



International Space Station Robotics Group Robotics Book - Flight Specific

ISS-1J

Mission Operations Directorate
Operations Division

13 MAY 08

Do not incorporate until
1J launch per
flight status sheet.

This publication replaces
all previous publications.

These procedures are available
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National Aeronautics and
Space Administration

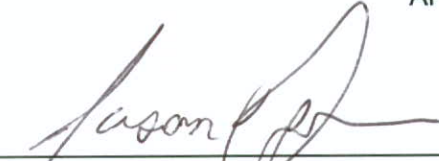
Lyndon B. Johnson Space Center
Houston, Texas




**INTERNATIONAL SPACE STATION
ROBOTICS GROUP
ROBOTICS BOOK - FLIGHT SPECIFIC
ISS-1J**

13 MAY 08

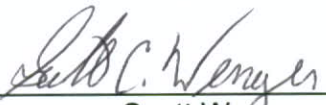
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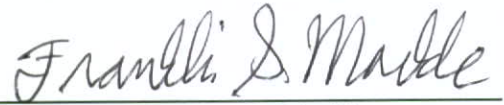
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Incorporates the following:		
CR: Robotics_FSU365A	Robotics_FSU372A	Robotics_FSU377
Robotics_FSU366A	Robotics_FSU373B	Robotics_FSU378
Robotics_FSU367	Robotics_FSU374A	
Robotics_FSU370A	Robotics_FSU375	
Robotics_FSU371A	Robotics_FSU376	

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

None

**INTERNATIONAL SPACE STATION
ROBOTICS GROUP
ROBOTICS BOOK - FLIGHT SPECIFIC
ISS-1J**

LIST OF EFFECTIVE PAGES

13 MAY 08

Sign Off.....	* 13 MAY 08	34.....	08 MAY 08
ii.....	* 13 MAY 08	35.....	13 MAY 08
iii.....	* 13 MAY 08	36.....	13 MAY 08
iv.....	* 13 MAY 08	37.....	02 MAY 08
v.....	* 13 MAY 08	38.....	02 MAY 08
vi.....	* 13 MAY 08	39.....	02 MAY 08
vii.....	13 MAY 08	40.....	02 MAY 08
viii.....	13 MAY 08	41.....	02 MAY 08
1.....	13 MAY 08	42.....	02 MAY 08
2.....	13 MAY 08	43.....	02 MAY 08
3.....	30 APR 08	44.....	02 MAY 08
4.....	30 APR 08	45.....	02 MAY 08
5.....	30 APR 08	46.....	02 MAY 08
6.....	30 APR 08	47.....	02 MAY 08
7.....	30 APR 08	48.....	02 MAY 08
8.....	30 APR 08	49.....	02 MAY 08
9.....	30 APR 08	50.....	02 MAY 08
10.....	TPIB	51.....	02 MAY 08
11.....	30 APR 08	52.....	02 MAY 08
12.....	30 APR 08	53.....	02 MAY 08
13.....	30 APR 08	54.....	02 MAY 08
14.....	30 APR 08	55.....	02 MAY 08
15.....	30 APR 08	56.....	02 MAY 08
16.....	30 APR 08	57.....	02 MAY 08
17.....	30 APR 08	58.....	02 MAY 08
18.....	30 APR 08	59.....	02 MAY 08
19.....	30 APR 08	60.....	02 MAY 08
20.....	TPIB	61.....	02 MAY 08
21.....	08 MAY 08	62.....	02 MAY 08
22.....	08 MAY 08	63.....	02 MAY 08
23.....	08 MAY 08	64.....	02 MAY 08
24.....	08 MAY 08	65.....	02 MAY 08
25.....	08 MAY 08	66.....	02 MAY 08
26.....	08 MAY 08	67.....	02 MAY 08
27.....	08 MAY 08	68.....	02 MAY 08
28.....	08 MAY 08	69.....	02 MAY 08
29.....	08 MAY 08	70.....	02 MAY 08
30.....	08 MAY 08	71.....	02 MAY 08
31.....	08 MAY 08	72.....	02 MAY 08
32.....	08 MAY 08	73.....	02 MAY 08
33.....	08 MAY 08	74.....	02 MAY 08

