International Space Station
Robotics Group
Robotics Book - Flight Specific

ISS-13A.1

Mission Operations Directorate
Operations Division

18 JUL 07

This publication replaces all previous publications.

These procedures are available electronically on the SODF Homepage at http://mod.jsc.nasa.gov/do3
INTERNATIONAL SPACE STATION
ROBOTICS GROUP
ROBOTICS BOOK - FLIGHT SPECIFIC
ISS-13A.1

18 JUL 07

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Incorporates the following:

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<td>1.410</td>
<td>SSRMS ESP3 HANDOFF</td>
<td>147</td>
</tr>
<tr>
<td>1.420</td>
<td>SSRMS ESP3 INSTALL</td>
<td>151</td>
</tr>
<tr>
<td>1.430</td>
<td>SSRMS ESP3 MANEUVER FOR TRANSLATE TO WS 4</td>
<td>161</td>
</tr>
<tr>
<td>1.435</td>
<td>MT PRE-TRANSLATION SURVEY - WS 7 TO WS 4 (GROUND)</td>
<td>165</td>
</tr>
</tbody>
</table>

## SASA/CETA

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.500</td>
<td>SSRMS MANEUVER TO SASA START POSITION</td>
<td>169</td>
</tr>
<tr>
<td>1.510</td>
<td>SSRMS SASA RELOCATE</td>
<td>173</td>
</tr>
<tr>
<td>1.520</td>
<td>SSRMS CETA CART RELOCATE</td>
<td>189</td>
</tr>
</tbody>
</table>

## CONTINGENCY

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.100</td>
<td>S5 SOFT DOCK ACQUISITION</td>
<td>213</td>
</tr>
<tr>
<td>2.200</td>
<td>SSRMS MANEUVER TO LAB PDGF PRE-GRAPPLE INTERMEDIATE - NO FI</td>
<td>217</td>
</tr>
</tbody>
</table>

## REFERENCE

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.100</td>
<td>FRAME OF REFERENCE (FOR): S5 MANEUVER AND INSTALL</td>
<td>223</td>
</tr>
<tr>
<td>3.110</td>
<td>DISPLAY FRAME: W1&gt;S5 INSTALL</td>
<td>225</td>
</tr>
<tr>
<td>3.200</td>
<td>OBSS BERTHING ALIGNMENT CUES</td>
<td>227</td>
</tr>
<tr>
<td>3.210</td>
<td>FRAME OF REFERENCE (FOR), DISPLAY FRAME: OBSS</td>
<td></td>
</tr>
</tbody>
</table>
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1.100 SSRMS MANEUVER TO S5 PRE-GRAPPLE
(RBT FS/13A.1/FIN 1) Page 1 of 3 pages

1. HAND CONTROLLER CALIBRATION

1.1 Translational Hand Controller (THC) Calibration

THC

Deflect [X] Axis to positive hard stop where [X] = \[X\] \[Y\] \[Z\]

Deflect [X] Axis to negative hard stop.

Repeat

1.2 Rotational Hand Controller (RHC) Calibration

RHC

Deflect [X] Axis to positive hard stop where [X] = \[P\] \[Y\] \[R\]

Deflect [X] Axis to negative hard stop.

Repeat

2. SETUP

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>13: LAB Stbd Zenith (0, +80)</td>
<td>03: S1 Lower Outboard (-5, -20)</td>
<td>37: MBS Mast (22: Base Elbow (-95, -15))</td>
</tr>
</tbody>
</table>

PCS

MSS: SSRMS: [SSRMS]

Change Loaded Parameters ► S5 ► S5 Maneuver SYH
Verify 'Loaded Parameters' (two) – S5 Maneuver, SY Held

Verify Unloaded Parameters – √
Change Unloaded Parameters ► Unloaded ► LEE Tip SYH
Verify 'Unloaded Parameters' (two) – LEE Tip, SY Held

Change Display ► W1 ► ISSACS (Verify W1>ISSACS)

Change Command ► SSRMS ► Internal (Verify SSRMS>Internal)

Verify SSRMS at 13A.1 Docking position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+145.0</td>
<td>0.0</td>
<td>-50.0</td>
<td>-120.0</td>
<td>-90.0</td>
<td>-73.0</td>
<td>+55.0</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+687</td>
<td>+1668</td>
<td>-239</td>
<td>+90.1</td>
<td>+21.0</td>
<td>+7.7</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W1>ISSACS
3. **PRE-GRAPPLE MANEUVER**

On SRMS operator GO for maneuver to S5 Pre-Grapple, SRMS at S5 Low Hover position:

**MSS:** SSRMS: SSRMS Safing:  

**cmd** Remove (Verify Not Safed)

**DCP**  
BRAKES SSRMS → OFF (Verify OFF)

**RHC**  
RATE → VERNIER (Verify Vernier on PCS)

**PCS**  
MSS: SSRMS:  

Enter Mode – Joint OCAS (Verify blue)  

SSRMS Joint OCAS

pick File ► W1MBS1 ► S5 Pre-grapple

Verify ‘Joint Angles’ ‘Destination’ for S5 Pre-Grapple position.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+35.5</td>
<td>+59.5</td>
<td>-132.5</td>
<td>-42.1</td>
<td>-31.3</td>
<td>-55.9</td>
<td>+15.4</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**  
Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>+145.0</td>
<td>0.0</td>
<td>-50.0</td>
<td>-120.0</td>
<td>-90.0</td>
<td>-73.0</td>
<td>+55.0</td>
</tr>
<tr>
<td>TGT</td>
<td>+35.5</td>
<td>+59.5</td>
<td>-132.5</td>
<td>-42.1</td>
<td>-31.3</td>
<td>-55.9</td>
<td>+15.4</td>
</tr>
<tr>
<td>ERR</td>
<td>+109.5</td>
<td>-59.5</td>
<td>+82.5</td>
<td>-77.9</td>
<td>-58.7</td>
<td>-17.1</td>
<td>+39.6</td>
</tr>
</tbody>
</table>
1.100 SSRMS MANEUVER TO S5 PRE-GRAPPLE
(RBT FS/13A.1/FIN 1) Page 3 of 3 pages

************************************************************************************
* If joint angles or errors are incorrect  
  PCS  *  cmd Cancel (Verify Sequence Status – Waiting Destination)  
*  Input correct Dest joint angles per table above.  
*  cmd Load (Verify Sequence Status – Confirm or Cancel)  
  MON  *  Verify joint angles and errors are correct on Joint Angle Position overlay.  
************************************************************************************

PCS  cmd Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
This Joint OCAS will take approximately 3 minutes to complete in Vernier rates.

DCP  AUTO SEQ → PROC

PCS  MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+35.5</td>
<td>+59.5</td>
<td>-132.5</td>
<td>-42.1</td>
<td>-31.3</td>
<td>-55.9</td>
<td>+15.4</td>
</tr>
</tbody>
</table>

Figure 3.- S5 Pre-Grapple
(13: LAB Stbd Zenith: 0, +50).

Figure 4.- S5 Pre-Grapple
(37: MBS Mast: +65, -10).

DCP  BRAKES SSRMS → ON (Verify ON)

Notify SRMS operator SSRMS at S5 Pre-Grapple position, GO for maneuver to S5 Starboard position.
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1.110 SSRMS S5 GRAPPLE

(RBT FS/13A.1/FIN 1) Page 1 of 4 pages

1. **SETUP**
   Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera D (-65, +20)</td>
<td>25: Tip LEE</td>
<td>13: LAB Stbd Zenith (+5, +30) (37: MBS Mast (+50, +5))</td>
<td>SRMS Elbow (-20, 0)</td>
</tr>
</tbody>
</table>

**NOTE**
The LEE Camera must be fully zoomed out to correspond to the target overlay.

Verify SSRMS at S5 Pre-Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+35.5</td>
<td>+59.5</td>
<td>-132.5</td>
<td>-42.1</td>
<td>-31.3</td>
<td>-55.9</td>
<td>+15.4</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+454</td>
<td>+1207</td>
<td>+1044</td>
<td>-11.0</td>
<td>-28.9</td>
<td>-143.1</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W1>ISSACS

![Figure 1.- S5 Pre-Grapple (91: Camera D: -65, +20).](image1)

![Figure 2.- S5 Pre-Grapple (13: LAB Stbd Zenith: +5, +30).](image2)

2. **S5 PRE-GRAPPLE**
   On SRMS operator GO for S5 grapple maneuver, SRMS at S5 Handoff position with brakes on:

   DCP BRAKES SSRMS → OFF (Verify OFF)

   √ Vernier

3. **SSRMS LEE CUE CARD REVIEW**
   Review {SSRMS LEE CUE CARD}, all (SODF: RBT GEN: REFERENCE).
4. **S5 GRAPPLE**

4.1 **Grapple Setup**

PCS

MSS: SSRMS: Rate:  

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired

4.2 **Thruster Inhibits**

MSS: SSRMS: Thrusters:  

Verify ‘Desat Request:’ – Inh

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

* If using shuttle attitude control;
* Coordinate with shuttle crew;
* DAP: FREE.

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

4.3 **SSRMS Maneuver**

MSS: SSRMS:  

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:  

Shoulder Yaw (Verify SY – Locked)

RHC/ THC

Maneuver to within grapple envelope.

4.4 **S5 Automatic Capture**

PCS

MSS: SSRMS: Tip LEE:  

Capture ➤ Automatic ➤ Slow, Limp (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

---

**CAUTION**

Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

**NOTE**

Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Capture
1.110 SSRMS S5 GRAPPLE

(RBT FS/13A.1/FIN 1) Page 3 of 4 pages

RHC
TRIGGER → press (momentarily)

PCS
Verify ‘Snare’ Close, Capture (two) – blue (12 s max)
Verify Capture to Latch – No (SCR 19282)
Verify ‘Carriage’ Tension ~5500 N (90 s max)
Verify ‘Carriage’ Retract – blue

DCP
BRAKES SSRMS → ON (Verify ON)

Notify SRMS operator GO for SRMS release, SSRMS S5 grapple complete and brakes on.

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

*If ‘R3Q - SSRMS LEE Uncommanded Derigidize’ Caution was
* annunciated during SRMS release or Carriage Tension < 4400 N

* MSS: SSRMS: Tip LEE: SSRMS Tip LEE

* cmd ‘Carriage’ Rigidize ▶ Slow (Verify Speed – Slow)

* Verify ‘Confirm or Terminate’ prompt.

* cmd Confirm (Verify RHC Trigger Hot icon)

* Verify LEE Mode – Rigidize

RHC
* TRIGGER → press (momentarily) (SCR 19064)

PCS
* Verify ‘Carriage’ Tension ~5500 N (90 s max)
* Verify ‘Carriage’ Retract – blue

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

Expected S5 Handoff joint angles and FOR:

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+51.8</td>
<td>+59.5</td>
<td>-130.4</td>
<td>-21.7</td>
<td>-27.7</td>
<td>-57.8</td>
<td>+30.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>+779</td>
<td>+913</td>
<td>+1147</td>
<td>+127.4</td>
<td>+65.7</td>
<td>+55.7</td>
</tr>
</tbody>
</table>

FOR  Loaded – S5 Maneuver, SY Held
Disp  W1>ISSACS
1.110 SSRMS S5 GRAPPLE
(RBT FS/13A.1/FIN 1) Page 4 of 4 pages

Figure 3.- S5 Grappled (91: Camera D: -65, +20).

Figure 4.- S5 Grappled (13: LAB Stbd Zenith: +5, +30).

On SRMS operator GO, SRMS released S5 Truss:

NOTE
Expect the following message when safing is commanded:
‘R3Z - MSS OCS SSRMS Prime(Redun) ACU SRT Cat-1 Brk Stat Fail’ (SCR 17495)
This message should return to Norm.

DCP
SAFING → SAFE (Verify ON)

PCS
MSS: SSRMS: Rate: [SSRMS Rate]
Set ‘Scale’ ‘Vernier’ Rate Scale: 1.0 (Verify 1.0)
1. SETUP

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera D (-65, +20)</td>
<td>22: Base Elbow (-160, -20)</td>
<td>37: MBS Mast (+50, +5) 03: S1 Lower Outboard (+60, +30)</td>
<td>SRMS Elbow (-15, +10)</td>
</tr>
</tbody>
</table>

PCS

MSS: SSRMS: [SSRMS]

Verify Loaded Parameters – √
Verify ‘Loaded Parameters’ (two) – S5 Maneuver, SY Held

Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held

Change Display ▶ W1 ▶ S5 Install (Verify W1>S5 Install)

Verify Command – SSRMS>Internal

Verify SSRMS at S5 Handoff position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+51.8</td>
<td>+59.5</td>
<td>-130.4</td>
<td>-21.7</td>
<td>-27.7</td>
<td>-57.8</td>
<td>+30.0</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-2322</td>
<td>-814</td>
<td>+1145</td>
<td>+19.6</td>
<td>+14.4</td>
<td>-179.4</td>
<td></td>
</tr>
</tbody>
</table>

FOR Loaded – S5 Maneuver, SY Held
Disp W1>S5 Install

Figure 1.- S5 Handoff (91: Camera D: -65, +20).
Figure 2.- S5 Handoff (22: Base Elbow: -160, -20).
2. **JOINT OCAS TO S5 INSTALL INTERMEDIATE POSITION**

\[\text{MCC-H}\]
S4 SARJ locked at 180, with BGAs locked at 1A = 180 and 3A = 270

**MON** Visually verify that SARJ position is within 5 degrees of 180 per Figure 3.

![Figure 3.- SARJ Angle Verification](image)

(37: MBS Mast: +175, -10).

* If using shuttle attitude control;
* Coordinate with shuttle crew;
* DAP: FREE.

**PCS MSS: SSRMS: SSRMS Safing:**

\[\text{cmd Remove (Verify Not Safed)}\]

**DCP**

BRAKES SSRMS → OFF (Verify OFF)

**RHC**

RATE → COARSE (Verify Coarse on PCS)

**PCS MSS: SSRMS:**

Enter Mode – Joint OCAS (Verify blue)

\[\text{SSRMS Joint OCAS} \]

pick File ▶ W1MBS1 ▶ S5 Install Intermed

Verify ‘Joint Angles’ ‘Destination’ for S5 Install Intermediate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-90.0</td>
<td>-54.8</td>
<td>+5.0</td>
<td>-20.3</td>
<td>-166.4</td>
<td>-49.2</td>
<td>+64.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)
MON
Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+51.7</td>
<td>+59.5</td>
<td>-130.1</td>
<td>-22.3</td>
<td>-27.7</td>
<td>-57.7</td>
<td>+29.9</td>
</tr>
<tr>
<td>TGT</td>
<td>-90.0</td>
<td>-54.8</td>
<td>+5.0</td>
<td>-20.3</td>
<td>-166.4</td>
<td>-49.2</td>
</tr>
<tr>
<td>ERR</td>
<td>+141.7</td>
<td>+114.3</td>
<td>-135.1</td>
<td>-2.0</td>
<td>+138.7</td>
<td>-8.5</td>
</tr>
</tbody>
</table>

* If joint angles or errors are incorrect

PCS
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * **cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON
* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS
**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
</table>
This Joint OCAS will take approximately 22 minutes to complete in Coarse rates.

DCP
AUTO SEQ → PROC

PCS
MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-90.0</td>
<td>-54.8</td>
<td>+5.0</td>
<td>-20.3</td>
<td>-166.4</td>
<td>-49.2</td>
<td>+64.0</td>
</tr>
</tbody>
</table>

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

* If using shuttle attitude control;
  * Coordinate with shuttle crew;
  * Verify Rate < 0.1 deg/s/axis, then DAP: AUTO
  * When in attitude, DAP: FREE.

******************************************************************************
3. **SINGLE JOINT MANEUVER TO PRE-INSTALL**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (-80, -2)</td>
<td>22: Base Elbow (-160, -20)</td>
<td>24: Tip Elbow (-80, +40)</td>
<td>SRMS Elbow (-15, +10)</td>
</tr>
</tbody>
</table>

MSS: SSRMS: Thrusters: **Thrust Control for MSS Ops**

Verify ‘Desat Request.’ – Inh

RHC  RATE → VERNIER (Verify Vernier on PCS)

PCS  MSS: SSRMS: **SSRMS**

Enter Mode – Single (Verify blue)
1.120 SSRMS S5 INSTALL

WARNING

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

NOTE

At the end of the SP maneuver, the proximities between the S5 Truss and the 3A and 1A BGAs will be 15 in (38 cm) and 19 in (49 cm) respectively and clearance between the SSRMS and the 3A Blanket Box will be 19 in (49 cm). All can be monitored using the Tip Elbow Camera.

THC

Perform Single Joint maneuver to S5 Pre-Install position (within 1 deg).

<table>
<thead>
<tr>
<th>S5 Install Intermediate</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: SR –</td>
<td>-97.2</td>
<td>-54.8</td>
<td>+5.0</td>
<td>-20.3</td>
<td>-166.4</td>
<td>-49.2</td>
<td>+64.0</td>
</tr>
<tr>
<td>2: SP –</td>
<td>-97.2</td>
<td>-54.8</td>
<td>-22.0</td>
<td>-20.3</td>
<td>-166.4</td>
<td>-49.2</td>
<td>+64.0</td>
</tr>
</tbody>
</table>

S5 Pre-Install

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>+200</td>
<td>-1</td>
<td>1</td>
<td>-0.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

FOR Loaded – S5 Maneuver, SY Held

Disp W1>S5 Install

PCS

MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

4. S5 INSTALL SETUP

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>V10 L</th>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10 R</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV1</td>
<td>37: MBS Mast (+170, -10)</td>
<td>22: Base Elbow (-160, -20)</td>
<td>24: Tip Elbow (-80, +40)</td>
<td>EV2</td>
</tr>
</tbody>
</table>

Figure 8.- S5 Pre-Install
(03: S1 Lower Outboard: -80, -2).

Figure 9.- S5 Pre-Install
(24: Tip Elbow: -80, +40).
Figure 10.- S5 Pre-Install

Figure 11.- S5 Pre-Install
(37: MBS Mast: +170, -10).

MSS: SSRMS: SSRMS

Change Loaded Parameters ▶ S5 ▶ S5 Install SRH
Verify ‘Loaded Parameters’ (two) – S5 Install, SR Held

Verify Display – W1>S5 Install
Verification Command – SSRMS>Internal
√ Vernier

NOTE
The maximum allowable rate during the maneuver through the S5 Install Corridor is 0.8 cm/s. This value can be monitored using the RWS overlays. With rate scale set to 0.4, a full hand controller deflection should correspond to a rate of 0.7 cm/s.

MSS: SSRMS: Rate: SSRMS Rate
Set ‘Scale’ ‘Vernier’ Rate Scale: 0.4 (Verify 0.4)

5. **S5 LAUNCH LOCK REMOVAL**

MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

**cmd** Shoulder Roll (Verify SR – Locked)
**CAUTION**

EVA GCA should maintain at least 1.2 inches (3 cm) of clearance between the 3A SSU and S5. To increase clearance, input a +Y THC command.

---

THC/RHC

On EV GO, ready for Launch Lock removal:

Maneuver S5, per EVA GCA, to Launch Lock Removal position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-97.2</td>
<td>-55.6</td>
<td>-1.9</td>
<td>-60.6</td>
<td>-146.7</td>
<td>-49.9</td>
<td>+63.4</td>
</tr>
</tbody>
</table>

FOR: Loaded – S5 Install, SR Held
Disp: W1>S5 Install

---

DCP

BRAKES SSRMS → ON (Verify ON)

Notify EV GO to remove S5 Launch Locks.

---

6. **S5 SOFTDOCK**

On EV GO, Launch Lock removal complete, ready for GCA:

BRAKES SSRMS → OFF (Verify OFF)

PCS

MSS: SSRMS: [SSRMS]

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: [Joint Lock]

**cmd** Shoulder Roll (Verify SR – Locked)

---

Figure 12.- S5 Launch Lock Removal (22: Base Elbow: -130, -20).

Figure 13.- S5 Launch Lock Removal (24: Tip Elbow: -60, +57).
1.120 SSRMS S5 INSTALL

(12 Jul 07)

THC/RHC

Align S5 for install per EVA GCA.

When EVA GCA is complete,

PCS

MSS: SSRMS: Snapshot: **Snapshot Frames**

**cmd** Snapshot

MSS: SSRMS: **SSRMS**

Change Display ▶ W1 ▶ S5 Install (Verify W1>S5 Install)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Coarse alignment cones at corners 2 and 3 are slightly longer than at corners 1 and 4. EV crew will initially be positioned at corners 2 and 3.</td>
</tr>
<tr>
<td>2. During translation from the launch lock removal position to the soft-dock position, if EV crew determines that S5 alignment will prevent S5 coarse alignment cones from entering the S4 alignment holes, perform steps in the following off-nominal block.</td>
</tr>
<tr>
<td>3. After S5 coarse alignment cones have entered the S4 alignment holes, input only a -X THC command until the SSRMS stalls or EV verifies all four softdocks are engaged. If less than four of four softdocks are acquired during initial push-in, refer to procedure [2.100 S5 SOFTDOCK ACQUISITION] (SODF: RBT FS: CONTINGENCY).</td>
</tr>
<tr>
<td>4. The minimum rate during S5 install should be 0.6 cm/s. The rate can be monitored using the FOR rate overlay.</td>
</tr>
</tbody>
</table>
1.120 SSRMS S5 INSTALL
(RBT FS/13A.1/FIN 1) Page 9 of 15 pages

- Stop SSRMS motion.
- Verify EV crew can see positive clearance between S5 and S4.
- Align S5 for install per EVA GCA.
- When EVA GCA is complete,

**PCS**
- MSS: SSRMS: Snapshot: [Snapshot Frames]
- **cmd** Snapshot
- MSS: SSRMS: [SSRMS]
- Change Display ► W1 ► S5 Install (Verify W1>S5 Install)

**THC/ RHC**
- Using SSRMS digitals, back off to an X value of +25 cm (+X Hand Controller input).

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

THC/ RHC

Maneuver S5 to Softdock position until EV verifies Softdocks are engaged.

Expected Softdock position:

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-97.2</td>
<td>-55.7</td>
<td>-0.1</td>
<td>-64.1</td>
<td>-145.0</td>
<td>-50.0</td>
<td>+63.3</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+2</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Loaded – S5 Install, SR Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W1&gt;S5 Install</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 14.- S5 Softdock
(22: Base Elbow: -130, -20).

Figure 15.- S5 Softdock
(24: Tip Elbow: -60, +57).
7. **SSRMS LIMP FOR MRTAS BOLTING**

PCS

MSS: SSRMS: **SSRMS**

Enter Mode – Standby (Verify blue)

Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SRH

Verify ‘Unloaded Parameters’ (two) – LEE Tip, SR Held

Change Display ▶ W1 ▶ Mated S5 GF (Verify W1>Mated S5 GF)

Change Command ▶ SSRMS ▶ Internal (Verify SSRMS>Internal)

MSS: SSRMS: Limp: **SSRMS Limp**

(cmd) All Limp (Verify Limp – blue)

MSS: SSRMS: **SSRMS**

Verify all joints – Limped

Notify EV SSRMS limped, GO for bolting.

8. **CARRIAGE PUSHOFF**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
</table>
| 22: Base Elbow (-140, -10)  
(24: Tip Elbow (-10, 0)) | 25: Tip LEE | 37: MBS Mast (+170, -10) | Camera C (+55, +15) |

Figure 16.- S5 Installed  
(22: Base Elbow: -140, -10).

Figure 17.- S5 Installed  
(37: MBS Mast: +170, -10).
1.120 SSRMS S5 INSTALL
(RBT FS/13A.1/FIN 1)  Page 11 of 15 pages

8.1 Verifying SSRMS Limp
On IV GO, MRTAS bolting initial torque complete, ready for release:

***************************************************************
* If using shuttle attitude control;
* Coordinate with shuttle crew;
* Verify Rate < 0.1 deg/s/axis, then DAP: AUTO.
***************************************************************

MSS: SSRMS: [SSRMS]

Verify all joints – Limped

8.2 Auto Release
MSS: SSRMS: Tip LEE: [SSRMS Tip LEE]

**cmd** Release ▶ Automatic ▶ Slow (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

---

**CAUTION**
Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

---

**NOTE**
Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Release

**RHC**
TRIGGER → press (momentarily)

**PCS**
Verify ‘Carriage’ Derigidize – blue (90 s max)
Verify ‘Snare’ Open – blue (12 s max)
Verify ‘Carriage’ Extend – blue (90 s max)

8.3 SSRMS Backoff
MSS: SSRMS: Limp: [SSRMS Limp]

**cmd** None Limp (Verify Standby – blue)

MSS: SSRMS: [SSRMS]

Verify Unloaded Parameters – ✓
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SR Held
Enter Mode – Manual (Verify blue)


**cmd** Shoulder Roll (Verify SR – Locked)

√ Vernier

MSS: SSRMS: Rate: **SSRMS Rate**

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired

---

**CAUTION**

This is not a nominal back-off due to clearance with the 3A solar array blanket box. As a result, the SSRMS is maneuvered to -60 cm (instead of the nominal -150 cm), where the clearance is approximately 14 inches (36 cm). Use the Base Elbow Camera to monitor this clearance.

---

THC/ RHC

Maneuver SSRMS to S5 Grapple Fixture Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-97.2</td>
<td>-53.1</td>
<td>-2.5</td>
<td>-59.5</td>
<td>-145.8</td>
<td>-47.7</td>
<td>+65.2</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-60</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – LEE Tip, SR Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W1&gt;Mated S5 GF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Figure 18.- S5 Grapple Fixture Clearance (22: Base Elbow: -140, -10).

Figure 19.- S5 Grapple Fixture Clearance (37: MBS Mast: +170, -10).
9. **PVRGF RELOCATE VIEWING**

9.1 **PVRGF Intermediate Position Maneuver**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>22: Base Elbow (-150, -15)</td>
<td>25: Tip LEE</td>
<td>03: S1 Lower Outboard (-80, -2)</td>
</tr>
</tbody>
</table>

**PCS**

MSS: SSRMS: Rate: **SSRMS Rate**

Set ‘Scale’ ‘Vernier’ Rate Scale: 1.0 (Verify 1.0)

MSS: SSRMS: **SSRMS**

Enter Mode – Single (Verify blue)

---

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**THC**

Perform Single Joint maneuver to PVRGF Intermediate position (within 1 deg).

<table>
<thead>
<tr>
<th>S5 Grapple Fixture Clearance</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: EP + PVRGF Intermediate</td>
<td>-97.2</td>
<td>-53.1</td>
<td>-2.5</td>
<td>-59.5</td>
<td>-145.8</td>
<td>-47.7</td>
<td>+65.2</td>
</tr>
<tr>
<td></td>
<td>-97.2</td>
<td>-53.1</td>
<td>-2.5</td>
<td>-20.0</td>
<td>-145.8</td>
<td>-47.7</td>
<td>+65.2</td>
</tr>
<tr>
<td>X Y Z Pitch Yaw Roll FOR Disp</td>
<td>-185</td>
<td>+328</td>
<td>+302</td>
<td>+4.9</td>
<td>-25.9</td>
<td>-28.7</td>
<td>W1&gt;Mated S5 GF</td>
</tr>
</tbody>
</table>

---

Figure 20.- PVRGF Intermediate (22: Base Elbow: -150, -15).

