



# 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>

National Aeronautics and  
Space Administration

Lyndon B. Johnson Space Center  
Houston, Texas



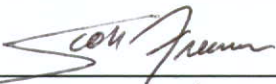
**United Space Alliance**




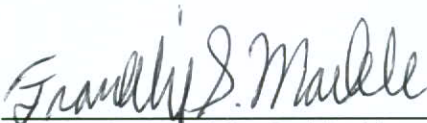
**INTERNATIONAL SPACE STATION  
ROBOTICS GROUP  
ROBOTICS BOOK - FLIGHT SPECIFIC  
ISS-13A.1**

18 JUL 07

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Uplinked Messages (or Approved Flight Notes) replaced by this revision,  
remove from Book:

None

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ROBOTICS BOOK - FLIGHT SPECIFIC  
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# 1.100 SSRMS MANEUVER TO S5 PRE-GRAPPLE

## 1. HAND CONTROLLER CALIBRATION

- 1.1 Translational Hand Controller (THC) Calibration
- THC Deflect [X] Axis to positive hard stop where [X] =
- 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] =
- Deflect [X] Axis to negative hard stop.
- Repeat

## 2. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
13: LAB Stbd Zenith (0, +80)	03: S1 Lower Outboard (-5, -20)	37: MBS Mast (+10, +30) (22: Base Elbow (-95, -15))

PCS MSS: 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).

SR	SY	SP	EP	WP	WY	WR
+145.0	0.0	-50.0	-120.0	-90.0	-73.0	+55.0
X	Y	Z	Pitch	Yaw	Roll	
+687	+1668	-239	+90.1	+21.0	+7.7	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W1>ISSACS					

# 1.100 SSRMS MANEUVER TO S5 PRE-GRAPPLE

(RBT FS/13A.1/FIN 1)

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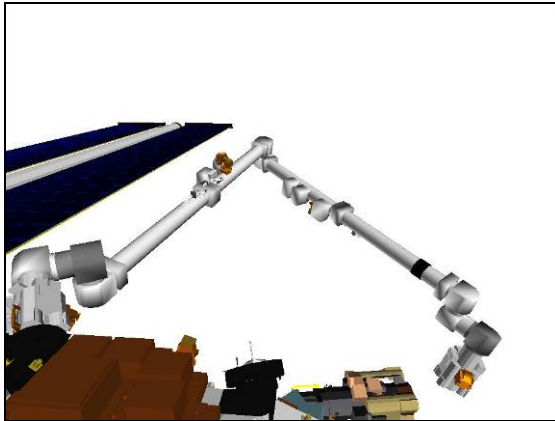


Figure 1.- 13A.1 Docking  
(03: S1 Lower Outboard: -5, -20).

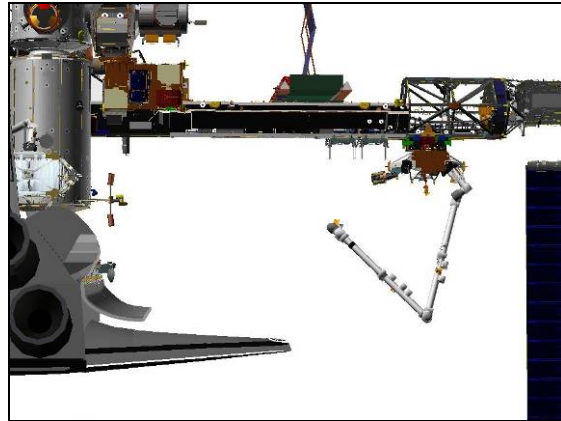


Figure 2.- 13A.1 Docking  
(ISS Nadir).

### 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)

pick File ► W1MBS1 ► S5 Pre-grapple

Verify 'Joint Angles' 'Destination' for S5 Pre-Grapple position.

SR	SY	SP	EP	WP	WY	WR
+35.5	+59.5	-132.5	-42.1	-31.3	-55.9	+15.4

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+145.0	0.0	-50.0	-120.0	-90.0	-73.0	+55.0
<b>TGT</b>	<b>+35.5</b>	<b>+59.5</b>	<b>-132.5</b>	<b>-42.1</b>	<b>-31.3</b>	<b>-55.9</b>	<b>+15.4</b>
<b>ERR</b>	+109.5	-59.5	+82.5	-77.9	-58.7	-17.1	+39.6

# 1.100 SSRMS MANEUVER TO S5 PRE-GRAPPLE

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\*\*\*\*\*

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 3 minutes to complete in Vernier rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+35.5	+59.5	-132.5	-42.1	-31.3	-55.9	+15.4



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

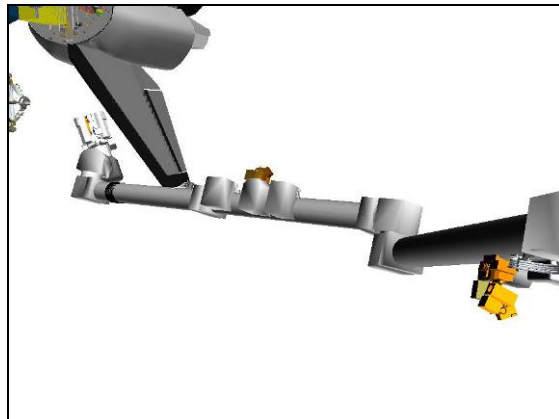


Figure 4.- S5 Pre-Grapple  
 (37: MBS Mast: +65, -10).

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.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera D (-65, +20)	25: Tip LEE	13: LAB Stbd Zenith (+5, +30) (37: MBS Mast (+50, +5))	SRMS Elbow (-20, 0)

#### 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).

SR	SY	SP	EP	WP	WY	WR
+35.5	+59.5	-132.5	-42.1	-31.3	-55.9	+15.4
X	Y	Z	Pitch	Yaw	Roll	
+454	+1207	+1044	-11.0	-28.9	-143.1	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W1>ISSACS					

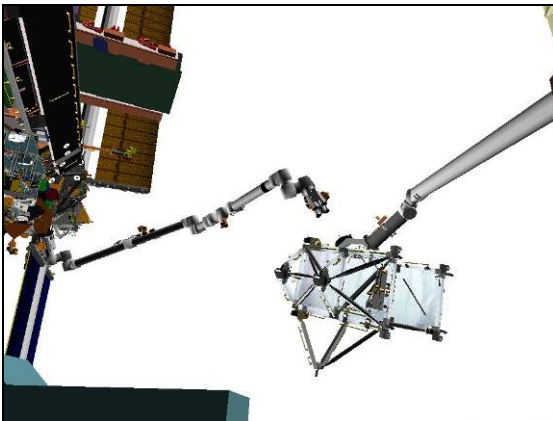


Figure 1.- S5 Pre-Grapple  
(91: Camera D: -65, +20).

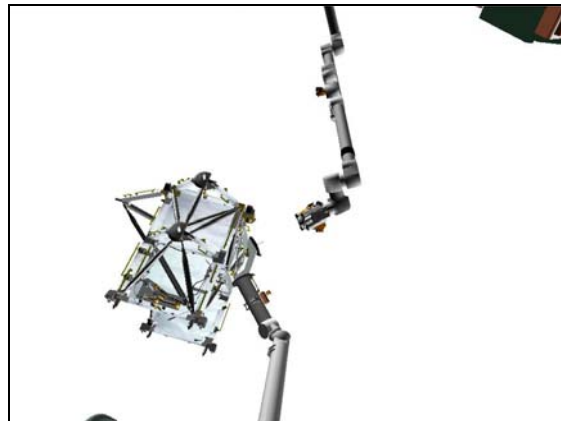


Figure 2.- S5 Pre-Grapple  
(13: LAB Stbd Zenith: +5, +30).

### 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).

# 1.110 SSRMS S5 GRAPPLE

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## 4. S5 GRAPPLE

PCS

### 4.1 Grapple Setup

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:

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

RHC/  
THC

Maneuver to within grapple envelope.

### 4.4 S5 Automatic Capture

PCS

MSS: SSRMS: Tip LEE:

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

Verify '**Confirm or Terminate**' prompt.

<b>CAUTION</b>
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.

<u>NOTE</u>
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

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- 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:

SR	SY	SP	EP	WP	WY	WR
+51.8	+59.5	-130.4	-21.7	-27.7	-57.8	+30.0
X	Y	Z	Pitch	Yaw	Roll	
+779	+913	+1147	+127.4	+65.7	+55.7	
FOR	Loaded – S5 Maneuver, SY Held					
Disp	W1>ISSACS					

## 1.110 SSRMS S5 GRAPPLE

(RBT FS/13A.1/FIN 1)

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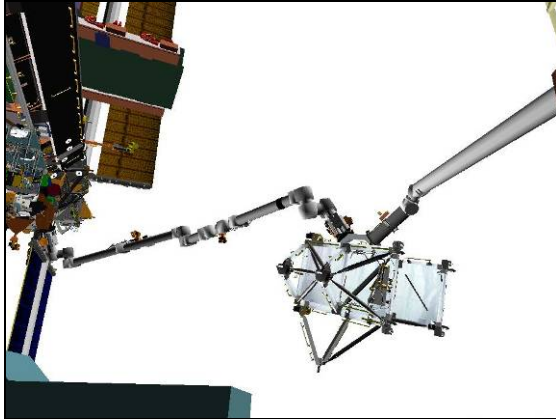


Figure 3.- S5 Grappled  
(91: Camera D: -65, +20).

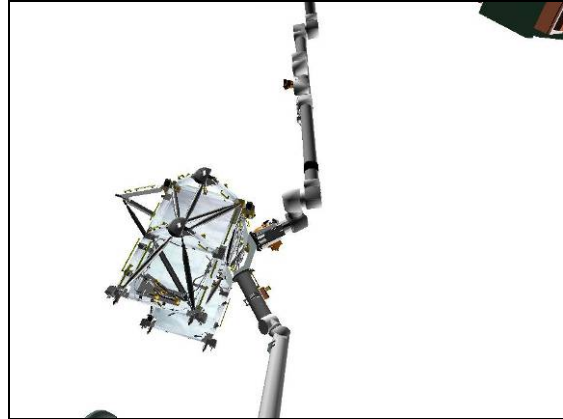


Figure 4.- S5 Grappled  
(13: LAB Stbd Zenith: +5, +30).

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:

Set 'Scale' 'Vernier' Rate Scale: 1.0 (Verify 1.0)

# 1.120 SSRMS S5 INSTALL

(RBT FS/13A.1/FIN 1)

Page 1 of 15 pages

## 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera D (-65, +20)	22: Base Elbow (-160, -20)	37: MBS Mast (+50, +5) 03: S1 Lower Outboard (+60, +30)	SRMS Elbow (-15, +10)

PCS

MSS: 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).

SR	SY	SP	EP	WP	WY	WR
+51.8	+59.5	-130.4	-21.7	-27.7	-57.8	+30.0
X	Y	Z	Pitch	Yaw	Roll	
-2322	-814	+1145	+19.6	+14.4	-179.4	
FOR	Loaded – S5 Maneuver, SY Held					
Disp	W1>S5 Install					

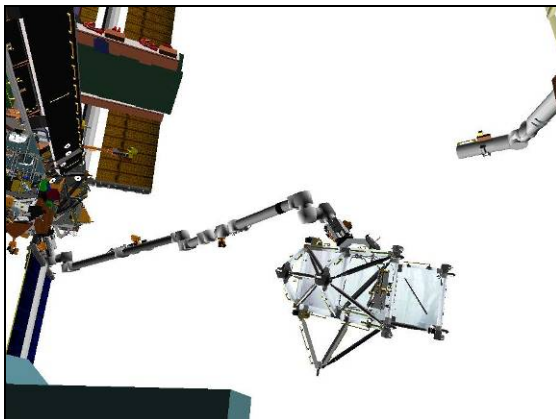


Figure 1.- S5 Handoff  
(91: Camera D: -65, +20).

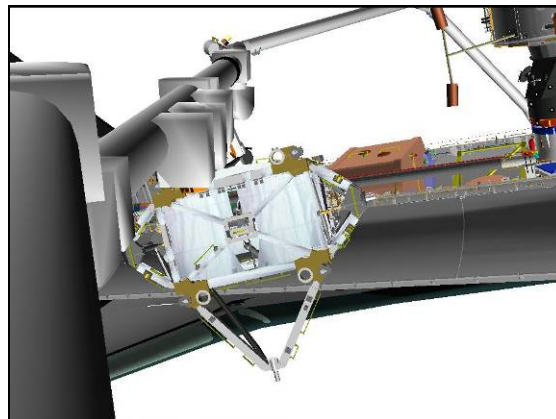


Figure 2.- S5 Handoff  
(22: Base Elbow: -160, -20).

## 1.120 SSRMS S5 INSTALL

(RBT FS/13A.1/FIN 1)

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### 2. JOINT OCAS TO S5 INSTALL INTERMEDIATE POSITION

√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.

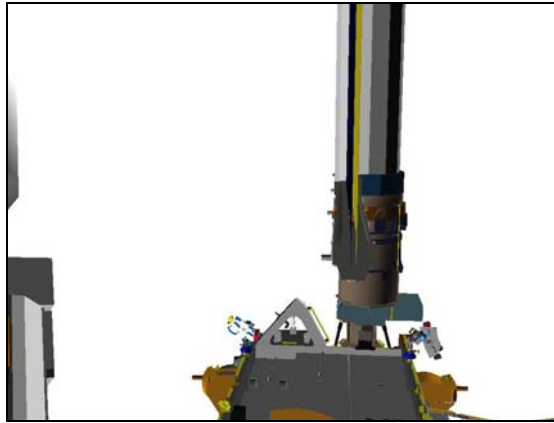


Figure 3.- SARJ Angle Verification  
(37: MBS Mast: +175, -10).

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

PCS MSS: SSRMS: SSRMS Safing:

**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)

pick File ► W1MBS1 ► S5 Install Intermed

Verify 'Joint Angles' 'Destination' for S5 Install Intermediate position.

SR	SY	SP	EP	WP	WY	WR
-90.0	-54.8	+5.0	-20.3	-166.4	-49.2	+64.0

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

# 1.120 SSRMS S5 INSTALL

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+51.7	+59.5	-130.1	-22.3	-27.7	-57.7	+29.9
<b>TGT</b>	<b>-90.0</b>	<b>-54.8</b>	<b>+5.0</b>	<b>-20.3</b>	<b>-166.4</b>	<b>-49.2</b>	<b>+64.0</b>
<b>ERR</b>	+141.7	+114.3	-135.1	-2.0	+138.7	-8.5	-34.1

\*\*\*\*\*

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 22 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
-90.0	-54.8	+5.0	-20.3	-166.4	-49.2	+64.0

\*\*\*\*\*

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

\*\*\*\*\*

# 1.120 SSRMS S5 INSTALL

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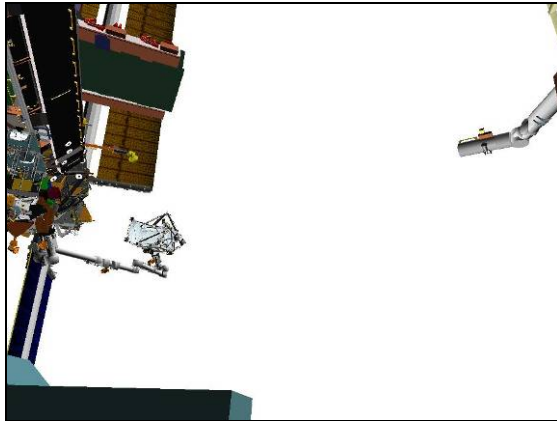


Figure 4.- S5 Install Intermediate  
(91: Camera D: -65, +20).

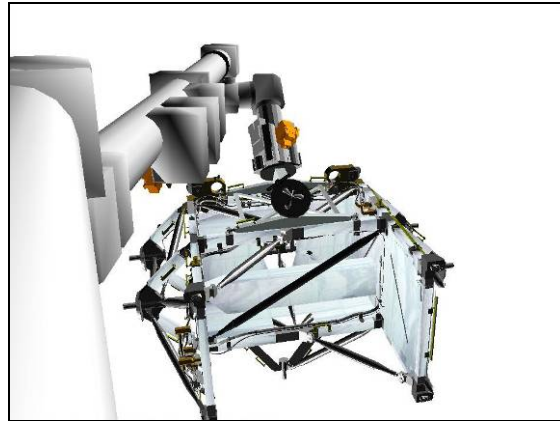


Figure 5.- S5 Install Intermediate  
(22: Base Elbow: -160, -20).

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

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (-80, -2)	22: Base Elbow (-160, -20)	24: Tip Elbow (-80, +40)	SRMS Elbow (-15, +10)

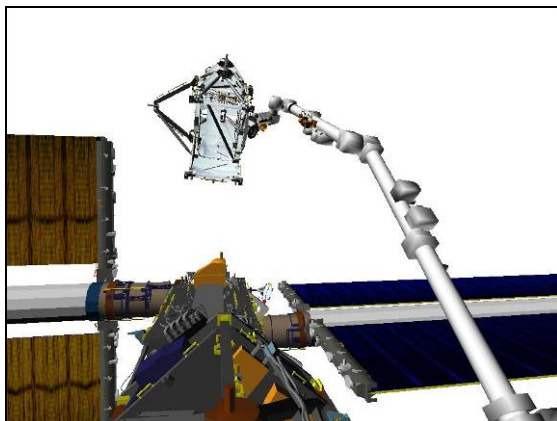


Figure 6.- S5 Install Intermediate  
(03: S1 Lower Outboard: -80, -2).

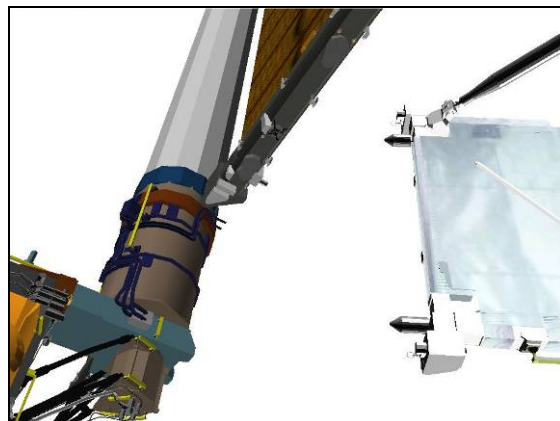


Figure 7.- S5 Install Intermediate  
(24: Tip Elbow: -80, +40).

MSS: SSRMS: Thrusters:

Verify 'Desat Request:' – Inh

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS:

Enter Mode – Single (Verify blue)



## 1.120 SSRMS S5 INSTALL

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### 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).

	SR	SY	SP	EP	WP	WY	WR	
S5 Install	-90.0	-54.8	+5.0	-20.3	-166.4	-49.2	+64.0	
Intermediate								
1: SR -	-97.2							
2: SP -			-22.0					
S5 Pre-Install	-97.2	-54.8	-22.0	-20.3	-166.4	-49.2	+64.0	
	X	Y	Z	Pitch	Yaw	Roll		
	+200	-1	1	-0.1	0.0	0.0		
	FOR	Loaded – S5 Maneuver, SY Held						
	Disp	W1>S5 Install						

PCS

MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

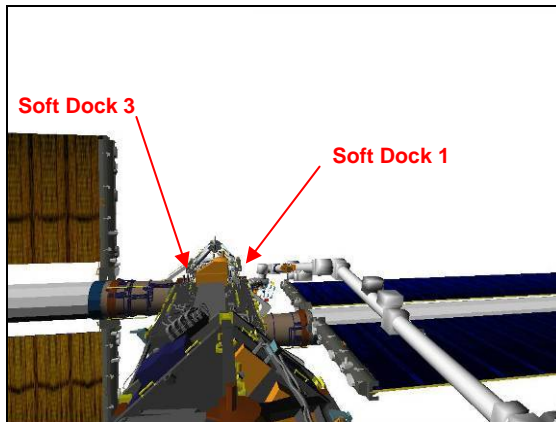


Figure 8.- S5 Pre-Install  
(03: S1 Lower Outboard: -80, -2).

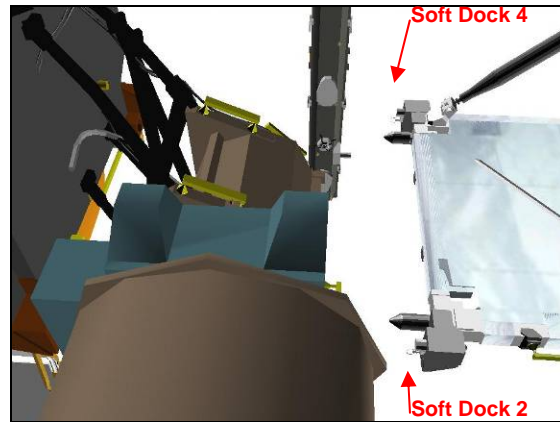


Figure 9.- S5 Pre-Install  
(24: Tip Elbow: -80, +40).

#### 4. S5 INSTALL SETUP

Configure Cameras and overlays as required.

V10 L	Monitor 1	Monitor 2	Monitor 3	V10 R
EV1	37: MBS Mast (+170, -10)	22: Base Elbow (-160, -20)	24: Tip Elbow (-80, +40)	EV2

## 1.120 SSRMS S5 INSTALL

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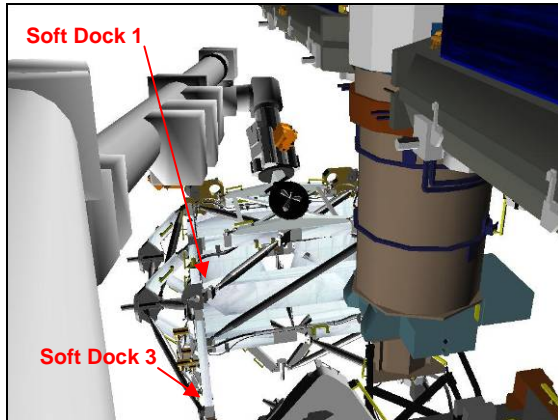


Figure 10.- S5 Pre-Install  
(22: Base Elbow: -160, -20).

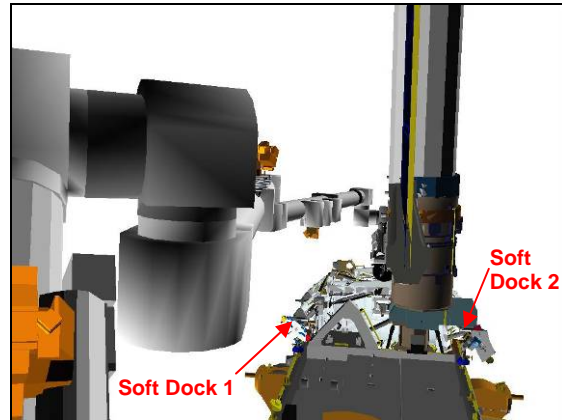


Figure 11.- S5 Pre-Install  
(37: MBS Mast: +170, -10).

MSS: SSRMS:

Change Loaded Parameters ► S5 ► S5 Install SRH  
Verify 'Loaded Parameters' (two) – S5 Install, SR Held

Verify Display – W1>S5 Install

Verify 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:

Set 'Scale' 'Vernier' Rate Scale: 0.4 (Verify 0.4)

### 5. S5 LAUNCH LOCK REMOVAL

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

## 1.120 SSRMS S5 INSTALL

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### 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).

Locked	SR	SY	SP	EP	WP	WY	WR
	-97.2	-55.6	-1.9	-60.6	-146.7	-49.9	+63.4
	X	Y	Z	Pitch	Yaw	Roll	
	+25	0	0	0.0	0.0	0.0	
FOR	Loaded – S5 Install, SR Held						
Disp	W1>S5 Install						

DCP

BRAKES SSRMS → ON (Verify ON)

Notify EV GO to remove S5 Launch Locks.

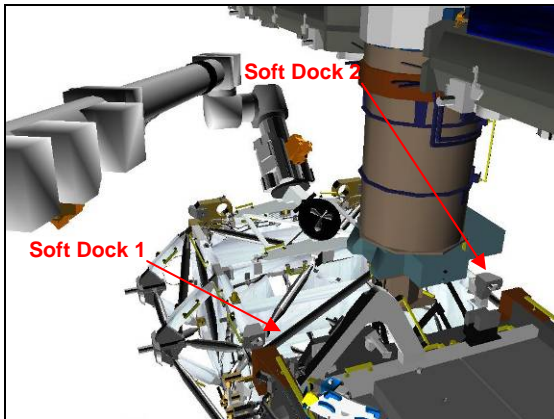


Figure 12.- S5 Launch Lock Removal  
(22: Base Elbow: -130, -20).

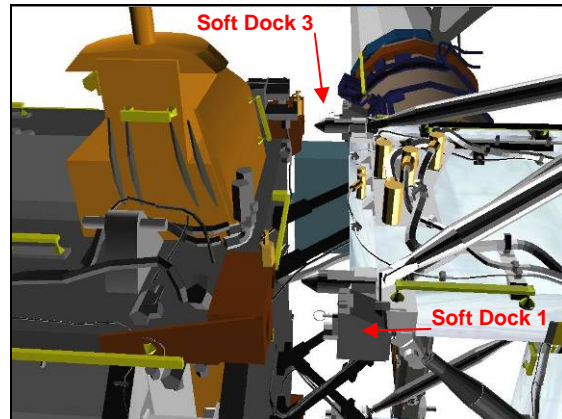


Figure 13.- S5 Launch Lock Removal  
(24: Tip Elbow: -60, +57).

### 6. S5 SOFTDOCK

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

BRAKES SSRMS → OFF (Verify OFF)

PCS

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

## 1.120 SSRMS S5 INSTALL

(RBT FS/13A.1/FIN 1)

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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)

### NOTE

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.
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.
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).
4. The minimum rate during S5 install should be 0.6 cm/s. The rate can be monitored using the FOR rate overlay.

# 1.120 SSRMS S5 INSTALL

(RBT FS/13A.1/FIN 1)

```

*****
THC/      * Stop SSRMS motion.
RHC      *
          * 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/ Maneuver S5 to Softdock position until EV verifies Softdocks are  
RHC engaged.

Expected Softdock position:

Locked							
SR	SY	SP	EP	WP	WY	WR	
-97.2	-55.7	-0.1	-64.1	-145.0	-50.0	+63.3	
X	Y	Z	Pitch	Yaw	Roll		
+2	0	0	0.0	0.0	0.0		
FOR	Loaded – S5 Install, SR Held						
Disp	W1>S5 Install						

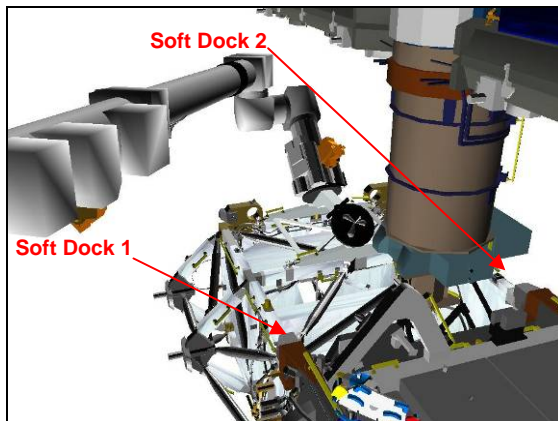


Figure 14.- S5 Softdock  
(22: Base Elbow: -130, -20).

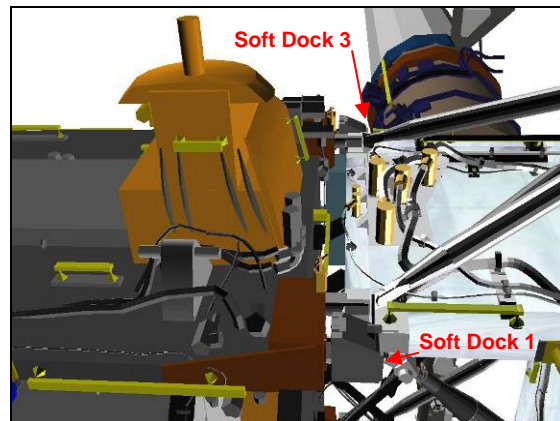


Figure 15.- S5 Softdock  
(24: Tip Elbow: -60, +57).

## 1.120 SSRMS S5 INSTALL

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### 7. SSRMS LIMP FOR MRTAS BOLTING

PCS

MSS: 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:

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

Noitfy EV SSRMS limped, GO for bolting.

### 8. CARRIAGE PUSHOFF

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
22: Base Elbow (-140, -10) (24: Tip Elbow (-10, 0))	25: Tip LEE	37: MBS Mast (+170, -10)	Camera C (+55, +15)

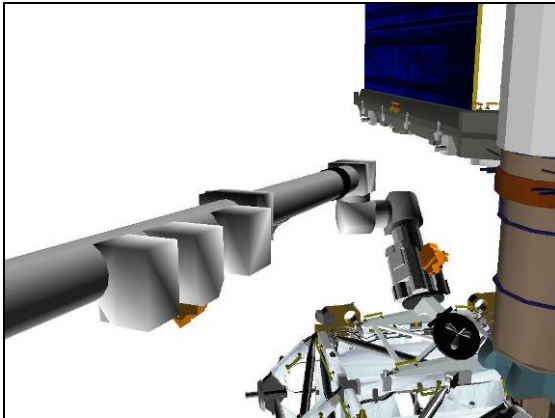


Figure 16.- S5 Installed  
(22: Base Elbow: -140, -10).

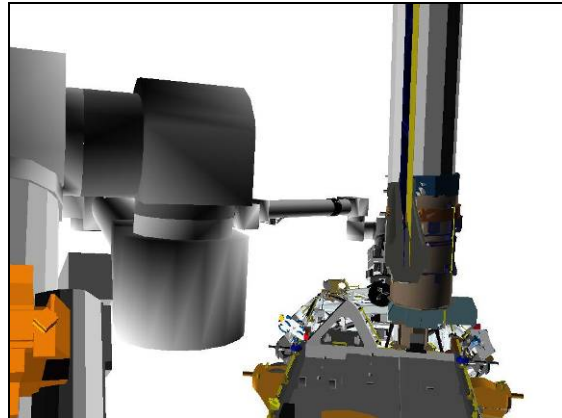


Figure 17.- S5 Installed  
(37: MBS Mast: +170, -10).

## 1.120 SSRMS S5 INSTALL

(RBT FS/13A.1/FIN 1)

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### 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:

Verify all joints – Limped

### 8.2 Auto Release

MSS: 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:

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

MSS: SSRMS:

Verify Unloaded Parameters – √

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

# 1.120 SSRMS S5 INSTALL

(RBT FS/13A.1/FIN 1)

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

√Vernier

MSS: 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).

Locked						
SR	SY	SP	EP	WP	WY	WR
-97.2	-53.1	-2.5	-59.5	-145.8	-47.7	+65.2
X	Y	Z	Pitch	Yaw	Roll	
-60	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	W1>Mated S5 GF					

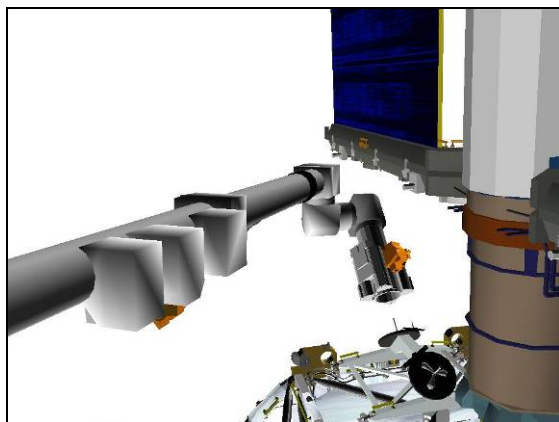


Figure 18.- S5 Grapple Fixture Clearance  
(22: Base Elbow: -140, -10).

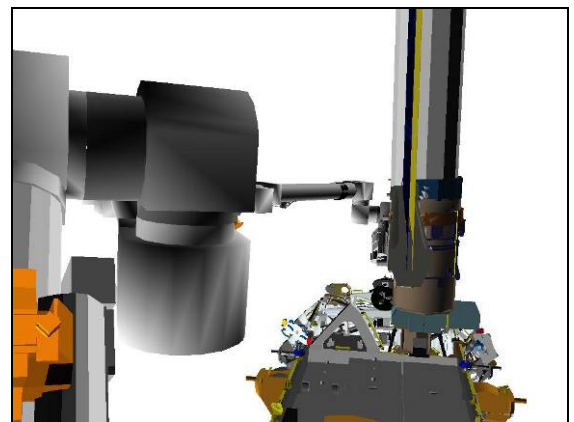


Figure 19.- S5 Grapple Fixture Clearance  
(37: MBS Mast: +170, -10).



# 1.120 SSRMS S5 INSTALL

(RBT FS/13A.1/FIN 1)

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## 9. PVRGF RELOCATE VIEWING

### 9.1 PVRGF Intermediate Position Maneuver

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
22: Base Elbow (-150, -15)	25: Tip LEE	03: S1 Lower Outboard (-80, -2)

PCS

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: 1.0 (Verify 1.0)

MSS: SSRMS:

Enter Mode – Single (Verify blue)

<b>WARNING</b>
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).

	SR	SY	SP	EP	WP	WY	WR
S5 Grapple Fixture Clearance	-97.2	-53.1	-2.5	-59.5	-145.8	-47.7	+65.2
1: EP + PVRGF Intermediate				-20.0			
	-97.2	-53.1	-2.5	-20.0	-145.8	-47.7	+65.2
	X	Y	Z	Pitch	Yaw	Roll	
	-185	+328	+302	+4.9	-25.9	-28.7	
FOR	Unloaded – LEE Tip, SR Held						
Disp	W1>Mated S5 GF						

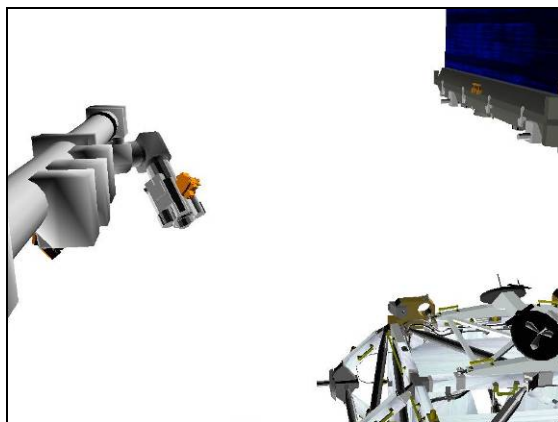


Figure 20.- PVRGF Intermediate (22: Base Elbow: -150, -15).

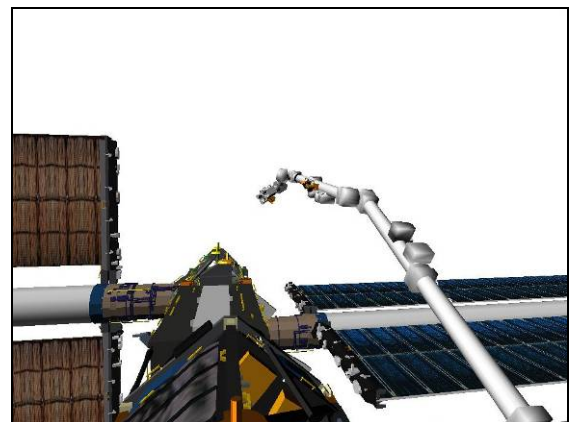


Figure 21.- PVRGF Intermediate (03: S1 Lower Outboard: -80, -2).

**1.120 SSRMS S5 INSTALL**

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.

SR	SY	SP	EP	WP	WY	WR
-97.2	-53.1	0.0	-20.0	-124.7	-12.6	+65.2

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

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

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

```
*****
* 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)
* |
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

# 1.120 SSRMS S5 INSTALL

(RBT FS/13A.1/FIN 1)

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

SR	SY	SP	EP	WP	WY	WR
-97.2	-53.1	0.0	-20.0	-124.7	-12.6	+65.2
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)

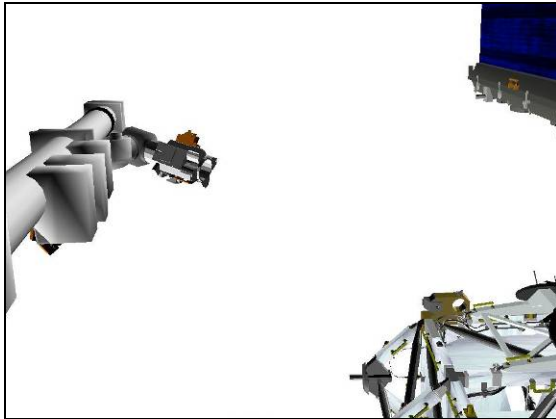


Figure 22.- PVRGF Viewing  
(22: Base Elbow: -150, -15).

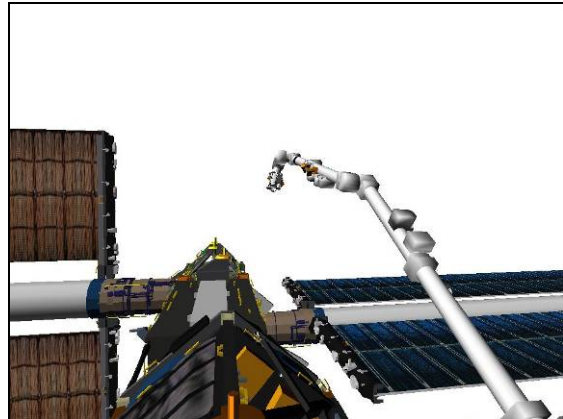


Figure 23.- PVRGF Viewing  
(03: S1 Lower Outboard: -80, -2).

### 9.3 PVRGF Viewing

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

Monitor 1	Monitor 2	Monitor 3
22: Base Elbow (-150, -15)	25: Tip LEE	24: Tip Elbow (-80, +5)

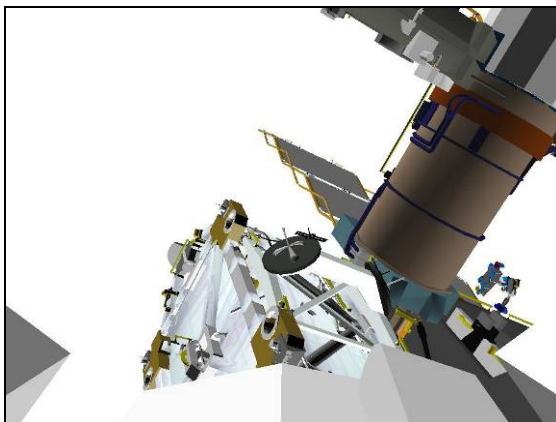


Figure 24.- PVRGF Viewing  
(25: Tip LEE).

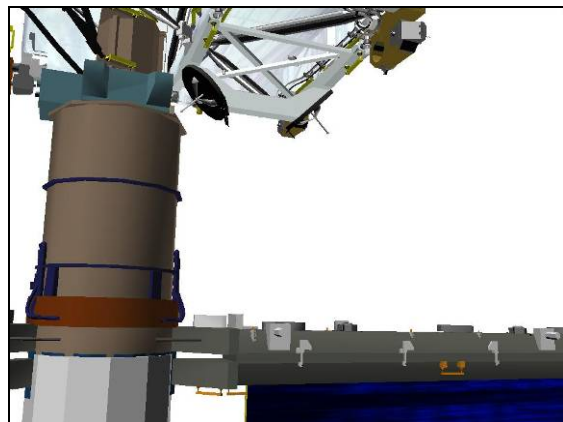


Figure 25.- PVRGF Viewing  
(24: Tip Elbow: -80, +5).

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# 1.130 SSRMS S5 MANEUVER FOR TRANSLATE TO WS4

(RBT FS/13A.1/FIN 1)

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## 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
13: LAB Stbd Zenith (0, +65)	03: S1 Lower Outboard (-50, -10)	24: Tip Elbow (0, 0)

PCS

MSS: SSRMS:

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

√Coarse

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

SR	SY	SP	EP	WP	WY	WR
-97.2	-53.1	0.0	-20.0	-124.7	-12.6	+65.2
X	Y	Z	Pitch	Yaw	Roll	
+228	+3721	+451	+106.0	-23.3	+157.5	
FOR	Unloaded – LEE Tip, SR Held					
Disp	W1>ISSACS					

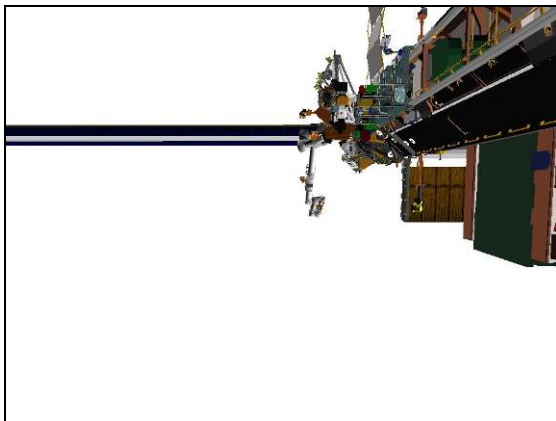


Figure 1.- PVRGF Viewing  
(13: LAB Stbd Zenith: 0, +65).

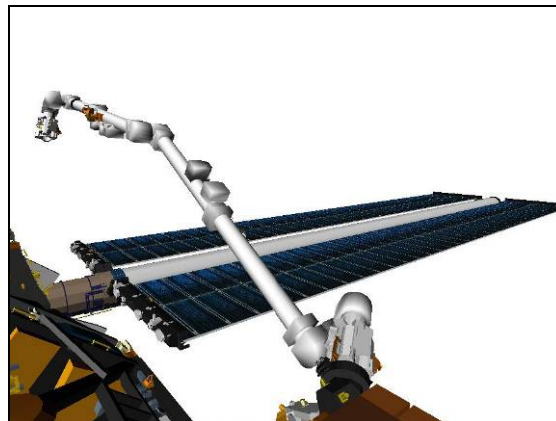


Figure 2.- PVRGF Viewing  
(03: S1 Lower Outboard: -50, -10).

## 2. STBD SAW CLEARANCE POSITION MANEUVER

DCP

BRAKES SSRMS → OFF (Verify OFF)

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W1MBS1 ► Stbd SAW Clearance

### 1.130 SSRMS S5 MANEUVER FOR TRANSLATE TO WS4

(RBT FS/13A.1/FIN 1) Page 2 of 5 pages

Verify 'Joint Angles' 'Destination' for Stbd SAW Clearance position.

SR	SY	SP	EP	WP	WY	WR
-185.0	+180.0	+165.0	+40.0	-43.0	-111.9	-3.1

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

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

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

\*\*\*\*\*

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)

<u>NOTE</u>	
1.	Expect singularity warning for EP between -15 and +15 deg.
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.

SR	SY	SP	EP	WP	WY	WR
-185.0	+180.0	+165.0	+40.0	-43.0	-111.9	-3.1

# 1.130 SSRMS S5 MANEUVER FOR TRANSLATE TO WS4

(RBT FS/13A.1/FIN 1)

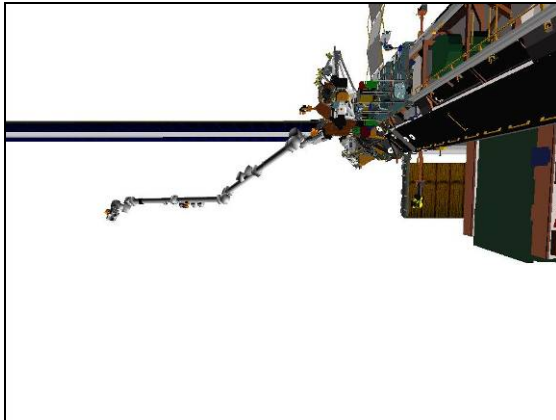


Figure 3.- Stbd SAW Clearance  
(13: LAB Stbd Zenith: 0, +65).

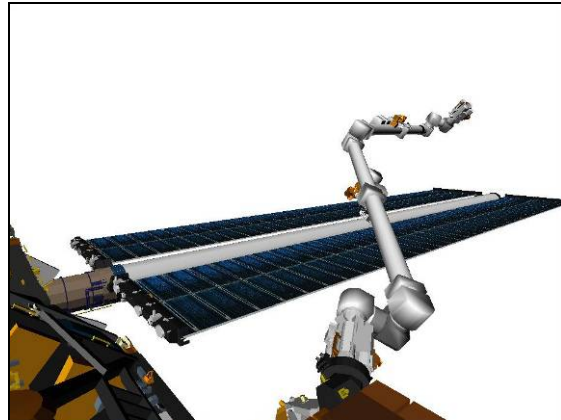


Figure 4.- Stbd SAW Clearance  
(03: S1 Lower Outboard: -50, -10).

### 3. MT TRANSLATE INTERMEDIATE POSITION MANEUVER

MSS: SSRMS:

Enter Mode – Single (Verify blue)

<b>WARNING</b>
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).

Stbd SAW Clearance 1: SP + MT Translate Intermediate	SR	SY	SP	EP	WP	WY	WR
	-185.0	+180.0	+165.0	+40.0	-43.0	-111.9	-3.1
			+200.0				
	-185.0	+180.0	+200.0	+40.0	-43.0	-111.9	-3.1
	X	Y	Z	Pitch	Yaw	Roll	
	+1846	+2133	+146	-109.1	-39.4	-84.5	
	FOR	Unloaded – LEE Tip, SR Held					
Disp	W1>ISSACS						

# 1.130 SSRMS S5 MANEUVER FOR TRANSLATE TO WS4

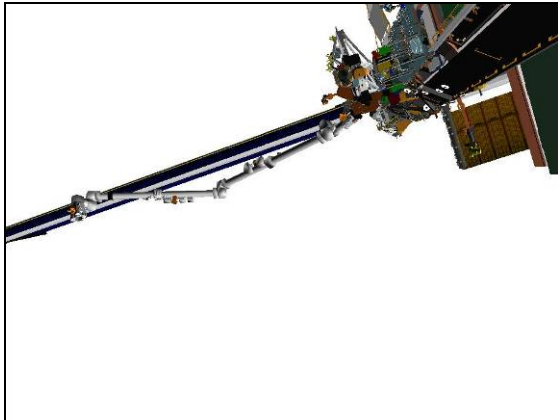


Figure 5.- MT Translate Intermediate (13: LAB Stbd Zenith: -20, +65).

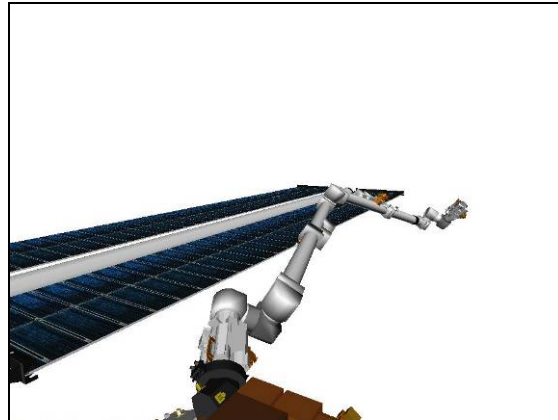


Figure 6.- MT Translate Intermediate (03: S1 Lower Outboard: -30, -10).

## 4. MANEUVERING TO MT TRANSLATE POSITION

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W1MBS1 ► MT Translate

Verify 'Joint Angles' 'Destination' for MT Translate position.

SR	SY	SP	EP	WP	WY	WR
-140.0	+140.0	+252.5	+140.0	-43.0	-111.9	-3.1

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

MON

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

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

\*\*\*\*\*

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.

\*\*\*\*\*



### 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)

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

SR	SY	SP	EP	WP	WY	WR
-140.0	+140.0	+252.5	+140.0	-43.0	-111.9	-3.1
X	Y	Z	Pitch	Yaw	Roll	
+728	+1949	-51	-24.4	+5.4	-176.4	
FOR	Unloaded – LEE Tip, SR Held					
Disp	W1>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)

RHC RATE → VERNIER (Verify Vernier on PCS)

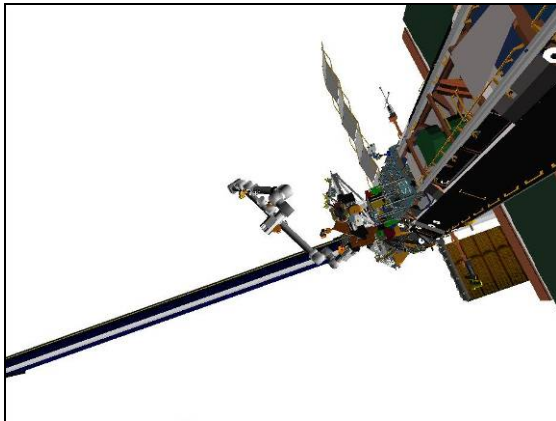


Figure 7.- MT Translate  
(13: LAB Stbd Zenith: -20, +85).

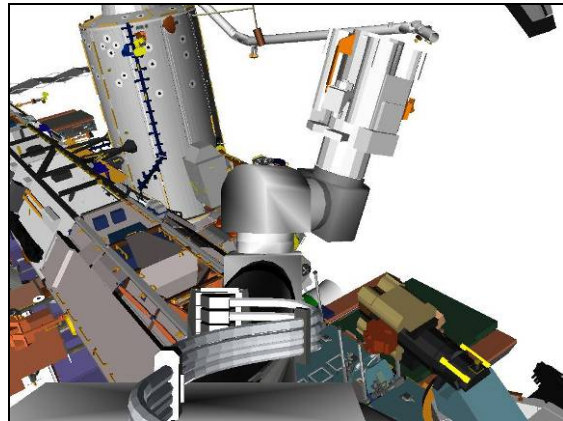


Figure 8.- MT Translate  
(24: Tip Elbow: 0, 0).

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# 1.135 MT PRE-TRANSLATION SURVEY – WS 1 TO WS 4 (GROUND)

(RBT FS/13A.1/FIN 1)

Page 1 of 3 pages

Configure the ISS Downlink per the following table:

1	2
Base Elbow (+50, +3) FL = 35 mm	LAB Stbd Zenith (+110, +70) FL = 13 mm

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

SR	SY	SP	EP	WP	WY	WR
-140.0	+140.0	+252.5	+140.0	-43.0	-111.9	-3.1

### 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

	Base Elb	Stop at	Survey Notes	Complete
Start Config	(+50, +3) FL = 35 mm	-	MT Translation Path	
1: Tilt Dn	(+50, -3)	(+50, +3)	MT Translation Path	
2: Pan Rt	(+60, -3)	(+54, -3)	MT Translation Path	
3: Tilt Dn	(+60, -6)	(+60, -3)	MT Translation Path	

Keyboard Commanding Window

**cmd** Finished Commanding

**cmd** Activate Position (Verify Deactivated)

## 1.135 MT PRE-TRANSLATION SURVEY – WS 1 TO WS 4 (GROUND)

(RBT FS/13A.1/FIN 1)

Page 2 of 3 pages

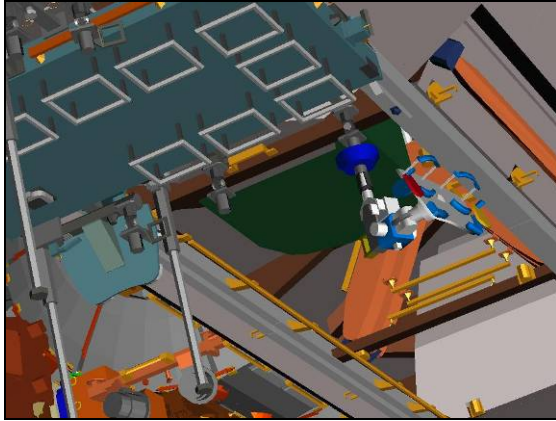


Figure 1.- Base Elbow Start  
(Base Elbow: +50, +3).

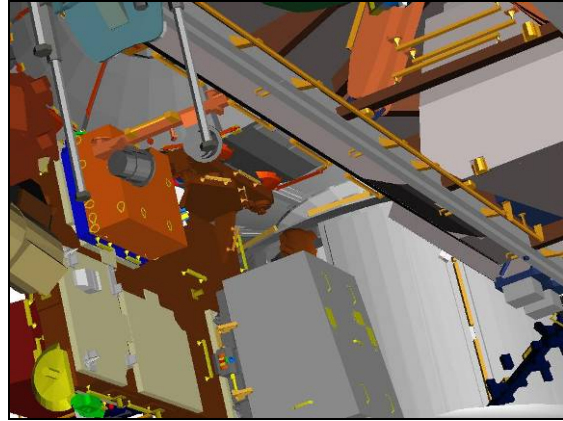


Figure 2.- Base Elbow - Step 1  
(Base Elbow: +50, -3).

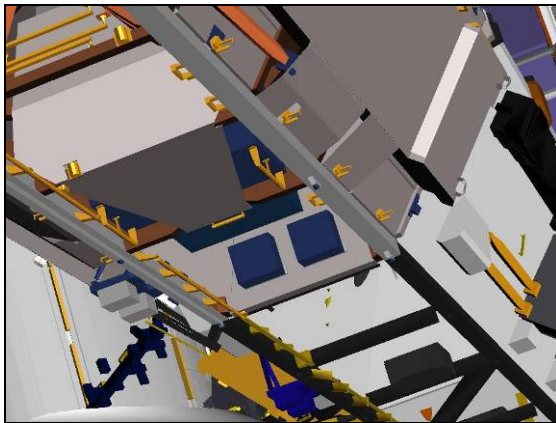


Figure 3.- Base Elbow - Step 2  
(Base Elbow: +60, -3).



Figure 4.- Base Elbow - Step 3  
(Base Elbow: +60, -6).

### 2. LAB STBD ZENITH CAMERA SURVEY

Coordinate with CATO to pan, tilt and zoom the LAB Stbd Zenith Camera as follows:

	LAB Stbd Zenith	Stop at	Survey Notes	Complete
Start Config	(+110, +70) FL = 13 mm		MT Translation Path	
1: Tilt Dn	(+110, +50)		MT Translation Path	
2: Pan Rt	(+130, +50)		MT Translation Path	
3: Tilt Dn	(+130, -40)		MT Translation Path	

**1.135 MT PRE-TRANSLATION SURVEY – WS 1 TO WS 4 (GROUND)**

(RBT FS/13A.1/FIN 1)

Page 3 of 3 pages

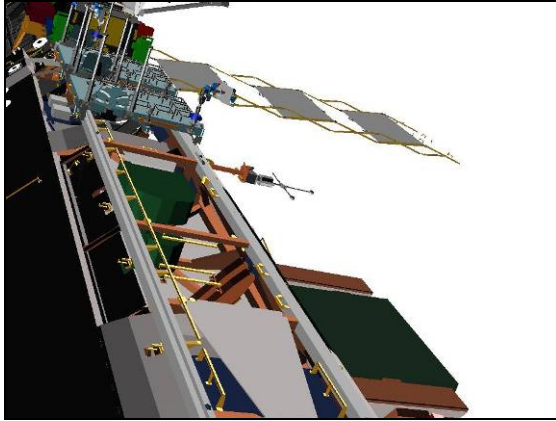


Figure 5.- LAB Stbd Zenith Start  
(LAB Stbd Zenith: +110, +70).



