>At a distance of 30ft (DP-DP) call &quot;Range 30 ft&quot; to ISS Crew.</td>
<td>UNDOCKING OPERATIONS (RNDZ, UNDOCKING/SEP TIMELINE), OSTP</td>
<td></td>
</tr>
<tr>
<td>U+250 sec</td>
<td>ISS RSS MCS moded to control, &quot;snap and hold&quot; attitude.</td>
<td></td>
<td>UNDOCKING OPERATIONS (RNDZ, UNDOCKING/SEP TIMELINE)</td>
<td></td>
</tr>
</tbody>
</table>
## SHUTTLE DEPARTURE

<table>
<thead>
<tr>
<th>Time to Undock</th>
<th>ISS Activity</th>
<th>Shuttle Activity</th>
<th>Constraint</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>U+20</td>
<td>At 400’, GO for ISS SAW repositioning and sun tracking.</td>
<td>Perform Station Fly Around at 450 ft. If Flyaround cannot be performed, separate to 400 ft on +Rbar and then perform 3 fps retrograde.</td>
<td>ISS FLYAROUND (RNDZ, UNDOCKING/SEP TIMELINE)</td>
<td>RS cmd procedure for RS Solar Arrays, US Solar Arrays remain locked.</td>
</tr>
<tr>
<td>U+60</td>
<td>MCC-M confirms battery charging based on ECS telemetry.</td>
<td>ACS Post Departure Moding</td>
<td>Tlm verification. Will depend if in insolation or eclipse.</td>
<td>ACS POST DEPARTURE MODING</td>
</tr>
<tr>
<td>U+100</td>
<td>MCC-M confirms via BITS telemetry that MCS performance is nominal.</td>
<td>MCC-M confirms battery charging based on Regul telemetry.</td>
<td>Tlm verification. Will depend if in insolation or eclipse.</td>
<td></td>
</tr>
<tr>
<td>U+155</td>
<td>Orbiter final sep burn. Could occur at U+43, U+66, U+89, or U+112 depending on the number of half-laps flown.</td>
<td>Sep Burn in NORMZ at 1000 ft. Final Sep burn + about 10 minutes.</td>
<td>SEP BURN (RNDZ, UNDOCKING/SEP TIMELINE)</td>
<td>SEP BURN (RNDZ, UNDOCKING/SEP TIMELINE)</td>
</tr>
<tr>
<td>U+200</td>
<td>MCC-M confirms battery SOC has recovered and is GO for ISS systems powerup.</td>
<td>SM &amp; FGB batteries back in incomplete charge mode.</td>
<td>ISS POWER-UP POST DEPARTURE.</td>
<td>RS Cmd Procedure</td>
</tr>
</tbody>
</table>
FLIGHT 5A
1. The total USOS loads for Shuttle Arrival should be ≤ 800 Watts.

2. Use the POWERUP column in reverse order to back out of the powerdown.

3. The loads for the major power users are presented below.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>dc Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMA3 Shell Heaters</td>
<td>0 W predicted</td>
</tr>
<tr>
<td>Node 1 Shell Heaters</td>
<td>0 W predicted</td>
</tr>
<tr>
<td></td>
<td>Total for String B 1284 W</td>
</tr>
<tr>
<td>PMA1 Shell Heaters</td>
<td>40 W predicted</td>
</tr>
<tr>
<td></td>
<td>Total for String B 272 W</td>
</tr>
<tr>
<td>SPDA Rail Heaters</td>
<td>120 W</td>
</tr>
<tr>
<td>Z1 EEATCS Flex Hose Heaters</td>
<td>160 W</td>
</tr>
<tr>
<td>Z1 DDCU Heaters</td>
<td>200 W</td>
</tr>
<tr>
<td>PCUs and Heaters</td>
<td>124 W</td>
</tr>
<tr>
<td>CMG Heaters</td>
<td>400 W</td>
</tr>
<tr>
<td>KU-Band and S-Band Heaters</td>
<td>610 W</td>
</tr>
<tr>
<td>Early Comm</td>
<td></td>
</tr>
<tr>
<td>Transmitter On</td>
<td>60 W</td>
</tr>
<tr>
<td>N1RS1 C</td>
<td></td>
</tr>
<tr>
<td>Port Antenna Power (5)</td>
<td>19 W</td>
</tr>
<tr>
<td>Port Antenna Heater (6)</td>
<td>70 W</td>
</tr>
<tr>
<td>Stbd Antenna Power (12)</td>
<td>65 W</td>
</tr>
<tr>
<td>Stbd Antenna Heater (13)</td>
<td>70 W</td>
</tr>
<tr>
<td>N1RS2 A</td>
<td></td>
</tr>
<tr>
<td>XCVR Power (5)</td>
<td>54 W</td>
</tr>
<tr>
<td>CTP Power (10)</td>
<td>23 W</td>
</tr>
<tr>
<td>RFPDB Power (11)</td>
<td>12 W</td>
</tr>
<tr>
<td>MDM N1-1</td>
<td></td>
</tr>
<tr>
<td>Primary Mode</td>
<td>67 W</td>
</tr>
<tr>
<td>Secondary Mode</td>
<td>67 W</td>
</tr>
<tr>
<td>Diagnostic Mode</td>
<td>37 W</td>
</tr>
<tr>
<td>MDM N1-2</td>
<td></td>
</tr>
<tr>
<td>Primary Mode</td>
<td>67 W</td>
</tr>
<tr>
<td>Secondary Mode</td>
<td>67 W</td>
</tr>
<tr>
<td>Diagnostic Mode</td>
<td>37 W</td>
</tr>
</tbody>
</table>

**NOTE**
During Node 1 Pre-Ingress Warm-up, Ingress, and Post Egress Dryout, the Node 1 and PMA1 Shell Heater power allocation and configuration will vary.
### POWERDOWN

**NOTE**

Depending on the heater configuration, power usage may not decrease after every step.

1. **RS LOAD POWERDOWN**
   
   TBD (Based on current data, SM and FGB do not require power downs for docking, this will be addressed at the upcoming OPS TIM.)

2. **INHIBITING PMA3 A AND B SHELL HTRS**
   
   Task: USOS Powerdown/up Pg 1
   
   3A USOS Powerdown Powerup Display 1

   sel PMA3 Htrs

   **PMA3 – HtrAvailability**

   sel Htr [X]A where [X] = [1 2 3 4 5]

   - **cmd** Inhibit
   - √Htr[X]A Availability – Inh
   - Repeat

   sel Htr [X]B where [X] = [1 2 3 4 5]

   - **cmd** Inhibit
   - √Htr[X]B Availability – Inh
   - Repeat

### POWERUP

- **cmd** Ena Backup
- **cmd** Ena Operate
### POWERDOWN

3. **INHIBITING NODE 1 A AND B HTRS (1 --- 6)**

<table>
<thead>
<tr>
<th>sel Node 1 Htrs 1 --- 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node1Htr16avail</td>
</tr>
</tbody>
</table>

- **sel Htr [X]A** where [X] = 1 2 3 4 5 6
  - **cmd** Inhibit
  - √Htr[X]A Availability – Inh

- **Repeat**

- **sel Htr [X]B** where [X] = 1 2 3 4 5 6
  - **cmd** Inhibit
  - √Htr[X]B Availability – Inh

- **Repeat**

4. **INHIBITING NODE 1 A AND B HTRS (7 --- 9)**

<table>
<thead>
<tr>
<th>sel Node 1 Htrs 7 --- 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node1Htr79avail</td>
</tr>
</tbody>
</table>

- **sel Htr [X]A** where [X] = 7 8 9
  - **cmd** Inhibit
  - √Htr[X]A Availability – Inh

- **Repeat**

- **sel Htr [X]B** where [X] = 7 8 9
  - **cmd** Inhibit
  - √Htr[X]B Availability – Inh

- **Repeat**

### POWERUP

- **cmd** Ena Backup
- **cmd** Ena Operate
### POWERDOWN

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td><strong>INHIBITING PMA1 A AND B SHELL HTRS</strong>&lt;br&gt;3A USOS Powerdown Powerup Display 1&lt;br&gt;sel PMA1 Htrs&lt;br&gt;PMA1 HtrAvailability&lt;br&gt;sel Htr [X]A where [X] = 1 3 4 5&lt;br&gt;cmd Inhibit&lt;br&gt;√ Htr[X]A Availability – Inh&lt;br&gt;Repeat&lt;br&gt;sel Htr [X]B where [X] = 1 2 3 5&lt;br&gt;cmd Inhibit&lt;br&gt;√ Htr[X]B Availability – Inh&lt;br&gt;Repeat</td>
</tr>
</tbody>
</table>

### POWERUP

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cmd Ena Backup</td>
</tr>
<tr>
<td></td>
<td>cmd Ena Operate</td>
</tr>
<tr>
<td></td>
<td>cmd Htr A Ena BU</td>
</tr>
<tr>
<td></td>
<td>cmd Htr B Ena Opr</td>
</tr>
<tr>
<td></td>
<td>cmd RPC 7 – Close (Verify – Cl)</td>
</tr>
<tr>
<td></td>
<td>cmd RPC 7 – Close (Verify – Cl)</td>
</tr>
</tbody>
</table>
## POWERDOWN