Figure 21.- PVRGF Intermediate (03: S1 Lower Outboard: -80, -2).
9.2 PVRGF Viewing Position Maneuver

PCS MSS: SSRMS: [SSRMS]

Enter Mode – Joint OCAS (Verify blue)

RHC RATE → COARSE (Verify Coarse on PCS)

PCS SSRMS Joint OCAS

pick File ▶ W1MBS1 ▶ PVRGF Viewing

Verify ‘Joint Angles’ ‘Destination’ for PVRGF Viewing position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-97.2</td>
<td>-53.1</td>
<td>0.0</td>
<td>-20.0</td>
<td>-124.7</td>
<td>-12.6</td>
<td>+65.2</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current) -97.2</td>
<td>-53.1</td>
<td>-2.5</td>
<td>-20.0</td>
<td>-145.8</td>
<td>-47.7</td>
<td>+65.2</td>
</tr>
<tr>
<td>TGT -97.2</td>
<td>-53.1</td>
<td>0.0</td>
<td>-20.0</td>
<td>-124.7</td>
<td>-12.6</td>
<td>+65.2</td>
</tr>
<tr>
<td>ERR 0.0</td>
<td>0.0</td>
<td>-2.5</td>
<td>0.0</td>
<td>-21.1</td>
<td>-35.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

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

PCS

* If joint angles or errors are incorrect
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest joint angles per table above.
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
* MON
* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**
This Joint OCAS will take less than 1 min to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange
Verify SSRMS at PVRGF Viewing position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-97.2</td>
<td>-53.1</td>
<td>0.0</td>
<td>-20.0</td>
<td>-124.7</td>
<td>-12.6</td>
<td>+65.2</td>
</tr>
</tbody>
</table>

X  Y  Z  Pitch  Yaw  Roll

-245  +363  +275  +49.0  -45.7  -14.2

FOR  Unloaded – LEE Tip, SR Held
Disp  W1>Mated S5 GF

DCP  BRAKES SSRMS → ON (Verify ON)

Figure 22.- PVRGF Viewing (22: Base Elbow: -150, -15).

Figure 23.- PVRGF Viewing (03: S1 Lower Outboard: -80, -2).

9.3 PVRGF Viewing
Configure Cameras and overlays as required to view PVRGF relocate task.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>22: Base Elbow (-150, -15)</td>
<td>25: Tip LEE</td>
<td>24: Tip Elbow (-80, +5)</td>
</tr>
</tbody>
</table>

Figure 24.- PVRGF Viewing (25: Tip LEE).

Figure 25.- PVRGF Viewing (24: Tip Elbow: -80, +5).
1.130 SSRMS S5 MANEUVER FOR TRANSLATE TO WS4

(RBT FS/13A.1/FIN 1)  Page 1 of 5 pages

1. **SETUP**
   Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>13: LAB Stbd Zenith</td>
<td>03: S1 Lower Outboard</td>
<td>24: Tip Elbow</td>
</tr>
<tr>
<td>(0, +65)</td>
<td>(-50, -10)</td>
<td>(0, 0)</td>
</tr>
</tbody>
</table>

PCS  MSS: SSRMS: [SSRMS]

Change Display ▶ W1 ▶ ISSACS (Verify W1>ISSACS)

√Coarse

Verify SSRMS at PVRGF Viewing position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-97.2</td>
<td>-53.1</td>
<td>0.0</td>
<td>-20.0</td>
<td>-124.7</td>
<td>-12.6</td>
<td>+65.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>+228</td>
<td>+3721</td>
<td>+451</td>
<td>+106.0</td>
<td>-23.3</td>
<td>+157.5</td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SR Held
Disp W1>ISSACS

Figure 1.- PVRGF Viewing (13: LAB Stbd Zenith: 0, +65).

Figure 2.- PVRGF Viewing (03: S1 Lower Outboard: -50, -10).

2. **STBD SAW CLEARANCE POSITION MANEUVER**

DCP
BRAKES SSRMS → OFF (Verify OFF)

PCS
MSS: SSRMS: [SSRMS]

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

pick File ▶ W1MBS1 ▶ Stbd SAW Clearance
Verify ‘Joint Angles’ ‘Destination’ for Stbd SAW Clearance position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-185.0</td>
<td>+180.0</td>
<td>+165.0</td>
<td>+40.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**
Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current) -97.2</td>
<td>-53.1</td>
<td>0.0</td>
<td>-20.0</td>
<td>-124.7</td>
<td>-12.6</td>
<td>+65.2</td>
</tr>
<tr>
<td>TGT -185.0</td>
<td>+180.0</td>
<td>+165.0</td>
<td>+40.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>ERR +87.8</td>
<td>-233.1</td>
<td>-165.0</td>
<td>-60.0</td>
<td>-81.7</td>
<td>+99.3</td>
<td>+68.3</td>
</tr>
</tbody>
</table>

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

**PCS**

* If joint angles or errors are incorrect
  * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * **cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

**PCS**

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**

2. This Joint OCAS will take approximately 3 minutes to complete in Coarse rates.

**DCP**
AUTO SEQ → PROC

**PCS**
MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-185.0</td>
<td>+180.0</td>
<td>+165.0</td>
<td>+40.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
</tbody>
</table>
3. **MT TRANSLATE INTERMEDIATE POSITION MANEUVER**

**MSS: SSRMS:**

Enter Mode – Single (Verify blue)

---

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

---

**THC**

Perform Single Joint maneuver to MT Translate Intermediate position (within 1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-185.0</td>
<td>+180.0</td>
<td>+165.0</td>
<td>+40.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>-185.0</td>
<td>+180.0</td>
<td>+200.0</td>
<td>+40.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+1846</td>
<td>+2133</td>
<td>+146</td>
<td>-109.1</td>
<td>-39.4</td>
<td>-84.5</td>
<td></td>
</tr>
</tbody>
</table>

**FOR**

Unloaded – LEE Tip, SR Held

**Disp**

W1>ISSACS
Figure 5.- MT Translate Intermediate (13: LAB Stbd Zenith: -20, +65).

Figure 6.- MT Translate Intermediate (03: S1 Lower Outboard: -30, -10).

4. **MANEUVERING TO MT TRANSLATE POSITION**

**PCS**

MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

pick File ▶ W1MBS1 ▶ MT Translate

Verify ‘Joint Angles’ ‘Destination’ for MT Translate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-140.0</td>
<td>+140.0</td>
<td>+252.5</td>
<td>+140.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
</tbody>
</table>

**MON**

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current) -185.0</td>
<td>+180.0</td>
<td>+200.0</td>
<td>+40.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>TGT   -140.0</td>
<td>+140.0</td>
<td>+252.5</td>
<td>+140.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>ERR   -45.0</td>
<td>+40.0</td>
<td>-52.5</td>
<td>-100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect
  * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * **cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

* Verify joint angles and errors are correct on Joint Angle Position overlay.

***********************************************************************************
1.130 SSRMS S5 MANEUVER FOR TRANSLATE TO WS4

(RBT FS/13A.1/FIN 1) Page 5 of 5 pages

PCS cmd Confirm (Verify Sequence Status – Auto Seq sw - Hot)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.</td>
</tr>
</tbody>
</table>

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at MT Translate position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-140.0</td>
<td>+140.0</td>
<td>+252.5</td>
<td>+140.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>+728</td>
<td>+1949</td>
<td>-51</td>
<td>-24.4</td>
<td>+5.4</td>
<td>-176.4</td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SR Held

Disp W1>ISSACS

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expect the following message when safing is commanded: ‘R3Z - MSS OCS SSRMS Prime(Redun) ACU SRT Cat-1 Brk Stat Fail’ (SCR 17495)</td>
</tr>
<tr>
<td>This message should return to Norm.</td>
</tr>
</tbody>
</table>

DCP SAFING → SAFE (Verify ON)

RHC RATE → VERNIER (Verify Vernier on PCS)

Figure 7.- MT Translate

Figure 8.- MT Translate
(24: Tip Elbow: 0, 0).
Configure the ISS Downlink per the following table:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Elbow</td>
<td>LAB Stbd Zenith</td>
</tr>
<tr>
<td></td>
<td>(+50, +3)</td>
<td>(+110, +70)</td>
</tr>
<tr>
<td>FL</td>
<td>35 mm</td>
<td>FL = 13 mm</td>
</tr>
</tbody>
</table>

Verify SSRMS is at the MT Translate position (within 1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-140.0</td>
<td>+140.0</td>
<td>+252.5</td>
<td>+140.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
</tbody>
</table>

**NOTE**

1. ‘PTU not following commands’ error messages may be generated when MSS Cameras are powered.

2. Due to MCCST command latency, the pan/tilt stop command should be issued 6 deg before the destination is reached.

1. **BASE ELBOW CAMERA SURVEY**

   **MCCST**

   ROBO Camera Commander

   ‘MSS Cameras’

   sel SSRMS Base Elb

   **cmd** Activate Position (Verify Activated)

   **cmd** Activate Commanding

   **Keyboard Commanding Window**

   Verify Current Camera: SSRMS Base Elb

<table>
<thead>
<tr>
<th>Start Config</th>
<th>Base Elb</th>
<th>Stop at</th>
<th>Survey Notes</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(+50, +3)</td>
<td></td>
<td></td>
<td>MT Translation Path</td>
</tr>
<tr>
<td>FL = 35 mm</td>
<td></td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Tilt Dn</td>
<td>(+50, -3)</td>
<td>(+50, +3)</td>
<td>MT Translation Path</td>
<td></td>
</tr>
<tr>
<td>2: Pan Rt</td>
<td>(+60, -3)</td>
<td>(+54, -3)</td>
<td>MT Translation Path</td>
<td></td>
</tr>
<tr>
<td>3: Tilt Dn</td>
<td>(+60, -6)</td>
<td>(+60, -3)</td>
<td>MT Translation Path</td>
<td></td>
</tr>
</tbody>
</table>

   **Keyboard Commanding Window**

   **cmd** Finished Commanding

   **cmd** Activate Position (Verify Deactivated)
2. LAB STBD ZENITH CAMERA SURVEY
Coordinate with CATO to pan, tilt and zoom the LAB Stbd Zenith Camera as follows:

<table>
<thead>
<tr>
<th>Start Config</th>
<th>LAB Stbd Zenith</th>
<th>Stop at</th>
<th>Survey Notes</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(+110, +70)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Tilt Dn</td>
<td>(+110, +50)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Pan Rt</td>
<td>(+130, +50)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: Tilt Dn</td>
<td>(+130, -40)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 5.- LAB Stbd Zenith Start
(LAB Stbd Zenith: +110, +70).

Figure 6.- LAB Stbd Zenith - Step 1
(LAB Stbd Zenith: +110, +50).

Figure 7.- LAB Stbd Zenith - Step 2
(LAB Stbd Zenith: +130, +50).

Figure 8.- LAB Stbd Zenith - Step 3
(LAB Stbd Zenith: +130, -40).
This Page Intentionally Blank
1. SETUP
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>13: LAB Stbd Zenith (-150, 0)</td>
<td>24: Tip Elbow (0, +10)</td>
<td>03: S1 Lower Outboard (+50, -20)</td>
<td>Camera C (0, +10)</td>
</tr>
</tbody>
</table>

PCS MSS: SSRMS:

Change Loaded Parameters ▶ OBSS ▶ OBSS Mid MPM SYH
Verify ‘Loaded Parameters’ (two) – OBSS Mid MPM, SY Held

Verify Unloaded Parameters – √
Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SYH
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held

Change Display ▶ W4 ▶ Berth OBSS FRGF NSP (Verify W4>Berth OBSS FRGF NSP)

Verify Command – SSRMS>Internal

Verify SSRMS at MT Translate position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-140.0</td>
<td>+140.0</td>
<td>+252.5</td>
<td>+140.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-190</td>
<td>+175</td>
<td>+1297</td>
<td>+24.5</td>
<td>+4.3</td>
<td>-1.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W4>Berth OBSS FRGF NSP

Figure 1.- MT Translate (13: LAB Stbd Zenith: -150, 0).

Figure 2.- MT Translate (03: S1 Lower Outboard: +50, -20).
2. **OBSS INTERMEDIATE PRE-GRAPPLE MANEUVER**

On SRMS Operator GO for maneuver to OBSS Pre-Grapple, SRMS at OBSS Pre-Grapple at Handoff position:

**MSS:** SSRMS: SSRMS Safing: [SSRMS Safing]

**cmd** Remove (Verify Not Safed)

**DCP**

BRAKES SSRMS → OFF (Verify OFF)

**PCS**

MSS: SSRMS: [SSRMS]

Enter Mode – Joint OCAS (Verify blue)

**RHC**

RATE → COARSE (Verify Coarse on PCS)

**PCS**

SSRMS Joint OCAS

pick File ▶ W4MBS1 ▶ Berth OBSS Int PreGr

Verify ‘Joint Angles’ ‘Destination’ for Berthed OBSS Intermediate Pre-Grapple position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-109.4</td>
<td>+138.5</td>
<td>+145.0</td>
<td>-72.4</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

Verify joint angles and errors are correct on Joint Angle position overlay.

<table>
<thead>
<tr>
<th>SR (current)</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-140.0</td>
<td>+140.0</td>
<td>+252.5</td>
<td>+140.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>-109.4</td>
<td>+138.5</td>
<td>+145.0</td>
<td>-72.4</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>-30.6</td>
<td>+1.5</td>
<td>+107.5</td>
<td>+212.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

* If joint angles or errors are incorrect
  
  **PCS**
  
  **cmd** Cancel (Verify Sequence Status – Waiting Destination)
  
  * Input correct Dest joint angles per table above.
  
  **PCS**
  
  **cmd** Load (Verify Sequence Status – Confirm or Cancel)
  
  **MON**
  
  * Verify joint angles and errors are correct on Joint Angle Position overlay.

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

16 JUL 07
1.200 SSRMS OBSS UNBERTH AND HANDOFF

(PCS) cmd Confirm (Verify Sequence Status – Auto Seq sw - Hot)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.</td>
</tr>
</tbody>
</table>

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at Berthed OBSS Intermediate Pre-Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-109.4</td>
<td>+138.5</td>
<td>+145.0</td>
<td>-72.4</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-67</td>
<td>-206</td>
<td>-21</td>
<td>-3.9</td>
<td>+0.1</td>
<td>-9.8</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W4>Berth OBSS FRGF NSP

Figure 3.- Berthed OBSS Intermediate Pre-Grapple
(24: Tip Elbow: 0, +10).

Figure 4.- Berthed OBSS Intermediate Pre-Grapple
(03: S1 Lower Outboard: +50, +10).

3. MANEUVERING TO OBSS PRE-GRAPPLING

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)
WARNING

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

THC

Perform Single Joint maneuver to OBSS Pre-Grapple position (within 1 deg).

<table>
<thead>
<tr>
<th>Berthed OBSS Intermediate Pre-Grapple</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-109.4</td>
<td>+138.5</td>
<td>+150</td>
<td>-72.4</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>1: SP – OBSS Pre-Grapple</td>
<td></td>
<td></td>
<td>+134.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-109.4</td>
<td>+138.5</td>
<td>+134.4</td>
<td>-72.4</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>X Y Z Pitch Yaw Roll</td>
<td>-149</td>
<td>-1</td>
<td>0</td>
<td>-0.1</td>
<td>0.0</td>
<td>-0.1</td>
<td></td>
</tr>
</tbody>
</table>
| FOR                                   | Unloaded – LEE Tip, SY Held
| Disp                                  | W4>Berth OBSS FRGF NSP

Figure 5.- OBSS Pre-Grapple (V10: Camera C: 0, +10).

Figure 6.- OBSS Pre-Grapple (03: S1 Lower Outboard: +50, +10).

4. OBSS GRAPPLE SETUP
Configure Cameras and overlays for grapple.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera D (-30, +20)</td>
<td>25: Tip LEE</td>
<td>03: S1 Lower Outboard (+50, +10)</td>
<td>Camera C (0, +10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(24: Tip Elbow (-130, -10))</td>
<td></td>
</tr>
</tbody>
</table>

NOTE
Tip LEE Camera must be fully zoomed out to correspond to target overlay.
1.200  SSRMS OBSS UNBERTH AND HANDOFF
(RBT FS/13A.1/FIN 1)  Page 5 of 15 pages

PCS  MSS: SSRMS: Rate: [SSRMS Rate]

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired

!!Figure 7.- OBSS Pre-Grapple
(91: Camera D: -30, +20).

5. OBSS CAPTURE
MSS: SSRMS: [SSRMS]

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: [Joint Lock]

!!!!cmd Shoulder Yaw (Verify SY – Locked)

RHC/ THC

Maneuver to within grapple envelope.

PCS  MSS: SSRMS: Tip LEE: [SSRMS Tip LEE]

!!!cmd Capture ► Automatic ► Slow, Limp (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

CAUTION
Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

NOTE
Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

!!!cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Capture
1.200 SSRMS OBSS UNBERTH AND HANDOFF

RHC TRIGGER → press (momentarily)

PCS Verify ‘Snare’ Close, Capture (two) – blue (12 s max)
Verify Capture to Latch – No (SCR 19282)
Verify ‘Carriage’ Tension ~5500 N (90 s max)
Verify ‘Carriage’ Retract – blue

Verify Posn Hold – orange
Verify Loaded Parameters – √
Verify ‘Loaded Parameters’ (two) – OBSS Mid MPM, SY Held

DCP BRAKES SSRMS → ON (Verify ON)

Review {SSRMS LEE CUE CARD}, all (SODF: RBT GEN: REFERENCE).

Record Berthed OBSS Grapple position:

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected</td>
<td>-99.9</td>
<td>+138.5</td>
<td>+142.7</td>
<td>-70.0</td>
<td>-65.4</td>
<td>-110.3</td>
<td>-22.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected</td>
<td>+45</td>
<td>+12</td>
<td>+23</td>
<td>+90.0</td>
<td>-0.1</td>
<td>-30.0</td>
</tr>
</tbody>
</table>

FOR  Loaded – OBSS Mid MPM, SY Held
Disp  W4>Berth OBSS FRGF NSP

Figure 8.- Berthed OBSS Grapple (91: Camera D: -30, +10).
Figure 9.- Berthed OBSS Grapple (03: S1 Lower Outboard: +50, +10).
6. **SETUP FOR MANEUVER**
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera D</td>
<td>92: Camera C</td>
<td>03: S1 Lower</td>
<td>SRMS Elbow</td>
</tr>
<tr>
<td>(-30, +10)</td>
<td>(+20, 0)</td>
<td>Outboard (+50, +10)</td>
<td>(-55, -10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(24: Tip Elbow</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-120, -10))</td>
<td></td>
</tr>
</tbody>
</table>

PCS

MSS: SSRMS: **SSRMS**

Change Display ► W4 ► Berth OBSS Mid NSP (Verify W4>Berth OBSS Mid NSP)

Change Command ► W4 ► Berth OBSS Mid NSP (Verify W4>Berth OBSS Mid NSP)

MSS: SSRMS: Rate: **SSRMS Rate**

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired.

![Figure 10.- Berthed OBSS Grapple](image1)

![Figure 11.- Berthed OBSS Grapple](image2)

7. **ATTITUDE CONTROL CONFIGURATION**

MSS: SSRMS: Thrusters: **Thruster Controls for MSS Ops**

Verify ‘Desat Request:’ Inh
8. **MRL RELEASE**
   Notify shuttle crew GO for STBD MRL release.

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Standby for OBSS thermal clock start time:</td>
</tr>
<tr>
<td>______ / _____ : _____ : _____</td>
</tr>
<tr>
<td>2. SRMS SPEE power must be applied within 90 minutes to prevent sensor damage.</td>
</tr>
</tbody>
</table>

   ****************************************************************************************
   * If ‘R3Q - SSRMS LEE Uncommanded Derigidize’ Caution was annunciated during MRL release or Carriage Tension < 4400 N
   * MSS: SSRMS: Tip LEE: **SSRMS Tip LEE**
   * **cmd** ‘Carriage’ Rigidize ▶ Slow (Verify Speed – Slow)
   * **cmd** Confirm (Verify RHC Trigger Hot icon)
   * Verify LEE Mode – Rigidize
   * TRIGGER → press (momentarily) (SCR 19064)
   * Verify ‘Carriage’ Tension ~5500 N (90 s max)
   * Verify ‘Carriage’ Retract – blue
   ****************************************************************************************

9. **LOW HOVER POSITION MANEUVER**
   On shuttle crew GO for OBSS unberth, MRLs released:

   **DCP** BRAKES SSRMS → OFF (Verify OFF)
   **PCS** MSS: SSRMS: **SSRMS**
   Enter Mode – Manual (Verify blue)
   **cmd** Shoulder Yaw (Verify SY – Locked)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor clearance between OBSS and the UHF Antenna with the SRMS Elbow Camera. Clearance at Low Hover is approximately 96 cm (3.1 ft).</td>
</tr>
</tbody>
</table>
THC/ RHC

Maneuver OBSS to Low Hover position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>-106.7</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

FOR Loaded – OBSS Mid MPM, SY Held
Disp W4>Berth OBSS Mid NSP

If using shuttle attitude control;
Coordinate with shuttle crew;
Verify Rate < 0.1 deg/s/axis; then DAP: AUTO.

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

Figure 12. - OBSS Low Hover
(91: Camera D: -30, +10).

Figure 13.- OBSS Low Hover
(V10: SRMS Elbow: -55, -10).

10. CLEAR OF UHF ANTENNA MANEUVER

PCS

MSS: SSRMS: Rate: [SSRMS Rate]
Set ‘Scale’ ‘Vernier’ Rate Scale: 1.0 (Verify 1.0)

MSS: SSRMS: [SSRMS]
Enter Mode – FOR OCAS (Verify blue)

MSS: SSRMS: SSRMS FOR OCAS: Joint Lock: [Joint Lock]

cmd Shoulder Yaw (Verify SY – Locked)

[SSRMS FOR OCAS]
pick File ▶ W4MBS1 ▶ OBSS Clear UHF
1.200 SSRMS OBSS UNBERTH AND HANDOFF
(RBT FS/13A.1/FIN 1)  Page 10 of 15 pages

Verify ‘FOR’ ‘Destination’ for Clear UHF Antenna position.

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>-190</td>
<td>-211</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**cmd Load** (Verify Sequence Status – Confirm or Cancel)

**MON**
Verify FOR and errors are correct on FOR position overlay.

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR</td>
<td>0</td>
<td>0</td>
<td>-100</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>TGT</td>
<td>0</td>
<td>-190</td>
<td>-211</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>ERR</td>
<td>0</td>
<td>+190</td>
<td>+111</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**NOTE**
Expect only Starboard motion of OBSS during this FOR OCAS.

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

**PCS**
If FOR or errors are incorrect

**cmd** Cancel (Verify Sequence Status – Waiting Destination)

* Input correct Dest FOR per table above.

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**
Verify FOR and errors are correct on FOR Position overlay.

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

**PCS**
**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**
This FOR OCAS will take approximately 1 minute to complete in Vernier rates.

**DCP**
AUTO SEQ → PROC

**PCS**
MSS: SSRMS: 

Verify Posn Hold – orange

Verify SSRMS at Clear UHF Antenna position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th></th>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>-112.6</td>
</tr>
<tr>
<td>SY</td>
<td>+138.5</td>
</tr>
<tr>
<td>SP</td>
<td>+148.5</td>
</tr>
<tr>
<td>EP</td>
<td>-77.4</td>
</tr>
<tr>
<td>WP</td>
<td>-48.8</td>
</tr>
<tr>
<td>WY</td>
<td>-112.7</td>
</tr>
<tr>
<td>WR</td>
<td>+2.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR</td>
<td>0</td>
<td>-190</td>
<td>-211</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Disp W4>Berth OBSS Mid NSP
11. **HANDOFF POSITION MANEUVER**
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: Camera C (0, +10)</td>
<td>91: SRMS Elbow (-55, -10)</td>
<td>03: S1 Lower Outboard (+60, +15) (24: Tip Elbow (-120, -10))</td>
<td>Camera D (-30, +10)</td>
</tr>
</tbody>
</table>

**MSS:** SSRMS: **SSRMS**
Verify SY – Locked

**SSRMS FOR OCAS**

pick File ➤ W4MBS1 ➤ OBSS Handoff

Verify 'FOR' ‘Destination’ for OBSS Handoff position.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>+325</td>
<td>0</td>
<td>-211</td>
<td>+91.1</td>
<td>-70.6</td>
<td>+47.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**
Verify FOR and errors are correct on FOR position overlay.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR</td>
<td>0</td>
<td>-190</td>
<td>-211</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>TGT</td>
<td>+325</td>
<td>0</td>
<td>-211</td>
<td>+91.1</td>
<td>-70.6</td>
</tr>
<tr>
<td>ERR</td>
<td>-325</td>
<td>-190</td>
<td>0</td>
<td>-91.1</td>
<td>+70.6</td>
</tr>
</tbody>
</table>
1.200 SSRMS OBSS UNBERTH AND HANDOFF
(RBT FS/13A.1/FIN 1)  

**********************************************************************
* If FOR or errors are incorrect
PCS * cmd Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest FOR per table above.
* cmd Load (Verify Sequence Status – Confirm or Cancel)
MON * Verify FOR and errors are correct on FOR Position overlay.
**********************************************************************

PCS cmd Confirm (Verify Sequence Status – Auto Seq Sw - Hot)

NOTE
1. Clearance between the OBSS and the UHF Antenna, the SPACEHAB module and the SRMS will be less than 60 cm (2 ft) and can be monitored with Camera C.
2. This FOR OCAS will take approximately 3 minutes to complete in Vernier rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at OBSS Handoff position (within 5 cm/1 deg).

Locked

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-113.8</td>
<td>+138.5</td>
<td>+119.5</td>
<td>-28.6</td>
<td>-117.2</td>
<td>-107.3</td>
<td>-133.8</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+325</td>
<td>0</td>
<td>-211</td>
<td>+91.1</td>
<td>-70.6</td>
<td>+47.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Loaded – OBSS Mid MPM, SY Held
Disp W4>Berth OBSS Mid NSP

DCP BRAKES SSRMS → ON (Verify ON)

Figure 16.- OBSS Handoff
(92: Camera C: 0, +10).

Figure 17.- OBSS Handoff
(91: SRMS Elbow: -45, -10).
12. **SRMS GRAPPLE**

Notify SRMS operator SSRMS at OBSS Handoff position, GO for OBSS grapple.

13. **SETUP FOR RELEASE**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: Camera C (+10, +10)</td>
<td>25: Tip LEE</td>
<td>91: SRMS Elbow (-45, -10)</td>
<td>Camera D (-10, +20)</td>
</tr>
</tbody>
</table>

**NOTE**

The LEE Camera must be fully zoomed out to correspond to the target overlay.

Figure 18.- OBSS Handoff (92: Camera C: +10, +10).

Figure 19.- OBSS Handoff (91: SRMS Elbow: -45, -10).

Figure 20.- OBSS Handoff (V10: Camera D: -10, +20).

PCS

MSS: SSRMS: SSRMS

Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held
Change Command ► SSRMS ► Internal (Verify SSRMS>Internal)
\Vernier

MSS: SSRMS: Rate: [SSRMS Rate]

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired.