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

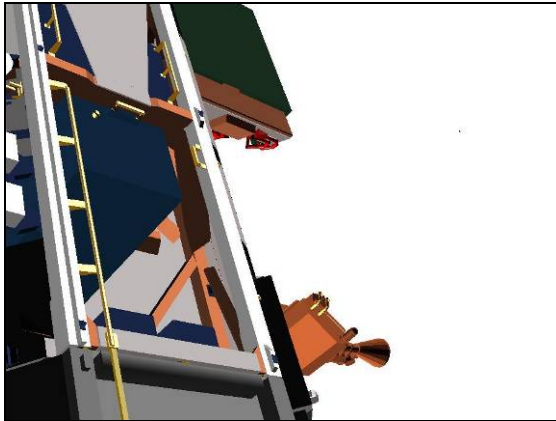


Figure 7.- LAB Stbd Zenith - Step 2  
(LAB Stbd Zenith: +130, +50).

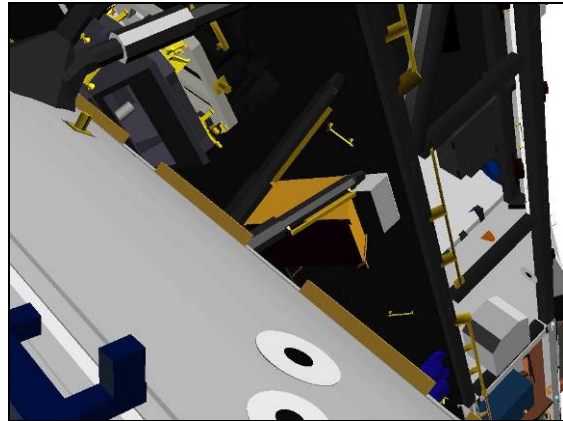


Figure 8.- LAB Stbd Zenith - Step 3  
(LAB Stbd Zenith: +130, -40).

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# 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

Page 1 of 15 pages

## 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
13: LAB Stbd Zenith (-150, 0)	24: Tip Elbow (0, +10)	03: S1 Lower Outboard (+50, -20)	Camera C (0, +10)

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).

SR	SY	SP	EP	WP	WY	WR
-140.0	+140.0	+252.5	+140.0	-43.0	-111.9	-3.1
X	Y	Z	Pitch	Yaw	Roll	
-190	+175	+1297	+24.5	+4.3	-1.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>Berth OBSS FRGF NSP					



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

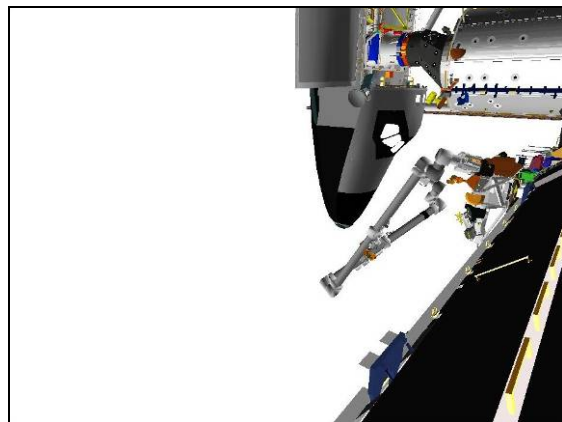


Figure 2.- MT Translate  
(03: S1 Lower Outboard: +50, -20).

## 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

Page 2 of 15 pages

### 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:

**cmd** Remove (Verify Not Safed)

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

RHC RATE → COARSE (Verify Coarse on PCS)

PCS

pick File ► W4MBS1 ► Berth OBSS Int PreGr

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

SR	SY	SP	EP	WP	WY	WR
-109.4	+138.5	+145.0	-72.4	-43.0	-111.9	-3.1

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-140.0	+140.0	+252.5	+140.0	-43.0	-111.9	-3.1
TGT	<b>-109.4</b>	<b>+138.5</b>	<b>+145.0</b>	<b>-72.4</b>	<b>-43.0</b>	<b>-111.9</b>	<b>-3.1</b>
ERR	-30.6	+1.5	+107.5	+212.4	0.0	0.0	0.0

\*\*\*\*\*

\* 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.

\*

\*\*\*\*\*



## 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

Page 3 of 15 pages

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

### NOTE

1. Expect singularity warning for EP between +15 and -15 deg.
2. This Joint OCAS will take approximately 2 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
-109.4	+138.5	+145.0	-72.4	-43.0	-111.9	-3.1
X	Y	Z	Pitch	Yaw	Roll	
-67	-206	-21	-3.9	+0.1	-9.8	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>Berth OBSS FRGF NSP					

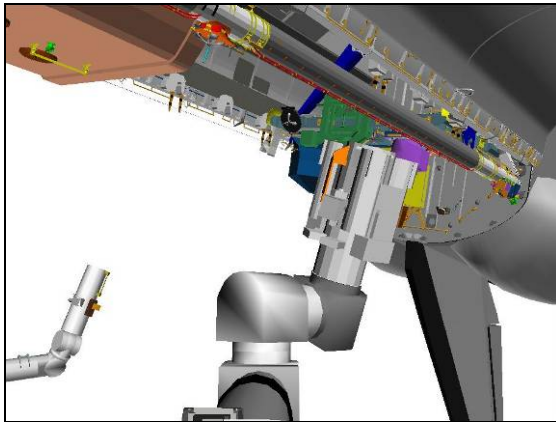


Figure 3.- Berthed OBSS Intermediate Pre-Grapple  
(24: Tip Elbow: 0, +10).

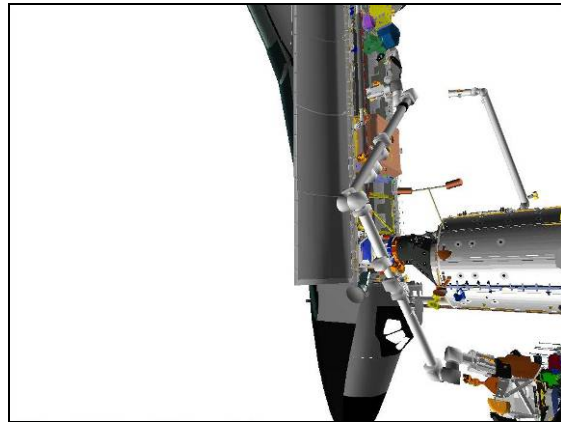


Figure 4.- Berthed OBSS Intermediate Pre-Grapple  
(03: S1 Lower Outboard: +50, +10).

### 3. MANEUVERING TO OBSS PRE-GRAPPLE

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS:

Enter Mode – Single (Verify blue)

## 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

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### 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).

	SR	SY	SP	EP	WP	WY	WR
Berthed OBSS Intermediate Pre-Grapple	-109.4	+138.5	+145.0	-72.4	-43.0	-111.9	-3.1
1: SP –			+134.4				
OBSS Pre-Grapple	-109.4	+138.5	+134.4	-72.4	-43.0	-111.9	-3.1
	X	Y	Z	Pitch	Yaw	Roll	
	-149	-1	0	-0.1	0.0	-0.1	
FOR	Unloaded – LEE Tip, SY Held						
Disp	W4>Berth OBSS FRGF NSP						

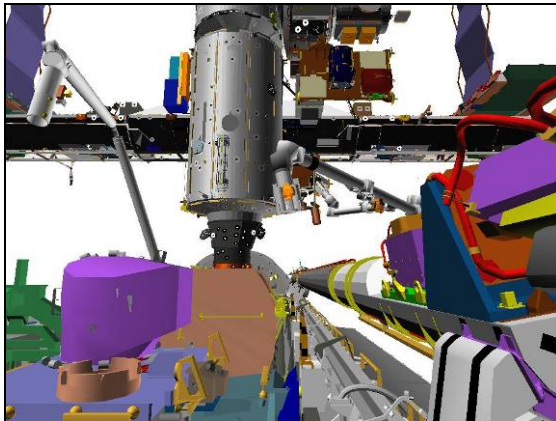


Figure 5.- OBSS Pre-Grapple (V10: Camera C: 0, +10).

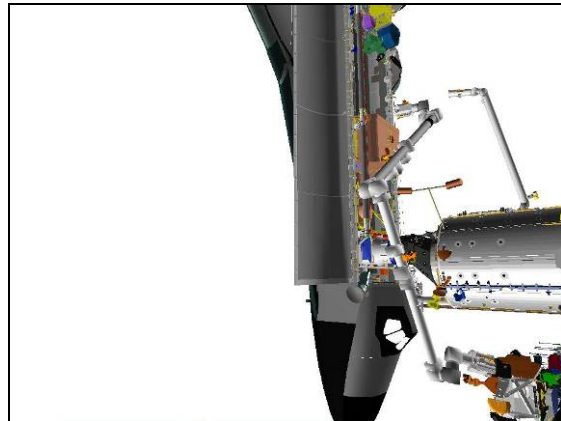


Figure 6.- OBSS Pre-Grapple (03: S1 Lower Outboard: +50, +10).

#### 4. OBSS GRAPPLE SETUP

Configure Cameras and overlays for grapple.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera D (-30, +20)	25: Tip LEE	03: S1 Lower Outboard (+50, +10) (24: Tip Elbow (-130, -10))	Camera C (0, +10)

#### 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)

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PCS MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: as desired

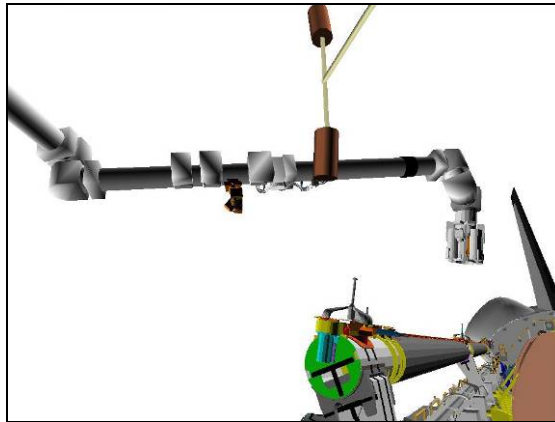


Figure 7.- OBSS Pre-Grapple  
(91: Camera D: -30, +20).

### 5. OBSS CAPTURE

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

RHC/  
THC Maneuver to within grapple envelope.

PCS MSS: 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

(RBT FS/13A.1/FIN 1)

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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:

	SR	SY	SP	EP	WP	WY	WR	
Expected	-99.9	+138.5	+142.7	-70.0	-65.4	-110.3	-22.5	
	X	Y	Z	Pitch	Yaw	Roll		
Expected	+45	+12	+23	+90.0	-0.1	-30.0		
	FOR	Loaded – OBSS Mid MPM, SY Held						
	Disp	W4>Berth OBSS FRGF NSP						

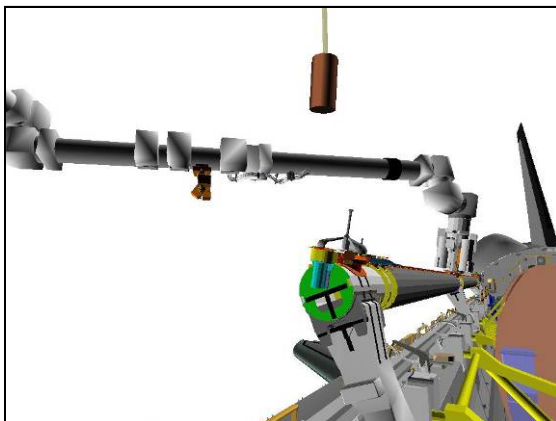


Figure 8.- Berthed OBSS Grapple  
 (91: Camera D: -30, +10).

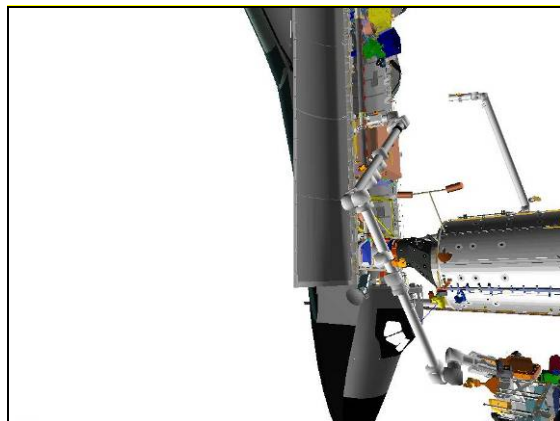


Figure 9.- Berthed OBSS Grapple  
 (03: S1 Lower Outboard: +50, +10).

## 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

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### 6. SETUP FOR MANEUVER

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera D (-30, +10)	92: Camera C (+20, 0)	03: S1 Lower Outboard (+50, +10) (24: Tip Elbow (-120, -10))	SRMS Elbow (-55, -10)

PCS

MSS: 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:

Set 'Scale' 'Vernier' Rate Scale: as desired.



Figure 10.- Berthed OBSS Grapple  
(92: Camera C: +20, 0).

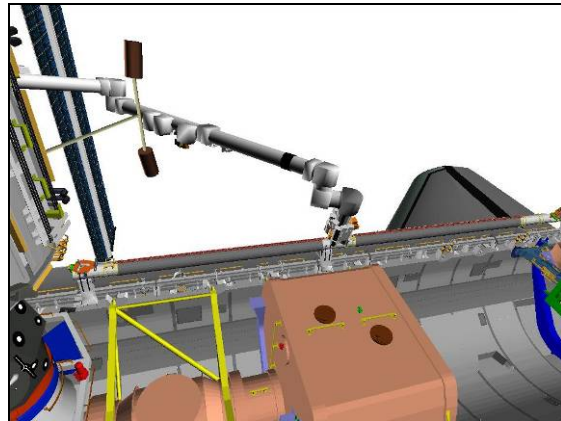


Figure 11.- Berthed OBSS Grapple  
(V10: SRMS Elbow: -55, -10).

### 7. ATTITUDE CONTROL CONFIGURATION

MSS: SSRMS: Thrusters:

Verify 'Desat Request:' Inh

## 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

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### 8. MRL RELEASE

Notify shuttle crew GO for STBD MRL release.

#### NOTE

1. Standby for OBSS thermal clock start time:

\_\_\_\_ / \_\_\_\_ : \_\_\_\_ : \_\_\_\_

2. SRMS SPEE power must be applied within 90 minutes to prevent sensor damage.

\*\*\*\*\*

\* If 'R3Q - SSRMS LEE Uncommanded Derigidize' Caution was annunciated  
\* during MRL release or Carriage Tension < 4400 N

\* MSS: 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

\*\*\*\*\*

### 9. LOW HOVER POSITION MANEUVER

On shuttle crew GO for OBSS unberth, MRLs released:

DCP

BRAKES SSRMS → OFF (Verify OFF)

PCS

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

#### NOTE

Monitor clearance between OBSS and the UHF Antenna with the SRMS Elbow Camera. Clearance at Low Hover is approximately 96 cm (3.1 ft).

# 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

THC/  
RHC

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
-106.7	+138.5	+140.4	-73.5	-50.9	-111.3	-8.4
X	Y	Z	Pitch	Yaw	Roll	
0	0	-100	0.0	0.0	0.0	
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.  
 \*\*\*\*\*

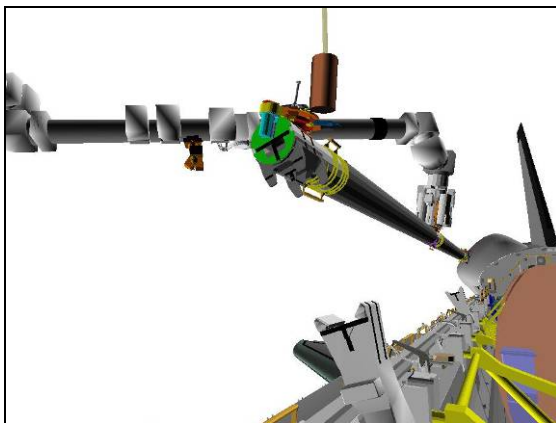


Figure 12. - OBSS Low Hover  
(91: Camera D: -30, +10).

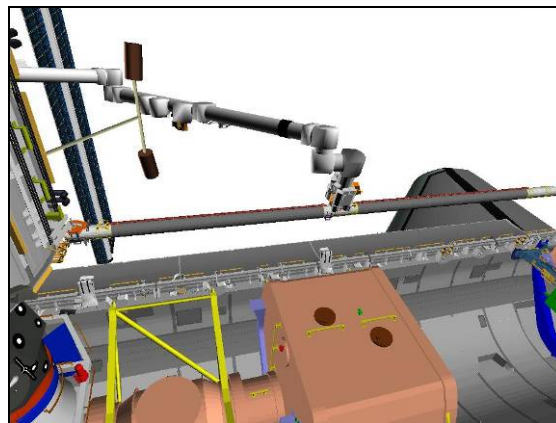


Figure 13.- OBSS Low Hover  
(V10: SRMS Elbow: -55, -10).

## 10. CLEAR OF UHF ANTENNA MANEUVER

PCS

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: 1.0 (Verify 1.0)

MSS: SSRMS:

Enter Mode – FOR OCAS (Verify blue)

MSS: SSRMS: SSRMS FOR OCAS: Joint Lock:

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

pick File ► W4MBS1 ► OBSS Clear UHF

# 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

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Verify 'FOR' 'Destination' for Clear UHF Antenna position.

X	Y	Z	Pitch	Yaw	Roll
0	-190	-211	0.0	0.0	0.0

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

MON

Verify FOR and errors are correct on FOR position overlay.

	X	Y	Z	Pitch	Yaw	Roll
FOR	0	0	-100	0.0	0.0	0.0
TGT	<b>0</b>	<b>-190</b>	<b>-211</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
ERR	0	+190	+111	0.0	0.0	0.0

NOTE

Expect only Starboard motion of OBSS during this FOR OCAS.

\*\*\*\*\*

\* 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

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
-112.6	+138.5	+148.5	-77.4	-48.8	-112.7	+2.7
X	Y	Z	Pitch	Yaw	Roll	
0	-190	-211	0.0	0.0	0.0	
FOR	Loaded – OBSS Mid MPM, SY Held					
Disp	W4>Berth OBSS Mid NSP					



# 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

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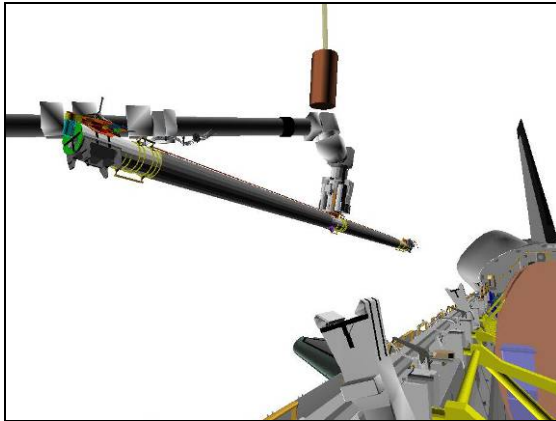


Figure 14.- Clear UHF Antenna  
(91: Camera D: -30, +10).

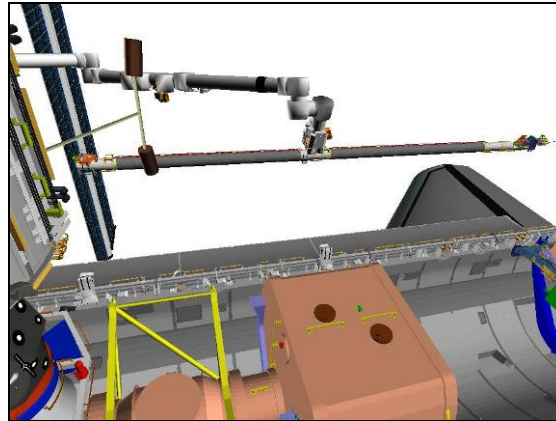


Figure 15.- Clear UHF Antenna  
(V10: SRMS Elbow: -55, -10).

## 11. HANDOFF POSITION MANEUVER

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
92: Camera C (0, +10)	91: SRMS Elbow (-55, -10)	03: S1 Lower Outboard (+60, +15) (24: Tip Elbow (-120, -10))	Camera D (-30, +10)

MSS: SSRMS:

Verify SY – Locked

pick File ► W4MBS1 ► OBSS Handoff

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

X	Y	Z	Pitch	Yaw	Roll
+325	0	-211	+91.1	-70.6	+47.0

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

MON

Verify FOR and errors are correct on FOR position overlay.

	X	Y	Z	Pitch	Yaw	Roll
FOR	0	-190	-211	0.0	0.0	0.0
TGT	<b>+325</b>	<b>0</b>	<b>-211</b>	<b>+91.1</b>	<b>-70.6</b>	<b>+47.0</b>
ERR	-325	-190	0	-91.1	+70.6	-47.0

# 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

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\*\*\*\*\*

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

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:

Verify Posn Hold – orange

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
-113.8	+138.5	+119.5	-28.6	-117.2	-107.3	-133.8
X	Y	Z	Pitch	Yaw	Roll	
+325	0	-211	+91.1	-70.6	+47.0	
FOR	Loaded – OBSS Mid MPM, SY Held					
Disp	W4>Berth OBSS Mid NSP					

DCP BRAKES SSRMS → ON (Verify ON)

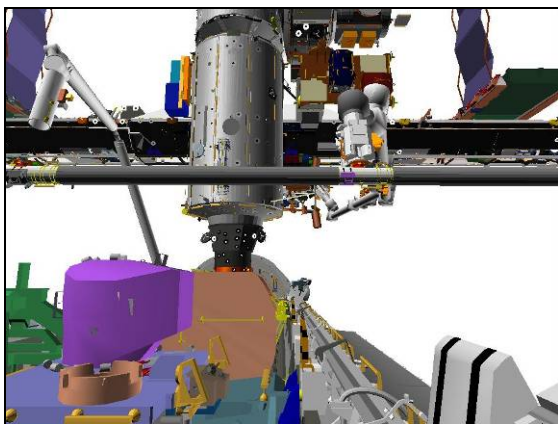


Figure 16.- OBSS Handoff  
(92: Camera C: 0, +10).

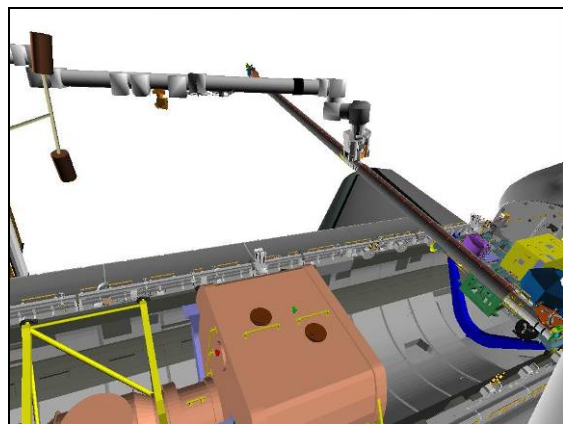


Figure 17.- OBSS Handoff  
(91: SRMS Elbow: -45, -10).

## 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

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### 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.

Monitor 1	Monitor 2	Monitor 3	V10
92: Camera C (+10, +10)	25: Tip LEE	91: SRMS Elbow (-45, -10)	Camera D (-10, +20)

#### NOTE

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

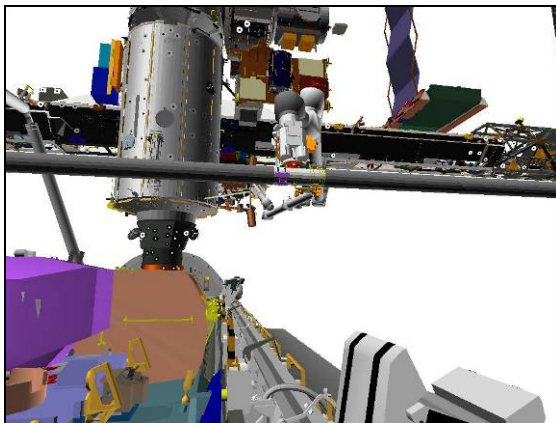


Figure 18.- OBSS Handoff  
(92: Camera C: +10, +10).

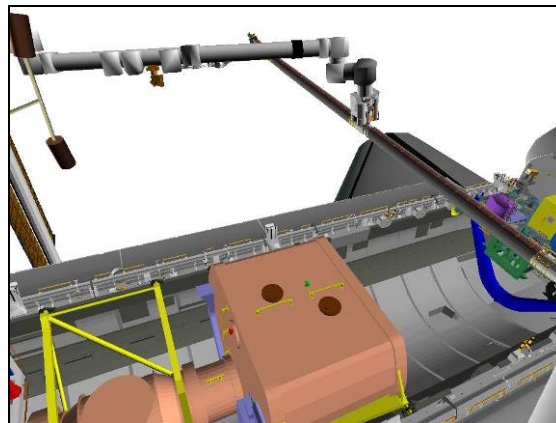


Figure 19.- OBSS Handoff  
(91: SRMS Elbow: -45, -10).

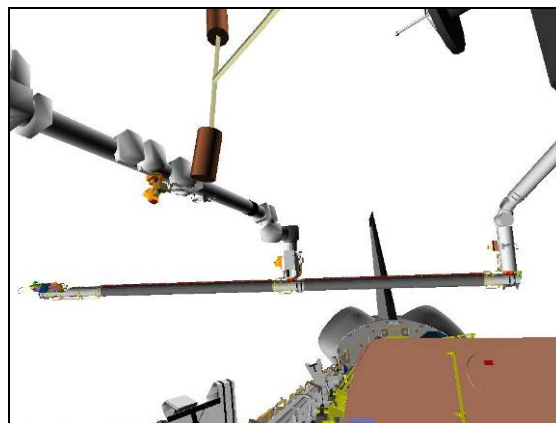


Figure 20.- OBSS Handoff  
(V10: Camera D: -10, +20).

PCS

MSS: SSRMS:

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

## 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1)

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

√Vernier

MSS: 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:

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

#### 14.2 Auto Release

MSS: 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 – √

# 1.200 SSRMS OBSS UNBERTH AND HANDOFF

(RBT FS/13A.1/FIN 1) Page 15 of 15 pages

## 14.3 SSRMS Backoff

MSS: SSRMS: Limp:

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

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

THC/  
RHC

Maneuver to OBSS Backoff position (-X THC Command)  
(within 5 cm/1 deg).

	Locked					
SR	SY	SP	EP	WP	WY	WR
-129.5	+138.5	+114.0	-46.7	-63.0	-104.9	-91.3
X	Y	Z	Pitch	Yaw	Roll	
+234	+82	-512	-75.1	-18.9	-85.5	
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.  
 \* \*\*\*\*\*

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# 1.210 SSRMS FOCUSED INSPECTION SUPPORT

(RBT FS/13A.1/FIN 1)

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## 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
92: Camera C (+10, +20)	13: LAB Stbd Zenith (-10, 0)	03: S1 Lower Outboard (+50, +10)	SRMS Elbow (-15, +10)

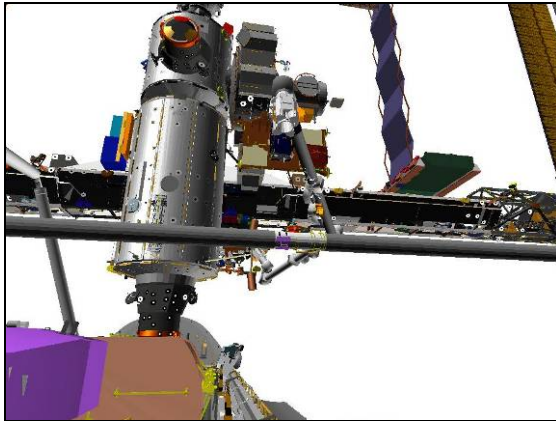


Figure 1.- OBSS Backoff  
(92: Camera C: +10, +20).

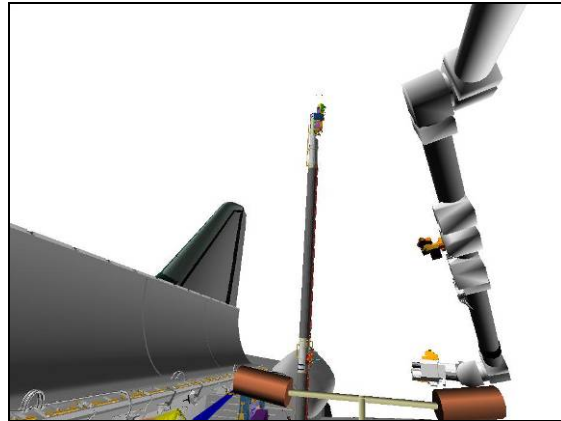


Figure 2.- OBSS Backoff  
(13: LAB Stbd Zenith: -10, 0).

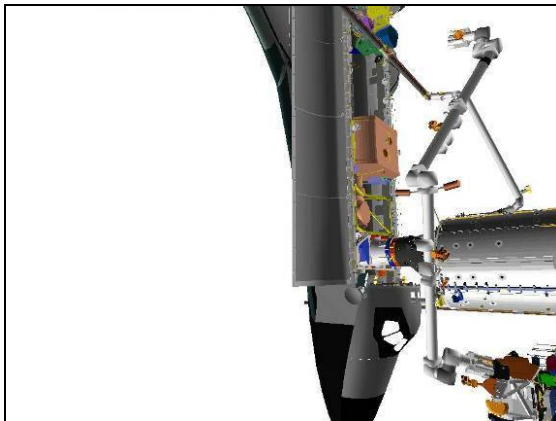


Figure 3.- OBSS Backoff  
(03: S1 Lower Outboard: +50, +10).

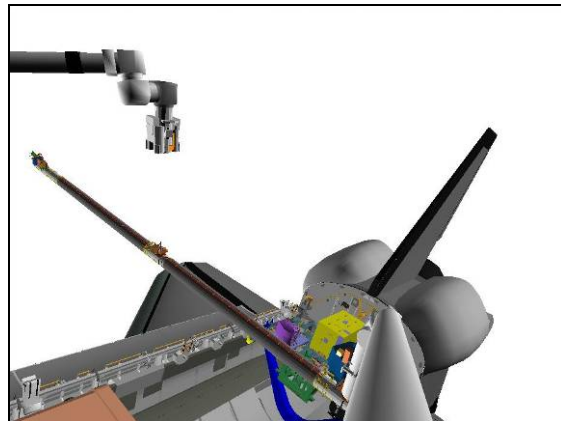


Figure 4.- OBSS Backoff  
(V10: SRMS Elbow: -15, +10).

PCS            MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

RHC            RATE → COARSE (Verify Coarse on PCS)

PCS            MSS: SSRMS:

pick File ► W4MBS1 ► Survey Support

# 1.210 SSRMS FOCUSED INSPECTION SUPPORT

Verify 'Joint Angles' 'Destination' for Survey Support Viewing position.

SR	SY	SP	EP	WP	WY	WR
-155.8	+163.3	+204.7	-43.1	-158.8	-51.3	+51.2

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-129.5	+138.5	+114.0	-46.7	-63.0	-104.9	-91.3
TGT	<b>-155.8</b>	<b>+163.3</b>	<b>+204.7</b>	<b>-43.1</b>	<b>-158.8</b>	<b>-51.3</b>	<b>+51.2</b>
ERR	+26.3	-24.8	-90.7	-3.6	+95.8	-53.6	-142.5

\*\*\*\*\*

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 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).

SR	SY	SP	EP	WP	WY	WR
-155.8	+163.3	+204.7	-43.1	-158.8	-51.3	+51.2
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					

DCP BRAKES SSRMS → ON (Verify ON)



## 1.210 SSRMS FOCUSED INSPECTION SUPPORT

(RBT FS/13A.1/FIN 1)

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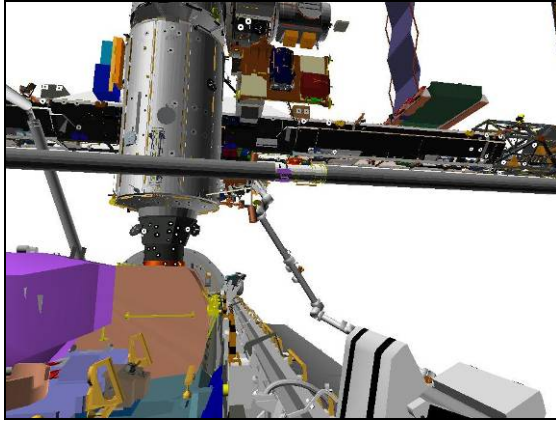


Figure 5.- Survey Support Viewing  
(92: Camera C: +10, +10).

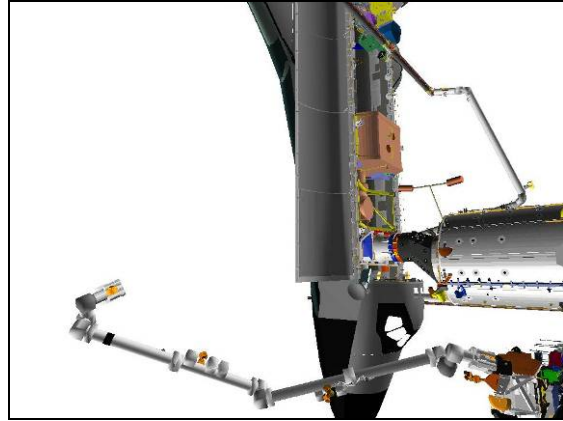


Figure 6.- Survey Support Viewing  
(03: S1 Lower Outboard: +50, +10).

## 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

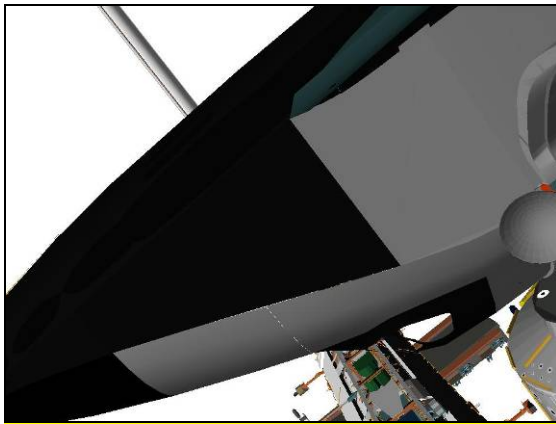


Figure 7.- Nose Area of Orbiter  
(24: Tip Elbow: -175, +30).

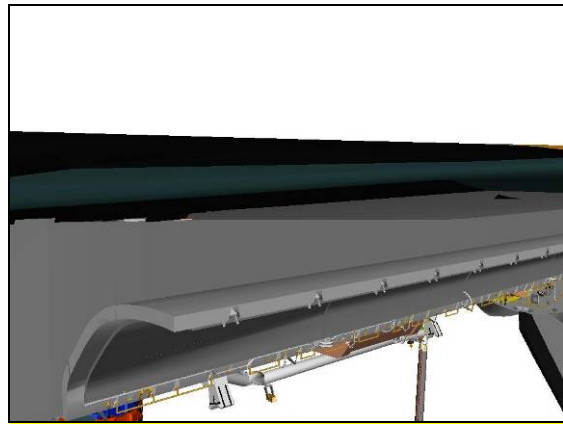


Figure 8.- Mid Area of Orbiter  
(24: Tip Elbow: -125, +50).

## 1.210 SSRMS FOCUSED INSPECTION SUPPORT

(RBT FS/13A.1/FIN 1)

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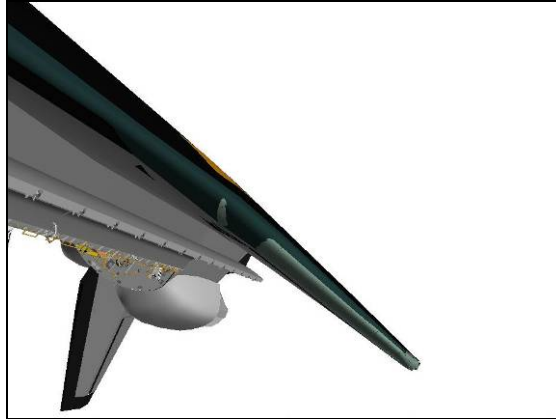


Figure 9.- Aft Area of Orbiter  
(24: Tip Elbow: -75, +45).

### 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:

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.

# 1.210 SSRMS FOCUSED INSPECTION SUPPORT

(RBT FS/13A.1/FIN 1)

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THC If viewing fwd area of orbiter  
 Perform Single Joint maneuver to Fwd Orbiter viewing position (within 1 deg).

Initial Viewing Posn	SR	SY	SP	EP	WP	WY	WR
	-155.8	+163.3	+204.7	-43.1	-158.8	-51.3	+51.2
1: WP -					-185.0		
2: WY +						-30.0	
Fwd Orbiter	-155.8	+163.3	+204.7	-43.1	-185.0	-30.0	+51.2
	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)

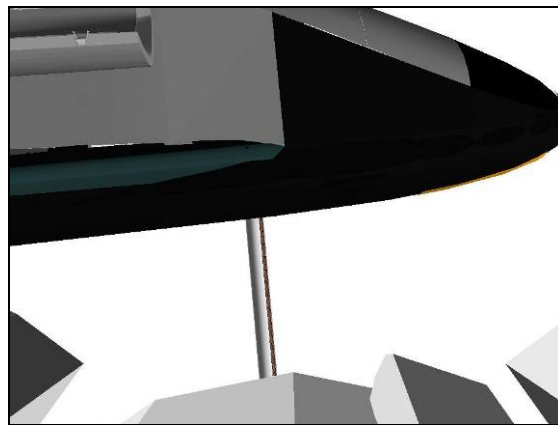


Figure 10.- Survey Support - Fwd Orbiter (25: Tip LEE).

THC If viewing mid area of orbiter  
 Perform Single Joint maneuver to Mid Orbiter viewing position (within 1 deg).

Initial Viewing Posn	SR	SY	SP	EP	WP	WY	WR
	-155.8	+163.3	+204.7	-43.1	-158.8	-51.3	+51.2
1: WP +					-135.0		
2: WY +						-50.0	
Mid Orbiter	-155.8	+163.3	+204.7	-43.1	-135.0	-50.0	+51.2
	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

(RBT FS/13A.1/FIN 1)

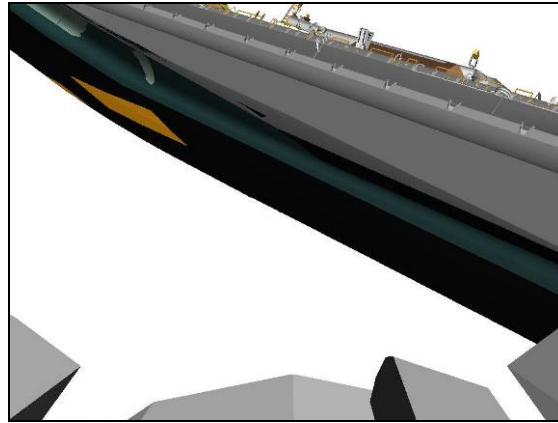


Figure 11.- Survey Support - Mid Orbiter  
(25: Tip LEE).

THC

If viewing aft area of orbiter

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

Initial Viewing  
Posn  
1: WP +  
2: WY +  
Aft Orbiter

SR	SY	SP	EP	WP	WY	WR
-155.8	+163.3	+204.7	-43.1	-158.8	-51.3	+51.2
				-115.0		
					-45.0	
-155.8	+163.3	+204.7	-43.1	-115.0	-45.0	+51.2
X	Y	Z	Pitch	Yaw	Roll	
-827	-1178	+170	-5.9	+40.3	-28.4	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>Berth OBSS Mid NSP					

DCP

BRAKES SSRMS → ON (Verify ON)

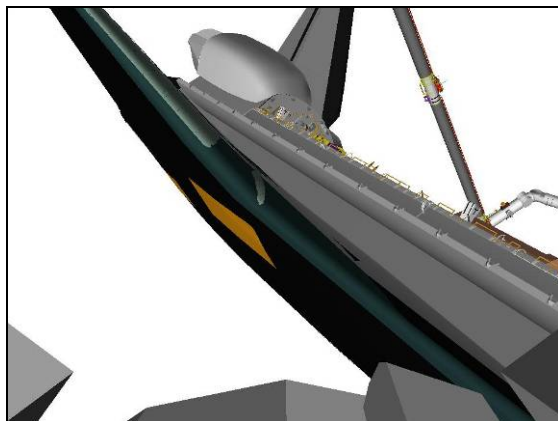


Figure 12.- Survey Support - Aft Orbiter  
(25: Tip LEE).

## 1.210 SSRMS FOCUSED INSPECTION SUPPORT

(RBT FS/13A.1/FIN 1)

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### 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:

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:

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

SR	SY	SP	EP	WP	WY	WR
-155.8	+163.3	+204.7	-43.1	-158.8	-51.3	+51.2
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 HANDOFF

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

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
92: Camera C (+10, +10)	13: LAB Stbd Zenith (-50, +40)	03: S1 Lower Outboard (+50, +10) 24: Tip Elbow (-145, 0)	SRMS Elbow (-55, +10)

## 1.210 SSRMS FOCUSED INSPECTION SUPPORT

(RBT FS/13A.1/FIN 1)

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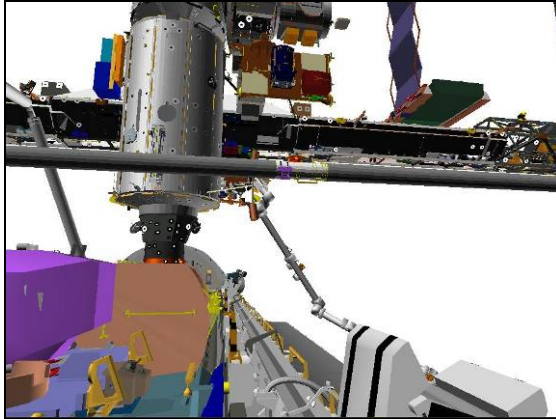


Figure 13.- Survey Support Viewing  
(92: Camera C: +10, +10).

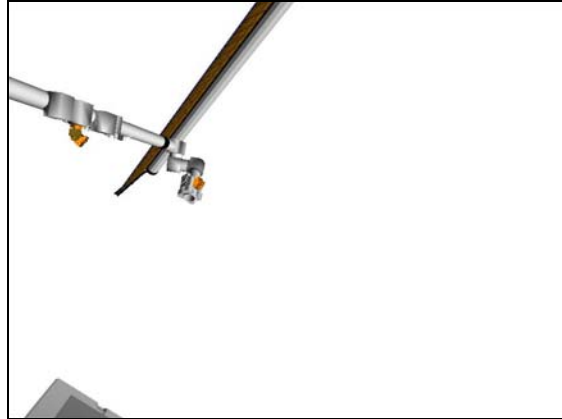


Figure 14.- Survey Support Viewing  
(13: LAB Stbd Zenith: -50, +40).

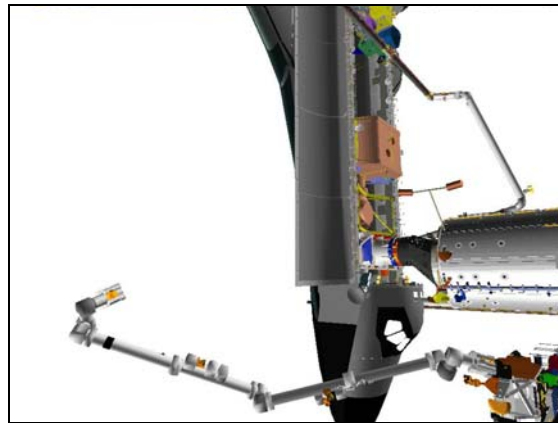


Figure 15.- Survey Support Viewing  
(03: S1 Lower Outboard +50, +10).

BRAKES SSRMS → OFF (Verify OFF)

√Coarse

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W4MBS1 ► OBSS Handoff

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

SR	SY	SP	EP	WP	WY	WR
-129.6	+139.3	+114.0	-46.8	-63.0	-105.7	-91.3

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

# 1.210 SSRMS FOCUSED INSPECTION SUPPORT

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

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

\*\*\*\*\*

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 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).

SR	SY	SP	EP	WP	WY	WR
-129.6	+139.3	+114.0	-46.8	-63.0	-105.7	-91.3
X	Y	Z	Pitch	Yaw	Roll	
+234	+84	-513	-75.1	-18.9	-85.4	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>Berth OBSS Mid NSP					

DCP BRAKES SSRMS → ON (Verify ON)

## 1.210 SSRMS FOCUSED INSPECTION SUPPORT

(RBT FS/13A.1/FIN 1)

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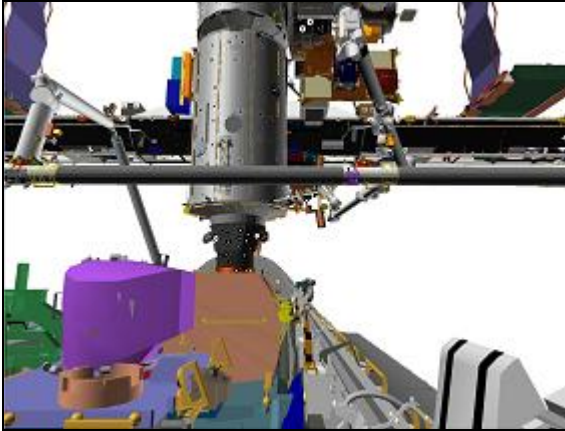


Figure 16.- OBSS Handoff Pre-Grapple  
(92: Camera C: 0, +10).

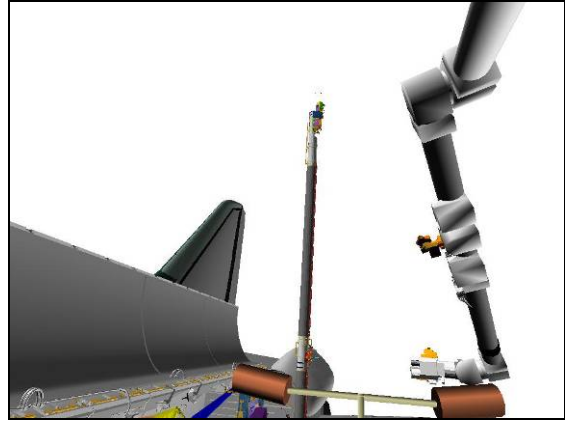


Figure 17.- OBSS Handoff Pre-Grapple  
(13: LAB Stbd Zenith: -10, 0).



## 1.220 SSRMS OBSS HANDOFF AND BERTH

(RBT FS/13A.1/FIN 1)

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### 1. SETUP

Configure Cameras and overlays for grapple.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera D (-10, +20)	25: Tip LEE	03: S1 Lower Outboard (+60, +25) 24: Tip Elbow (-150, -10)	SRMS Elbow (-55, +10)

#### 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.

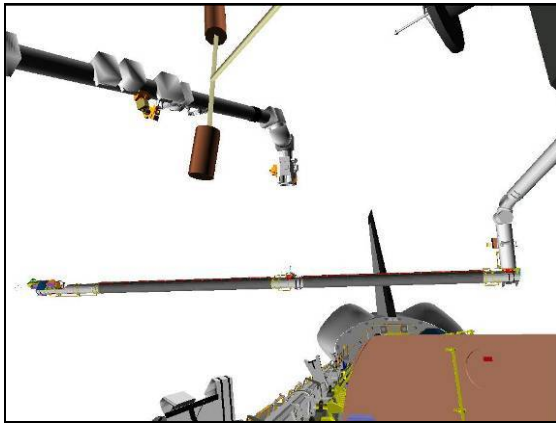


Figure 1.- OBSS Handoff Pre-Grapple  
(91: Camera D: -10, +20).

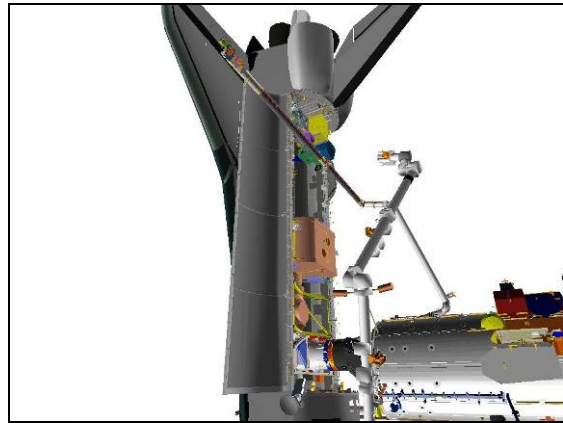


Figure 2.- OBSS Handoff Pre-Grapple  
(03: S1 Lower Outboard: +60, +25).

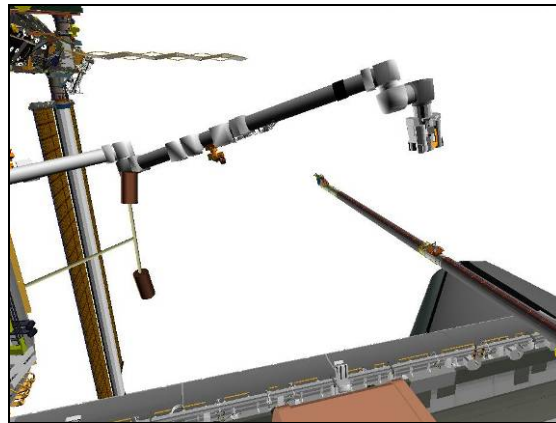


Figure 3.- OBSS Handoff Pre-Grapple  
(V10: SRMS Elbow: -55, +10).

## 1.220 SSRMS OBSS HANDOFF AND BERTH

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RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: as desired.

### 2. ATTITUDE CONTROL CONFIGURATION

PCS MSS: SSRMS: Thrusters:

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:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

RHC/  
THC Maneuver to within grapple envelope.

#### 3.2 Slow Capture Commands

MSS: 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).

## 1.220 SSRMS OBSS HANDOFF AND BERTH

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

Verify LEE Mode – Auto Capture

RHC 3.3 Grapple  
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 3.4 Cleanup  
BRAKES SSRMS → ON (Verify ON)

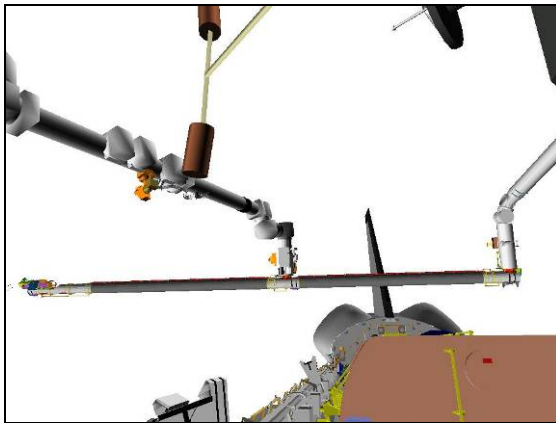


Figure 4.- OBSS Grapple  
(91: Camera D: -10, +20).

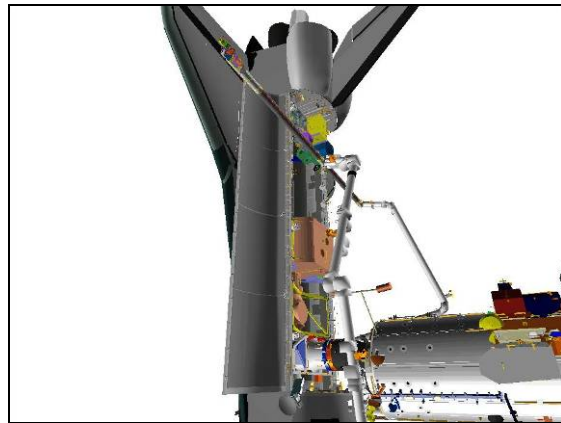


Figure 5.- OBSS Grapple  
(03: S1 Lower Outboard: +60, +25).

PCS MSS: 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).

SR	SY	SP	EP	WP	WY	WR
-114.1	+139.3	+119.6	-29.0	-115.4	-107.9	-132.0
X	Y	Z	Pitch	Yaw	Roll	
+325	0	-211	+91.1	-70.6	+46.9	
FOR	Loaded – OBSS Mid MPM, SY Held					
Disp	W4>Berth OBSS Mid NSP					

## 1.220 SSRMS OBSS HANDOFF AND BERTH

(RBT FS/13A.1/FIN 1)

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### 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.

Monitor 1	Monitor 2	Monitor 3	V10
92: Camera C (0, +10)	91: SRMS Elbow (-45, -10)	03: S1 Lower Outboard (+60, +15) 24: Tip Elbow (-150, -10)	Camera D (-10, +20)



Figure 6.- OBSS Grapple  
(92: Camera C: 0, +10).

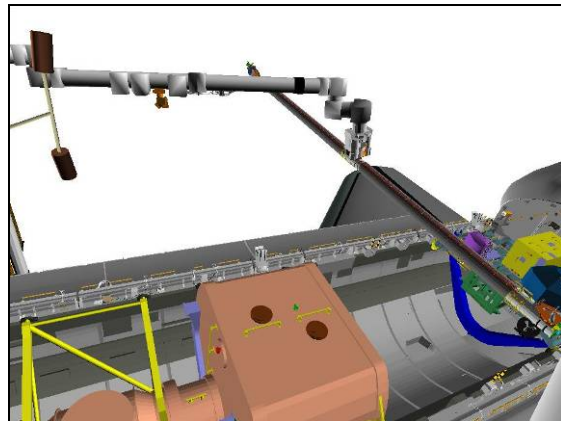


Figure 7.- OBSS Grapple  
(91: SRMS Elbow: -45, -10).

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: 1.0 (Verify 1.0)

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS:

Enter Mode – FOR OCAS (Verify blue)

MSS: SSRMS: SSRMS FOR OCAS: Joint Lock:

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

pick File ► W4MBS1 ► OBSS Clear UHF

Verify 'FOR' 'Destination' for OBSS Clear UHF position.

X	Y	Z	Pitch	Yaw	Roll
0	-190	-211	0.0	0.0	0.0

## 1.220 SSRMS OBSS HANDOFF AND BERTH

(RBT FS/13A.1/FIN 1)

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

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

	X	Y	Z	Pitch	Yaw	Roll
FOR	+325	0	-211	+91.1	-70.6	+46.9
TGT	<b>0</b>	<b>-190</b>	<b>-211</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
ERR	+325	+190	0	+91.1	-70.6	+46.9

\*\*\*\*\*

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)

<u>NOTE</u>	
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).

	Locked					
SR	SY	SP	EP	WP	WY	WR
-113.0	+139.3	+148.4	-77.4	-49.0	-113.6	+2.7
X	Y	Z	Pitch	Yaw	Roll	
0	-190	-211	0.0	0.0	0.0	
FOR	Loaded – OBSS Mid MPM SY Held					
Disp	W4>Berth OBSS Mid NSP					

## 1.220 SSRMS OBSS HANDOFF AND BERTH

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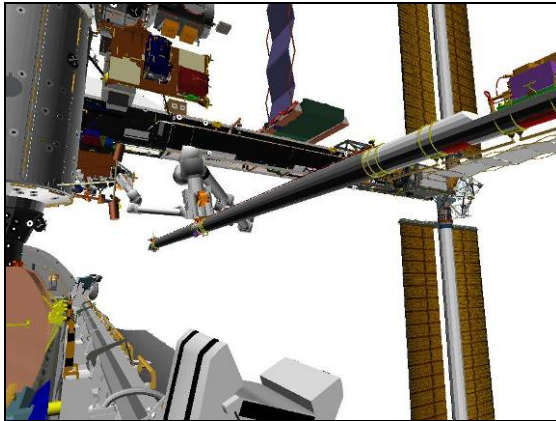


Figure 8.- OBSS Clear UHF  
(92: Camera C: +30, +10).