<table>
<thead>
<tr>
<th>DISABLING Z1 DDCU HEATERS</th>
<th>POWERUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘DDCU Htrs - 1’</td>
<td>‘RPCM Z14B B’</td>
</tr>
<tr>
<td>cmd RPC 11 – Op (Verify – Op)</td>
<td>cmd RPC 11 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>‘RPCM Z13B B’</td>
<td>cmd RPC 11 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>‘DDCU Htrs - 2’</td>
<td>‘RPCM Z13B B’</td>
</tr>
<tr>
<td>cmd RPC 11 – Op (Verify – Op)</td>
<td>cmd RPC 16 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>‘RPCM Z14B B’</td>
<td>cmd RPC 16 – Close (Verify – Cl)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISABLING PCUs AND HEATERS</th>
<th>POWERUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘PCU 1 and PCU 2 Htr’</td>
<td>‘RPCM Z13B B’</td>
</tr>
<tr>
<td>cmd RPC 15 – Op (Verify – Op)</td>
<td>cmd RPC 15 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>cmd RPC 16 – Op (Verify – Op)</td>
<td>cmd RPC 16 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>‘PCU 2 and PCU 1 Htr’</td>
<td>‘RPCM Z14B B’</td>
</tr>
<tr>
<td>cmd RPC 15 – Op (Verify – Op)</td>
<td>cmd RPC 15 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>cmd RPC 14 – Op (Verify – Op)</td>
<td>cmd RPC 14 – Close (Verify – Cl)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DISABLING CMG HEATERS</th>
<th>POWERUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘CMG External Htrs’</td>
<td>‘RPCM Z13B B’</td>
</tr>
<tr>
<td>cmd RPC 10 – Op (Verify – Op)</td>
<td>cmd RPC 10 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>cmd RPC 12 – Op (Verify – Op)</td>
<td>cmd RPC 12 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>‘CMG External Htrs’</td>
<td>‘RPCM Z14B B’</td>
</tr>
<tr>
<td>cmd RPC 10 – Op (Verify – Op)</td>
<td>cmd RPC 10 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>cmd RPC 12 – Op (Verify – Op)</td>
<td>cmd RPC 12 – Close (Verify – Cl)</td>
</tr>
</tbody>
</table>
### POWERDOWN

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| 11.  | **DISABLING S-BAND HEATERS**  
    ‘S-Band Htrs’  
    ‘RPCM Z14B B’  
    
    **cmd** RPC 1 – Op (Verify – Op)  
    **cmd** RPC 4 – Op (Verify – Op) |
| 12.  | **TURNING OFF EARLY COMM ANTENNA HEATERS**  
    **CAUTION**  
    The Early Comm Antennas may experience hardware damage after several hours without heater power.  
    
    * sel 3A USOS Pwrdn/Pwrup – Display 2  
    * 3A USOS Powerdown Powerup Display 2  
    * ‘Early Comm’  
    * ‘Port Antenna Htr’  
    
    **cmd** RPC 6 – Op **Execute** (Verify – Op)  
    ‘Stbd Antenna Htr’  
    **cmd** RPC 13 – Op **Execute** (Verify – Op)  
    \[ \sqrt{(RACU 5 \text{ Vout} \times RACU 5 \text{ Iout}) + (RACU 6 \text{ Vout} \times RACU 6 \text{ Iout})} \leq 700 \text{ W} \] |

### POWERUP

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| cmd  | RPC 1 – Close (Verify – Cl)  
    **cmd** RPC 4 – Close (Verify – Cl)  
    **cmd** RPC 6 – Close **Execute** (Verify – Cl)  
    **cmd** RPC 13 – Close **Execute** (Verify – Cl) |
1. VERIFYING ACS MODING PRE-ARRIVAL CONFIGURATION AND STATUS

PCS

MCS: ACS Moding

ACS Moding

‘ACS Configuration’

Verify Moding Role Primary, Secondary NCS – Full

********************************************************************

If Primary(Secondary) NCS Moding Role is not set to Full, then the following commands should be sent

sel Moding Role

Moding Role

cmd N1-2(N1-1) – Arm

Verify Arm Status Primary(Secondary) NCS – Arm

cmd N1-2(N1-1) – Full

Verify Moding Role Primary(Secondary) NCS – Full

Verify Arm Status Primary(Secondary) NCS – Disarm

********************************************************************

Verify RS Mode Primary, Secondary NCS – Cntl

‘Arrival’

Verify PMA3 Arrival Response SW Primary, Secondary NCS – Inh

2. ENABLING ACS MODING INDICATOR LIGHTS

NOTE

Each of the primary and secondary MDMs command one of the LED units (i.e., two units per PMA, four LEDs per unit). LED configurations: On - Active Attitude Control, Flash - Station in Free Drift, Off - LED Control Software is Inhibited or an MDM loss of comm situation has occurred.

PCS

MCS: ACS Moding

ACS Moding

‘ACS Configuration’

sel LED Control SW

LED Control SW

‘Primary NCS’

cmd Enable

√LED Control SW – Ena

Verify PMA3 LED State – On
‘Secondary NCS’

**cmd** Enable

√LED Control SW – Ena
Verify PMA3 LED State – On

### 3. ENABLING ARRIVAL RESPONSE SOFTWARE FOR ACS MODING

ACS Moding
‘Arrival’

sel PMA3 Arrival Response SW

[**PMA3 Arrival Response SW**]  
‘Primary NCS’

**cmd** Enable

Verify Arrival Response SW – Ena

‘Secondary NCS’

**cmd** Enable

Verify Arrival Response SW – Ena

**************************************************************************

If Primary(Secondary) NCS Arrival Response SW needs to be  
inhibited (wave off, etc), then the following commands should  
be sent

sel PMA3 Arrival Response SW

[**PMA3 Arrival Response SW**]  
‘Primary NCS’(‘Secondary NCS’)

**cmd** Arm

Verify Arm Status Primary(Secondary) NCS – Arm

**cmd** Inhibit

Verify Arrival Response SW Primary(Secondary) NCS – Inh

**************************************************************************
1. **VERIFYING ACS MODING PRE-ARRIVAL CONFIGURATION AND STATUS**

   PCS
   - MCS: ACS Moding
   - ACS Moding
   - ‘ACS Configuration’

   Verify Moding Role Primary, Secondary NCS – Full
   Verify RS Mode Primary, Secondary NCS – Cntl

   √ LED Control SW Primary, Secondary NCS – Ena
   Verify PMA3 LED State Primary, Secondary NCS – On

   ‘Arrival’

   √ PMA3 Arrival Response SW Primary, Secondary NCS – Ena

2. **CAPTURE**

   Orbiter ⇒ ISS, “Capture confirmed.”

   RS Laptop
   - CM: TBM PROC
   - sel F1_10 [YB] OrbiterArrival
   - cmd Execute

3. **VERIFYING STATION ACS MODING POST-DOCKING CONFIGURATION**

   PCS
   - MCS: ACS Moding
   - ACS Moding
   - ‘ACS Configuration’
   - ‘Arrival’

   Verify PMA3 Capture Long Primary, Secondary NCS – X
   Verify Arrival Event Primary, Secondary NCS – X

   ‘ACS Configuration’

   Verify RS Mode Primary, Secondary NCS – Drift
   Verify PMA3 LED State Primary, Secondary NCS – Flash

   ISS ⇒ orbiter, MCC-H, “ISS is Free Drift.”

   **NOTE**
   The following signals appear at hardmate, which may take up to 17 minutes to occur after capture.

   ‘Departure’

   Verify PMA3 Interface Sealed Primary, Secondary NCS – X
   Verify PMA3 Separation Primary, Secondary NCS – Blank
1. **INHIBITING LED INDICATORS**

PCS

MCS: ACS Moding

ACS Moding

‘ACS Configuration’

sel LED Control SW

<table>
<thead>
<tr>
<th>LED Control SW</th>
<th>‘Primary NCS’</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd Inhibit</td>
<td></td>
</tr>
</tbody>
</table>

\(\sqrt{\text{LED Control SW – Inh}}\)

Verify PMA2, PMA3 LED State – Off

‘Secondary NCS’

<table>
<thead>
<tr>
<th>cmd Inhibit</th>
</tr>
</thead>
</table>

\(\sqrt{\text{LED Control SW – Inh}}\)

Verify PMA3 LED State – Off

2. **DISABLING ARRIVAL RESPONSE SOFTWARE**

ACS Moding

‘Arrival’

sel PMA3 Arrival Response SW

<table>
<thead>
<tr>
<th>PMA3 Arrival Response SW</th>
<th>‘Primary NCS’</th>
</tr>
</thead>
<tbody>
<tr>
<td>cmd Arm</td>
<td></td>
</tr>
</tbody>
</table>

Verify Arm Status – Arm

<table>
<thead>
<tr>
<th>cmd Inhibit</th>
</tr>
</thead>
</table>

Verify Arrival Response SW – Inh
Verify Arm Status – Disarm

‘Secondary NCS’

<table>
<thead>
<tr>
<th>cmd Arm</th>
</tr>
</thead>
</table>

Verify Arm Status – Arm

<table>
<thead>
<tr>
<th>cmd Inhibit</th>
</tr>
</thead>
</table>

Verify Arrival Response SW – Inh
Verify Arm Status – Disarm
At 170 foot station-keeping, ADCO will prompt Blue/White FCR Flights to this page. At Rendezvous 10 meters (30ft): Blue/White FCR Flights will call “All Quiet.” All Controllers will monitor Shuttle FD and A/G Loops.