14. **OBSS UNGRAPPLE (CARRIAGE PUSHOFF)**

On SRMS operator GO, OBSS Grapple complete, GO for OBSS release:

DCP
BRAKES SSRMS → OFF (Verify OFF)

14.1 **SSRMS Limp**

PCS
MSS: SSRMS: Limp: [SSRMS Limp]

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS: [SSRMS]

Verify all joints – Limped

14.2 **Auto Release**

MSS: SSRMS: Tip LEE: [SSRMS Tip LEE]

**cmd** Release ► Automatic ► Slow (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

---

**CAUTION**

Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

**NOTE**

Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Release

RHC
TRIGGER → press (momentarily)

PCS
Verify ‘Carriage’ Derigidize – blue (90 s max)
Verify ‘Snare’ Open – blue (12 s max)
Verify ‘Carriage’ Extend – blue (90 s max)

Verify Unloaded Parameters – √
14.3 SSRMS Backoff
MSS: SSRMS: Limp: [SSRMS Limp]

**cmd** None Limp (Verify Standby – blue)

MSS: SSRMS: [SSRMS]

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: [Joint Lock]

**cmd** Shoulder Yaw (Verify SY – Locked)

<table>
<thead>
<tr>
<th>THC/ RHC</th>
<th>Maneuver to OBSS Backoff position (-X THC Command)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locked</td>
<td>(within 5 cm/1 deg).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-129.5</td>
<td>+138.5</td>
<td>+114.0</td>
<td>-46.7</td>
<td>-63.0</td>
<td>-104.9</td>
<td>-91.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>+234</td>
<td>+82</td>
<td>-512</td>
<td>-75.1</td>
<td>-18.9</td>
<td>-85.5</td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W4>Berth OBSS Mid NSP

* ************************************************************
* If using shuttle attitude control;
* Coordinate with shuttle crew;
* Verify Rate < 0.1 deg/s/axis; then DAP: AUTO.
* ************************************************************
This Page Intentionally Blank
1. **SETUP**
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: Camera C (+10, +20)</td>
<td>13: LAB Stbd Zenith (-10, 0)</td>
<td>03: S1 Lower Outboard (+50, +10)</td>
<td>SRMS Elbow (-15, +10)</td>
</tr>
</tbody>
</table>

**Figure 1.- OBSS Backoff**
(92: Camera C: +10, +20).

**Figure 2.- OBSS Backoff**
(13: LAB Stbd Zenith: -10, 0).

**Figure 3.- OBSS Backoff**
(03: S1 Lower Outboard: +50, +10).

**Figure 4.- OBSS Backoff**
(V10: SRMS Elbow: -15, +10).

PCS
MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

**RHC**
RATE ➔ COARSE (Verify Coarse on PCS)

PCS
MSS: SSRMS: SSRMS

SSRMS Joint OCAS

pick File ➔ W4MBS1 ➔ Survey Support

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-158.8</td>
<td>-51.3</td>
<td>+51.2</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-129.5</td>
<td>+138.5</td>
<td>+114.0</td>
<td>-46.7</td>
<td>-63.0</td>
<td>-104.9</td>
</tr>
<tr>
<td>TGT</td>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-158.8</td>
<td>-51.3</td>
</tr>
<tr>
<td>ERR</td>
<td>+26.3</td>
<td>-24.8</td>
<td>-90.7</td>
<td>-3.6</td>
<td>+95.8</td>
<td>-53.6</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect
  * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * **cmd** Load (Verify Sequence Status – Confirm or Cancel)
  * Verify joint angles and errors are correct on Joint Angle Position overlay.
***********************************************************************************

**NOTE**

This Joint OCAS will take approximately 1 minute to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify SSRMS at Survey Support Viewing position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-158.8</td>
<td>-51.3</td>
<td>+51.2</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-865</td>
<td>-1108</td>
<td>+177</td>
<td>-42.3</td>
<td>+58.9</td>
<td>+33.4</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held

Disp W4>Berth OBSS Mid NSP

DCP BRAKES SSRMS → ON (Verify ON)
2. SURVEY SUPPORT VIEWING

NOTE
To view specific areas below the orbiter, the Tip Elbow Camera may be configured as follows:

a) Nose area of orbiter: P: -175, T: +30
b) Mid area of orbiter: P: -125, T: +50
c) Aft area of orbiter: P: -75, T: +45
2.1 Viewing Areas of Orbiter with Tip LEE Camera (Optional)

To view areas of the orbiter using the Tip LEE Camera, the Wrist Cluster can be reconfigured in Single Joint mode as follows:

- **DCP**: BRAKES SSRMS → OFF (Verify OFF)
- **PCS**: MSS: SSRMS: **SSRMS**
  Enter Mode – Single (Verify blue)
- **RHC**: RATE → VERNIER (Verify Vernier on PCS)

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**NOTE**

At a WY of -20.0 degrees an approaching wrist self-collision signal will be indicated on the PCS.
If viewing fwd area of orbiter

THC

Perform Single Joint maneuver to Fwd Orbiter viewing position (within 1 deg).

Initial Viewing Posn

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: WP –</td>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-158.8</td>
<td>-51.3</td>
<td>+51.2</td>
</tr>
<tr>
<td>2: WY +</td>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-185.0</td>
<td>-30.0</td>
<td>+51.2</td>
</tr>
</tbody>
</table>

Fwd Orbiter

X Y Z Pitch Yaw Roll

-939 -1064 +160 -109.9 +72.7 +114.2

FOR Unloaded – LEE Tip, SY Held

Disp W4>Berth OBSS Mid NSP

DCP

BRAKES SSRMS → ON (Verify ON)

If viewing mid area of orbiter

THC

Perform Single Joint maneuver to Mid Orbiter viewing position (within 1 deg).

Initial Viewing Posn

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: WP +</td>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-158.8</td>
<td>-51.3</td>
<td>+51.2</td>
</tr>
<tr>
<td>2: WY +</td>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-135.0</td>
<td>-50.0</td>
<td>+51.2</td>
</tr>
</tbody>
</table>

Mid Orbiter

X Y Z Pitch Yaw Roll

-839 -1144 +173 -19.8 +50.9 -3.6

FOR Unloaded – LEE Tip, SY Held

Disp W4>Berth OBSS Mid NSP

DCP

BRAKES SSRMS → ON (Verify ON)
1.210 SSRMS FOCUSED INSPECTION SUPPORT

If viewing aft area of orbiter

THC

Perform Single Joint maneuver to Aft Orbiter viewing position (within 1 deg).

<table>
<thead>
<tr>
<th>Initial Viewing Posn</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: WP +</td>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-158.8</td>
<td>-51.3</td>
<td>+51.2</td>
</tr>
<tr>
<td>2: WY +</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-115.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Aft Orbiter          | -155.8 | +163.3 | +204.7 | -43.1 | -115.0 | -45.0 | +51.2 |

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>-827</td>
<td>-1178</td>
<td>+170</td>
<td>-5.9</td>
<td>+40.3</td>
<td>-28.4</td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W4>Berth OBSS Mid NSP

DCP

BRAKES SSRMS → ON (Verify ON)
2.2 Returning to Survey Support Viewing Position

If required, once viewing support complete, return to the Initial Survey Support Viewing Position using Single Joint mode:

BRAKES SSRMS → OFF (Verify OFF)

PCS

MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

If WP not -158.8

DCP

JOINT SELECT → WP (Verify WP – Selected on PCS)

THC

Perform Single Joint maneuver to WP: -158.8

If WY not -51.3

DCP

JOINT SELECT → WY (Verify WY – Selected on PCS)

THC

Perform Single Joint maneuver to WY: -51.3

PCS

MSS: SSRMS: SSRMS

Verify SSRMS at Survey Support Viewing position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-158.8</td>
<td>-51.3</td>
<td>+51.2</td>
</tr>
</tbody>
</table>

X

Y

Z

Pitch

Yaw

Roll

-865

-1108

+177

-42.3

+58.9

+33.4

FOR

Unloaded – LEE Tip, SY Held

Disp

W4>Berth OBSS Mid NSP

3. **CLEANUP**

DCP

Verify BRAKES SSRMS – ON

4. **JOINT OCAS TO HANDBOFF**

On SRMS operator GO, focused inspection complete, SRMS is at OBSS Handoff position:

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: Camera C (+10, +10)</td>
<td>13: LAB Stbd Zenith (-50, +40)</td>
<td>03: S1 Lower Outboard (+50, +10)</td>
<td>SRMS Elbow (-55, +10)</td>
</tr>
<tr>
<td>24: Tip Elbow (-145, 0)</td>
<td>24: Tip Elbow (-145, 0)</td>
<td>24: Tip Elbow (-145, 0)</td>
<td>24: Tip Elbow (-145, 0)</td>
</tr>
</tbody>
</table>
BRAKES SSRMS → OFF (Verify OFF)

√ Coarse

PCS

MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

pick File ▶ W4MBS1 ▶ OBSS Handoff

Verify ‘Joint Angles’ ‘Destination’ for OBSS Handoff Pre-Grapple position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-129.6</td>
<td>+139.3</td>
<td>+114.0</td>
<td>-46.8</td>
<td>-63.0</td>
<td>-105.7</td>
<td>-91.3</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)
MON Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-155.8</td>
<td>+163.3</td>
<td>+204.7</td>
<td>-43.1</td>
<td>-158.8</td>
<td>-51.3</td>
<td>51.2</td>
</tr>
<tr>
<td>TGT</td>
<td>-129.6</td>
<td>+139.3</td>
<td>+114.0</td>
<td>-46.8</td>
<td>-63.0</td>
<td>-105.7</td>
<td>-91.3</td>
</tr>
<tr>
<td>ERR</td>
<td>-26.2</td>
<td>+24.0</td>
<td>+90.7</td>
<td>+3.7</td>
<td>-95.8</td>
<td>+54.4</td>
<td>+142.5</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

PCS

* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
This Joint OCAS will take approximately 1 minute to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify SSRMS at OBSS Handoff Pre-Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR</td>
<td>-129.6</td>
<td>+139.3</td>
<td>+114.0</td>
<td>-46.8</td>
<td>-63.0</td>
<td>-105.7</td>
<td>-91.3</td>
</tr>
<tr>
<td>Disp</td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+234</td>
<td>+84</td>
<td>-513</td>
<td>-75.1</td>
<td>-18.9</td>
<td>-85.4</td>
<td></td>
</tr>
</tbody>
</table>

DCP BRAKES SSRMS → ON (Verify ON)
Figure 16.- OBSS Handoff Pre-Grapple
(92: Camera C: 0, +10).

Figure 17.- OBSS Handoff Pre-Grapple
(13: LAB Stbd Zenith: -10, 0).
1. **SETUP**
Configure Cameras and overlays for grapple.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera D (-10, +20)</td>
<td>25: Tip LEE</td>
<td>03: S1 Lower Outboard (+60, +25) 24: Tip Elbow (-150, -10)</td>
<td>SRMS Elbow (-55, +10)</td>
</tr>
</tbody>
</table>

**NOTE**

1. The LEE Camera must be fully zoomed out to correspond to the target overlay.

2. OBSS Handoff Pre-Grapple is at 250 cm from the grapple fixture.

![Figure 1.- OBSS Handoff Pre-Grapple (91: Camera D: -10, +20).](image1)

![Figure 2.- OBSS Handoff Pre-Grapple (03: S1 Lower Outboard: +60, +25).](image2)

![Figure 3.- OBSS Handoff Pre-Grapple (V10: SRMS Elbow: -55, +10).](image3)
1.220 SSRMS OBSS HANDOFF AND BERTH

RHC
RATE → VERNIER (Verify Vernier on PCS)

PCS
MSS: SSRMS: Rate: SSRMS Rate
Set ‘Scale’ ‘Vernier’ Rate Scale: as desired.

2. ATTITUDE CONTROL CONFIGURATION

PCS
MSS: SSRMS: Thrusters: Thruster Controls for MSS Ops
Verify ‘Desat Request:’ – Inh

***********************************************************************
* If using shuttle attitude control;
* Coordinate with shuttle crew; DAP: FREE.
***********************************************************************

3. OBSS GRAPPLE SETUP AND CAPTURE

3.1 Setup

DCP
BRAKES SSRMS → OFF (Verify OFF)

PCS
MSS: SSRMS: SSRMS
Enter Mode – Manual (Verify blue)
MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

RHC/THC

MSS: SSRMS: Tip LEE: SSRMS Tip LEE

3.2 Slow Capture Commands
MSS: SSRMS: Tip LEE: SSRMS Tip LEE

cmd Capture ▶ Automatic ▶ Slow, Limp (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

CAUTION
Due to end-to-end system latency, the RHC Trigger is hot up to
3 seconds prior to receiving a Trigger Hot icon status on the PCS.

NOTE
Once the trigger is hot, only safing or trigger commands should
be sent to the Robotics equipment. If a configuration change is
required, including routing MSS Cameras, safe the system to exit
LEE operations (SCR 23262, 14662).
**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Capture

### 3.3 Grapple

**RHC**

TRIGGER → press (momentarily)

**PCS**

Verify ‘Snare’ Close, Capture (two) – blue (12 s max)  
Verify Capture to Latch – No (SCR 19282)  
Verify ‘Carriage’ Tension ~5500 N (90 s max)  
Verify ‘Carriage’ Retract – blue

### 3.4 Cleanup

**DCP**

BRAKES SSRMS → ON (Verify ON)

---

**Figure 4.** OBSS Grapple  
(91: Camera D: -10, +20).  
(03: S1 Lower Outboard: +60, +25).

**Figure 5.** OBSS Grapple  
(03: S1 Lower Outboard: +60, +25).

**PCS**

MSS: SSRMS: [SSRMS]  
Verify Loaded Parameters – √  
Verify ‘Loaded Parameters’ (two) – OBSS Mid MPM, SY Held

Notify SRMS operator OBSS grapple complete, GO for release.

Review {SSRMS LEE CUE CARD}, all (SODF: RBT GEN: REFERENCE).

Verify SSRMS at OBSS Grapple position (within 5 cm/1 deg).  

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-114.1</td>
<td>+139.3</td>
<td>+119.6</td>
<td>-29.0</td>
<td>-115.4</td>
<td>-107.9</td>
<td>-132.0</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+325</td>
<td>0</td>
<td>-211</td>
<td>+91.1</td>
<td>-70.6</td>
<td>+46.9</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td></td>
<td></td>
<td>Loaded – OBSS Mid MPM, SY Held</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td></td>
<td></td>
<td>W4&gt;Berth OBSS Mid NSP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. **CLEAR UHF POSITION MANEUVER**
On SRMS operator GO, release complete, ready for OBSS maneuver to Clear UHF position:

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: Camera C (0, +10)</td>
<td>91: SRMS Elbow (-45, -10)</td>
<td>03: S1 Lower Outboard (+60, +15) 24: Tip Elbow (-150, -10)</td>
<td>Camera D (-10, +20)</td>
</tr>
</tbody>
</table>

Figure 6.- OBSS Grapple (92: Camera C: 0, +10).  
Figure 7.- OBSS Grapple (91: SRMS Elbow: -45, -10).

- **MSS:** SSRMS: **Rate:** [SSRMS Rate]
- Set ‘Scale’ ‘Vernier’ Rate Scale: 1.0 (Verify 1.0)
- **DCP**  BRAKES SSRMS → OFF (Verify OFF)
- **PCS**  MSS: SSRMS: [SSRMS]
  Enter Mode – FOR OCAS (Verify blue)
  MSS: SSRMS: SSRMS FOR OCAS: Joint Lock: [Joint Lock]

**cmd** Shoulder Yaw (Verify SY – Locked)

- **SSRMS FOR OCAS**
- pick File ▶ W4MBS1 ▶ OBSS Clear UHF

Verify ‘FOR’ ‘Destination’ for OBSS Clear UHF position.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-190</td>
<td>-211</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
**cmd Load (Verify Sequence Status – Confirm or Cancel)**

**MON**

Verify FOR and errors are correct on FOR position overlay.

<table>
<thead>
<tr>
<th>FOR</th>
<th>TGT</th>
<th>ERR</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
</tr>
<tr>
<td>+325</td>
<td>0</td>
<td>-211</td>
</tr>
<tr>
<td>0</td>
<td>-190</td>
<td>-211</td>
</tr>
<tr>
<td>+325</td>
<td>+190</td>
<td>0</td>
</tr>
</tbody>
</table>

* If FOR or errors are incorrect

**PCS**

* cmd Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest FOR per table above.
* cmd Load (Verify Sequence Status – Confirm or Cancel)
* Verify FOR and errors are correct on FOR Position overlay.

**NOTE**

1. Clearance between the OBSS and both the UHF Antenna, the SPACEHAB module and the SRMS will be less than 60 cm (2 ft) and can be monitored with Camera C.
2. This FOR OCAS will take approximately 3 minutes to complete in Vernier rates.

**DCP**

AUTO SEQ → PROC

**PCS**

MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify SSRMS at Clear UHF position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>-113.0</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

FOR Loaded – OBSS Mid MPM SY Held
Disp W4>Berth OBSS Mid NSP
5. SETUP FOR MANEUVER TO LOW HOVER
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: Camera C (+10, +5)</td>
<td>91: Camera D (-30, +10)</td>
<td>03: S1 Lower Outboard (+50, +10)</td>
<td>SRMS Elbow (-55, -10)</td>
</tr>
</tbody>
</table>

6. LOW HOVER POSITION MANEUVER

NOTE
Monitor clearance to UHF Antenna using Camera D. Clearance at Low Hover is approximately 96 cm (3.1 ft).

MSS: SSRMS: ■ SSRMS
Verify SY – Locked
SSRMS FOR OCAS

pick File ▶ W4MBS1 ▶ OBSS Low Hover

Verify ‘FOR’ ‘Destination’ for OBSS Low Hover position.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>-100</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON Verify FOR and errors are correct on FOR position overlay.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR</td>
<td>0</td>
<td>-190</td>
<td>-211</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>TGT</td>
<td>0</td>
<td>0</td>
<td>-100</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>ERR</td>
<td>0</td>
<td>-190</td>
<td>-111</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

******************************************************************************
* If FOR or errors are incorrect
*     cmd Cancel (Verify Sequence Status – Waiting Destination)
*     Input correct Dest FOR per table above.
*     cmd Load (Verify Sequence Status – Confirm or Cancel)
* MON Verify FOR and errors are correct on FOR Position overlay.
******************************************************************************

PCS cmd Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
1. Expect only Port motion of OBSS during this FOR OCAS.
2. This FOR OCAS will take approximately 1 minute to complete in Vernier rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at OBSS Low Hover position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>-106.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>-100</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

FOR Loaded – OBSS Mid MPM, SY Held
Disp W4>Berth OBSS Mid NSP
7. ATTITUDE CONTROL CONFIGURATION

MSS: SSRMS: Thrusters: **Thruster Controls for MSS Ops**

Verify ‘Desat Request.’ – Inh

********************************************************************************
* If using shuttle attitude control;
* Coordinate with shuttle crew; DAP: FREE.
********************************************************************************

8. BERTHING OBSS

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>24: Tip Elbow</td>
<td>92: Mux D/C</td>
<td>03: S1 Lower</td>
<td>SRMS Elbow</td>
</tr>
<tr>
<td>(-130, -10)</td>
<td>(D: -25, +5)</td>
<td>Outboard (+50, +10)</td>
<td>(-55, -10)</td>
</tr>
<tr>
<td></td>
<td>(C: +25, 0)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Verify shuttle crew standing by for STBD RMS R-F-L callouts during berth.

MSS: SSRMS: Rate: [SSRMS Rate]

Set ‘Scale’ ‘Vernier’ Rate Scale: 0.5 (Verify 0.5)

MSS: SSRMS: [SSRMS]

Change Command ▶ W4 ▶ Berth OBSS Mid NSP (Verify W4>Berth OBSS Mid NSP)

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: [Joint Lock]

cmd Shoulder Yaw (Verify SY – Locked)
1.220 SSRMS OBSS HANDOFF AND BERTH

THC/RHC Maneuver OBSS to Berthed position (until shuttle crew callout that three of three STBD RMS R-F-L tb - gray, expected at Z = 0)

Expected OBSS Berthed position.

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recorded during unberth</td>
<td>-100.2</td>
<td>+139.3</td>
<td>+142.6</td>
<td>-70.0</td>
<td>-65.3</td>
<td>-111.1</td>
<td>-22.2</td>
</tr>
<tr>
<td>Expected</td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>Recorded during unberth</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Expected FOR Loaded – OBSS Mid MPM, SY Held Disp W4&gt;Berth OBSS Mid NSP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PCS MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Enter Mode – Standby (Verify blue)

Figure 17.- OBSS Berth (03: S1 Lower Outboard: +65, +15).
Figure 18.- OBSS Berth (92: Mux D/C; D FL=10mm).

9. MRL LATCHING SEQUENCE
9.1 Limp Wrist Joints

MSS: SSRMS: Limp: [SSRMS Limp]

sel WP, WY, WR

cmd Execute
1.220 SSRMS OBSS HANDOFF AND BERTH
(RBT FS/13A.1/FIN 1) Page 11 of 15 pages

MSS: SSRMS: [SSRMS]
Verify Limp – blue
Verify WP, WY, WR – Limped

9.2 Latching MRLs to TC
Notify shuttle crew SSRMS limped, GO to latch STBD MRLs to Topological Capture.

9.3 Carriage Derigidization
On shuttle crew GO, ready to limp all SSRMS Joints and derigidize:

MSS: SSRMS: Limp: [SSRMS Limp]
cmd All Limp (Verify Limp – blue)
MSS: SSRMS: [SSRMS]
Verify all joints – Limped
MSS: SSRMS: Tip LEE: [SSRMS Tip LEE]
cmd ‘Carriage’ Derigidize ➤ Slow (Verify Speed – Slow)
Verify ‘Confirm or Terminate’ prompt.
cmd Confirm (Verify RHC Trigger Hot icon)
Verify LEE Mode – Derigidize

RHC TRIGGER → press (momentarily) (SCR 19064)
PCS Verify ‘Carriage’ Derigidize – blue (90 s max)

Notify shuttle crew carriage derigidized, GO to complete latching of STBD MRLs.

10. BERTHING CLEANUP

NOTE
Carriage rigidization is performed in this step to reseat the SSRMS LEE over the OBSS GF prior to initiating a nominal push-off release operation.

On shuttle crew GO, ready for OBSS release:

MSS: SSRMS: Tip LEE: [SSRMS Tip LEE]
cmd ‘Carriage’ Rigidize ➤ Slow (Verify Speed – Slow)
Verify ‘**Confirm or Terminate**’ prompt.

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Rigidize

**RHC** TRIGGER → press (momentarily) (SCR 19064)

**PCS** Verify ‘Carriage’ Tension ~5500 N (90 s max)  
Verify ‘Carriage’ Retract – blue

**DCP** BRAKES SSRMS → ON (Verify ON)

### 11. SETUP FOR RELEASE

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: Camera D</td>
<td>25: Tip LEE</td>
<td>03: S1 Lower</td>
<td>SRMS Elbow</td>
</tr>
<tr>
<td>(-30, +10)</td>
<td></td>
<td>Outboard</td>
<td>(-55, -10)</td>
</tr>
</tbody>
</table>

**NOTE**  
Tip LEE Camera must be fully zoomed out to correspond to target overlay.

Figure 19.- OBSS Berth  
(92: Camera D: -30, +10).

Figure 20.- OBSS Berth  
(03: S1 Lower Outboard: +50, +10).
1.220 SSRMS OBSS HANDOFF AND BERTH
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Figure 21.- OBSS Berth
(V10: SRMS Elbow: -55, -10).

PCS

MSS: SSRMS: [SSRMS]
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held

Change Display ▶ W4 ▶ Berth OBSS FRGF NSP (Verify W4>Berth OBSS FRGF NSP)

Change Command ▶ SSRMS ▶ Internal (Verify SSRMS>Internal)

MSS: SSRMS: Rate: [SSRMS Rate]
Set ‘Scale’ ‘Vernier’ Rate Scale: as desired.

Verify SSRMS at OBSS Berth position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100.2</td>
<td>+139.3</td>
<td>+142.6</td>
<td>-70.0</td>
<td>-65.3</td>
<td>-111.1</td>
<td>-22.2</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+45</td>
<td>+12</td>
<td>+23</td>
<td>+90.0</td>
<td>0.0</td>
<td>-30.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Loaded – OBSS Mid MPM, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;Berth OBSS FRGF NSP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. RELEASING OBSS (PUSHOFF)
DCP
BRAKES SSRMS → OFF (Verify OFF)

12.1 SSRMS Limp
PCS
MSS: SSRMS: Limp: [SSRMS Limp]

(cmd) All Limp (Verify Limp – blue)

MSS: SSRMS: [SSRMS]
Verify all joints – Limped
12.2 Auto Release
MSS: SSRMS: Tip LEE: SSRMS Tip LEE

**cmd** Release ▶ Automatic ▶ Slow (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

**CAUTION**
Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

**NOTE**
Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Release

RHC
TRIGGER → press (momentarily)

PCS
Verify ‘Carriage’ Derigidize – blue (90 s max)
Verify ‘Snare’ Open – blue (12 s max)
Verify ‘Carriage’ Extend – blue (90 s max)

Verify Unloaded Parameters – √

12.3 SSRMS Backoff
MSS: SSRMS: Limp: SSRMS Limp

**cmd** None Limp (Verify Standby – blue)

MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

**cmd** Shoulder Yaw (Verify SY – Locked)
THC/ RHC Maneuver SSRMS to Grapple Fixture Backoff position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>-109.6</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>-150</td>
</tr>
<tr>
<td>FOR</td>
</tr>
<tr>
<td>Disp</td>
</tr>
</tbody>
</table>

Verify Posn Hold – orange

DCP BRAKES SSRMS → ON (Verify ON)

Notify SRMS operator OBSS release complete, GO for maneuver to pre-crade.

Figure 22.- Grapple Fixture Backoff (91: Camera D: -30, +20).

Figure 23.- Grapple Fixture Backoff (03: S1 Lower Outboard: +50, +10).
1. **SETUP**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+75, +10)</td>
<td>22: Base Elbow (-130, -15)</td>
<td>24: Tip Elbow (-130, -10) (37: MBS Mast (+105, -50))</td>
<td>Camera C (0, +20)</td>
</tr>
</tbody>
</table>

PCS

MSS: SSRMS: 

Change Loaded Parameters ▶ Walk Off ▶ LAB PDGF
Verify ‘Loaded Parameters’ (two) – LAB PDGF, SR Held

Verify Unloaded Parameters – √
Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SRH
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SR Held

Change Display ▶ W4 ▶ LAB PDGF (Verify W4>LAB PDGF)
Verify Command – SSRMS>Internal

√ Vernier

MSS: SSRMS: Rate: 

Set ‘Scale’ ‘Vernier’ Rate Scale: 1.0 (Verify 1.0)

Verify SSRMS at Grapple Fixture Backoff position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-109.6</td>
<td>+139.3</td>
<td>+134.4</td>
<td>-72.5</td>
<td>-43.5</td>
<td>-112.7</td>
<td>-3.5</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-219</td>
<td>-654</td>
<td>-388</td>
<td>+83.4</td>
<td>-8.3</td>
<td>-37.9</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SR Held
Disp W4>LAB PDGF
1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF
(RBT FS/13A.1/FIN 1)  Page 2 of 15 pages

2. **JOINT OCAS TO INTERMEDIATE POSITION**
On SRMS operator GO, maneuver to Pre-Cradle complete:

**DCP**  BRAKES SSRMS → OFF (Verify OFF)

**PCS**  MSS: SSRMS: **SSRMS**

Enter Mode – Joint OCAS (Verify blue)

**SSRMS** Joint OCAS

pick File ▶ W4MBS1 ▶ LAB Pregrap Inter
Verify ‘Joint Angles’ ‘Destination’ for LAB PDGF Pre-Grapple Intermediate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-158.7</td>
<td>+117.8</td>
<td>+110.0</td>
<td>-73.0</td>
<td>-144.5</td>
<td>+17.6</td>
<td>-65.4</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**
Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR (current)</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-109.6</td>
<td>+139.3</td>
<td>+134.4</td>
<td>-72.5</td>
<td>-43.5</td>
<td>-112.7</td>
<td>-3.5</td>
</tr>
</tbody>
</table>

**TGT**

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-158.7</td>
<td>+117.8</td>
<td>+110.0</td>
<td>-73.0</td>
<td>-144.5</td>
<td>+17.6</td>
<td>-65.4</td>
</tr>
</tbody>
</table>

**ERR**

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+49.1</td>
<td>+21.5</td>
<td>+24.4</td>
<td>+0.5</td>
<td>+101.0</td>
<td>-130.3</td>
<td>+61.9</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

**PCS**

- **cmd** Cancel (Verify Sequence Status – Waiting Destination)
- Input correct Dest joint angles per table above.
- **cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

- Verify joint angles and errors are correct on Joint Angle Position overlay.