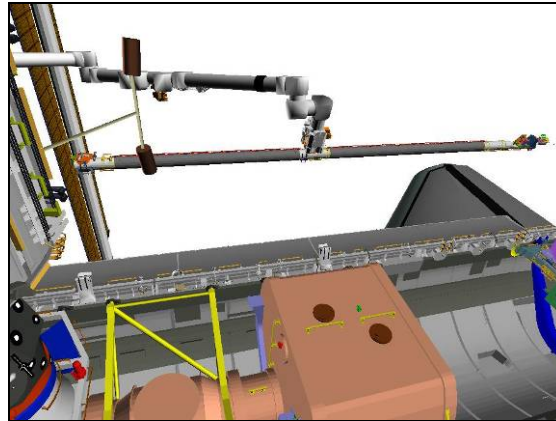


Figure 9.- OBSS Clear UHF  
(91: SRMS Elbow: -55, -10).

### 5. SETUP FOR MANEUVER TO LOW HOVER

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
92: Camera C (+10, +5)	91: Camera D (-30, +10)	03: S1 Lower Outboard (+50, +10) 24: Tip Elbow (-120, -10)	SRMS Elbow (-55, -10)

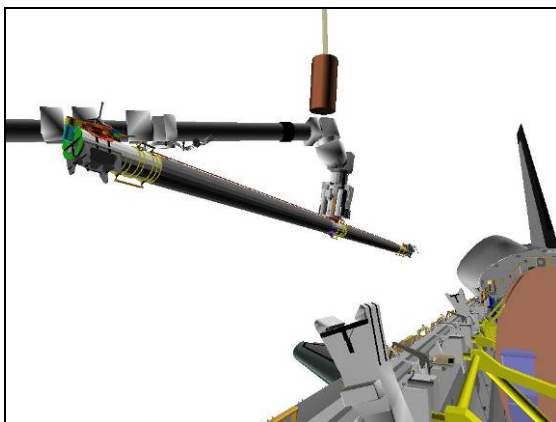


Figure 10.- Clear UHF Antenna  
(91: Camera D: -30, +10).

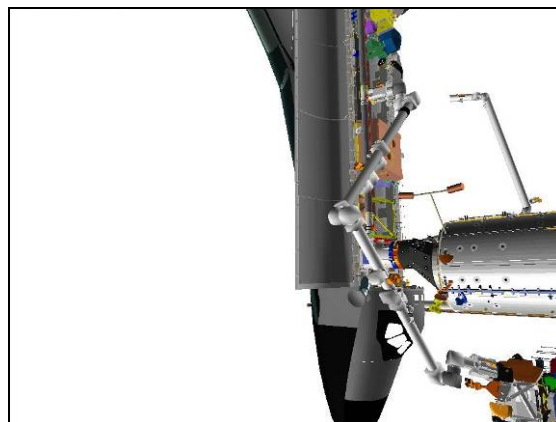


Figure 11.- Clear UHF Antenna  
(03: S1 Lower Outboard: +50, +10).

### 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:

Verify SY – Locked

# 1.220 SSRMS OBSS HANDOFF AND BERTH

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SSRMS FOR OCAS

pick File ► W4MBS1 ► OBSS Low Hover

Verify 'FOR' 'Destination' for OBSS Low Hover position.

X	Y	Z	Pitch	Yaw	Roll
0	0	-100	0.0	0.0	0.0

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

MON

Verify FOR and errors are correct on FOR position overlay.

	X	Y	Z	Pitch	Yaw	Roll
FOR	0	-190	-211	0.0	0.0	0.0
TGT	<b>0</b>	<b>0</b>	<b>-100</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
ERR	0	-190	-111	0.0	0.0	0.0

\*\*\*\*\*

\* 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)

<u>NOTE</u>	
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).

	Locked					
SR	SY	SP	EP	WP	WY	WR
-106.9	+139.3	+140.3	-73.6	-51.3	-112.1	-8.6
X	Y	Z	Pitch	Yaw	Roll	
0	0	-100	0.0	0.0	0.0	
FOR	Loaded – OBSS Mid MPM, SY Held					
Disp	W4>Berth OBSS Mid NSP					

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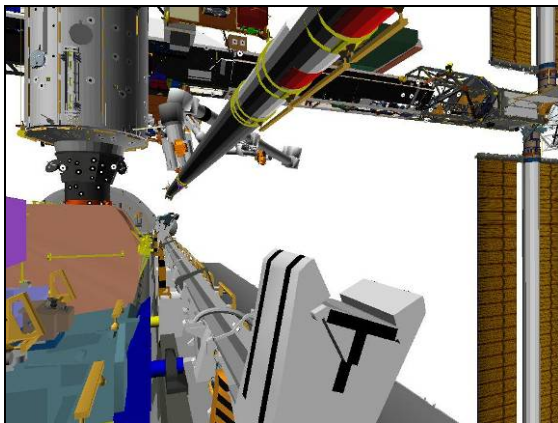


Figure 12.- OBSS Low Hover  
(92: Camera C: +20, 0).

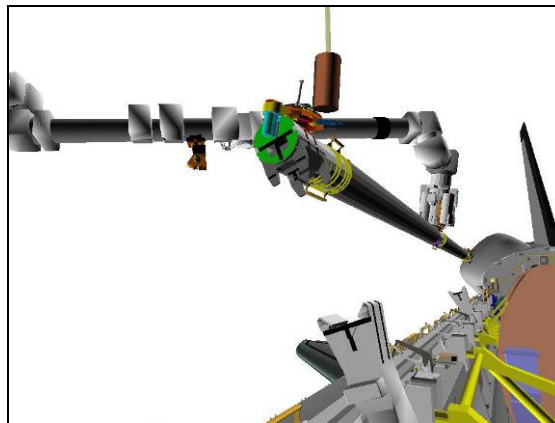


Figure 13.- OBSS Low Hover  
(91: Camera D: -30, +10).

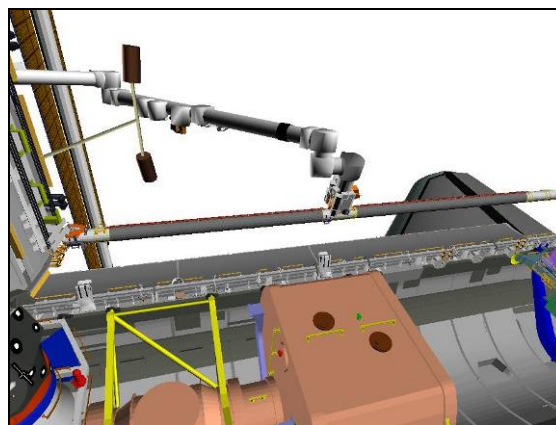


Figure 14.- OBSS Low Hover  
(V10: SRMS Elbow: -55, -10).

### 7. ATTITUDE CONTROL CONFIGURATION

MSS: SSRMS: Thrusters:

Verify 'Desat Request:' – Inh

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

### 8. BERTHING OBSS

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
24: Tip Elbow (-130, -10)	92: Mux D/C (D: -25, +5) (C: +25, 0)	03: S1 Lower Outboard (+50, +10)	SRMS Elbow (-55, -10)



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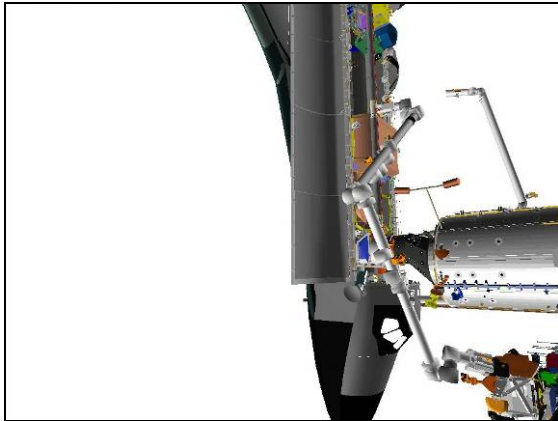


Figure 15.- OBSS Low Hover  
(03: S1 Lower Outboard: +50, +10).

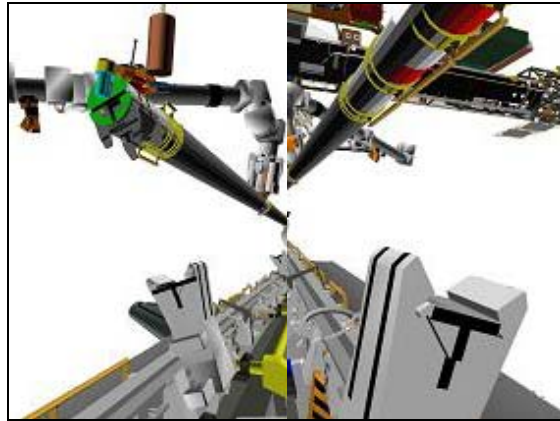


Figure 16.- OBSS Low Hover  
(92: Mux D/C).

Verify shuttle crew standing by for STBD RMS R-F-L callouts during berth.

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: 0.5 (Verify 0.5)

MSS: 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:

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

## 1.220 SSRMS OBSS HANDOFF AND BERTH

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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.

	Locked							
	SR	SY	SP	EP	WP	WY	WR	
Recorded during unberth								
Expected	-100.2	+139.3	+142.6	-70.0	-65.3	-111.1	-22.2	
	X	Y	Z	Pitch	Yaw	Roll		
Recorded during unberth								
Expected	0	0	0	0.0	0.0	0.0		
	FOR	Loaded – OBSS Mid MPM, SY Held						
	Disp	W4>Berth OBSS Mid NSP						

PCS                      MSS: SSRMS:

Verify Posn Hold – orange

Enter Mode – Standby (Verify blue)

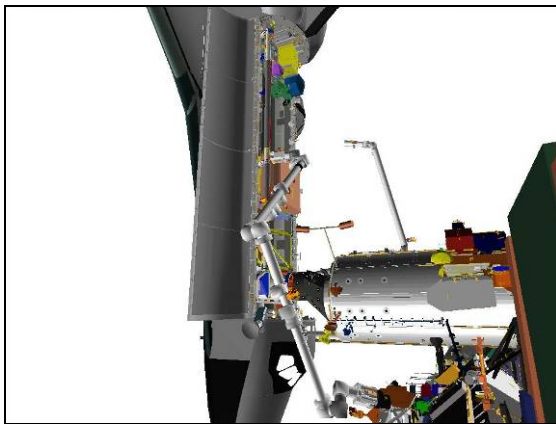


Figure 17.- OBSS Berth  
(03: S1 Lower Outboard: +65, +15).

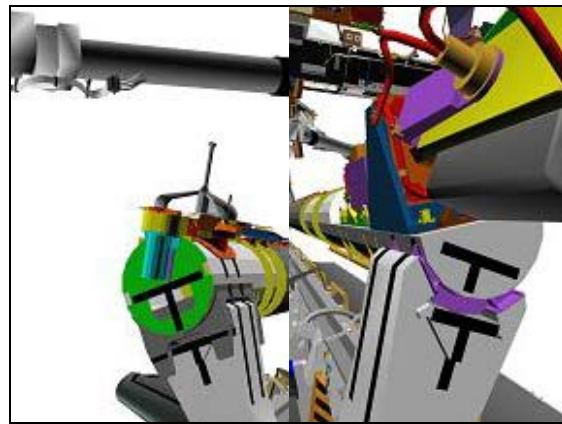


Figure 18.- OBSS Berth  
(92: Mux D/C; D FL=10mm).

## 9. MRL LATCHING SEQUENCE

### 9.1 Limp Wrist Joints

MSS: SSRMS: Limp:

sel WP, WY, WR

**cmd Execute**

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MSS: 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:

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

MSS: 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 reseal 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:

**cmd** 'Carriage' Rigidize ► Slow (Verify Speed – Slow)

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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.

Monitor 1	Monitor 2	Monitor 3	V10
92: Camera D (-30, +10)	25: Tip LEE	03: S1 Lower Outboard (+50, +10)	SRMS Elbow (-55, -10)

#### NOTE

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

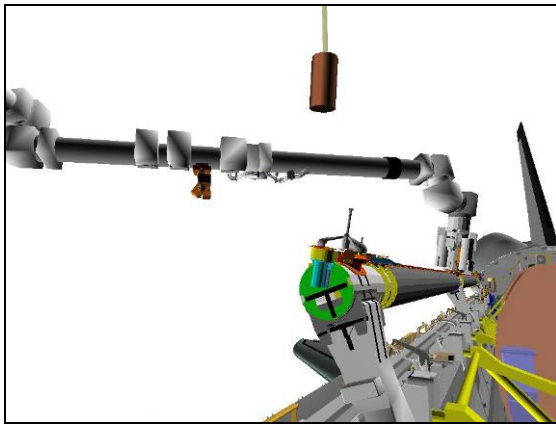


Figure 19.- OBSS Berth  
(92: Camera D: -30, +10).

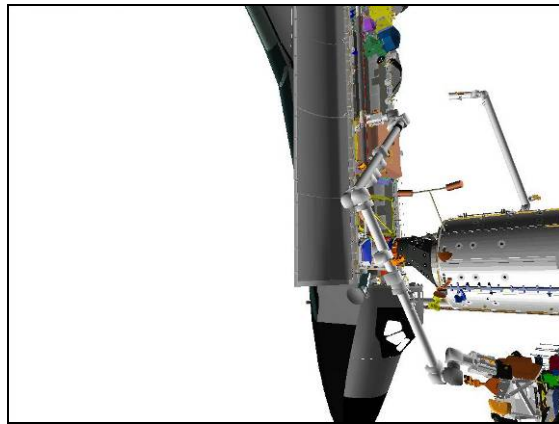


Figure 20.- OBSS Berth  
(03: S1 Lower Outboard: +50, +10).

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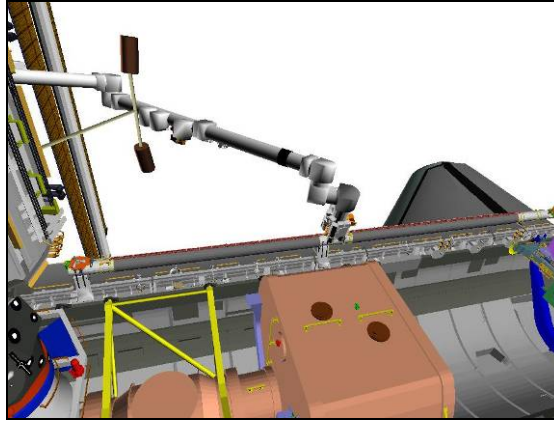


Figure 21.- OBSS Berth  
(V10: SRMS Elbow: -55, -10).

PCS

MSS: 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:

Set 'Scale' 'Vernier' Rate Scale: as desired.

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

SR	SY	SP	EP	WP	WY	WR
-100.2	+139.3	+142.6	-70.0	-65.3	-111.1	-22.2
X	Y	Z	Pitch	Yaw	Roll	
+45	+12	+23	+90.0	0.0	-30.0	
FOR	Loaded – OBSS Mid MPM, SY Held					
Disp	W4>Berth OBSS FRGF NSP					

### 12. RELEASING OBSS (PUSHOFF)

DCP

BRAKES SSRMS → OFF (Verify OFF)

#### 12.1 SSRMS Limp

PCS

MSS: SSRMS: Limp:

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

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### 12.2 Auto Release

MSS: 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:

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

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

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THC/  
RHC

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

		Locked					
SR	SY	SP	EP	WP	WY	WR	
-109.6	+139.3	+134.4	-72.5	-43.5	-112.7	-3.5	
X	Y	Z	Pitch	Yaw	Roll		
-150	0	0	0.0	0.0	0.0		
FOR	Unloaded – LEE Tip, SY Held						
Disp	W4>Berth OBSS FRGF NSP						

Verify Posn Hold – orange

DCP

BRAKES SSRMS → ON (Verify ON)

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

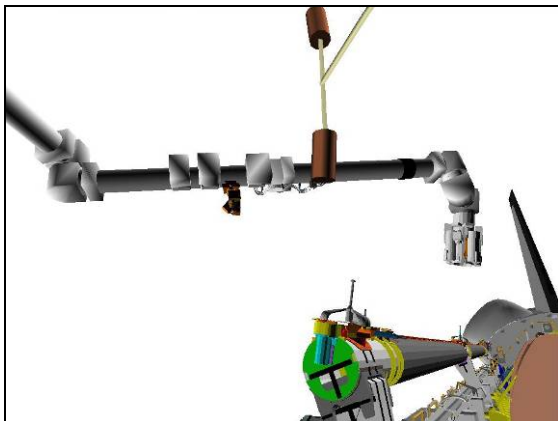


Figure 22.- Grapple Fixture Backoff  
(91: Camera D: -30, +20).

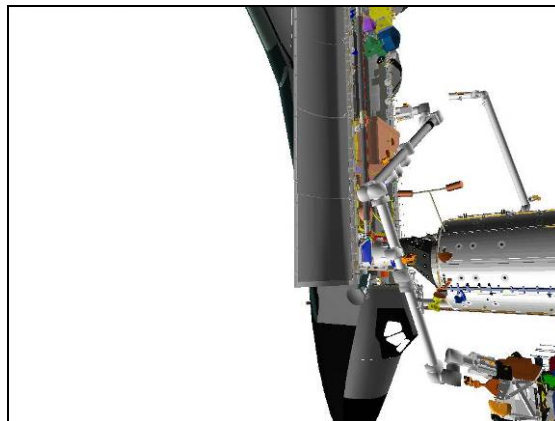


Figure 23.- Grapple Fixture Backoff  
(03: S1 Lower Outboard: +50, +10).

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## 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

Page 1 of 15 pages

### 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+75, +10)	22: Base Elbow (-130, -15)	24: Tip Elbow (-130, -10) (37: MBS Mast (+105, -50))	Camera C (0, +20)

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).

SR	SY	SP	EP	WP	WY	WR
-109.6	+139.3	+134.4	-72.5	-43.5	-112.7	-3.5
X	Y	Z	Pitch	Yaw	Roll	
-219	-654	-388	+83.4	-8.3	-37.9	
FOR	Unloaded – LEE Tip, SR Held					
Disp	W4>LAB PDGF					



Figure 1.- Grapple Fixture Backoff  
(03: S1 Lower Outboard: +75, +10).

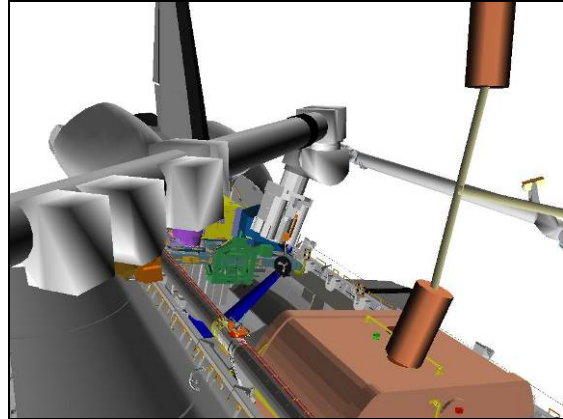


Figure 2.- Grapple Fixture Backoff  
(22: Base Elbow: -130, -15).

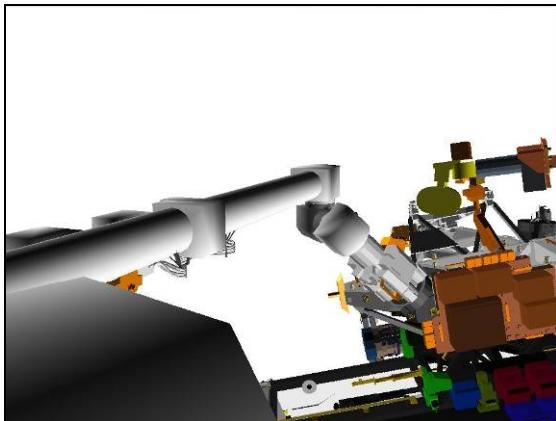


Figure 3.- Grapple Fixture Backoff  
(24: Tip Elbow: -130, -10).

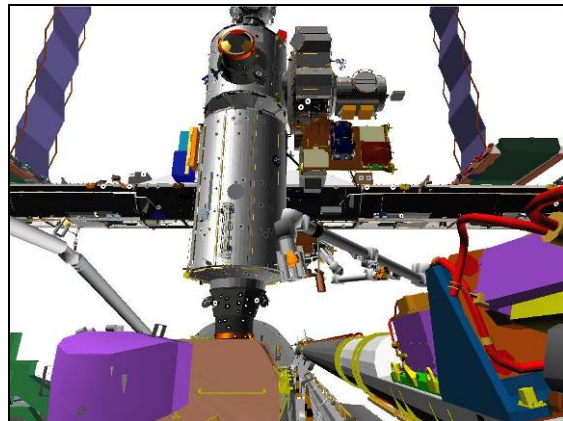


Figure 4.- Grapple Fixture Backoff  
(V10: Camera C: 0, +20).

## 2. JOINT OCAS TO INTERMEDIATE POSITION

On SRMS operator GO, maneuver to Pre-Cradle complete:

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W4MBS1 ► LAB Pregrap Inter

**1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF**

(RBT FS/13A.1/FIN 1)

Verify 'Joint Angles' 'Destination' for LAB PDGF Pre-Grapple Intermediate position.

SR	SY	SP	EP	WP	WY	WR
-158.7	+117.8	+110.0	-73.0	-144.5	+17.6	-65.4

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-109.6	+139.3	+134.4	-72.5	-43.5	-112.7	-3.5
<b>TGT</b>	<b>-158.7</b>	<b>+117.8</b>	<b>+110.0</b>	<b>-73.0</b>	<b>-144.5</b>	<b>+17.6</b>	<b>-65.4</b>
<b>ERR</b>	+49.1	+21.5	+24.4	+0.5	+101.0	-130.3	+61.9

\*\*\*\*\*

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 3 minutes to complete in Vernier rates.

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
-158.7	+117.8	+110.0	-73.0	-144.5	+17.6	-65.4

# 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

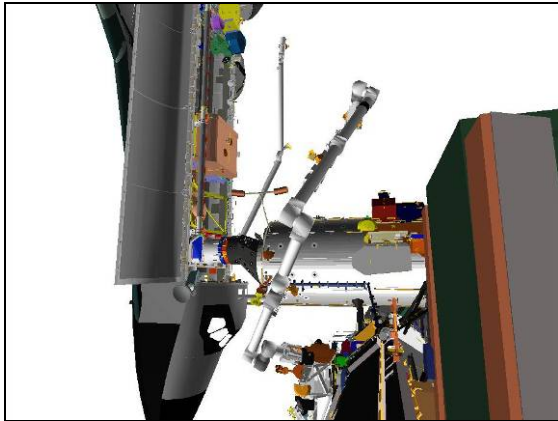


Figure 5.- LAB PDGF Pre-Grapple Intermediate  
(03: S1 Lower Outboard: +75, +10).

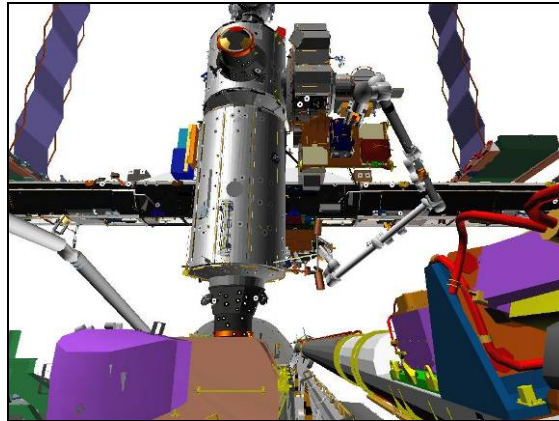


Figure 6.- LAB PDGF Pre-Grapple Intermediate  
(V10: Camera C: 0, +20).

### 3. LAB PDGF PRE-GRAPPLE MANEUVER

MSS: SSRMS:

Enter Mode – Single (Verify blue)

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

<b>NOTE</b>
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).

	SR	SY	SP	EP	WP	WY	WR
LAB PDGF Pre-Grapple Intermediate	-158.7	+117.8	+110.0	-73.0	-144.5	+17.6	-65.4
1: SP –			+65.0				
LAB PDGF Pre-Grapple	-158.7	+117.8	+65.0	-73.0	-144.5	+17.6	-65.4
	X	Y	Z	Pitch	Yaw	Roll	
	-150	1	0	0.0	-0.1	+0.1	
FOR	Unloaded – LEE Tip, SR Held						
Disp	W4>LAB PDGF						

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

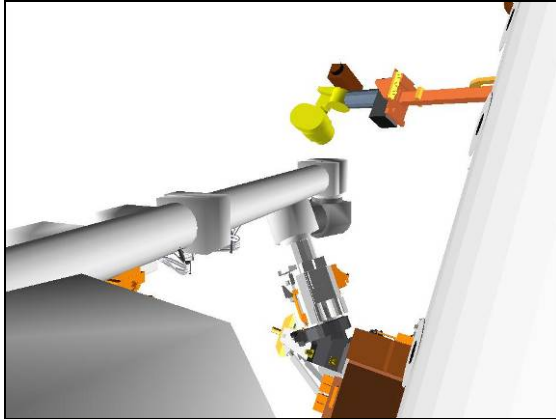


Figure 7.- LAB PDGF Pre-Grapple  
(24: Tip Elbow: -130, -10).

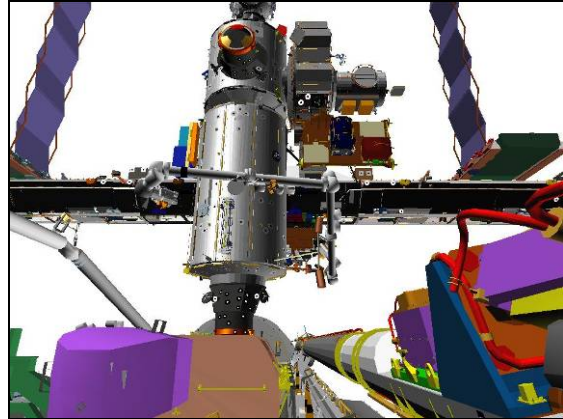


Figure 8.- LAB PDGF Pre-Grapple  
(V10: Camera C: 0, +20).

4. LAB PDGF GRAPPLE SETUP

Configure Cameras and overlays for grapple.

Monitor 1	Monitor 2	Monitor 3	V10
09: P1 Lower Ouboard (+100, +13) FL = 25 mm	25: Tip LEE	37: MBS Mast (+105, -5)	Camera C (0, +20)

**NOTE**

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

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: as desired

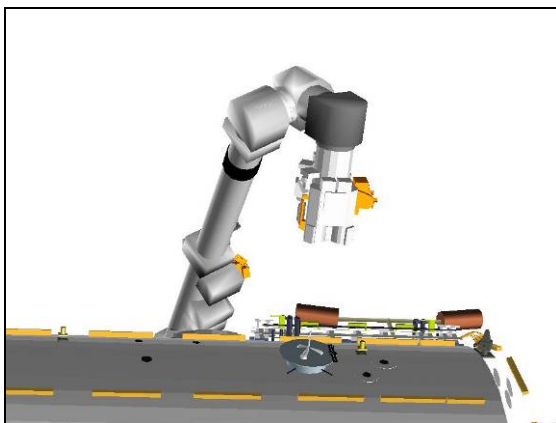


Figure 9.- LAB PDGF Pre-Grapple  
(09: P1 Lower Ouboard: +100, +13  
FL = 25 mm).

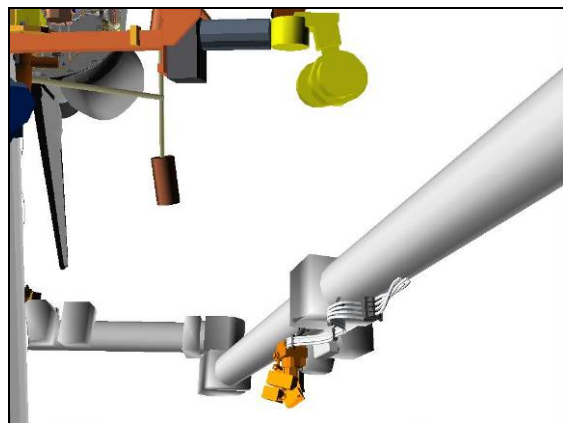


Figure 10.- LAB PDGF Pre-Grapple  
(37: MBS Mast: +105, -5).

## 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

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### 5. LAB PDGF GRAPPLE

PCS

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

RHC/  
THC

Maneuver to within grapple envelope.

PCS

MSS: 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)

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**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

Verify Loaded Parameters – √

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

SR	SY	SP	EP	WP	WY	WR
-158.7	+120.7	+74.5	-91.4	-135.2	+20.1	-66.9
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
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 Fail'** (SCR 17495)  
 This message should return to Norm.

DCP SAFING → SAFE (Verify ON)

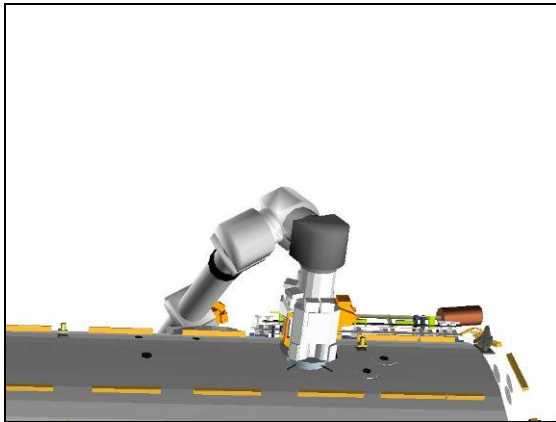


Figure 11.- LAB PDGF Grapple  
 (09: P1 Lower Outboard: +100, +13  
 FL = 25 mm).

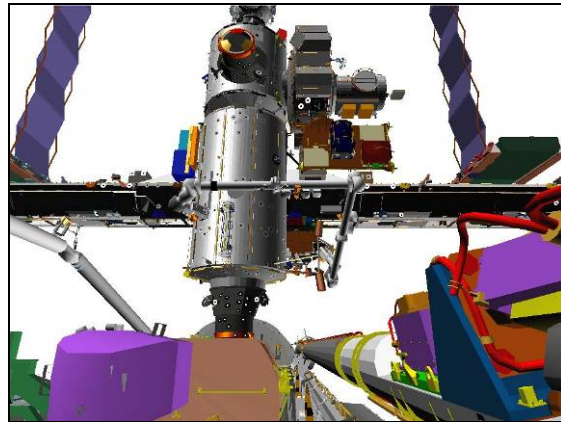


Figure 12.- LAB PDGF Grapple  
 (V10: Camera C: 0, +20).

# 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

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## 6. BASE CHANGE CLEANUP

On **MCC-H GO**, base change complete:

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+75, 0)	25: Tip LEE	24: Tip Elbow (-10, +20) 37: MBS Mast (+105, -5)	Camera C (0, +20)

### NOTE

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

PCS

MSS: 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).

SR	SY	SP	EP	WP	WY	WR
-66.9	-20.1	-135.2	-91.4	+74.5	-120.7	-158.7
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – MBS PDGF 1, SR Held					
Disp	ISS>W4MBS PDGF 1					

√Vernier

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: as desired

MSS: SSRMS: SSRMS Safing:

**cmd** Remove (Verify Not Safed)

DCP

BRAKES SSRMS → OFF (Verify OFF)



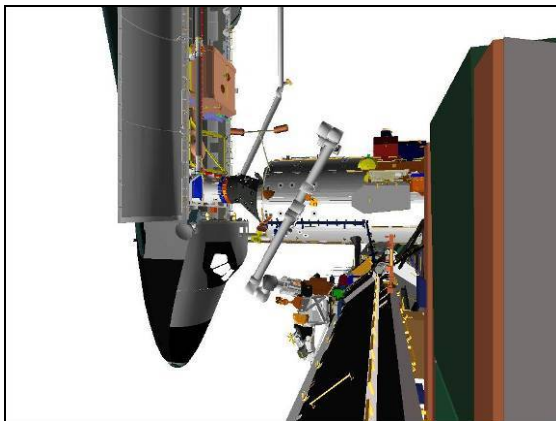


Figure 13.- MBS PDGF 1 Grapple  
(03: S1 Lower Outboard: +75, 0).



Figure 14.- MBS PDGF 1 Grapple  
(24: Tip Elbow: -10, +20).

7. MBS PDGF 1 RELEASE

7.1 Joint Limp and Mode Entry

PCS

MSS: SSRMS: Limp:

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

Wait 30 seconds.

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

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

7.2 Carriage Rigidize

MSS: SSRMS: Tip LEE:

**cmd** 'Carriage' Rigidize ► Slow (Verify Speed – Slow)

Verify '**Confirm or Terminate**' prompt.

## 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

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### 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:

**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)

## 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

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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).

Locked	SR	SY	SP	EP	WP	WY	WR
	-66.9	-27.4	-136.2	-85.6	+65.1	-127.2	-164.3
	X	Y	Z	Pitch	Yaw	Roll	
	-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held						
Disp	ISS>W4MBS PDGF 1						

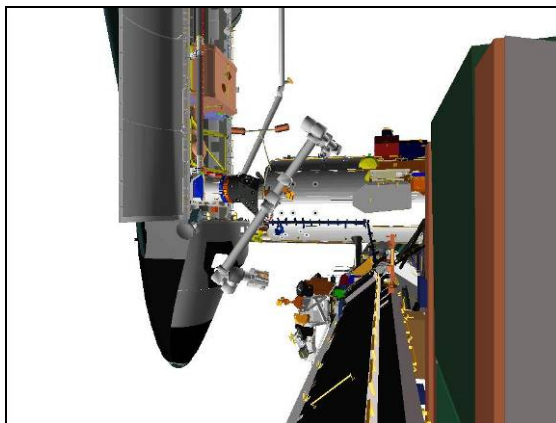


Figure 15.- MBS PDGF 1 Pre-Grapple  
(03: S1 Lower Outboard: +75, 0).

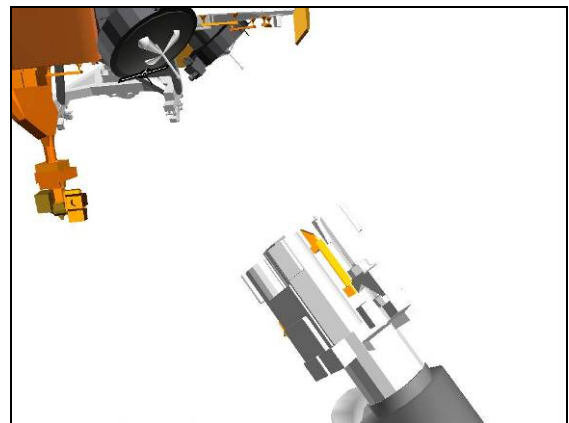


Figure 16.- MBS PDGF 1 Pre-Grapple  
(24: Tip Elbow: -10, +20).

## 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

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### 8. LAB/ESP2 CLEARANCE MANEUVER

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+75, +10)	22: Base Elbow (-120, -10)	37: MBS Mast (+105, -18)	Camera C (0, +20)

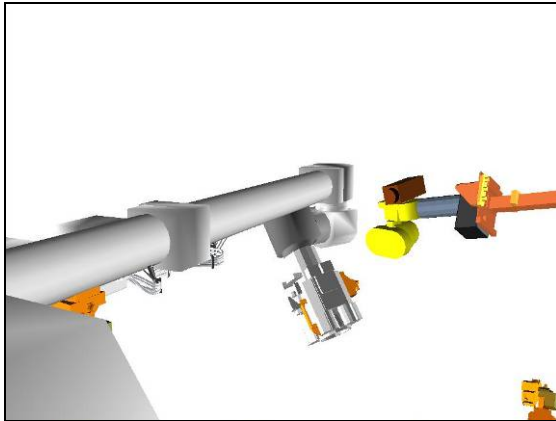


Figure 17.- MBS PDGF 1 Pre-Grapple (22: Base Elbow: -120, -10).

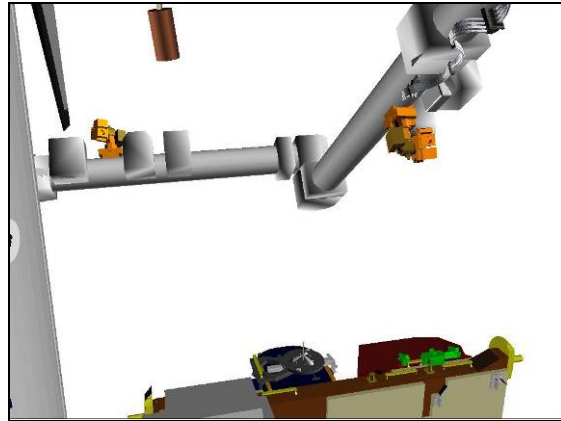


Figure 18.- MBS PDGF 1 Pre-Grapple (37: MBS Mast: +105, -18).

PCS MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: 1.0 (Verify 1.0)

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 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.

### 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

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

MBS PDGF 1 Pre-Grapple 1: SP + LAB/ESP-2 Clearance	SR	SY	SP	EP	WP	WY	WR
	-66.9	-27.4	-136.2	-85.6	+65.1	-127.2	-164.3
			-64.0				
	-66.9	-27.4	-64.0	-85.6	+65.1	-127.2	-164.3
	X	Y	Z	Pitch	Yaw	Roll	
	+33	+521	+962	+31.9	-28.5	-52.0	
	FOR	Unloaded – LEE Tip, SR Held					
	Disp	ISS>W4MBS PDGF 1					

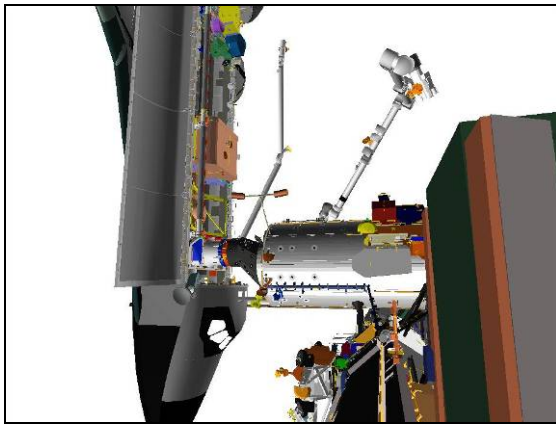


Figure 19.- LAB/ESP2 Clearance  
(03: S1 Lower Outboard: +75, +10).

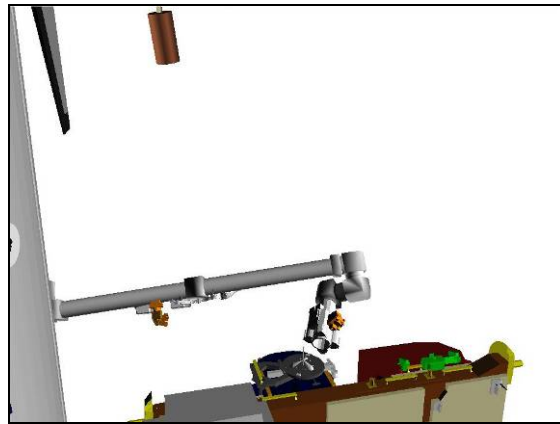


Figure 20.- LAB/ESP2 Clearance  
(37: MBS Mast: +105, -18).

### 9. OVERNIGHT PARK POSITION MANEUVER

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+100, +20) 09: P1 Lower Outboard (+100, +20)	22: Base Elbow (-120, -10)	91: Camera D (-10, +60)	Camera C (0, +40)

# 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

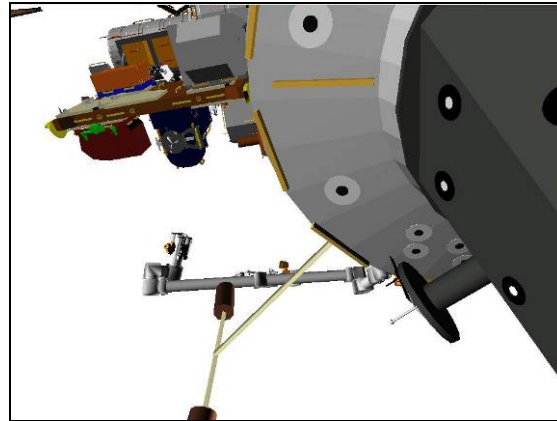


Figure 21.- LAB/ESP2 Clearance  
(91: Camera D: -10, +60).

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

RHC RATE → COARSE (Verify Coarse on PCS)

Input 'Joint Angles' 'Destination' for Overnight Park position.

SR	SY	SP	EP	WP	WY	WR
-68.9	+25.7	-74.1	-83.2	+4.0	+32.0	-170.5

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-66.9	-27.4	-64.0	-85.6	+65.1	-127.2	-164.3
<b>TGT</b>	<b>-68.9</b>	<b>+25.7</b>	<b>-74.1</b>	<b>-83.2</b>	<b>+4.0</b>	<b>+32.0</b>	<b>-170.5</b>
<b>ERR</b>	+2.0	-53.1	+10.1	-2.4	+61.1	-159.2	+6.2

\*\*\*\*\*

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)

### 1.230 SSRMS WALKOFF PDGF 1 TO LAB PDGF

(RBT FS/13A.1/FIN 1)

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#### 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.

SR	SY	SP	EP	WP	WY	WR
-68.9	+25.7	-74.1	-83.2	+4.0	+32.0	-170.5

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)

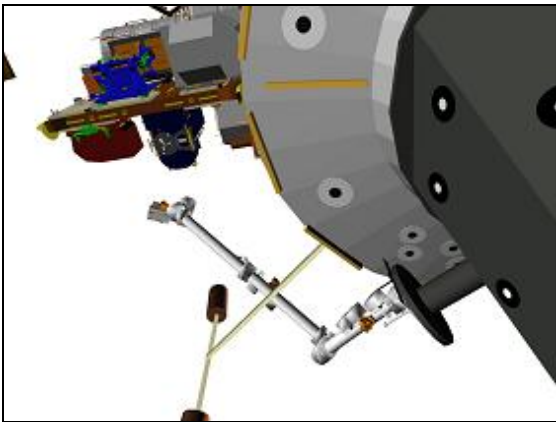


Figure 22.- Overnight Park  
(91: Camera D: -10, +60).

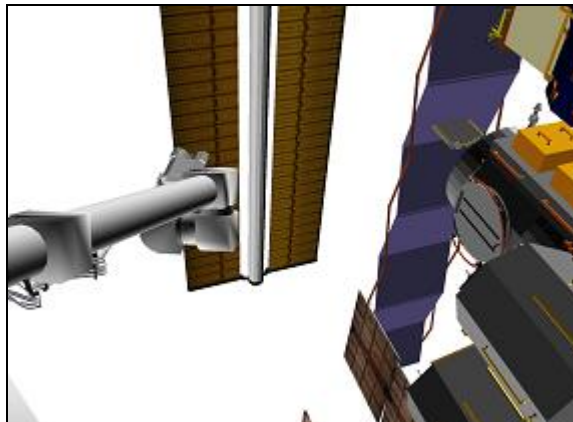


Figure 23.- Overnight Park  
(22: Base Elbow: -110, -10).

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## 1.235 MT PRE-TRANSLATION SURVEY - WS 4 TO WS 7 (GROUND)

(RBT FS/13A.1/FIN 1)

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Configure the ISS Downlink per the following table:

1	2
LAB Stbd Zenith (+150, -40) FL = 30 mm	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).

SR	SY	SP	EP	WP	WY	WR
-68.9	+25.7	-74.1	-83.2	+4.0	+32.0	-170.5

### 1. LAB STBD ZENITH CAMERA SURVEY

Coordinate with CATO to pan, tilt and zoom the LAB Stbd Zenith Camera as follows:

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

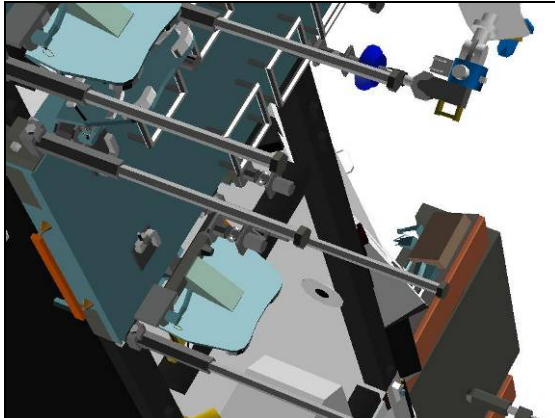


Figure 1.- LAB Stbd Zenith Start  
(LAB Stbd Zenith: +150, -40).

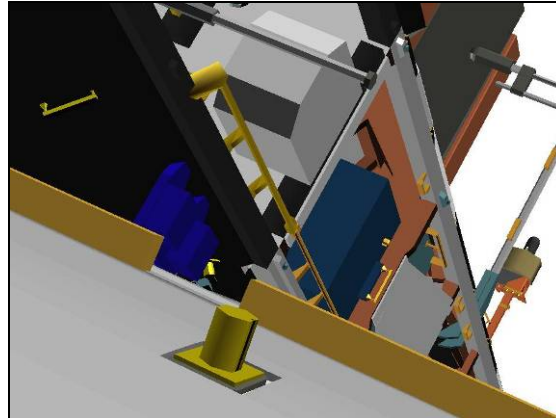


Figure 2.- LAB Stbd Zenith - Step 1  
(LAB Stbd Zenith: +150, -50).

# 1.235 MT PRE-TRANSLATION SURVEY - WS 4 TO WS 7 (GROUND)

(RBT FS/13A.1/FIN 1)

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## 2. CAMERA A SURVEY

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

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

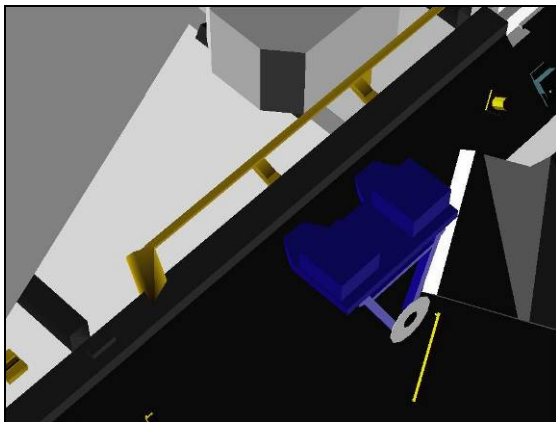


Figure 3.- Camera A Start  
(Camera A: -46, +122).

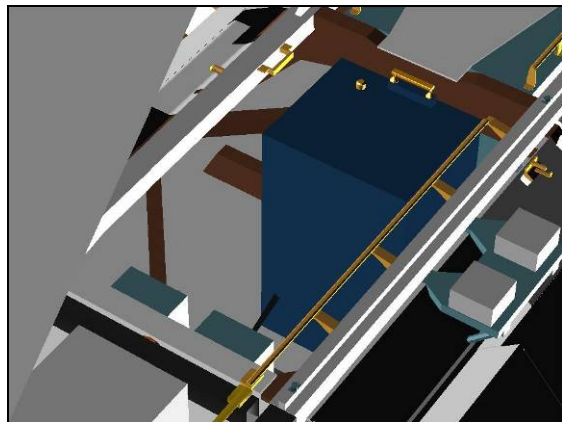


Figure 4.- Camera A - Step 2  
(Camera A: -56, +134).

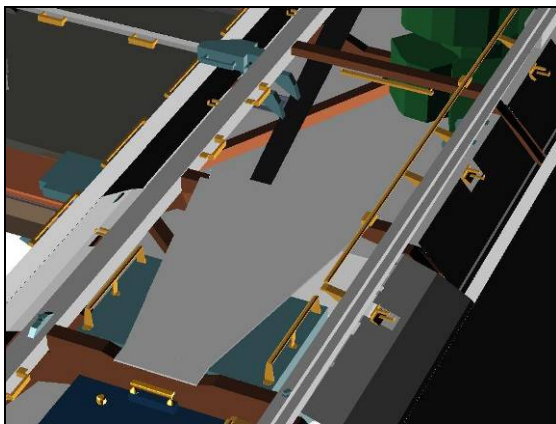


Figure 5.- Camera A - Step 4  
(Camera A: -66, +143).

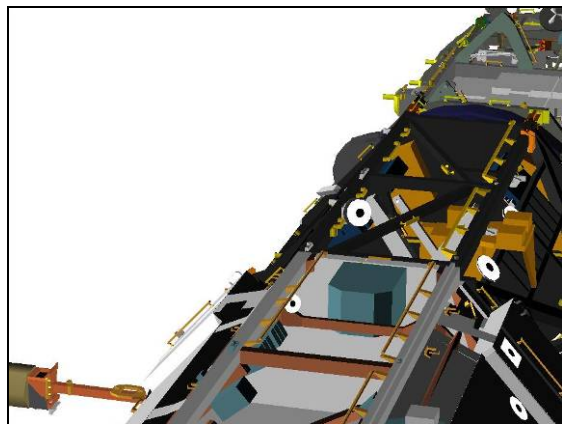


Figure 6.- Camera A - Step 6  
(Camera A: -75, +160).

# 1.235 MT PRE-TRANSLATION SURVEY - WS 4 TO WS 7 (GROUND)

(RBT FS/13A.1/FIN 1)

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## 3. CAMERA B SURVEY

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

	Camera B	Stop at	Survey Notes	Complete
Start Config	<b>(-5, +19)</b> FL = 50 mm		MT Translation Path	
1: Pan Lt	<b>(-30, +19)</b>		MT Translation Path	
2: Tilt Dn	<b>(-30, +14)</b>		MT Translation Path	
3: Pan Lt	<b>(-40, +14)</b>		MT Translation Path	

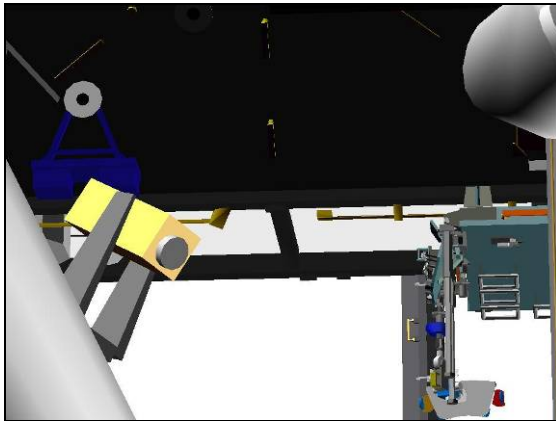


Figure 7.- Camera B Start  
(Camera B: -5, +19).

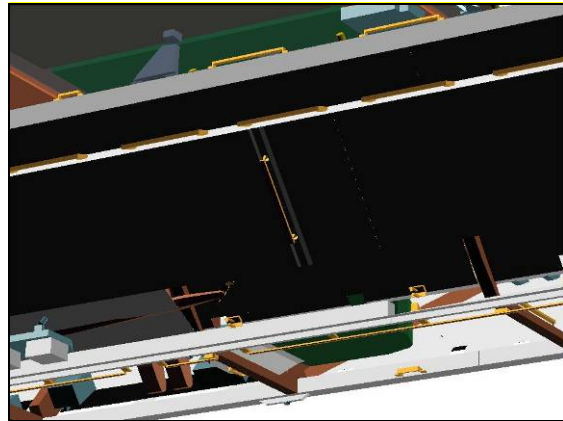


Figure 8.- Camera B - Step 1  
(Camera B: -30, +19).



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

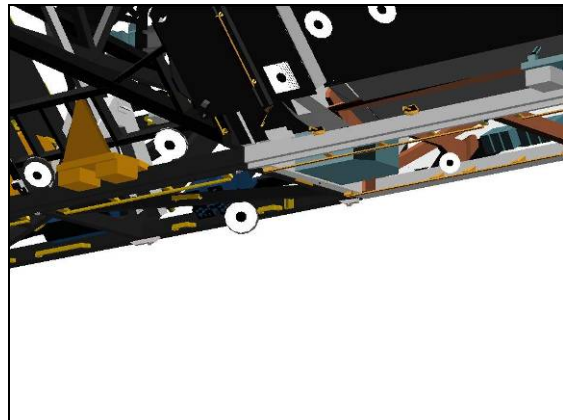


Figure 10.- Camera B - Step 3  
(Camera B: -40, +14).

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### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

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#### 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+95, +15) (09: P1 Lower Outboard (+90, +15))	24: Tip Elbow (-5, 0)	22: Base Elbow (-110, -20)	Camera C (+10, +30)

PCS

MSS: SSRMS:

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).

SR	SY	SP	EP	WP	WY	WR
-68.9	+25.7	-74.1	-83.2	+4.0	+32.0	-170.5
X	Y	Z	Pitch	Yaw	Roll	
-351	+797	+1015	+89.9	+61.8	-88.5	
FOR	Unloaded - LEE Tip, SY Held					
Disp	ISS>ISSACS					

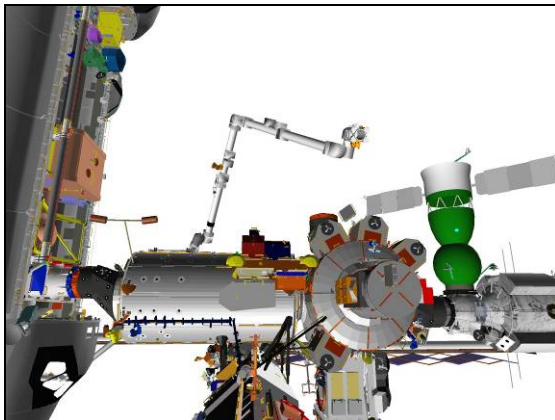


Figure 1.- Overnight Park  
(03: S1 Lower Outboard: +95, +15).

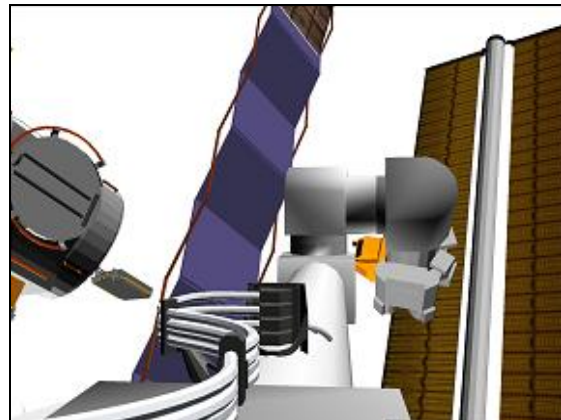


Figure 2.- Overnight Park  
(24: Tip Elbow: -5, 0).

#### 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)

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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.