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75.....	02 MAY 08	125.....	30 APR 08
76.....	02 MAY 08	126.....	30 APR 08
77.....	02 MAY 08	127.....	30 APR 08
78.....	02 MAY 08	128.....	TPIB
79.....	02 MAY 08	129.....	13 MAY 08
80.....	02 MAY 08	130.....	13 MAY 08
81.....	02 MAY 08	131.....	05 MAY 08
82.....	02 MAY 08	132.....	05 MAY 08
83.....	02 MAY 08	133.....	05 MAY 08
84.....	02 MAY 08	134.....	05 MAY 08
85.....	02 MAY 08	135.....	01 MAY 08
86.....	TPIB	136.....	01 MAY 08
87.....	13 MAY 08	137.....	01 MAY 08
88.....	13 MAY 08	138.....	01 MAY 08
89.....	30 APR 08	139.....	01 MAY 08
90.....	30 APR 08	140.....	01 MAY 08
91.....	30 APR 08	141.....	01 MAY 08
92.....	30 APR 08	142.....	01 MAY 08
93.....	30 APR 08	143.....	01 MAY 08
94.....	30 APR 08	144.....	01 MAY 08
95.....	30 APR 08	145.....	01 MAY 08
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97.....	30 APR 08	147.....	01 MAY 08
98.....	TPIB	148.....	TPIB
99.....	13 MAY 08	149.....	01 MAY 08
100.....	13 MAY 08	150.....	01 MAY 08
101.....	29 APR 08	151.....	01 MAY 08
102.....	29 APR 08	152.....	01 MAY 08
103.....	29 APR 08	153.....	01 MAY 08
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105.....	29 APR 08	155.....	01 MAY 08
106.....	TPIB	156.....	01 MAY 08
107.....	01 MAY 08	157.....	01 MAY 08
108.....	01 MAY 08	158.....	01 MAY 08
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114.....	01 MAY 08	164.....	01 MAY 08
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116.....	01 MAY 08	166.....	01 MAY 08
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123.....	30 APR 08	173.....	30 APR 08
124.....	30 APR 08	174.....	TPIB

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183.....	01 MAY 08	233.....	30 APR 08
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191.....	08 MAY 08	241.....	30 APR 08
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193.....	08 MAY 08	243.....	13 MAY 08
194.....	08 MAY 08	244.....	13 MAY 08
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196.....	08 MAY 08	246.....	TPIB
197.....	08 MAY 08	247.....	01 MAY 08
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200.....	08 MAY 08	250.....	TPIB
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205.....	30 APR 08	255.....	01 MAY 08
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222.....	30 APR 08	272.....	TPIB
223.....	30 APR 08	273.....	01 MAY 08
224.....	30 APR 08	274.....	TPIB

* - Omit from flight book

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278.....	TPIB
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287.....	08 MAY 08
288.....	08 MAY 08
289.....	08 MAY 08
290.....	08 MAY 08
291.....	08 MAY 08
292.....	08 MAY 08
293.....	08 MAY 08
294.....	08 MAY 08
295.....	08 MAY 08
296.....	TPIB
297.....	11 MAR 08
298.....	TPIB
299.....	12 MAR 08
300.....	TPIB
301.....	12 MAR 08
302.....	TPIB

* - Omit from flight book

CONTENTS

OBSS HANDOFF	1
1.101 MNVR TO OBSS GRAPPLE	3
1.102 OBSS UNBERTH AND HANDOFF	11
1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE	21
JPM	35
2.101 MNVR TO JPM GRAPPLE	37
2.102 JPM INSTALL	49
2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3	65
FOCUSED INSPECTION SUPPORT	87
3.101 MNVR TO FOCUSED INSPECTION SUPPORT	89
JLP	99
4.101 MNVR FROM FI SUPPORT TO JLP PRE-GRAPPLE	101
4.102 JLP RELOCATE	107
4.103 JLP UNGRAPPLE TO JEM RMS VIEWING	121
EVA SUPPORT	129
5.101 JEM RMS VIEWING TO EVA 3 START	131
5.102 S1 NTA RETRIEVE	135
5.103 NTA RETRIEVE AT ESP3	149
5.104 S1 NTA INSTALL	157
CONTINGENCY	171
6.101 CBM LATCH STALL RECOVERY	173
6.201 JPM INSTALL - CBCS FAILED	175
6.202 JLP RELOCATE - CBCS FAILED	191
6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE	205
6.401 JLP RELEASE TO JPM GRAPPLE	215
6.402 JPM RELEASE TO EVA 3 START	227
6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE	235
REFERENCE	243
7.101 FRAME OF REFERENCE (FOR): JPM UNBERTH OBAS	245
7.102 FRAME OF REFERENCE (FOR): JPM MATE CBCS	247
7.103 FRAME OF REFERENCE (FOR): JPM MATE OBAS	249
7.104 FRAME OF REFERENCE (FOR): JLP MATE CBCS	251
7.105 FRAME OF REFERENCE (FOR): JLP MATE ISSACS	253
7.106 FRAME OF REFERENCE (FOR): OBSS MNVR ISSACS	255
7.107 FRAME OF REFERENCE (FOR): CHEST WIF 12/NN/F/6	257
7.201 DISPLAY FRAME: ORBITER>JPM PDGF	259
7.202 DISPLAY FRAME: ORBITER>JPM UNBERTH OBAS	261
7.203 DISPLAY FRAME: NODE2>JPM MATE CBCS	263
7.204 DISPLAY FRAME: NODE2>JPM MATE OBAS	265