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

**PCS**

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

---

**NOTE**
This Joint OCAS will take approximately 3 minutes to complete in Vernier rates.

**DCP**
AUTO SEQ → PROC

**PCS**

MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-158.7</td>
<td>+117.8</td>
<td>+110.0</td>
<td>-73.0</td>
<td>-144.5</td>
<td>+17.6</td>
<td>-65.4</td>
</tr>
</tbody>
</table>
3. **LAB PDGF PRE-GRAPPLE MANEUVER**

MSS: SSRMS: [SSRMS]

Enter Mode – Single (Verify blue)

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**NOTE**

Clearance between the SSRMS Base Boom and the LAB External Camera will be less than 58 cm (1.9 ft) at the end of this maneuver and can be monitored using the Tip Elbow or MBS Mast Camera.

**THC** Perform Single Joint maneuver to LAB PDGF Pre-Grapple position (within 1 deg).

<table>
<thead>
<tr>
<th>LAB PDGF Pre-Grapple Intermediate</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: SP</td>
<td>-158.7</td>
<td>+117.8</td>
<td>+110.0</td>
<td>-73.0</td>
<td>-144.5</td>
<td>+17.6</td>
<td>-65.4</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SR Held

<table>
<thead>
<tr>
<th>PCS</th>
<th>MSS: SSRMS: [SSRMS]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enter Mode – Standby (Verify blue)</td>
</tr>
</tbody>
</table>

13 JUL 07 82 18383.doc
4. **LAB PDGF GRAPPLE SETUP**

Configure Cameras and overlays for grapple.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>09: P1 Lower Outboard (+100, +13) FL = 25 mm</td>
<td>25: Tip LEE</td>
<td>37: MBS Mast (+105, -5)</td>
<td>Camera C (0, +20)</td>
</tr>
</tbody>
</table>

**NOTE**

The LEE Camera must be fully zoomed out to correspond to the target overlay.

MSS: SSRMS: Rate: [SSRMS Rate]

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired
5. **LAB PDGF GRAPPLE**

**PCS**

MSS: SSRMS: **SSRMS**

Enter Mode – Manual (Verify blue)


**cmd** Shoulder Roll (Verify SR – Locked)

**RHC/THC**

Maneuver to within grapple envelope.

**PCS**

MSS: SSRMS: Tip LEE: **SSRMS Tip LEE**

**cmd** Capture ▶ Automatic ▶ Slow, Limp (Verify Speed – Slow)

Verify ‘**Confirm or Terminate**’ prompt.

### CAUTION

Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

### NOTE

Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Capture

### NOTE

Clearance between the SSRMS Tip Boom and the US LAB will be less than 46 cm (1.5 ft) at the end of this maneuver and can be monitored using the Base Elbow, Tip Elbow, and P1 Lower Outboard Cameras.

**RHC**

TRIGGER → press (momentarily)

**PCS**

Verify ‘Snare’ Close, Capture (two) – blue (12 s max)

Verify Capture to Latch – Yes (SCR 19282)

Verify ‘Carriage’ Tension ~5500 N (90 s max)

Verify ‘Carriage’ Retract – blue

Verify ‘Latch’ Latch – blue (65 s max)

### NOTE

Expect ‘**R3L – SSRMS Pwr Flags Fail**’ Robotics Advisory message while Tip LEE is mated (SCR 19019).
1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF
(RBT FS/13A.1/FIN 1) Page 7 of 15 pages

Verify LEE Mode – Mate

RHC
TRIGGER → press (momentarily)

PCS
Verify ‘Umbilical’ Mate – blue (10 s max)
Verify ‘Connector Continuity’ Prime, Redundant (two) – Yes

Verify Loaded Parameters – √

Verify SSRMS at LAB PDGF Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-158.7</td>
<td>+120.7</td>
<td>+74.5</td>
<td>-91.4</td>
<td>-135.2</td>
<td>+20.1</td>
<td>-66.9</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Loaded – LAB PDGF, SR Held
Disp W4>LAB PDGF

NOTE
Expect the following message when safing is commanded:
‘R3Z - MSS OCS SSRMS Prime(Redun) ACU SRT Cat-1 Brk Stat Fall’ (SCR 17495)
This message should return to Norm.

DCP
SAFING → SAFE (Verify ON)

Figure 11.- LAB PDGF Grapple
(09: P1 Lower Outboard: +100, +13 FL = 25 mm).

Figure 12.- LAB PDGF Grapple
(V10: Camera C: 0, +20).
6. **BASE CHANGE CLEANUP**

On MCC-H GO, base change complete:

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+75, 0)</td>
<td>25: Tip LEE</td>
<td>24: Tip Elbow (-10, +20)</td>
<td>Camera C (0, +20)</td>
</tr>
<tr>
<td>37: MBS Mast (+105, -5)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**
The LEE Camera must be fully zoomed out to correspond to the target overlay.

PCS

**MSS: SSRMS: SSRMS**

Verify Loaded Parameters – √
Verify ‘Loaded Parameters’ (two) – MBS PDGF 1, SR Held

Verify ‘Unloaded Parameters’ (two) – LEE Tip, SR Held

Change Display ▶ISS ▶W4MBS PDGF 1 (Verify ISS>W4MBS PDGF 1)

Verify Command – SSRMS>Internal

Verify SSRMS at MBS PDGF 1 Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-66.9</td>
<td>-20.1</td>
<td>-135.2</td>
<td>-91.4</td>
<td>+74.5</td>
<td>-120.7</td>
<td>-158.7</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Loaded – MBS PDGF 1, SR Held
Disp ISS>W4MBS PDGF 1

√Vernier

**MSS: SSRMS: Rate: SSRMS Rate**

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired

**MSS: SSRMS: SSRMS Safing: SSRMS Safing**

**cmd** Remove (Verify Not Safed)

DCP

BRAKES SSRMS → OFF (Verify OFF)
7. **MBS PDGF 1 RELEASE**

7.1 Joint Limp and Mode Entry

PCS

**MSS: SSRMS: Limp:** [SSRMS Limp]

**cmd** All Limp (Verify Limp – blue)

**MSS: SSRMS:** [SSRMS]

Verify all joints – Limped

Wait 30 seconds.

**cmd** None Limp (Verify Standby – blue)

**MSS: SSRMS:** [SSRMS]

Enter Mode – Manual (Verify blue)

**MSS: SSRMS: SSRMS Manual: Joint Lock:** [Joint Lock]

**cmd** Shoulder Roll (Verify SR – Locked)

7.2 Carriage Rigidize

**MSS: SSRMS: Tip LEE:** [SSRMS Tip LEE]

**cmd** ‘Carriage’ Rigidize ► Slow (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.
CAUTION
Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

NOTE
Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Rigidize

RHC

TRIGGER → press (momentarily) (SCR 19064)

PCS

Verify ‘Carriage’ Tension ~5500 N (90 s max)

Verify ‘Carriage’ Retract – blue

7.3 Semi-Manual Release

MSS: SSRMS: Tip LEE: [SSRMS Tip LEE]

**cmd** Release ► Semi-manual ► Slow (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

CAUTION
Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

NOTE
Expect ‘R3L – SSRMS Pwr Flags Fail’ Robotics Advisory message to return to norm when Tip LEE umbilicals are demated (SCR 19019).

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Semi-manual Release

RHC

TRIGGER → press (hold until ‘Latch’ Brakes – On) (10 s max)
1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF (RBT FS/13A.1/FIN 1)

PCS Verify ‘Umbilical’ Demate – blue
RHC TRIGGER → press (hold until ‘Latch’ Brakes – On) (65 s max)
PCS Verify ‘Latch’ Unlatch – blue
RHC TRIGGER → press (hold until ‘Carriage’ Brakes – On) (90 s max)
PCS Verify ‘Carriage’ Derigidize – blue
RHC TRIGGER → press (hold until ‘Snare’ Brakes – On) (12 s max)
PCS Verify ‘Snare’ Open – blue

7.4 Release Completion
THC Back off from grapple fixture until clear of pin.
RHC TRIGGER → press (hold until ‘Carriage’ Brakes – On) (90 s max)
PCS Verify ‘Carriage’ Extend – blue
THC/RHC Maneuver SSRMS to MBS PDGF 1 Pre-Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-66.9</td>
<td>-27.4</td>
<td>-136.2</td>
<td>-85.6</td>
<td>+65.1</td>
<td>-127.2</td>
<td>-164.3</td>
</tr>
<tr>
<td></td>
<td>-150</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – LEE Tip, SR Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>ISS&gt;W4MBS PDGF 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 15.- MBS PDGF 1 Pre-Grapple (03: S1 Lower Outboard: +75, 0).
Figure 16.- MBS PDGF 1 Pre-Grapple (24: Tip Elbow: -10, +20).
8. **LAB/ESP2 CLEARANCE MANEUVER**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+75, +10)</td>
<td>22: Base Elbow (-120, -10)</td>
<td>37: MBS Mast (+105, -18)</td>
<td>Camera C (0, +20)</td>
</tr>
</tbody>
</table>

Figure 17.- MBS PDGF 1 Pre-Grapple (22: Base Elbow: -120, -10).

Figure 18.- MBS PDGF 1 Pre-Grapple (37: MBS Mast: +105, -18).

PCS

MSS: SSRMS: Rate: [SSRMS Rate]

Set ‘Scale’ ‘Vernier’ Rate Scale: 1.0 (Verify 1.0)

MSS: SSRMS: [SSRMS]

Enter Mode – Single (Verify blue)

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**NOTE**

Clearance between the SSRMS and ESP2 will be less than 58 cm (1.9 ft) during this maneuver and can be monitored using the S1 Lower Outboard or MBS Mast Cameras.
THC

Perform Single Joint maneuver to LAB/ESP2 Clearance position (within 1 deg).

<table>
<thead>
<tr>
<th>MBS PDGF 1 Pre-Grapple</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: SP +</td>
<td>-66.9</td>
<td>-27.4</td>
<td>-136.2</td>
<td>-85.6</td>
<td>+65.1</td>
<td>-127.2</td>
<td>-164.3</td>
</tr>
<tr>
<td>LAB/ESP-2 Clearance</td>
<td>-66.9</td>
<td>-27.4</td>
<td>-64.0</td>
<td>-85.6</td>
<td>+65.1</td>
<td>-127.2</td>
<td>-164.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>+33</td>
<td>+521</td>
<td>+962</td>
<td>+31.9</td>
<td>-28.5</td>
<td>-52.0</td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SR Held
Disp ISS>W4MBS PDGF 1

Figure 19.- LAB/ESP2 Clearance
(03: S1 Lower Outboard: +75, +10).

Figure 20.- LAB/ESP2 Clearance
(37: MBS Mast: +105, -18).

9. **OVERNIGHT PARK POSITION MANEUVER**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+100, +20)</td>
<td>22: Base Elbow (-120, -10)</td>
<td>91: Camera D (-10, +60)</td>
<td>Camera C (0, +40)</td>
</tr>
</tbody>
</table>
PCS  MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

RHC  RATE → COARSE (Verify Coarse on PCS)

SSRMS Joint OCAS

Input ‘Joint Angles’ ‘Destination’ for Overnight Park position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-68.9</td>
<td>+25.7</td>
<td>-74.1</td>
<td>-83.2</td>
<td>+4.0</td>
<td>+32.0</td>
<td>-170.5</td>
</tr>
</tbody>
</table>

cmd Load (Verify Sequence Status – Confirm or Cancel)

MON  Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-66.9</td>
<td>-27.4</td>
<td>-64.0</td>
<td>-85.6</td>
<td>+65.1</td>
<td>-127.2</td>
</tr>
<tr>
<td>TGT</td>
<td>-68.9</td>
<td>+25.7</td>
<td>-74.1</td>
<td>-83.2</td>
<td>+4.0</td>
<td>+32.0</td>
</tr>
<tr>
<td>ERR</td>
<td>+2.0</td>
<td>-53.1</td>
<td>+10.1</td>
<td>-2.4</td>
<td>+61.1</td>
<td>-159.2</td>
</tr>
</tbody>
</table>

************************************************************************************
* If joint angles or errors are incorrect
  * cmd Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * cmd Load (Verify Sequence Status – Confirm or Cancel)
  * Verify joint angles and errors are correct on Joint Angle Position overlay.
  **********************************************************************************

PCS  cmd Confirm (Verify Sequence Status – Auto Seq sw - Hot)
**NOTE**
This Joint OCAS will take approximately 1 minute to complete in Coarse rates.

DCP  AUTO SEQ → PROC

PCS  MSS: SSRMS:  
Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-68.9</td>
<td>+25.7</td>
<td>-74.1</td>
<td>-83.2</td>
<td>+4.0</td>
<td>+32.0</td>
<td>-170.5</td>
</tr>
</tbody>
</table>

RHC  RATE → VERNIER (Verify Vernier on PCS)

**NOTE**
Expect the following message when safing is commanded:

'R3Z - MSS OCS SSRMS Prime(Redun) ACU SRT Cat-1 Brk Stat Fail' (SCR 17495)

This message should return to Norm.

DCP  SAFING → SAFE (Verify ON)

Figure 22.- Overnight Park
(91: Camera D: -10, +60).

Figure 23.- Overnight Park
(22: Base Elbow: -110, -10).
Configure the ISS Downlink per the following table:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1 | LAB Stbd Zenith  
   (+150, -40)  
   FL = 30 mm |
| 2 | Camera A  
   (-46, +122)  
   FL = 30 mm |
|   | Camera B  
   (-5, +19)  
   FL = 50 mm |

Verify SSRMS is at the Overnight Park position (within 1 deg).

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>SY</td>
<td>SP</td>
<td>EP</td>
<td>WP</td>
<td>WY</td>
</tr>
<tr>
<td>-68.9</td>
<td>+25.7</td>
<td>-74.1</td>
<td>-83.2</td>
<td>+4.0</td>
<td>+32.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-170.5</td>
</tr>
</tbody>
</table>

1. **LAB STBD ZENITH CAMERA SURVEY**
   Coordinate with CATO to pan, tilt and zoom the LAB Stbd Zenith Camera as follows:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| LAB Stbd Zenith  
   (+150, -40)  
   FL = 30 mm | Stop at | Survey Notes | Complete |
| Start Config | MT Translation Path | MT Translation Path |
| 1: Tilt Dn  
   (+150, -50) | | |

Figure 1.- LAB Stbd Zenith Start  
(LAB Stbd Zenith: +150, -40).

Figure 2.- LAB Stbd Zenith - Step 1  
(LAB Stbd Zenith: +150, -50).
2. **CAMERA A SURVEY**

Coordinate with INCO to pan, tilt, and zoom Camera A as follows:

<table>
<thead>
<tr>
<th></th>
<th>Camera A</th>
<th>Stop at</th>
<th>Survey Notes</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start Config</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FL</strong> = 30 mm</td>
<td>(-46, +122)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MT Translation Path</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Pan Lt</td>
<td>(-56, +122)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Tilt Up</td>
<td>(-56, +134)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: Pan Lt</td>
<td>(-66, +134)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: Tilt Up</td>
<td>(-66, +143)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: Pan Lt</td>
<td>(-75, +143)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6: Tilt Up</td>
<td>(-75, +160)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 3.- Camera A Start](image1)

(Camera A: -46, +122).

![Figure 4.- Camera A - Step 2](image2)

(Camera A: -56, +134).

![Figure 5.- Camera A - Step 4](image3)

(Camera A: -66, +143).

![Figure 6.- Camera A - Step 6](image4)

(Camera A: -75, +160).
3. **CAMERA B SURVEY**

Coordinate with INCO to pan, tilt, and zoom Camera B as follows:

<table>
<thead>
<tr>
<th>Camera B</th>
<th>Stop at</th>
<th>Survey Notes</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Config</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FL = 50 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Pan Lt (-30, +19)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Tilt Dn (-30, +14)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: Pan Lt (-40, +14)</td>
<td>MT Translation Path</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 7.- Camera B Start](Camera B: -5, +19).

![Figure 8.- Camera B - Step 1](Camera B: -30, +19).

![Figure 9.- Camera B - Step 2](Camera B: -30, +14).

![Figure 10.- Camera B - Step 3](Camera B: -40, +14).
1. SETUP
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+95, +15)</td>
<td>24: Tip Elbow (-5, 0)</td>
<td>22: Base Elbow (-110, -20)</td>
<td>Camera C (+10, +30)</td>
</tr>
<tr>
<td>(09: P1 Lower Outboard (+90, +15))</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PCS

Verify Unloaded Parameters – √
Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SYH
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held
Change Display ▶ ISS ▶ ISSACS (Verify ISS>ISSACS)
Change Command ▶ ISS ▶ ISSACS (Verify ISS>ISSACS)

√Vernier

Verify SSRMS at Overnight Park position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-68.9</td>
<td>+25.7</td>
<td>-74.1</td>
<td>-83.2</td>
<td>+4.0</td>
<td>+32.0</td>
<td>-170.5</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-351</td>
<td>+797</td>
<td>+1015</td>
<td>+89.9</td>
<td>+61.8</td>
<td>-88.5</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - LEE Tip, SY Held
Disp ISS>ISSACS

2. AIRLOCK APPROACH MANEUVER

MSS: SSRMS: SSRMS Safing:

cmd Remove (Verify Not Safed)
1.300 SSRMS CMG R&R EVA SUPPORT
(RBT FS/13A.1/FIN 1)

DCP  BRAKES SSRMS → OFF (Verify OFF)

RHC  RATE → COARSE (Verify Coarse on PCS)

PCS  MSS: SSRMS: SSRMS
Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input ‘Joint Angles’ ‘Destination’ for Airlock Approach position.

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>SY</td>
<td>SP</td>
<td>EP</td>
<td>WP</td>
<td>WY</td>
<td>WR</td>
</tr>
<tr>
<td>-69.2</td>
<td>25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON  Verify joint angles and errors are correct on Joint Angle Position overlay.

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(current) SR</td>
<td>SY</td>
<td>SP</td>
<td>EP</td>
<td>WP</td>
<td>WY</td>
<td>WR</td>
</tr>
<tr>
<td>-68.9</td>
<td>25.7</td>
<td>-74.1</td>
<td>-83.2</td>
<td>+4.0</td>
<td>+32.0</td>
<td>-170.5</td>
</tr>
<tr>
<td>TGT</td>
<td>-69.2</td>
<td>25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
</tr>
<tr>
<td>ERR</td>
<td>+0.3</td>
<td>0.0</td>
<td>+7.8</td>
<td>-3.2</td>
<td>+14.6</td>
<td>+97.4</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

PCS  * **cmd** Cancel (Verify Sequence Status – Waiting Destination)

* Input correct Dest joint angles per table above.

* **cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON  * Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS  **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
This Joint OCAS will take approximately 1 minute to complete in Coarse rates.

DCP  AUTO SEQ → PROC

PCS  MSS: SSRMS: SSRMS
Verify Posn Hold – orange
Verify SSRMS at Airlock Approach position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-522</td>
<td>+684</td>
<td>+932</td>
<td>+170.0</td>
<td>-14.8</td>
<td>+29.7</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - LEE Tip, SY Held
Disp ISS>ISSACS

Figure 3.- Airlock Approach
(03: S1 Lower Outboard: +95, +15).

Figure 4.- Airlock Approach
(24: Tip Elbow: -5, 0).

3. **APFR INSTALL AND INGRESS MANEUVER**

**RHC**

RATE → VERNIER (Verify Vernier on PCS)

On EV GO, ready for maneuver for APFR install:

**PCS**

MSS: SSRMS: **SSRMS**

Enter Mode – Single (Verify blue)

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**THC**

Perform Single Joint maneuver to APFR Install and Ingress position (within 1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-95.3</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
<tr>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-95.3</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-472</td>
<td>+558</td>
<td>+775</td>
<td>+165.8</td>
<td>-19.7</td>
<td>+42.3</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - LEE Tip, SY Held
Disp ISS>ISSACS
1.300 SSRMS CMG R&R EVA SUPPORT
(RBT FS/13A.1/FIN 1) Page 4 of 31 pages

PCS MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

THC/RHC

Perform EVA GCA as required for APFR install and ingress.

NOTE
APFR settings are 12/PP/F/4 for this task.

PCS MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

Change Unloaded Parameters ▶ EVA ▶ Chest 12/PP/F/4 SYH
Verify ‘Unloaded Parameters’ (two) – Chest 12/PP/F/4, SY Held

Change Command ▶ SSRMS ▶ Internal (Verify SSRMS>Internal)

4. AIRLOCK APPROACH MANEUVER
On EV GO, APFR ingressed, ready to maneuver clear:

MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)
WARNING

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

THC

Perform Single Joint maneuver to Airlock Approach position (within 1 deg).

<table>
<thead>
<tr>
<th>APFR Install and Ingress</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-95.3</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
<tr>
<td>Airlock Approach</td>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>-655</td>
<td>+625</td>
<td>+823</td>
<td>+40.7</td>
<td>-67.4</td>
<td>-41.6</td>
</tr>
</tbody>
</table>

FOR: Unloaded - Chest 12/PP/F/4, SY Held
Disp: ISS>ISSACS

PCP

* If FOR at Airlock Approach is not within 5 cm/1 deg due to EVA GCA, perform the following:

* MSS: SSRMS: SSRMS

* Change Command ▶ ISS ▶ ISSACS (Verify ISS>ISSACS)

* MSS: SSRMS: SSRMS

* Enter Mode – Manual (Verify blue)

* MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

* cmd Shoulder Yaw (Verify SY – Locked)

THC/RHC

* Maneuver to Airlock Approach position per above FOR table.

* MSS: SSRMS: SSRMS

* Change Command ▶ SSRMS ▶ Internal (Verify SSRMS>Internal)

PEND 103
5. MANEUVER TO PAYLOAD BAY

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+95, +15)</td>
<td>24: Tip Elbow (-5, +10)</td>
<td>91: SRMS Elbow (-145, +5)</td>
<td>Camera C (+10, +30)</td>
</tr>
<tr>
<td>(09: P1 Lower Outboard (+90, +15))</td>
<td>(22: Base Elbow (-115, -20))</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 9.- Airlock Approach (91: SRMS Elbow: -145, +5).

PCS

MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

RHC

RATE → COARSE (Verify Coarse on PCS)

PCS

SSRMS Joint OCAS

pick File ▶ LAB ▶ Payload Bay Access
Verify ‘Joint Angles’ ‘Destination’ for Payload Bay Access position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+21.4</td>
<td>+42.7</td>
<td>-32.4</td>
<td>+102.6</td>
<td>-47.2</td>
<td>+26.8</td>
<td>+119.5</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
<tr>
<td>TGT</td>
<td>+21.4</td>
<td>+42.7</td>
<td>-32.4</td>
<td>+102.6</td>
<td>-47.2</td>
<td>+26.8</td>
</tr>
<tr>
<td>ERR</td>
<td>-90.6</td>
<td>-17.0</td>
<td>-49.5</td>
<td>-182.6</td>
<td>+36.6</td>
<td>-92.2</td>
</tr>
</tbody>
</table>

**************************************************************************************
* If joint angles or errors are incorrect
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* * Input correct Dest joint angles per table above.
* * **cmd** Load (Verify Sequence Status – Confirm or Cancel)
* * MON
* * Verify joint angles and errors are correct on Joint Angle Position overlay.
**************************************************************************************

PCS

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**


2. This Joint OCAS will take approximately 5 minutes to complete in Coarse rates.

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify SSRMS at Payload Bay Access position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+21.4</td>
<td>+42.7</td>
<td>-32.4</td>
<td>+102.6</td>
<td>-47.2</td>
<td>+26.8</td>
<td>+119.5</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+500</td>
<td>-151</td>
<td>+1935</td>
<td>0.0</td>
<td>0.0</td>
<td>+145.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - Chest 12/PP/F/4, SY Held
Disp ISS>ISSACS
6. CMG/FRAM REMOVAL FROM ESP3
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>09: P1 Lower Outboard (+110, +30)</td>
<td>22: Base Elbow (+95, -10)</td>
<td>13: LAB Stbd Zenith (0, -40)</td>
<td>Camera B (+15, +40)</td>
</tr>
<tr>
<td>(03: S1 Lower Outboard (+95, +15))</td>
<td>(24: Tip Elbow (-5, -5))</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On EV GO, ready for maneuver to CMG:

RHC_RATE → VERNIER (Verify Vernier on PCS)

PCS_MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

**cmd** Shoulder Yaw (Verify SY – Locked)

**THC/RHC** Maneuver to ESP3 CMG/FRAM Removal position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>+9.7</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>+785</td>
</tr>
</tbody>
</table>

**FOR** Unloaded - Chest 12/PP/F/4, SY Held

**Disp** ISS>ISSACS

Perform EVA GCA as required for CMG/FRAM removal.

**Figure 14.** ESP-3 CMG/FRAM Removal (22: Base Elbow: +105, -10).

**Figure 15.** ESP-3 CMG/FRAM Removal (13: LAB Stbd Zenith: 0, -40).

On EV GO, FRAM released, ready to maneuver to ESP2:

Maneuver to Payload Bay Access position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>+21.4</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>+500</td>
</tr>
</tbody>
</table>

**FOR** Unloaded - Chest 12/PP/F/4, SY Held

**Disp** ISS>ISSACS
7. **ESP2 MANEUVER WITH NEW CMG**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+95, +15)</td>
<td>24: Tip Elbow (-5, 0)</td>
<td>92: Camera B (+15, +35)</td>
<td>SRMS Elbow (-145, +5)</td>
</tr>
</tbody>
</table>

PCS

MSS: SSRMS: **SSRMS**

Enter Mode – Joint OCAS (Verify blue)

**SSRMS Joint OCAS**

pick File ▶ LAB ▶ ESP2 Clearance

Verify ‘Joint Angles’ ‘Destination’ for ESP2 Clearance position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-85.8</td>
<td>+14.4</td>
<td>-84.0</td>
<td>-66.0</td>
<td>-156.1</td>
<td>-12.1</td>
<td>+146.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>+21.4</td>
<td>+42.7</td>
<td>-32.4</td>
<td>+102.6</td>
<td>-47.2</td>
<td>+26.8</td>
</tr>
<tr>
<td>TGT</td>
<td>-85.8</td>
<td>+14.4</td>
<td>-84.0</td>
<td>-66.0</td>
<td>-156.1</td>
<td>-12.1</td>
</tr>
<tr>
<td>ERR</td>
<td>+107.2</td>
<td>+28.3</td>
<td>+51.6</td>
<td>+168.6</td>
<td>+108.9</td>
<td>+38.9</td>
</tr>
</tbody>
</table>
**1.300 SSRMS CMG R&R EVA SUPPORT**

13 JUL 07

---

**PCS**

* If joint angles or errors are incorrect

**cmd** Cancel (Verify Sequence Status – Waiting Destination)

* Input correct Dest joint angles per table above.

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

* Verify joint angles and errors are correct on Joint Angle Position overlay.