SR	SY	SP	EP	WP	WY	WR
-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-68.9	+25.7	-74.1	-83.2	+4.0	+32.0	-170.5
<b>TGT</b>	<b>-69.2</b>	<b>+25.7</b>	<b>-81.9</b>	<b>-80.0</b>	<b>-10.6</b>	<b>-65.4</b>	<b>-14.8</b>
<b>ERR</b>	+0.3	0.0	+7.8	-3.2	+14.6	+97.4	-155.7

\*\*\*\*\*

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 1 minute to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

Verify SSRMS at Airlock Approach position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8
X	Y	Z	Pitch	Yaw	Roll	
-522	+684	+932	+170.0	-14.8	+29.7	
FOR	Unloaded - LEE Tip, SY Held					
Disp	ISS>ISSACS					

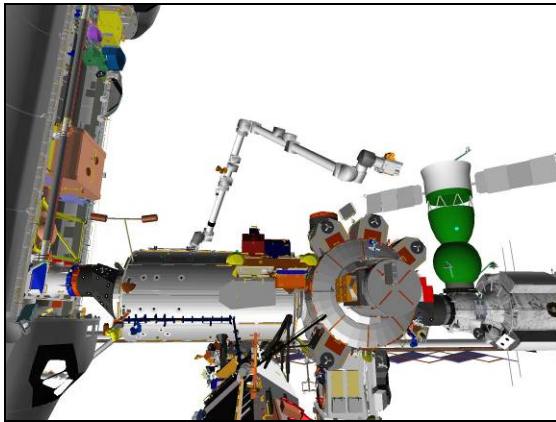


Figure 3.- Airlock Approach  
(03: S1 Lower Outboard: +95, +15).

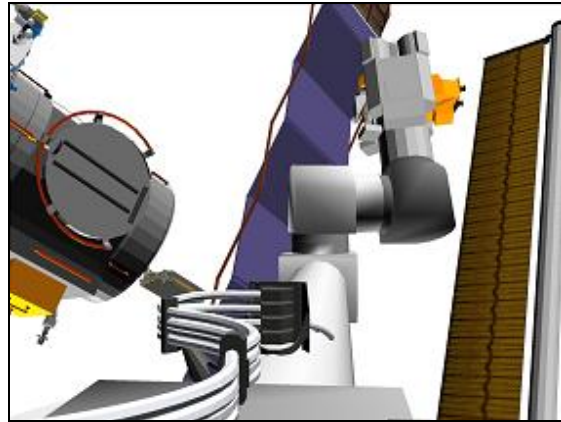


Figure 4.- Airlock Approach  
(24: Tip Elbow: -5, 0).

### 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:

Enter Mode – Single (Verify blue)

<b>WARNING</b>
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).

Airlock Approach  
1: EP –  
APFR Install  
and Ingress

SR	SY	SP	EP	WP	WY	WR
-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8
			-95.3			
-69.2	+25.7	-81.9	-95.3	-10.6	-65.4	-14.8
X	Y	Z	Pitch	Yaw	Roll	
-472	+558	+775	+165.8	-19.7	+42.3	
FOR	Unloaded - LEE Tip, SY Held					
Disp	ISS>ISSACS					

### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

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PCS

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: 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:

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)

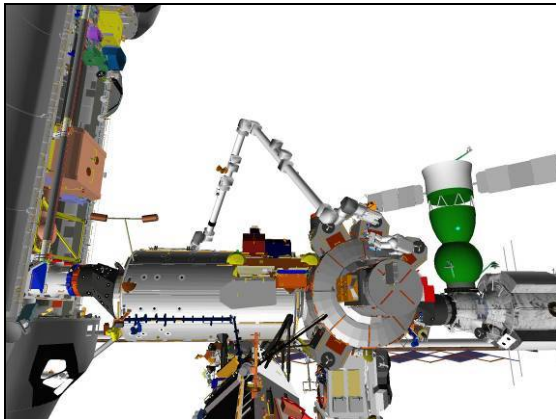


Figure 5.- APFR Install and Ingress  
(03: S1 Lower Outboard: +95, +15).

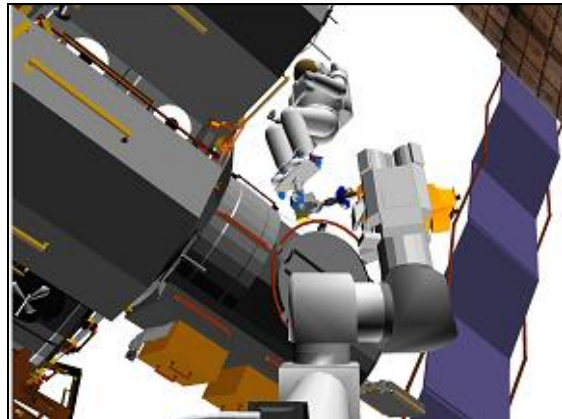


Figure 6.- APFR Install and Ingress  
(24: Tip Elbow: -5, +10).

#### 4. [AIRLOCK APPROACH MANEUVER](#)

On EV GO, APFR ingressed, ready to maneuver clear:

MSS: SSRMS:

Enter Mode – Single (Verify blue)



**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

<b>WARNING</b>
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).

	SR	SY	SP	EP	WP	WY	WR	
APFR Install and Ingress	-69.2	+25.7	-81.9	-95.3	-10.6	-65.4	-14.8	
1: EP +				-80.0				
Airlock Approach	-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8	
	X	Y	Z	Pitch	Yaw	Roll		
	-655	+625	+823	+40.7	-67.4	-41.6		
	FOR	Unloaded - Chest 12/PP/F/4, SY Held						
	Disp	ISS>ISSACS						

\*\*\*\*\*

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

PCS

\* MSS: SSRMS:

\* Change Command ► ISS ► ISSACS (Verify ISS>ISSACS)

\* MSS: SSRMS:

\* Enter Mode – Manual (Verify blue)

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

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

THC/  
RHC

\* Maneuver to Airlock Approach position per above FOR table.

PCS

\* MSS: SSRMS:

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

\*\*\*\*\*

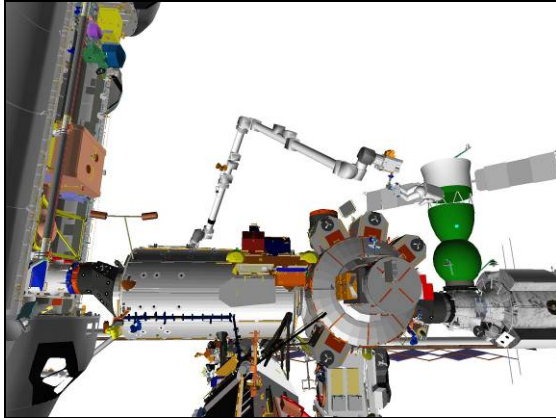


Figure 7.- Airlock Approach  
(03: S1 Lower Outboard: +95, +15).

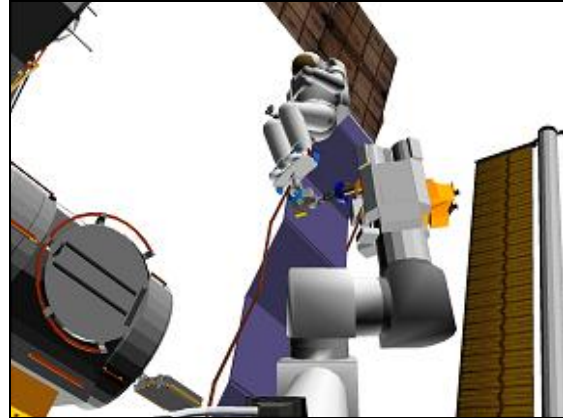


Figure 8.- Airlock Approach  
(24: Tip Elbow: -5, +10).

5. MANEUVER TO PAYLOAD BAY

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+95, +15) 09: P1 Lower Outboard (+90, +15)	24: Tip Elbow (-5, +10) 22: Base Elbow (-115, -20)	91: SRMS Elbow (-145, +5)	Camera C (+10, +30)

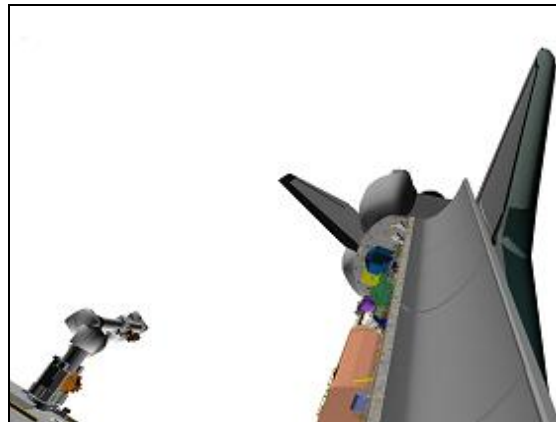


Figure 9.- Airlock Approach  
(91: SRMS Elbow: -145, +5).

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

RHC

RATE → COARSE (Verify Coarse on PCS)

PCS

pick File ► LAB ► Payload Bay Access

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

Verify 'Joint Angles' 'Destination' for Payload Bay Access position.

SR	SY	SP	EP	WP	WY	WR
+21.4	+42.7	-32.4	+102.6	-47.2	+26.8	+119.5

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8
<b>TGT</b>	<b>+21.4</b>	<b>+42.7</b>	<b>-32.4</b>	<b>+102.6</b>	<b>-47.2</b>	<b>+26.8</b>	<b>+119.5</b>
<b>ERR</b>	-90.6	-17.0	-49.5	-182.6	+36.6	-92.2	-134.3

\*\*\*\*\*

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)

<u>NOTE</u>	
1. Expect singularity warning for EP between -15 and +15 deg.	
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).

SR	SY	SP	EP	WP	WY	WR
+21.4	+42.7	-32.4	+102.6	-47.2	+26.8	+119.5
X	Y	Z	Pitch	Yaw	Roll	
+500	-151	+1935	0.0	0.0	+145.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

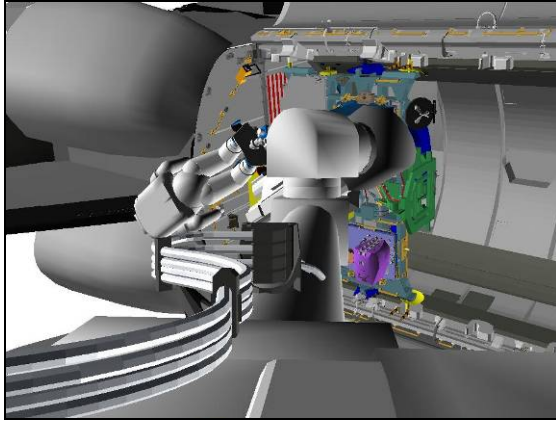


Figure 10.- Payload Bay Access  
(24: Tip Elbow: -5, -5).

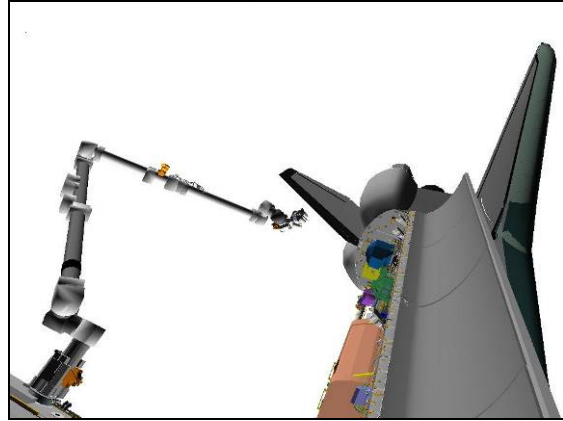


Figure 11.- Payload Bay Access  
(91: SRMS Elbow: -145, +5).

6. CMG/FRAM REMOVAL FROM ESP3

Configure Cameras and overlays as required.

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

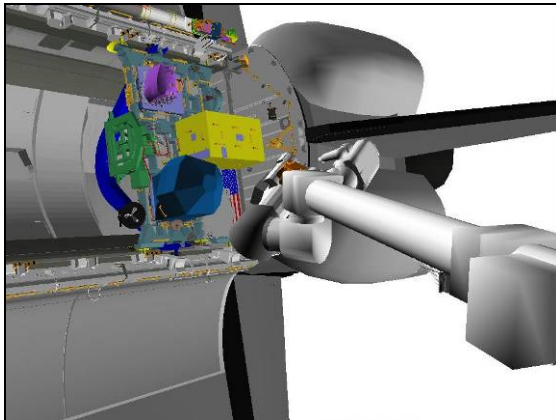


Figure 12.- Payload Bay Access  
(22: Base Elbow: +95, -10).

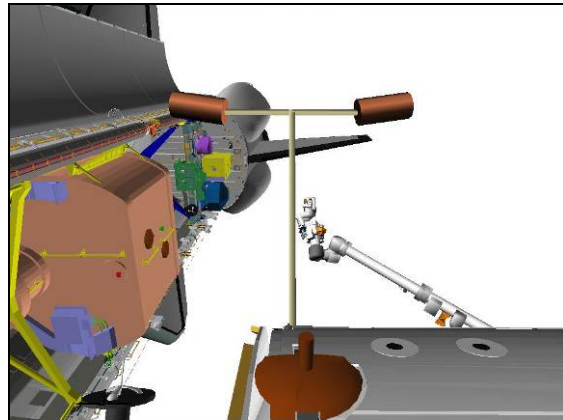


Figure 13.- Payload Bay Access  
(13: LAB Stbd Zenith: 0, -40).

On EV GO, ready for maneuver to CMG:

RHC            RATE → VERNIER (Verify Vernier on PCS)

PCS            MSS: SSRMS:

Enter Mode – Manual (Verify blue)

### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

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

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

THC/  
RHC

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
+9.7	+42.7	-18.4	+96.0	-67.0	+29.3	+128.8
X	Y	Z	Pitch	Yaw	Roll	
+785	-151	+1935	0.0	0.0	+145.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

Perform EVA GCA as required for CMG/FRAM removal.

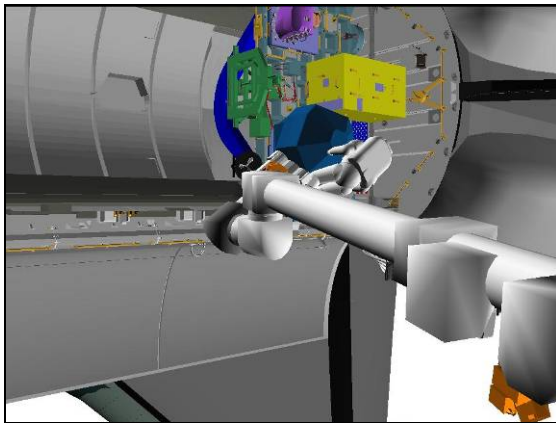


Figure 14.- ESP-3 CMG/FRAM Removal  
(22: Base Elbow: +105, -10).

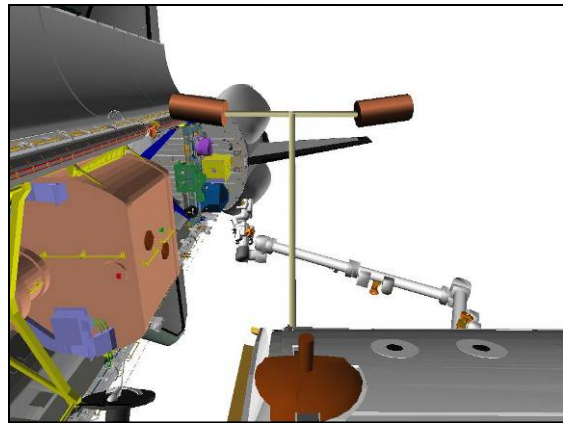


Figure 15.- ESP-3 CMG/FRAM Removal  
(13: LAB Stbd Zenith: 0, -40).

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

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
+21.4	+42.7	-32.4	+102.6	-47.2	+26.8	+119.5
X	Y	Z	Pitch	Yaw	Roll	
+500	-151	+1935	0.0	0.0	+145.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

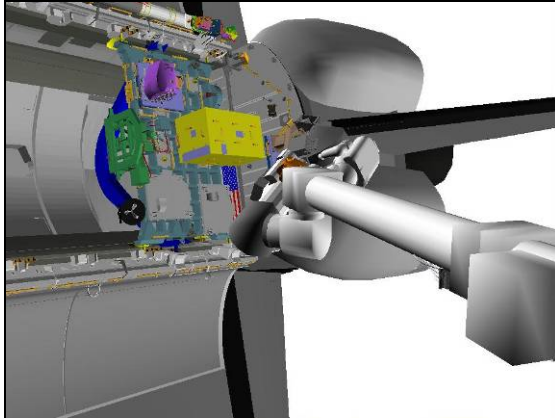


Figure 16.- Payload Bay Access  
(22: Base Elbow: +95, -10).

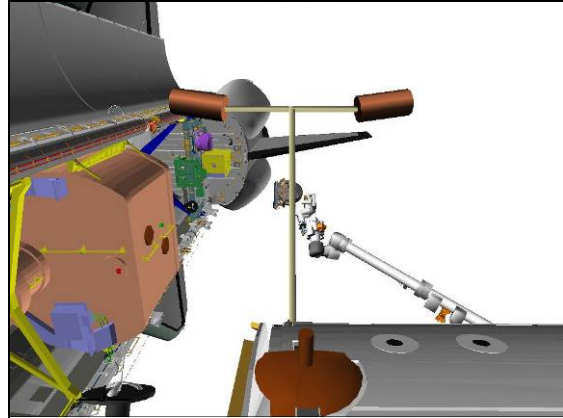


Figure 17.- Payload Bay Access  
(13: LAB Stbd Zenith: 0, -40).

7. ESP2 MANEUVER WITH NEW CMG

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+95, +15)	24: Tip Elbow (-5, 0)	92: Camera B (+15, +35)	SRMS Elbow (-145, +5)

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► LAB ► ESP2 Clearance

Verify 'Joint Angles' 'Destination' for ESP2 Clearance position.

SR	SY	SP	EP	WP	WY	WR
-85.8	+14.4	-84.0	-66.0	-156.1	-12.1	+146.0

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+21.4	+42.7	-32.4	+102.6	-47.2	+26.8	+119.5
<b>TGT</b>	<b>-85.8</b>	<b>+14.4</b>	<b>-84.0</b>	<b>-66.0</b>	<b>-156.1</b>	<b>-12.1</b>	<b>+146.0</b>
<b>ERR</b>	+107.2	+28.3	+51.6	+168.6	+108.9	+38.9	-26.5

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

\*\*\*\*\*  
 \* 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

1. Expect singularity warning for EP between +15 and -15 deg.
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).

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

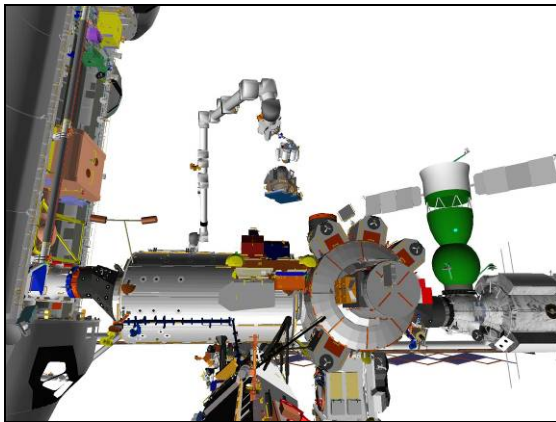


Figure 18.- ESP2 Clearance  
 (03: S1 Lower Outboard: +95, +15).

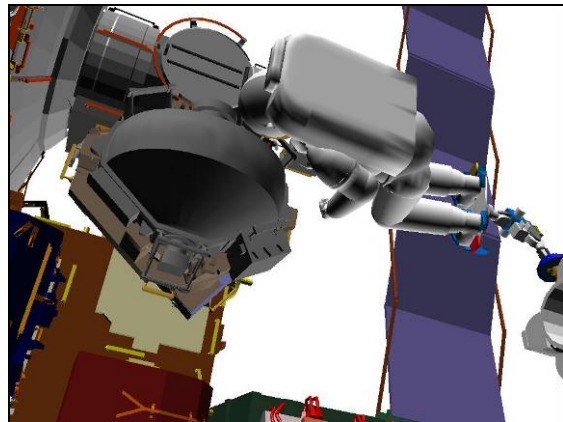


Figure 19.- ESP2 Clearance  
 (24: Tip Elbow: -45, +15).

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

**8. CMG/FRAM INSTALL**

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+95, +15)	24: Tip Elbow (-45, +15)	22: Base Elbow (-110, -20) (92: Camera C (+10, +30))	SRMS Elbow (-145, +5)

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

THC/  
RHC

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
-86.7	+14.4	-87.9	-68.5	-149.9	-11.4	+146.5
X	Y	Z	Pitch	Yaw	Roll	
-110	+650	+860	+90.0	+0.1	-90.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

Perform EVA GCA as required for CMG/FRAM install.

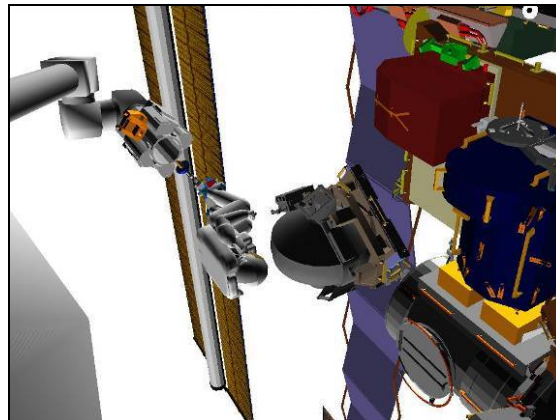


Figure 20.- ESP2 CMG/FRAM Install  
(22: Base Elbow: -110, -20).



**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

**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).

	Locked					
SR	SY	SP	EP	WP	WY	WR
-85.8	+14.4	-84.0	-66.0	-156.0	-12.1	+146.0
X	Y	Z	Pitch	Yaw	Roll	
-110	+650	+960	+90.0	+0.1	-90.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

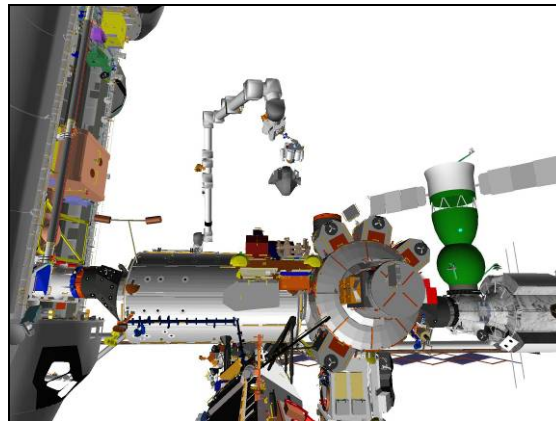


Figure 21.- ESP2 Clearance  
(03: S1 Lower Outboard: +95, +15).

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► LAB ► Z1 Intermediate 1

Verify 'Joint Angles' 'Destination' for Z1 Intermediate1 position.

SR	SY	SP	EP	WP	WY	WR
-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-85.8	+14.4	-84.0	-66.0	-156.0	-12.1	+146.0
TGT	<b>-15.0</b>	<b>+20.0</b>	<b>+20.0</b>	<b>-110.0</b>	<b>+20.0</b>	<b>-10.0</b>	<b>+30.0</b>
ERR	-70.8	-5.6	-104.0	+44.0	-176.0	-2.1	+116.0

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

\*\*\*\*\*

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 5 minutes to complete in Vernier rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0

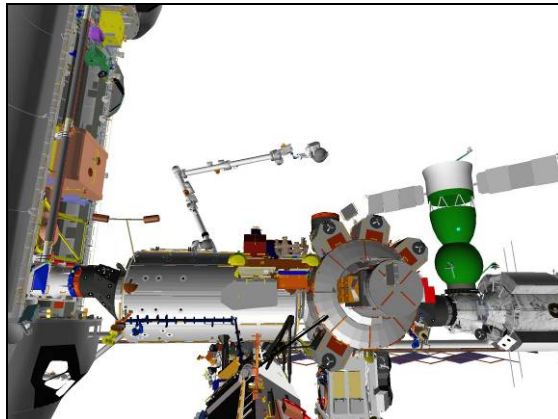


Figure 22.- Z1 Intermediate 1  
 (03: S1 Lower Outboard: +95, +15).

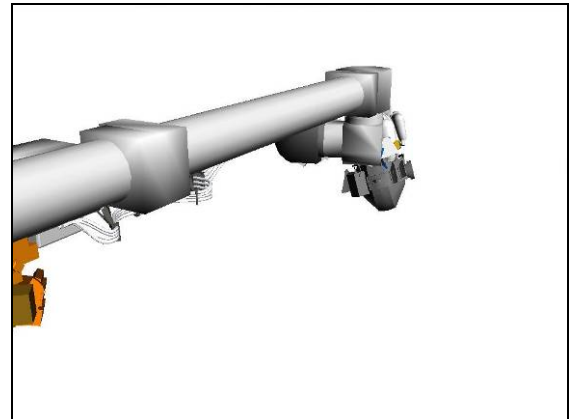


Figure 23.- Z1 Intermediate 1  
 (22: Base Elbow: -100, -20).

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

9.2 Second Z1 Intermediate Maneuver  
Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
09: P1 Lower Outboard (+75, +15) 37: MBS Mast (+145, -5)	22: Base Elbow (-100, -10) (24: Tip Elbow (0, 0))	91: Camera B (-10, 40) 92: Camera A (0, +40)	SRMS Elbow (+170, +10)

**SSRMS Joint OCAS**

pick File ► LAB ► Z1 Intermediate 2

Verify 'Joint Angles' 'Destination' for Z1 Intermediate 2 position.

SR	SY	SP	EP	WP	WY	WR
+32.6	-24.5	-55.0	-61.5	-48.1	+27.9	-17.3

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0
<b>TGT</b>	<b>+32.6</b>	<b>-24.5</b>	<b>-55.0</b>	<b>-61.5</b>	<b>-48.1</b>	<b>+27.9</b>	<b>-17.3</b>
<b>ERR</b>	-47.6	+44.5	+75.0	-48.5	+68.1	-37.9	+47.3

\*\*\*\*\*

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

\*\*\*\*\*

PCS

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

<b>NOTE</b>
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

### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+32.6	-24.5	-55.0	-61.5	-48.1	+27.9	-17.3

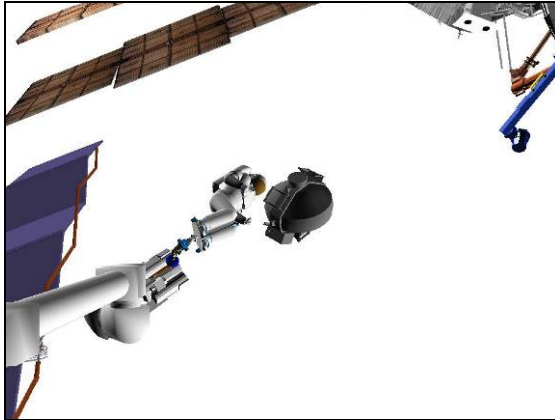


Figure 24.- Z1 Intermediate 2  
(22: Base Elbow: -120, 0).

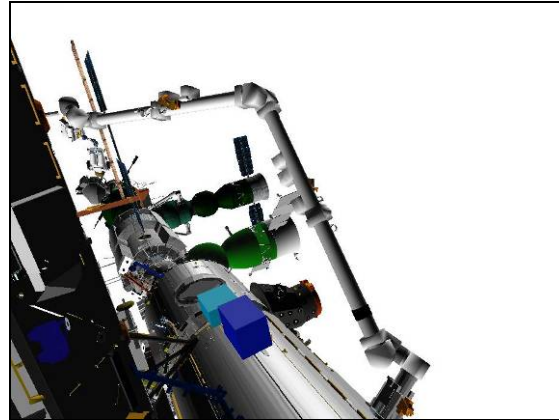


Figure 25.- Z1 Intermediate 2  
(V10: SRMS Elbow: +170, +10).

#### 9.3 Z1 Access Maneuver

MSS: SSRMS:

Enter Mode – Single (Verify blue)

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

<u>NOTE</u>
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).

Z1 Interm 2  
1: SP –  
Z1 Access

SR	SY	SP	EP	WP	WY	WR
+32.6	-24.5	-55.0	-61.5	-48.1	+27.9	-17.3
		-83.1				
+32.6	-24.5	-83.1	-61.5	-48.1	+27.9	-17.3
X	Y	Z	Pitch	Yaw	Roll	
-776	-100	+56	+0.1	+15.0	+90.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

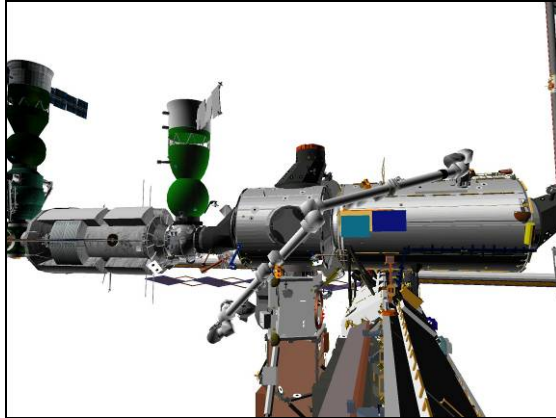


Figure 26.- Z1 Access  
(09: P1 Lower Outboard: +75, +5).

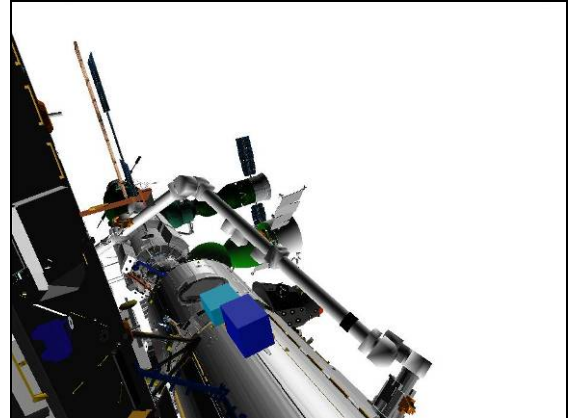


Figure 27.- Z1 Access  
(V10: SRMS Elbow: +170, +10).

10. CMG HANDOFF

On EV GO, ready to maneuver to CMG Handoff:

PCS

MSS: SSRMS:

Change Command ► ISS ► ISSACS/Internal  
Verify ISS>ISSACS/Internal

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).

	Locked						
SR	SY	SP	EP	WP	WY	WR	
+31.1	-24.5	-85.7	-62.3	-43.4	+28.2	-18.8	
X	Y	Z	Pitch	Yaw	Roll		
-776	-20	+56	+0.1	+15.0	+90.0		
FOR	Unloaded - Chest 12/PP/F/4, SY Held						
Disp	ISS>ISSACS						

Perform EVA GCA as required for CMG handoff.

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

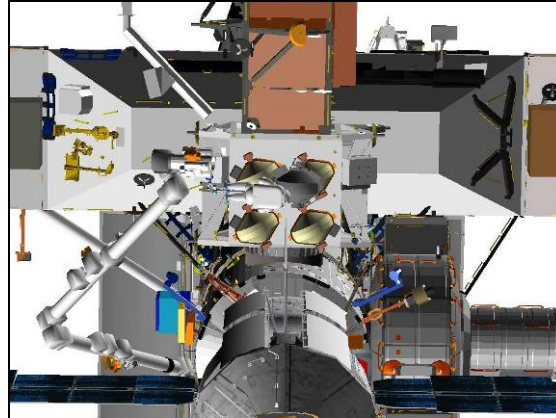


Figure 28.- CMG Handoff  
(ISS Aft).

On EV GO, CMG handed off, ready for APFR egress:

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

		Locked						
	SR	SY	SP	EP	WP	WY	WR	
	+31.1	-24.5	-85.7	-62.3	-43.4	+28.2	-18.8	
	X	Y	Z	Pitch	Yaw	Roll		
CMG Handoff	-776	-20	+56	+0.1	+15.0	+90.0		
1: Y -		-175						
2: X +	-645							
APFR Egress	-645	-175	+56	+0.1	+15.0	+90.0		
	SR	SY	SP	EP	WP	WY	WR	
	+37.4	-24.5	-75.5	-74.7	-46.7	+26.8	+12.5	
	FOR	Unloaded - Chest 12/PP/F/4, SY Held						
	Disp	ISS>ISSACS						

Perform EVA GCA as required for APFR egress.

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

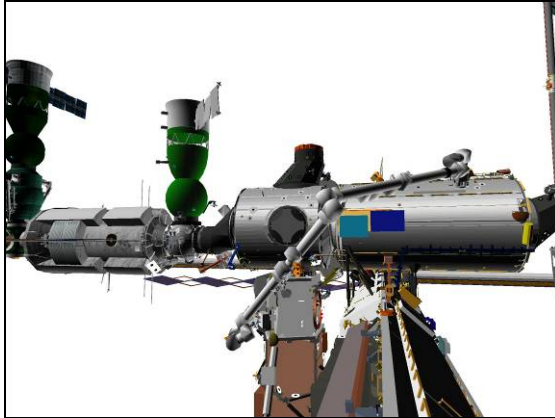


Figure 29.- APFR Egress  
(09: P1 Lower Outboard: +75, +5).

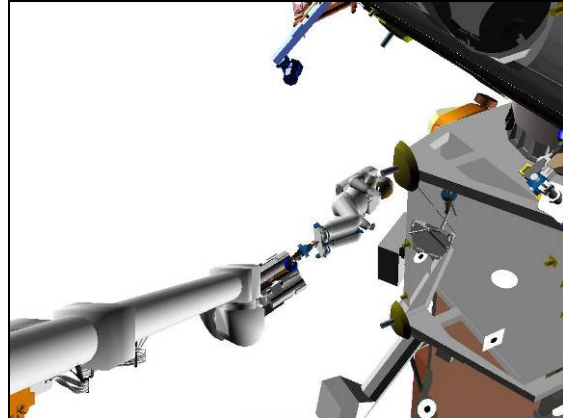


Figure 30.- APFR Egress  
(22: Base Elbow: -120, 0).

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).

		Locked							
		SR	SY	SP	EP	WP	WY	WR	
		+37.4	-24.5	-75.5	-74.7	-46.7	+26.8	+12.5	
		X	Y	Z	Pitch	Yaw	Roll		
APFR Egress		-645	-175	+56	+0.1	+15.0	+90.0		
1: X	-	-776							
2: Y	+		-20						
CMG Handoff		-776	-20	+56	+0.1	+15.0	+90.0		
		SR	SY	SP	EP	WP	WY	WR	
		+31.2	-24.5	-85.7	-62.2	-43.4	+28.2	-18.8	
		FOR	Unloaded - Chest 12/PP/F/4, SY Held						
		Disp	ISS>ISSACS						

### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

On EV GO, failed CMG received, ready to maneuver to ESP2:

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

Locked						
SR	SY	SP	EP	WP	WY	WR
+32.6	-24.5	-83.1	-61.4	-48.1	+27.9	-17.3
X	Y	Z	Pitch	Yaw	Roll	
-776	-100	+56	0.1	+15.0	+90.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

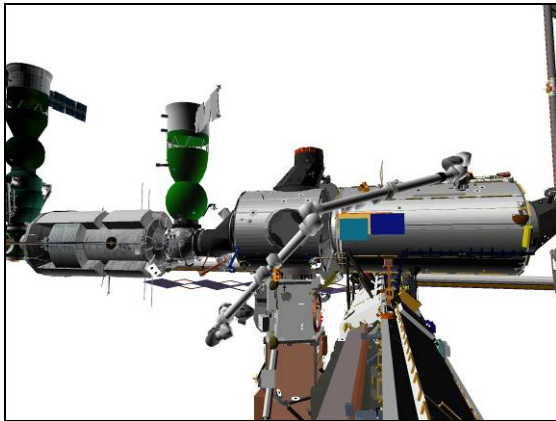


Figure 31.- Z1 Access  
(09: P1 Lower Outboard: +75, +5).

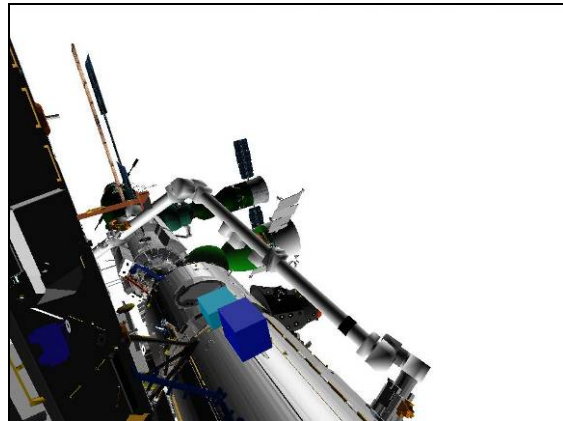


Figure 32.- Z1 Access  
(V10: SRMS Elbow: +170, +10).

## 11. ESP2 MANEUVER WITH FAILED CMG

### 11.1 Z1 Intermediate 2 Maneuver

PCS

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 Z1 Intermediate 2 position (within 1 deg).

Z1 Access  
1: SP +  
Z1 Intern 2

SR	SY	SP	EP	WP	WY	WR
+32.6	-24.5	-83.1	-61.4	-48.1	+27.9	-17.3
		-55.0				
+32.6	-24.5	-55.0	-61.4	-48.1	+27.9	-17.3
X	Y	Z	Pitch	Yaw	Roll	
-827	-681	+282	+18.3	+35.1	+71.1	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					



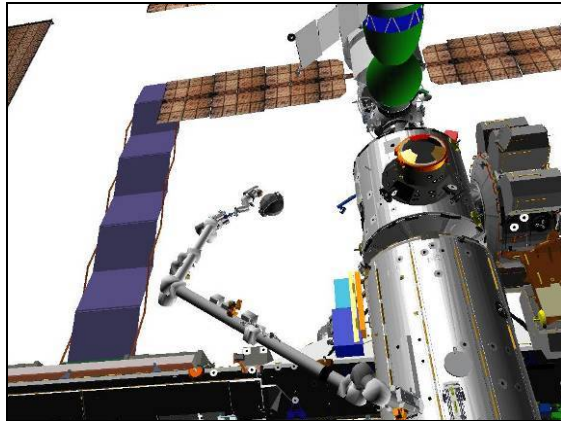


Figure 33.- Z1 Intermediate 2  
(91: Camera B: -10, +40).

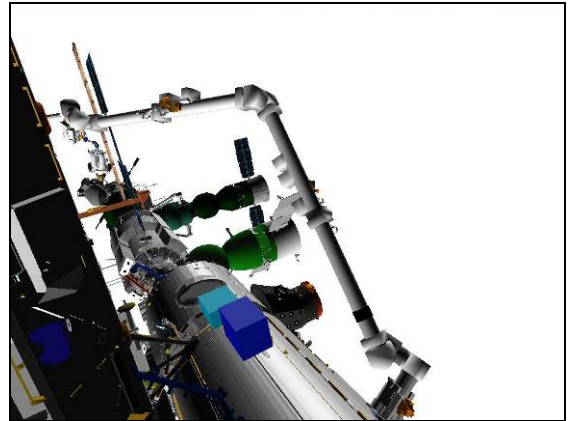


Figure 34.- Z1 Intermediate 2  
(V10: SRMS Elbow: +170, +10).

11.2 Z1 Intermediate 1 Maneuver

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► LAB ► Z1 Intermediate 1

Verify 'Joint Angles' 'Destination' for Z1 Intermediate 1 position.

SR	SY	SP	EP	WP	WY	WR
-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+32.6	-24.5	-55.0	-61.4	-48.1	+27.9	-17.3
TGT	-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0
ERR	+47.6	-44.5	-75.0	+48.6	-68.1	+37.9	-47.3

\*\*\*\*\*

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.  
 \*

\*\*\*\*\*

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

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.

SR	SY	SP	EP	WP	WY	WR
-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0

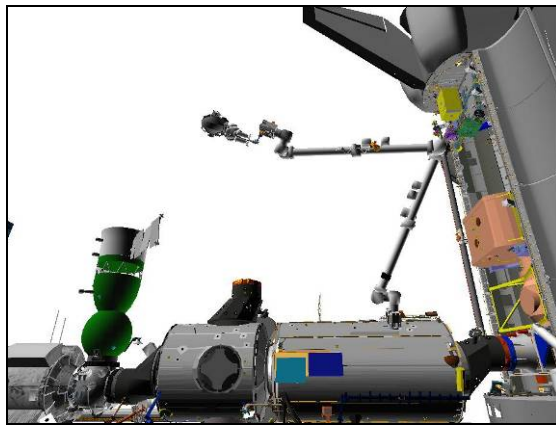


Figure 35.- Z1 Intermediate 1  
(09: P1 Lower Outboard: +85, +25).

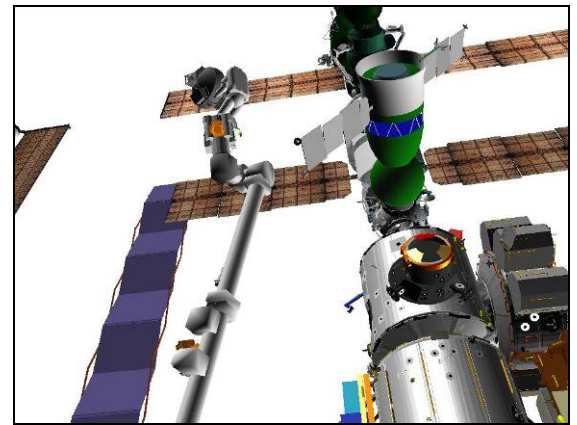


Figure 36.- Z1 Intermediate 1  
(91: Camera B: -10, +50).

**11.3 ESP2 Clearance Maneuver**

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+95, +15)	22: Base Elbow (-100, -20) 24: Tip Elbow (0, 0)	91: Camera B (-15, +35)	SRMS Elbow (-145, +5)

SSRMS Joint OCAS

pick File ► LAB ► ESP2 Clearance

Verify 'Joint Angles' 'Destination' for ESP2 Clearance position.

SR	SY	SP	EP	WP	WY	WR
-85.8	+14.4	-84.0	-66.0	-156.1	-12.1	+146.0

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

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

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

(current)	SR	SY	SP	EP	WP	WY	WR
	-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0
<b>TGT</b>	<b>-85.8</b>	<b>+14.4</b>	<b>-84.0</b>	<b>-66.0</b>	<b>-156.1</b>	<b>-12.1</b>	<b>+146.0</b>
<b>ERR</b>	<b>+70.8</b>	<b>+5.6</b>	<b>+104.0</b>	<b>-44.0</b>	<b>+176.1</b>	<b>+2.1</b>	<b>-116.0</b>

\*\*\*\*\*

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 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).

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

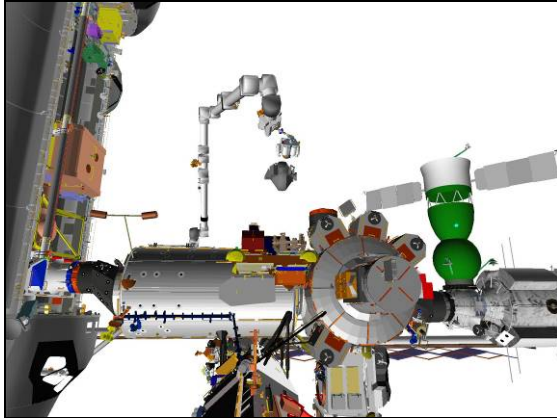


Figure 37.- ESP2 Clearance  
(03: S1 Lower Outboard: +95, +15).



Figure 38.- ESP2 Clearance  
(22: Base Elbow: -110, -20).

12. FAILED CMG INSTALL

MSS: SSRMS:

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

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

√Vernier

THC/  
RHC

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

	<input type="text" value="Locked"/>					
SR	SY	SP	EP	WP	WY	WR
-86.7	+14.4	-87.8	-68.5	-149.9	-11.4	+146.5
X	Y	Z	Pitch	Yaw	Roll	
-110	+650	+860	+90.0	+0.1	-90.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

Perform EVA GCA as required for CMG install.

### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

On EV GO, CMG installed, ready to maneuver clear of ESP2:

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
-85.8	+14.4	-84.0	-66.0	-156.0	-12.1	+146.0
X	Y	Z	Pitch	Yaw	Roll	
-110	+650	+960	+90.0	+0.1	-90.0	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

### 13. APFR EGRESS AND REMOVAL

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+95, +15)	22: Base Elbow (-110, -20)	24: Tip Elbow (-35, +15)	Camera C (+10, +30)

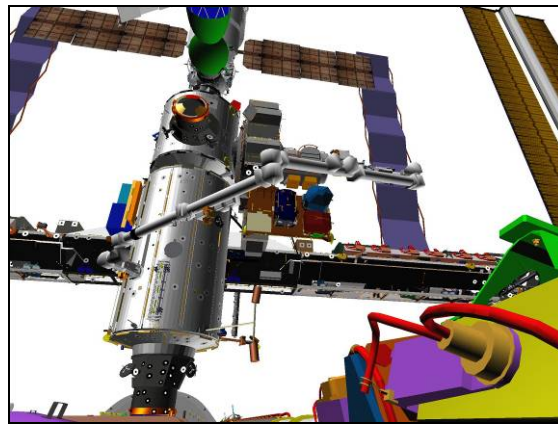


Figure 39.- ESP2 Clearance (V10: Camera C: +10, +30).

#### 13.1 Airlock Approach

RHC

RATE → COARSE (Verify Coarse on PCS)

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

Input 'Joint Angles' 'Destination' for Airlock Approach position.

SR	SY	SP	EP	WP	WY	WR
-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8

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

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-85.8	+14.4	-84.0	-66.0	-156.0	-12.1	+146.0
<b>TGT</b>	<b>-69.2</b>	<b>+25.7</b>	<b>-81.9</b>	<b>-80.0</b>	<b>-10.6</b>	<b>-65.4</b>	<b>-14.8</b>
<b>ERR</b>	-16.6	-11.3	-2.1	+14.0	-145.4	+53.3	+160.8

\*\*\*\*\*

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).

SR	SY	SP	EP	WP	WY	WR
-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8
X	Y	Z	Pitch	Yaw	Roll	
-665	+625	+823	+40.7	-67.4	-41.6	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

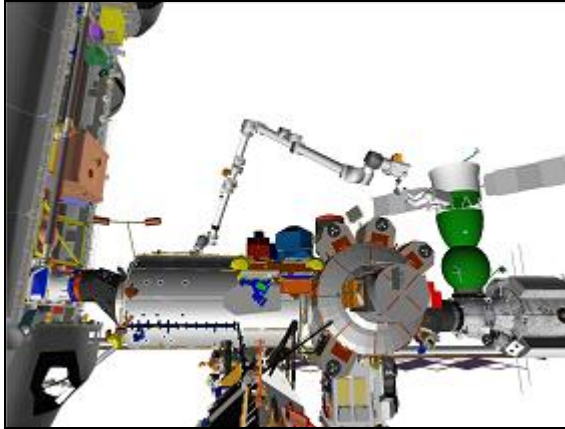


Figure 40.- Airlock Approach  
(03: S1 Lower Outboard: +95, +15).

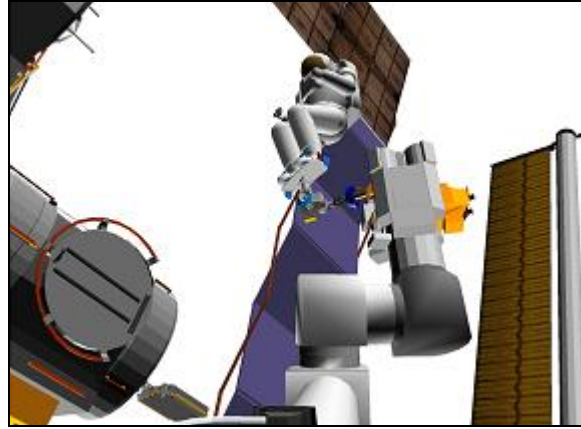


Figure 41.- Airlock Approach  
(24: Tip Elbow: -5, +10).

13.2 APFR Egress and Removal

On EV GO, ready to approach airlock:

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS:

Enter Mode – Single (Verify blue)

<b>WARNING</b>
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).

Airlock Approach  
1: EP –  
APFR Egress and  
Removal

SR	SY	SP	EP	WP	WY	WR
-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8
			-91.5			
-69.2	+25.7	-81.9	-91.5	-10.6	-65.4	-14.8
X	Y	Z	Pitch	Yaw	Roll	
-606	+511	+699	+10.2	-70.1	-67.8	
FOR	Unloaded - Chest 12/PP/F/4, SY Held					
Disp	ISS>ISSACS					

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

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MSS: SSRMS: SSRMS Manual: Joint Lock:

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

THC/  
RHC

Perform EVA GCA as required for APFR egress and removal.

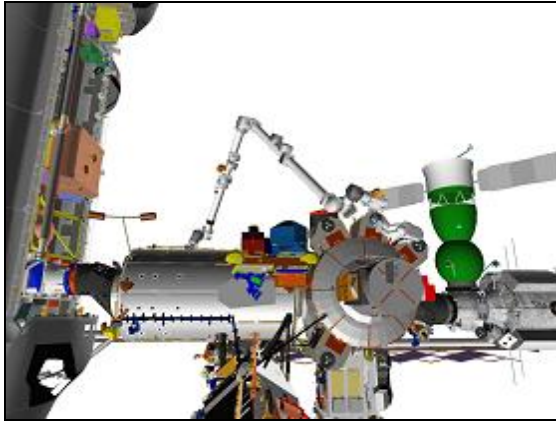


Figure 42.- APFR Egress and Removal  
(03: S1 Lower Outboard: +95, +15).

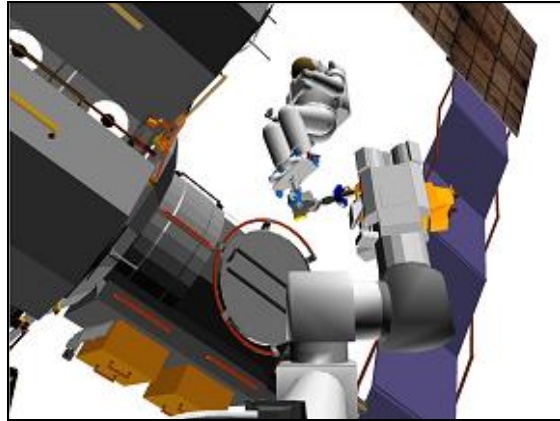


Figure 43.- APFR Egress and Removal  
(24: Tip Elbow: -5, +10).

#### 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)

THC

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

APFR Egress and Removal  
1: EP +  
Airlock Approach

SR	SY	SP	EP	WP	WY	WR
-69.2	+25.7	-81.9	-91.5	-10.6	-65.4	-14.8
			-80.0			
-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8
X	Y	Z	Pitch	Yaw	Roll	
-522	+684	+932	+170.0	-14.8	+29.7	
FOR	Unloaded - LEE Tip, SY Held					
Disp	ISS>ISSACS					

\*\*\*\*\*

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

PCS

\* MSS: SSRMS:

\* Enter Mode – Manual (Verify blue)

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

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

THC/RHC

\* Maneuver to Airlock Approach position per above FOR table.

\*\*\*\*\*

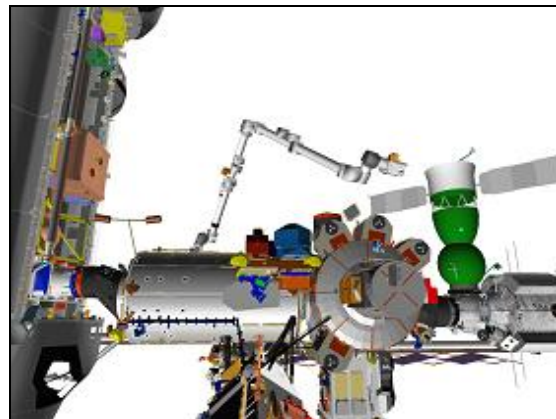


Figure 44.- Airlock Approach  
(03: S1 Lower Outboard: +95, +15).

14.2 Airlock Clearance

RHC

RATE → COARSE (Verify Coarse on PCS)

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

**1.300 SSRMS CMG R&R EVA SUPPORT**

(RBT FS/13A.1/FIN 1)

**SSRMS Joint OCAS**

pick File ► LAB ► Airlock Clearance

Verify 'Joint Angles' 'Destination' for Airlock Clearance position.

SR	SY	SP	EP	WP	WY	WR
-76.1	+25.5	-62.8	-94.2	-172.8	-118.9	+201.6

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

MON

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

(current)  
**TGT**  
**ERR**

SR	SY	SP	EP	WP	WY	WR
-69.2	+25.7	-81.9	-80.0	-10.6	-65.4	-14.8
<b>-76.1</b>	<b>+25.5</b>	<b>-62.8</b>	<b>-94.2</b>	<b>-172.8</b>	<b>-118.9</b>	<b>+201.6</b>
+6.9	+0.2	-19.1	+14.2	+162.3	+53.5	-216.4

\*\*\*\*\*

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)

<u>NOTE</u>
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).

Locked		SR	SY	SP	EP	WP	WY	WR
		-76.1	+25.5	-62.8	-94.2	-172.8	-118.9	+201.6
		X	Y	Z	Pitch	Yaw	Roll	
		-299	+580	+1076	±180.0	+0.1	+47.0	
FOR	Unloaded - LEE Tip, SY Held							
Disp	ISS>ISSACS							

### 1.300 SSRMS CMG R&R EVA SUPPORT

(RBT FS/13A.1/FIN 1)

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MSS: SSRMS:

Enter Mode – Standby (Verify blue)

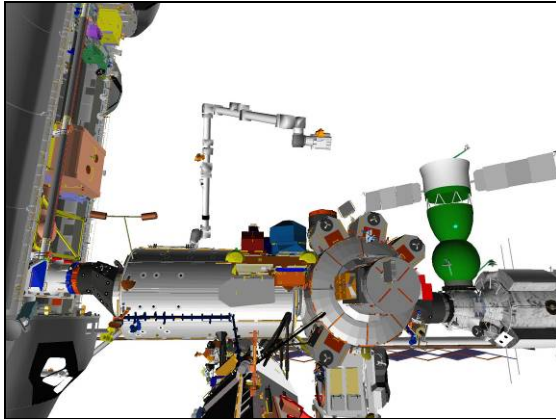


Figure 45.- Airlock Clearance  
(03: S1 Lower Outboard: +95, +15).

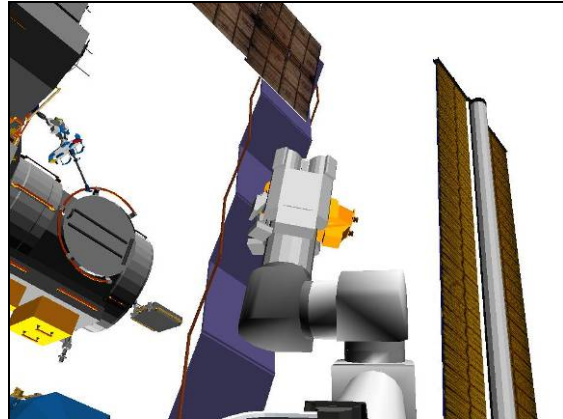


Figure 46.- Airlock Clearance  
(24: Tip Elbow: -10, +10).

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## 1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2

(RBT FS/13A.1/FIN 1)

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### 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
91: Camera C (-20, +30)	37: MBS Mast (+140, -5)	09: P1 Lower Outboard (+100, +30)

PCS

MSS: 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).