1. CAPTURE PHASE

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNC</td>
<td>“PCT ARMED”</td>
<td>Shuttle FD</td>
<td></td>
</tr>
<tr>
<td>MMACS</td>
<td>“CONTACT”</td>
<td>Shuttle FD</td>
<td></td>
</tr>
<tr>
<td>Shuttle Crew</td>
<td>“CAPTURE CONFIRMED”</td>
<td>2A/G2</td>
<td>ISS Crew - Command ISS to Free Drift.</td>
</tr>
<tr>
<td>MMACS</td>
<td>“MMACS CONFIRMS CAPTURE CONFIRMED”</td>
<td>Shuttle FD</td>
<td>SSP GC - Start 60 second wall clock in WFCR &amp; BFCR. RIO - Call <strong>MCC-M</strong> on ISS OPS and inform of Capture. ADCO – Confirm Capture Long and Arrival Event on ISS FD.</td>
</tr>
<tr>
<td>GNC</td>
<td>“SHUTTLE FREE DRIFT”</td>
<td>Shuttle FD</td>
<td></td>
</tr>
</tbody>
</table>

2. ISS FREE DRIFT – NOMINAL PATH

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS Crew</td>
<td>“ISS FREE DRIFT”</td>
<td>2A/G2</td>
<td>ADCO/RIO – Confirm INDICATOR on ISS FD.</td>
</tr>
<tr>
<td>ISS FD</td>
<td>“STATION FLIGHT CONFIRMS FREE DRIFT”</td>
<td>Shuttle FD</td>
<td>CAPCOM – Table 5 block 1.</td>
</tr>
</tbody>
</table>

3. ISS FREE DRIFT – NO CALL FROM ISS CREW

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADCO</td>
<td>“ADCO confirms INDICATOR”</td>
<td>ISS FD</td>
<td>After ADCO confirmation, ISS Flight to wait for RIO call. At NET “Capture Confirmed” + 50 seconds Flight to proceed with status call to Shuttle FD.</td>
</tr>
<tr>
<td>RIO</td>
<td>“MOSCOW CONFIRMS INDICATOR”</td>
<td>ISS FD</td>
<td></td>
</tr>
<tr>
<td>ISS FD</td>
<td>“STATION FLIGHT CONFIRMS FREE DRIFT”</td>
<td>Shuttle FD</td>
<td>CAPCOM – Table 5 block 1.</td>
</tr>
</tbody>
</table>

4. ISS ACTIVE CONTROL – NO CHANGE AT CAPTURE CONFIRMED + 50 sec

<table>
<thead>
<tr>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADCO</td>
<td>“ADCO CONFIRMS ACTIVE CONTROL”</td>
<td>ISS FD</td>
<td>RIO – Call <strong>MCC-M</strong> on ISS OPS for update.</td>
</tr>
<tr>
<td>ISS FD</td>
<td>“STATION FLIGHT CONFIRMS ACTIVE CONTROL”</td>
<td>Shuttle FD</td>
<td>CAPCOM – Table 5 block 2.</td>
</tr>
</tbody>
</table>
5. **FINAL CALLS TO SHUTTLE CREW – NLT CAPTURE CONFIRMED + 60 sec**

<table>
<thead>
<tr>
<th></th>
<th>Controller</th>
<th>Expected Call</th>
<th>Loop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ISS FD</td>
<td>“ISS IS FREE DRIFT.”</td>
<td>Shuttle FD</td>
</tr>
<tr>
<td></td>
<td>CAPCOM</td>
<td>“STATION FREE DRIFT CONFIRMED.”</td>
<td>A/G</td>
</tr>
<tr>
<td>2</td>
<td>ISS FD</td>
<td>“ISS IS ACTIVE CONTROL.”</td>
<td>Shuttle FD</td>
</tr>
<tr>
<td></td>
<td>CAPCOM</td>
<td>“STATION IN ACTIVE CONTROL, PERFORM FAILED CAPTURE TO UNDOCK.”</td>
<td>A/G</td>
</tr>
</tbody>
</table>
1. Once P6 is activated, the ISS power generation capability is such that an
ISS powerdown will not be required unless the absolute solar beta angle
≥ 50°.

For absolute solar beta angle ≥ 50°, the total ISS powerdown required is
600 Watts (~200 from the RS and ~400 from the USOS).

2. Use the POWERUP column in reverse order to back out of the
powerdown.

3. The loads for the major power users are presented below.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>dc Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMA3 Shell Heaters</td>
<td>0 W predicted</td>
</tr>
<tr>
<td>Node 1 Shell Heaters</td>
<td>0 W predicted</td>
</tr>
<tr>
<td>Total for String B</td>
<td>1284 W</td>
</tr>
<tr>
<td>PMA1 Shell Heaters</td>
<td>40 W predicted</td>
</tr>
<tr>
<td>Total for String B</td>
<td>272 W</td>
</tr>
<tr>
<td>SPDA Rail Heaters</td>
<td>120 W</td>
</tr>
<tr>
<td>Z1 EEATCS Heaters</td>
<td>TBD W</td>
</tr>
<tr>
<td>Z1 DDCU Heaters</td>
<td>200 W</td>
</tr>
<tr>
<td>PCUs and Heaters</td>
<td>124 W</td>
</tr>
<tr>
<td>CMG Heaters</td>
<td>400 W</td>
</tr>
<tr>
<td>KU-Band and S-Band Heaters</td>
<td>610 W</td>
</tr>
</tbody>
</table>

Early Comm

<table>
<thead>
<tr>
<th>Transmitter On</th>
<th>Low Rate</th>
<th>High Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1RS1 C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port Antenna Power (5)</td>
<td>19 W</td>
<td>147 W</td>
</tr>
<tr>
<td>Port Antenna Heater (6)</td>
<td>70 W</td>
<td>70 W</td>
</tr>
<tr>
<td>Stbd Antenna Power (12)</td>
<td>65 W</td>
<td>19 W</td>
</tr>
<tr>
<td>Stbd Antenna Heater (13)</td>
<td>70 W</td>
<td>70 W</td>
</tr>
</tbody>
</table>

N1RS2 A

| XCVR Power (5) | 54 W     | 54 W     |
| CTP Power (10) | 23 W     | 23 W     |
| RFPDB Power (11) | 12 W  | 51 W     |

MDM N1-1

| Primary Mode | 67 W |
| Secondary Mode | 67 W |
| Diagnostic Mode | 37 W |

MDM N1-2

| Primary Mode | 67 W |
| Secondary Mode | 67 W |
| Diagnostic Mode | 37 W |
### POWERDOWN

**NOTE**
Depending on the heater configuration, power usage may not decrease after every step.

1. **POWERDOWN REQUIREMENT VERIFICATION**
   If absolute solar beta angle < 50° (no powerdown required) >>

2. **RS LOAD POWERDOWN**
   TBD (Based on current data, SM and FGB total powerdown will be 200 W.)

3. **INHIBITING PMA3 A AND B SHELL HTRS**
   Task: USOS Powerdown/up Pg 1
   PCS
   sel PMA3 Htrs
   
   sel Htr [X]A where [X] = 1 2 3 4 5
   - **cmd** Inhibit
     - √Htr[X]A Availability – Inh
     - Repeat

   sel Htr [X]B where [X] = 1 2 3 4 5
   - **cmd** Inhibit
     - √Htr[X]B Availability – Inh
     - Repeat

### POWERUP

**cmd** Ena Backup

**cmd** Ena Operate
### POWERDOWN

4. **INHIBITING NODE 1 A AND B HTRS (1 --- 6)**

   - **3A USOS Powerdown Powerup Display 1**
   - sel Node 1 Htrs 1 --- 6
   - Node1Htr16avail
   - sel Htr [X]A where [X] = 1 2 3 4 5 6
     - **cmd** Inhibit
     - √Htr[X]A Availability – Inh
     - Repeat
   - sel Htr [X]B where [X] = 1 2 3 4 5 6
     - **cmd** Inhibit
     - √Htr[X]B Availability – Inh
     - Repeat

5. **INHIBITING NODE 1 A AND B HTRS (7 --- 9)**

   - **3A USOS Powerdown Powerup Display 1**
   - sel Node 1 Htrs 7 --- 9
   - Node1Htr79avail
   - sel Htr [X]A where [X] = 7 8 9
     - **cmd** Inhibit
     - √Htr[X]A Availability – Inh
     - Repeat
   - sel Htr [X]B where [X] = 7 8 9
     - **cmd** Inh
     - √Htr[X]B Availability – Inh
     - Repeat

### POWERUP

- **cmd** Ena Backup
- **cmd** Ena Operate
### POWERDOWN

<table>
<thead>
<tr>
<th>6. INHIBITING PMA1 A AND B SHELL HTRS</th>
<th>POWERUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A USOS Powerdown Powerup Display 1</td>
<td>cmd Ena Backup</td>
</tr>
</tbody>
</table>

 sel PMA1 Htrs

 PMA1 HtrAvailability

 sel Htr [X]A where [X] = 1 3 4 5

   cmd Inhibit

 √Htr[X]A Availability – Inh

 Repeat

 sel Htr [X]B where [X] = 1 2 3 5

   cmd Inhibit

 √Htr[X]B Availability – Inh

 Repeat

<table>
<thead>
<tr>
<th>7. DISABLING Z1 SPDA HEATERS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3A USOS Powerdown Powerup Display 1</td>
<td>cmd Ena Operate</td>
</tr>
</tbody>
</table>