---

**PCS**

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**


2. This Joint OCAS will take approximately 6 minutes to complete in Vernier rates.

---

**DCP**

AUTO SEQ → PROC

**PCS**

MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at ESP2 Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-85.8</td>
<td>+14.4</td>
<td>-84.0</td>
<td>-66.0</td>
<td>-156.1</td>
<td>-12.1</td>
<td>+146.0</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-110</td>
<td>+650</td>
<td>+961</td>
<td>+90.0</td>
<td>+0.1</td>
<td>-90.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded - Chest 12/PP/F/4, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>ISS&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Figure 18.** - ESP2 Clearance

(03: S1 Lower Outboard: +95, +15).

**Figure 19.** - ESP2 Clearance

(24: Tip Elbow: -45, +15).
8. **CMG/FRAM INSTALL**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+95, +15)</td>
<td>24: Tip Elbow (-45, +15)</td>
<td>22: Base Elbow (-110, -20) (92: Camera C (+10, +30))</td>
<td>SRMS Elbow (-145, +5)</td>
</tr>
</tbody>
</table>

**MSS: SSRMS:** [SSRMS]

Enter Mode – Manual (Verify blue)

**MSS:** SSRMS: SSRMS Manual: Joint Lock: [Joint Lock]

**cmd** Shoulder Yaw (Verify SY – Locked)

**THC/RHC** Maneuver to ESP2 CMG/FRAM Install position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-86.7</td>
<td>+14.4</td>
<td>-87.9</td>
<td>-68.5</td>
<td>-149.9</td>
<td>-11.4</td>
<td>+146.5</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-110</td>
<td>+650</td>
<td>+860</td>
<td>+90.0</td>
<td>+0.1</td>
<td>-90.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - Chest 12/PP/F/4, SY Held

Disp ISS>ISSACS

Perform EVA GCA as required for CMG/FRAM install.

![Figure 20.- ESP2 CMG/FRAM Install (22: Base Elbow: -110, -20).](image-url)
9. **Z1 ACCESS MANEUVER**

9.1 First Z1 Intermediate Maneuver

On EV GO, FRAM Installed, ready to maneuver to Z1:

Maneuver to ESP2 Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-85.8</td>
<td>+14.4</td>
<td>-84.0</td>
<td>-66.0</td>
<td>-156.0</td>
<td>-12.1</td>
<td>+146.0</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-110</td>
<td>+650</td>
<td>+960</td>
<td>+90.0</td>
<td>+0.1</td>
<td>-90.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - Chest 12/PP/F/4, SY Held
Disp ISS>ISSACS

---

Figure 21.- ESP2 Clearance
(03: S1 Lower Outboard: +95, +15).

**PCS**

MSS: SSRMS: **SSRMS**

Enter Mode – Joint OCAS (Verify blue)

**SSRMS Joint OCAS**

pick File ► LAB ► Z1 Intermediate 1

Verify ‘Joint Angles’ ‘Destination’ for Z1 Intermediate1 position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
<td>+30.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-85.8</td>
<td>+14.4</td>
<td>-84.0</td>
<td>-66.0</td>
<td>-156.0</td>
<td>-12.1</td>
</tr>
<tr>
<td><strong>TGT</strong></td>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
</tr>
<tr>
<td><strong>ERR</strong></td>
<td>-70.8</td>
<td>-5.6</td>
<td>-104.0</td>
<td>+44.0</td>
<td>-176.0</td>
<td>-2.1</td>
</tr>
</tbody>
</table>
* If joint angles or errors are incorrect
  * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * **cmd** Load (Verify Sequence Status – Confirm or Cancel)

* Verify joint angles and errors are correct on Joint Angle Position overlay.

---

**PCS**

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**

This Joint OCAS will take approximately 5 minutes to complete in Vernier rates.

**DCP**

AUTO SEQ → PROC

**PCS**

MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
<td>+30.0</td>
</tr>
</tbody>
</table>

Figure 22.- Z1 Intermediate 1
(03: S1 Lower Outboard: +95, +15).

Figure 23.- Z1 Intermediate 1
(22: Base Elbow: -100, -20).
9.2 Second Z1 Intermediate Maneuver
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>09: P1 Lower Outboard (+75, +15)</td>
<td>22: Base Elbow (-100, -10) (24: Tip Elbow (0, 0))</td>
<td>91: Camera B (-10, 40) 92: Camera A (0, +40)</td>
<td>SRMS Elbow (+170, +10)</td>
</tr>
</tbody>
</table>

**SSRMS Joint OCAS**

pick File ▶ LAB ▶ Z1 Intermediate 2

Verify ‘Joint Angles’ ‘Destination’ for Z1 Intermediate 2 position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+32.6</td>
<td>-24.5</td>
<td>-55.0</td>
<td>-61.5</td>
<td>-48.1</td>
<td>+27.9</td>
<td>-17.3</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**
Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
</tr>
<tr>
<td>TGT</td>
<td>+32.6</td>
<td>-24.5</td>
<td>-55.0</td>
<td>-61.5</td>
<td>-48.1</td>
<td>+27.9</td>
</tr>
<tr>
<td>ERR</td>
<td>-47.6</td>
<td>+44.5</td>
<td>+75.0</td>
<td>-48.5</td>
<td>+68.1</td>
<td>-37.9</td>
</tr>
</tbody>
</table>

*******************************************************************************
* If joint angles or errors are incorrect
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* * Input correct Dest joint angles per table above.
* * **cmd** Load (Verify Sequence Status – Confirm or Cancel)
* * **MON**
* * Verify joint angles and errors are correct on Joint Angle
* * Position overlay.
*******************************************************************************

**PCS**
**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**
This Joint OCAS will take approximately 3 minutes to complete in Vernier rates.

**DCP**
AUTO SEQ → PROC

**PCS**
MSS: SSRMS: [SSRMS]
Verify Posn Hold – orange
Verify Joint Angle values.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+32.6</td>
<td>-24.5</td>
<td>-55.0</td>
<td>-61.5</td>
<td>-48.1</td>
<td>+27.9</td>
<td>-17.3</td>
</tr>
</tbody>
</table>

Figure 24.- Z1 Intermediate 2
(22: Base Elbow: -120, 0).

Figure 25.- Z1 Intermediate 2
(V10: SRMS Elbow: +170, +10).

9.3 Z1 Access Maneuver

MSS: SSRMS

Enter Mode – Single (Verify blue)

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**NOTE**

Clearance between the new CMG and the Z1 truss will not be visible at the end of the maneuver. EV should confirm clearances while approaching the Z1 truss.

THC

Perform Single Joint maneuver to Z1 Access position (within 1 deg).

<table>
<thead>
<tr>
<th>Z1 Interm 2</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: SP –</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z1 Access</td>
<td>+32.6</td>
<td>-24.5</td>
<td>-83.1</td>
<td>-61.5</td>
<td>-48.1</td>
<td>+27.9</td>
<td>-17.3</td>
</tr>
</tbody>
</table>

FOR Unloaded - Chest 12/PP/F/4, SY Held
Disp ISS>ISSACS
10. **CMG HANDOFF**

On EV GO, ready to maneuver to CMG Handoff:

**PCS**

MSS: SSRMS: [SSRMS]

Change Command ➤ ISS ➤ ISSACS/Internal

Verify ISS>ISSACS/Internal

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: [Joint Lock]

**cmd** Shoulder Yaw (Verify SY – Locked)

**THC/ RHC**

Maneuver to CMG Handoff position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+31.1</td>
<td>-24.5</td>
<td>-85.7</td>
<td>-62.3</td>
<td>-43.4</td>
<td>+28.2</td>
<td>-18.8</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-776</td>
<td>-20</td>
<td>+56</td>
<td>+0.1</td>
<td>+15.0</td>
<td>+90.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - Chest 12/PP/F/4, SY Held

Disp ISS>ISSACS

Perform EVA GCA as required for CMG handoff.
On EV GO, CMG handed off, ready for APFR egress:

Maneuver to APFR Egress position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th></th>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>SY</td>
</tr>
<tr>
<td>+31.1</td>
<td>-24.5</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>-776</td>
<td>-20</td>
</tr>
</tbody>
</table>

CMG Handoff

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Y</td>
<td>-</td>
<td>-175</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: X</td>
<td>+</td>
<td>-645</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

APFR Egress

<table>
<thead>
<tr>
<th></th>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>SY</td>
</tr>
<tr>
<td>+37.4</td>
<td>-24.5</td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded - Chest 12/PP/F/4, SY Held</td>
</tr>
<tr>
<td>Disp</td>
<td>ISS&gt;ISSACS</td>
</tr>
</tbody>
</table>

Perform EVA GCA as required for APFR egress.

PCS

MSS: SSRMS: **SSRMS**

Enter Mode – Standby (Verify blue)
On EV GO, APFR ingressed, ready to maneuver to CMG Handoff:

MSS: SSRMS: 

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: 

**cmd** Shoulder Yaw (Verify SY – Locked)

**THC/RHC**

Maneuver to CMG Handoff position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+37.4</td>
<td>-24.5</td>
<td>-75.5</td>
<td>-74.7</td>
<td>-46.7</td>
<td>+26.8</td>
<td>+12.5</td>
</tr>
<tr>
<td>APFR Egress</td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>1: X</td>
<td>-645</td>
<td>-175</td>
<td>+56</td>
<td>+0.1</td>
<td>+15.0</td>
<td>+90.0</td>
<td></td>
</tr>
<tr>
<td>2: Y</td>
<td>-776</td>
<td>-20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMG Handoff</td>
<td>-776</td>
<td>-20</td>
<td>+56</td>
<td>+0.1</td>
<td>+15.0</td>
<td>+90.0</td>
<td></td>
</tr>
</tbody>
</table>

| FOR | Unloaded - Chest 12/PP/F/4, SY Held |
| Disp | ISS>ISSACS |
On EV GO, failed CMG received, ready to maneuver to ESP2:

Maneuver to Z1 Access position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+32.6</td>
<td>-24.5</td>
<td>-83.1</td>
<td>-61.4</td>
<td>-48.1</td>
<td>+27.9</td>
<td>-17.3</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-776</td>
<td>-100</td>
<td>+56</td>
<td>0.1</td>
<td>+15.0</td>
<td>+90.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - Chest 12/PP/F/4, SY Held
Disp ISS>ISSACS

![Figure 31.- Z1 Access](09: P1 Lower Outboard: +75, +5).

![Figure 32.- Z1 Access](V10: SRMS Elbow: +170, +10).

**11. ESP2 MANEUVER WITH FAILED CMG**

**11.1 Z1 Intermediate 2 Maneuver**

**PCS**

Enter Mode – Single (Verify blue)

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**THC**

Perform Single Joint maneuver to Z1 Intermediate 2 position (within 1 deg).

<table>
<thead>
<tr>
<th>Z1 Access</th>
<th>1:</th>
<th>SP</th>
<th>+</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>+32.6</td>
<td>-24.5</td>
<td>-83.1</td>
<td>-61.4</td>
<td>-48.1</td>
<td>+27.9</td>
<td>-17.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z1 Interm 2</td>
<td></td>
<td>+32.6</td>
<td>-24.5</td>
<td>-55.0</td>
<td>-61.4</td>
<td>-48.1</td>
<td>+27.9</td>
<td>-17.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded - Chest 12/PP/F/4, SY Held
Disp ISS>ISSACS
11.2 Z1 Intermediate 1 Maneuver

PCS

MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

pick File ▶ LAB ▶ Z1 Intermediate 1

Verify ‘Joint Angles’ ‘Destination’ for Z1 Intermediate 1 position.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
<td>+30.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>+32.6</td>
<td>-24.5</td>
<td>-55.0</td>
<td>-61.4</td>
<td>-48.1</td>
<td>+27.9</td>
<td>-17.3</td>
</tr>
<tr>
<td>TGT</td>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
<td>+30.0</td>
</tr>
<tr>
<td>ERR</td>
<td>+47.6</td>
<td>-44.5</td>
<td>-75.0</td>
<td>+48.6</td>
<td>-68.1</td>
<td>+37.9</td>
<td>-47.3</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

PCS

* **cmd** Cancel (Verify Sequence Status – Waiting Destination)

* Input correct Dest joint angles per table above.

* **cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

* Verify joint angles and errors are correct on Joint Angle Position overlay.

******************************************************************************
PCS  
**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Joint OCAS will take approximately 3 minutes to complete in Vernier rates.</td>
</tr>
</tbody>
</table>

DCP  
**AUTO SEQ → PROC**

PCS  
MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
<td>+30.0</td>
</tr>
</tbody>
</table>

11.3 **ESP2 Clearance Maneuver**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+95, +15)</td>
<td>22: Base Elbow (-100, -20)</td>
<td>91: Camera B (-15, +35)</td>
<td>SRMS Elbow (-145, +5)</td>
</tr>
<tr>
<td>24: Tip Elbow (0, 0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SSRMS Joint OCAS

pick File ► LAB ► ESP2 Clearance

Verify ‘Joint Angles’ ‘Destination’ for ESP2 Clearance position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-85.8</td>
<td>+14.4</td>
<td>-84.0</td>
<td>-66.0</td>
<td>-156.1</td>
<td>-12.1</td>
<td>+146.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)
**1.300 SSRMS CMG R&R EVA SUPPORT**

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>(current)</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
<td>+30.0</td>
<td></td>
</tr>
</tbody>
</table>

| TGT | -85.8 | +14.4 | -84.0 | -66.0 | -156.1 | -12.1 | +146.0 |
| ERR  | +70.8 | +5.6  | +104.0 | -44.0 | +176.1 | +2.1  | -116.0 |

* If joint angles or errors are incorrect
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest joint angles per table above.
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)

Verify joint angles and errors are correct on Joint Angle Position overlay.

**NOTE**
This Joint OCAS will take approximately 5 minutes to complete in Vernier rates.

**DCP**
AUTO SEQ → PROC

**PCS**
MSS: SSRMS: **[SSRMS]**

Verify Posn Hold – orange

Verify SSRMS at ESP2 Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-85.8</td>
<td>+14.4</td>
<td>-84.0</td>
<td>-66.0</td>
<td>-156.1</td>
<td>-12.1</td>
<td>+146.0</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-110</td>
<td>+650</td>
<td>+961</td>
<td>+90.0</td>
<td>+0.1</td>
<td>-90.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded - Chest 12/PP/F/4, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>ISS&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12. **FAILED CMG INSTALL**

MSS: SSRMS: **SSRMS**

Change Command ► SSRMS ► Internal (Verify SSRMS>Internal)

Enter Mode – Manual (Verify blue)


**cmd** Shoulder Yaw (Verify SY – Locked)

√ Vernier

THC/ RHC

Maneuver to Failed CMG Install position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-86.7</td>
<td>+14.4</td>
<td>-87.8</td>
<td>-68.5</td>
<td>-149.9</td>
<td>-11.4</td>
<td>+146.5</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
</tr>
<tr>
<td></td>
<td>-110</td>
<td>+650</td>
<td>+860</td>
<td>+90.0</td>
<td>+0.1</td>
<td>-90.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded - Chest 12/PP/F/4, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>ISS&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Perform EVA GCA as required for CMG install.
On EV GO, CMG installed, ready to maneuver clear of ESP2:

Maneuver to ESP2 Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>-85.8</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>-110</td>
</tr>
<tr>
<td>FOR Unloaded</td>
</tr>
<tr>
<td>Disp</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+95, +15)</td>
<td>22: Base Elbow (-110, -20)</td>
<td>24: Tip Elbow (-35, +15)</td>
<td>Camera C (+10, +30)</td>
</tr>
</tbody>
</table>

13. APFR EGRESS AND REMOVAL
Configure Cameras and overlays as required.

13.1 Airlock Approach
RHC RATE → COARSE (Verify Coarse on PCS)

PCS MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input ‘Joint Angles’ ‘Destination’ for Airlock Approach position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
</tbody>
</table>

cmd Load (Verify Sequence Status – Confirm or Cancel)
MON Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-85.8</td>
<td>+14.4</td>
<td>-84.0</td>
<td>-66.0</td>
<td>-156.0</td>
<td>-12.1</td>
<td>+146.0</td>
</tr>
<tr>
<td>TGT</td>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
<tr>
<td>ERR</td>
<td>-16.6</td>
<td>-11.3</td>
<td>-2.1</td>
<td>+14.0</td>
<td>-145.4</td>
<td>+53.3</td>
<td>+160.8</td>
</tr>
</tbody>
</table>

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

PCS

* If joint angles or errors are incorrect
  * cmd Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * cmd Load (Verify Sequence Status – Confirm or Cancel)

MON

* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS cmd Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
This Joint OCAS will take approximately 4 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify SSRMS at Airlock Approach position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-665</td>
<td>+625</td>
<td>+823</td>
<td>+40.7</td>
<td>-67.4</td>
<td>-41.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOR Unloaded - Chest 12/PP/F/4, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp ISS&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13.2 APFR Egress and Removal
On EV GO, ready to approach airlock:

RHC
RATE → VERNIER (Verify Vernier on PCS)

PCS
MSS: SSRMS: SSRMS
Enter Mode – Single (Verify blue)

**WARNING**
The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

THC
Perform Single Joint maneuver to APFR Egress and Removal position (within 1 deg).

<table>
<thead>
<tr>
<th>Airlock Approach</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: APFR Egress and Removal</td>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-91.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOR</th>
<th>Unloaded - Chest 12/PP/F/4, SY Held</th>
</tr>
</thead>
</table>

PCS
MSS: SSRMS: SSRMS
Enter Mode – Manual (Verify blue)
14. **EVA 2 CLEANUP**

14.1 Airlock Backoff

On EV GO, APFR removed, ready for SSRMS maneuver clear:

**PCS**

**MSS: SSRMS:**

Enter Mode – Standby (Verify blue)

Change Unloaded Parameters ⇒ Unloaded ⇒ LEE Tip SYH
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held

Change Command ⇒ ISS ⇒ ISSACS (Verify ISS>ISSACS)

**MSS: SSRMS:**

Enter Mode – Single (Verify blue)

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.
1.300  SSRMS CMG R&R EVA SUPPORT
(RBT FS/13A.1/FIN 1)  Page 29 of 31 pages

THC

**Perform Single Joint maneuver to Airlock Approach position (within 1 deg).**

<table>
<thead>
<tr>
<th>APFR Egress and Remo**</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: EP + Airlock Approach</td>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-91.5</td>
<td>-10.6</td>
<td>-65.4</td>
<td>-14.8</td>
</tr>
<tr>
<td></td>
<td>1: EP +</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td>-522</td>
<td>+684</td>
<td>+932</td>
<td>+170.0</td>
<td>-14.8</td>
<td>29.7</td>
<td></td>
</tr>
</tbody>
</table>

**If FOR at Airlock Approach is not within 5 cm/1 deg due to EVA GCA,**
**perform the following:**

**MSS: SSRMS: SSRMS**

**Enter Mode – Manual (Verify blue)**

**MSS: SSRMS: SSRMS Manual: Joint Lock:**

**cmd Shoulder Yaw (Verify SY – Locked)**

**Maneuver to Airlock Approach position per above FOR table.**

---

**Figure 44.- Airlock Approach**
(03: S1 Lower Outboard: +95, +15).

14.2  Airlock Clearance

RHC
**RATE → COARSE (Verify Coarse on PCS)**

PCS
**MSS: SSRMS: SSRMS**

Enter Mode – Joint OCAS (Verify blue)
SSRMS Joint OCAS

pick File ➤ LAB ➤ Airlock Clearance

Verify ‘Joint Angles’ ‘Destination’ for Airlock Clearance position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-76.1</td>
<td>+25.5</td>
<td>-62.8</td>
<td>-94.2</td>
<td>-172.8</td>
<td>-118.9</td>
<td>+201.6</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-69.2</td>
<td>+25.7</td>
<td>-81.9</td>
<td>-80.0</td>
<td>-10.6</td>
<td>-65.4</td>
</tr>
<tr>
<td>TGT</td>
<td>-76.1</td>
<td>+25.5</td>
<td>-62.8</td>
<td>-94.2</td>
<td>-172.8</td>
<td>-118.9</td>
</tr>
<tr>
<td>ERR</td>
<td>+6.9</td>
<td>+0.2</td>
<td>-19.1</td>
<td>+14.2</td>
<td>+162.3</td>
<td>+53.5</td>
</tr>
</tbody>
</table>

***If joint angles or errors are incorrect***

* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest joint angles per table above.
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
* Verify joint angles and errors are correct on Joint Angle Position overlay.

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify SSRMS at Airlock Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-76.1</td>
<td>+25.5</td>
<td>-62.8</td>
<td>-94.2</td>
<td>-172.8</td>
<td>-118.9</td>
<td>+201.6</td>
</tr>
<tr>
<td>X</td>
<td>-299</td>
<td>+580</td>
<td>+1076</td>
<td>±180.0</td>
<td>+0.1</td>
<td>+47.0</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>FOR</td>
<td>Unloaded - LEE Tip, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>Disp</td>
<td>ISS&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitch</td>
<td>Roll</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roll</td>
<td>Roll</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13 JUL 07

128 18412.doc
Enter Mode – Standby (Verify blue)

Figure 45.- Airlock Clearance
(03: S1 Lower Outboard: +95, +15).

Figure 46.- Airlock Clearance
(24: Tip Elbow: -10, +10).
1. SETUP
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera C (-20, +30)</td>
<td>37: MBS Mast (+140, -5)</td>
<td>09: P1 Lower Outboard (+100, +30)</td>
</tr>
</tbody>
</table>

PCS
MSS: SSRMS: SSRMS

Change Loaded Parameters ▶ Walk Off ▶ MBS PDGF 2
Verify ‘Loaded Parameters’ (two) – MBS PDGF 2, SR Held

Change Display ▶ ISS ▶ W7MBS PDGF 2 (Verify ISS>W7MBS PDGF 2)
Change Command ▶ SSRMS ▶ Internal (Verify SSRMS>Internal)

√Coarse

Verify SSRMS at Airlock Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-76.1</td>
<td>+25.5</td>
<td>-62.8</td>
<td>-94.2</td>
<td>-172.8</td>
<td>-118.9</td>
<td>+201.6</td>
</tr>
</tbody>
</table>

FOR

Disp Unloaded – LEE Tip, SY Held

ISS>W7MBS PDGF 2

2. Z1 INTERMEDIATE POSITION 1 MANEUVER
Verify SRMS at CMG R&R Viewing position.

MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)
SSRMS Joint OCAS

pick File ▶ LAB ▶ Z1 Intermediate 1


<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
<td>+30.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-76.1</td>
<td>+25.5</td>
<td>-62.8</td>
<td>-94.2</td>
<td>-172.8</td>
<td>-118.9</td>
</tr>
<tr>
<td>TGT</td>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
</tr>
<tr>
<td>ERR</td>
<td>-61.1</td>
<td>+5.5</td>
<td>-82.8</td>
<td>+15.8</td>
<td>-192.8</td>
<td>-108.9</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

PCS * **cmd** Cancel (Verify Sequence Status – Waiting Destination)

* * Input correct Dest joint angles per table above.

* * **cmd** Load (Verify Sequence Status – Confirm or Cancel)

* MON * Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**
This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify SSRMS at Z1 Intermediate Position 1 (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
<td>+30.0</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+366</td>
<td>-2001</td>
<td>-14</td>
<td>+16.8</td>
<td>-24.8</td>
<td>-125.6</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – LEE Tip, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>ISS&gt;W7MBS PDGF 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. **PDGF 2 INTERMEDIATE POSITION MANEUVER**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: Camera A (+50, +40)</td>
<td>37: MBS Mast (+135, -15)</td>
<td>09: P1 Lower Outboard (+100, +35)</td>
</tr>
</tbody>
</table>

Figure 5.- Z1 Intermediate Position 1 (92: Camera A: +50, +40).

**SSRMS Joint OCAS**

pick File ➤ LAB ➤ PDGF2 Intermediate

Verify ‘Joint Angles’ ‘Destination’ for PDGF 2 Intermediate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+100.0</td>
<td>+3.5</td>
<td>+20.0</td>
<td>-36.2</td>
<td>-91.5</td>
<td>+129.9</td>
<td>-81.8</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)
MON
Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>-15.0</td>
<td>+20.0</td>
<td>+20.0</td>
<td>-110.0</td>
<td>+20.0</td>
<td>-10.0</td>
</tr>
<tr>
<td>TGT</td>
<td>+100.0</td>
<td>+3.5</td>
<td>+20.0</td>
<td>-36.2</td>
<td>-91.5</td>
<td>+129.9</td>
</tr>
<tr>
<td>ERR</td>
<td>-115.0</td>
<td>+16.5</td>
<td>0.0</td>
<td>-73.8</td>
<td>+111.5</td>
<td>-139.9</td>
</tr>
</tbody>
</table>

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

PCS
* If joint angles or errors are incorrect
  * cmd Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * cmd Load (Verify Sequence Status – Confirm or Cancel)

MON
* Verify joint angles and errors are correct on Joint Angle Position overlay.
  ***********************************************************************************

PCS cmd Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
1. An expected singularity indication will be present when SR is approximately 75 degrees.
2. This Joint OCAS will take approximately 1 minute to complete in Coarse rates.

DCP
AUTO SEQ → PROC

PCS MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify SSRMS at PDGF 2 Intermediate position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+100.0</td>
<td>+3.5</td>
<td>+20.0</td>
<td>-36.2</td>
<td>-91.5</td>
<td>+129.9</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+344</td>
<td>-1867</td>
<td>+859</td>
<td>+35.4</td>
<td>-38.1</td>
<td>+94.5</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp ISS>W7MBS PDGF 2
4. **SINGLE JOINT TO PDGF 2 PRE-GRAPPLE**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B</td>
<td>22: Base Elbow</td>
<td>09: P1 Lower Elbow Outboard</td>
</tr>
<tr>
<td>(-45, +25)</td>
<td>(-160, -10)</td>
<td>(+120, +35)</td>
</tr>
</tbody>
</table>

**WARNING**
The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**RHC**

RATE → VERNIER (Verify Vernier on PCS)

**PCS**

MSS: SSRMS: **SSRMS**

Enter Mode – Single (Verify blue)
THC

Perform Single Joint maneuver to PDGF 2 Pre-Grapple position (within 1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+100.0</td>
<td>+3.5</td>
<td>+20.0</td>
<td>-36.2</td>
<td>-91.5</td>
<td>+129.9</td>
<td>-81.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-73.9</td>
</tr>
<tr>
<td>+92.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+92.7</td>
<td>+3.5</td>
<td>-73.9</td>
<td>-36.2</td>
<td>-91.5</td>
<td>+129.9</td>
<td>-81.8</td>
</tr>
</tbody>
</table>


X Y Z Pitch Yaw Roll

-151 0 1 0.0 0.0 0.0

FOR Unloaded – LEE Tip, SY Held

Disp ISS>W7MBS PDGF 2

Figure 10.- PDGF 2 Pre-Grapple (91: Camera B: -30, +10).

Figure 11.- PDGF 2 Pre-Grapple (22: Base Elbow: -160, -10).

5. **MBS PDGF 2 GRAPPLE**

Configure Cameras and overlays for grapple.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (-30, +10)</td>
<td>25: Tip LEE</td>
<td>37: MBS Mast (-155, -10)</td>
</tr>
</tbody>
</table>

**NOTE**

The LEE Camera must be fully zoomed out to correspond to the target overlay.
Figure 12.- MBS PDGF 2 Pre-Grapple
(37: MBS Mast: -155, -10).

PCS
MSS: SSRMS: Rate: SSRMS Rate
Set ‘Scale’ ‘Vernier’ Rate Scale: as desired
MSS: SSRMS: SSRMS
Enter Mode – Manual (Verify blue)
MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock
cmd Shoulder Yaw (Verify SY – Locked)

RHC/ THC
Maneuver to within grapple envelope.