SR	SY	SP	EP	WP	WY	WR
-76.1	+25.5	-62.8	-94.2	-172.8	-118.9	+201.6
X	Y	Z	Pitch	Yaw	Roll	
-324	-2277	-955	+37.0	-9.0	-80.2	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>W7MBS PDGF 2					

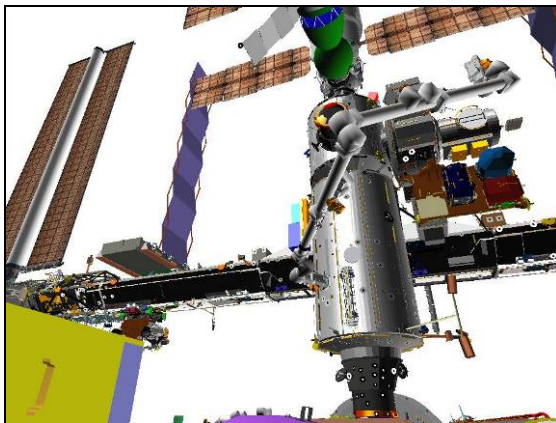


Figure 1.- Airlock Clearance  
(91: Camera C: -20, +30).

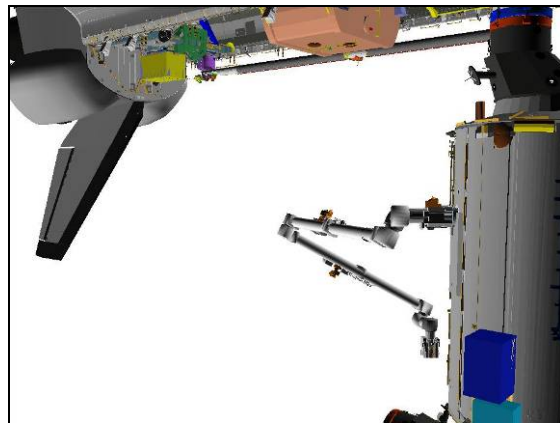


Figure 2.- Airlock Clearance  
(37: MBS Mast: +140, -5).

### 2. Z1 INTERMEDIATE POSITION 1 MANEUVER

Verify SRMS at CMG R&R Viewing position.

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

**1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2**

SSRMS Joint OCAS

pick File ► LAB ► Z1 Intermediate 1

Verify 'Joint Angles' 'Destination' for Z1 Intermediate Position 1.

SR	SY	SP	EP	WP	WY	WR
-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-76.1	+25.5	-62.8	-94.2	-172.8	-118.9	+201.6
<b>TGT</b>	<b>-15.0</b>	<b>+20.0</b>	<b>+20.0</b>	<b>-110.0</b>	<b>+20.0</b>	<b>-10.0</b>	<b>+30.0</b>
<b>ERR</b>	-61.1	+5.5	-82.8	+15.8	-192.8	-108.9	+171.6

\*\*\*\*\*

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 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).

SR	SY	SP	EP	WP	WY	WR
-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0
X	Y	Z	Pitch	Yaw	Roll	
+366	-2001	-14	+16.8	-24.8	-125.6	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>W7MBS PDGF 2					

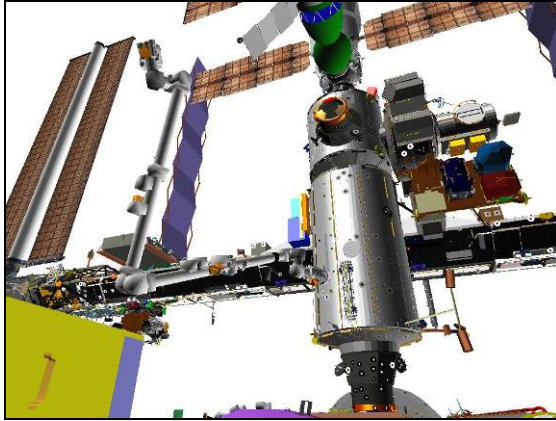


Figure 3.- Z1 Intermediate Position 1  
 (91: Camera C: -20, +30).

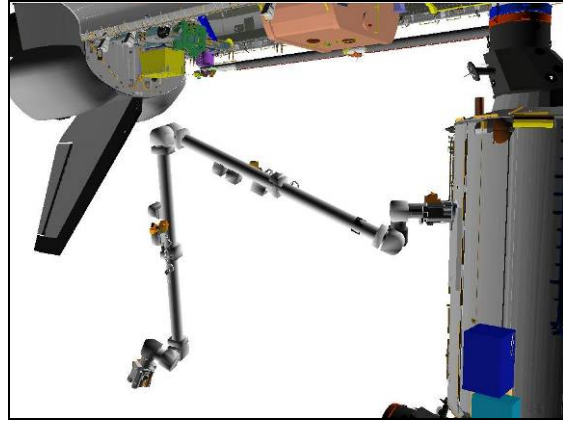


Figure 4.- Z1 Intermediate Position 1  
 (37: MBS Mast: +140, -5).

3. PDGF 2 INTERMEDIATE POSITION MANEUVER

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
92: Camera A (+50, +40)	37: MBS Mast (+135, -15)	09: P1 Lower Outboard (+100, +35)

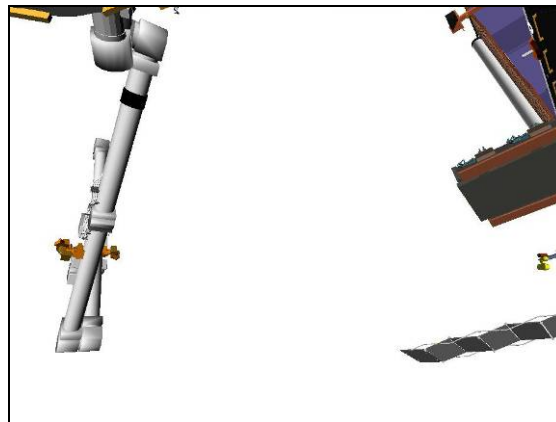


Figure 5.- Z1 Intermediate Position 1  
 (92: Camera A: +50, +40).

SSRMS Joint OCAS

pick File ► LAB ► PDGF2 Intermediate

Verify 'Joint Angles' 'Destination' for PDGF 2 Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+100.0	+3.5	+20.0	-36.2	-91.5	+129.9	-81.8

cmd Load (Verify Sequence Status – Confirm or Cancel)

**1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2**

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-15.0	+20.0	+20.0	-110.0	+20.0	-10.0	+30.0
<b>TGT</b>	<b>+100.0</b>	<b>+3.5</b>	<b>+20.0</b>	<b>-36.2</b>	<b>-91.5</b>	<b>+129.9</b>	<b>-81.8</b>
<b>ERR</b>	-115.0	+16.5	0.0	-73.8	+111.5	-139.9	+111.8

\*\*\*\*\*

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)

<u>NOTE</u>	
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).

SR	SY	SP	EP	WP	WY	WR
+100.0	+3.5	+20.0	-36.2	-91.5	+129.9	-81.8
X	Y	Z	Pitch	Yaw	Roll	
+344	-1867	+859	+35.4	-38.1	+94.5	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>W7MBS PDGF 2					



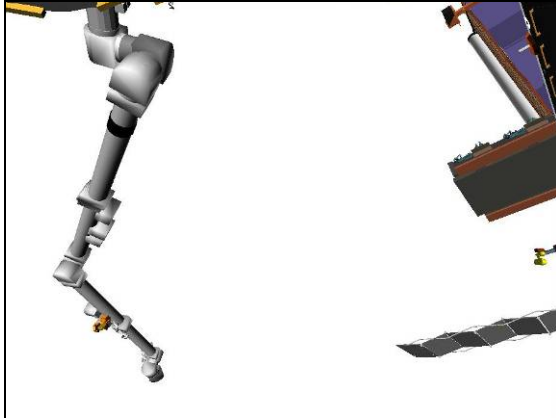


Figure 6.- PDGF 2 Intermediate  
 (92: Camera A: +50, +40).



Figure 7.- PDGF 2 Intermediate  
 (09: P1 Lower Outboard: +100, +35).

4. SINGLE JOINT TO PDGF 2 PRE-GRAPPLE  
 Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
91: Camera B (-45, +25)	22: Base Elbow (-160, -10)	09: P1 Lower Outboard (+120, +35)

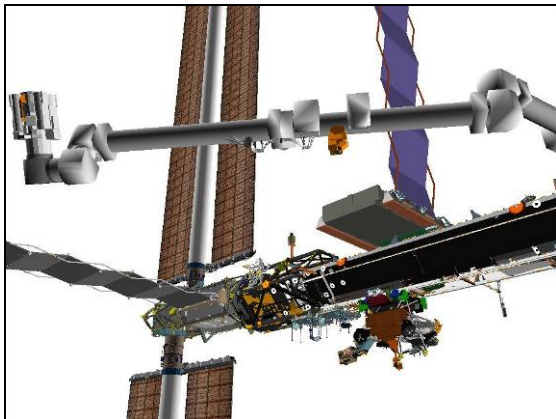


Figure 8.- PDGF 2 Intermediate  
 (91: Camera B: -45, +25).

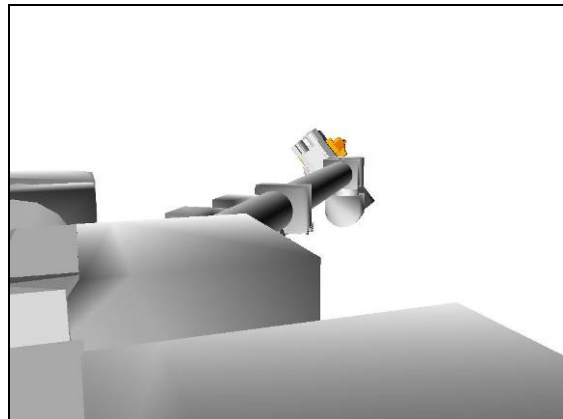


Figure 9.- PDGF 2 Intermediate  
 (22: Base Elbow: -160, -10).

RHC RATE → VERNIER (Verify Vernier on PCS)

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.

**1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2**

(RBT FS/13A.1/FIN 1)

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THC Perform Single Joint maneuver to PDGF 2 Pre-Grapple position (within 1 deg).

	SR	SY	SP	EP	WP	WY	WR
PDGF 2 Intermediate	+100.0	+3.5	+20.0	-36.2	-91.5	+129.9	-81.8
1: SP -			-73.9				
2: SR -	+92.7						
PDGF 2 Pre-Grapple	+92.7	+3.5	-73.9	-36.2	-91.5	+129.9	-81.8
	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						

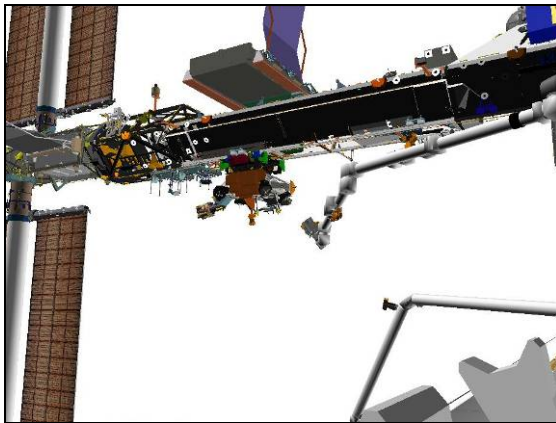


Figure 10.- PDGF 2 Pre-Grapple (91: Camera B: -30, +10).

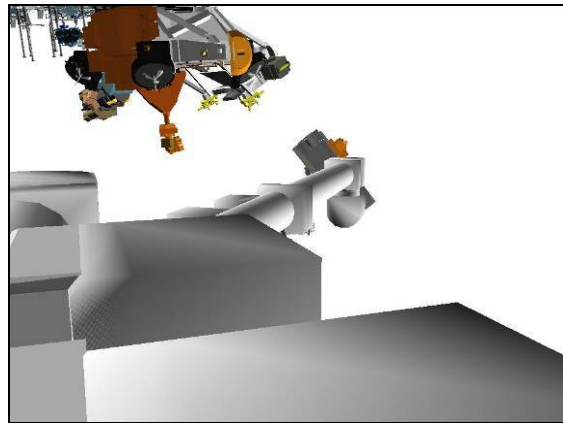


Figure 11.- PDGF 2 Pre-Grapple (22: Base Elbow: -160, -10).

**5. MBS PDGF 2 GRAPPLE**

Configure Cameras and overlays for grapple.

Monitor 1	Monitor 2	Monitor 3
91: Camera B (-30, +10)	25: Tip LEE	37: MBS Mast (-155, -10)

**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:

Set 'Scale' 'Vernier' Rate Scale: as desired

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

RHC/  
THC

Maneuver to within grapple envelope.

MSS: 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).

SR	SY	SP	EP	WP	WY	WR
+88.3	+3.5	-74.6	-27.4	-104.5	+131.7	-75.7
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – MBS PDGF 2, SR Held					
Disp	LAB>W7MBS PDGF 2					

## 1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2

(RBT FS/13A.1/FIN 1)

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### 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)

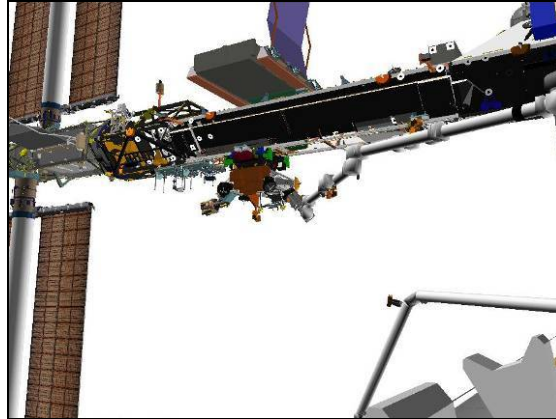


Figure 13.- MBS PDGF 2 Grapple  
(91: Camera B: -30, +10).

## 6. LAB PDGF RELEASE SETUP

On **MCC-H GO**, base change complete:

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
91: Camera B (-10, +20)	25: Tip LEE	22: Base Elbow (-150, -10) (09: P1 Lower Outboard (+110, 0))

PCS

MSS: 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

## 1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2

(RBT FS/13A.1/FIN 1)

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

SR	SY	SP	EP	WP	WY	WR
-75.7	-131.7	-104.5	-27.4	-74.6	-3.5	+88.3
X	Y	Z	Pitch	Yaw	Roll	
1	0	0	0.0	0.0	0.0	
FOR	Loaded – LAB PDGF, SR Held					
Disp	W7>LAB PDGF					

√Vernier

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: as desired

MSS: SSRMS: SSRMS Safing:

**cmd** Remove (Verify Not Safed)

DCP

BRAKES SSRMS → OFF (Verify OFF)

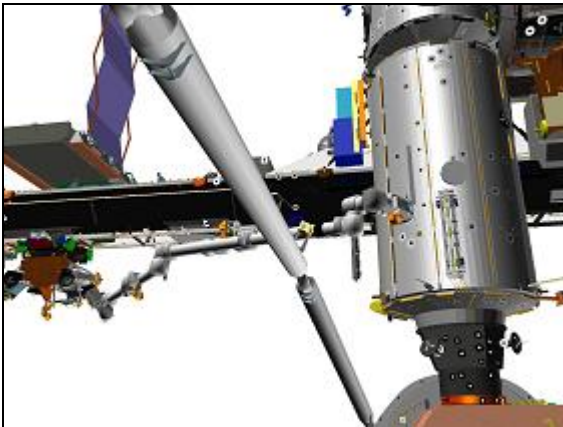


Figure 14.- LAB PDGF Grapple  
(91: Camera B: -10, +20).

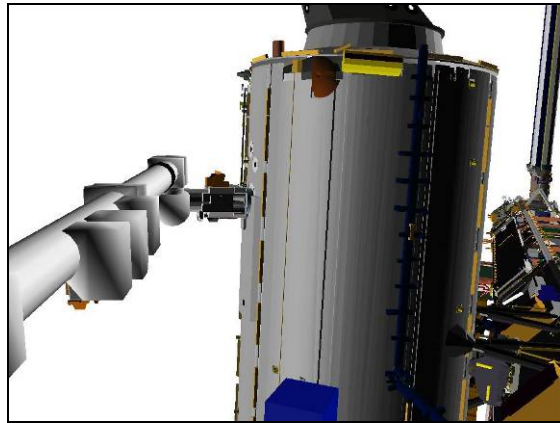


Figure 15.- LAB PDGF Grapple  
(22: Base Elbow: -150, -10).

### 7. LAB PDGF RELEASE

PCS

MSS: SSRMS: Limp:

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

Wait 30 seconds.

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

## 1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2

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MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

MSS: 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

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

**1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2**

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**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).

	Locked					
SR	SY	SP	EP	WP	WY	WR
-75.1	-131.7	-99.2	-26.4	-81.3	-3.3	+88.0
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W7>LAB PDGF					

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

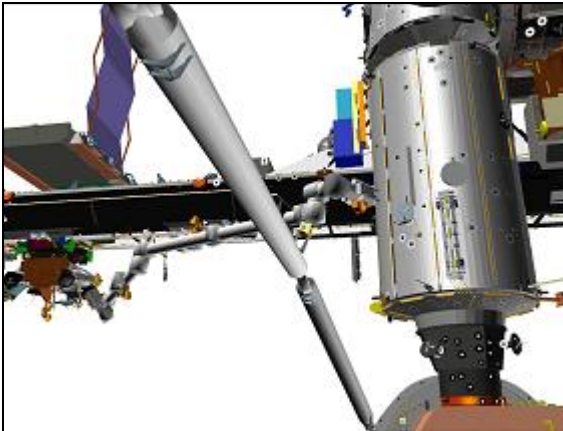


Figure 16.- LAB PDGF Pre-Grapple  
(91: Camera B: -10, +20).

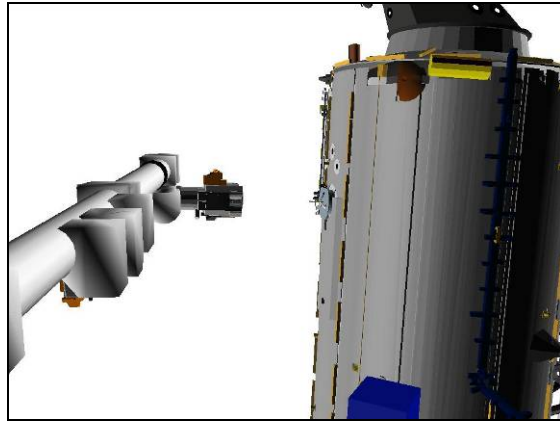


Figure 17.- LAB PDGF Pre-Grapple  
(22: Base Elbow: -150, -10).

**9. SINGLE JOINT TO ESP3 PRE-GRAPPLE INTERMEDIATE POSITION**

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (-20, +20)	37: MBS Mast (+155, 0)	09: P1 Lower Outboard (+110, 0)	Camera A (+60, +40)



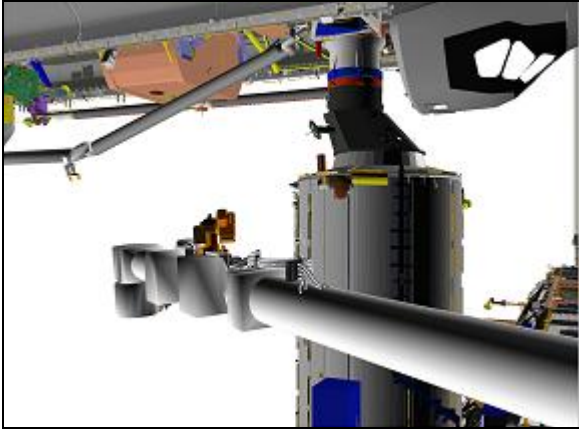


Figure 18.- LAB PDGF Pre-Grapple  
 (37: MBS Mast: +155, 0).

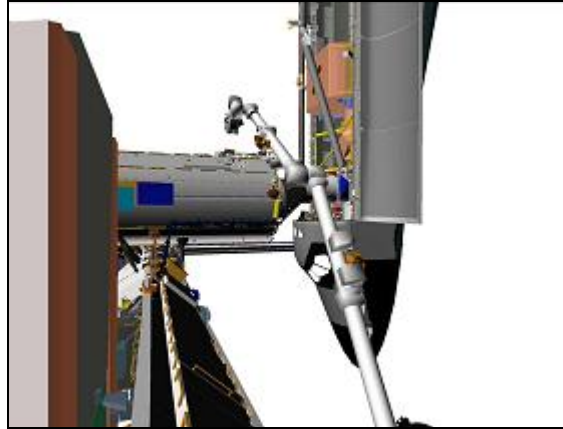


Figure 19.- LAB PDGF Pre-Grapple  
 (09: P1 Lower Outboard: +110, 0).

MSS: SSRMS:

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).

	SR	SY	SP	EP	WP	WY	WR
LAB PDGF Pre-Grapple	-75.1	-131.7	-99.2	-26.4	-81.3	-3.3	+88.0
1: SY +		+35.4					
2: EP +				+40.0			
ESP3 Pre-Grapple Intermediate	-75.1	+35.4	-99.2	+40.0	-81.3	-3.3	+88.0
	X	Y	Z	Pitch	Yaw	Roll	
	-725	+100	-341	-170.3	-13.0	-10.8	
FOR	Unloaded – LEE Tip, SY Held						
Disp	W7>LAB PDGF						

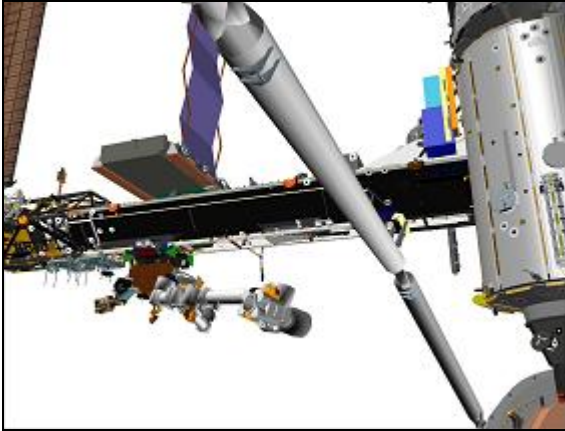


Figure 20.- ESP3 Pre-Grapple Intermediate (91: Camera B: -20, +20).

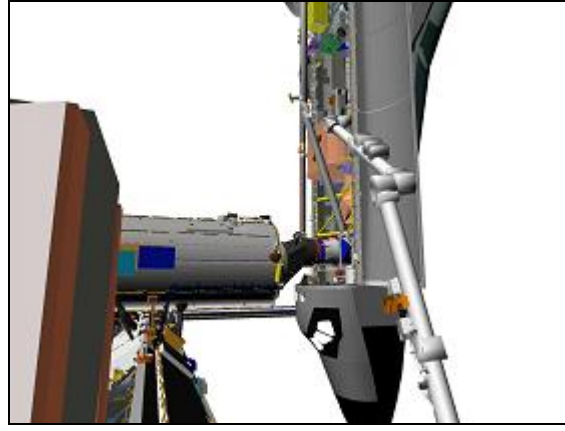


Figure 21.-ESP3 Pre-Grapple Intermediate (09: P1 Lower Outboard: +110, +10).

10. JOINT OCAS TO ESP3 PRE-GRAPPLE POSITION

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (-20, 0)	24: Tip Elbow (0, 0)	09: P1 Lower Outboard (+110, +10) 13: LAB Stbd Zenith (-180, -50)	Camera A (+90, +10)

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

Input 'Joint Angles' 'Destination' for ESP3 Pre-Grapple position.

SR	SY	SP	EP	WP	WY	WR
+118.3	+37.5	-76.2	+117.4	+49.7	-9.1	-158.3

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-75.1	+35.4	-99.2	+40.0	-81.3	-3.3	+88.0
<b>TGT</b>	<b>+118.3</b>	<b>+37.5</b>	<b>-76.2</b>	<b>+117.4</b>	<b>+49.7</b>	<b>-9.1</b>	<b>-158.3</b>
<b>ERR</b>	-193.4	-2.1	-23.0	-77.4	-131.0	+5.8	+246.3

**1.400 SSRMS WALKOFF LAB PDGF TO PDGF 2**

\*\*\*\*\*  
 \* 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)

<u>NOTE</u>
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 ESP3 Pre-Grapple position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+118.3	+37.5	-76.2	+117.4	+49.7	-9.1	-158.3
X	Y	Z	Pitch	Yaw	Roll	
+139	+1609	-720	+164.4	-60.7	-171.2	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W7>LAB PDGF					

RHC RATE → VERNIER (Verify Vernier on PCS)

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

DCP SAFING → SAFE (Verify ON)

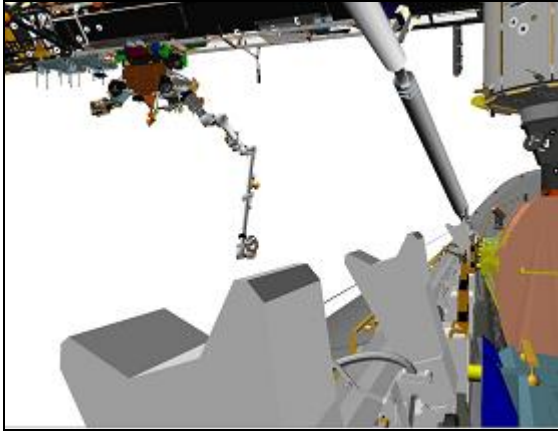


Figure 22.- ESP3 Pre-Grapple  
(91: Camera B: -20, 0).

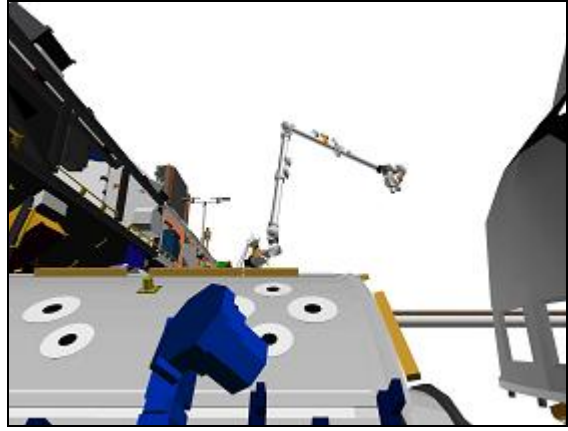


Figure 23.- ESP3 Pre-Grapple  
(13: LAB Stbd Zenith: -180, -50).

# 1.410 SSRMS ESP3 HANDOFF

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

1. SETUP  
PCS MSS: 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:

Set 'Scale' 'Vernier' Rate Scale: as desired

Verify SSRMS at ESP3 Pre-Grapple position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+118.3	+37.5	-76.2	+117.4	+49.7	-9.1	-158.3
X	Y	Z	Pitch	Yaw	Roll	
+1073	-1332	-420	-81.8	+23.7	+19.2	
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:

Verify 'Desat Request:' – Inh

\*\*\*\*\*

\* If using shuttle attitude control;

\* Coordinate with shuttle crew; DAP: FREE.

\*\*\*\*\*

## 1.410 SSRMS ESP3 HANDOFF

(RBT FS/13A.1/FIN 1)

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### 3. ESP3 GRAPPLE

On SRMS operator GO, SRMS in ESP3 Handoff position with brakes on:

Configure Cameras and overlays for grapple.

Monitor 1	Monitor 2	Monitor 3
91: SRMS Elbow (+20, +20)	25: Tip LEE	37: MBS Mast (-120, +45) (09: P1 Lower Outboard (+150, -30))

#### NOTE

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

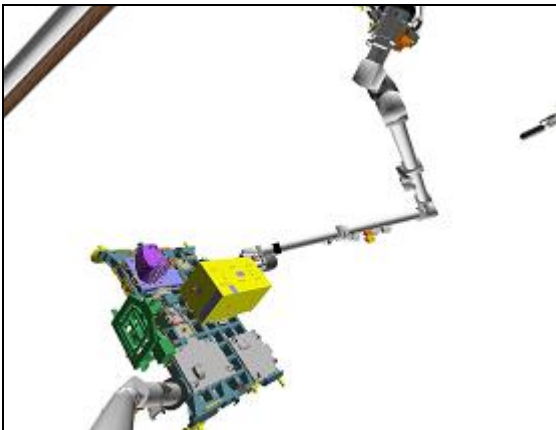


Figure 1.- ESP-3 Pre-Grapple  
(91: SRMS Elb: +20, +20).

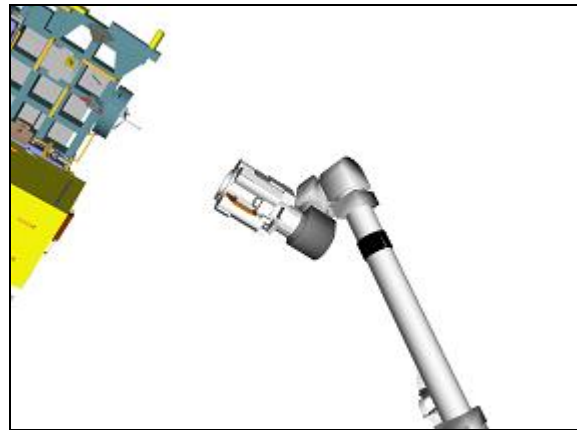


Figure 2.- ESP-3 Pre-Grapple  
(37: MBS Mast: -120, +45).

MSS: SSRMS: SSRMS Safing:

**cmd** Remove (Verify Not Safed)

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

RHC/  
THC Maneuver to within grapple envelope.

PCS MSS: SSRMS: Tip LEE:

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

## 1.410 SSRMS ESP3 HANDOFF

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

Verify '**Confirm or Terminate**' prompt.

<b>CAUTION</b>
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.

<u>NOTE</u>
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.

SR	SY	SP	EP	WP	WY	WR
+118.3	+35.4	-65.8	+119.8	+36.5	-9.1	-160.5
X	Y	Z	Pitch	Yaw	Roll	
+1073	-1038	-51	-40.9	-59.9	-53.0	
FOR	Loaded – ESP3 Maneuver, SR Held					
Disp	W7>ISSACS					

## 1.410 SSRMS ESP3 HANDOFF

(RBT FS/13A.1/FIN 1)

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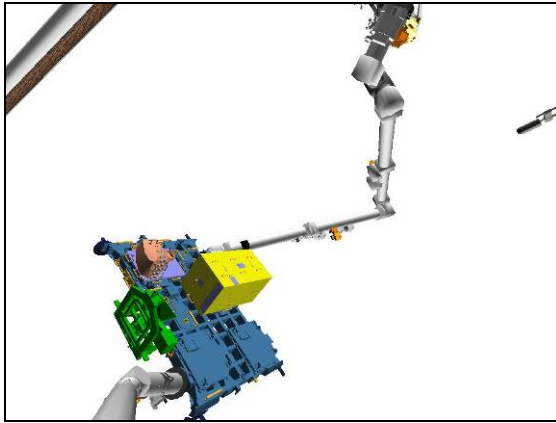


Figure 3.- ESP3 Handoff  
(91: SRMS Elb: +20, +20).

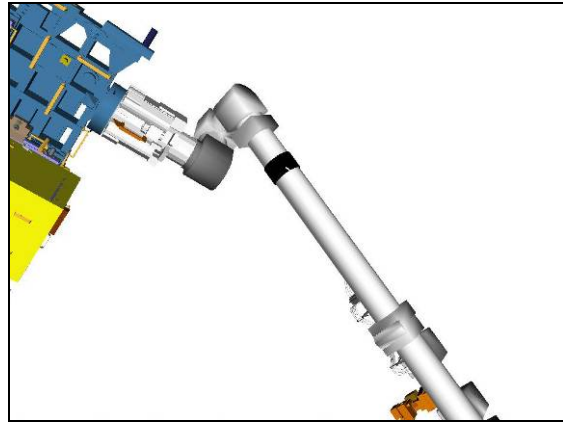


Figure 4.- ESP3 Handoff  
(37: MBS Mast: -120, +45).

### 4. EBCS POWER APPLICATION

PCS

MSS: 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(Redundant) On (Verify On)

Notify SRMS operator grapple complete, GO for ESP3 release.



# 1.420 SSRMS ESP3 INSTALL

## 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: SRMS Elbow (+40, 0) 91: SRMS EE	37: MBS Mast (-160, +45)	24: Tip Elbow (+20, 0) 22: Base Elbow (-60, -15)	Camera B (-20, 0)

PCS

MSS: 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).

SR	SY	SP	EP	WP	WY	WR
+118.3	+35.4	-65.8	+119.8	+36.6	-9.1	-160.4
X	Y	Z	Pitch	Yaw	Roll	
+155	+1159	+1385	+69.2	+22.3	-8.0	
FOR	Loaded – ESP3 Maneuver, SR Held					
Disp	W7>ESP3 Install					

√Vernier

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: 1.0 (Verify 1.0)

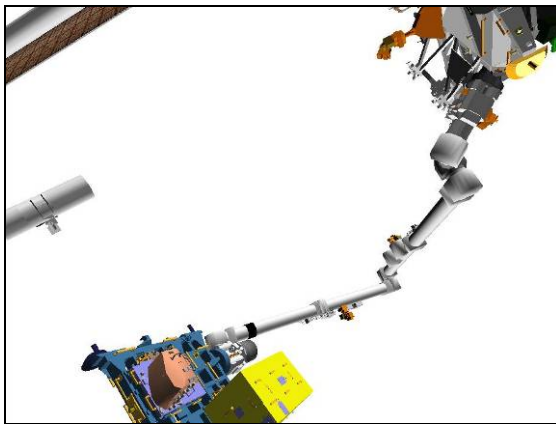


Figure 1.- ESP3 Handoff (91: SRMS Elbow: +40, 0).

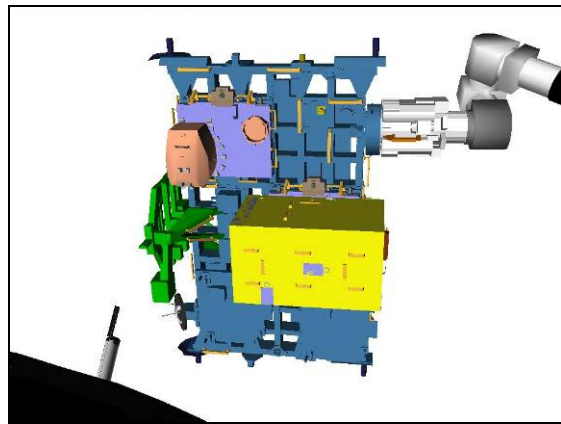


Figure 2.- ESP3 Handoff (37: MBS Mast: -160, +45).

# 1.420 SSRMS ESP3 INSTALL

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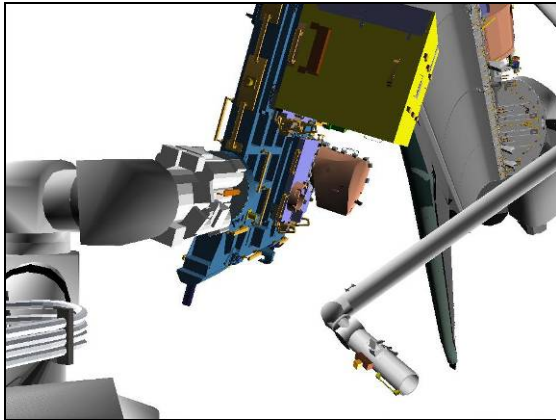


Figure 3.- ESP3 Handoff  
(24: Tip Elbow: +20, 0).

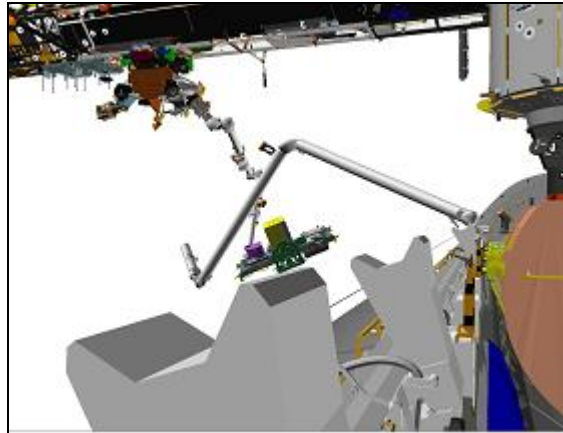


Figure 4.- ESP3 Handoff  
(V10: Camera B: -20, 0).

## 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:

Enter Mode – Joint OCAS (Verify blue)

Input 'Joint Angles' 'Destination' for ESP3 Pre-Install position.

SR	SY	SP	EP	WP	WY	WR
+113.3	-39.4	-90.6	-71.6	-88.5	-0.9	-166.0

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+118.3	+35.4	-65.8	+119.8	+36.6	-9.1	-160.4
<b>TGT</b>	<b>+113.3</b>	<b>-39.4</b>	<b>-90.6</b>	<b>-71.6</b>	<b>-88.5</b>	<b>-0.9</b>	<b>-166.0</b>
<b>ERR</b>	+5.0	+74.8	+24.8	+191.4	+125.0	-8.2	+5.5

# 1.420 SSRMS ESP3 INSTALL

\*\*\*\*\*

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. 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.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

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).

SR	SY	SP	EP	WP	WY	WR
+113.3	-39.4	-90.6	-71.6	-88.5	-0.9	-166.0
X	Y	Z	Pitch	Yaw	Roll	
-200	0	0	-172.4	+90.0	-97.6	
FOR	Loaded – ESP3 Maneuver, SR Held					
Disp	W7>ESP3 Install					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

## 1.420 SSRMS ESP3 INSTALL

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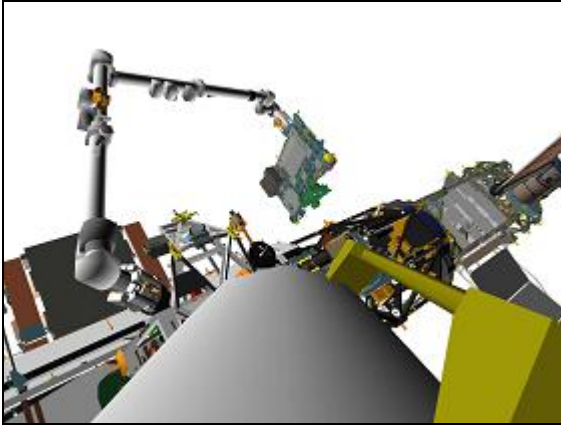


Figure 5.- ESP3 Pre-Install  
(91: SRMS EE).

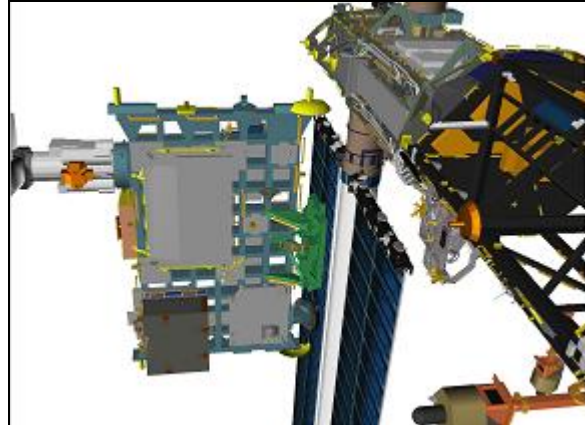


Figure 6.- ESP3 Pre-Install  
(22: Base Elbow: -100, -15).

### 3. SETUP FOR INSTALL

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
91: SRMS EE (37: MBS Mast (-110, -15))	28: EBCS	24: Tip Elbow (-40, +5) (22: Base Elbow (-100, -15))

#### NOTE

EBCS Target may not be visible until X = ~100 cm

MSS: 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:

Set 'Scale' 'Vernier' Rate Scale: 0.4 (Verify 0.4)

## 1.420 SSRMS ESP3 INSTALL

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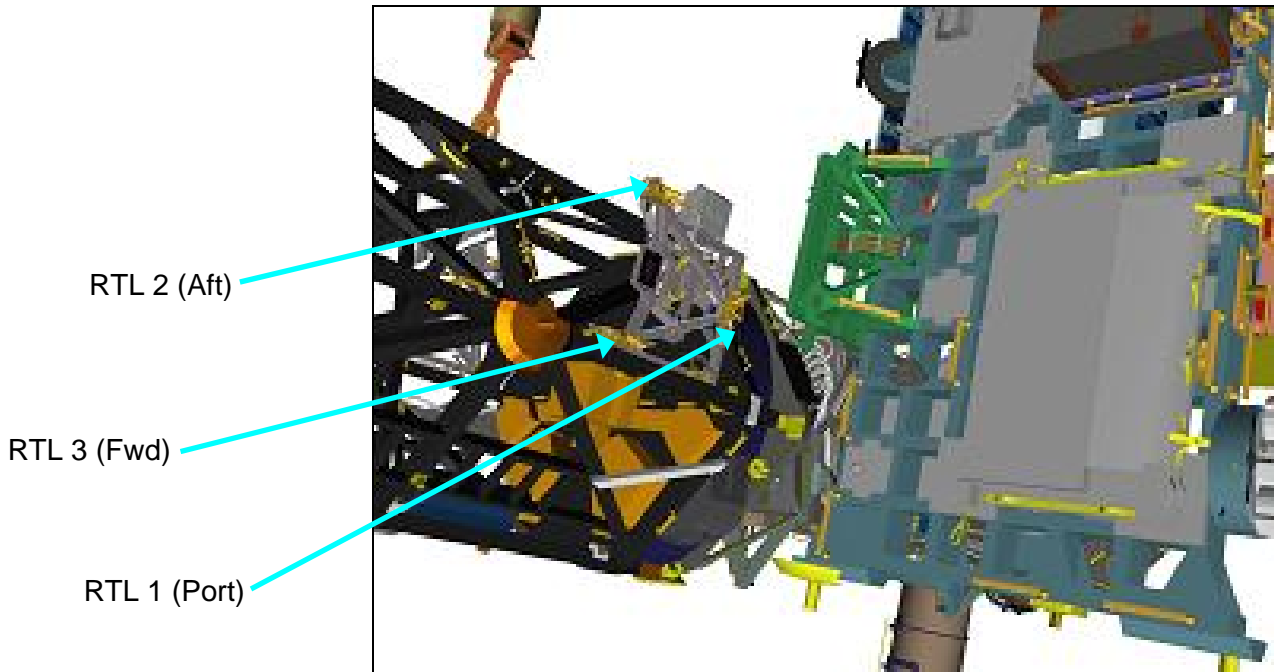


Figure 7.- P3 UCCAS RTLs  
(24: Tip Elbow: -40, +5).

### 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.

## 1.420 SSRMS ESP3 INSTALL

(RBT FS/13A.1/FIN 1)

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THC/  
RHC

Maneuver to acquire RTLs. Expected RTL position:

Locked						
SR	SY	SP	EP	WP	WY	WR
+113.3	-39.2	-93.2	-84.0	-73.5	-0.8	-165.8
X	Y	Z	Pitch	Yaw	Roll	
-6	0	0	0.0	0.0	0.0	
FOR	Loaded – ESP3 Install, SR Held					
Disp	W7>ESP3 Install					

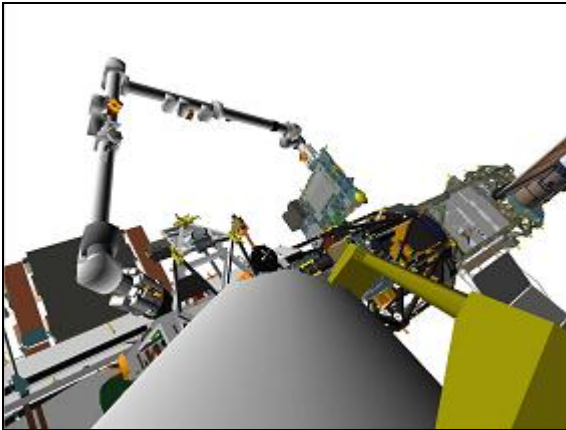


Figure 8.- RTL Position  
(92: SRMS EE).

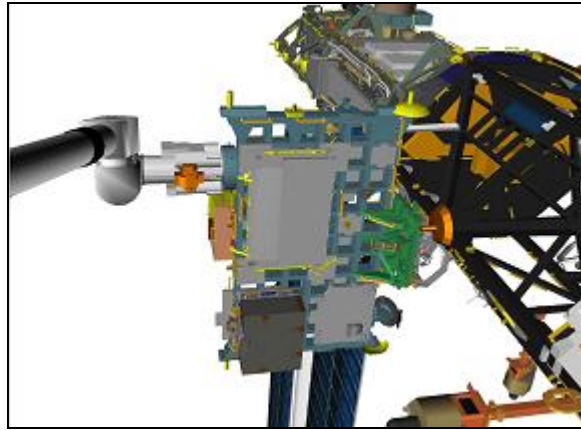


Figure 9.- RTL Position  
(22: Base Elbow: -100, -15).

### 6. ESP3 INSTALL

MSS: 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:

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify joints – Limped

Notify CAS operator GO for second stage capture, all joints limped.

# 1.420 SSRMS ESP3 INSTALL

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On CAS operator GO for Brakes On (when ESP3 fully torqued):

DCP BRAKES SSRMS → ON (Verify – ON)

Record ESP3 Installed joint angles and FOR:

	SR	SY	SP	EP	WP	WY	WR	
Expected	+113.3	-39.2	-93.3	-84.3	-73.1	-0.8	-165.8	
	X	Y	Z	Pitch	Yaw	Roll		
Expected	0	0	0	0.0	0.0	0.0		
	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.  
 \*\*\*\*\*

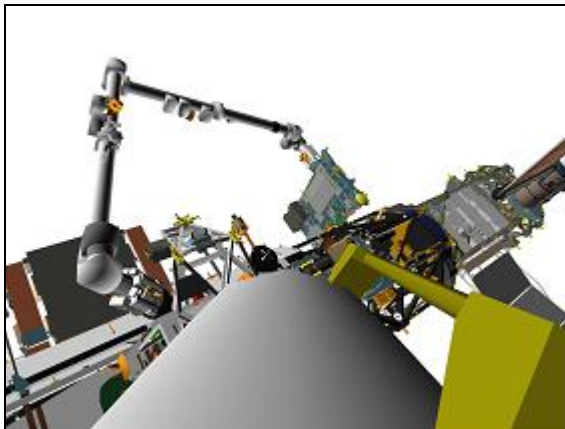


Figure 10.- ESP3 Installed (92: SRMS EE).

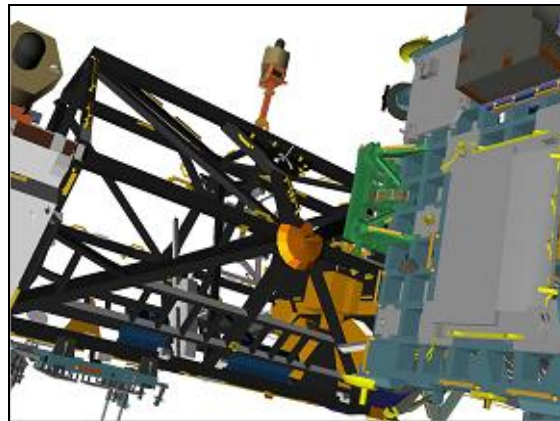


Figure 11.- ESP3 Installed (24: Tip Elbow: -40, +10).

## 7. SETUP FOR RELEASE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
92: SRMS EE	25: Tip LEE	22: Base Elbow (-120, -15)

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)

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Change Display ► W7 ► Installed ESP3 GF (Verify W7>Installed ESP3 GF)

Verify Command – SSRMS>Internal

MSS: SSRMS: Rate:

Set 'Scale' 'Vernier' Rate Scale: as desired

Verify SSRMS at ESP3 Installed position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+113.3	-39.2	-93.3	-84.3	-73.1	-0.8	-165.8
X	Y	Z	Pitch	Yaw	Roll	
+301	+133	+10	-0.3	0.0	±180.0	
FOR	Loaded – ESP3 Install, SR Held					
Disp	W7>Installed ESP3 GF					

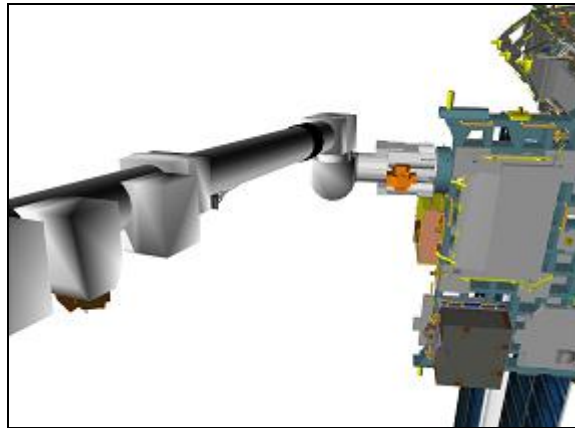


Figure 12.- ESP3 Installed  
(22: Base Elbow: -120, -15).

## 8. [SSRMS RELEASE](#)

### 8.1 [Power Removal From EBCS](#)

**On MCC-H GO**, ready for ESP3 release:

MSS: SSRMS: Power:

#### 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



# 1.420 SSRMS ESP3 INSTALL

## 8.2 ESP3 Release

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

MSS: 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).

Locked						
SR	SY	SP	EP	WP	WY	WR
+113.3	-39.4	-90.9	-75.2	-84.6	-0.9	-166.0
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	W7>Installed ESP3 GF					

## 1.420 SSRMS ESP3 INSTALL

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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)

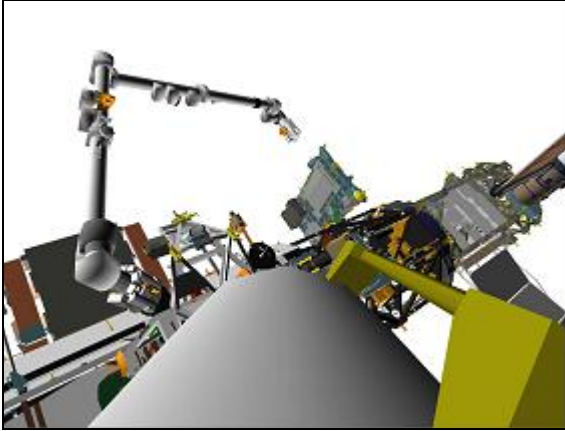


Figure 13.- ESP3 GF Backoff  
(92: SRMS EE).

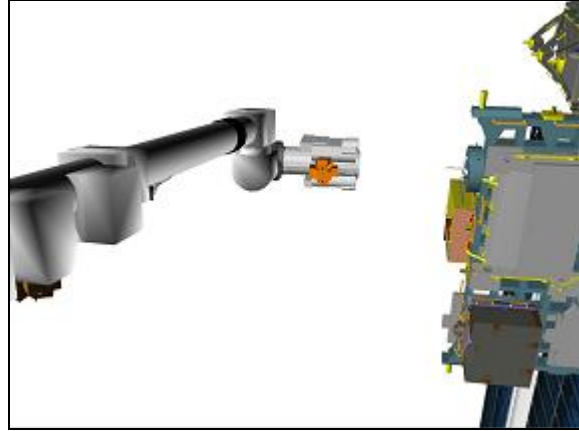


Figure 14.- ESP3 GF Backoff  
(22: Base Elbow: -120, -15).

# 1.430 SSRMS ESP3 MANEUVER FOR TRANSLATE TO WS 4

(RBT FS/13A.1/FIN 1)

Page 1 of 3 pages

## 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
13: LAB Stbd Zenith (-180, -30)	37: MBS Mast (-60, -20)	92: SRMS Elbow (+85, -10)	Camera C (-20, +20)

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).

SR	SY	SP	EP	WP	WY	WR
+113.3	-39.4	-90.9	-75.2	-84.6	-0.9	-166.0
X	Y	Z	Pitch	Yaw	Roll	
+48	-2416	-656	-90.0	+0.1	+89.9	
FOR	Unloaded – LEE Tip, SR Held					
Disp	W7>ISSACS					

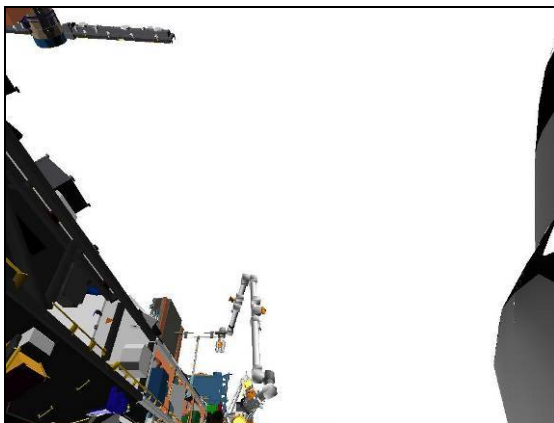


Figure 1.- ESP3 GF Backoff  
(13: LAB Stbd Zenith: -180, -30).



Figure 2.- ESP3 GF Backoff  
(37: MBS Mast: -60, -20).

# 1.430 SSRMS ESP3 MANEUVER FOR TRANSLATE TO WS 4

(RBT FS/13A.1/FIN 1)

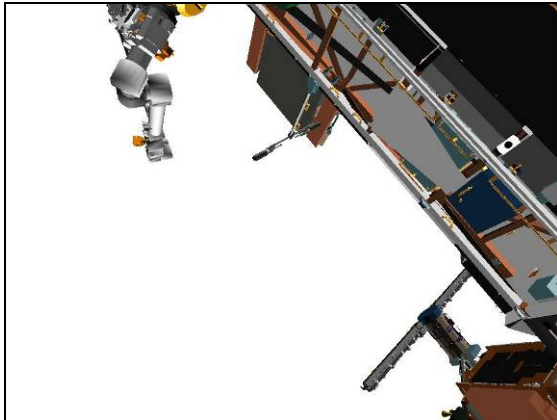


Figure 3.- ESP3 GF Backoff  
(92: SRMS Elbow: +85, -10).

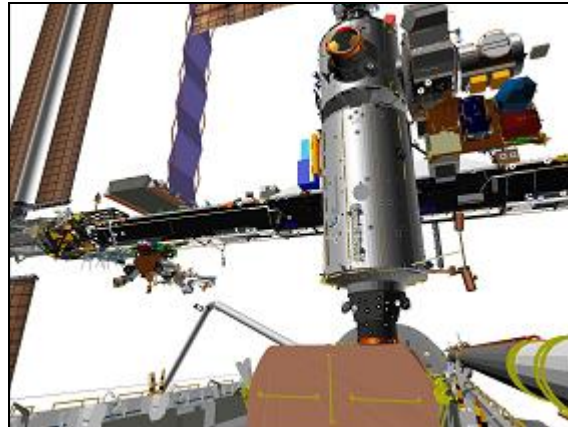


Figure 4.- ESP3 GF Backoff  
(V10: Camera C: -20, +20).

## 2. MT TRANSLATE POSITION MANEUVER

RHC RATE → COARSE (Verify Coarse on PCS)

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W7MBS2 ► MT Translate

Verify 'Joint Angles' 'Destination' for MT Translate position.

SR	SY	SP	EP	WP	WY	WR
+250.0	+60.0	+65.0	-155.0	-59.0	-74.4	-102.3

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+113.3	-39.4	-90.9	-75.2	-84.6	-0.9	-166.0
<b>TGT</b>	<b>+250.0</b>	<b>+60.0</b>	<b>+65.0</b>	<b>-155.0</b>	<b>-59.0</b>	<b>-74.4</b>	<b>-102.3</b>
<b>ERR</b>	-136.7	-99.4	-155.9	+79.8	-25.6	+73.5	-63.7

\*\*\*\*\*

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.