 'Pwr Bus Rail Htrs - A'

 cmd Z13B HtrA Inh (√Availability – Inhibit) cmd Htr A Ena BU
 cmd Z14B HtrA Inh (√Availability – Inhibit) cmd Htr A Ena BU

 'Pwr Bus Rail Htrs - B'

 cmd Z13B HtrB Inh (√Availability – Inhibit) cmd Htr B Ena Opr
 cmd Z14B HtrB Inh (√Availability – Inhibit) cmd Htr B Ena Opr

<table>
<thead>
<tr>
<th>8. DISABLING Z1 EEATCS HEATERS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>‘EEATCS Loop A Non Op Htr1’</td>
<td>cmd RPC 7 – Close</td>
</tr>
<tr>
<td>‘RPCM Z13B B’</td>
<td>(Verify – Cl)</td>
</tr>
</tbody>
</table>

 cmd RPC 7 – Op (Verify – Op)

 ‘EEATCS Loop B Non Op Htr1’  | cmd RPC 7 – Close |
| ‘RPCM Z14B B’                | (Verify – Cl) |

 cmd RPC 7 – Op (Verify – Op)
### POWERDOWN

<table>
<thead>
<tr>
<th>DISABLING Z1 DDCU HEATERS</th>
<th>POWERUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>'DDCU Htrs - 1'</td>
<td></td>
</tr>
<tr>
<td>'RPCM Z14B B'</td>
<td></td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 11 – Op (Verify – Op)</td>
<td><strong>cmd</strong> RPC 11 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>'RPCM Z13B B'</td>
<td></td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 11 – Op (Verify – Op)</td>
<td><strong>cmd</strong> RPC 11 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>'DDCU Htrs - 2'</td>
<td></td>
</tr>
<tr>
<td>'RPCM Z13B B'</td>
<td></td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 6 – Op (Verify – Op)</td>
<td><strong>cmd</strong> RPC 6 – Close (Verify – Cl)</td>
</tr>
<tr>
<td>'RPCM Z14B B'</td>
<td></td>
</tr>
<tr>
<td><strong>cmd</strong> RPC 16 – Op (Verify – Op)</td>
<td><strong>cmd</strong> RPC 16 – Close (Verify – Cl)</td>
</tr>
</tbody>
</table>
1. **VERIFYING ISS SYSTEMS HAVE BEEN POWERED DOWN**

   √MCC-H that {2.505 ISS POWERDOWN AND RECOVERY FOR SHUTTLE ARRIVAL (DEPARTURE)} has been completed.

   **NOTE**
   Procedure to be completed for both channels. Total Time to complete procedure = 1 hour.

2. **VERIFYING COMM WITH BGA CONTROLLER**

   P6: EPS: BGA 4B(2B)
   BGA 4B(2B)
   'ECU 4B(2B)'

   Verify Integ Cnt - <incrementing>

3. **VERIFYING ECU PWR SUPPLY TEMPS AND VOLTAGE STATUS**

   Verify SAW PS Temp, °C: -45 --- 54

   Verify BGA PS Temp, °C: -45 --- 54
   Voltage, V: 115 --- 125

4. **RECORDING PRESENT BGA STATUS**

   BGA 4B(2B)
   'BGA 4B(2B)'

   Record data.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Ch 4B(2B) Mode, Primary PVCU</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>BGA Mode, Primary PVCU</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Actual Angle, deg</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Actual Angle Rate, deg/s</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Motor State</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Motor Velocity, deg/s</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Motor Current, A</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Latch 1 Pin Status</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>Latch 2 Pin Status</td>
<td>_______</td>
<td>_______</td>
</tr>
</tbody>
</table>

   Copy recorded values for BGA 2B into column titled “INITIAL” in step 13.1.

   Copy recorded values for BGA 4B into column titled “INITIAL” in step 13.2.
5. **VERIFYING BGA MOD**
   If the BGA Mode is “Safe/Lock”, “Manual Free”, “Null”, or “Blind” check with **MCC-H** before proceeding. (Safe/Lock to Safe/Lock mode transitions are not possible.)

6. **VERIFYING BLIND MODE IMPLEMENTATION TIME AND BGA ANGLE**
   **√MCC-H** for Blind Mode implementation time and BGA angle.

<table>
<thead>
<tr>
<th>Directed Position, Time After LOC</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>_________sec</td>
<td>_________sec</td>
<td></td>
</tr>
<tr>
<td>(Protect for second Dock/Undock attempt + 15 minutes, 270 minutes max)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   | Directed Position, Cmded Angle | _________deg | _________deg |
   | (Optimal power generation position) | (0 to 360) |

   Copy Time After LOC and Cmded Angle values into steps 7 and 8.

7. **SETTING BGA BLIND MODE TO DIRECTED POSTION FOR PRIMARY MDM**
   sel Blind Modes
   **BGA 4B(2B) Blind Modes**
   ‘Primary PVCU’
   ‘Directed Position’

   input LOC Timer: 1

   input Time After LOC: _________sec or _________sec
   input Cmded Angle: _________deg or _________deg
   (From step 6) (From step 6)

   **cmd Arm**
   **cmd Set**

   Verify Preselected Blind Mode - Directed Position
   Verify Actual LOC Timer - Implement

<table>
<thead>
<tr>
<th>Verify Preselected Time After LOC:</th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>_________sec or _________sec</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   | Verify Preselected Parameter: | _________deg or _________deg |
   | (From step 6) | (From step 6) |
8. **SETTING BGA BLIND MODE TO DIRECTED POSITION FOR BACK-UP MDM**

'Backup PVCU'
'Directed Position'

input LOC Timer: 1

<table>
<thead>
<tr>
<th></th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>input Time After LOC:</td>
<td>_______ sec or _______ sec</td>
<td>_______ sec or _______ sec</td>
</tr>
<tr>
<td>input Cmded Angle:</td>
<td>_______ deg or _______ deg</td>
<td>_______ deg or _______ deg</td>
</tr>
</tbody>
</table>

**cmd Arm**
**cmd Set**

Verify Preselected Blind Mode - Directed Position
Verify Actual LOC Timer - Implement

<table>
<thead>
<tr>
<th></th>
<th>BGA 2B</th>
<th>BGA 4B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify Preselected Time After LOC:</td>
<td>_______ sec or _______ sec</td>
<td>_______ sec or _______ sec</td>
</tr>
<tr>
<td>Verify Preselected Parameter:</td>
<td>_______ deg or _______ deg</td>
<td>_______ deg or _______ deg</td>
</tr>
</tbody>
</table>

9. **SETTING BGA CONTINGENCY CONTROL TO ANGLE HOLD**

`BGA 4B(2B)`

'sel Contingency Control'

<table>
<thead>
<tr>
<th></th>
<th>BGA 4B(2B) Contingency Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>'Angle Hold'</td>
<td></td>
</tr>
</tbody>
</table>

**cmd Arm**
**cmd Set**

**NOTE**

SPN 15635 (PR 15635) BGA 2B and BGA 4B Contingency Control parameter static and indicates “Angle Hold”
(Fixed for 5A and subsequent flights).

Verify Contingency Control - Angle Hold
10. **VERIFYING BGA CONTINGENCY MODE**

   Confirm Contingency Control status with **MCC-H** when time permits; continue procedure.

   **NOTE**

   Repeat steps 2 ---10 for the opposite BGA before proceeding.

11. **VERIFYING NEW BGA FEATHER ANGLE AND LATCH SELECTION**

   

   

   If **MCC-H** not available use the following table.

   Record BGA 2B BGA 4B

   Cmded Angle: (0 to 360) _________ deg _________ deg

   Latch Select: (1 or 2) _________ _________

   Flight | Rendezvous Angle, deg (Latch) | Departure Angle, deg (Latch)
   -------|-------------------------------|-------------------------------
   BGA 2B | BGA 4B                         | BGA 2B | BGA 4B
   4A     | N/A                           | N/A    | 258.75 (1) | 101.25 (1)
   Progress 3 | 219.375 (1) | 140.625 (1) | N/A | N/A
   5A     | 270 (1)                       | 90 (1)  | 258.75 (1) | 101.25 (1)
   Progress 4 | 219.375 (1) | 140.625 (1) | N/A | N/A
   5A.1   | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   6A     | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   Soyuz 2 | 219.375 (1) | 140.625 (1) | N/A | N/A
   7A     | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   4R     | 219.375 (1) | 140.625 (1) | N/A | N/A
   7A.1   | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   UF1    | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   8A     | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   UF2    | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   9A     | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   11A    | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)
   9A.1   | 149.063 (2) | 210.937 (2) | 149.063 (2) | 210.937 (2)

   Copy BGA 2B Cmded Angle and Latch values into step 12, into column titled “FINAL” in step 13.1 and step 14.

   Copy BGA 4B Cmded Angle and Latch values into step 12, into column titled “FINAL” in step 13.2 and step 14.
12. **CONFIGURING BGA MODE TO DIRECTED POSITION**

**NOTE**

In order to save time, one BGA can be commanded to Directed Position Mode while the other is still in transition. Analysis has shown that perturbations due to additive torque disturbance are minimal.