7.205	DISPLAY FRAME: NODE2>JPM PDGF	267
7.206	DISPLAY FRAME: NODE2>JLP PORT FRGF	269
7.207	DISPLAY FRAME: NODE2>JLP DEMATE ISSACS	271
7.208	DISPLAY FRAME: JPM>JLP MATE CBCS	273
7.209	DISPLAY FRAME: JPM>JLP MATE ISSACS	275
7.210	DISPLAY FRAME: JPM>JLP PORT FRGF	277
7.211	DISPLAY FRAME: S1>OBSS FRGF	279
7.212	DISPLAY FRAME: S1>OBSS UNSTOW ISSACS	281
7.301	SSRMS JOINT ANGLES AND FOR COORDINATES	283
7.401	JPM PRLA CONFIGURATION	297
7.402	JPM RTL TECHNIQUE	299
7.403	JLP RTL TECHNIQUE	301

OBSS HANDOFF

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1.101 MNVR TO OBSS GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 1 of 7 pages

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
03: S1 Lower Outboard (+68, -25) Zoom: 13 mm	22: Base Elbow (+65, -5)	37: MBS Mast (-150, -15)

PCS

MSS: SSRMS:

Change Loaded Parameters ► OBSS ► OBSS MnvR ISSACS SYH
Verify 'Loaded Parameters' (two) – OBSS MnvR ISSACS, SY Held

Verify Unloaded Parameters – √

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

Change Display ► S1 ► OBSS FRGF (Verify S1>OBSS FRGF)

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

SR	SY	SP	EP	WP	WY	WR
-106.2	-159.4	-137.5	+122.2	-86.0	-36.0	-10.7
X	Y	Z	Pitch	Yaw	Roll	
-279	+89	-44	+124.4	+44.5	+160.6	
FOR	Unloaded – LEE Tip, SY Held					
Disp	S1>OBSS FRGF					

1.101 MNVR TO OBSS GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 2 of 7 pages

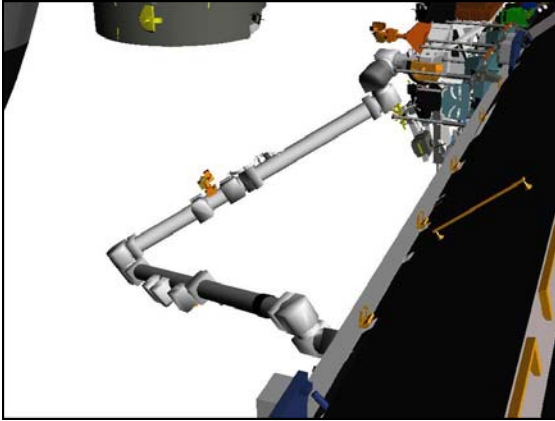


Figure 1.- Park Position
(03: S1 Lower Outboard: +68, -25)
Zoom: 13 mm.

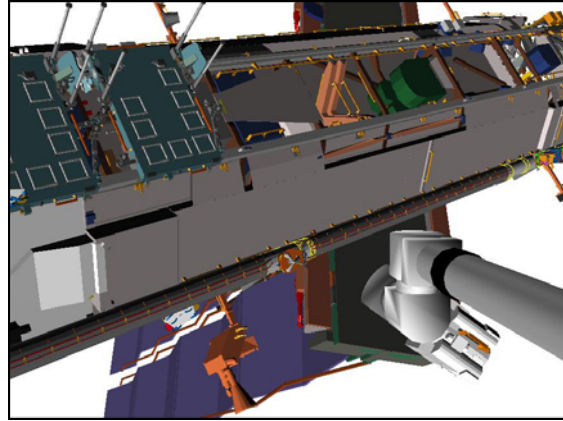


Figure 2.- Park Position
(22: Base Elbow: +65, -5).

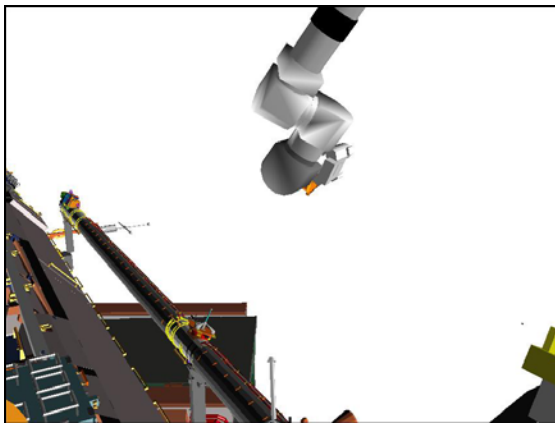


Figure 3.- Park Position
(37: MBS Mast: -150, -15).