\*\*\*\*\*

# 1.430 SSRMS ESP3 MANEUVER FOR TRANSLATE TO WS 4

(RBT FS/13A.1/FIN 1)

Page 3 of 3 pages

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:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+250.0	+60.0	+65.0	-155.0	-59.0	-74.4	-102.3

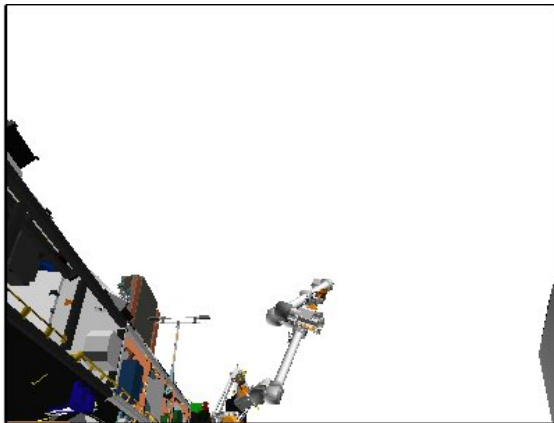


Figure 5.- MT Translate  
(13: LAB Stbd Zenith: -180, -30).

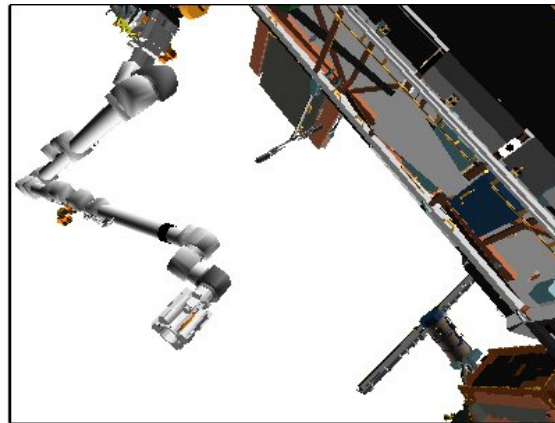


Figure 6.- MT Translate  
(92: SRMS Elbow: +85, -10).

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)

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# 1.435 MT PRE-TRANSLATION SURVEY - WS 7 TO WS 4 (GROUND)

(RBT FS/13A.1/FIN 1)

Page 1 of 3 pages

Configure the ISS Downlink per the following table:

1 Base Elbow (-10, +5)	2 MBS Mast (+175, -29) FL = 20 mm
------------------------------	--

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

SR	SY	SP	EP	WP	WY	WR
+250.0	+60.0	+65.0	-155.0	-59.0	-74.4	-102.3

### 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

	Base Elb	Stop at	Survey Notes	Complete
Start Config	<b>(-10, +5)</b>	-	MT Translation Path	
1: Pan Lt	<b>(-30, +5)</b>	<b>(-24, +5)</b>	MT Translation Path	

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)

Page 2 of 3 pages

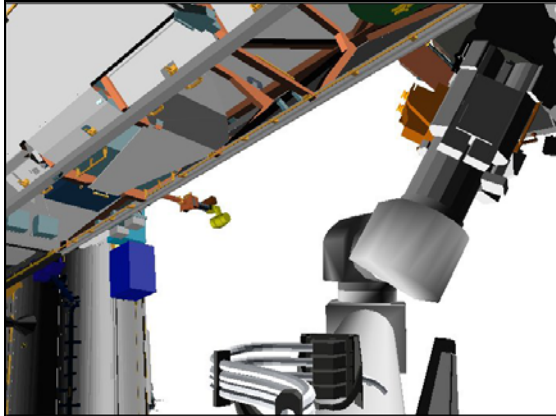


Figure 1.- Base Elbow Start  
(Base Elbow: -10, +5).

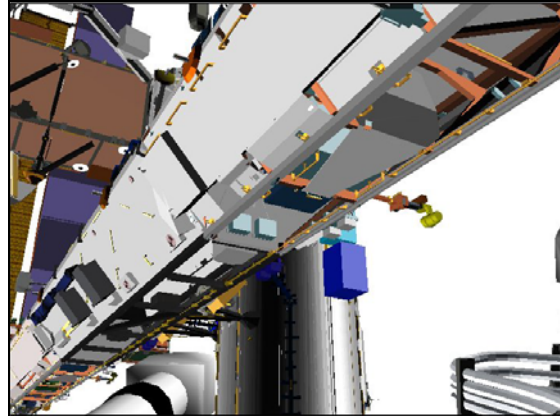


Figure 2.- Base Elbow - Step 1  
(Base Elbow: -30, +5).

### 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

	MBS Mast	Stop at	Survey Notes	Complete
Start Config	<b>(+175, -29)</b> <b>FL = 20 mm</b>	-	MT Translation Path	
1: Tilt Up	<b>(+175, -14)</b>	<b>(+175, -20)</b>	MT Translation Path	
2: Zoom In	<b>(+175, -14)</b> <b>FL = 28 mm</b>	-	MT Translation Path	
3: Tilt Up	<b>(+175, -9)</b>	<b>(+175, -14)</b>	MT Translation Path	
4: Zoom In	<b>(+175, -9)</b> <b>FL = 35 mm</b>	-	MT Translation Path	

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)

Page 3 of 3 pages

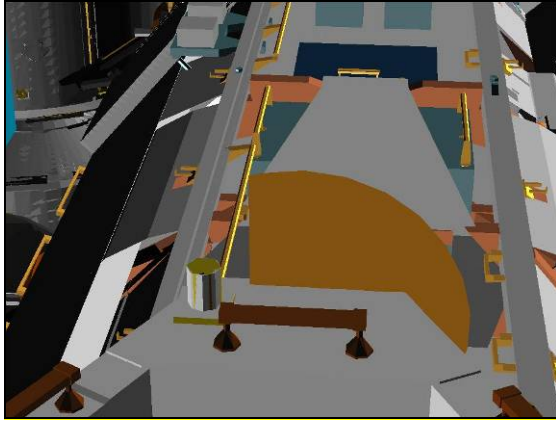


Figure 3.- MBS Mast Start  
(MBS Mast: +175, -29, FL = 20 mm).



Figure 4.- MBS Mast - Step 2  
(MBS Mast: +175, -14, FL = 28 mm).

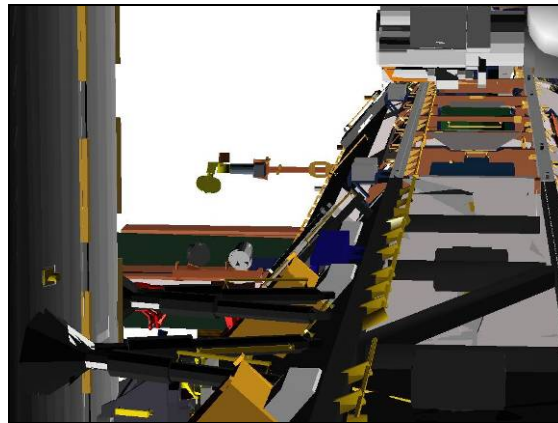


Figure 5.- MBS Mast - Step 4  
(MBS Mast: +175, -9, FL = 35 mm).

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# 1.500 SSRMS MANEUVER TO SASA START POSITION

(RBT FS/13A.1/FIN 1)

Page 1 of 4 pages

## 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+50, -40)	24: Tip Elbow (0, 0)	13: LAB Stbd Zenith (-180, +40)	SRMS Elbow (+90, -60)

PCS

MSS: 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).

SR	SY	SP	EP	WP	WY	WR
+250.0	+60.0	+65.0	-155.0	-59.0	-74.4	-102.3
X	Y	Z	Pitch	Yaw	Roll	
+655	+927	-216	-26.1	+15.7	-1.7	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>ISSACS					

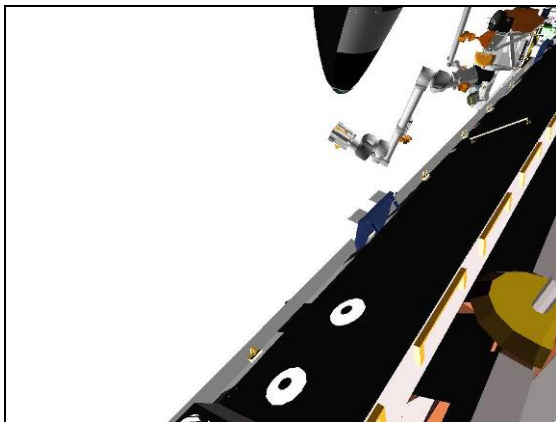


Figure 1.- MT Translate  
(03: S1 Lower Outboard: +50, -40).

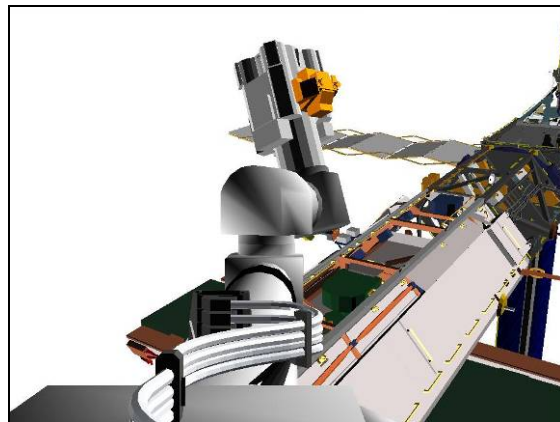


Figure 2.- MT Translate  
(24: Tip Elbow: 0, 0).

# 1.500 SSRMS MANEUVER TO SASA START POSITION

(RBT FS/13A.1/FIN 1)



Figure 3.- MT Translate  
(13: LAB Stbd Zenith: -180, +40).



Figure 4.- MT Translate  
(V10: SRMS Elbow: +90, -60).

## 2. SASA START MANEUVER

MSS: SSRMS: SSRMS Safing:

**cmd** Remove (Verify Not Safed)

DCP BRAKES SSRMS → OFF (Verify OFF)

√Vernier

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W4MBS2 ► SASA Start Inter

Verify 'Joint Angles' 'Destination' for SASA Start Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+216.9	0.0	-5.0	-106.2	-59.0	-74.4	-102.3

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+250.0	+60.0	+65.0	-155.0	-59.0	-74.4	-102.3
<b>TGT</b>	<b>+216.9</b>	<b>0.0</b>	<b>-5.0</b>	<b>-106.2</b>	<b>-59.0</b>	<b>-74.4</b>	<b>-102.3</b>
<b>ERR</b>	+33.1	+60.0	+70.0	-48.8	0.0	0.0	0.0