<table>
<thead>
<tr>
<th>BGA 4B(2B) Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directed Position</td>
</tr>
</tbody>
</table>

If PV Ch 4B(2B) Mode, Primary PVCU - Non-Solar Tracking (Fully Commanded) (Contingency/Safe) sel BGA Modes

<table>
<thead>
<tr>
<th>BGA 4B(2B) Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directed Position</td>
</tr>
</tbody>
</table>

input Cmded Angle: ___________deg or ___________deg (From step 11) (From step 11)

**cmd** Arm

**cmd** Set

Verify BGA Mode - Directed Position

<table>
<thead>
<tr>
<th>BGA 4B(2B) Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directed Position</td>
</tr>
</tbody>
</table>

**NOTE**

SPN 17198 (PR 17198) Cmded Angle parameter contains a positive bias and can be as much as 1 deg greater than the value issued during commanding. This bias does not affect the Actual Angle parameter.

Verify Cmded Angle: ___________deg (± 1.0) or ___________deg (± 1.0) (From step 11) (From step 11)

If PV Ch 4B(2B) Mode, Primary PVCU - Autonomous sel Channel Targeted Modes

| BGA 4B(2B) Ch Targeted Modes |


input Cmded Angle: \[
\begin{align*}
\text{BGA 2B} & \quad \text{deg} \quad \text{or} \quad \text{deg} \\
(\text{From step 11}) & \quad (\text{From step 11})
\end{align*}
\]

\text{cmd} \text{ Set}

Verify Ch 4B(2B) Mode - Non-Solar Tracking
Verify BGA Mode - Directed Position

\text{BGA 4B(2B)}

\text{‘BGA 4B(2B)’}

\text{NOTE}
SPN 17198 (PR 17198) Cmded Angle parameter contains a positive bias and can be as much as 1 deg greater than the value issued during commanding. This bias does not affect the Actual Angle parameter.

Verify Cmded Angle: \[
\begin{align*}
\text{BGA 2B} & \quad \text{deg} (\pm 1.0) \quad \text{or} \quad \text{deg} (\pm 1.0) \\
(\text{From step 11}) & \quad (\text{From step 11})
\end{align*}
\]

\text{NOTE}
Repeat steps 11 through 12 for the opposite BGA before proceeding.

13. \text{VERIFYING BGA TRANSITION TO DIRECTED POSITION MODE AND CMDED ANGLE}

\text{NOTE}
It can take up to 30 minutes if one of the anti-rotation latches is engaged (15 minutes to unlatch pin and 15 minutes to complete the rotation).

13.1 \text{Verify BGA 2B Transition to Directed Position Mode and Cmded Angle.}

\text{PCS}
\text{P6: EPS: BGA 2B}

\text{BGA 2B}

\text{‘BGA 2B’}
13.2 Verify BGA 4B Transition to Directed Position Mode and Cmded Angle.

PCS
P6: EPS: BGA 4B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial</th>
<th>Transition</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGA Actual Angle, deg</td>
<td>(From step 4)</td>
<td>&lt;Approaching Target Angle&gt;</td>
<td>± 0.5) (From step 11)</td>
</tr>
<tr>
<td>BGA Error Angle, deg</td>
<td>N/A</td>
<td>&lt;Decreasing&gt;</td>
<td>0.000 (± 1.0)</td>
</tr>
<tr>
<td>BGA Actual Angle Rate, deg/s</td>
<td>(From step 4)</td>
<td>+0.07 --- +0.28 or -0.07 --- -0.28</td>
<td>0.000</td>
</tr>
<tr>
<td>Divergence Indicator</td>
<td>&lt;Blank&gt;</td>
<td>&lt;Blank&gt;</td>
<td>&lt;Blank&gt;</td>
</tr>
<tr>
<td>BGA Motor State</td>
<td>(From step 4)</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>BGA Motor Velocity, deg/s</td>
<td>(From step 4)</td>
<td>+0.07 --- +0.28 or -0.07 --- -0.28</td>
<td>0.000</td>
</tr>
<tr>
<td>BGA Motor Current, A</td>
<td>(From step 4)</td>
<td>0.10 --- 0.70 (± 0.4)</td>
<td>0.10 (± 0.4)</td>
</tr>
<tr>
<td>Latch 1 Pin Status</td>
<td>(From step 4)</td>
<td>Unlatched</td>
<td>Unlatched</td>
</tr>
<tr>
<td>Latch 2 Pin Status</td>
<td>(From step 4)</td>
<td>Unlatched</td>
<td>Unlatched</td>
</tr>
</tbody>
</table>
14. **CONFIGURING BGA MODE TO SAFE/LOCK (AS NECESSARY)**

**NOTE**
In order to save time, one BGA can be commanded to Safe/Lock Mode while the other is still in transition. Analysis has shown that perturbations due to additive torque disturbance are minimal.

BGA 4B(2B) Modes

‘BGA 4B(2B)’

sel BGA Modes

BGA 4B(2B) Modes

‘Safe/Lock’

input Cmded Angle = _______deg or _______deg
input Latch Select = ____________ or ____________
(From step 11) (From step 11)

**cmd** Arm

**cmd** Set

Verify BGA Mode - Safe/Lock

BGA 4B(2B) Modes

‘BGA 4B(2B)’

**NOTE**
SPN 17198 (PR 17198) Cmded Angle parameter contains a positive bias and can be as much as 1 deg greater than the value issued during commanding. This bias does not affect the Actual Angle parameter.

Verify Cmded Angle = _____ deg (± 1.0) or _____ deg (± 1.0)
(From step 11) (From step 11)

**NOTE**
Repeat step 14 for the opposite BGA before proceeding.
15. **VERIFYING BGA LATCH SEQUENCE COMPLETE (AS NECESSARY)**

NOTE

BGA Latch Sequence Duration takes 8.5 minutes (average) from the point at which the BGA is within 1 deg of the commanded angle to start of column A in the latch sequence. This time delay allows time to dampen any remaining motor perturbations before driving the latch mechanism. It takes 11 minutes (average) to complete columns A through D of the latch sequence. TOTAL TIME = 19.5 minutes at ambient temperature for each BGA.

15.1 Verifying BGA 2B Latch Sequence Complete

PCS

P6: EPS: BGA 2B

‘BGA 2B’

Verify the appropriate anti-rotation latch is “Latched.”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial (~8.5 min)</th>
<th>Column A: (~4 min) Voltage/Current On</th>
<th>Column B: (~1 min) Active Actuator Indication</th>
<th>Column C: (~6 min) Inactive Actuator Indication</th>
<th>Column D: Latched Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGA Latch 1(2) Pin Status</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Latched</td>
</tr>
<tr>
<td>BGA Latch 1(2) Actuator</td>
<td>Inactive</td>
<td>Inactive</td>
<td>Active</td>
<td>Inactive</td>
<td>Inactive</td>
</tr>
<tr>
<td>BGA Latch 1(2) Current, A</td>
<td>Off Scale Low</td>
<td>~1.25</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
</tr>
<tr>
<td>BGA Latch 1(2) Voltage, V</td>
<td>0.0 – 0.1</td>
<td>~15</td>
<td>0.0 – 0.1</td>
<td>0.0 – 0.1</td>
<td>0.0 – 0.1</td>
</tr>
<tr>
<td>BGA Latch 1(2) Abort</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>BGA Motor State</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF*</td>
</tr>
</tbody>
</table>

Initial = BGA within 1 deg of commanded angle

* Just after column D in the BGA latch sequence, the motor will turn off indicating the BGA has completed its latch sequence.

** Actual angle may be slightly different than commanded, due to final pin alignment. (± 0.3 deg).
15.2 Verifying BGA 4B Latch Sequence Complete

Verify the appropriate anti-rotation latch is “Latched.”

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial (~8.5 min)</th>
<th>Column A: (~4 min Voltage/Current On)</th>
<th>Column B: (~1 min Active Actuator Indication)</th>
<th>Column C: (~6 min Inactive Actuator Indication)</th>
<th>Column D: Latched Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGA Latch 1(2) Pin Status</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Unlatched</td>
<td>Latched</td>
</tr>
<tr>
<td>BGA Latch 1(2) Actuator</td>
<td>Inactive</td>
<td>Inactive</td>
<td>Active</td>
<td>Inactive</td>
<td>Inactive</td>
</tr>
<tr>
<td>BGA Latch 1(2) Current, A</td>
<td>Off Scale Low</td>
<td>~1.25</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
<td>Off Scale Low</td>
</tr>
<tr>
<td>BGA Latch 1(2) Voltage, V</td>
<td>0.0 – 0.1</td>
<td>~15</td>
<td>0.0 – 0.1</td>
<td>0.0 – 0.1</td>
<td>0.0 – 0.1</td>
</tr>
<tr>
<td>BGA Latch 1(2) Abort</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>BGA Motor State</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>OFF*</td>
</tr>
</tbody>
</table>

Initial = BGA within 1 deg of commanded angle
* Just after step D in the BGA latch sequence, the motor will turn off indicating the BGA has completed its latch sequence.
** Actual angle may be slightly different than commanded, due to final pin alignment. (± 0.3 deg).