MSS: SSRMS: Tip LEE: SSRMS Tip LEE
cmd Capture ► Automatic ► Slow, Limp (Verify Speed – Slow)
Verify ‘Confirm or Terminate’ prompt.

CAUTION
Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

NOTE
Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

cmd Confirm (Verify RHC Trigger Hot icon)
Verify LEE Mode – Auto Capture
1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2
(RBT FS/13A.1/FIN 1) Page 8 of 16 pages

RHC TRIGGER → press (momentarily)

PCS Verify ‘Snare’ Close, Capture (two) – blue (12 s max)
Verify Capture to Latch – Yes (SCR 19282)
Verify ‘Carriage’ Tension ~5500 N (90 s max)
Verify ‘Carriage’ Retract – blue
Verify ‘Latch’ Latch – blue (65 s max)

| NOTE |
| Expect ‘R3L – SSRMS Pwr Flags Fail’ Robotics Advisory message while Tip LEE is mated (SCR 19019). |

**cmd** ‘Umbilical’ Mate (Verify ‘Confirm or Terminate’ prompt)

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Mate

RHC TRIGGER → press (momentarily)

PCS Verify ‘Umbilical’ Mate – blue (10 s max)
Verify ‘Connector Continuity’ Prime, Redundant (two) – Yes

**cmd** ‘Carriage’ Derigidize ► Slow (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Derigidize

RHC TRIGGER → press (momentarily) (SCR 19064)

PCS Verify ‘Carriage’ Derigidize – blue (90 s max)

Verify Loaded Parameters – √
Verify ‘Loaded Parameters’ (two) – MBS PDGF 2, SR Held

Verify SSRMS at MBS PDGF 2 Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+88.3</td>
<td>+3.5</td>
<td>-74.6</td>
<td>-27.4</td>
<td>-104.5</td>
<td>+131.7</td>
<td>-75.7</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Loaded – MBS PDGF 2, SR Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>LAB&gt;W7MBS PDGF 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13 JUL 07 138
NOTE
Expect the following message when safing is commanded:
‘R3Z - MSS OCS SSRMS Prime(Redun) ACU SRT Cat-1 Brk Stat Fall’ (SCR 17495)
This message should return to Norm.

DCP
SAFING → SAFE (Verify ON)

Figure 13.- MBS PDGF 2 Grapple
(91: Camera B: -30, +10).

6. **LAB PDGF RELEASE SETUP**

On MCC-H GO, base change complete:

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (-10, +20)</td>
<td>25: Tip LEE</td>
<td>22: Base Elbow (-150, -10) (09: P1 Lower Outboard (+110, 0))</td>
</tr>
</tbody>
</table>

PCS
MSS: SSRMS: **SSRMS**

Verify Loaded Parameters – √
Verify ‘Loaded Parameters’ (two) – LAB PDGF, SR Held

Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held

Change Display ► W7 ► LAB PDGF (Verify W7>LAB PDGF)

Verify Command – SSRMS>Internal
Verify SSRMS at LAB PDGF Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-75.7</td>
<td>-131.7</td>
<td>-104.5</td>
<td>-27.4</td>
<td>-74.6</td>
<td>-3.5</td>
<td>+88.3</td>
</tr>
</tbody>
</table>

X Y Z Pitch Yaw Roll

FOR   | Loaded – LAB PDGF, SR Held
Disp   | W7>LAB PDGF

√ Vernier

MSS: SSRMS: Rate: SSRMS Rate

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired

MSS: SSRMS: SSRMS Safing: SSRMS Safing

**cmd** Remove (Verify Not Safed)

**DCP** BRAKES SSRMS \(\rightarrow\) OFF (Verify OFF)

Figure 14.- LAB PDGF Grapple (91: Camera B: -10, +20).

Figure 15.- LAB PDGF Grapple (22: Base Elbow: -150, -10).

7. **LAB PDGF RELEASE**

**PCS** MSS: SSRMS: Limp: SSRMS Limp

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS: SSRMS

Verify all joints – Limped

Wait 30 seconds.

**cmd** None Limp (Verify Standby – blue)
MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

**cmd** Shoulder Yaw (Verify SY – Locked)

MSS: SSRMS: Tip LEE: Tip LEE

**cmd** Release ► Semi-manual ► Slow (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

**CAUTION**

Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

**NOTE**

Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Semi-manual Release

**NOTE**

Expect ‘R3L – SSRMS Pwr Flags Fail’ Robotics Advisory message to return to norm when Tip LEE umbilicals are demated (SCR 19019).

**RHC** TRIGGER → press (hold until ‘Latch’ Brakes – On) (10 s max)

**PCS** Verify ‘Umbilical’ Demate – blue

**RHC** TRIGGER → press (hold until ‘Latch’ Brakes – On) (65 s max)

**PCS** Verify ‘Latch’ Unlatch – blue

**RHC** TRIGGER → press (hold until ‘Carriage’ Brakes – On) (90 s max)

**PCS** Verify ‘Carriage’ Derigidize – blue

**RHC** TRIGGER → press (hold until ‘Snare’ Brakes – On) (12 s max)

**PCS** Verify ‘Snare’ Open – blue
8. **LAB PDGF BACKOFF**

THC
Back off from grapple fixture until clear of pin.

RHC
TRIGGER → press (hold until ‘Carriage’ Brakes – On) (90 s max)

PCS
Verify ‘Carriage’ Extend – blue

THC/
RHC
Maneuver to LAB PDGF Pre-Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
</tr>
<tr>
<td>-75.1</td>
</tr>
<tr>
<td>X</td>
</tr>
<tr>
<td>-150</td>
</tr>
<tr>
<td>FOR</td>
</tr>
<tr>
<td>Disp</td>
</tr>
</tbody>
</table>

PCS
MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

---

**Figure 16.** LAB PDGF Pre-Grapple
(91: Camera B: -10, +20).

**Figure 17.** LAB PDGF Pre-Grapple
(22: Base Elbow: -150, -10).

9. **SINGLE JOINT TO ESP3 PRE-GRAPPLE INTERMEDIATE POSITION**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (-20, +20)</td>
<td>37: MBS Mast (+155, 0)</td>
<td>09: P1 Lower Outboard (+110, 0)</td>
<td>Camera A (+60, +40)</td>
</tr>
</tbody>
</table>
line 1

1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2
(RBT FS/13A.1/FIN 1) Page 13 of 16 pages

Figure 18.- LAB PDGF Pre-Grapple (37: MBS Mast: +155, 0).

Figure 19.- LAB PDGF Pre-Grapple (09: P1 Lower Outboard: +110, 0).

MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)

RHC RATE → COARSE (Verify Coarse on PCS)

WARNING
The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

NOTE
Expect singularity warning for EP between -15 and +15 deg.

THC Perform Single Joint maneuver to ESP 3 Pre-Grapple Intermediate position (within 1 deg).

<table>
<thead>
<tr>
<th>LAB PDGF Pre-Grapple</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: SY +</td>
<td>-75.1</td>
<td>-131.7</td>
<td>-99.2</td>
<td>-26.4</td>
<td>-81.3</td>
<td>-3.3</td>
<td>+88.0</td>
</tr>
<tr>
<td>2: EP +</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESP3 Pre-Grapple Intermediate</td>
<td>-75.1</td>
<td>+35.4</td>
<td>-99.2</td>
<td>+40.0</td>
<td>-81.3</td>
<td>-3.3</td>
<td>+88.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>-725</td>
<td>+100</td>
<td>-341</td>
<td>-170.3</td>
<td>-13.0</td>
<td>-10.8</td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W7>LAB PDGF
10. **Joint OCAS to ESP3 Pre-Grapple Position**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (-20, 0)</td>
<td>24: Tip Elbow (0, 0)</td>
<td>09: P1 Lower Outboard (+110, +10)</td>
<td>Camera A (+90, +10)</td>
</tr>
<tr>
<td>13: LAB Stbd Zenith (-180, -50)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PCS**

MSS: SSRMS: **SSRMS**

Enter Mode – Joint OCAS (Verify blue)

**SSRMS Joint OCAS**

Input ‘Joint Angles’ ‘Destination’ for ESP3 Pre-Grapple position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+118.3</td>
<td>+37.5</td>
<td>-76.2</td>
<td>+117.4</td>
<td>+49.7</td>
<td>-9.1</td>
<td>-158.3</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>current)</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGT</td>
<td>+118.3</td>
<td>+37.5</td>
<td>-76.2</td>
<td>+117.4</td>
<td>+49.7</td>
<td>-9.1</td>
<td>-158.3</td>
</tr>
<tr>
<td>ERR</td>
<td>-193.4</td>
<td>-2.1</td>
<td>-23.0</td>
<td>-77.4</td>
<td>-131.0</td>
<td>+5.8</td>
<td>+246.3</td>
</tr>
</tbody>
</table>
* If joint angles or errors are incorrect
    * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
    * Input correct Dest joint angles per table above.
    * **cmd** Load (Verify Sequence Status – Confirm or Cancel)

* **MON**
  * Verify joint angles and errors are correct on Joint Angle Position overlay.

---

**PCS**  
**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.</td>
</tr>
</tbody>
</table>

**DCP**  
AUTO SEQ → PROC

**PCS**  
MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify SSRMS at ESP3 Pre-Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+118.3</td>
<td>+37.5</td>
<td>-76.2</td>
<td>+117.4</td>
<td>+49.7</td>
<td>-9.1</td>
<td>-158.3</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+139</td>
<td>+1609</td>
<td>-720</td>
<td>+164.4</td>
<td>-60.7</td>
<td>-171.2</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held

Disp W7>LAB PDGF

**RHC**  
RATE → VERNIER (Verify Vernier on PCS)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expect the following message when safing is commanded:</td>
</tr>
<tr>
<td>‘R3Z - MSS OCS SSRMS Prime(Reun) ACU SRT Cat-1 Brk Stat Fail’ (SCR 17495)</td>
</tr>
<tr>
<td>This message should return to Norm.</td>
</tr>
</tbody>
</table>

**DCP**  
SAFING → SAFE (Verify ON)
Figure 22.- ESP3 Pre-Grapple
(91: Camera B: -20, 0).

Figure 23.- ESP3 Pre-Grapple
1.410 SSRMS ESP3 HANDBOFF
(RBT FS/13A.1/FIN 1) Page 1 of 4 pages

1. SETUP

PCS MSS: SSRMS: SSRMS

Change Loaded Parameters ▶ ESP3 ▶ ESP3 Maneuver SRH
Verify 'Loaded Parameters' (two) – ESP3 Maneuver, SR Held

Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SRH
Verify 'Unloaded Parameters' (two) – LEE Tip, SR Held

Change Display ▶ W7 ▶ ISSACS (Verify W7>ISSACS)

Verify Command – SSRMS>Internal

\Vernier

MSS: SSRMS: Rate: SSRMS Rate

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired

Verify SSRMS at ESP3 Pre-Grapple position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+118.3</td>
<td>+37.5</td>
<td>-76.2</td>
<td>+117.4</td>
<td>+49.7</td>
<td>-9.1</td>
<td>-158.3</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+1073</td>
<td>-1332</td>
<td>-420</td>
<td>-81.8</td>
<td>+23.7</td>
<td>+19.2</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SR Held
Disp W7>ISSACS

2. SETUP FOR CAPTURE

Review {SSRMS LEE CUE CARD}, all (SODF: RBT GEN: REFERENCE).

MSS: SSRMS: Thrusters: Thruster Controls for MSS Ops

Verify ‘Desat Request.’ – Inh

******************************************************************************
* If using shuttle attitude control;
* Coordinate with shuttle crew; DAP: FREE.
******************************************************************************
3. **ESP3 GRAPPLE**
On SRMS operator GO, SRMS in ESP3 Handoff position with brakes on:

Configure Cameras and overlays for grapple.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: SRMS Elbow</td>
<td>25: Tip LEE</td>
<td>37: MBS Mast</td>
</tr>
<tr>
<td>(+20, +20)</td>
<td></td>
<td>(-120, +45)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(09: P1 Lower)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outboard (+150, -30))</td>
</tr>
</tbody>
</table>

**NOTE**
The LEE Camera must be fully zoomed out to correspond to the target overlay.

![Figure 1.- ESP-3 Pre-Grapple (91: SRMS Elb: +20, +20).](image)

![Figure 2.- ESP-3 Pre-Grapple (37: MBS Mast: -120, +45).](image)

**MSS**: SSRMS: SSRMS Safing: [SSRMS Safing]

**cmd** Remove (Verify Not Safed)

**DCP**
BRAKES SSRMS → OFF (Verify OFF)

**PCS**
MSS: SSRMS: [SSRMS]

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: [Joint Lock]

**cmd** Shoulder Roll (Verify SR – Locked)

**RHC/THC**
Maneuver to within grapple envelope.

**PCS**
MSS: SSRMS: Tip LEE: [SSRMS Tip LEE]

**cmd** Capture ➤ Automatic ➤ Slow, Limp (Verify Speed – Slow)
Verify ‘Confirm or Terminate’ prompt.

**CAUTION**

Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

**NOTE**

Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Capture

RHC  TRIGGER → press (momentarily)

PCS  Verify ‘Snare’ Close, Capture (two) – blue (12 s max)

Verify Capture to Latch – Yes (SCR 19282)

Verify ‘Carriage’ Tension ~5500 N (90 s max)

Verify ‘Carriage’ Retract – blue

Verify ‘Latch’ Latch – blue (65 s max)

**cmd** ‘Umbilical’ Mate (Verify ‘Confirm or Terminate’ prompt)

**cmd** Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Mate

RHC  TRIGGER → press (momentarily)

PCS  Verify ‘Umbilical’ Mate – blue (10 s max)

Verify ‘Connector Continuity’ Prime, Redundant (two) – Yes

PCS  MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

DCP  BRAKES SSRMS → ON (Verify ON)

Expected Joint Angles and FOR at ESP3 Handoff position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+118</td>
<td>35.4</td>
<td>-65.8</td>
<td>+119.8</td>
<td>+36.5</td>
<td>-9.1</td>
<td>-160.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>+1073</td>
<td>-1038</td>
<td>-51</td>
<td>-40.9</td>
<td>-59.9</td>
<td>-53.0</td>
</tr>
</tbody>
</table>

FOR  Loaded – ESP3 Maneuver, SR Held

Disp  W7>ISSACS
4. **EBCS POWER APPLICATION**

PCS

MSS: SSRMS: Power: SSRMS Power

**NOTE**

The Prime payload power feed controls power to the Primary (Left) EBCS Camera, and the Redundant payload power feed controls power to the Secondary (Right) EBCS Camera.

**cmd** ‘Payload’ Prime(Reundant) On (Verify On)

Notify SRMS operator grapple complete, GO for ESP3 release.
1.420  SSRMS ESP3 INSTALL
(RBT FS/13A.1/FIN 1)  Page 1 of 10 pages

1. SETUP
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: SRMS Elbow (+40, 0)</td>
<td>37: MBS Mast (-160, +45)</td>
<td>24: Tip Elbow (+20, 0) 22: Base Elbow (-60, -15)</td>
<td>Camera B (-20, 0)</td>
</tr>
</tbody>
</table>

PCS MSS: SSRMS: [SSRMS]

Verify Loaded Parameters – √
Verify ‘Loaded Parameters’ (two) – ESP3 Maneuver, SR Held

Change Display ▶ W7 ▶ ESP3 Install (Verify W7>ESP3 Install)

Verify SSRMS at ESP3 Handoff position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+118.3</td>
<td>+35.4</td>
<td>-65.8</td>
<td>+119.8</td>
<td>+36.6</td>
<td>-9.1</td>
<td>-160.4</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+155</td>
<td>+1159</td>
<td>+1385</td>
<td>+69.2</td>
<td>+22.3</td>
<td>-8.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Loaded – ESP3 Maneuver, SR Held
Disp W7>ESP3 Install

\√Vernier

MSS: SSRMS: Rate: [SSRMS Rate]

Set ‘Scale’ ‘Vernier’ Rate Scale: 1.0 (Verify 1.0)

Figure 1.- ESP3 Handoff
(91: SRMS Elbow: +40, 0).

Figure 2.- ESP3 Handoff
(37: MBS Mast: -160, +45).
2. **JOINT OCAS TO ESP3 PRE-INSTALL POSITION**

On SRMS operator GO, SRMS is in the ESP3 Install Viewing position:

**********************************************************
* If using shuttle attitude control;
* Coordinate with shuttle crew; DAP: FREE.
**********************************************************

DCP  BRAKES SSRMS → OFF (Verify OFF)

PCS  MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

**SSRMS Joint OCAS**

Input ‘Joint Angles’ ‘Destination’ for ESP3 Pre-Install position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+113.3</td>
<td>-39.4</td>
<td>-90.6</td>
<td>-71.6</td>
<td>-88.5</td>
<td>-0.9</td>
<td>-166.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON  Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>(current)</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGT</td>
<td>+113.3</td>
<td>-39.4</td>
<td>-90.6</td>
<td>-71.6</td>
<td>-88.5</td>
<td>-0.9</td>
<td>-166.0</td>
</tr>
</tbody>
</table>

| ERR       | +5.0   | +74.8  | +24.8  | +191.4 | +125.0 | -8.2   | +5.5   |

16 JUL 07
* If joint angles or errors are incorrect
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest joint angles per table above.
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
* Verify joint angles and errors are correct on Joint Angle Position overlay.

**NOTE**
1. Clearance between the MBS MCAS UMA and the Base Boom of the SSRMS will be as small as 68 cm (2.25 ft) through install. Monitor this clearance with the SRMS EE view.
2. Expect singularity warning for EP between +15 and -15 deg.
3. This Joint OCAS will take approximately 48 minutes to complete in Vernier rates.

**PCD**

**AUTO SEQ → PROC**

Verify Posn Hold – orange

**NOTE**
FOR Pitch, Yaw and Roll telemetry is unreliable when Yaw is close to ± 90 degrees.

Verify SSRMS at ESP3 Pre-Install position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+113.3</td>
<td>-39.4</td>
<td>-90.6</td>
<td>-71.6</td>
<td>-88.5</td>
<td>-0.9</td>
<td>-166.0</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>-200</td>
<td>0</td>
<td>0</td>
<td>-172.4</td>
<td>+90.0</td>
<td>-97.6</td>
<td></td>
</tr>
</tbody>
</table>

FOR Loaded – ESP3 Maneuver, SR Held
Disp W7>ESP3 Install

**MSS: SSRMS:**

Enter Mode – Standby (Verify blue)
3. **SETUP FOR INSTALL**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
</table>

**NOTE**
EBCS Target may not be visible until X = ~100 cm

**MSS: SSRMS: [SSRMS]**

Change Loaded Parameters ▶ ESP3 ▶ ESP3 Install SRH
Verify ‘Loaded Parameters’ (two) – ESP3 Install, SR Held
Verify Display – W7>ESP3 Install
Verify Command – SSRMS>Internal

\Vernier

**MSS: SSRMS: Rate: [SSRMS Rate]**
Set ‘Scale’ ‘Vernier’ Rate Scale: 0.4 (Verify 0.4)
4. **VERIFICATION OF DESAT REQUEST**

MSS: SSRMS: Thrusters: 

Verify ‘Desat Request:’ – Inh

******************************************************************************
* If using shuttle attitude control;
* Coordinate with shuttle crew;
* Verify Rate < 0.1 deg/s/axis; then DAP: AUTO.
* When in attitude; DAP: FREE.
******************************************************************************

5. **MANEUVERING TO ESP3 RTL POSITION**

MSS: SSRMS: 

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: 

cmd Shoulder Roll (Verify SR – Locked)

**NOTE**
Clearance between ESP3 and the P3 trunion pin will close to less than 76 cm (2.5 ft). Monitor this clearance using the Tip Elbow Camera.
THC/THC
MSS: SSRMS: SSRMS
Verify Posn Hold – orange

Notify CAS operator GO for first phase capture, maneuver to RTL complete.

On CAS operator GO for SSRMS Limp Mode, first phase capture complete:

Enter Mode – Standby (Verify blue)

MSS: SSRMS: Limp: [SSRMS Limp]

cmd All Limp (Verify Limp – blue)

MSS: SSRMS: SSRMS

Verify joints – Limped

Notify CAS operator GO for second stage capture, all joints limped.
1.420 SSRMS ESP3 INSTALL
(RBT FS/13A.1/FIN 1) Page 7 of 10 pages

On CAS operator GO for Brakes On (when ESP3 fully torqued):

**DCP**  BRAKES SSRMS → ON (Verify – ON)

Record ESP3 Installed joint angles and FOR:

<table>
<thead>
<tr>
<th>Expected</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+113.3</td>
<td>-39.2</td>
<td>-93.3</td>
<td>-84.3</td>
<td>-73.1</td>
<td>-0.8</td>
<td>-165.8</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FOR Loaded – ESP3 Install, SR Held
Disp W7>ESP3 Install

***************************************************************
* If using shuttle attitude control;
* Coordinate with shuttle crew;
* Verify Rate < 0.1 deg/s/axis; then DAP: AUTO.
***************************************************************

Figure 10.- ESP3 Installed (92: SRMS EE).
Figure 11.- ESP3 Installed (24: Tip Elbow: -40, +10).

7. **SETUP FOR RELEASE**
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>92: SRMS EE</td>
<td>25: Tip LEE</td>
<td>22: Base Elbow (-120, -15)</td>
</tr>
</tbody>
</table>

PCS MSS: SSRMS: 

Verify Loaded Parameters – √
Verify 'Loaded Parameters' (two) – ESP3 Install, SR Held
Verify 'Unloaded Parameters' (two) – LEE Tip, SR Held
1.420 SSRMS ESP3 INSTALL
(RBT FS/13A.1/FIN 1) Page 8 of 10 pages

Change Display ▶ W7 ▶ Installed ESP3 GF (Verify W7>Installed ESP3 GF)

Verify Command – SSRMS>Internal

MSS: SSRMS: Rate: [SSRMS Rate]

Set ‘Scale’ ‘Vernier’ Rate Scale: as desired

Verify SSRMS at ESP3 Installed position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+113.3</td>
<td>-39.2</td>
<td>-93.3</td>
<td>-84.3</td>
<td>-73.1</td>
<td>-0.8</td>
<td>-165.8</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+301</td>
<td>+133</td>
<td>+10</td>
<td>-0.3</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
</tbody>
</table>

FOR Loaded – ESP3 Install, SR Held
Disp W7>Installed ESP3 GF

Figure 12.- ESP3 Installed (22: Base Elbow: -120, -15).

8. SSRMS RELEASE
8.1 Power Removal From EBCS
On MCC-H GO, ready for ESP3 release:

MSS: SSRMS: Power: [SSRMS Power]

NOTE
To ensure no risk of demating a hot connector, check that both the Prime and Redundant power feeds show Off prior to beginning step 9.2.

cmd ‘Payload’ Prime(Redundant) Off

Verify Prime, Redundant (two) – Off
8.2 ESP3 Release

DCP
BRAKES SSRMS → OFF (Verify OFF)

PCS
MSS: SSRMS: SSRMS
Enter Mode – Manual (Verify blue)
MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock
/cmd Shoulder Roll (Verify SR – Locked)
MSS: SSRMS: Tip LEE: SSRMS Tip LEE
/cmd Release ➤ Automatic ➤ Slow (Verify Speed – Slow)

Verify ‘Confirm or Terminate’ prompt.

**CAUTION**

Due to end-to-end system latency, the RHC Trigger is hot up to 3 seconds prior to receiving a Trigger Hot icon status on the PCS.

**NOTE**

Once the trigger is hot, only safing or trigger commands should be sent to the Robotics equipment. If a configuration change is required, including routing MSS Cameras, safe the system to exit LEE operations (SCR 23262, 14662).

/cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Release

RHC
TRIGGER → press (momentarily)

PCS
Verify ‘Umbilical’ Demate – blue (10 s max)
Verify ‘Latch’ Unlatch – blue (65 s max)
Verify ‘Carriage’ Derigidize – blue (90 s max)
Verify ‘Snare’ Open – blue (12 s max)

THC/ RHC
Maneuver to ESP3 GF Backoff position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR</td>
<td>Unloaded – LEE Tip, SR Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W7&gt;Installed ESP3 GF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+113.3</td>
<td>-39.4</td>
<td>-90.9</td>
<td>-75.2</td>
<td>-84.6</td>
<td>-0.9</td>
<td>-166.0</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-150</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

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PCS Verify ‘Carriage’ Extend – blue (90 s max)

MSS: SSRMS: Enter Mode – Standby (Verify blue)

MSS: SSRMS: Rate: Set ‘Scale’ ‘Vernier’ Rate Scale: 1.0 (Verify 1.0)

Figure 13.- ESP3 GF Backoff (92: SRMS EE).

Figure 14.- ESP3 GF Backoff (22: Base Elbow: -120, -15).
1. **SETUP**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>13: LAB Stbd Zenith (-180, -30)</td>
<td>37: MBS Mast (-60, -20)</td>
<td>92: SRMS Elbow (+85, -10)</td>
<td>Camera C (-20, +20)</td>
</tr>
</tbody>
</table>

PCS  

MSS: SSRMS:

Verify Unloaded Parameters – √
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SR Held

Change Display ▶ W7 ▶ ISSACS (Verify W7>ISSACS)

Verify SSRMS at ESP3 GF Backoff position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+113.3</td>
<td>-39.4</td>
<td>-90.9</td>
<td>-75.2</td>
<td>-84.6</td>
<td>-0.9</td>
<td>-166.0</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+48</td>
<td>-2416</td>
<td>-656</td>
<td>-90.0</td>
<td>+0.1</td>
<td>+89.9</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SR Held
Disp W7>ISSACS

Figure 1.- ESP3 GF Backoff (13: LAB Stbd Zenith: -180, -30).

Figure 2.- ESP3 GF Backoff (37: MBS Mast: -60, -20).
2. MT TRANSLATE POSITION MANEUVER

RHC
RATE → COARSE (Verify Coarse on PCS)

PCS
MSS: SSRMS: SSRMS
Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

pick File ▶ W7MBS2 ▶ MT Translate

Verify ‘Joint Angles’ ‘Destination’ for MT Translate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+250.0</td>
<td>+60.0</td>
<td>+65.0</td>
<td>-155.0</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON
Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR (current)</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+113.3</td>
<td>-39.4</td>
<td>-90.9</td>
<td>-75.2</td>
<td>-84.6</td>
<td>-0.9</td>
<td>-166.0</td>
</tr>
<tr>
<td><strong>TGT</strong> +250.0</td>
<td>+60.0</td>
<td>+65.0</td>
<td>-155.0</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
<tr>
<td>ERR -136.7</td>
<td>-99.4</td>
<td>-155.9</td>
<td>+79.8</td>
<td>-25.6</td>
<td>+73.5</td>
<td>-63.7</td>
</tr>
</tbody>
</table>

************************************************************************************
* If joint angles or errors are incorrect
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest joint angles per table above.
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
* Verify joint angles and errors are correct on Joint Angle Position overlay.
************************************************************************************
PCS

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.</td>
</tr>
</tbody>
</table>

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+250.0</td>
<td>+60.0</td>
<td>+65.0</td>
<td>-155.0</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
</tbody>
</table>

RHC

RATE → VERNIER (Verify Vernier on PCS)

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expect the following message when safing is commanded:</td>
</tr>
<tr>
<td>‘R3Z - MSS OCS SSRMS Prime(Redun) ACU SRT Cat-1 Brk Stat Fail’ (SCR 17495)</td>
</tr>
<tr>
<td>This message should return to Norm.</td>
</tr>
</tbody>
</table>

DCP

SAFING → SAFE (Verify ON)
Configure the ISS Downlink per the following table:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Elbow</td>
<td>MBS Mast</td>
</tr>
<tr>
<td></td>
<td>(-10, +5)</td>
<td>(+175, -29)</td>
</tr>
<tr>
<td>FL</td>
<td>20 mm</td>
<td></td>
</tr>
</tbody>
</table>

Verify SSRMS is at the MT Translate position (within 1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+250.0</td>
<td>+60.0</td>
<td>+65.0</td>
<td>-155.0</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
</tbody>
</table>

**NOTE**

1. ‘**PTU not following commands**’ error messages may be generated when MSS Cameras are powered.