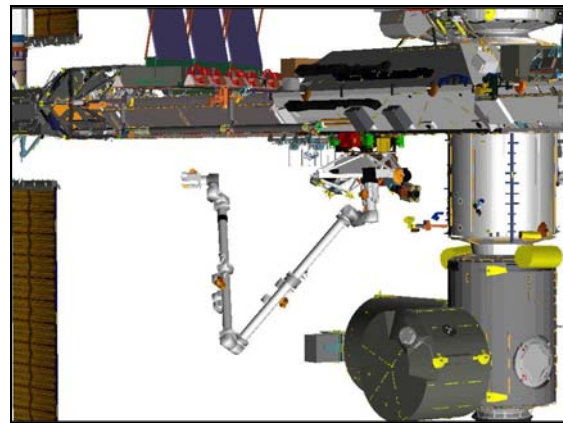


Figure 4.- Park Position
(Bird's Eye View).

3. JOINT OCAS MANEUVER TO OBSS PRE-GRAPPLE

MSS: SSRMS: MSS Safing:

cmd 'SSRMS' 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)

1.101 MNVR TO OBSS GRAPPLE

(RBT FS/1J/FIN/SPN)

SSRMS Joint OCAS

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

SR	SY	SP	EP	WP	WY	WR
-106.2	-159.4	-137.5	+122.2	-147.0	-181.2	-10.7

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)	-106.2	-159.4	-137.5	+122.2	-86.0	-36.0	-10.7
TGT	-106.2	-159.4	-137.5	+122.2	-147.0	-181.2	-10.7
ERR	0.0	0.0	0.0	0.0	+61.0	+145.2	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.

PCS

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

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS: SSRMS

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
-106.2	-159.4	-137.5	+122.2	-147.0	-181.2	-10.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	S1>OBSS FRGF					

1.101 MNVR TO OBSS GRAPPLE

(RBT FS/1J/FIN/SPN)

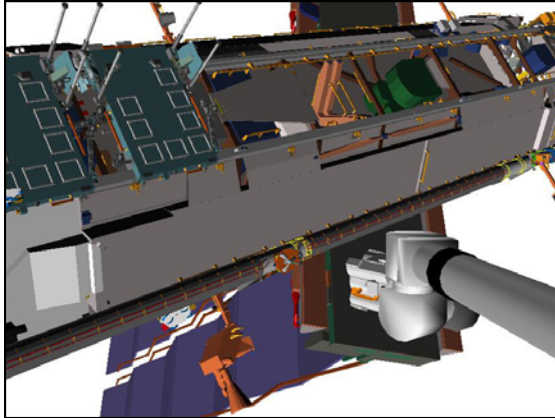


Figure 5.- OBSS Pre-Grapple
(22: Base Elbow: +65, -5).

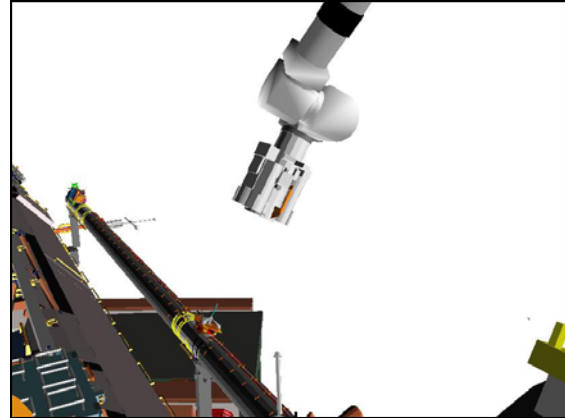


Figure 6.- OBSS Pre-Grapple
(37: MBS Mast: -150, -15).

4. SETUP FOR OBSS GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+68, -25) Zoom: 13 mm	25: Tip LEE	37: MBS Mast (-55, -10)	Camera B (+24, +26) HFOV: 5 deg	Camera C (+15, +27) HFOV: 40 deg

NOTE

1. The closest clearance which occurs during the maneuver to OBSS Grapple is between the SSRMS Shoulder cluster and the MBS MCAS Assembly: 41 cm (16 in). This may be monitored with the MBS Mast Camera.
2. The LEE Camera must be fully zoomed out to correspond to the target overlay.