If Actuator time-out occurs or Latch 1(2) Abort = “X”, √MCC-H.
If Latch 1(2) Pin Status = “Unlatched” after 20 minutes, √MCC-H.
1. **VERIFYING ACS Moding ROLE CONFIGURATION**

MCS: ACS Moding

ACS Moding

'ACS Configuration'

Verify Moding Role Primary, Secondary NCS – Full

*******************************************************************

If Primary(Secondary) NCS Moding Role is not set to Full, then the following commands should be sent
sel Moding Role

Moding Role

**cmd** N1-2(N1-1) – Arm

Verify Arm Status Primary(Secondary) NCS – Arm

**cmd** N1-2(N1-1) – Full

Verify Moding Role Primary(Secondary) NCS – Full

Verify Arm Status Primary (Secondary) NCS – Disarm

*******************************************************************

2. **VERIFYING RUSSIAN SEGMENT MODE STATUS**

'ACS Configuration’

Verify RS Mode Primary,Secondary NCS – Drift

3. **VERIFYING DEPARTURE EVENT STATUS AND CONFIGURATION**

'Departure’

Verify PMA3 Interface Sealed Primary,Secondary NCS – X

Verify PMA3 Separation Primary,Secondary NCS – Blank

Verify Departure Event Primary,Secondary NCS – Blank

4. **PENDING BACK OFF TIMER SET FOR ORBITER DEPARTURE**

**NOTE**

Pending Back Off Timer of 250 seconds allows the orbiter to reach a safe distance prior to ISS resuming active attitude control.

PCs

MCS: ACS Moding

ACS Moding

'Departure’

sel Pending Back Off Time

**Pending Back Off Time**

'Primary NCS’

input Time: 250 (seconds)
cmd Accept Time

Verify Pending Back Off Time: 250 (seconds)
Verify Arm Status – Arm

cmd Incorporate Pending Back Off Time

Verify Back Off Time: 250 (seconds)
Verify Arm Status – Disarm

‘Secondary NCS’

input Time: 250 (seconds)

cmd Accept Time

Verify Pending Back Off Time: 250 (seconds)
Verify Arm Status – Arm

cmd Incorporate Pending Back Off Time

Verify Back Off Time: 250 (seconds)
Verify Arm Status – Disarm

*************************************************************************
If, before incorporating this time, the Pending Back Off Time needs to be canceled or configured later, disarm the current Pending Back Off Time as follows

sel Pending Back Off Time

[Pending Back Off Time]
‘Primary NCS’(‘Secondary NCS’)

cmd Disarm

Verify Arm Status – Disarm
*************************************************************************

5. **ENABLING APAS LED LIGHTING**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each of the primary and secondary MDMs command one of the LED units (i.e., two units per PMA, four LEDs per unit). LED configurations: On - Active Attitude Control, Flash - Station in Drift, Off - LED Control SW is Inhibited or an MDM loss of comm situation has occurred.</td>
</tr>
</tbody>
</table>

PCS  
MCS: ACS Moding

ACS Moding

‘ACS Configuration’
sel LED Control SW

LED Control SW
‘Primary NCS’

(cmd Enable

Verify LED Control SW – Ena
Verify PMA3 LED State – Flash

‘Secondary NCS’

(cmd Enable

Verify LED Control SW – Ena
Verify PMA3 LED State – Flash

6. CREW VERIFICATION OF LED STATE

MCC-H At a convenient time, get visual verification by orbiter crew that LED indicators are Flashing (orbiter overhead windows).

7. ENABLING DEPARTURE EVENT MONITORING FOR ACS MODING

PCS MCS: ACS Moding

ACS Moding
‘Departure’

sel PMA3 Departure Response SW

PMA3 Departure Response SW
‘Primary NCS’

(cmd Arm

Verify Arm Status – Arm

(cmd Enable

Verify Departure Response SW – Ena
Verify Arm Status – Disarm

‘Secondary NCS’

(cmd Arm

Verify Arm Status – Arm

(cmd Enable

Verify Departure Response SW – Ena
Verify Arm Status – Disarm
8. **VERIFYING DEPARTURE EVENT SOFTWARE STATUS**

ACS Moding

‘Departure’

Verify Departure Event Primary,Secondary NCS – blank

**************************************************************************

**CAUTION**

If the Primary(Secondary) Time Since Separation is observed to be incrementing any time prior to planned departure, ISS may take attitude control after 250 seconds. IMMEDIATE ACTION IS REQUIRED.

If the Primary(Secondary) Time Since Separation is observed to be incrementing any time prior to planned departure

sel Moding Role

[Moding Role]

**cmd** N1-2(N1-1) – Arm

Verify Arm Status Primary(Secondary) NCS – Arm

**cmd** N1-2(N1-1) – Off

Verify Moding Role Primary(Secondary) NCS – Off

Verify Arm Status Primary(Secondary) NCS – Disarm

**************************************************************************
1. **VERIFYING ACS MODING SOFTWARE CONFIGURATION**

PCS

**MCS: ACS Moding**

ACS Moding

‘Departure’

Verify PMA3 Interface Sealed Primary,Secondary NCS – X
Verify PMA3 Separation Primary,Secondary NCS – Blank
Verify PMA3 Departure Response SW Primary,Secondary NCS – Ena
Verify Back Off Time Primary,Secondary NCS: 250 (seconds)
Verify Time Since Separation Primary,Secondary NCS: 0
Verify Departure Event Primary,Secondary NCS – Blank

**************************************************************************

**CAUTION**

If the Primary(Secondary) Time Since Separation is observed to be incrementing any time prior to planned departure, ISS may take attitude control after 250 seconds. IMMEDIATE ACTION IS REQUIRED.

If the Primary(Secondary) Time Since Separation is observed to be incrementing any time prior to planned departure

sel Moding Role

**Moding Role**

**cmd** N1-2(N1-1) – Arm

Verify Arm Status Primary(Secondary) NCS – Arm

**cmd** N1-2(N1-1) – Off

Verify Moding Role Primary(Secondary) NCS – Off
Verify Arm Status Primary(Secondary) NCS – Disarm

Wait for the orbiter call of Separation, then

- If Primary moding role has been commanded off, perform only step 2 before exiting this procedure.
- If Secondary moding role has been commanded off, perform the remaining steps of this procedure.

**************************************************************************

2. **COMMANDING ISS TO ATTITDUE HOLD FOR DEPARTURE**

**Orbiter ⇒ ISS, “Range 30 feet.”**

**RS Laptop**

**CM: TBM PROC**

CM:TBM:Procedures

sel [YB] F1_11 OrbiterDeparture (to be verified)

**cmd** Execute

ISS ⇒ orbiter, “Station is in Attitude Hold.”
3. **MONITORING NCS SEPARATION SIGNALS, VERIFICATION OF ORBITER DEPARTURE AND POST SEPARATION LED MODE CHANGE**

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For flights prior to onboard crew, orbiter monitoring of station telemetry is discontinued when orbiter OIU is disconnected.</td>
</tr>
<tr>
<td>2. The Time Since Separation counter is initiated when Separation is true (X) and Interface Sealed is false (Blank).</td>
</tr>
<tr>
<td>3. The Departure Event is set when the Time Since Separation equals the set Back Off Time. When the SM receives the Departure Event signal, it will resume active attitude control.</td>
</tr>
</tbody>
</table>

‘Departure’

- Verify PMA3 Interface Sealed Primary,Secondary NCS – Blank
- Verify PMA3 Separation Primary,Secondary NCS – X
- Verify Time Since Separation Primary,Secondary NCS – Increasing

When Time Since Separation equals Back Off Time
- Verify Departure Event Primary,Secondary NCS – X

**PCS**

**MCS: ACS Moding**

- ACS Moding
- ‘ACS Configuration’

- Verify RS Mode Primary,Secondary NCS – Cntl
- Verify PMA3 LED State Primary,Secondary NCS – On

ISS ⇒ Orbiter, “Station in Thrusters, holding Current Attitude.”
1. **INHIBITING ACS MODING INDICATOR LIGHTS**

   PCS

   MCS: ACS Moding
   - ACS Moding
   - 'ACS Configuration'

   sel LED Control SW

   - LED Control SW
   - 'Primary NCS'

   **cmd** Inhibit

   √LED Control SW – Inh
   Verify PMA3 LED State – Off

   - 'Secondary NCS'

   **cmd** Inhibit

   √LED Control SW – Inh
   Verify PMA3 LED State – Off

2. **INHIBITING DEPARTURE RESPONSE**

   ACS Moding
   - 'Departure'

   sel PMA3 Departure Response SW

   - PMA3 Departure Response SW
   - 'Primary NCS'

   **cmd** Inhibit

   Verify Departure Response SW – Inh
   Verify Arm Status – Disarm

   - 'Secondary NCS'

   **cmd** Inhibit

   Verify Departure Response SW – Inh
   Verify Arm Status – Disarm

   - ACS Moding
   - 'Departure'

   Verify Departure Event Primary,Secondary NCS – Blank
NOTE
ODS vestibule pressurization will take approximately 2 minutes.

Node 1 Deck Hatch
1. Open Node 1 Deck Hatch per decal.

2. √MPEV – CL

PMA3 APAS Hatch
3. APAS EQUAL VLV → OP

4. Wait 2 minutes.

5. APAS EQ VLV → CL

6. Wait 5 minutes for thermal stabilization.

SM 177 EXTERNAL AIRLOCK

CRT
7. Record A/L-VEST ∆P: ______ psid.
   Wait 30 minutes.

***********************************************************
If A/L-VEST ∆P ≥ previously recorded + 0.16 psid, notify MCC-H (Vestibule/PMA 2 leak). >>
***********************************************************

8. Report results of leak monitoring to ISS and MCC-H.

PMA3 APAS Hatch
9. APAS EQUAL VLV → OP
EXT A/L 1. √ODS Upper Hatch closed
   Equal vlv caps (two) → installed

   Unstrap centerline camera diffuser flex duct from EXT A/L wall.
   Attach flex duct to camera bracket to direct air flow to window.
   If required, tape diffuser open.