**1.500 SSRMS MANEUVER TO SASA START POSITION**

(RBT FS/13A.1/FIN 1)

```

*****
* 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 1.5 minutes to complete in Vernier rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+216.9	0.0	-5.0	-106.2	-59.0	-74.4	-102.3

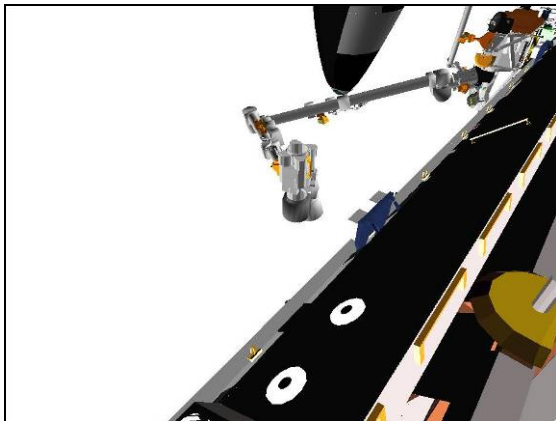


Figure 5.- SASA Start Intermediate (03: S1 Lower Outboard: +50, -40).

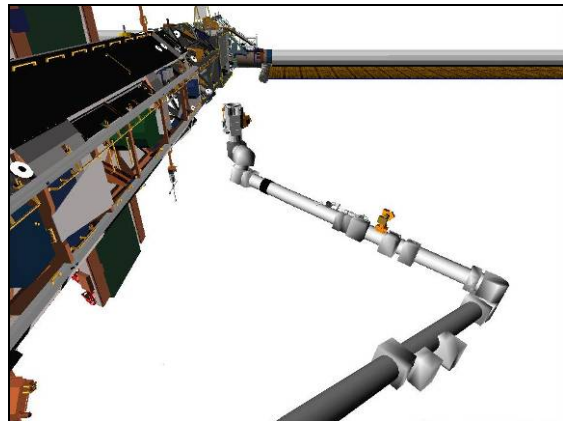


Figure 6.- SASA Start Intermediate (13: LAB Stbd Zenith: -180, +80).

MSS: SSRMS:

Enter Mode – Single (Verify blue)

# 1.500 SSRMS MANEUVER TO SASA START POSITION

(RBT FS/13A.1/FIN 1)

Page 4 of 4 pages

<b>WARNING</b>
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).

	SR	SY	SP	EP	WP	WY	WR
SASA Start	+216.9	0.0	-5.0	-106.2	-59.0	-74.4	-102.3
Intermediate							
1: SP -			-9.4				
SASA Start	+216.9	0.0	-9.4	-106.2	-59.0	-74.4	-102.3
	X	Y	Z	Pitch	Yaw	Roll	
	+315	+1480	+76	-90.0	-0.1	+17.0	
FOR	Unloaded - LEE Tip, SY Held						
Disp	W4>ISSACS						

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

DCP SAFING → SAFE (Verify ON)

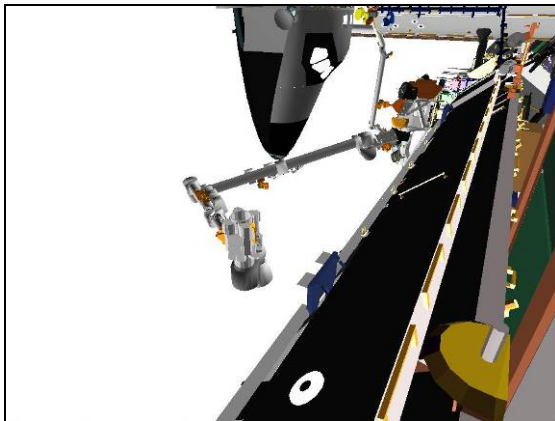


Figure 7.- SASA Start  
(03: S1 Lower Outboard: +60, -30).

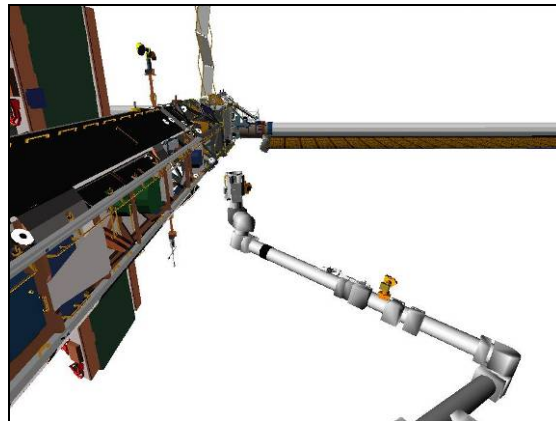


Figure 8.- SASA Start  
(13: LAB Stbd Zenith: -180, +90).

# 1.510 SSRMS SASA RELOCATE

(RBT FS/13A.1/FIN 1)

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## 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+60, -30)	22: Base Elbow (-110, -15)	13: LAB Stbd Zenith (-180, +90)	SRMS Elbow (+90, -60)

PCS

MSS: 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).

SR	SY	SP	EP	WP	WY	WR
+216.9	0.0	-9.4	-106.2	-59.0	-74.4	-102.3
X	Y	Z	Pitch	Yaw	Roll	
+315	+1480	+76	-90.0	-0.1	+17.1	
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.

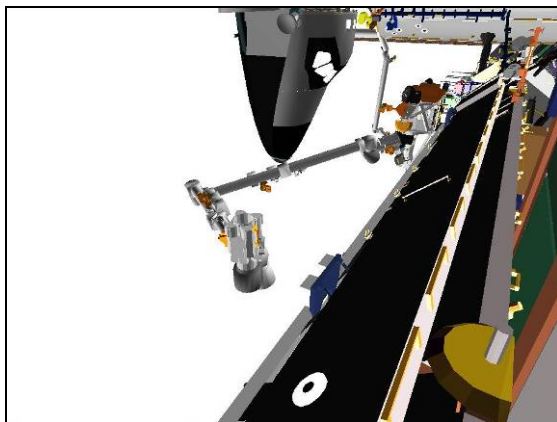


Figure 1.- SASA Start  
(03: S1 Lower Outboard: +60, -30).

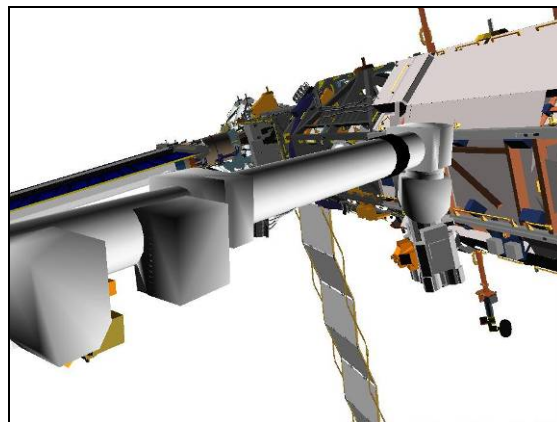


Figure 2.- SASA Start  
(22: Base Elbow: -110, -15).

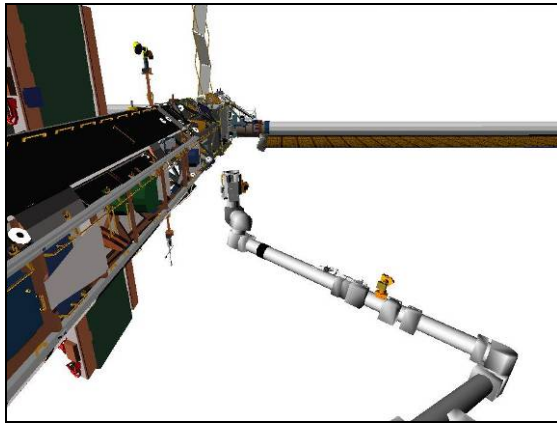


Figure 3.- SASA Start  
 (13: LAB Stbd Zenith: -180, +90).

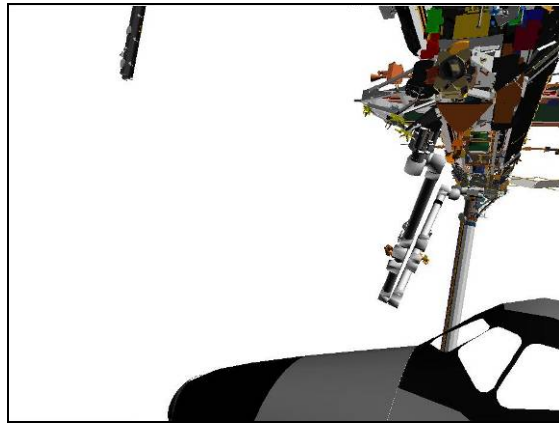


Figure 4.- SASA Start  
 (V10: SRMS Elbow: +90, -60).

**2. APFR INGRESS**

Verify SRMS in P6 SASA Relocation Viewing position with brakes on.

MSS: SSRMS: SSRMS Safing:

**cmd** Remove (Verify Not Safed)

DCP BRAKES SSRMS → OFF (Verify OFF)

√Vernier

**2.1 APFR Ingress**

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

**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).

	Locked					
SR	SY	SP	EP	WP	WY	WR
+205.7	0.0	-5.9	-102.3	-103.1	-71.7	-140.5
X	Y	Z	Pitch	Yaw	Roll	
+315	+1480	-105	-90.0	-0.1	+17.1	
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>ISSACS					



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

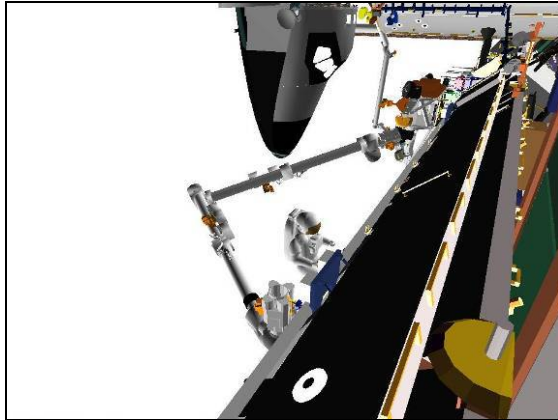


Figure 5.- APFR Ingress  
 (03: S1 Lower Outboard: +60, -30).

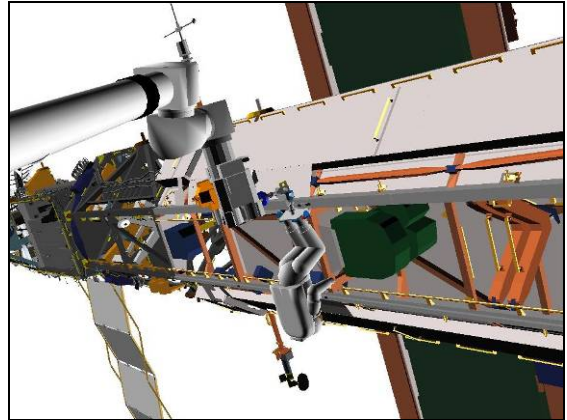


Figure 6.- APFR Ingress  
 (22: Base Elbow: -90, -20).

2.2 EVA Clear of S1

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (+25, +15) 22: Base Elbow (-110, -15)	24: Tip Elbow (-10, +20)	13: LAB Stbd Zenith (-180, +75) 37: MBS Mast (-170, -5)	SRMS Elbow (+90, -60)

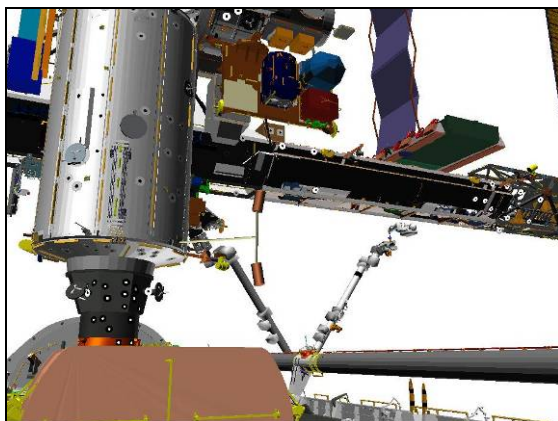


Figure 7.- APFR Ingress  
 (91: Camera B: +25, +15).

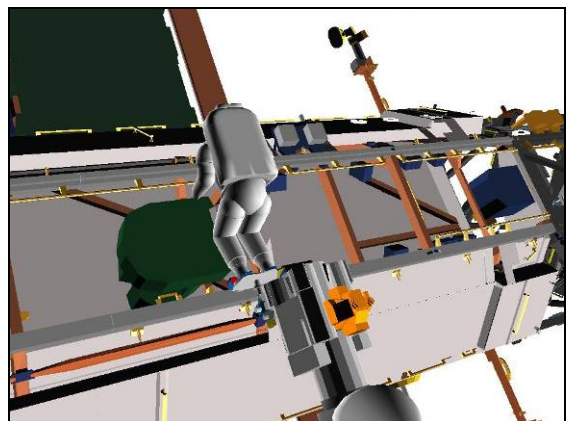


Figure 8.- APFR Ingress  
 (24: Tip Elbow: -10, +20).

# 1.510 SSRMS SASA RELOCATE

On EV GO, APFR ingressed, ready for maneuver:

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

**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).

		Locked					
	SR	SY	SP	EP	WP	WY	WR
	+205.7	0.0	-5.9	-102.3	-103.1	-71.7	-140.5
	X	Y	Z	Pitch	Yaw	Roll	
	+227	+1479	+55	±180.0	-0.1	-0.1	
APFR Ingress							
1: X +	+350						
2: Z -			-500				
S1 Clearance	+350	+1479	-500	±180.0	-0.1	-0.1	
	SR	SY	SP	EP	WP	WY	WR
	+174.6	0.0	-11.5	-73.6	-161.9	-46.8	-180.7
	FOR	Unloaded – Ch 12/PP/F/6, SY Held					
	Disp	W4>ISSACS					

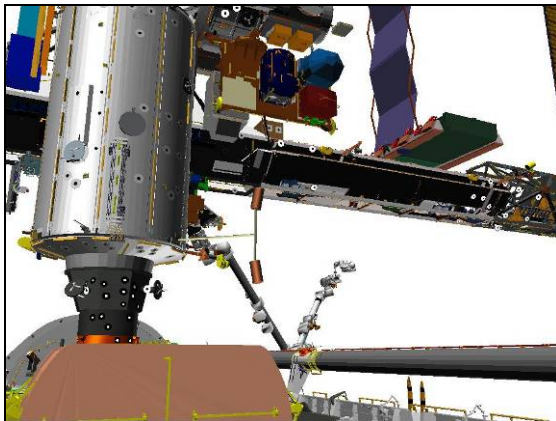


Figure 9.- S1 Clearance  
(91: Camera B: +25, +15).

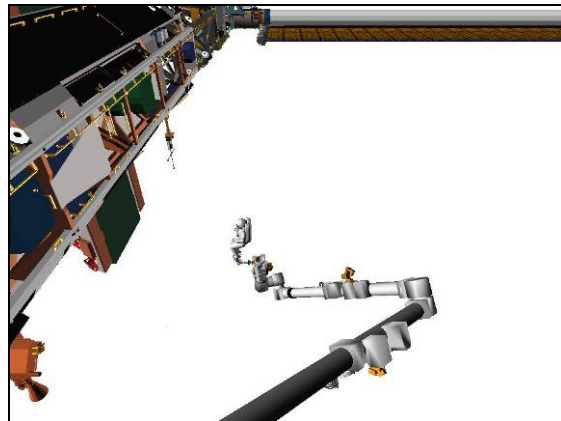


Figure 10.- S1 Clearance  
(13: LAB Stbd Zenith: -180, +75).

### 3. JOINT OCAS TO P6

√MCC-H 2B BGA locked at 90 degrees, 4B BGA locked at 270 degrees

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

# 1.510 SSRMS SASA RELOCATE

RHC RATE → COARSE (Verify Coarse on PCS)

PCS SSRMS Joint OCAS

Input 'Joint Angles' 'Destination' for P6 Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+119.3	0.0	-50.0	-79.9	-28.7	-36.4	-80.1

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+174.6	0.0	-11.5	-73.6	-161.9	-46.8	-180.7
<b>TGT</b>	<b>+119.3</b>	<b>0.0</b>	<b>-50.0</b>	<b>-79.9</b>	<b>-28.7</b>	<b>-36.4</b>	<b>-80.1</b>
<b>ERR</b>	+55.3	0.0	+38.5	+6.3	-133.2	-10.4	-100.6

\*\*\*\*\*

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 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+119.3	0.0	-50.0	-79.9	-28.7	-36.4	-80.1

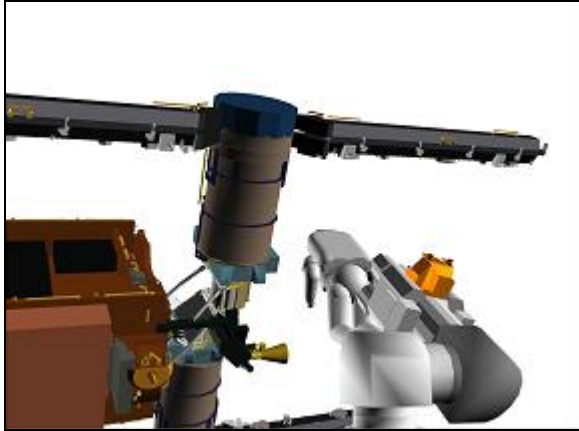


Figure 11.- P6 Intermediate  
 (24: Tip Elbow: -10, +15).

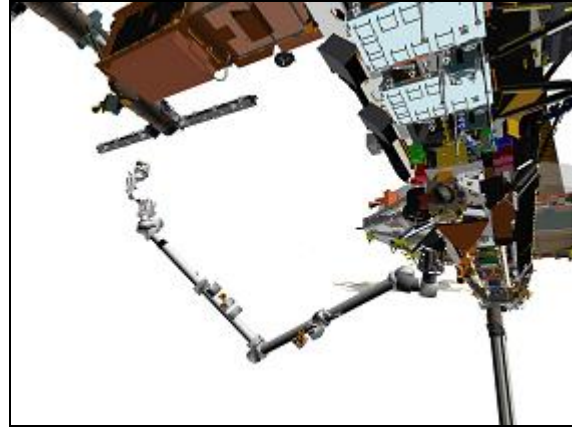


Figure 12.- P6 Intermediate  
 (V10: SRMS Elbow: +90, -40).

**4. SASA REMOVAL FROM P6**

4.1 Single Joint to SASA Base Bolt Location

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS:

Enter Mode – Single (Verify blue)

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

<b>NOTE</b>
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).

P6 Intermediate  
 1: SP – Base Bolt Location

SR	SY	SP	EP	WP	WY	WR
+119.3	0.0	-50.0	-79.9	-28.7	-36.4	-80.1
		-60.0				
+119.3	0.0	-60.0	-79.9	-28.7	-36.4	-80.1
X	Y	Z	Pitch	Yaw	Roll	
-250	+155	-1265	-104.0	-90.0	+166.1	*
FOR	Unloaded – Ch 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

\*Display Singularity

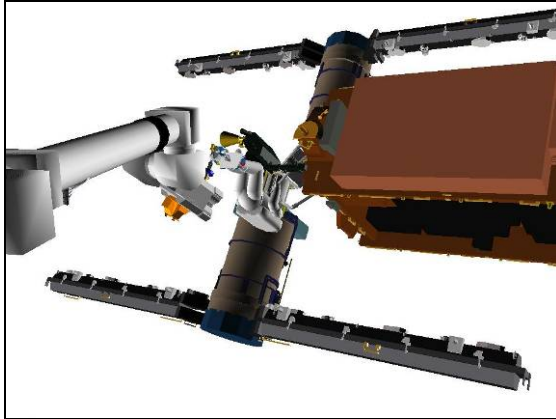


Figure 13.- SASA Base Bolt  
 (22: Base Elbow: -110, -15).



Figure 14.- SASA Base Bolt  
 (V10: SRMS Elbow: +90, -40).

PCS                    4.2 SASA Removal  
 MSS: SSRMS:

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

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: 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).

	Locked					
SR	SY	SP	EP	WP	WY	WR
+119.3	0.0	-60.0	-79.9	-28.7	-36.4	-80.1
X	Y	Z	Pitch	Yaw	Roll	
-250	+155	-1265	-104.0	-90.0	+166.1	*
FOR	Unloaded – Ch 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

\*Display Singularity

PCS                    4.3 Setup for Joint OCAS to P1  
 MSS: SSRMS:

Enter Mode – Single (Verify blue)

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<b>WARNING</b>
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).

P6 Clearance  
1: SP +  
P1 Joint  
OCAS Setup

SR	SY	SP	EP	WP	WY	WR
+119.3	0.0	-60.0	-79.9	-28.7	-36.4	-80.1
		-22.7				
+119.3	0.0	-22.7	-79.9	-28.7	-36.4	-80.1
X	Y	Z	Pitch	Yaw	Roll	
+398	+605	-1513	+65.3	-67.9	+5.5	
FOR	Unloaded – Ch 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

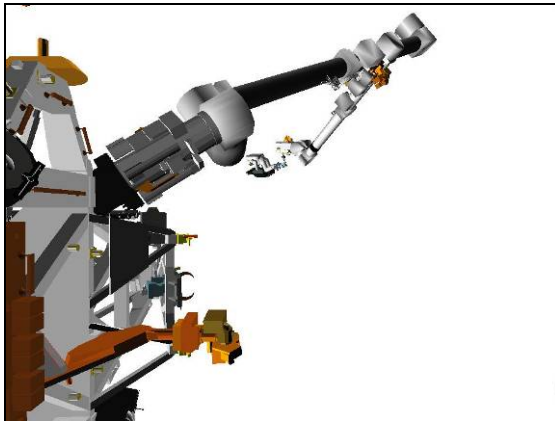


Figure 15.- P1 Joint OCAS Setup  
(13: LAB Stbd Zenith: -180, +20).

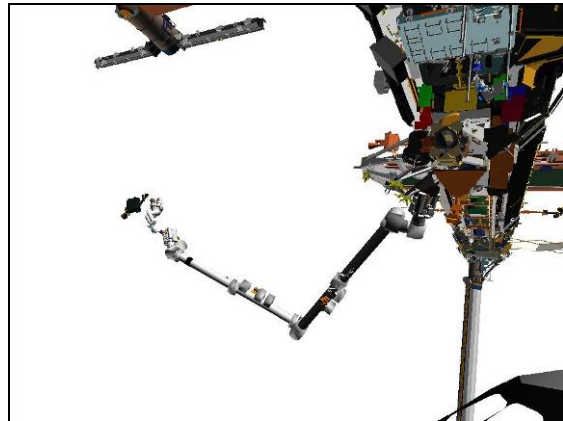


Figure 16.- P1 Joint OCAS Setup  
(V10: SRMS Elbow: +90, -50).

## 5. [JOINT OCAS TO P1](#)

<u>NOTE</u>
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:

Enter Mode – Joint OCAS (Verify blue)

RHC

RATE → COARSE (Verify Coarse on PCS)

pick File ► W4MBS2 ► P1 Approach

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Verify 'Joint Angles' 'Destination' for P1 Approach position.

SR	SY	SP	EP	WP	WY	WR
+56.3	0.0	-98.2	-51.6	-60.2	-24.1	-63.5

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+119.3	0.0	-22.7	-79.9	-28.7	-36.4	-80.1
<b>TGT</b>	<b>+56.3</b>	<b>0.0</b>	<b>-98.2</b>	<b>-51.6</b>	<b>-60.2</b>	<b>-24.1</b>	<b>-63.5</b>
<b>ERR</b>	+63.0	0.0	+75.5	-28.3	+31.5	-12.3	-16.6

\*\*\*\*\*

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 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).

SR	SY	SP	EP	WP	WY	WR
+56.3	0.0	-98.2	-51.6	-60.2	-24.1	-63.5
X	Y	Z	Pitch	Yaw	Roll	
+60	-870	-400	-90.0	0.0	±180.0	
FOR	Unloaded – Ch 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

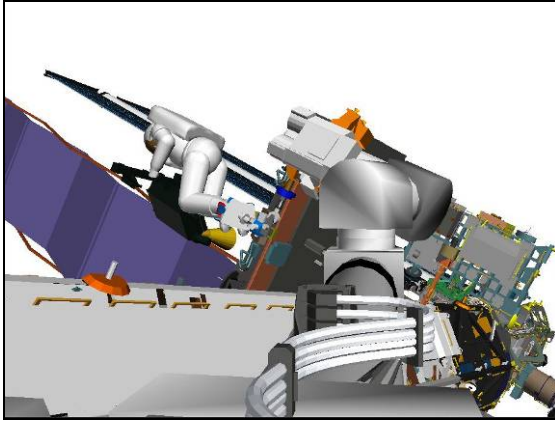


Figure 17.- P1 Approach  
 (24: Tip Elbow: -10, 0).

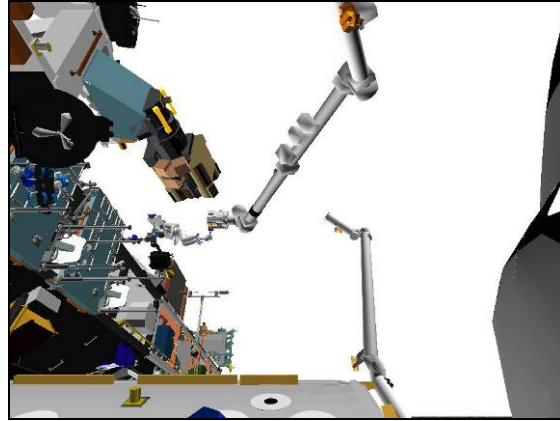


Figure 18.- P1 Approach  
 (13: LAB Stbd Zenith: -180, -35).

**6. SASA INSTALL**

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (-5, +15)	22: Base Elbow (-130, -10)	37: MBS Mast (-15, -15)	SRMS Elbow (+90, -50)

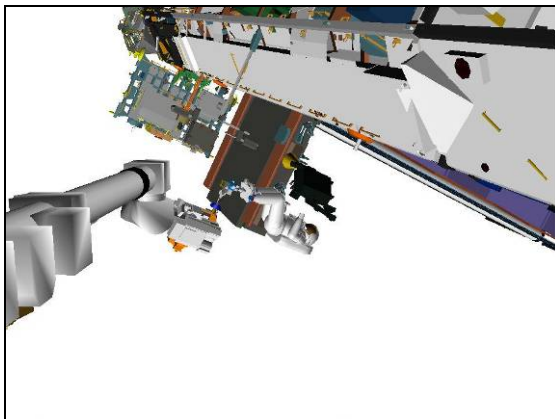


Figure 19.- P1 Approach  
 (22: Base Elbow: -130, -10).

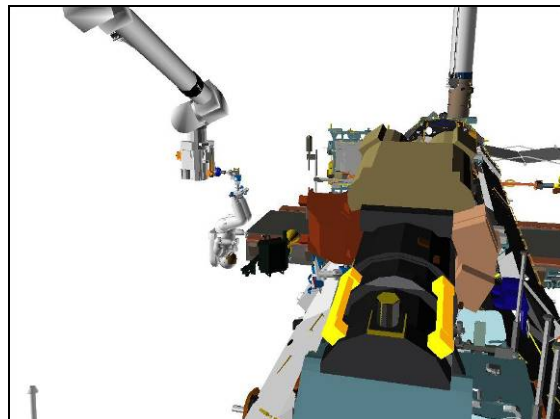


Figure 20.- P1 Approach  
 (37: MBS Mast: -15, -15).

On EV GO, ready to approach P1:

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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



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THC/  
RHC

Maneuver SSRMS to SASA Install position (within 5 cm/1 deg).

	Locked					
SR	SY	SP	EP	WP	WY	WR
+50.9	0.0	-98.5	-55.9	-57.5	-21.4	-68.5
X	Y	Z	Pitch	Yaw	Roll	
+60	-870	-280	-90.0	0.0	±180.0	
FOR	Unloaded – Ch 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

Perform EVA GCA as required for SASA Install on P1.

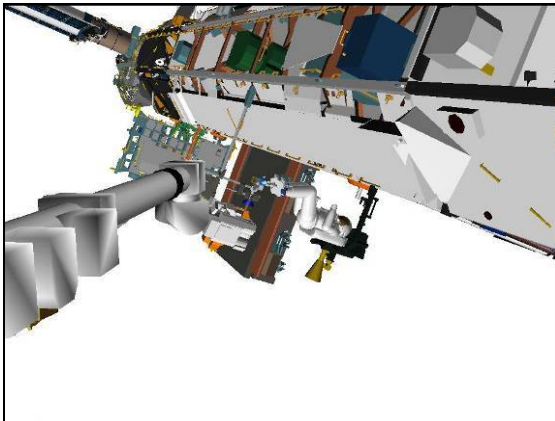


Figure 21.- SASA Install  
(22: Base Elbow: -130, -10).

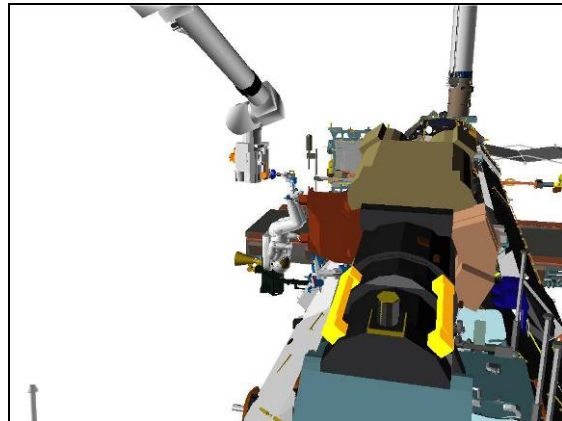


Figure 22.- SASA Install  
(37: MBS Mast: -15, -15).

## 7. APFR RECONFIGURATION AND EGRESS/INGRESS

On EV GO, SASA install complete:

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
+46.9	0.0	-88.0	-56.6	-68.5	-19.1	-72.1
X	Y	Z	Pitch	Yaw	Roll	
+300	-870	-280	-90.0	0.0	±180.0	
FOR	Unloaded – Ch 12/PP/F/6, SY Held					
Disp	W4>ISSACS					

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

7.1 APFR Reconfiguration  
 Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (-5, +15)	24: Tip Elbow (-10, 0)	13: LAB Stbd Zenith (-180, -35)	SRMS Elbow (+90, -50)

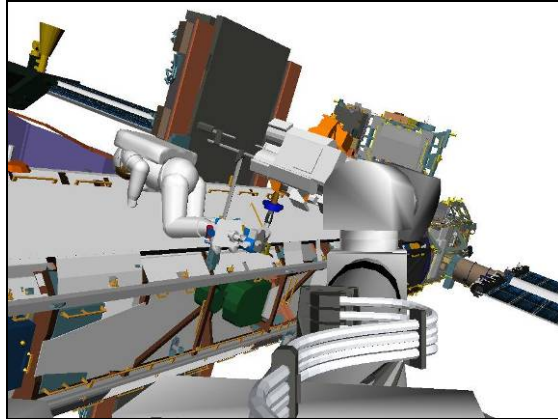


Figure 23.- APFR Reconfig  
 (24: Tip Elbow: -10, 0).

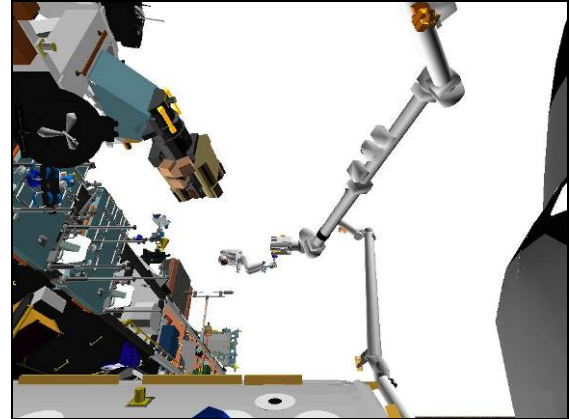


Figure 24.- APFR Reconfig  
 (13: LAB Stbd Zenith: -180, -35).

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:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W4MBS2 ► EVA 3 Intermediate

Verify 'Joint Angles' 'Destination' for EVA 3 Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+70.1	-30.0	-99.8	-43.9	+13.2	+1.1	+73.5

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

# 1.510 SSRMS SASA RELOCATE

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+46.9	0.0	-88.0	-56.6	-68.5	-19.1	-72.1
<b>TGT</b>	<b>+70.1</b>	<b>-30.0</b>	<b>-99.8</b>	<b>-43.9</b>	<b>+13.2</b>	<b>+1.1</b>	<b>+73.5</b>
<b>ERR</b>	-23.2	+30.0	+11.8	-12.7	-81.7	-20.2	-145.6

\*\*\*\*\*

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 3 minutes to complete in Vernier rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+70.1	-30.0	-99.8	-43.9	+13.2	+1.1	+73.5

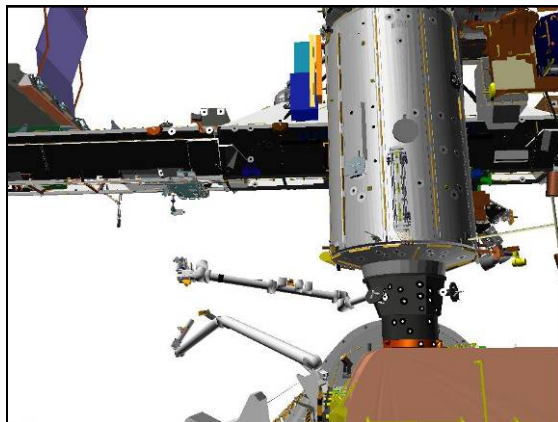


Figure 25.- EVA 3 Intermediate (91: Camera B: -5, +15).

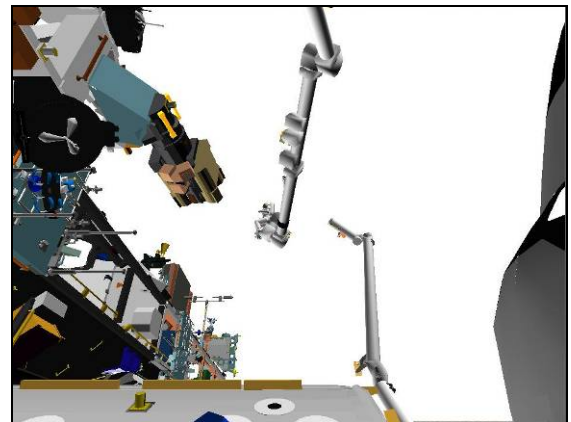


Figure 26.- EVA 3 Intermediate (13: LAB Stbd Zenith: -180, -35).

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## 7.2 CETA Cart Clearance Position Maneuver

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

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

THC/  
RHC

	Locked					
SR	SY	SP	EP	WP	WY	WR
+46.3	-30.0	-112.1	-41.0	+33.1	-15.8	+61.6
X	Y	Z	Pitch	Yaw	Roll	
+400	-995	-5	±180.0	0.0	±180.0	
FOR	Unloaded – Ch 12/PP/A/6, SY Held					
Disp	W4>ISSACS					

## 7.3 APFR Egress/Ingress Maneuver

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (-5, +15)	24: Tip Elbow (+10, +20)	32: MBS POA	SRMS Elbow (+90, -50)

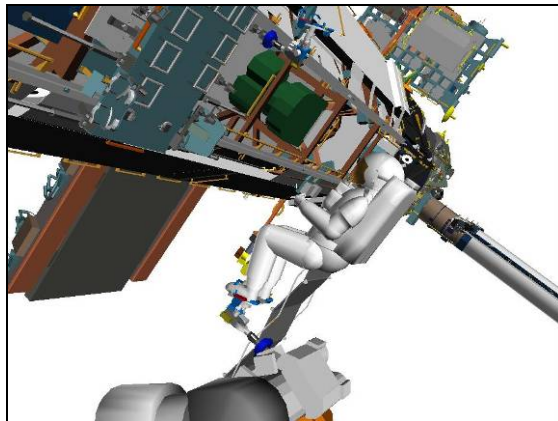


Figure 27.- CETA Cart Clearance  
(24: Tip Elbow: +10, +20).

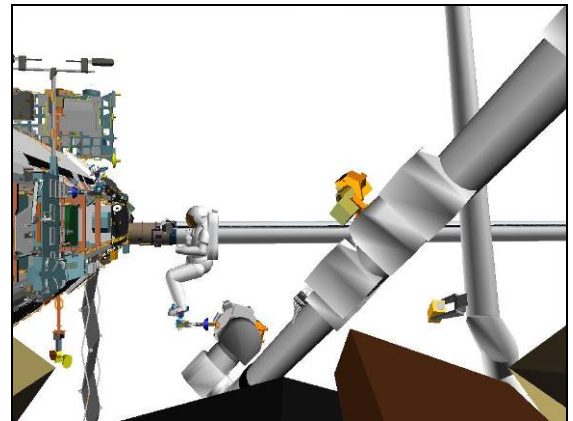


Figure 28.- CETA Cart Clearance  
(32: MBS POA).

# 1.510 SSRMS SASA RELOCATE

(RBT FS/13A.1/FIN 1)

On EV GO, ready to egress APFR:

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

	Locked					
SR	SY	SP	EP	WP	WY	WR
+51.4	-30.0	-119.4	-38.0	+35.4	-12.0	+63.9
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					

Perform EVA GCA as required for APFR egress.

DCP

BRAKES SSRMS → ON (Verify ON)

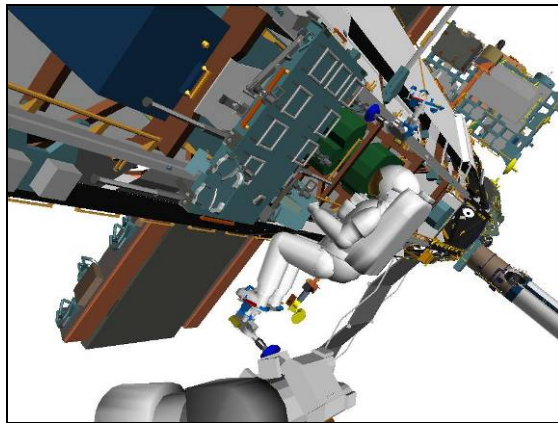


Figure 29.- APFR Egress  
(24: Tip Elbow: +10, +20).

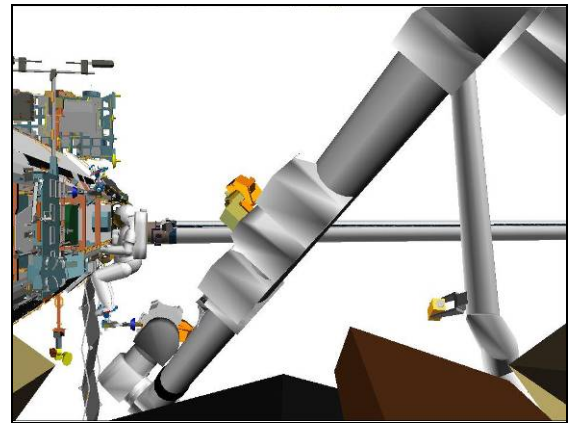


Figure 30.- APFR Egress  
(32: MBS POA).

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## 1.520 SSRMS CETA CART RELOCATE

(RBT FS/13A.1/FIN 1)

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### 1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (-5, +15)	24: Tip Elbow (+10, +20)	13: LAB Stbd Zenith (-180, -35)	SRMS Elbow (+90, -60)

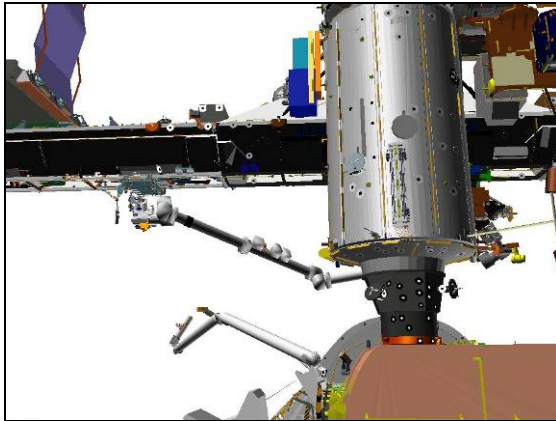


Figure 1.- APFR Ingress  
(91: Camera B: -5, +15).

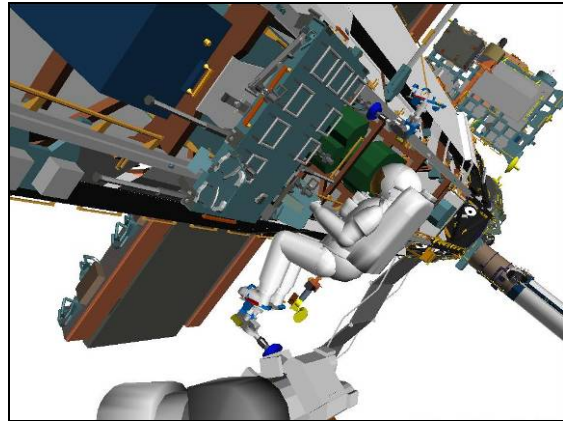


Figure 2.- APFR Ingress  
(24: Tip Elbow: +10, +20).

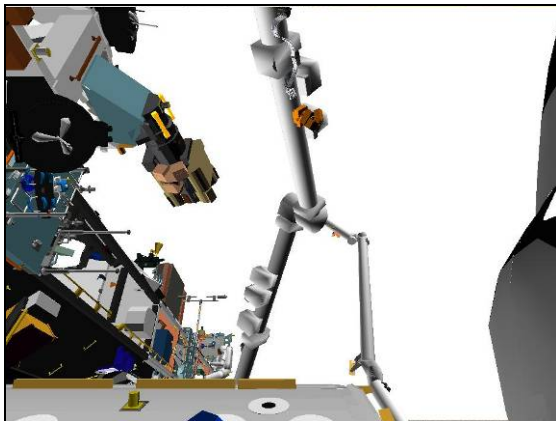


Figure 3.- APFR Ingress  
(13: LAB Stbd Zenith: -180, -35).

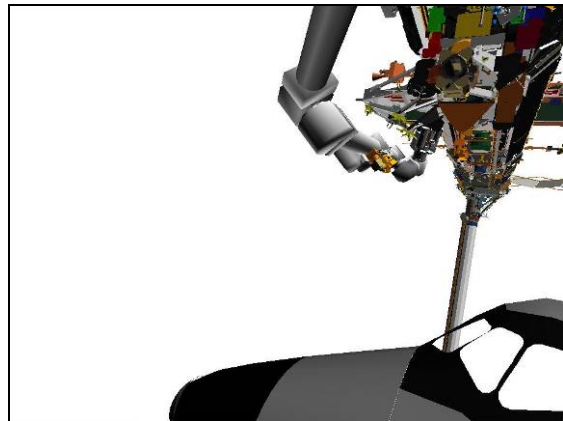


Figure 4.- APFR Ingress  
(V10: SRMS Elbow: +90, -60).

PCS

MSS: SSRMS:

Verify Unloaded Parameters – √

Verify 'Unloaded Parameters' (two) – Chest 12/PP/A/6, SY Held

Verify Display – W4>ISSACS

Verify Command – SSRMS>Internal

√Vernier

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Verify SSRMS at APFR Egress/Ingress position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+51.4	-30.0	-119.4	-38.0	+35.4	-12.0	+63.9
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:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: 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).

		Locked				
	SR	SY	SP	EP	WP	WY
	+51.4	-30.0	-119.4	-38.0	+35.4	-12.0
	X	Y	Z	Pitch	Yaw	Roll
	+285	-995	-5	±180.0	0.0	±180.0
APFR Ingress 1: X + 2: Z -		+400				
			-955			
Port Zenith Clearance		+400	-995	-955	±180.0	0.0
		SR	SY	SP	EP	WP
	+77.9	-30.0	-107.7	-14.7	-12.3	+6.1
	FOR	Unloaded – Chest 12/PP/A/6, SY Held				
	Disp	W4>ISSACS				



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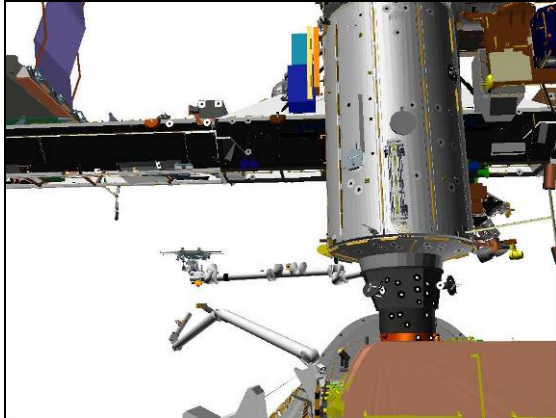


Figure 5.- Port Zenith Clearance  
(91: Camera B: -5, +15).

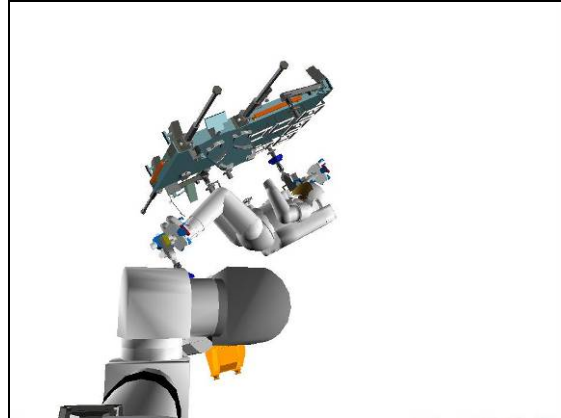


Figure 6.- Port Zenith Clearance  
(24: Tip Elbow: +10, +10).

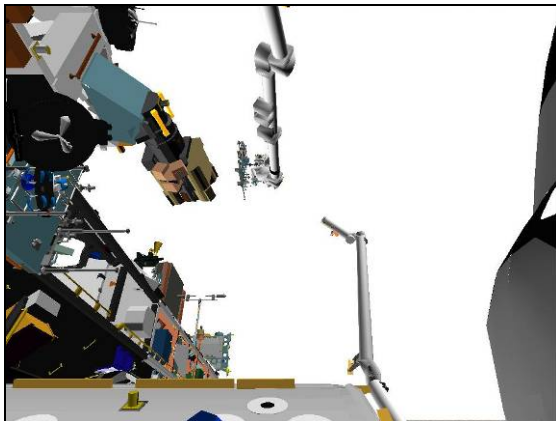


Figure 7.- Port Zenith Clearance  
(13: LAB Stbd Zenith: -180, -35).

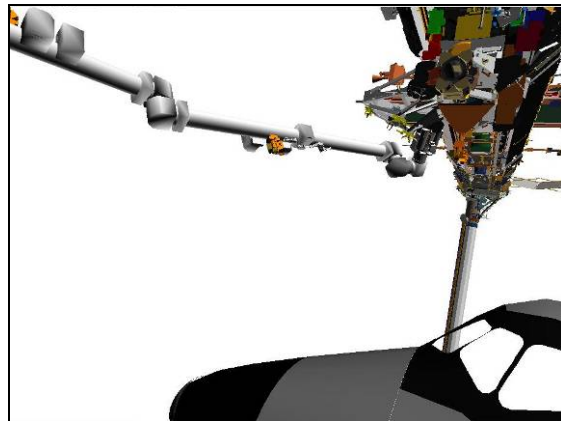


Figure 8.- Port Zenith Clearance  
(V10: SRMS Elbow: +90, -60).

### 3. ZENITH INTERMEDIATE POSITION MANEUVER

RHC

RATE → COARSE (Verify Coarse on PCS)

PCS

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W4MBS2 ► Zenith Intermediate

Verify 'Joint Angles' 'Destination' for Zenith Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0

cmd Load (Verify Sequence Status – Confirm or Cancel)

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+77.9	-30.0	-107.7	-14.7	-12.3	+6.1	+78.1
<b>TGT</b>	<b>+107.2</b>	<b>0.0</b>	<b>-55.6</b>	<b>-54.3</b>	<b>-34.1</b>	<b>+47.0</b>	<b>+81.0</b>
<b>ERR</b>	-29.3	-30.0	-52.1	+39.6	+21.8	-40.9	-2.9

\*\*\*\*\*

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 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0

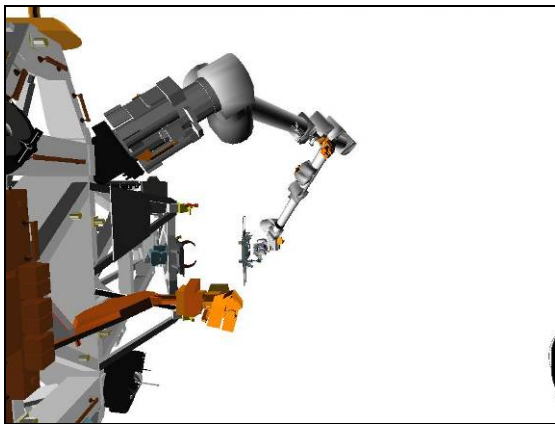


Figure 9.- Zenith Intermediate (13: LAB Stbd Zenith: -180, +15).

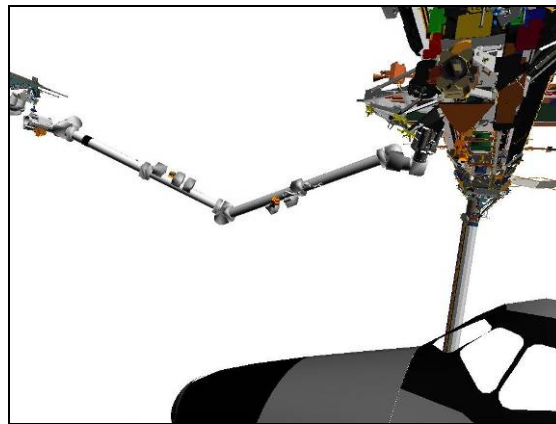


Figure 10.- Zenith Intermediate (V10: SRMS Elbow: +90, -60).

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## 4. STARBOARD ZENITH CLEARANCE POSITION MANEUVER

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (+25, +5)	22: Base Elbow (-130, -5)	13: LAB Stbd Zenith (-180, +30)	91: SRMS Elbow (+90, -60)

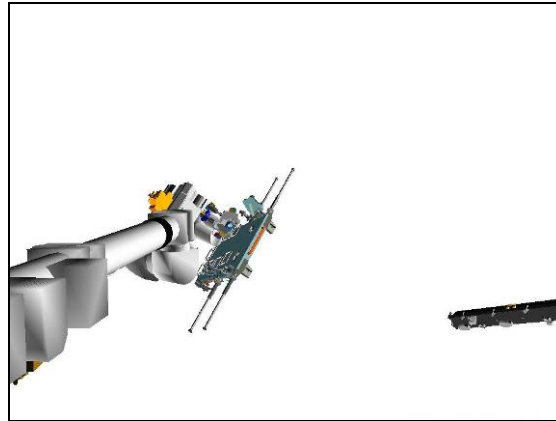


Figure 11.- Zenith Intermediate  
(22: Base Elbow: -130, -5).

MSS: SSRMS:

pick File ► W4MBS2 ► Stbd Zen Clearance

Verify 'Joint Angles' 'Destination' for Starboard Zenith Clearance position.

SR	SY	SP	EP	WP	WY	WR
+177.6	0.0	-13.7	-64.3	-147.2	+38.5	+183.9

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0
<b>TGT</b>	<b>+177.6</b>	<b>0.0</b>	<b>-13.7</b>	<b>-64.3</b>	<b>-147.2</b>	<b>+38.5</b>	<b>+183.9</b>
<b>ERR</b>	-70.4	0.0	-41.9	+10.0	+113.1	+8.5	-102.9

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```

*****
* 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 2.5 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+177.6	0.0	-13.7	-64.3	-147.2	+38.5	+183.9

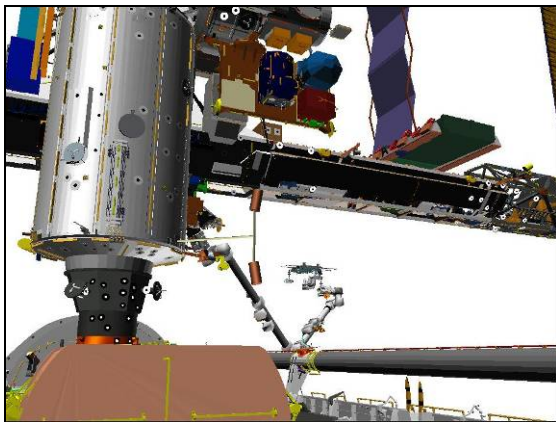


Figure 12.- Starboard Zenith Clearance  
 (91: Camera B: +25, +15).

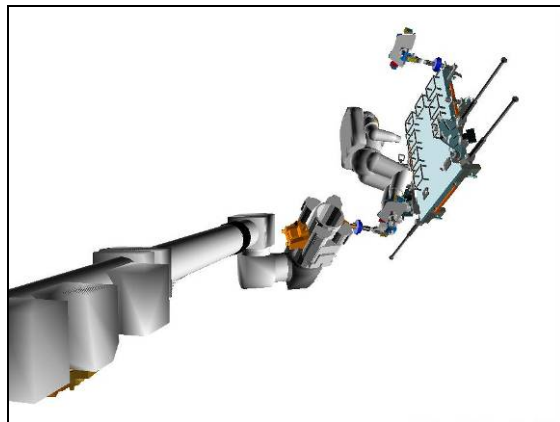


Figure 13.- Starboard Zenith Clearance  
 (22: Base Elbow: -130, -5).

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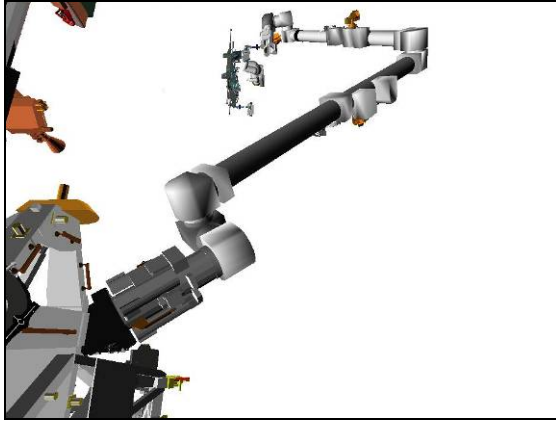


Figure 14.- Starboard Zenith Clearance  
(13: LAB Stbd Zenith: -180, +40).

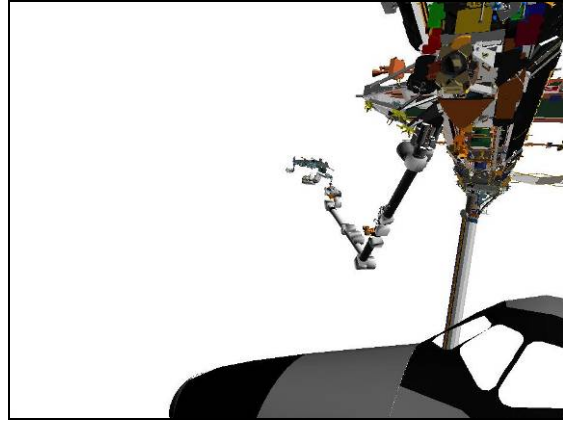


Figure 15.- Starboard Zenith Clearance  
(V10: SRMS Elbow: +90, -60).

### 5. CETA CART INSTALLATION

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (+25, +15)	22: Base Elbow (-110, -5) 24: Tip Elbow (+10, +20)	03: S1 Lower Outboard (+60, -40) 13: LAB Stbd Zenith (-180, +30)	SRMS Elbow (+90, -60)

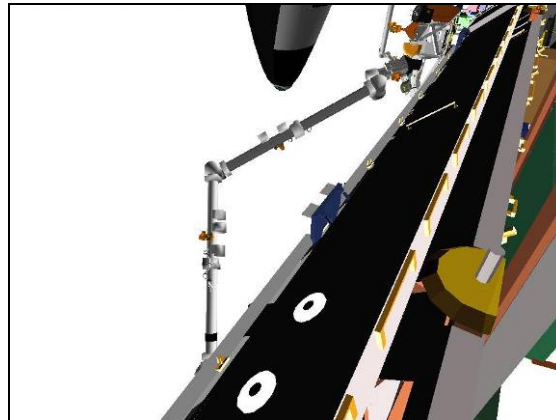


Figure 16.- Starboard Zenith Clearance  
(03: S1 Lower Outboard: +60, -40).

RHC

RATE → VERNIER (Verify Vernier on PCS)

PCS

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

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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).

Stbd Zenith  
Clearance  
1: Z +  
2: X -  
CETA Cart  
Delivery

	Locked					
SR	SY	SP	EP	WP	WY	WR
+177.6	0.0	-13.7	-64.3	-147.2	+38.5	+183.9
X	Y	Z	Pitch	Yaw	Roll	