MSS: SSRMS:

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

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS: Rate:

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

1.101 MNVR TO OBSS GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 5 of 7 pages

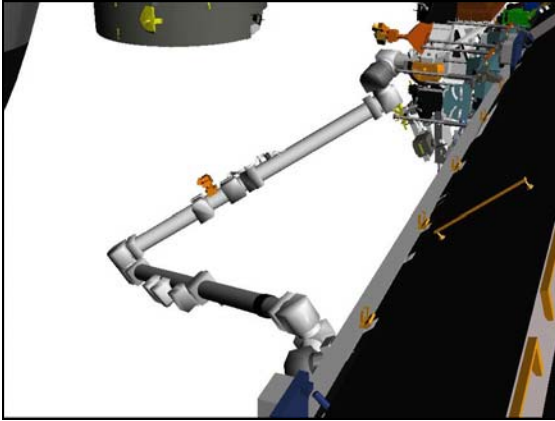


Figure 7.- OBSS Pre-Grapple
(03: S1 Lower Outboard: +68, -25)
Zoom: 13 mm.

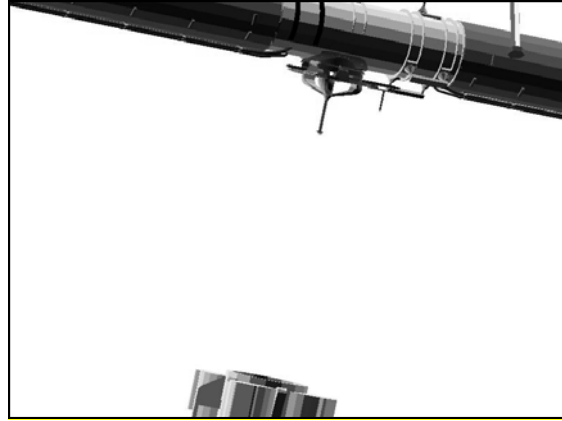


Figure 8.- OBSS Pre-Grapple
(V10: Camera B: +24, +26)
HFOV: 5 deg.

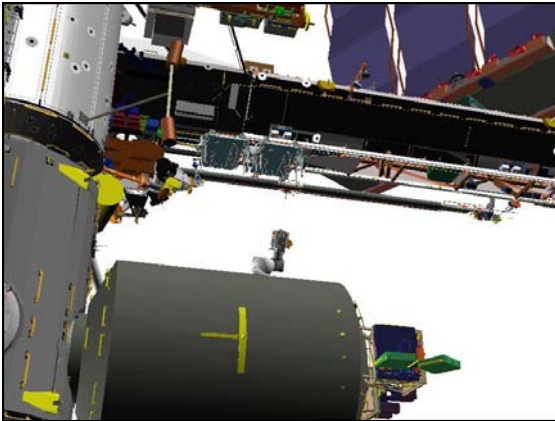


Figure 9.- OBSS Pre-Grapple
(V10: Camera C: +15, +27)
HFOV: 40 deg.

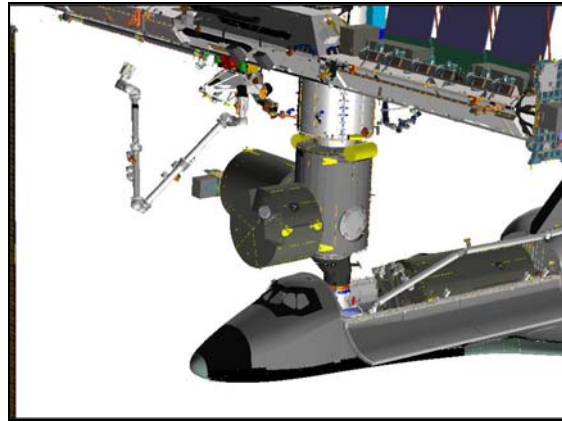


Figure 10.- OBSS Pre-Grapple
Bird's Eye View.

5. ATTITUDE CONTROL CONFIGURATION

√MCC that attitude control is in a good configuration

If using shuttle attitude control, coordinate with shuttle crewmembers
DAP: FREE

1.101 MNVR TO OBSS GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 6 of 7 pages

6. MANUAL GRAPPLE OF OBSS TO ZERO TENSION

6.1 Grapple Maneuver

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Yaw (Verify SY – Locked)

Maneuver to within grapple envelope.

RHC/
THC

6.2 SSRMS Limp

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

PCS

6.3 Closing Snares

MSS: SSRMS: Tip LEE:

cmd 'Snare' Close ► Slow, Soft Stops

Verify Speed – Slow

Verify Stops – Soft

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 – Close Snares

1.101 MNVR TO OBSS GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 7 of 7 pages

RHC TRIGGER → press (hold until 'Snare' Brakes – On) (12 s max)

PCS Verify 'Snare' Close, Capture (two) – blue

Expected OBSS Captured position.

SR	SY	SP	EP	WP	WY	WR
-106.0	-159.4	-124.9	+121.7	-159.3	-181.3	-10.4
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	S1>OBSS FRGF					

Give MCC-H GO for Zero Tension Grapple.