AW18A 2. LTG FLOOD 1(3,4) – OFF

A6L 3. √SYS PWR SYS 1,SYS 2 (two) – ON
      √cb DOCK LT (four) – cl

4. LT TRUSS FWD,AFT (two) – ON
5. LT VEST PORT,STBD (two) – ON

MO13Q 6. AIRLK FAN A(B) – OFF

EXT A/L 7. Disconnect airlock flex duct from booster fan muffler.
   Rotate into middeck, and secure.

MO13Q 8. AIRLK FAN A(B) – ON

9. AIRLK 2 – OFF/ON

10. TNL ADAPT 1 – OFF/ON

11. √Airflow at muffler

Middeck 12. Close Inner Hatch per decal.

13. Equal vlv (two) – OFF, install caps
A6L
1. LT VEST PORT, STBD (two) – OFF
2. LT TRUSS FWD, AFT (two) – OFF

Inner Hatch
3. Equal vlv caps (two) – remove
4. Equal vlv (two) – NORM
5. $\sqrt{\text{Hatch } \Delta P < 0.2 \text{ psid}}$
6. Open Hatch per decal.
7. Equal vlv (two) – OFF, reinstall caps

MO13Q
8. TNL ADAPT 1 – ON/OFF
9. ARLK 2 – ON/OFF
10. ARLK FAN A(B) – OFF

Middeck
11. Remove diffuser cap from floor fitting.
   Stow.
   Mark stowage location (will be reused).

EXT A/L
12. Unstrap airlock flex duct.
   Connect to middeck floor fitting and to booster fan muffler inlet.

MO13Q
13. ARLK FAN A(B) – ON

AW18A
14. As required, LTG FLOOD 1(3,4) – ON

15. $\sqrt{\text{Airflow at top of external airlock halo}}$

EXT A/L
16. Unstrap centerline camera diffuser flex duct from camera bracket.
   Stow duct along stbd top of EXT A/L wall (in straps).
17. Remove, stow Centerline Camera.
TOOLS AND EQUIPMENT REQUIRED:

NOD1
- MPEV Muffler
- Internal Sampling Adapter (ISA)
- 5 ft. Vacuum Access Jumper (VAJ)
- Scopemeter

1. **INITIAL HATCH LEAK CHECK**
   ISS report to Shuttle, “Initial hatch leak check complete; proceeding with PMA/ODS vestibule pressurization.”

2. **PRESSURIZE PMA/ODS VESTIBULE**

   Node 1
   - Fwd(Deck) MPEV → OPEN
   - ISS report to shuttle, “PMA ODS Vestibule pressurization beginning.”

   Fwd(Deck) MPEV → CLOSED
   - Node 1 Fwd(Deck) MPEV
   - When dp/dt ~0.0 (~7 minutes, 9 minutes maximum)
   - Record GMT: ____/____:____:____

3. **ISA/VAJ/MPEV SETUP**

   Figure 1.- ISA Sample Valve.

   3.1 √ISA Sample Port Valve – CLOSED, Capped (refer to Figure 1)

   3.2 √One ISA-VAJ Port – Capped
3.3 Install ISA and Vacuum Access Jumper per Figure 2.

3.4 Attach Scopemeter to ISA Pressure Module.

3.5 COM – COM, and V – V on Scopemeter/ISA Pressure Module connection

**WARNING**
Failure to secure ISA/VAJ assembly may result in damage to equipment and/or injury to crew.

3.6 Secure ISA/VAJ assembly to seat track with bungees and anchors.

4. **LEAK CHECK**

   **Scope**
   4.1 Ten minutes after GMT recorded in step 3:

   **Meter**
   Depress yellow button for 2 seconds while selecting V
   
   \((1mV = 1mmHg, \text{ or } \text{Readout} \times 1000 = \text{mmHg})\)

   **ISA**
   4.2 ISA Pressure Module \(\rightarrow\) mmHgA

---

08 NOV 00

218
Node 1 Fwd(Deck) MPEV → OPEN

4.4 Wait 1 minute.

4.5 Record Scope Meter: _____ V
Record GMT ____/____:____:____ GMT, wait 5 minutes, then:
Report values to MCC-H.

4.6 Record Scope Meter: _____ V
Record GMT ____/____:____:____ GMT
Report values to MCC-H.

*********************************************************
If ΔP reading > 1
Node 1 Fwd(Deck) MPEV → CL

Notify MCC-H.

ISS report to Shuttle, “Abnormal leakage is being observed through Hatches.
*********************************************************

Node 1 Fwd(Deck) MPEV → CL

5. DETACHING AND STOWING EQUIPMENT

Scope-meter

5.1 Scopemeter → OFF

5.2 Detach Scopemeter from pressure module of ISA and stow.

ISA

5.3 ISA Pressure module → OFF

5.4 Detach ISA, cap all ports, and stow.

5.5 Detach Vacuum Access Jumper from MPEV, cap both ends of VAJ, and stow.
Radio frequency interference may cause a temporary loss of the VHF link. Reattempt contact for several minutes prior to declaring a failure.

Focus troubleshooting SHUTTLE VHF first since it is not permanent H/W and requires significant configuration.

1. Shuttle or ISS
   - MCC to verify other ship configured for VHF 1 ops

2. Shuttle or ISS
   - Reattempt contact
   - Contact successful?
     - Yes
     - Continue nominal operations.
     - No
     - No

3. Shuttle or ISS
   - Ask MCC if other ship receiving and to have other ship attempt contact.
   - Establishes what partial capability may exist if time does not permit extensive troubleshooting.

4. Shuttle or ISS
   - ISS
   - MCC for next available VHF 1 ground site pass and attempt ground contact
   - ISS ground contact successful?
     - Yes
     - Problem isolated to ISS H/W.
     - No

5. Problem isolated to ISS H/W.
   - Configure alternate comm panel for VHF 1 A/G voice and reattempt contact.
   - Contact successful?
     - Yes
     - Notify MCC of successful ground contact
     - Standby while Shuttle troubleshooting continues.
     - No

6. Problem isolated to Shuttle H/W.
   - MCC for next available VHF 1 ground site pass and attempt ground contact
   - ISS ground contact successful?
     - Yes
     - Problem isolated to Shuttle H/W.
     - No

7. Problem isolated to Shuttle H/W.
   - MCC for next available VHF 1 ground site pass and attempt ground contact
   - ISS ground contact successful?
     - Yes
     - Problem isolated to Shuttle H/W.
     - No

8. Original ISS comm panel problem.
   - Continue nominal ops on alternate comm panel.

9. SHUTTLE VHF radio problem.
   - Error messages on radio LCD
   - Any messages?
     - Yes
     - No

10. Shuttle or ISS
    - MCC to verify other ship configured for VHF 1 ops

    - Antenna, Antenna Cable, and Attenuator connections for proper mating/installation
    - Reattempt contact with ISS.
    - Contact successful?
      - Yes
      - No

12. Shuttle
    - MCC
    - Swap out radio.

13. Shuttle
    - MCC
    - Swap out radio.

14. Shuttle
    - MCC
    - Swap out radio.

15. Continue nominal operations.

16. Continue nominal operations.

17. Continue nominal operations.

18. Continue nominal operations.

19. Continue nominal operations.

20. Continue nominal operations.

21. Continue nominal operations.

22. Continue nominal operations.

23. Continue nominal operations.

24. Continue nominal operations.

25. Continue nominal operations.


27. Continue nominal operations.

28. Continue nominal operations.
14

16 Shuttle

• Readjust squelch setting to just above noise.
• Reattempt contact.

Contact successful?

Yes

17

• Continue nominal operations.

No

18 Shuttle

• Stuck key (mutes rcvr!)

TX displayed on radio LCD when audio loop not keyed?

Yes

19 Problem isolated to SHUTTLE H/W. BPSMU, ATU, ARIU, or VHF radio problem.

No

20 Shuttle

• Radio being keyed and xmt transmit on radio LCD

• Go to meter mode on radio [mode (6), pwr (8)]
• Key audio loop and perform test count.

TX (and approx 5 bars for MED pwr) displayed on radio LCD while counting?

Yes

21 Problem isolated to SHUTTLE H/W. BPSMU, ATU, ARIU, or VHF radio problem.

No

22 Shuttle

Perform following steps as time permits, reattempting contact after each step:
• Cycle PTT several times.
• Check or swap out BPSMU.
• Replace BPSMU with VLHS/HIU plugged into ARIU.
• ARIU switch to EXCL MIR XMIT.
• ARIU switch to XMIT DIS.
• Use radio handset or swap out ARIU.
• Power cycle VHF radio.
• Swap out VHF radio.
• Swap out each interface cable.

• MCC

23 Shuttle

• Internal pwr supply status

While still in meter mode:
• Press [R/T] to display PS1 (~500)
• Press [R/T] to display PS2 (~120)
• Press [R/T] to display PS3 (~500)
• Press [R/T] to display PS4 (~120)
• Press [R/T] to display PS5 (~240)
• Press [R/T] to display PS6 (~700)
• Press [R/T] to return to signal strength meter
• Exit meter mode [mode (6), pwr (8)]

All pwr supplies as expected?

Yes

24 Shuttle VHF radio problem.

No

25 Shuttle

• MCC
• Swap out radio.