2. Due to MCCST command latency, the pan/tilt stop command should be issued 6 degrees before the destination is reached.

1. **BASE ELBOW CAMERA SURVEY**

**MCCST**

ROBO Camera Commander

‘MSS Cameras’

sel SSRMS Base Elb

cmd Activate Position (Verify Activated)
cmd Activate Commanding

Keyboard Commanding Window

Verify Current Camera: SSRMS Base Elb

<table>
<thead>
<tr>
<th>Start Config</th>
<th>Base Elb</th>
<th>Stop at</th>
<th>Survey Notes</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(-10, +5)</td>
<td></td>
<td>MT Translation Path</td>
<td></td>
</tr>
<tr>
<td>1: Pan Lt</td>
<td>(-30, +5)</td>
<td>(-24, +5)</td>
<td>MT Translation Path</td>
<td></td>
</tr>
</tbody>
</table>

Keyboard Commanding Window

cmd Finished Commanding
cmd Activate Position (Verify Deactivated)
1.435 MT PRE-TRANSLATION SURVEY - WS 7 TO WS 4 (GROUND)
(RBT FS/13A.1/FIN 1)

Figure 1.- Base Elbow Start
(Base Elbow: -10, +5).

Figure 2.- Base Elbow - Step 1
(Base Elbow: -30, +5).

2. MBS MAST CAMERA SURVEY

sel SSRMS MBS Mast

**cmd** Activate Position (Verify Activated)

**cmd** Activate Commanding

Keyboard Commanding Window

Verify Current Camera: MBS Mast

<table>
<thead>
<tr>
<th>Start Config</th>
<th>MBS Mast</th>
<th>Stop at</th>
<th>Survey Notes</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(+175, -29) FL = 20 mm</td>
<td>-</td>
<td>MT Translation Path</td>
<td></td>
</tr>
<tr>
<td>1: Tilt Up</td>
<td>(+175, -14)</td>
<td>(+175, -20)</td>
<td>MT Translation Path</td>
<td></td>
</tr>
<tr>
<td>2: Zoom In</td>
<td>(+175, -14) FL = 28 mm</td>
<td>-</td>
<td>MT Translation Path</td>
<td></td>
</tr>
<tr>
<td>3: Tilt Up</td>
<td>(+175, -9)</td>
<td>(+175, -14)</td>
<td>MT Translation Path</td>
<td></td>
</tr>
<tr>
<td>4: Zoom In</td>
<td>(+175, -9) FL = 35 mm</td>
<td>-</td>
<td>MT Translation Path</td>
<td></td>
</tr>
</tbody>
</table>

Keyboard Commanding Window

**cmd** Finished Commanding

**cmd** Activate Position (Verify Deactivated)
Figure 3.- MBS Mast Start
(MBS Mast: +175, -29, FL = 20 mm).

Figure 4.- MBS Mast - Step 2
(MBS Mast: +175, -14, FL = 28 mm).

Figure 5.- MBS Mast - Step 4
(MBS Mast: +175, -9, FL = 35 mm).
1. **SETUP**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+50, -40)</td>
<td>24: Tip Elbow (0, 0)</td>
<td>13: LAB Stbd Zenith (-180, +40)</td>
<td>SRMS Elbow (+90, -60)</td>
</tr>
</tbody>
</table>

PCS MSS: SSRMS: SSRMS

Verify Unloaded Parameters – √
Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SYH
Verify 'Unloaded Parameters' (two) – LEE Tip, SY Held

Change Display ▶ W4 ▶ ISSACS (Verify W4>ISSACS)

Verify SSRMS at MT Translate position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+250.0</td>
<td>+60.0</td>
<td>+65.0</td>
<td>-155.0</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+655</td>
<td>+927</td>
<td>-216</td>
<td>-26.1</td>
<td>+15.7</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W4>ISSACS

---

Figure 1.- MT Translate (03: S1 Lower Outboard: +50, -40).

Figure 2.- MT Translate (24: Tip Elbow: 0, 0).
1.500 SSRMS MANEUVER TO SASA START POSITION
(RBT FS/13A.1/FIN 1)  Page 2 of 4 pages

2. SASA START MANEUVER
MSS: SSRMS: SSRMS Safing: ✅ SSRMS Safing

**cmd** Remove (Verify Not Safed)

DCP

BRAKES SSRMS → OFF (Verify OFF)

\✓ Vernier

PCS

MSS: SSRMS: ✅ SSRMS

Enter Mode – Joint OCAS (Verify blue)

**SSRMS Joint OCAS**

pick File ➤ W4MBS2 ➤ SASA Start Inter


<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+216.9</td>
<td>0.0</td>
<td>-5.0</td>
<td>-106.2</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>(current)</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+250.0</td>
<td>+60.0</td>
<td>+65.0</td>
<td>-155.0</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
<tr>
<td>TGT</td>
<td>+216.9</td>
<td>0.0</td>
<td>-5.0</td>
<td>-106.2</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
<tr>
<td>ERR</td>
<td>+33.1</td>
<td>+60.0</td>
<td>+70.0</td>
<td>-48.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
1.500 SSRMS MANEUVER TO SASA START POSITION
(RBT FS/13A.1/FIN 1)

* If joint angles or errors are incorrect
  * cmd Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * cmd Load (Verify Sequence Status – Confirm or Cancel)
  * Verify joint angles and errors are correct on Joint Angle Position overlay.

PCS

PC S

NOTE
This Joint OCAS will take approximately 1.5 minutes to complete in Vernier rates.

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+216.9</td>
<td>0.0</td>
<td>-5.0</td>
<td>-106.2</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
</tbody>
</table>

MSS: SSRMS: SSRMS

Enter Mode – Single (Verify blue)
**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**THC**

Perform Single Joint maneuver to SASA Start position (within 1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+216.9</td>
<td>0.0</td>
<td>-5.0</td>
<td>-106.2</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
<tr>
<td>SASA Start Intermediate 1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>216.9</td>
<td>0.0</td>
<td>-9.4</td>
<td>-106.2</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – LEE Tip, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**

Expect the following message when safing is commanded:

'R3Z - MSS OCS SSRMS Prime(Redun) ACU SRT Cat-1 Brk Stat Fall' (SCR 17495)

This message should return to Norm.

**DCP**

SAFINING → SAFE (Verify ON)

Figure 7.- SASA Start
(03: S1 Lower Outboard: +60, -30).

Figure 8.- SASA Start
1. **SETUP**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard</td>
<td>22: Base Elbow</td>
<td>13: LAB Stbd Zenith</td>
<td>SRMS Elbow</td>
</tr>
<tr>
<td>(+60, -30)</td>
<td>(-110, -15)</td>
<td>(-180, +90)</td>
<td>(+90, -60)</td>
</tr>
</tbody>
</table>

PCS

MSS: SSRMS: SSRMS

Verify Unloaded Parameters – √
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held

Verify Display – W4>ISSACS

Change Command ► W4 ► ISSACS/Internal (Verify W4>ISSACS/Internal)

Verify SSRMS at SASA Start position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+216.9</td>
<td>0</td>
<td>-9.4</td>
<td>-106.2</td>
<td>-59.0</td>
<td>-74.4</td>
<td>-102.3</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+315</td>
<td>+1480</td>
<td>+76</td>
<td>90.0</td>
<td>-0.1</td>
<td>+17.1</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held
Disp W4>ISSACS

**NOTE**

1. This position is intended to be the APFR Install position, if GCA is required it should be done as part of step 2.1.

2. APFR settings for the SASA relocate task are 12/PP/F/6.

3. Clearance between the APFR Ingress Aid and the truss will be 43 cm (17 in) and can be monitored using the LAB Stbd Zenith Camera.

---

Figure 1.- SASA Start (03: S1 Lower Outboard: +60, -30).

Figure 2.- SASA Start (22: Base Elbow: -110, -15).
2. APFR INGRESS
Verify SRMS in P6 SASA Relocation Viewing position with brakes on.

MSS: SSRMS: SSRMS Safing: **SSRMS Safing**

**cmd** Remove (Verify Not Safed)

DCP
BRAKES SSRMS → OFF (Verify OFF)

√ Vernier

2.1 APFR Ingress
MSS: SSRMS: **SSRMS**

Enter Mode – Manual (Verify blue)


**cmd** Shoulder Yaw (Verify SY – Locked)

On EV GO, APFR installed, ready for APFR ingress:

THC/RHC
Perform EVA GCA as required for APFR ingress.

Expected APFR Ingress position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+205.7</td>
<td>0.0</td>
<td>-5.9</td>
<td>-102.3</td>
<td>-103.1</td>
<td>-71.7</td>
<td>-140.5</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+315</td>
<td>+1480</td>
<td>-105</td>
<td>-90.0</td>
<td>-0.1</td>
<td>+17.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – LEE Tip, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PCS

MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

Change Unloaded Parameters ▶ EVA ▶ Chest 12/PP/F/6 SYH
Verify ‘Unloaded Parameters’ (two) – Chest 12/PP/F/6, SY Held

Figure 5.- APFR Ingress
(03: S1 Lower Outboard: +60, -30).

Figure 6.- APFR Ingress
(22: Base Elbow: -90, -20).

2.2 EVA Clear of S1
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (+25, +15)</td>
<td>24: Tip Elbow (-10, +20)</td>
<td>13: LAB Stbd Zenith (-180, +75)</td>
<td>37: MBS Mast (-170, -5)</td>
</tr>
<tr>
<td>22: Base Elbow (-110, -15)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7.- APFR Ingress
(91: Camera B: +25, +15).

Figure 8.- APFR Ingress
(24: Tip Elbow: -10, +20).
On EV GO, APFR ingressed, ready for maneuver:

MSS: SSRMS: **SSRMS**

Enter Mode – Manual (Verify blue)


**cmd** Shoulder Yaw (Verify SY – Locked)

THC/ RHC Maneuver SSRMS to S1 Clearance position (within 5 cm/1 deg) (small offsets in position and orientation due to EVA GCA should also be corrected during this motion).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+205.7</td>
<td>0.0</td>
<td>-5.9</td>
<td>-102.3</td>
<td>-103.1</td>
<td>-71.7</td>
<td>-140.5</td>
<td></td>
</tr>
<tr>
<td>+227</td>
<td>+1479</td>
<td>+55</td>
<td>±180.0</td>
<td>-0.1</td>
<td>-0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+350</td>
<td>-500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+350</td>
<td>+1479</td>
<td>-500</td>
<td>±180.0</td>
<td>-0.1</td>
<td>-0.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

APFR Ingress

1: X +

2: Z -

S1 Clearance

FOR Unloaded – Ch 12/PP/F/6, SY Held

Disp W4>ISSACS

Figure 9.- S1 Clearance
(91: Camera B: +25, +15).

Figure 10.- S1 Clearance
(13: LAB Stbd Zenith: -180, +75).

3. **JOINT OCAS TO P6**

\(\sqrt{MCC-H}\) 2B BGA locked at 90 degrees, 4B BGA locked at 270 degrees

PCS MSS: SSRMS: **SSRMS**

Enter Mode – Joint OCAS (Verify blue)
RHC RATE → COARSE (Verify Coarse on PCS)

PCS SSRMS Joint OCAS

Input ‘Joint Angles’ ‘Destination’ for P6 Intermediate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+119.3</td>
<td>0.0</td>
<td>-50.0</td>
<td>-79.9</td>
<td>-28.7</td>
<td>-36.4</td>
<td>-80.1</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>+174.6</td>
<td>0.0</td>
<td>-11.5</td>
<td>-73.6</td>
<td>-161.9</td>
<td>-46.8</td>
</tr>
<tr>
<td>TGT</td>
<td>+119.3</td>
<td>0.0</td>
<td>-50.0</td>
<td>-79.9</td>
<td>-28.7</td>
<td>-36.4</td>
</tr>
<tr>
<td>ERR</td>
<td>+55.3</td>
<td>0.0</td>
<td>+38.5</td>
<td>+6.3</td>
<td>-133.2</td>
<td>-10.4</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

**cmd** Cancel (Verify Sequence Status – Waiting Destination)

* Input correct Dest joint angles per table above.

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+119.3</td>
<td>0.0</td>
<td>-50.0</td>
<td>-79.9</td>
<td>-28.7</td>
<td>-36.4</td>
<td>-80.1</td>
</tr>
</tbody>
</table>
4. SASA REMOVAL FROM P6

4.1 Single Joint to SASA Base Bolt Location

RHC
RATE → VERNIER (Verify Vernier on PCS)

PCS
MSS: SSRMS: SSRMS
Enter Mode – Single (Verify blue)

**WARNING**
The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

**NOTE**
FOR values for Pitch and Roll are unreliable when Yaw ~90 degrees due to display singularity.

THC
Maneuver SSRMS to SASA Base Bolt position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>P6 Intermediate</th>
<th>SR: +119.3</th>
<th>SY: 0.0</th>
<th>SP: -60.0</th>
<th>EP: -79.9</th>
<th>WP: -28.7</th>
<th>WY: -36.4</th>
<th>WR: -80.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: SP – Base Bolt Location</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+119.3</td>
<td>0.0</td>
<td>-50.0</td>
<td>-79.9</td>
<td>-28.7</td>
<td>-36.4</td>
<td>-80.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-250</td>
<td>+155</td>
<td>-1265</td>
<td>-104.0</td>
<td>-90.0</td>
<td>+166.1</td>
<td>*</td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Ch 12/PP/F/6, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.2 SASA Removal

**PCS**  
**MSS: SSRMS:**  
Change Command ▶ SSRMS ▶ Internal (Verify SSRMS>Internal)

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:  
**Joint Lock**

**cmd** Shoulder Yaw (Verify SY – Locked)

On EV GO, ready for GCA:

**THC/RHC**  
Maneuver per EVA GCA to remove SASA.

On EV GO, SASA removed:

Maneuver SSRMS to SASA Base Bolt position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+119.3</td>
<td>0.0</td>
<td>-60.0</td>
<td>-79.9</td>
<td>-28.7</td>
<td>-36.4</td>
<td>-80.1</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-250</td>
<td>+155</td>
<td>-1265</td>
<td>-104.0</td>
<td>-90.0</td>
<td>+166.1</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Ch 12/PP/F/6, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Display Singularity

4.3 Setup for Joint OCAS to P1

**PCS**  
**MSS: SSRMS:**  
Enter Mode – Single (Verify blue)
WARNING

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

THC

Maneuver SSRMS to P1 Joint OCAS Setup position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+119.3</td>
<td>0.0</td>
<td>-60.0</td>
<td>-79.9</td>
<td>-28.7</td>
<td>-36.4</td>
<td>-80.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-22.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+119.3</td>
<td>0.0</td>
<td>-22.7</td>
<td>-79.9</td>
<td>-28.7</td>
<td>-36.4</td>
<td>-80.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – Ch 12/PP/F/6, SY Held
Disp W4>ISSACS

5. JOINT OCAS TO P1

NOTE

Base Boom clearance to the MCAS RTL will be 81 cm (2.6 ft) at the end of the Joint OCAS. There is no risk of collision between these elements.

PCS

MSS: SSRMS: SSRMS

Enter Mode – Joint OCAS (Verify blue)

RHC

RATE → COARSE (Verify Coarse on PCS)

SSRMS Joint OCAS

pick File W4MBS2 P1 Approach
1.510  SSRMS SASA RELOCATE
(RBT FS/13A.1/FIN 1)  Page 9 of 15 pages

Verify ‘Joint Angles’ ‘Destination’ for P1 Approach position.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+56.3</td>
<td>0.0</td>
<td>-98.2</td>
<td>-51.6</td>
<td>-60.2</td>
<td>-24.1</td>
<td>-63.5</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON** Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>+119.3</td>
<td>0.0</td>
<td>-22.7</td>
<td>-79.9</td>
<td>-28.7</td>
<td>-36.4</td>
<td>-80.1</td>
</tr>
<tr>
<td>TGT</td>
<td>+56.3</td>
<td>0.0</td>
<td>-98.2</td>
<td>-51.6</td>
<td>-60.2</td>
<td>-24.1</td>
<td>-63.5</td>
</tr>
<tr>
<td>ERR</td>
<td>+63.0</td>
<td>0.0</td>
<td>+75.5</td>
<td>-28.3</td>
<td>+31.5</td>
<td>-12.3</td>
<td>-16.6</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

**PCS**
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest joint angles per table above.
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
* **MON** Verify joint angles and errors are correct on Joint Angle Position overlay.

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

**PCS** **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**
This Joint OCAS will take approximately 3 minutes to complete in Coarse rates.

**DCP** AUTO SEQ → PROC

**PCS** MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify SSRMS at P1 Approach position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+56.3</td>
<td>0.0</td>
<td>-98.2</td>
<td>-51.6</td>
<td>-60.2</td>
<td>-24.1</td>
<td>-63.5</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+60</td>
<td>-870</td>
<td>-400</td>
<td>-90.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Ch 12/PP/F/6, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11 JUL 07 181 18393.doc
6. **SASA INSTALL**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (-5, +15)</td>
<td>22: Base Elbow (-130, -10)</td>
<td>37: MBS Mast (-15, -15)</td>
<td>SRMS Elbow (+90, -50)</td>
</tr>
</tbody>
</table>

On EV GO, ready to approach P1:

- **RHC**
  - RATE → VERNIER (Verify Vernier on PCS)

- **PCS**
  - MSS: SSRMS: SSRMS
  - Enter Mode – Manual (Verify blue)
  - MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock
  - **cmd** Shoulder Yaw (Verify SY – Locked)
THC/ RHC

Maneuver SSRMS to SASA Install position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+50.9</td>
<td>0.0</td>
<td>-98.5</td>
<td>-55.9</td>
<td>-57.5</td>
<td>-21.4</td>
<td>-68.5</td>
</tr>
<tr>
<td>X</td>
<td>+60</td>
<td>-870</td>
<td>-280</td>
<td>-90.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Ch 12/PP/F/6, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Perform EVA GCA as required for SASA Install on P1.

**Figure 21.** - SASA Install (22: Base Elbow: -130, -10).

**Figure 22.** - SASA Install (37: MBS Mast: -15, -15).

7. **APFR RECONFIGURATION AND EGRESS/INGRESS**

On EV GO, SASA install complete:

Maneuver SSRMS to APFR Reconfig position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+46.9</td>
<td>0.0</td>
<td>-88.0</td>
<td>-56.6</td>
<td>-68.5</td>
<td>-19.1</td>
<td>-72.1</td>
</tr>
<tr>
<td>X</td>
<td>+300</td>
<td>-870</td>
<td>-280</td>
<td>-90.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Ch 12/PP/F/6, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PCS MSS: SSRMS: **SSRMS**

Enter Mode – Standby (Verify blue)
7.1 APFR Reconfiguration
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B</td>
<td>24: Tip Elbow</td>
<td>13: LAB Stbd Zenith</td>
<td>SRMS Elbow</td>
</tr>
<tr>
<td>(-5, +15)</td>
<td>(-10, 0)</td>
<td>(-180, -35)</td>
<td>(+90, -50)</td>
</tr>
</tbody>
</table>

Figure 23.- APFR Reconfig
(24: Tip Elbow: -10, 0).

Figure 24.- APFR Reconfig

On EV GO, APFR reconfiguration complete:

**NOTE**

APFR settings for the CETA relocate task are 12/PP/A/6.

Change Unloaded Parameters ► EVA ► Chest 12/PP/A/6 SYH
Verify ‘Unloaded Parameters’ (two) – Chest 12/PP/A/6, SY Held

MSS: SSRMS: [SSRMS]

Enter Mode – Joint OCAS (Verify blue)

pick File ► W4MBS2 ► EVA 3 Intermediate

SSRMS Joint OCAS

Verify ‘Joint Angles’ ‘Destination’ for EVA 3 Intermediate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+70.1</td>
<td>-30.0</td>
<td>-99.8</td>
<td>-43.9</td>
<td>+13.2</td>
<td>+1.1</td>
<td>+73.5</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)
Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>(current)</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+46.9</td>
<td>0.0</td>
<td>-88.0</td>
<td>-56.6</td>
<td>-68.5</td>
<td>-19.1</td>
<td>-72.1</td>
<td></td>
</tr>
<tr>
<td>TGT</td>
<td>+70.1</td>
<td>-30.0</td>
<td>-99.8</td>
<td>-43.9</td>
<td>+13.2</td>
<td>+1.1</td>
<td>+73.5</td>
</tr>
<tr>
<td>ERR</td>
<td>-23.2</td>
<td>+30.0</td>
<td>+11.8</td>
<td>-12.7</td>
<td>-81.7</td>
<td>-20.2</td>
<td>-145.6</td>
</tr>
</tbody>
</table>

* If joint angles or errors are incorrect
  * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * **cmd** Load (Verify Sequence Status – Confirm or Cancel)
  * Verify joint angles and errors are correct on Joint Angle Position overlay.

**NOTE**
This Joint OCAS will take approximately 3 minutes to complete in Vernier rates.

Verify Posn Hold – orange
Verify Joint Angle values.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGT</td>
<td>+70.1</td>
<td>-30.0</td>
<td>-99.8</td>
<td>-43.9</td>
<td>+13.2</td>
<td>+1.1</td>
<td>+73.5</td>
</tr>
</tbody>
</table>

Figure 25.- EVA 3 Intermediate
(91: Camera B: -5, +15).
Figure 26.- EVA 3 Intermediate
7.2 CETA Cart Clearance Position Maneuver
MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

Maneuver to CETA Cart Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+46.3</td>
<td>-30.0</td>
<td>-112.1</td>
<td>-41.0</td>
<td>+33.1</td>
<td>-15.8</td>
<td>+61.6</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+400</td>
<td>-995</td>
<td>-5</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – Ch 12/PP/A/6, SY Held
Disp W4>ISSACS

7.3 APFR Egress/Ingress Maneuver
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B</td>
<td>24: Tip Elbow</td>
<td>32: MBS POA</td>
<td>SRMS Elbow</td>
</tr>
<tr>
<td>(-5, +15)</td>
<td>(+10, +20)</td>
<td>(+90, -50)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 27.- CETA Cart Clearance (24: Tip Elbow: +10, +20).
Figure 28.- CETA Cart Clearance (32: MBS POA).
On EV GO, ready to egress APFR:

Maneuver to APFR Egress/Ingress position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+51.4</td>
<td>-30.0</td>
<td>-119.4</td>
<td>-38.0</td>
<td>+35.4</td>
<td>-12.0</td>
<td>+63.9</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+285</td>
<td>-995</td>
<td>-5</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Ch 12/PP/A/6, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Perform EVA GCA as required for APFR egress.

DCP  BRAKES SSRMS → ON (Verify ON)

Figure 29.- APFR Egress  
(24: Tip Elbow: +10, +20).

Figure 30.- APFR Egress  
(32: MBS POA).
1. **SETUP**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>14: Camera B (-5, +15)</td>
<td>24: Tip Elbow (+10, +20)</td>
<td>13: LAB Stbd Zenith (-180, -35)</td>
<td>SRMS Elbow (+90, -60)</td>
</tr>
</tbody>
</table>

Figure 1.- APFR Ingress (91: Camera B: -5, +15).

Figure 2.- APFR Ingress (24: Tip Elbow: +10, +20).

Figure 3.- APFR Ingress (13: LAB Stbd Zenith: -180, -35).

Figure 4.- APFR Ingress (V10: SRMS Elbow: +90, -60).

PCs MSS: SSRMS: **SSRMS**

- Verify Unloaded Parameters – √
- Verify ‘Unloaded Parameters’ (two) – Chest 12/PP/A/6, SY Held

- Verify Display – W4>ISSACS

- Verify Command – SSRMS>Internal

- √Vernier
Verify SSRMS at APFR Egress/Ingress position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+51.4</td>
<td>-30.0</td>
<td>-119.4</td>
<td>-38.0</td>
<td>+35.4</td>
<td>-12.0</td>
<td>+63.9</td>
</tr>
</tbody>
</table>

X Y Z Pitch Yaw Roll

+285 -995 -5 ±180.0 0.0 ±180.0

FOR Unloaded – Ch 12/PP/A/6, SY Held

Disp W4>ISSACS

2. CETA CART REMOVAL AND MANEUVER TO CLEARANCE POSITION

On EV GO, ready for APFR ingress:

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)

THC/RHC

Perform EVA GCA as required for APFR ingress and CETA cart removal.

On EV GO, CETA cart disconnected:

Maneuver to Port Zenith Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>SY</td>
</tr>
<tr>
<td>+51.4</td>
<td>-30.0</td>
</tr>
</tbody>
</table>

X Y Z Pitch Yaw Roll

+285 -995 -5 ±180.0 0.0 ±180.0

APFR Ingress

1: X + 400

2: Z – 955

Port Zenith Clearance

+400 -995 -955 ±180.0 0.0 ±180.0

SR SY SP EP WP WY WR

+77.9 -30.0 -107.7 -14.7 -12.3 +6.1 +78.1

FOR Unloaded – Chest 12/PP/A/6, SY Held

Disp W4>ISSACS
3. **ZENITH INTERMEDIATE POSITION MANEUVER**

**RHC**

RATE → COARSE (Verify Coarse on PCS)

**PCS**

MSS: SSRMS: [SSRMS]

Enter Mode – Joint OCAS (Verify blue)

[SSRMS Joint OCAS]

pick File ▶ W4MBS2 ▶ Zenith Intermediate

Verify 'Joint Angles' 'Destination' for Zenith Intermediate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)
MON Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>+77.9</td>
<td>-30.0</td>
<td>-107.7</td>
<td>-14.7</td>
<td>-12.3</td>
<td>+6.1</td>
<td>+78.1</td>
</tr>
<tr>
<td>TGT</td>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
<tr>
<td>ERR</td>
<td>-29.3</td>
<td>-30.0</td>
<td>-52.1</td>
<td>+39.6</td>
<td>+21.8</td>
<td>-40.9</td>
<td>-2.9</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

** PCS
**
** cmd Cancel (Verify Sequence Status – Waiting Destination)**

**
** Input correct Dest joint angles per table above.

**
** cmd Load (Verify Sequence Status – Confirm or Cancel)

**
** MON

**
** Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS cmd Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
</tbody>
</table>

Figure 9.- Zenith Intermediate (13: LAB Stbd Zenith: -180, +15).

Figure 10.- Zenith Intermediate (V10: SRMS Elbow: +90, -60).
4. **STARBOARD ZENITH CLEARANCE POSITION MANEUVER**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (+25, +5)</td>
<td>22: Base Elbow (-130, -5)</td>
<td>13: LAB Stbd Zenith (-180, +30)</td>
<td>91: SSRMS Elbow (+90, -60)</td>
</tr>
</tbody>
</table>

**Figure 11.- Zenith Intermediate**

(22: Base Elbow: -130, -5).