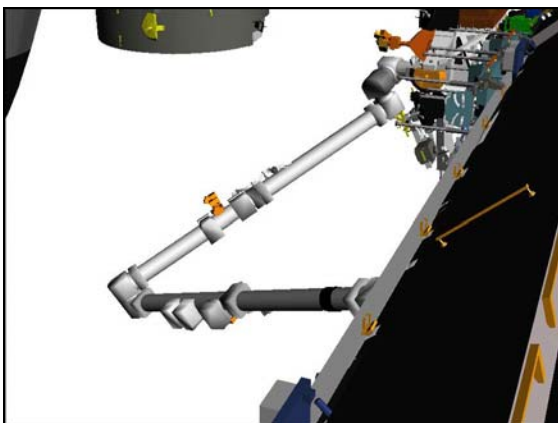


Figure 11.- OBSS Captured
(03: S1 Lower Outboard: +68, -25)
Zoom: 13 mm.



Figure 12.- OBSS Captured
(37: MBS Mast: -55, -10).

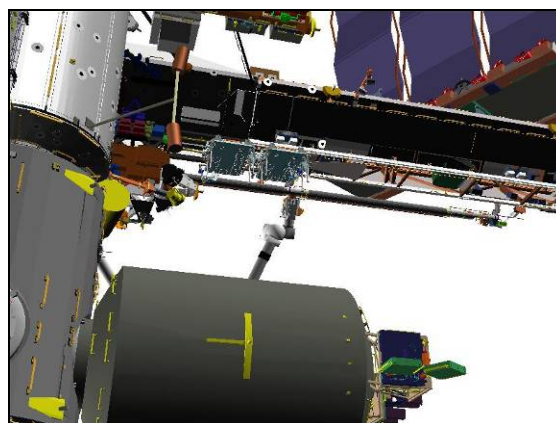


Figure 13.- OBSS Captured
(V10: Camera C: +15, +27)
HFOV: 40 deg.

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1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

Page 1 of 9 pages

1. SETUP FOR EV MID SSBAD RELEASE

NOTE

1. May receive a Cat-2 '**R3Q - SSRMS LEE Uncommanded Derigidize**' message when SSRMS Safing is canceled (SCR 36485). The brakes will not release until the override command is issued.
2. The LAB Stbd Zenith Camera must be Panned to the value shown below in order to follow the Joint OCAS motion in Step 6.

√**MCC-H** that Zero Tension Grapple is complete

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
03: S1 Lower Outboard (+68, -25) Zoom: 13 mm	13: LAB Stbd Zenith (-170, +65)	24: Tip Elbow (+40, 0) 37: MBS Mast (-150, -20)

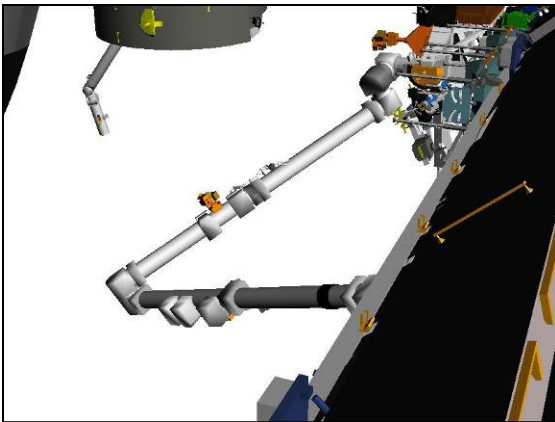


Figure 1.- OBSS Grapple
(03: S1 Lower Outboard: +68, -25)
Zoom: 13 mm.

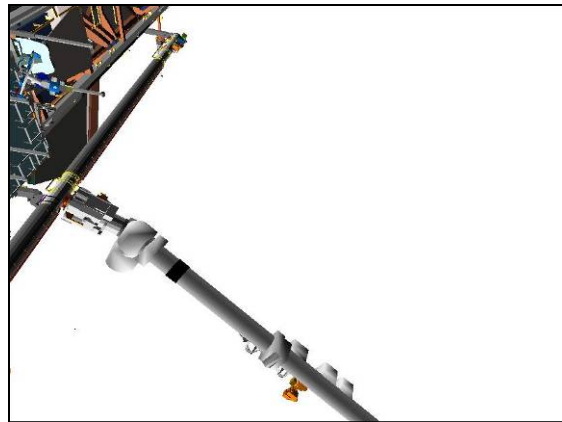


Figure 2.- OBSS Grapple
(13: LAB Stbd Zenith: -170, +65).