26
SHUTTLE/ISS VHF COMM MAL
(JNT OPS/5A/FIN B)  Page 3 of 3 pages

26 Shuttle
Perform following steps as time permits, reattempting contact after each step:
• Power cycle VHF radio.
• Check or swap out BPSMU.
• Use radio handset or swap out ARIU.

27 Shuttle and ISS
Attempt contact via VHF 2 frequency set.
• Verify not over CONUS.
  • \text{MCC} to verify other ship configuring for VHF 2 comm

28 Shuttle
• Select CH 5 on VHF radio.
  \text{MCC}

ISS
• Configure comm panel for VHF 2.
  \text{MCC}

29 Shuttle or ISS
• Reattempt contact.
Contact successful?

Yes

30 VHF 1 freq set problem.

No

31 Shuttle and ISS
Return to VHF 1 freq. set.

32 Shuttle
• Select CH 1(2) on VHF radio.
  \text{MCC}

ISS
• Configure comm panel for VHF 1.
  \text{MCC}

4 VHF 2 frequency set interferes with CONUS air traffic control. VHF 2 use over CONUS restricted to emergency situations only.

5 SHUTTLE VHF 2 freq set:
XMIT = 121.75
RCV = 121.75

ISS VHF 2 freq set:
XMIT = 130.167
RCV = 130.1625
NOTE
1. This Expedited undocking should be used for the following failures
   - Non-isolatable prop leak (shuttle)
   - Cabin Leak (shuttle)
   - Loss of cooling (two cabin fans, water coolant loops, Freon coolant loops (shuttle))

2. Entrance to this procedure based on Cabin Leak or Loss of Cooling scenario assumes that this
   procedure will be worked concurrently with the associated FDF ORB PKT and ENTRY PKT
   powerdown.

3. At least 20 minutes are required to perform mandatory activities through physical separation. An
   additional 45 minutes required for ANY ATTITUDE SEPARATION, or an additional 18 minutes
   required for SHUTTLE EMERGENCY SEPARATION (to OMS TIG).

4. Highly desirable steps are listed beginning with step 21. These steps should be performed as
   time permits.
<table>
<thead>
<tr>
<th>CREW ABOARD ISS</th>
<th>MS</th>
<th>CDR/PLT</th>
</tr>
</thead>
</table>
| **MS1/MS4** 1. IF COMM, √ MCC **If not using ISS atmosphere** | MS3 2. **If time available,** perf. ISS LOADSHED **Node 1 Loadshed** | CDR 3. PREPARE FOR UNDOCKING **A6U** √ SENSE: -Z  
**DAP: LO Z** |
| EGRESS Cue Card, all (SODF: JNT OPS: CUE CARD), then: | **SM_220 NODE_1-2N** **ITEM 4 +9 9 EXEC** | O14. **Pri RJD DRIVER, LOGIC (sixteen) – ON**  
O15, O16:F **All DDU cbs (six) – cl** |
| **MS2/3** 5. **Perform ISS SAFING (DFD,ORB PKT, PL PWRDN) as required,** then MS reports to CDR “Pre-Undock ISS Safing complete.” | **NOTE** If time available, perform steps 21 --- 24 for ECS powerup and EPCS shutdown. | O14, O15, O16:E |
| **If performing UTILIZE ISS ATMOSPHERE procedure for orbiter cabin leak, hold until procedure cplt and GO from CDR.** | **MS1 9. DEPRESSURIZING SHUTTLE VESTIBULE** **ODS Hatch closed** **ODS HATCH EQUAL VLVS (two) – OFF**  
**OFF, caps installed**  
**cb ESS 1BC SYS PWR CNTL SYS 1 – cl**  
**cb ESS 2CA SYS PWR CNTL SYS 2 – cl**  
**cb ESS 1BC DEP SYS 1 VENT ISOL – cl**  
**cb ESS 2CA DEP SYS 2 VENT ISOL – cl**  
**cb ESS MNA DEP SYS 1 VENT – cl**  
**cb ESS MBN DEP SYS 2 VENT – cl**  
**SYS PWR MN A, MN B (two) – on (hold 5 seconds)**  
**SYS PWR SYS 1, SYS 2 tb (two) – ON**  
**VEST DEP VLV SYS 1(2) VENT ISOL (two) – OP (tb-OP)**  
**VEST DP VLV SYS 1(2) VENT (two) – OP (tb-OP)** | **PLT 10. FLT CNTLR PWRUP** **GNC 25 RM ORBIT** **SW RM INH – ITEM 16 (*)** |
| **MS3 8. PERFORM APU DEACT** **APCU 1,2 CONV – OFF**  
**CONV tb – bp**  
**OUTPUT tb – bp**  
**OUTPUT – OFF** | If performing UTILIZE ISS ATMOSPHERE procedure for orbiter cabin leak, hold until procedure cplt and GO from CDR. | **A6U** FLT CNTLR PWR – ON **CRT** SW RM INH – ITEM 16 (*) |
<table>
<thead>
<tr>
<th>CREW ABOARD ISS</th>
<th>MS</th>
<th>CDR/PLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS1</td>
<td>11.</td>
<td>12.</td>
</tr>
<tr>
<td></td>
<td>ODS PREPARATION FOR UNDOCKING</td>
<td>CONFIGURING DAP</td>
</tr>
<tr>
<td></td>
<td>If required, perform PMA-2 HOOKS OPEN (FDF, RNDZ, APDS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perform DOCKING MECHANISM PWRUP (FDF, RNDZ, APDS)</td>
<td>GNC_20_DAP_CONFIG</td>
</tr>
<tr>
<td></td>
<td>If Airlock Pressure &lt; 8.0 PSIA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If time permits, terminate EVA and repress airlock</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If time not available, expect hooks motor drive to fail during drive operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perform UNDOCKING PREP (FDF, RNDZ, APDS)</td>
<td></td>
</tr>
</tbody>
</table>

 utilise

GNC_UNIV_PTG

√ Rates < 0.1 °/second DAP: FREE

A6U

GNC_20_DAP_CONFIG

CONFIG DAP A,B to A7,B7

√ DAP A CNTL ACC – ITEM 28 +0 EXEC

√ DAP B CNTL ACC – ITEM 48 +0 EXEC
# Joint Expedited Undocking and Separation

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<table>
<thead>
<tr>
<th><strong>MS</strong></th>
<th><strong>CDR/PLT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold until given “GO TO UNDOCK” from CDR.</td>
<td>CDR give MS “GO for COMMAND UNDOCKING.”</td>
</tr>
<tr>
<td><strong>A7L 13. COMMAND UNDOCKING</strong>&lt;br&gt;After DAP configured, and On MCC GO (if Comm),&lt;br&gt;· If HOOKS 1(2) OP Lt failed ON&lt;br&gt;· APDS PWR Aₜₚ – OFF&lt;br&gt;· Aₜₚ failed its off&lt;br&gt;· APDS CIRC PROT OFF pb – push (√lt on)</td>
<td>CDR 14. After separation cpt&lt;br&gt;If OMS TIG &lt; 1 hour&lt;br&gt;Go to SHUTTLE EMERGENCY SEPARATION (FDF, RNDZ, CONTINGENCY OPS).&lt;br&gt;MS&lt;br&gt;CDR</td>
</tr>
<tr>
<td><strong>-2:20</strong>&lt;br&gt;15. UNDOCKING pb – push&lt;br&gt;· HOOKS 1, HOOKS 2 CL lt (two) – off&lt;br&gt;CRT&lt;br&gt;· HOOKS 1, HOOKS 2 POS &lt; 92 % and decr&lt;br&gt;CRT&lt;br&gt;· If HOOKS 1(2) fail to drive (HOOKS 1(2) DRV CMD – OFF),&lt;br&gt;· pb OPEN HOOKS – push&lt;br&gt;· If HOOKS 1(2) appear to stop before reaching end-of-travel (HOOKS 1(2) POS &gt; 4 % and not decr), allow for single motor drive time (~4:40) before performing pnl A7L pwr cycle.</td>
<td><strong>-1:30</strong>&lt;br&gt;A7L 16. √ INTERF SEALED lt – off&lt;br&gt;· RDY to HK lt – off (HOOKS 1, HOOKS 2 POS ~30 %)&lt;br&gt;0:00 17. √ HOOKS 1, HOOKS 2 OP Its (two) – on&lt;br&gt;CRT&lt;br&gt;· HOOKS 1, HOOKS 2 POS = 4 %&lt;br&gt;· UNDOCK COMPLETE lt – on</td>
</tr>
</tbody>
</table>
MS1 18. POST UNDOCKING
    pb PWR OFF – push
    STATUS It (eighteen) – off

MS1 19. Perform DOCKING MECHANISM PWRDN (FDF, RNDZ, APDS)

MS 20. If required, return to PL SAFING (FDF, ORB PKT, PL PWRDN).

MS 21. ECS POWER UP

MS2 22. INHIBIT RT FDIR

23. TAKE EPCS OFF ORB BUS
    When EPCS no longer required
    PCS CDS Main Control panel window
    sel “Terminate to MDM” icon

24. ECS TRANSMITTER ON

NOTE:
   Wait until step 23 is complete and at least 1 minute
   (if possible) after step 21 before executing the following
   Transmitter ON command. Both of these steps are needed
   for the ECS to establish a link with the primary MDM.

SM223 EARLY COMM-2N
XMIT ON - ITEM 17 EXEC (*)