+400	+1440	-955	±180.0	0.0	±180.0	
		-5				
+300						
+300	+1440	-5	±180.0	0.0	±180.0	
SR	SY	SP	EP	WP	WY	WR
+230.7	0.0	-17.3	-86.1	-133.1	-4.0	+218.3
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.

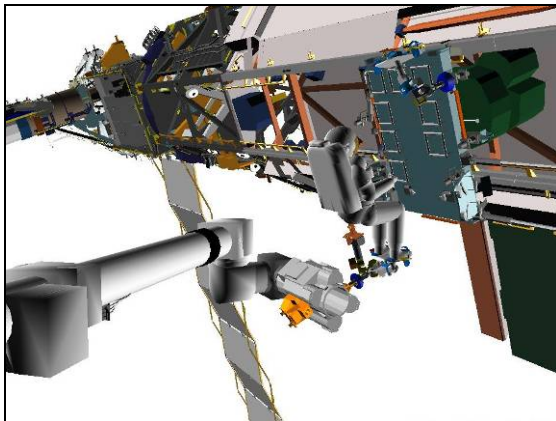


Figure 17.- CETA Cart Delivery  
(22: Base Elbow: -110, -5).

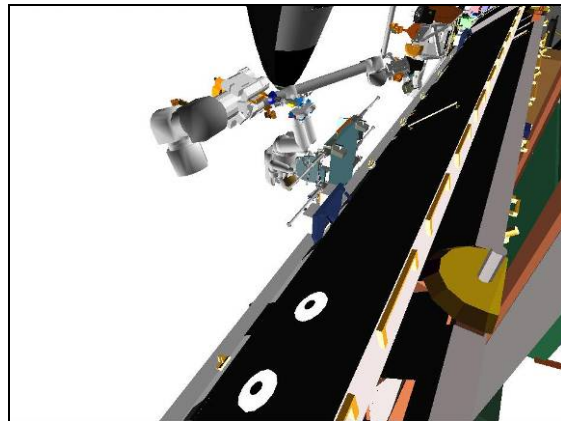


Figure 18.- CETA Cart Delivery  
(03: S1 Lower Outboard: +60, -40).

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## 6. STBD ZENITH CLEARANCE POSITION MANEUVER

On EV GO, CETA cart secured:

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

CETA Cart Delivery 1: X + 2: Z - Stbd Zenith Clearance		Locked					
	SR	SY	SP	EP	WP	WY	WR
	+230.7	0.0	-17.3	-86.1	-133.1	-4.0	+218.3
	X	Y	Z	Pitch	Yaw	Roll	
	+300	+1440	-5	±180.0	0.0	±180.0	
	+400						
			-955				
	+400	+1440	-955	±180.0	0.0	±180.0	
	SR	SY	SP	EP	WP	WY	WR
	+177.6	0.0	-13.7	-64.3	-147.2	+38.5	+183.9
FOR	Unloaded – Chest 12/PP/A/6, SY Held						
Disp	W4>ISSACS						

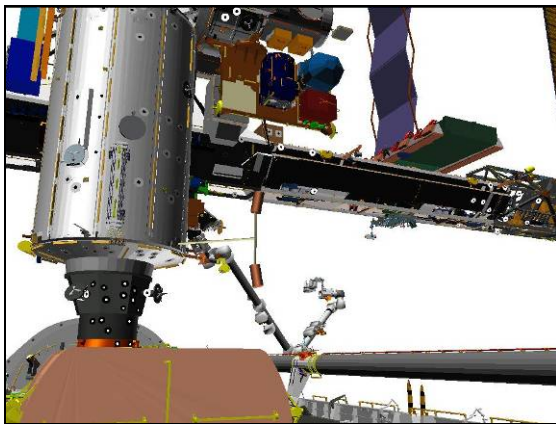


Figure 19.- Starboard Zenith (91: Camera B: +25,+15).

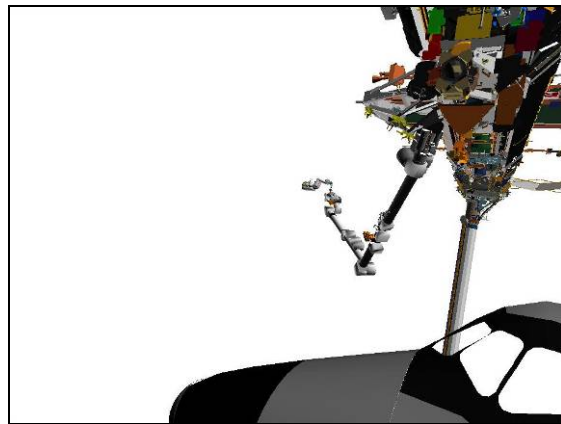


Figure 20.- Starboard Zenith (V10: SRMS Elbow: +90, -60).

## 7. ZENITH INTERMEDIATE POSITION MANEUVER

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

RHC RATE → COARSE (Verify Coarse on PCS)

pick File ► W4MBS2 ► Zenith Intermediate

**1.520 SSRMS CETA CART RELOCATE**

Verify 'Joint Angles' 'Destination' for Zenith Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+177.6	0.0	-13.7	-64.3	-147.2	+38.5	+183.9
<b>TGT</b>	<b>+107.2</b>	<b>0.0</b>	<b>-55.6</b>	<b>-54.3</b>	<b>-34.1</b>	<b>+47.0</b>	<b>+81.0</b>
<b>ERR</b>	+70.4	0.0	+41.9	-10.0	-113.1	-8.5	+102.9

\*\*\*\*\*

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.

SR	SY	SP	EP	WP	WY	WR
+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0



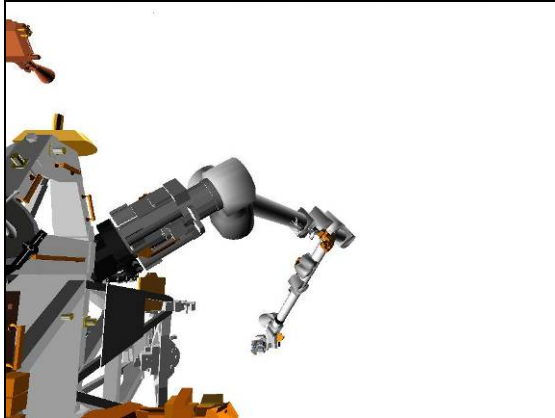


Figure 21.- Zenith Intermediate  
 (13: LAB Stbd Zenith: -180, +30).

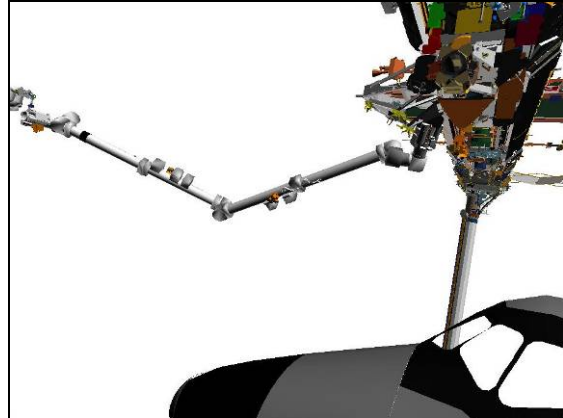


Figure 22.- Zenith Intermediate  
 (V10: SRMS Elbow: +90, -60).

8. PORT ZENITH CLEARANCE POSITION MANEUVER

SSRMS Joint OCAS

pick File ► W4MBS2 ► Port Zen Clearance

Verify 'Joint Angles' 'Destination' for Port Zenith Clearance position.

SR	SY	SP	EP	WP	WY	WR
+77.9	-30.0	-107.7	-14.8	-12.2	+6.1	+78.1

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0
<b>TGT</b>	<b>+77.9</b>	<b>-30.0</b>	<b>-107.7</b>	<b>-14.8</b>	<b>-12.2</b>	<b>+6.1</b>	<b>+78.1</b>
<b>ERR</b>	+29.3	+30.0	+52.1	-39.5	-21.9	+40.9	+2.9

\*\*\*\*\*

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)

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### NOTE

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+77.9	-30.0	-107.7	-14.8	-12.2	+6.1	+78.1

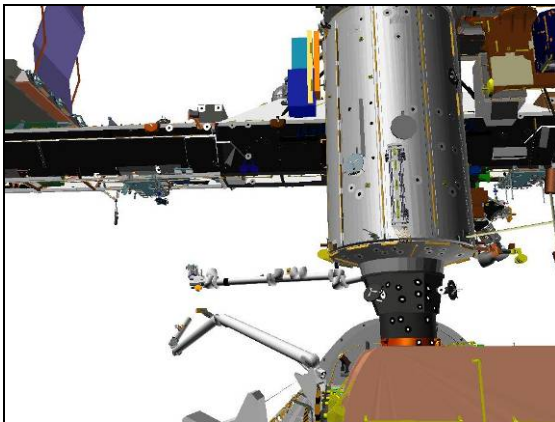


Figure 23.- Port Zenith  
(91: Camera B: -5, +15).

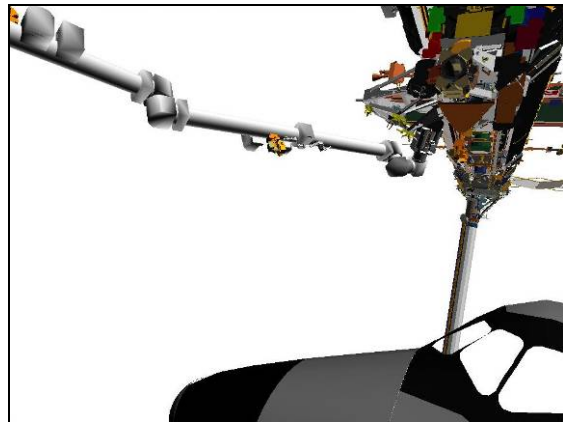


Figure 24.- Port Zenith  
(V10: SRMS Elbow: +90, -60).

### 9. CETA CART PICKUP

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

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THC/  
RHC

Maneuver to CETA Cart Pickup position (within 5 cm/1 deg).

		Locked						
		SR	SY	SP	EP	WP	WY	WR
		+77.9	-30.0	-107.7	-14.8	-12.2	+6.1	+78.1
		X	Y	Z	Pitch	Yaw	Roll	
Port Zenith		+401	-995	-954	±180.0	0.0	±180.0	
1: Z +				-5				
2: X -		+285						
Cart Pickup		+285	-995	-5	±180.0	0.0	±180.0	
		SR	SY	SP	EP	WP	WY	WR
		+51.4	-30.0	-119.4	-38.0	+35.4	-12.0	+63.9
FOR		Unloaded – Chest 12/PP/A/6, SY Held						
Disp		W4>ISSACS						

Perform EVA GCA as required for CETA cart pickup.

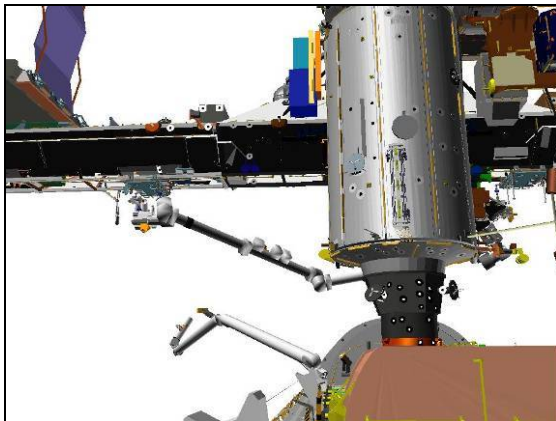


Figure 25.- Cart Pickup  
(91: Camera B: -5, +15).

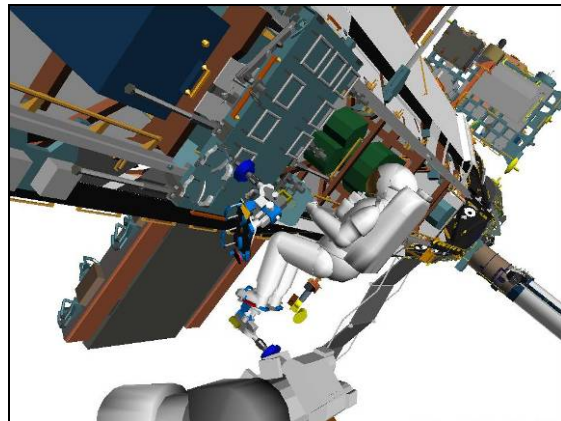


Figure 26.- Cart Pickup  
(24: Tip Elbow: +10, +20).

### 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).

		Locked						
		SR	SY	SP	EP	WP	WY	WR
		+51.4	-30.0	-119.4	-38.0	+35.4	-12.0	+63.9
		X	Y	Z	Pitch	Yaw	Roll	
Cart Pickup		+285	-995	-5	±180.0	0.0	±180.0	
1: X +		+400						
2: Z -				-955				
Port Zenith		+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						

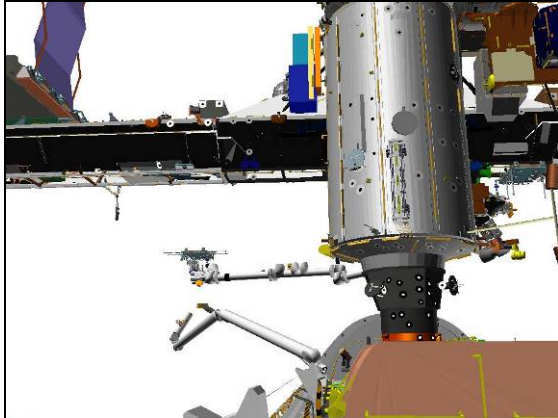


Figure 27.- Port Zenith Clearance  
 (91: Camera B: -5, +15).

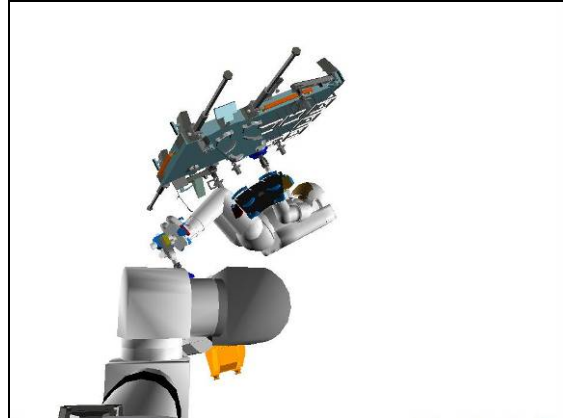


Figure 28.- Port Zenith Clearance  
 (24: Tip Elbow: +10, +10).

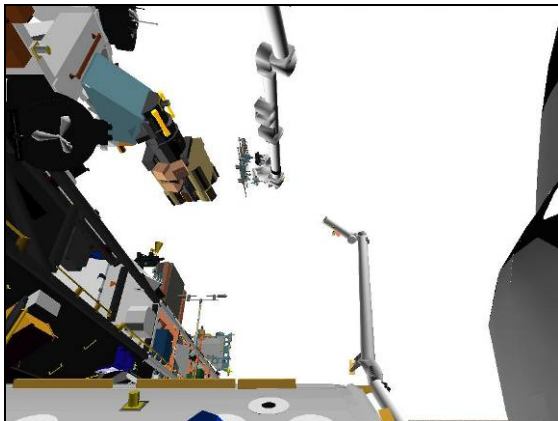


Figure 29.- Port Zenith Clearance  
 (13: LAB Stbd Zenith: -180, -35).

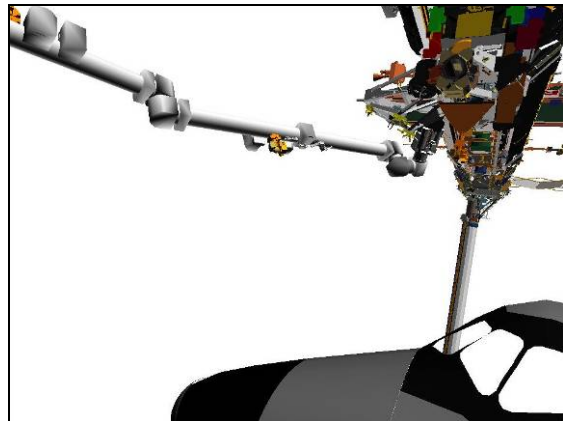


Figure 30.- Port Zenith Clearance  
 (V10: SRMS Elbow: +90, -60).

**11. MANEUVERING TO ZENITH INTERMEDIATE POSITION**

RHC RATE → COARSE (Verify Coarse on PCS)

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► W4MBS2 ► Zenith Intermediate

Input 'Joint Angles' 'Destination' for Zenith Intermediate position.

SR	SY	SP	EP	WP	WY	WR
+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0

cmd Load (Verify Sequence Status – Confirm or Cancel)

# 1.520 SSRMS CETA CART RELOCATE

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+77.9	-30.0	-107.7	-14.7	-12.3	+6.1	+78.1
<b>TGT</b>	<b>+107.2</b>	<b>0.0</b>	<b>-55.6</b>	<b>-54.3</b>	<b>-34.1</b>	<b>+47.0</b>	<b>+81.0</b>
<b>ERR</b>	-29.3	-30.0	-52.1	+39.6	+21.8	-40.9	-2.9

\*\*\*\*\*

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 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0

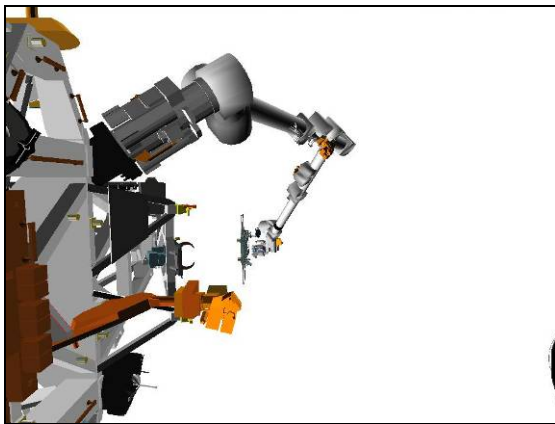


Figure 31.- Zenith Intermediate (13: LAB Stbd Zenith: -180, +15).

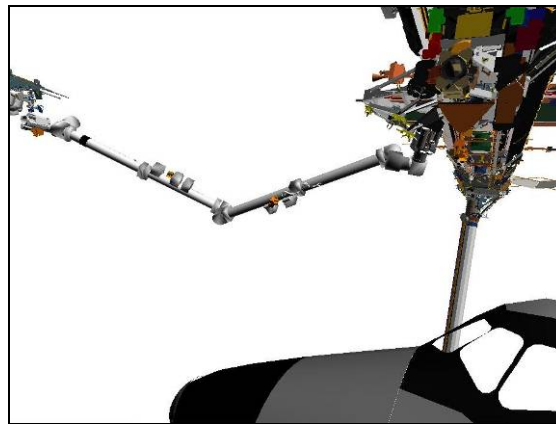


Figure 32.- Zenith Intermediate (V10: SRMS Elbow: +90, -60).

# 1.520 SSRMS CETA CART RELOCATE

## 12. STARBOARD ZENITH CLEARANCE POSITION MANEUVER

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (+25, +15)	22: Base Elbow (-130, -5)	13: LAB Stbd Zenith (-180, +40)	91: SRMS Elbow (+90, -60)

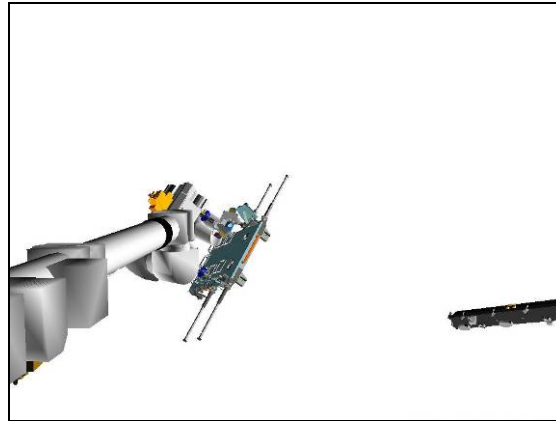


Figure 33.- Zenith Intermediate  
(22: Base Elbow: -130, -5).

MSS: SSRMS:

pick File ► W4MBS2 ► Stbd Zen Clearance

Input 'Joint Angles' 'Destination' for Starboard Zenith Clearance position.

SR	SY	SP	EP	WP	WY	WR
+177.6	0.0	-13.7	-64.3	-147.2	+38.5	+183.9

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

MON

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+107.2	0.0	-55.6	-54.3	-34.1	+47.0	+81.0
<b>TGT</b>	<b>+177.6</b>	<b>0.0</b>	<b>-13.7</b>	<b>-64.3</b>	<b>-147.2</b>	<b>+38.5</b>	<b>+183.9</b>
<b>ERR</b>	-70.4	0.0	-41.9	+10.0	+113.1	+8.5	-102.9

# 1.520 SSRMS CETA CART RELOCATE

\*\*\*\*\*

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.

SR	SY	SP	EP	WP	WY	WR
+177.6	0.0	-13.7	-64.3	-147.2	+38.5	+183.9

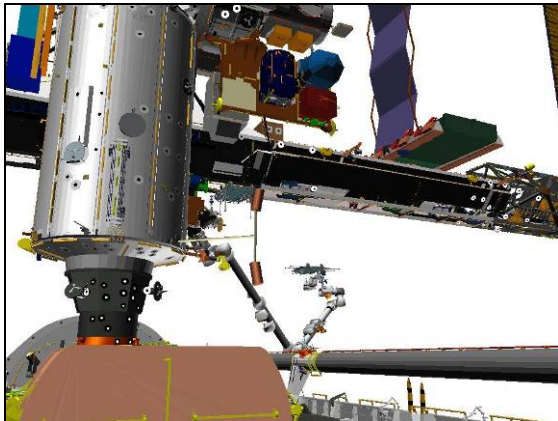


Figure 34.- Starboard Zenith Clearance (91: Camera B: +25, +15).

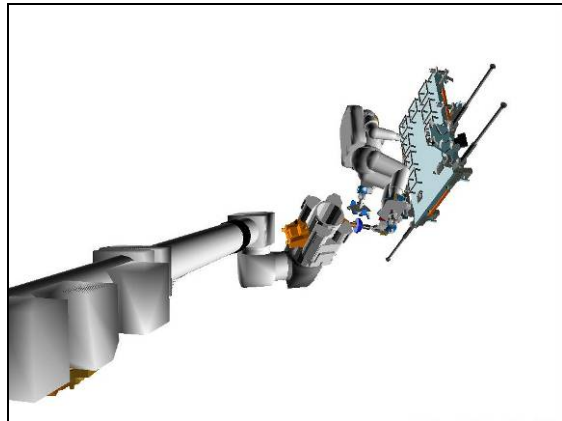


Figure 35.- Starboard Zenith Clearance (22: Base Elbow: -130, -5).

## 1.520 SSRMS CETA CART RELOCATE

(RBT FS/13A.1/FIN 1)

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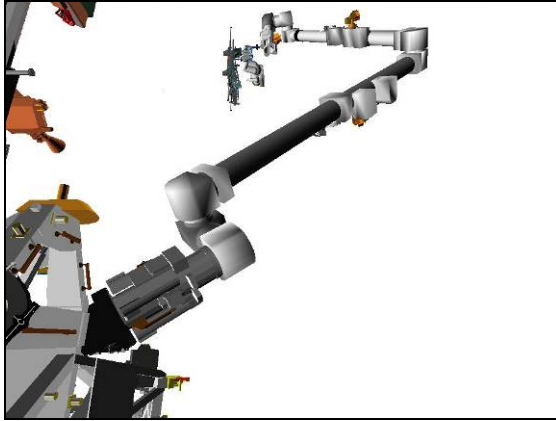


Figure 36.- Starboard Zenith Clearance  
(13: LAB Stbd Zenith: -180, +40).

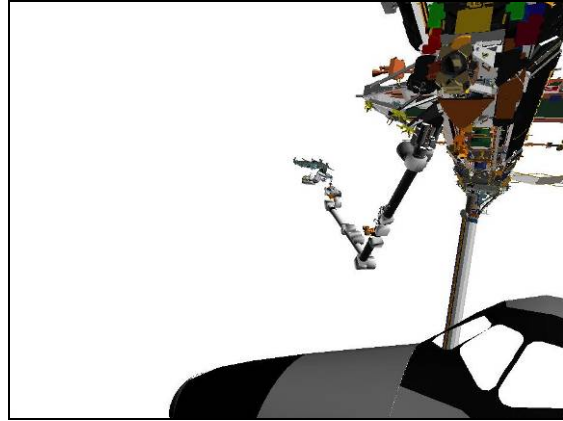


Figure 37.- Starboard Zenith Clearance  
(V10: SRMS Elbow: +90, -60).

### 13. CETA CART INSTALLATION AND APFR EGRESS

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
91: Camera B (+25, +15)	22: Base Elbow (-110, -5)	03: S1 Lower Outboard (+60, -40)	SRMS Elbow (+90, -60)

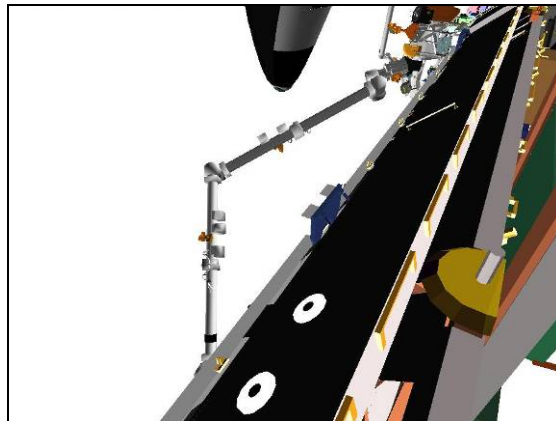


Figure 38.- Starboard Zenith Clearance  
(03: S1 Lower Outboard: +60, -40).

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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



# 1.520 SSRMS CETA CART RELOCATE

THC/ RHC Maneuver to CETA Cart Delivery position (within 5 cm/1 deg).

		Locked						
	SR	SY	SP	EP	WP	WY	WR	
	+177.6	0.0	-13.7	-64.3	-147.2	+38.5	+183.9	
	X	Y	Z	Pitch	Yaw	Roll		
Stbd Zenith Clearance	+399	+1440	-955	±180.0	0.0	±180.0		
1: Z +			-5					
2: X -	+300							
CETA Cart Delivery	+300	+1440	-5	±180.0	0.0	±180.0		
	SR	SY	SP	EP	WP	WY	WR	
	+230.5	0.0	-17.1	-86.2	-133.2	-3.8	+218.2	
	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.

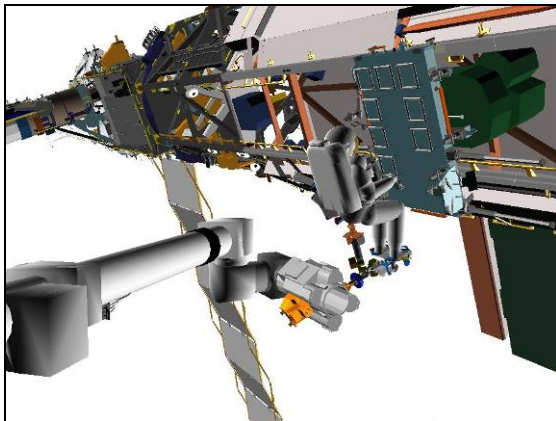


Figure 39.- CETA Cart Delivery (22: Base Elbow: -110, -5).

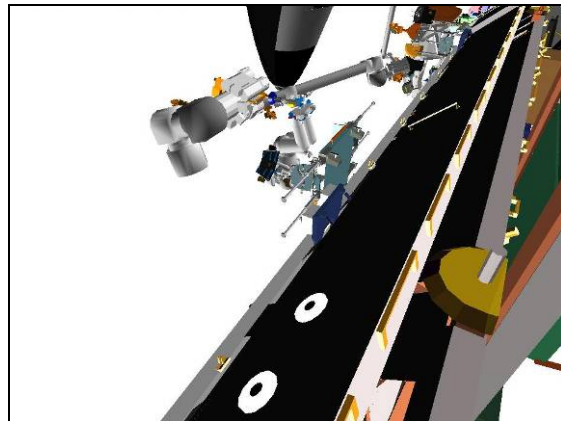


Figure 40.- CETA Cart Delivery (03: S1 Lower Outboard: +60, -40).

On EV GO, ready for APFR egress:

Perform EVA GCA as required for APFR egress.

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

## 14. APFR REMOVAL

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

# 1.520 SSRMS CETA CART RELOCATE

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).

	Locked					
SR	SY	SP	EP	WP	WY	WR
+222.8	0.0	-12.7	-88.7	-135.1	+2.5	+214.0
X	Y	Z	Pitch	Yaw	Roll	
+388	+1444	+11	+29.3	-89.9	+136.3	*
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).

	Locked					
SR	SY	SP	EP	WP	WY	WR
+222.8	0.0	-12.7	-88.7	-135.1	+2.5	+214.0
X	Y	Z	Pitch	Yaw	Roll	
+388	+1444	+11	+29.3	-89.9	+136.3	*
FOR	Unloaded – LEE Tip, SY Held					
Disp	W4>ISSACS					

\*Display singularity

# 1.520 SSRMS CETA CART RELOCATE

(RBT FS/13A.1/FIN 1)

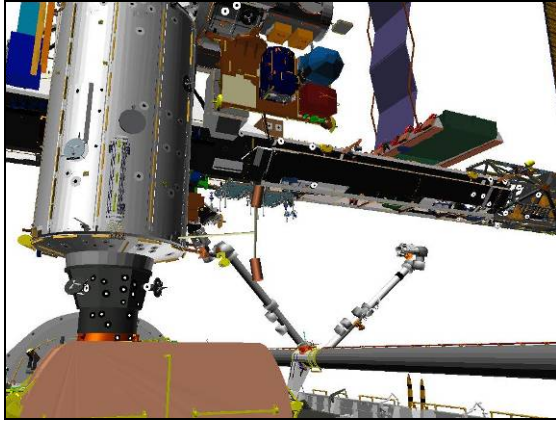


Figure 41.- SSRMS Clearance  
(91: Camera B: +25, +15).

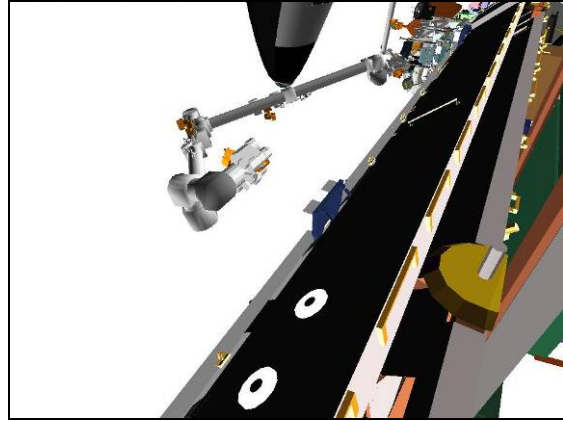


Figure 42.- SSRMS Clearance  
(03: S1 Lower Outboard: +60, -40).

## 15. WRIST RECONFIGURATION FOR UNDOCK

PCS

MSS: SSRMS:

Enter Mode – Single (Verify blue)

<b>WARNING</b>
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).

	SR	SY	SP	EP	WP	WY	WR
SSRMS Clearance	+222.8	0.0	-12.7	-88.7	-135.1	+2.5	+214.0
1: WP +					-88.0		
2: WY +						+113.0	
SSRMS Park	+222.8	0.0	-12.7	-88.7	-88.0	+113.0	+214.0
	X	Y	Z	Pitch	Yaw	Roll	
	+408	+1662	-131	+89.9	+13.0	-97.4	
FOR	Unloaded – LEE Tip, SY Held						
Disp	W4>ISSACS						

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

DCP

SAFING → SAFE (Verify ON)

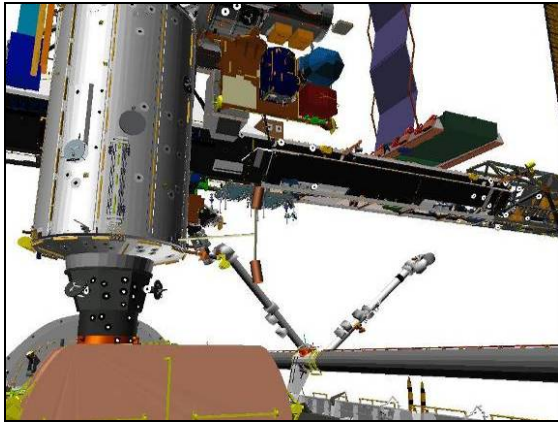


Figure 43.- SSRMS Park  
(91: Camera B: +25, +15).

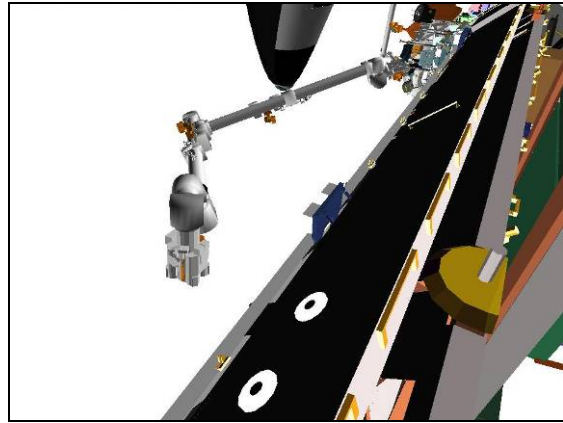


Figure 44.- SSRMS Park  
(03: S1 Lower Outboard: +60, -40).

CONTINGENCY

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## 2.100 S5 SOFT DOCK ACQUISITION

(RBT FS/13A.1/FIN 1)

Page 1 of 3 pages

### 1. SSRMS LIMP AND DELIMP

PCS

MSS: SSRMS:

Verify 'Loaded Parameters' (two) – S5 Install, SR Held

√Command – SSRMS>Internal

Enter Mode – Standby (Verify blue)

MSS: SSRMS: Limp:

**cmd** All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

Wait 30 seconds.

MSS: SSRMS: Limp:

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

### 2. MANUAL MODE SETUP

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

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

If at least one softdock indicator is already acquired

MSS: SSRMS: SSRMS Manual: POHS:

**cmd** All DOFs Off

MSS: SSRMS: Manual:

Verify 'X' 'Y' 'Z' 'Pitch' 'Yaw' 'Roll' (six) – Off

## 2.100 S5 SOFT DOCK ACQUISITION

(RBT FS/13A.1/FIN 1)

Page 2 of 3 pages

### 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

Missing Softdock	THC/RHC Input
1	-Pitch,-Yaw
2	+Pitch,-Yaw
3	-Pitch,+Yaw
4	+Pitch,+Yaw
1,3	-Pitch
2,4	+Pitch
1,2	-Yaw
3,4	+Yaw
1,2,3	-Pitch,-Yaw
1,2,4	+Pitch,-Yaw
1,3,4	-Pitch,+Yaw
2,3,4	+Pitch,+Yaw
All	Refer to note 3



## 2.100 S5 SOFT DOCK ACQUISITION

(RBT FS/13A.1/FIN 1)

Page 3 of 3 pages

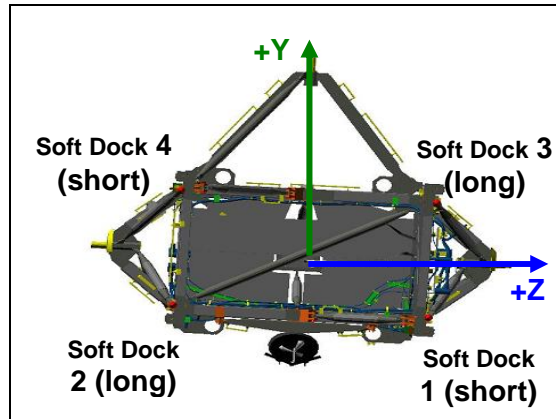


Figure 1.- S5 Install FOR.

When all four softdock indicators are acquired

Go to {1.120 SSRMS S5 INSTALL}, steps 8 and 9  
(SODF: RBT FS: S5).

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## 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.

Monitor 1	Monitor 2	Monitor 3
03: S1 Lower Outboard (+65, -30)	24: Tip Elbow (0, 0)	13: LAB Stbd Zenith (-160, 0) 91: Camera D (-90, +30)

PCS

MSS: 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).

SR	SY	SP	EP	WP	WY	WR
-140.0	+140.0	+252.5	+140.0	-43.0	-111.9	-3.1
X	Y	Z	Pitch	Yaw	Roll	
+701	+276	-377	+106.5	-18.9	-32.5	
FOR	Unloaded – LEE Tip, SR Held					
Disp	W4>LAB PDGF					

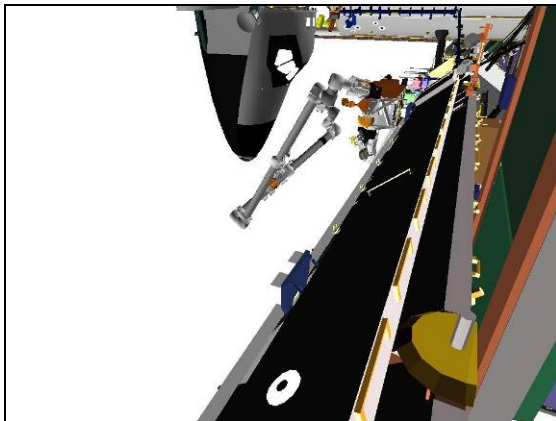


Figure 1.- MT Translate  
(03: S1 Lower Outboard: +65, -30).

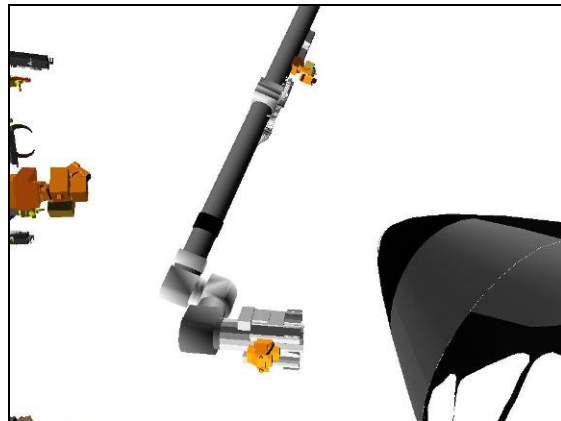


Figure 2.- MT Translate  
(13: LAB Stbd Zenith: -160, 0).

**2.200 SSRMS MANEUVER TO LAB PDGF PRE-GRAPPLE INTERMEDIATE  
- NO FI**

(RBT FS/13A.1/FIN 1)

Page 2 of 3 pages

**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.

SR	SY	SP	EP	WP	WY	WR
-158.7	+117.8	+110.0	-73.0	-144.5	+17.6	-65.4

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

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

	SR	SY	SP	EP	WP	WY	WR
(current)	-140.0	+140.0	+252.5	+140.0	-43.0	-111.9	-3.1
<b>TGT</b>	<b>-158.7</b>	<b>+117.8</b>	<b>+110.0</b>	<b>-73.0</b>	<b>-144.5</b>	<b>+17.6</b>	<b>-65.4</b>
<b>ERR</b>	<b>+18.7</b>	<b>+22.2</b>	<b>+142.5</b>	<b>+213.0</b>	<b>+101.5</b>	<b>-129.5</b>	<b>+62.3</b>

\*\*\*\*\*

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)

## 2.200 SSRMS MANEUVER TO LAB PDGF PRE-GRAPPLE INTERMEDIATE - NO FI

(RBT FS/13A.1/FIN 1)

Page 3 of 3 pages

### NOTE

1. Expect singularity warning for EP between -15 and +15 deg.
2. This Joint OCAS will take approximately 3 minutes to complete in Coarse rates.

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
-158.7	+117.8	+110.0	-73.0	-144.5	+17.6	-65.4

RHC RATE → VERNIER (Verify Vernier on PCS)

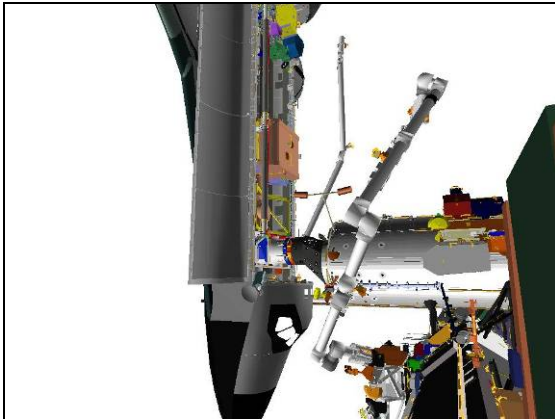


Figure 3.- LAB PDGF Pre-Grapple Intermediate  
(03: S1 Lower Outboard: +65, +10).

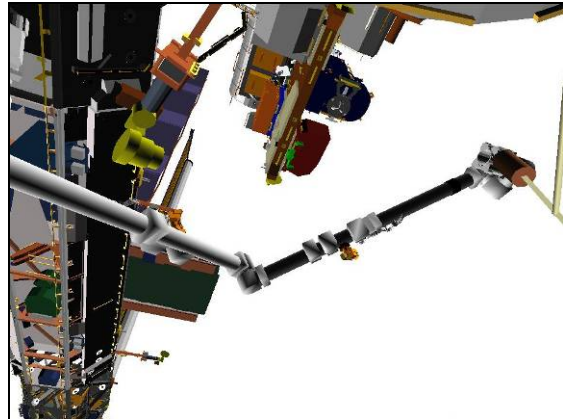


Figure 4.- LAB PDGF Pre-Grapple Intermediate  
(91: Camera D: -70, +50).

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).

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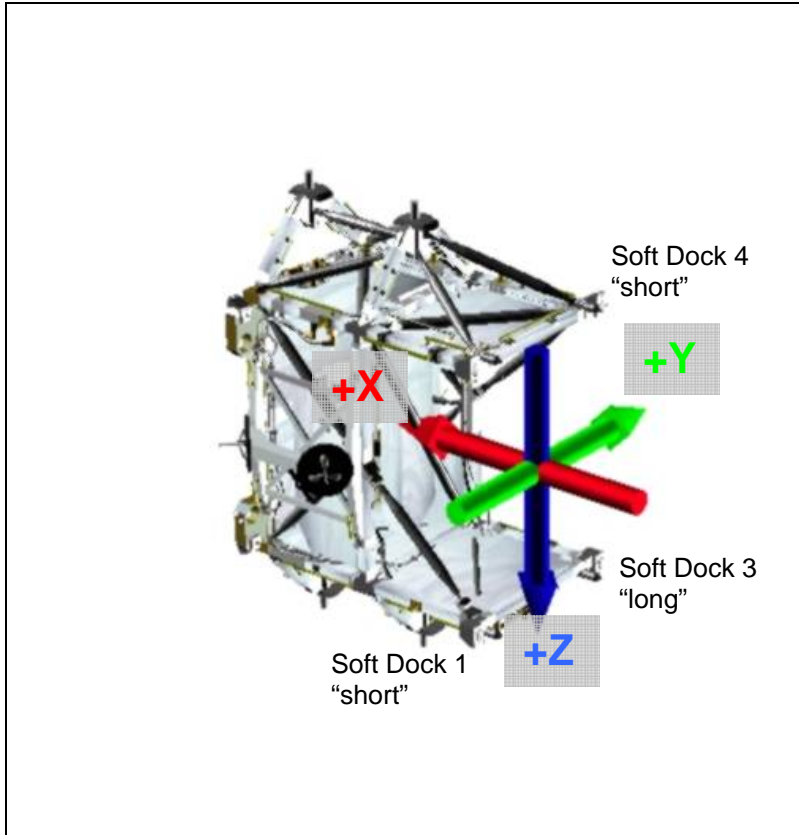
REFERENCE

REFERENCE

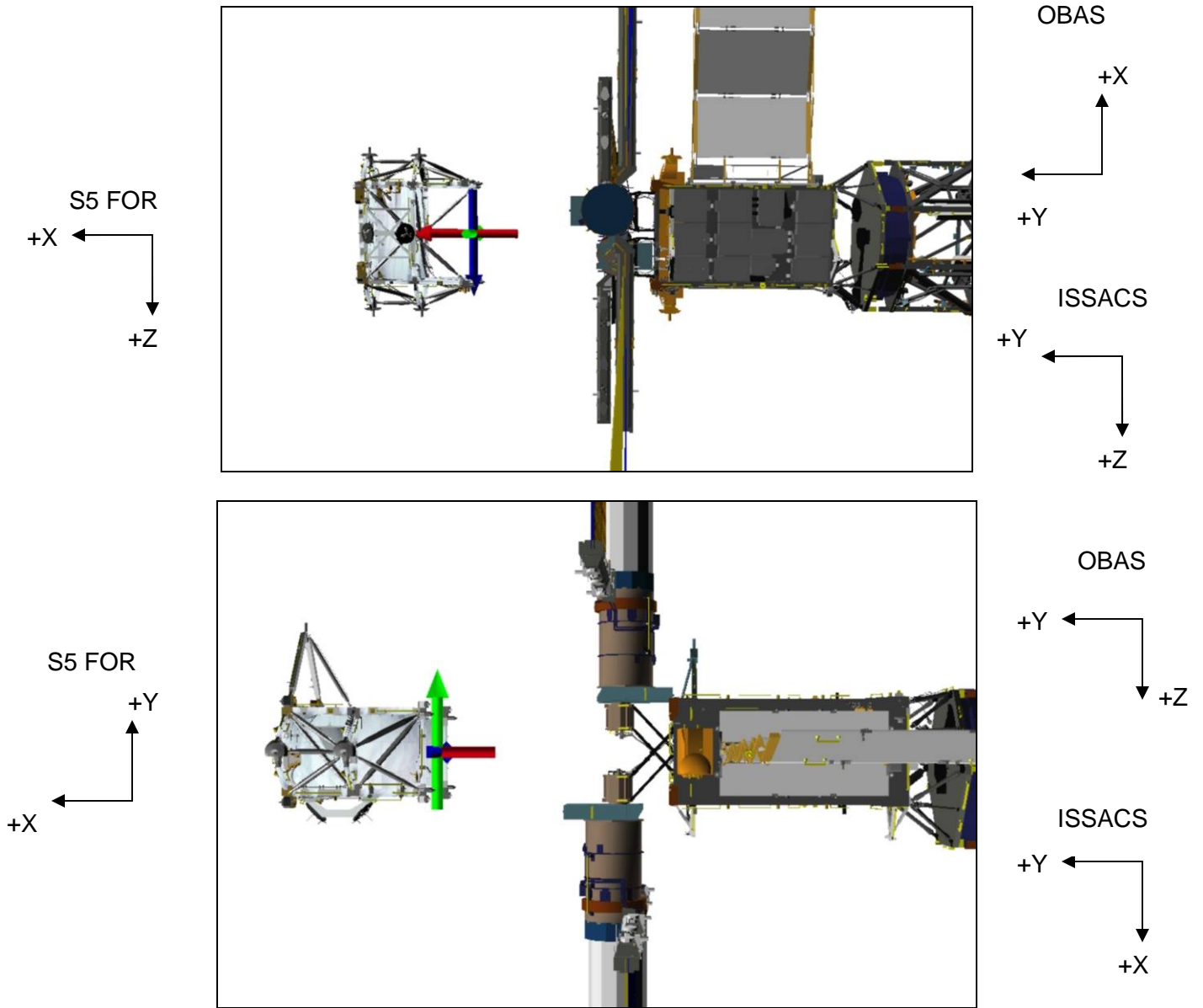
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**3.100 FRAME OF REFERENCE (FOR): S5 MANEUVER AND INSTALL**  
(RBT FS/13A.1/FIN 1) Page 1 of 2 pages



**3.100 FRAME OF REFERENCE (FOR): S5 MANEUVER AND INSTALL**  
 (RBT FS/13A.1/FIN 1) Page 2 of 2 pages



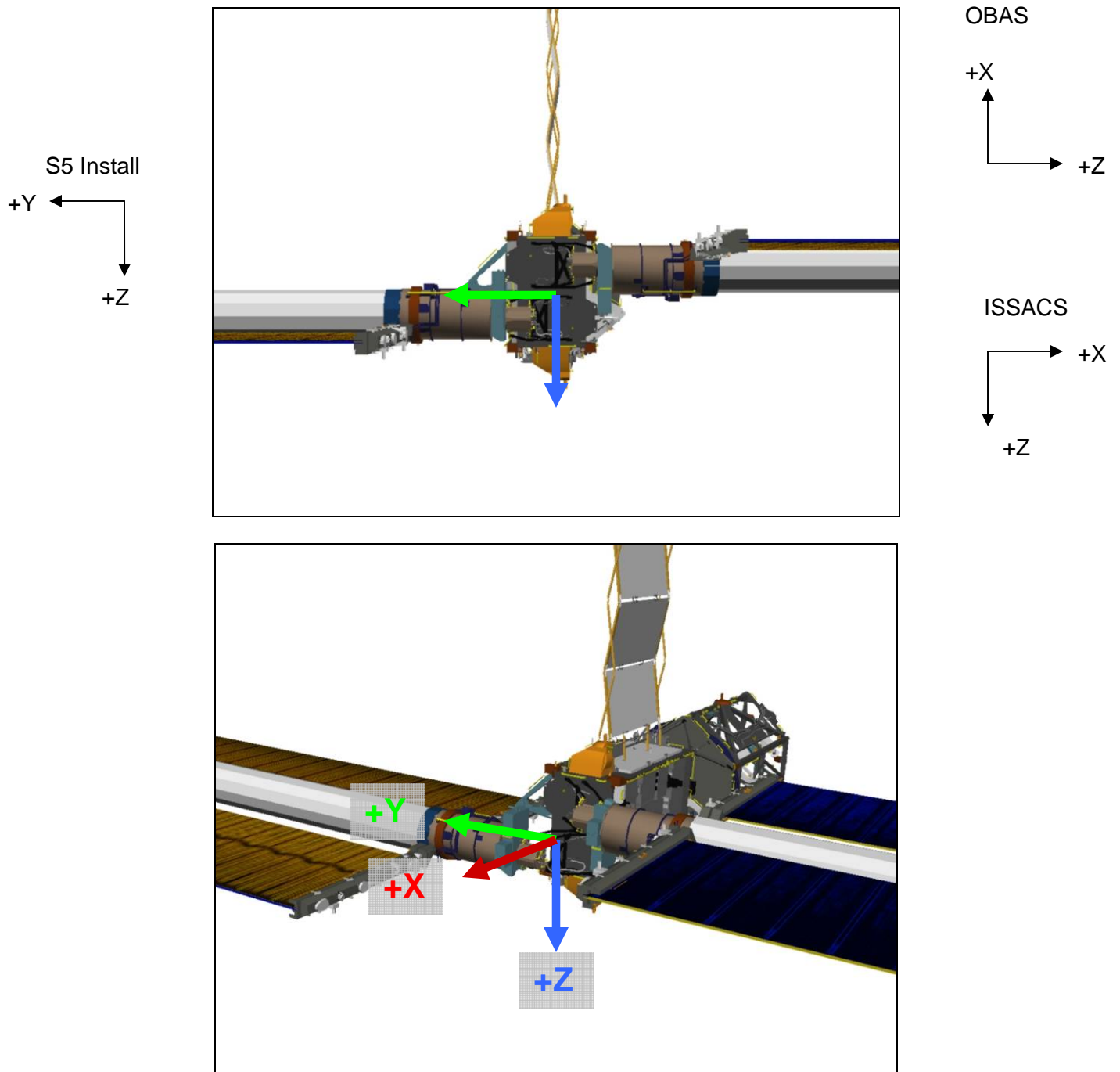
Location:

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)

Page 1 of 1 page



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).

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### 3.200 OBSS BERTHING ALIGNMENT CUES

(RBT FS/13A.1/FIN 1)

Page 1 of 2 pages

#### NOTE

The OBSS is shown at Z = -15 cm.

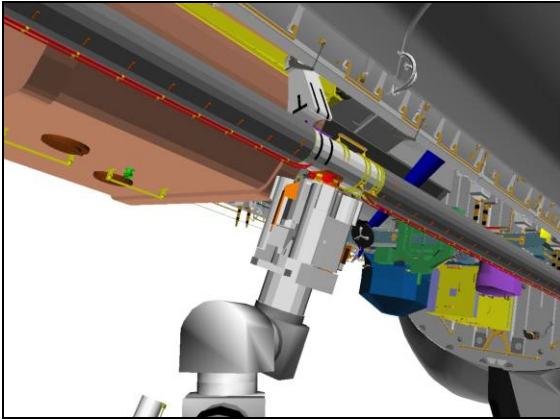


Figure 1.- Wrist Cluster  
24: Tip Elbow  
(3, 13)  
FL = 9 mm

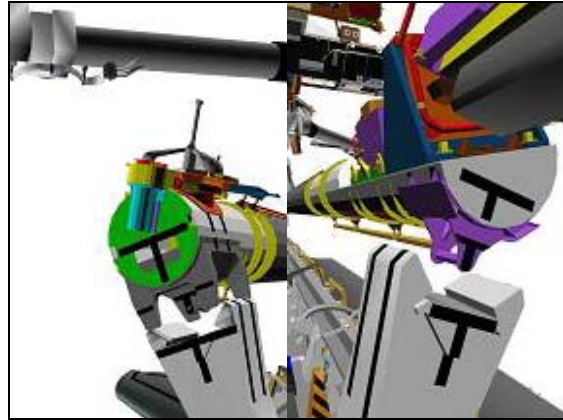


Figure 2.- OBSS Alignment  
92: Mux D/C  
(D: -25, +5) (C: +25, 0)  
Camera D FL = 10 mm

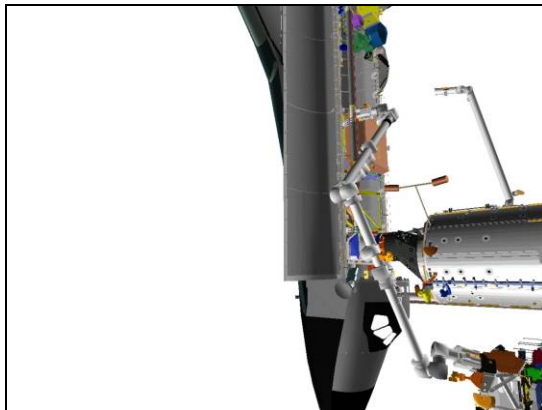


Figure 3.- Big Picture  
03: S1 Lower Outboard  
(+50, +10)  
FL = 6 mm

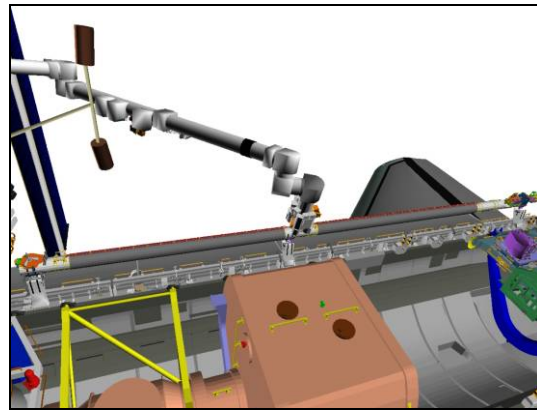


Figure 4.- OBSS Alignment  
SRMS Elbow  
(OBSS Pre-Grapple at Handoff Position)  
(-51, -10)  
FL = 6 mm

### 3.200 OBSS BERTHING ALIGNMENT CUES

(RBT FS/13A.1/FIN 1)

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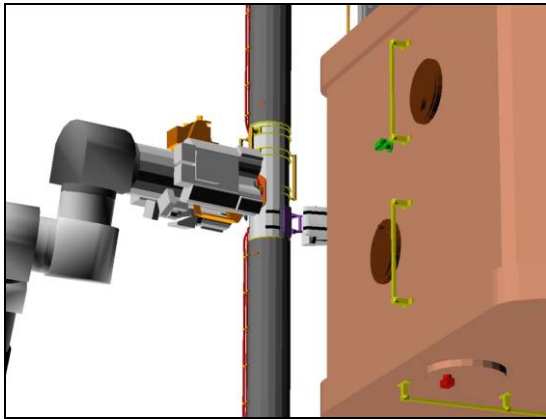


Figure 5. - Mid MPM Alignment  
09: P1 Lower Outboard  
(+112, +19)  
FL = 50 mm

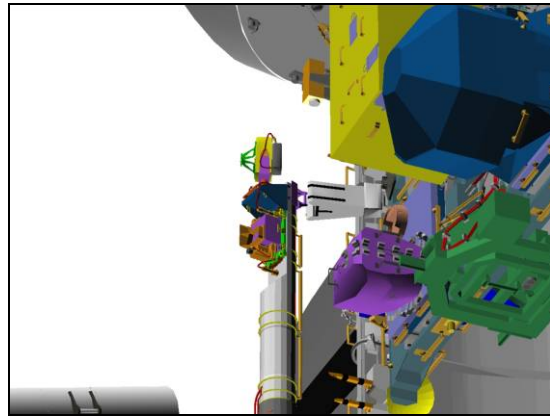


Figure 6.- Aft MPM Alignment  
09: P1 Lower Outboard  
(+112, +35)  
FL = 50 mm

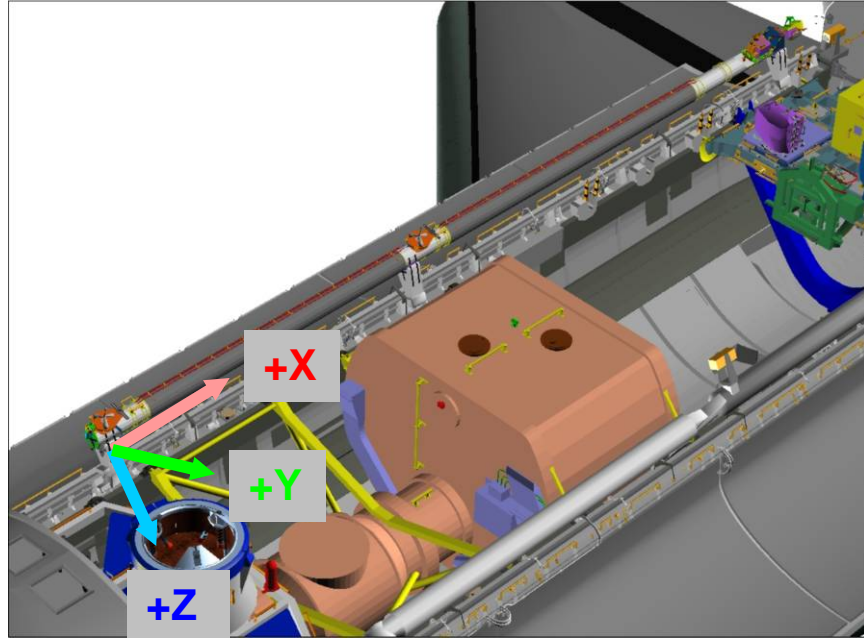


Figure 1.- OBSS Fwd MPM FOR.

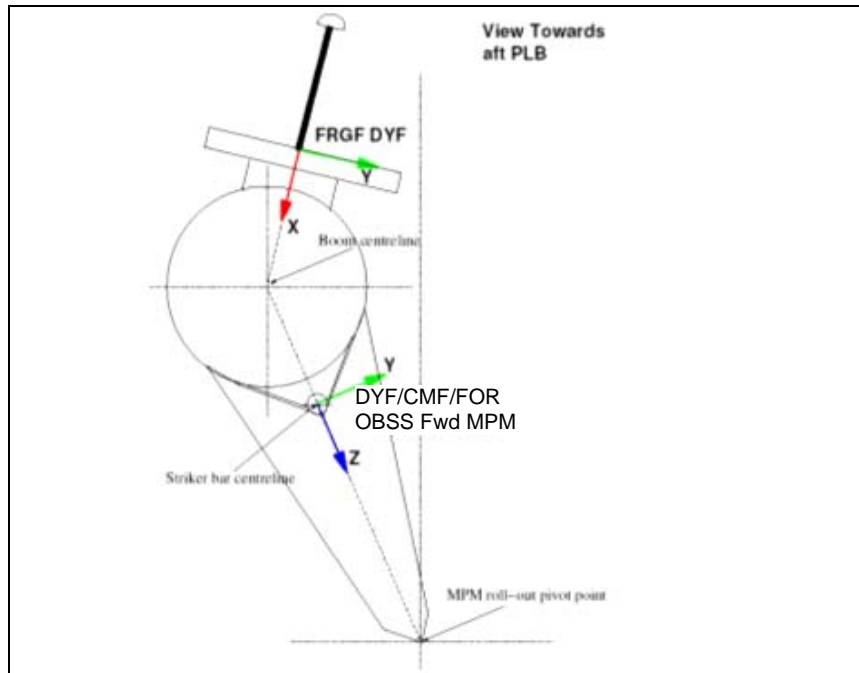


Figure 2.- OBSS Fwd MPM Command Frame, Display Frame, and FOR.

Location:

Located at FWD MRL, midpoint of OBSS striker bar centerline, when OBSS is deployed and berthed onto Orbiter Stbd MPMs.

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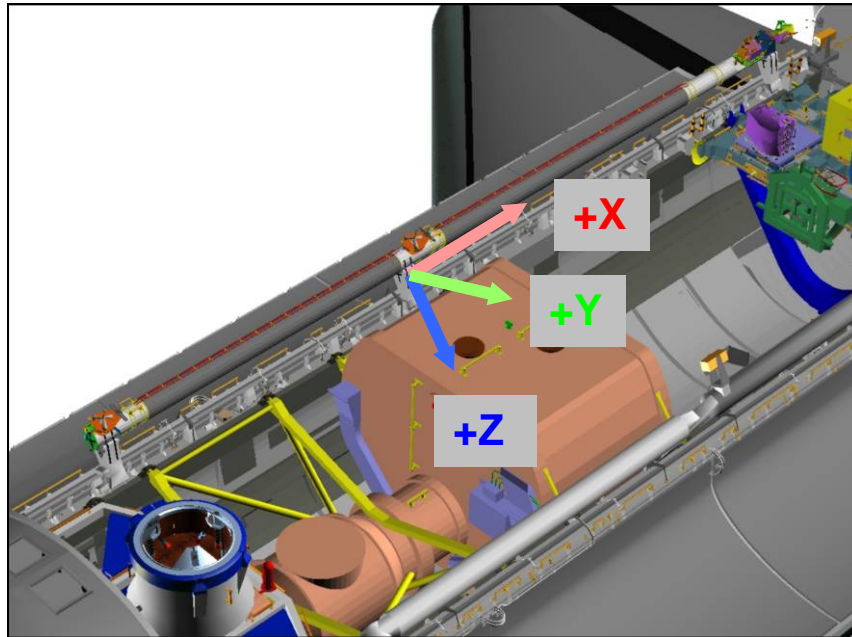


Figure 1.- OBSS Mid MPM FOR.

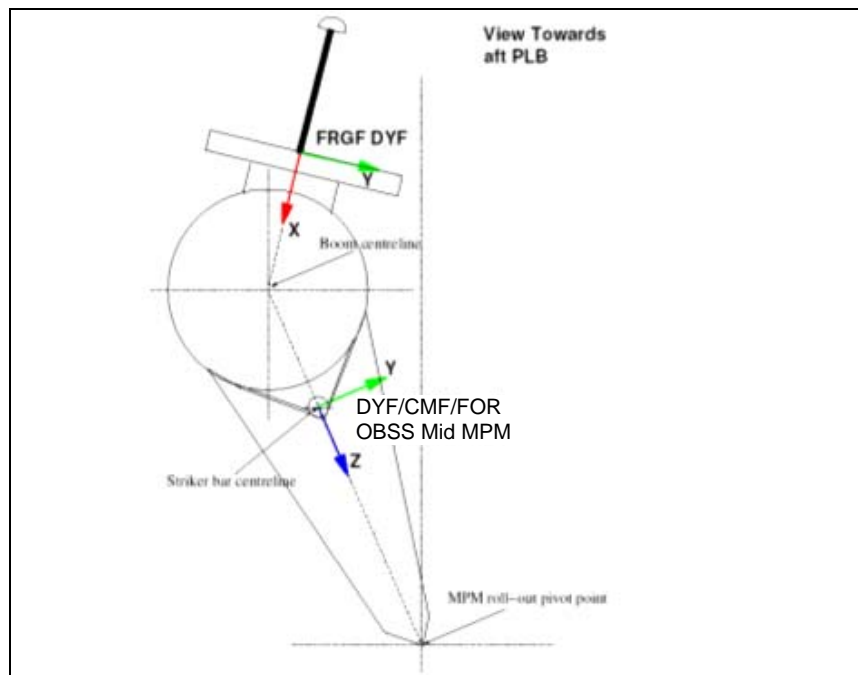


Figure 2.- OBSS Mid MPM Command Frame, Display Frame, and FOR.

Location:

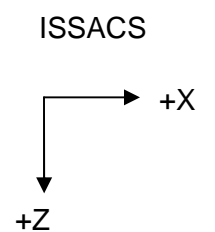
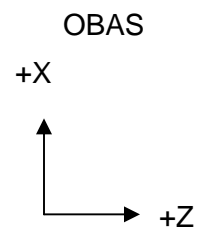
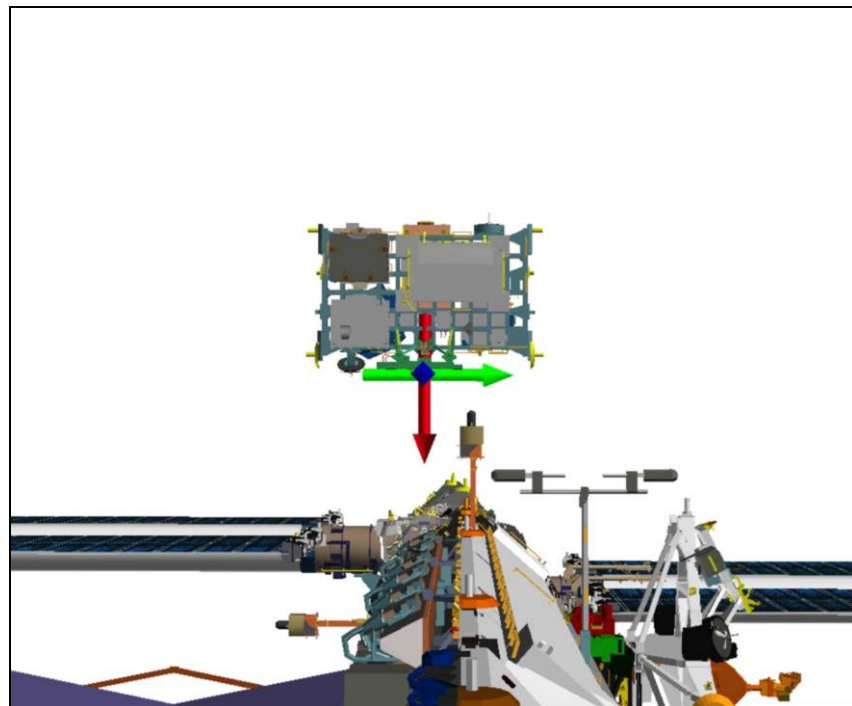
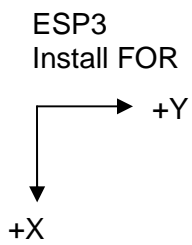
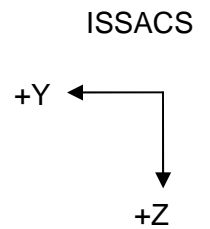
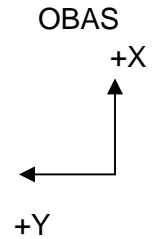
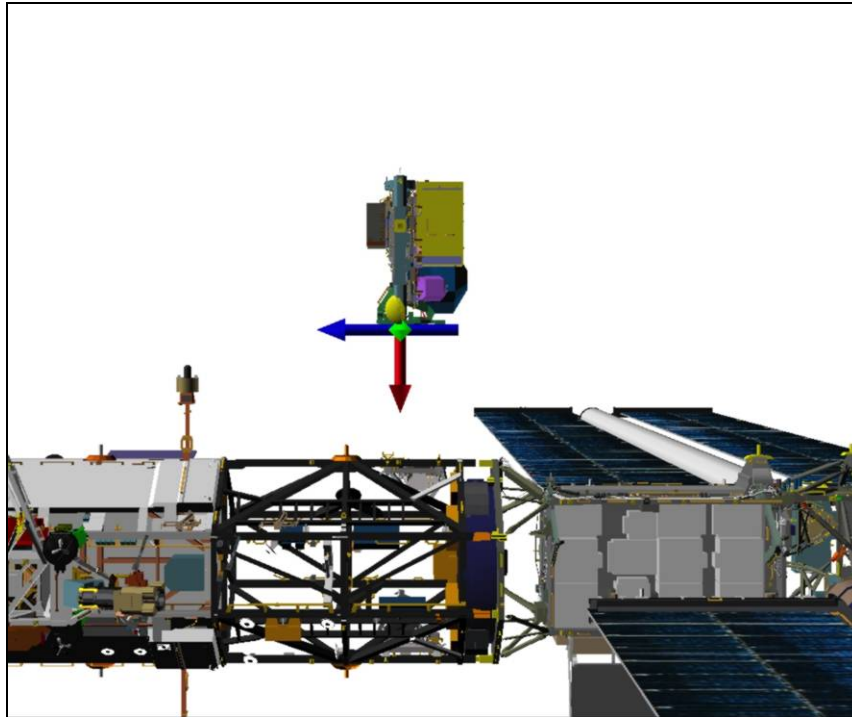
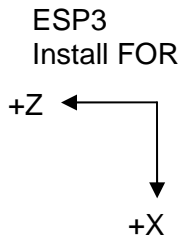
Located at MID MRL, midpoint of OBSS striker bar centerline, when OBSS is deployed and berthed onto Orbiter Stbd MPMs.

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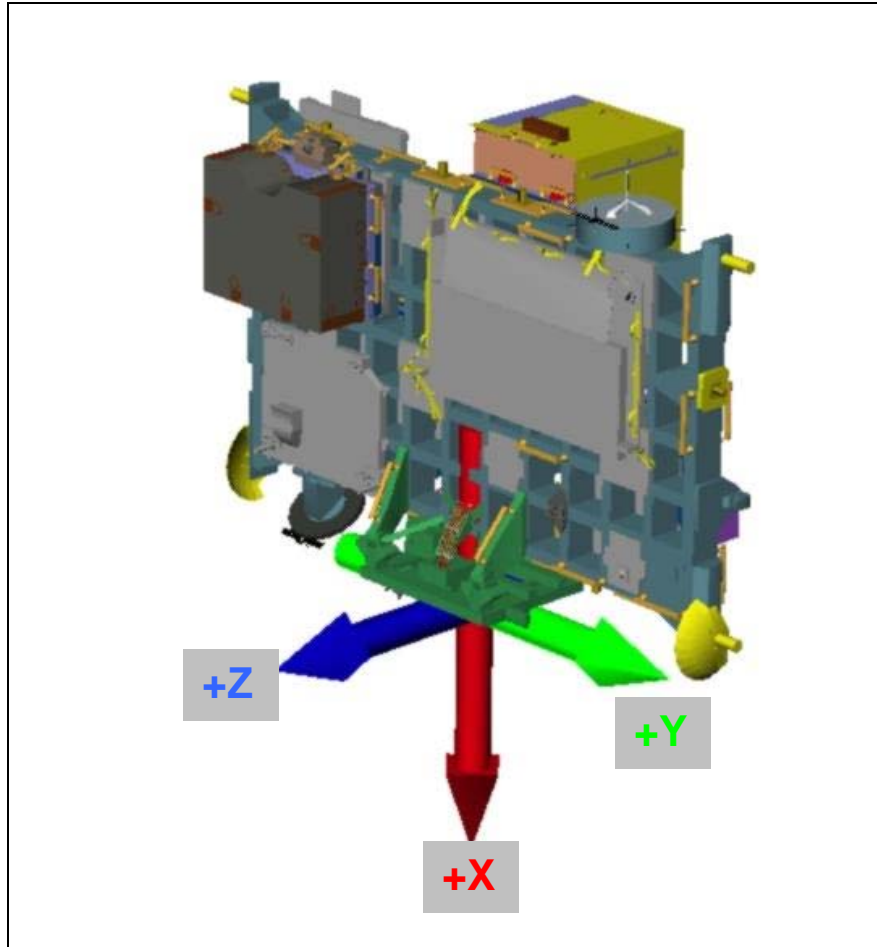
**3.300 FRAME OF REFERENCE (FOR): ESP3 MANEUVER AND INSTALL**  
 (RBT FS/13A.1/FIN 1) Page 1 of 2 pages

**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:

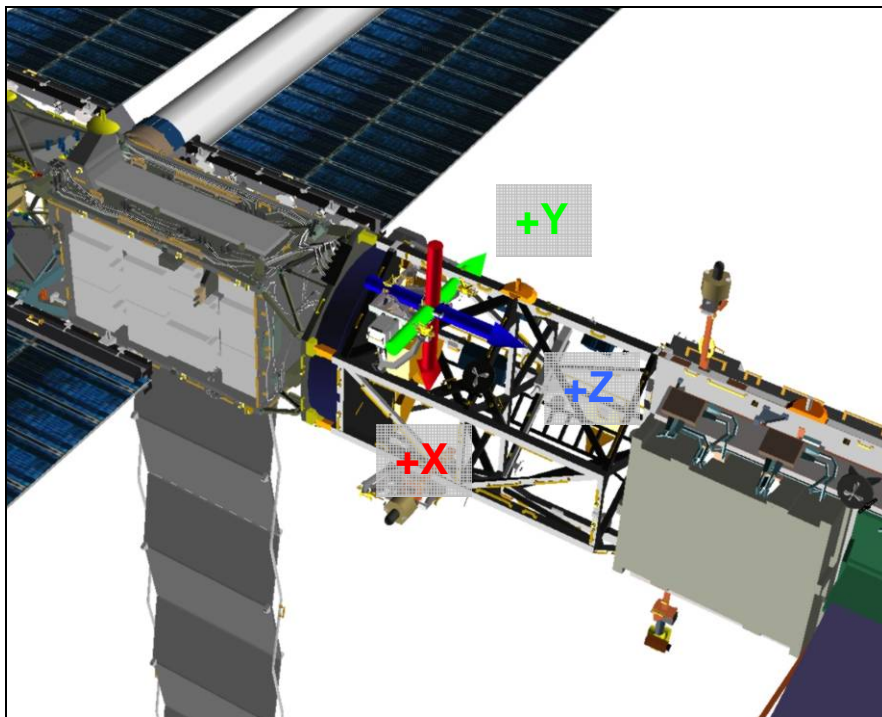
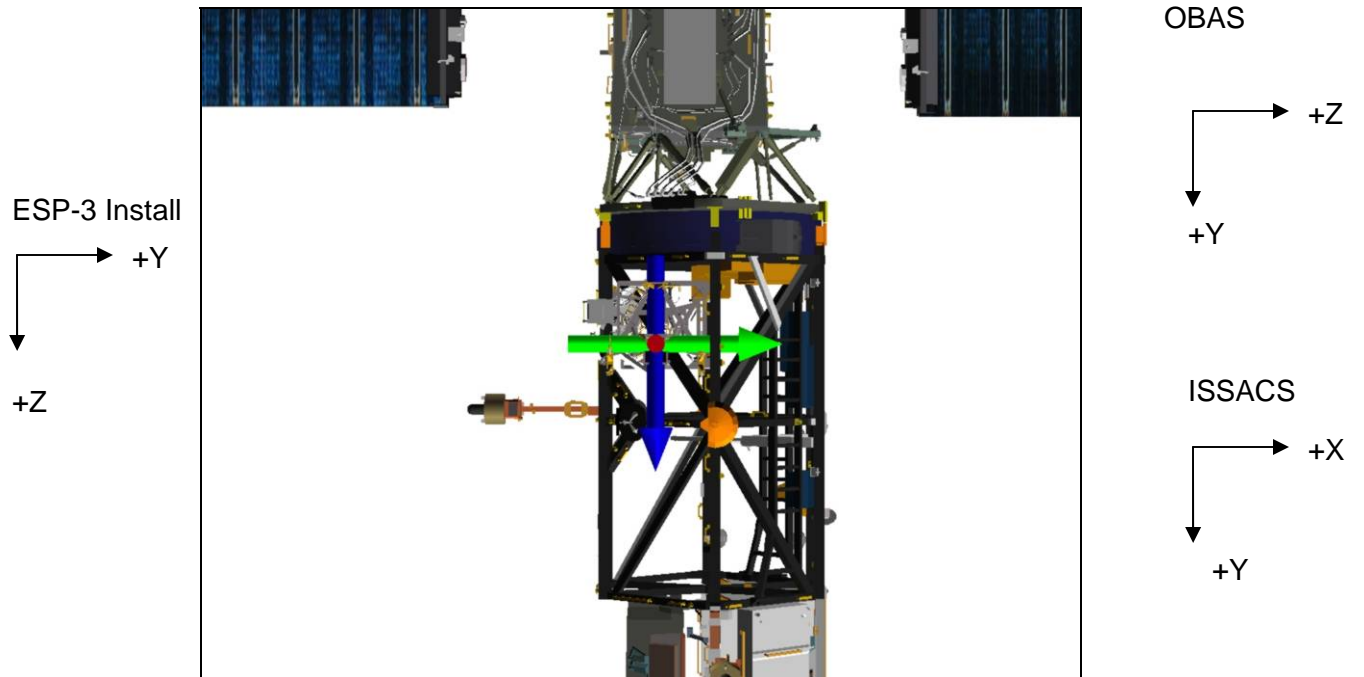
Maneuver frame: aligned with ISSACS

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).

### 3.310 DISPLAY FRAME: W7>ESP3 INSTALL

(RBT FS/13A.1/FIN 1)

Page 1 of 1 page



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).

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### 3.320 ESP3 RTL ACQUISITION

(RBT FS/13A.1/FIN 1)

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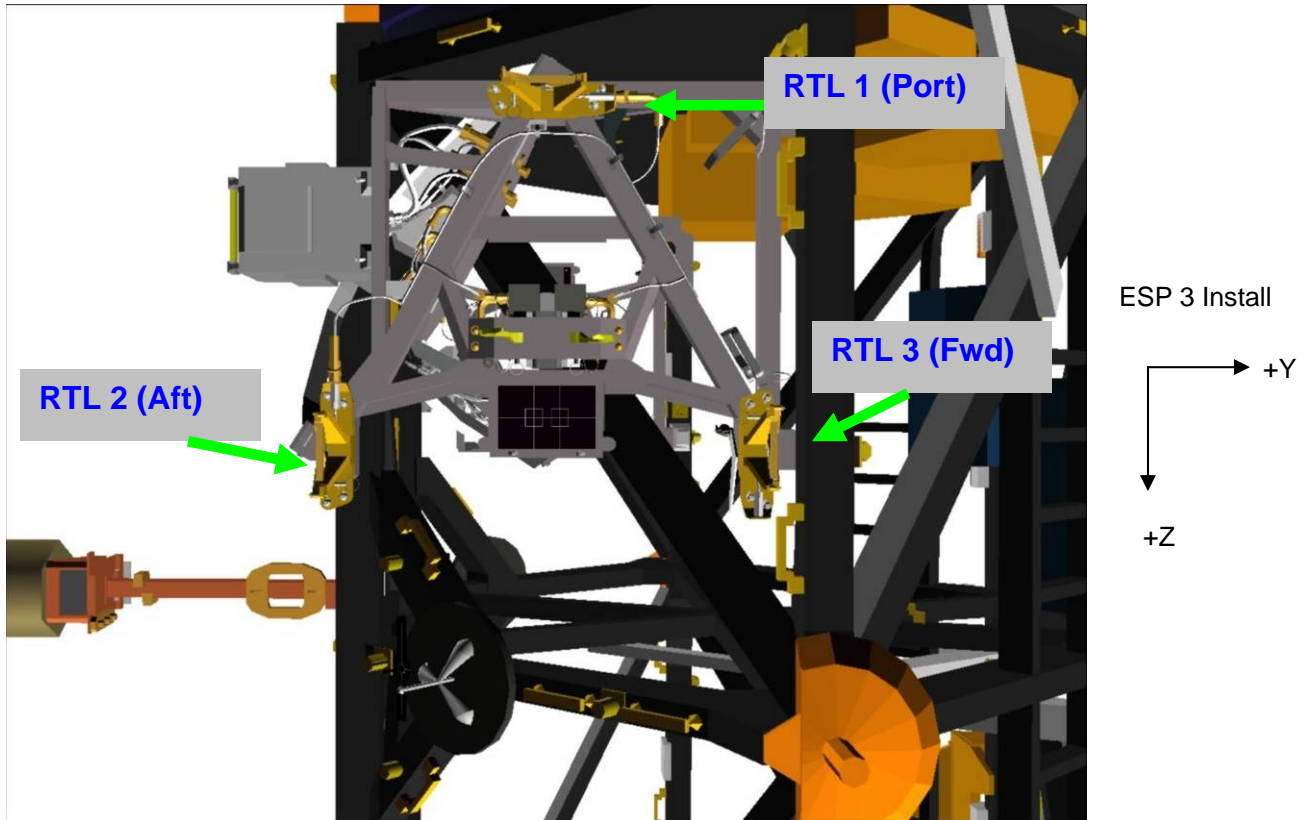


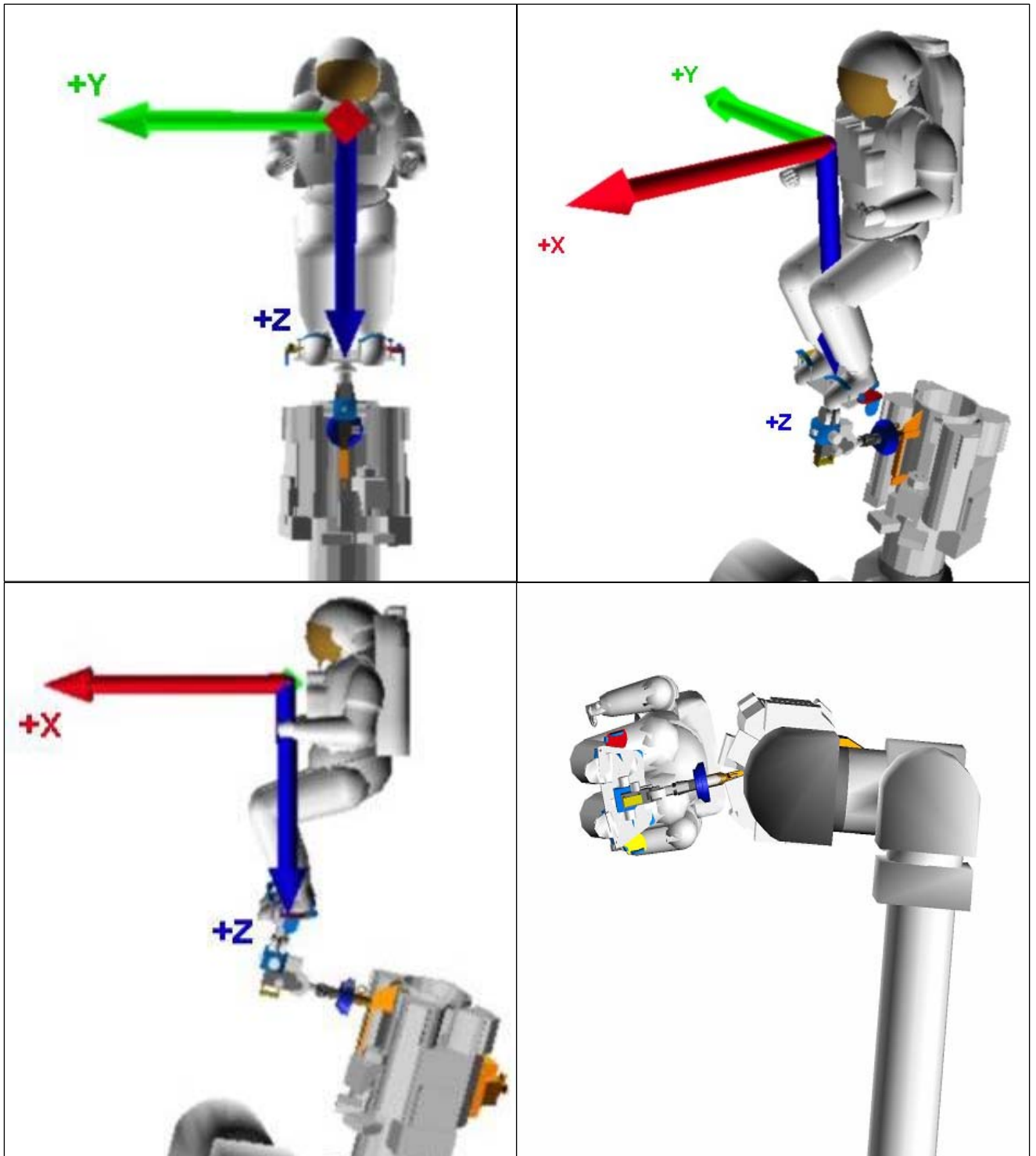
Figure 1.- P3 Zenith UCCAS.

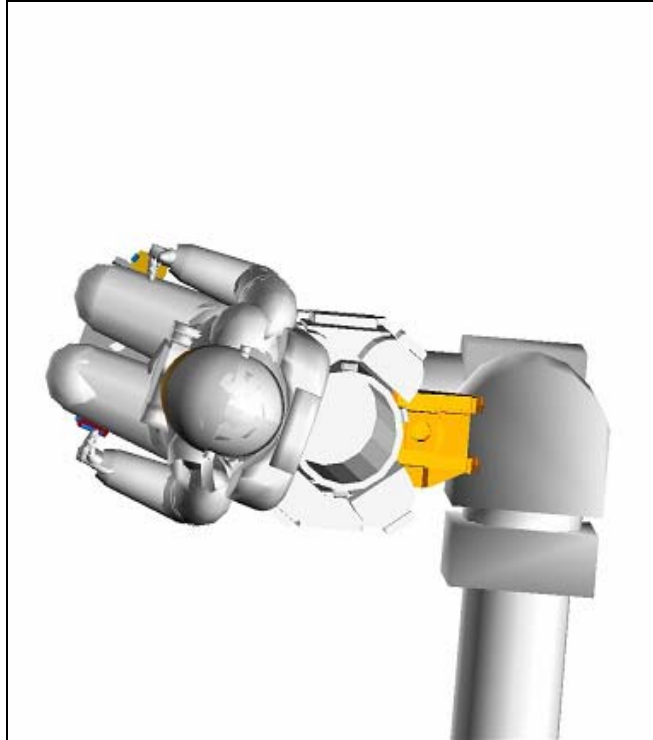
Table 1. Inputs to Acquire RTLs

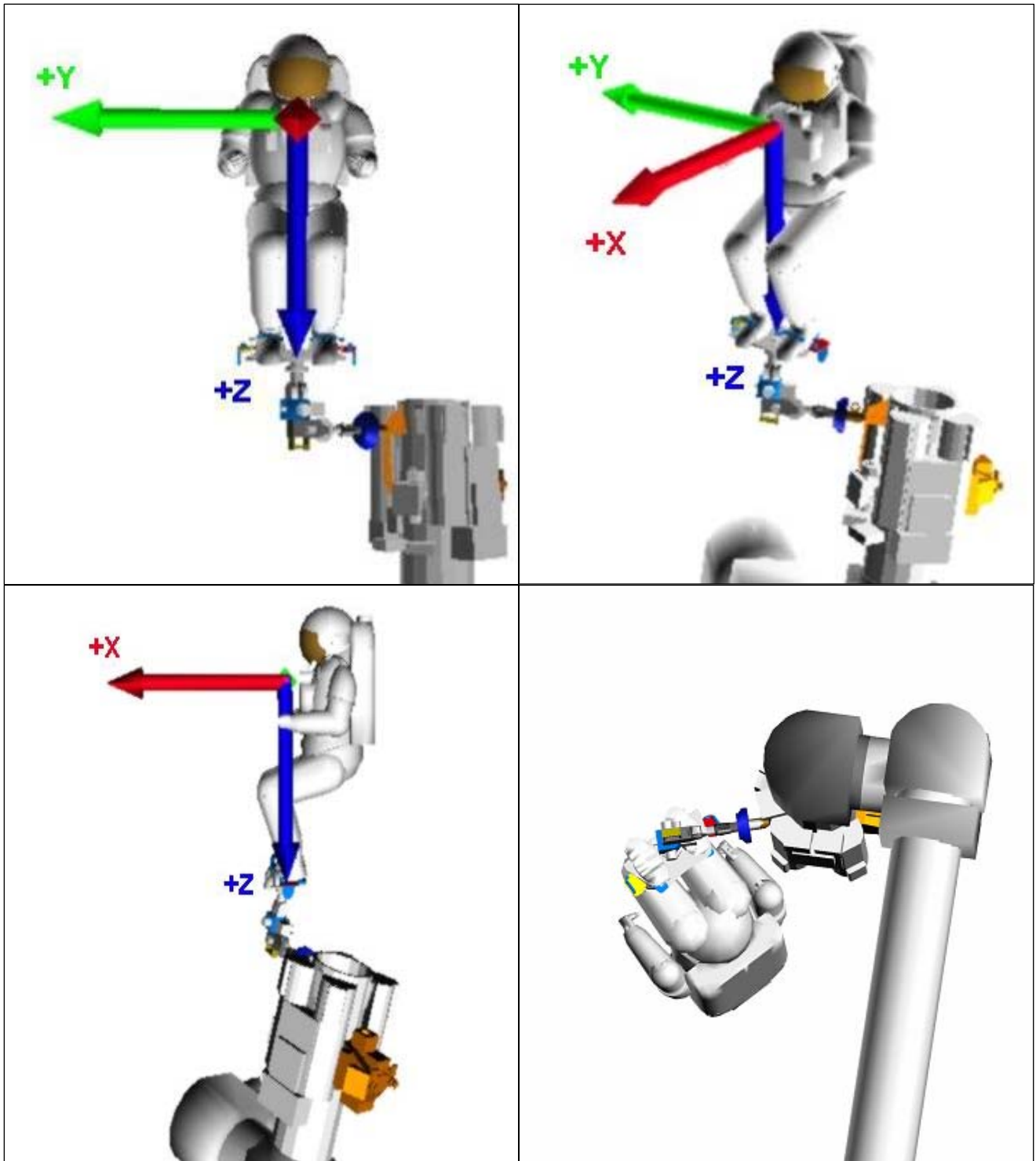
Missing RTL	RHC Input
3	-Yaw, +Pitch
1	-Pitch
2	+Yaw, +Pitch
3, 2	+Pitch
3, 1	-Yaw, then -Pitch
1, 2	+Yaw, then -Pitch

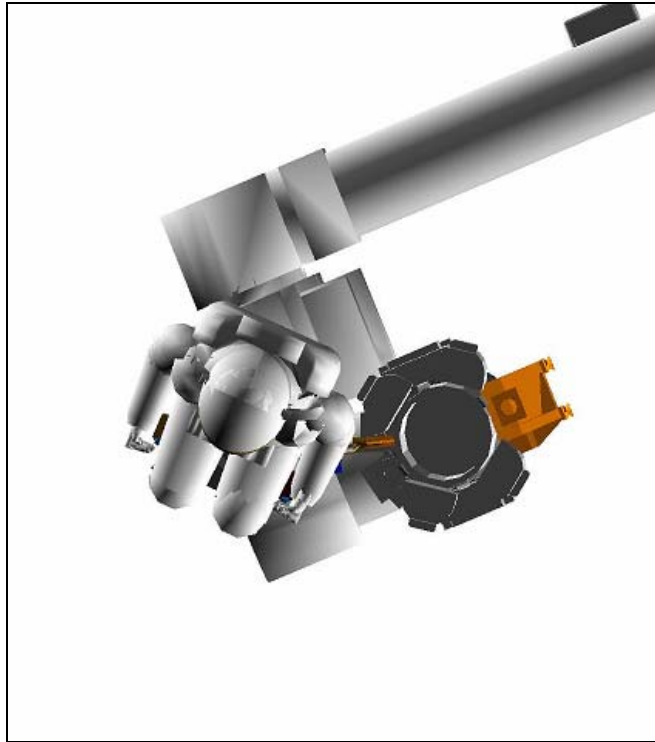
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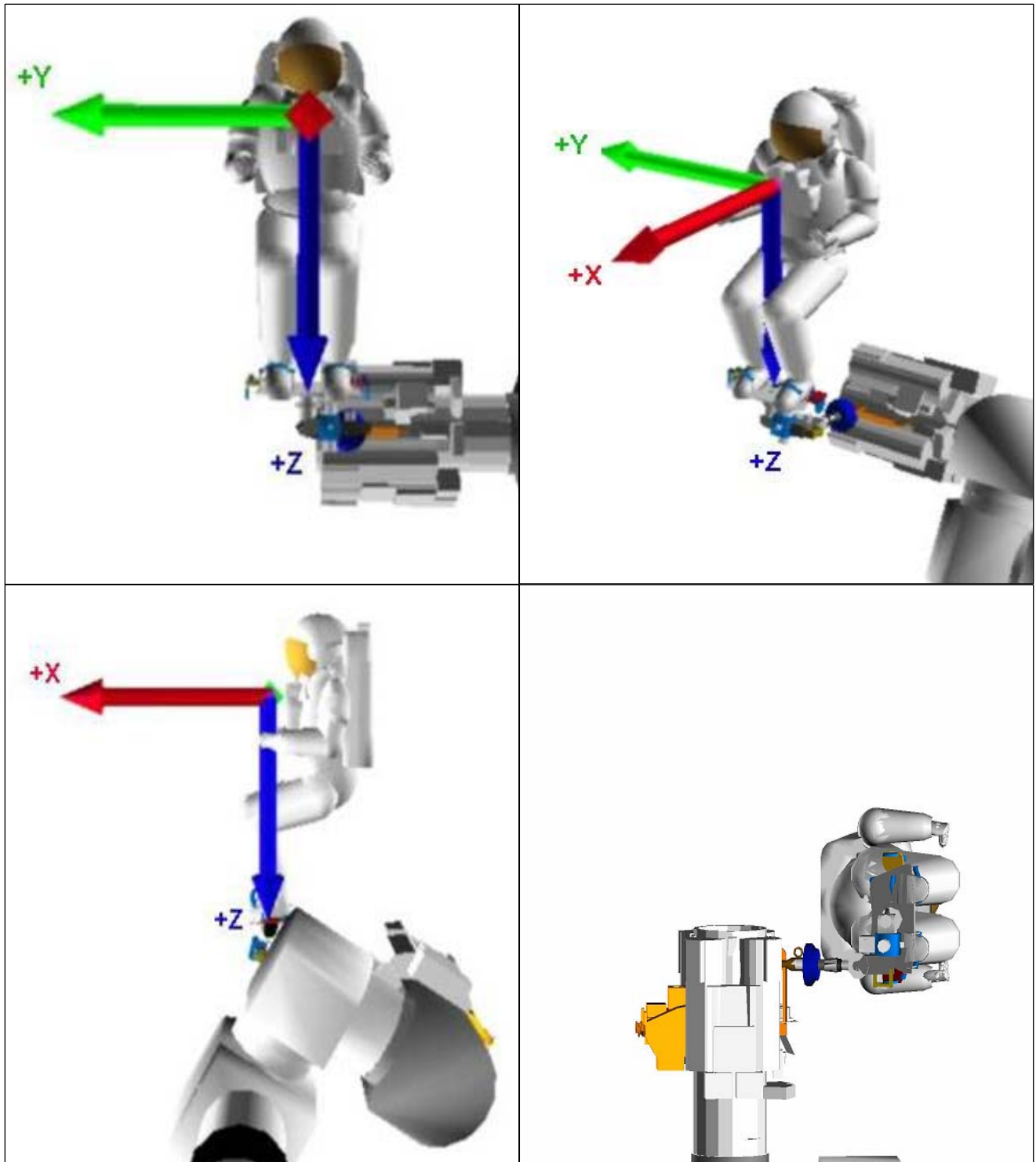


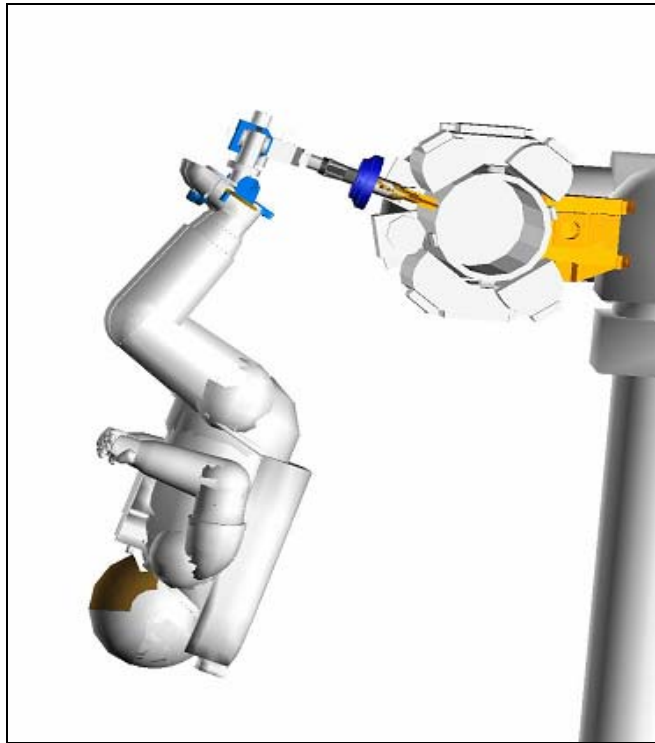










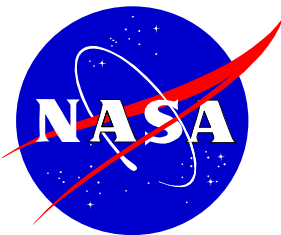


JSC-48540-13A.1  
APPLICABLE FOR ISS-13A.1



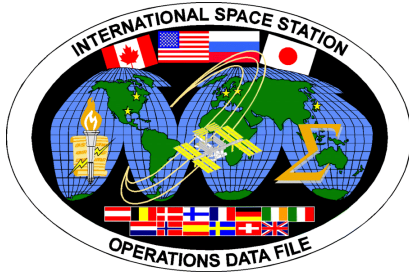
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