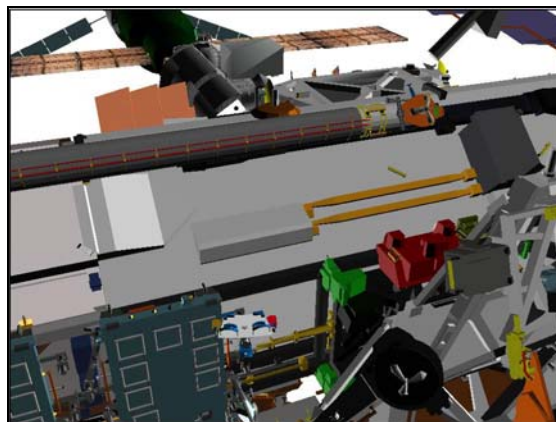


Figure 3.- OBSS Grapple
(24: Tip Elbow: +40, 0).

1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

Page 2 of 9 pages

On EV GO for SSRMS Limping:

PCS MSS: SSRMS: MSS Safing:

cmd 'SSRMS' Remove (Verify Not Safed)

DCP BRAKES SSRMS → OFF

PCS MSS: SSRMS:

Verify Brake Override – Override or Limp or Cancel

PCS MSS: SSRMS: Brake Override

cmd 'Remove Brakes and Limping'

MSS: SSRMS:

Verify Limp – blue

Verify all joints – Limped

Give EV GO for Mid SSBAD Release.

2. OBSS GRAPPLE COMPLETION

On EV GO, "Ready for SSRMS Rigidization."

MSS: SSRMS: Tip LEE:

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

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

CAUTION

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

NOTE

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

cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Rigidize Carriage

RHC TRIGGER → press (momentarily) (SCR 19064)

PCS Verify 'Carriage' Tension ~5500 N (90 s max)
Verify 'Carriage' Retract – blue

1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

Page 3 of 9 pages

3. GRAPPLE CLEANUP

On SRMS operator GO, “at OBSS Pre-Grapple at Handoff”:

Give EV GO for Outboard SSBAD Release.

Configure remaining Cameras.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+68, -25) Zoom: 13 mm	13: LAB Stbd Zenith (-170, +65)	24: Tip Elbow (+40, 0) 37: MBS Mast (-150, -20)	SRMS Elbow (+90, -30)	Camera C (+15, +27) HFOV: 40 deg

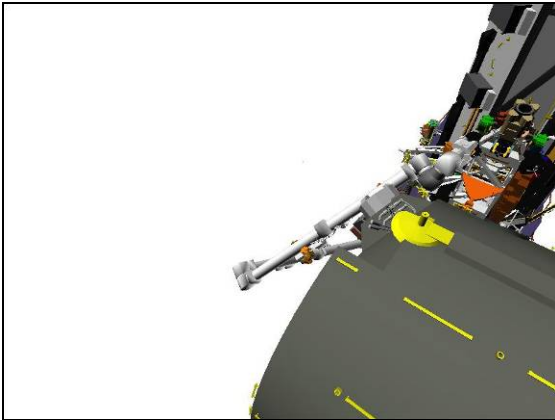


Figure 4.- OBSS Grapple
(V10: SRMS Elbow: +90, -30).

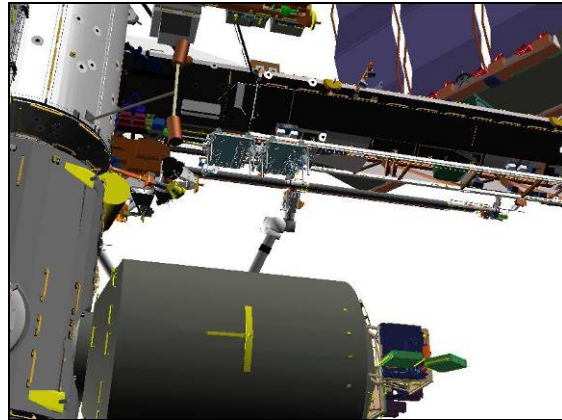


Figure 5.- OBSS Grapple
(V10: Camera C: +15, +27)
HFOV: 40 deg.

On EV GO, “Outboard SSBAD Released.”

MSS: SSRMS: Limp:

cmd None Limp (Verify Standby – blue)

Verify Loaded Parameters – √

Verify ‘Loaded Parameters’ (two) – OBSS Mnvr ISSACS, SY Held

Change Display ► S1 ► OBSS Unstow ISSACS (Verify S1>OBSS Unstow ISSACS)

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

1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

Page 4 of 9 pages

Expected OBSS Grapple position.