MSS: SSRMS: **SSRMS**

**SSRMS Joint OCAS**

pick File ▶ W4MBS2 ▶ Stbd Zen Clearance

Verify ‘Joint Angles’ ‘Destination’ for Starboard Zenith Clearance position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR (current)</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
<tr>
<td>TGT</td>
<td>+177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
</tr>
<tr>
<td>ERR</td>
<td>-70.4</td>
<td>0.0</td>
<td>-41.9</td>
<td>+10.0</td>
<td>+113.1</td>
<td>+8.5</td>
</tr>
</tbody>
</table>
1. If joint angles or errors are incorrect
   * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
   * Input correct Dest joint angles per table above.
   * **cmd** Load (Verify Sequence Status – Confirm or Cancel)
   * Verify joint angles and errors are correct on Joint Angle Position overlay.

---

PCS

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**

This Joint OCAS will take approximately 2.5 minutes to complete in Coarse rates.

---

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
<td>+183.9</td>
</tr>
</tbody>
</table>

---

Figure 12. - Starboard Zenith Clearance (91: Camera B: +25, +15).

Figure 13. - Starboard Zenith Clearance (22: Base Elbow: -130, -5).
5. **CETA CART INSTALLATION**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (+25, +15)</td>
<td>22: Base Elbow (-110, -5)</td>
<td>03: S1 Lower Outboard (+60, -40)</td>
<td>SRMS Elbow (+90, -60)</td>
</tr>
<tr>
<td>24: Tip Elbow (+10, +20)</td>
<td>13: LAB Stbd Zenith (-180, +30)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RHC**

RATE → VERNIER (Verify Vernier on PCS)

**PCS**

MSS: SSRMS: **SSRMS**

Enter Mode – Manual (Verify blue)
MSS: SSRMS: SSRMS Manual: Joint Lock: [Joint Lock]

**cmd** Shoulder Yaw (Verify SY – Locked)

**THC/RHC**

Maneuver to CETA Cart Delivery position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
<td>+183.9</td>
</tr>
<tr>
<td>Stbd Zenith</td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>Clearance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Z +</td>
<td>+400</td>
<td>+1440</td>
<td>-955</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td>2: X – CETA Cart Delivery</td>
<td>+300</td>
<td>+1440</td>
<td>-5</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
</tbody>
</table>

On EV GO, ready for CETA cart delivery:

Perform EVA GCA as required for CETA cart installation.

---

**Figure 17.** CETA Cart Delivery
(22: Base Elbow: -110, -5).

**Figure 18.** CETA Cart Delivery
(03: S1 Lower Outboard: +60, -40).
6. **STBD ZENITH CLEARANCE POSITION MANEUVER**

On EV GO, CETA cart secured:

Maneuver to Starboard Zenith Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>CETA Cart Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1: X +</td>
</tr>
<tr>
<td></td>
<td>2: Z –</td>
</tr>
<tr>
<td></td>
<td>Stbd Zenith Clearance</td>
</tr>
<tr>
<td>SR</td>
<td>SY</td>
</tr>
<tr>
<td>+230.7</td>
<td>0.0</td>
</tr>
<tr>
<td>X Y Z Pitch Yaw Roll</td>
<td></td>
</tr>
<tr>
<td>+300</td>
<td>+1440</td>
</tr>
<tr>
<td>+400</td>
<td></td>
</tr>
<tr>
<td>+400</td>
<td>+1440</td>
</tr>
<tr>
<td>SR</td>
<td>SY</td>
</tr>
<tr>
<td>+177.6</td>
<td>0.0</td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Chest 12/PP/A/6, SY Held</td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
</tr>
</tbody>
</table>

---

**Figure 19.- Starboard Zenith**
(91: Camera B: +25, +15).

**Figure 20.- Starboard Zenith**
(V10: SRMS Elbow: +90, -60).

7. **ZENITH INTERMEDIATE POSITION MANEUVER**

**PCS**
MSS: SSRMS: \[\text{SSRMS}\]

Enter Mode – Joint OCAS (Verify blue)

**RHC**
RATE → COARSE (Verify Coarse on PCS)

**SSRMS Joint OCAS**

pick File ▶ W4MBS2 ▶ Zenith Intermediate

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>+177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
<td>+183.9</td>
</tr>
<tr>
<td>TGT</td>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
<tr>
<td>ERR</td>
<td>+70.4</td>
<td>0.0</td>
<td>+41.9</td>
<td>-10.0</td>
<td>-113.1</td>
<td>-8.5</td>
<td>+102.9</td>
</tr>
</tbody>
</table>

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

**PCS**

* If joint angles or errors are incorrect
  * **cmd** Cancel (Verify Sequence Status – Waiting Destination)
  * Input correct Dest joint angles per table above.
  * **cmd** Load (Verify Sequence Status – Confirm or Cancel)
  * **MON**
    * Verify joint angles and errors are correct on Joint Angle Position overlay.

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

**PCS**

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**

This Joint OCAS will take approximately 2.5 minutes to complete in Coarse rates.

**DCP**

AUTO SEQ → PROC

**PCS**

MSS: SSRMS: [SSRMS]

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th></th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
</tbody>
</table>
8. PORT ZENITH CLEARANCE POSITION MANEUVER

SSRMS Joint OCAS

pick File ▶ W4MBS2 ▶ Port Zen Clearance

Verify ‘Joint Angles’ ‘Destination’ for Port Zenith Clearance position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+77.9</td>
<td>-30.0</td>
<td>-107.7</td>
<td>-14.8</td>
<td>-12.2</td>
<td>+6.1</td>
<td>+78.1</td>
</tr>
</tbody>
</table>

`cmd` Load (Verify Sequence Status – Confirm or Cancel)

MON

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current)</td>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
</tr>
<tr>
<td>TGT</td>
<td>+77.9</td>
<td>-30.0</td>
<td>-107.7</td>
<td>-14.8</td>
<td>-12.2</td>
<td>+6.1</td>
</tr>
<tr>
<td>ERR</td>
<td>+29.3</td>
<td>+30.0</td>
<td>+52.1</td>
<td>-39.5</td>
<td>-21.9</td>
<td>+40.9</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

PCS

* `cmd` Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest joint angles per table above.
* `cmd` Load (Verify Sequence Status – Confirm or Cancel)

MON

* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS

`cmd` Confirm (Verify Sequence Status – Auto Seq sw - Hot)
NOTE
This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.

DCP
AUTO SEQ → PROC

PCS
MSS: SSRMS: SSRMS
Verify Posn Hold – orange
Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+77.9</td>
<td>-30.0</td>
<td>-107.7</td>
<td>-14.8</td>
<td>-12.2</td>
<td>+6.1</td>
<td>+78.1</td>
</tr>
</tbody>
</table>

Figure 23.- Port Zenith
(91: Camera B: -5, +15).

Figure 24.- Port Zenith
(V10: SRMS Elbow: +90, -60).

9. CETA CART PICKUP

RHC
RATE → VERNIER (Verify Vernier on PCS)

PCS
MSS: SSRMS: SSRMS
Enter Mode – Manual (Verify blue)
MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

cmd Shoulder Yaw (Verify SY – Locked)
Maneuver to CETA Cart Pickup position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+77.9</td>
<td>-30.0</td>
<td>-107.7</td>
<td>-14.8</td>
<td>-12.2</td>
<td>+6.1</td>
<td>+78.1</td>
</tr>
<tr>
<td>Port Zenith</td>
<td>X Y Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Z</td>
<td>+401</td>
<td>-995</td>
<td>-954</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td>2: X</td>
<td>-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cart Pickup</td>
<td>+285</td>
<td>-995</td>
<td>-5</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+51.4</td>
<td>-30.0</td>
<td>-119.4</td>
<td>-38.0</td>
<td>+35.4</td>
<td>-12.0</td>
<td>+63.9</td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Chest 12/PP/A/6, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Perform EVA GCA as required for CETA cart pickup.

10. **CETA CART REMOVAL AND MANEUVER TO CLEARANCE POSITION**

On EV GO, CETA cart disconnected:

Maneuver to Port Zenith Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+51.4</td>
<td>-30.0</td>
<td>-119.4</td>
<td>-38.0</td>
<td>+35.4</td>
<td>-12.0</td>
<td>+63.9</td>
</tr>
<tr>
<td>Cart Pickup</td>
<td>X Y Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: X</td>
<td>+400</td>
<td>-995</td>
<td>-955</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td>2: Z</td>
<td>-955</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port Zenith</td>
<td>+400</td>
<td>-995</td>
<td>-955</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+77.9</td>
<td>-30.0</td>
<td>-107.7</td>
<td>-14.7</td>
<td>-12.3</td>
<td>+6.1</td>
<td>+78.1</td>
</tr>
<tr>
<td>FOR</td>
<td>Unloaded – Chest 12/PP/A/6, SY Held</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disp</td>
<td>W4&gt;ISSACS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.520 SSRMS CETA CART RELOCATE
(RBT FS/13A.1/FIN 1)  Page 14 of 22 pages

11 JUL 07

11. MANEUVERING TO ZENITH INTERMEDIATE POSITION

RHC
RATE ➔ COARSE (Verify Coarse on PCS)

PCS
MSS: SSRMS: SSRMS
Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

pick File ➔ W4MBS2 ➔ Zenith Intermediate


<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)
MON Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>(current)</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+77.9</td>
<td>-30.0</td>
<td>-107.7</td>
<td>-14.7</td>
<td>-12.3</td>
<td>+6.1</td>
<td>+78.1</td>
</tr>
<tr>
<td>TGT</td>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
<tr>
<td>ERR</td>
<td>-29.3</td>
<td>-30.0</td>
<td>-52.1</td>
<td>+39.6</td>
<td>+21.8</td>
<td>-40.9</td>
<td>-2.9</td>
</tr>
</tbody>
</table>

************************************************************************************
* If joint angles or errors are incorrect
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)
* Verify joint angles and errors are correct on Joint Angle Position overlay.
***********************************************************************************

PCS **cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

**NOTE**
This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
</tbody>
</table>

Figure 31.- Zenith Intermediate (13: LAB Stbd Zenith: -180, +15).

Figure 32.- Zenith Intermediate (V10: SRMS Elbow: +90, -60).
12. **STARBOARD ZENITH CLEARANCE POSITION MANEUVER**
Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (+25, +15)</td>
<td>22: Base Elbow (-130, -5)</td>
<td>13: LAB Stbd Zenith (-180, +40)</td>
<td>91: SRMS Elbow (+90, -60)</td>
</tr>
</tbody>
</table>

![Image](image.png)

Figure 33.- Zenith Intermediate (22: Base Elbow: -130, -5).

**MSS:** SSRMS: [SSRMS]

**SSRMS Joint OCAS**

pick File ▶ W4MBS2 ▶ Stbd Zen Clearance

Input ‘Joint Angles’ ‘Destination’ for Starboard Zenith Clearance position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
<td>+183.9</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>(current) +107.2</td>
<td>0.0</td>
<td>-55.6</td>
<td>-54.3</td>
<td>-34.1</td>
<td>+47.0</td>
<td>+81.0</td>
</tr>
<tr>
<td>TGT  +177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
<td>+183.9</td>
</tr>
<tr>
<td>ERR  -70.4</td>
<td>0.0</td>
<td>-41.9</td>
<td>+10.0</td>
<td>+113.1</td>
<td>+8.5</td>
<td>-102.9</td>
</tr>
</tbody>
</table>
PCS

* If joint angles or errors are incorrect
* **cmd** Cancel (Verify Sequence Status – Waiting Destination)
* Input correct Dest joint angles per table above.
* **cmd** Load (Verify Sequence Status – Confirm or Cancel)

MON

* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

PCS

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)

NOTE
This Joint OCAS will take approximately 2.5 minutes to complete in Coarse rates.

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS: **SSRMS**

Verify Posn Hold – orange

Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
<td>+183.9</td>
</tr>
</tbody>
</table>

Figure 34.- Starboard Zenith Clearance (91: Camera B: +25, +15).

Figure 35.- Starboard Zenith Clearance (22: Base Elbow: -130, -5).
13. **CETA CART INSTALLATION AND APFR EGRESS**

Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>91: Camera B (+25, +15)</td>
<td>22: Base Elbow (-110, -5)</td>
<td>03: S1 Lower Outboard (+60, -40)</td>
<td>SRMS Elbow (+90, -60)</td>
</tr>
</tbody>
</table>

RHC

RATE → VERNIER (Verify Vernier on PCS)

PCS

MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

**cmd** Shoulder Yaw (Verify SY – Locked)
THC/RHC Maneuver to CETA Cart Delivery position (within 5 cm/1 deg).

```
<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+177.6</td>
<td>0.0</td>
<td>-13.7</td>
<td>-64.3</td>
<td>-147.2</td>
<td>+38.5</td>
<td>+183.9</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+399</td>
<td>+1440</td>
<td>-955</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+300</td>
<td>+1440</td>
<td>-5</td>
<td>±180.0</td>
<td>0.0</td>
<td>±180.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Stbd Zenith Clearance
1: Z +
2: X -

CETA Cart Delivery

FOR Unloaded – Chest 12/PP/A/6, SY Held
Disp W4>ISSACS

On EV GO, ready for CETA cart delivery:

Perform EVA GCA as required for CETA cart installation.

On EV GO, ready for APFR egress:

Perform EVA GCA as required for APFR egress.

PCS MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

14. **APFR REMOVAL**

Change Unloaded Parameters ▶ Unloaded ▶ LEE Tip SYH
Verify ‘Unloaded Parameters’ (two) – LEE Tip, SY Held
Change Command ▶ ISS ▶ ISSACS (Verify ISS>ISSACS)

**NOTE**
FOR values for Pitch and Roll are unreliable when Yaw ~90 degrees due to a display singularity.

MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock: Joint Lock

**cmd** Shoulder Yaw (Verify SY – Locked)

**THC/ RHC**

Maneuver to APFR Removal position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+222.8</td>
<td>0.0</td>
<td>-12.7</td>
<td>-88.7</td>
<td>-135.1</td>
<td>+2.5</td>
<td>+214.0</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+388</td>
<td>+1444</td>
<td>+11</td>
<td>+29.3</td>
<td>-89.9</td>
<td>+136.3 *</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held

Disp W4>ISSACS

*Display singularity

Perform EVA GCA as required for APFR removal.

On EV GO, APFR removed, ready for maneuver:

Maneuver to SSRMS Clearance position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>Locked</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+222.8</td>
<td>0.0</td>
<td>-12.7</td>
<td>-88.7</td>
<td>-135.1</td>
<td>+2.5</td>
<td>+214.0</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+388</td>
<td>+1444</td>
<td>+11</td>
<td>+29.3</td>
<td>-89.9</td>
<td>+136.3 *</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held

Disp W4>ISSACS

*Display singularity
15. **WRIST RECONFIGURATION FOR UNDOCK**

PCS

MSS: SSRMS: **SSRMS**

Enter Mode – Single (Verify blue)

---

**WARNING**

The active joint must be checked on the PCS before initiating motion. Failure to do so may result in movement of the wrong joint.

---

THC

Perform Single Joint maneuver to SSRMS Park position (within 1 deg).

<table>
<thead>
<tr>
<th>SSRMS Clearance</th>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP +</td>
<td>+222.8</td>
<td>0.0</td>
<td>-12.7</td>
<td>-88.7</td>
<td>-135.1</td>
<td>+2.5</td>
<td>+214.0</td>
</tr>
<tr>
<td>WY +</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-88.0</td>
<td>+113.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SSRMS Park</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Pitch</th>
<th>Yaw</th>
<th>Roll</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+408</td>
<td>+1662</td>
<td>+131</td>
<td>+89.9</td>
<td>+13.0</td>
<td>-97.4</td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SY Held

Disp W4>ISSACS

---

**NOTE**

Expect the following message when safing is commanded:

'R3Z - MSS OCS SSRMS Prime(Redun) ACU SRT Cat-1 Brk Stat Fail’ (SCR 17495)

This message should return to Norm.

---

DCP

SAFING → SAFE (Verify ON)
Figure 43.- SSRMS Park
(91: Camera B: +25, +15).

Figure 44.- SSRMS Park
(03: S1 Lower Outboard: +60, -40).
1. **SSRMS LIMP AND DELIMP**

PCS

Verify ‘Loaded Parameters’ (two) – S5 Install, SR Held

√ Command – SSRMS>Internal

Enter Mode – Standby (Verify blue)

MSS: SSRMS: Limp: **SSRMS Limp**

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS: **SSRMS**

Verify all joints – Limped

Wait 30 seconds.

MSS: SSRMS: Limp: **SSRMS Limp**

**cmd** None Limp (Verify Standby – blue)

2. **MANUAL MODE SETUP**

MSS: SSRMS: **SSRMS**

Enter Mode – Manual (Verify blue)


**cmd** Shoulder Roll (Verify SR – Locked)

If at least one softdock indicator is already acquired


**cmd** All DOFs Off


Verify ‘X’ ‘Y’ ‘Z’ ‘Pitch’ ‘Yaw’ ‘Roll’ (six) – Off
3. **SOFTDOCK ACQUISITION**

**NOTE**

1. If the SSRMS stalls (EV crew cannot see motion), ramp out the hand controller inputs within 10 seconds, and repeat steps 1 to 3 to obtain the remaining softdock indicators.

2. If only opposite diagonal softdock indicators are engaged, use the table to obtain missing softdock indicators one at a time. After obtaining the first missing softdock indicator, repeat steps 1 to 3 to obtain the final softdock indicator.

3. If no softdocks indicators are acquired, use EVA GCA to correct alignment and continue -X motion, or use the table below to acquire closest softdock indicator.

4. Order of inputs in the table below is arbitrary. Simultaneous inputs can be used.

**THC/RHC**

Using Table 1 and referring to Figure 1, input commands to obtain remaining softdocks.

**Table 1. Inputs to Acquire Softdocks**

<table>
<thead>
<tr>
<th>Missing Softdock</th>
<th>THC/RHC Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-Pitch,-Yaw</td>
</tr>
<tr>
<td>2</td>
<td>+Pitch,-Yaw</td>
</tr>
<tr>
<td>3</td>
<td>-Pitch,+Yaw</td>
</tr>
<tr>
<td>4</td>
<td>+Pitch,+Yaw</td>
</tr>
<tr>
<td>1,3</td>
<td>-Pitch</td>
</tr>
<tr>
<td>2,4</td>
<td>+Pitch</td>
</tr>
<tr>
<td>1,2</td>
<td>-Yaw</td>
</tr>
<tr>
<td>3,4</td>
<td>+Yaw</td>
</tr>
<tr>
<td>1,2,3</td>
<td>-Pitch,-Yaw</td>
</tr>
<tr>
<td>1,2,4</td>
<td>+Pitch,-Yaw</td>
</tr>
<tr>
<td>1,3,4</td>
<td>-Pitch,+Yaw</td>
</tr>
<tr>
<td>2,3,4</td>
<td>+Pitch,+Yaw</td>
</tr>
<tr>
<td>All</td>
<td>Refer to note 3</td>
</tr>
</tbody>
</table>
2.100 S5 SOFT DOCK ACQUISITION
(RBT FS/13A.1/FIN 1)  

Figure 1.- S5 Install FOR.

When all four softdock indicators are acquired
Go to {1.120 SSRMS S5 INSTALL}, steps 8 and 9
(SODF: RBT FS: S5).
2.200 SSRMS MANEUVER TO LAB PDGF PRE-GRAPPLE INTERMEDIATE
- NO FI
(RBT FS/13A.1/FIN 1)  Page 1 of 3 pages

1. **SETUP**
   Configure Cameras and overlays as required.

<table>
<thead>
<tr>
<th>Monitor 1</th>
<th>Monitor 2</th>
<th>Monitor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>03: S1 Lower Outboard (+65, -30)</td>
<td>24: Tip Elbow (0, 0)</td>
<td>13: LAB Stbd Zenith (-160, 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>91: Camera D (-90, +30)</td>
</tr>
</tbody>
</table>

PCS  
MSS: SSRMS: [SSRMS]

Change Loaded Parameters ► Walk Off ► LAB PDGF  
Verify ‘Loaded Parameters’ (two) – LAB PDGF, SR Held

Verify ‘Unloaded Parameters’ (two) – LEE Tip, SR Held

Change Display ► W4 ► LAB PDGF (Verify W4>LAB PDGF)

Verify Command – SSRMS>Internal

√ Vernier

Verify SSRMS at MT Translate position (within 5 cm/1 deg).

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-140.0</td>
<td>+140.0</td>
<td>+252.5</td>
<td>+140.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>Pitch</td>
<td>Yaw</td>
<td>Roll</td>
<td></td>
</tr>
<tr>
<td>+701</td>
<td>+276</td>
<td>-377</td>
<td>+106.5</td>
<td>-18.9</td>
<td>-32.5</td>
<td></td>
</tr>
</tbody>
</table>

FOR Unloaded – LEE Tip, SR Held  
Disp W4>LAB PDGF

---

**Figure 1.** - MT Translate  
(03: S1 Lower Outboard: +65, -30).

**Figure 2.** - MT Translate  

13 JUL 07 217 18413.doc
2. **JOINT OCAS TO INTERMEDIATE POSITION**

MSS: SSRMS: SSRMS Safing: [SSRMS Safing]

**cmd** Remove (Verify Not Safed)

**DCP**

BRAKES SSRMS → OFF (Verify OFF)

**RHC**

RATE → COARSE (Verify Coarse on PCS)

**PCS**

MSS: SSRMS: [SSRMS]

Enter Mode – Joint OCAS (Verify blue)

[SSRMS Joint OCAS]

pick File ▶ W4MBS1 ▶ LAB Pregrap Inter

Verify ‘Joint Angles’ ‘Destination’ for LAB PDGF Pre-Grapple intermediate position.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-158.7</td>
<td>+117.8</td>
<td>+110.0</td>
<td>-73.0</td>
<td>-144.5</td>
<td>+17.6</td>
<td>-65.4</td>
</tr>
</tbody>
</table>

**cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

Verify joint angles and errors are correct on Joint Angle Position overlay.

<table>
<thead>
<tr>
<th>SR (current)</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-140.0</td>
<td>+140.0</td>
<td>+252.5</td>
<td>+140.0</td>
<td>-43.0</td>
<td>-111.9</td>
<td>-3.1</td>
</tr>
<tr>
<td>TGT</td>
<td>-158.7</td>
<td>+117.8</td>
<td>+110.0</td>
<td>-73.0</td>
<td>-144.5</td>
<td>+17.6</td>
</tr>
<tr>
<td>ERR</td>
<td>+18.7</td>
<td>+22.2</td>
<td>+142.5</td>
<td>+213.0</td>
<td>+101.5</td>
<td>-129.5</td>
</tr>
</tbody>
</table>

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

* If joint angles or errors are incorrect

**PCS**

* **cmd** Cancel (Verify Sequence Status – Waiting Destination)

* Input correct Dest joint angles per table above.

* **cmd** Load (Verify Sequence Status – Confirm or Cancel)

**MON**

* Verify joint angles and errors are correct on Joint Angle Position overlay.

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

**PCS**

**cmd** Confirm (Verify Sequence Status – Auto Seq sw - Hot)
NOTE
2. This Joint OCAS will take approximately 3 minutes to complete in Coarse rates.

DCP
AUTO SEQ → PROC

PCS
MSS: SSRMS: SSRMS
Verify Posn Hold – orange
Verify Joint Angle values.

<table>
<thead>
<tr>
<th>SR</th>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-158.7</td>
<td>+117.8</td>
<td>+110.0</td>
<td>-73.0</td>
<td>-144.5</td>
<td>+17.6</td>
<td>-65.4</td>
</tr>
</tbody>
</table>

RHC
RATE → VERNIER (Verify Vernier on PCS)

Figure 3.- LAB PDGF Pre-Grapple Intermediate
(03: S1 Lower Outboard: +65, +10).

Figure 4.- LAB PDGF Pre-Grapple Intermediate
(91: Camera D: -70, +50).

To complete walkoff to LAB PDGF, go to {1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF}, steps 3 to 9 (SODF: RBT FS: OBSS).
Location:
Located at the center of the plane created by the four S5 to S4 attach points.
Oriented so that XYZPYR = 0's when mated.
-X motion to mate.
3.110 DISPLAY FRAME: W1>S5 INSTALL
(RBT FS/13A.1/FIN 1)

Location:
Located at the center of the plane created by the four S5 to S4 attach points.
Oriented so that XYZPYR = 0’s when mated.
+X points Station Starboard (ISSACS +Y), +Y points Station Aft (ISSACS -X), and
+Z points Station Nadir (ISSACS +Z).
NOTE
The OBSS is shown at Z = -15 cm.

Figure 1.- Wrist Cluster
24: Tip Elbow
   (3, 13)
   FL = 9 mm

Figure 2.- OBSS Alignment
92: Mux D/C
   (D: -25, +5)   (C: +25, 0)
   Camera D FL = 10 mm

Figure 3.- Big Picture
03: S1 Lower Outboard
   (+50, +10)
   FL = 6 mm

Figure 4.- OBSS Alignment
SRMS Elbow
   (OBSS Pre-Grapple at Handoff Position)
   (-51, -10)
   FL = 6 mm
3.200 OBSS BERTHING ALIGNMENT CUES
(RBT FS/13A.1/FIN 1) Page 2 of 2 pages

Figure 5. - Mid MPM Alignment
  09: P1 Lower Outboard
  (+112, +19)
  FL = 50 mm

Figure 6. - Aft MPM Alignment
  09: P1 Lower Outboard
  (+112, +35)
  FL = 50 mm
3.210 FRAME OF REFERENCE (FOR), DISPLAY FRAME: OBSS FWD MPM

Location:
Located at FWD MRL, midpoint of OBSS striker bar centerline, when OBSS is deployed and berthed onto Orbiter Stbd MPMs.
This Page Intentionally Blank
3.220 FRAME OF REFERENCE (FOR), DISPLAY FRAME: OBSS MID MPM

Location:
Located at MID MRL, midpoint of OBSS striker bar centerline, when OBSS is deployed and berthed onto Orbiter Stbd MPMs.
NOTE
The ESP3 Maneuver and Install frames are located at the same position; however, the Maneuver frame is aligned with ISSACS, whereas the Install frame is aligned as shown and described below.
3.300 FRAME OF REFERENCE (FOR): ESP3 MANEUVER AND INSTALL

(RBT FS/13A.1/FIN 1) Page 2 of 2 pages

Location:
Located at the center of ESP3 mating interface so that XYZPYR = 0’s when mated to P3 Zenith CAS.

Orientation:
Maneuver frame: aligned with ISSACS

Install frame: +X motion to mate, +Y motion is to the right and +Z motion is “down” in EBCS view (similar to Internal when grappling a GF and using Tip LEE camera view).
Location:
Located at the center of the P3 Zenith CAS interface so that XYZPYR = 0’s when ESP3 is mated.
+X points Station Nadir (ISSACS +Z), +Y points Station Forward (ISSACS +X), and +Z points Station Starboard (ISSACS +Y).
**Table 1. Inputs to Acquire RTLs**

<table>
<thead>
<tr>
<th>Missing RTL</th>
<th>RHC Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>-Yaw, +Pitch</td>
</tr>
<tr>
<td>1</td>
<td>-Pitch</td>
</tr>
<tr>
<td>2</td>
<td>+Yaw, +Pitch</td>
</tr>
<tr>
<td>3, 2</td>
<td>+Pitch</td>
</tr>
<tr>
<td>3, 1</td>
<td>-Yaw, then -Pitch</td>
</tr>
<tr>
<td>1, 2</td>
<td>+Yaw, then -Pitch</td>
</tr>
</tbody>
</table>

**Figure 1.** P3 Zenith UCCAS.
3.410 FRAME OF REFERENCE (FOR): EVA>CHEST 12/PP/F/4
(RBT FS/13A.1/FIN 1)
INTERNATIONAL SPACE STATION

ROBOTICS FS