SR	SY	SP	EP	WP	WY	WR
-106.0	-159.4	-124.9	+121.7	-159.3	-181.3	-10.4
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – OBSS Mnvr ISSACS, SY Held					
Disp	S1>OBSS Unstow ISSACS					

4. MANEUVER TO CABLE REMOVAL

NOTE

- The closest clearances that occur during the maneuver to Cable Removal position, are:
 - OBSS to MBS: 79 cm (31 in). May be monitored with the Tip Elbow Camera.
 - OBSS to CETA Carts: 127 cm (50 in). May be monitored with the Tip Elbow Camera.
 - SSRMS Shoulder Cluster to MBS MCAS Assembly: 39 cm (16 in). May be monitored with the MBS Mast Camera.
- At the end of the +X motion in the following maneuver, the clearance of the OBSS to the SSBADs is 40 cm (16 in). This may be monitored with the LAB Starboard Zenith Camera or with Camera C.

On EV GO, "Ready for Maneuver to KAD/P411 Removal position."

√Vernier

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Yaw (Verify SY – Locked)

1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

Page 5 of 9 pages

THC/
RHC

Maneuver OBSS to Cable Removal position (within 5 cm/1 deg).
Expect "+X" motion (THC in).

	Locked					
SR	SY	SP	EP	WP	WY	WR
-104.1	-159.4	-129.7	+123.0	-156.5	-181.8	-8.8
X	Y	Z	Pitch	Yaw	Roll	
+50	0	0	0.0	0.0	0.0	
FOR	Loaded – OBSS Mnvr ISSACS, SY Held					
Disp	S1>OBSS Unstow ISSACS					

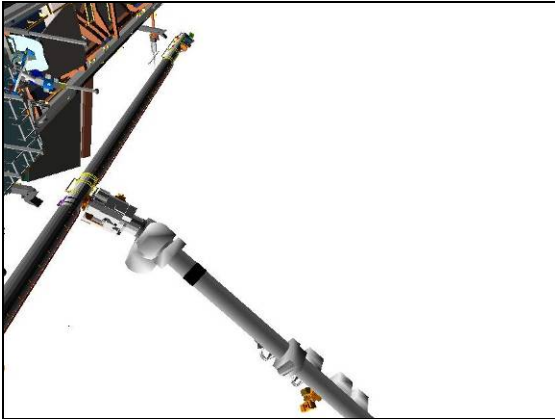


Figure 6.- Cable Removal
(13: LAB Stbd Zenith: -170, +65).

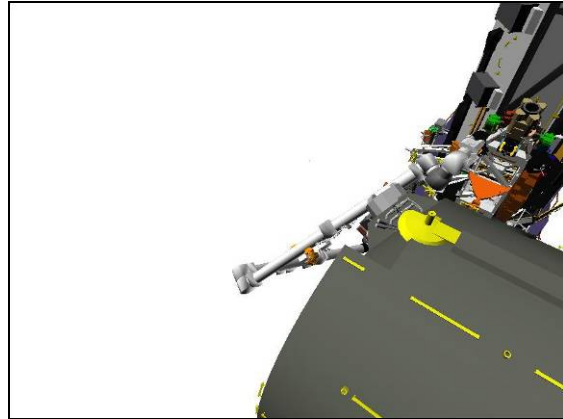


Figure 7.- Cable Removal
(V10: SRMS Elbow: +90, -30).

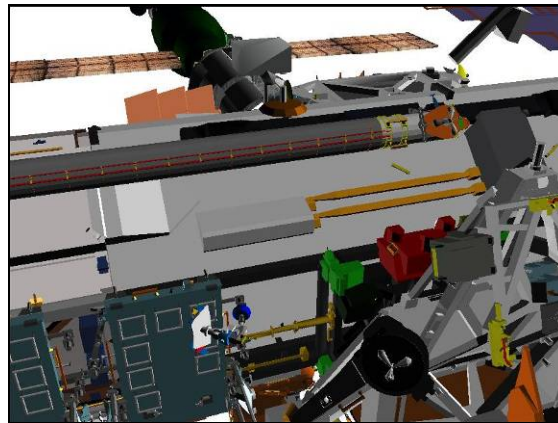


Figure 8.- Cable Removal
(24: Tip Elbow: +40, 0).

DCP

BRAKES SSRMS → ON (Verify ON)

Notify EV that SSRMS is in the KAD/P411 Removal Position.

1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

5. MANEUVER TO JOCAS START

On EV GO to maneuver to JOCAS Start position:

BRAKES SSRMS → OFF (Verify OFF)

√Vernier

PCS

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Yaw (Verify SY – Locked)

THC/
RHC

Maneuver OBSS to JOCAS Start position (within 5 cm/1 deg).
Expect “-Z” motion (THC up).

	Locked					
SR	SY	SP	EP	WP	WY	WR
-131.0	-159.4	-126.7	+98.1	-126.1	-172.6	-32.3
X	Y	Z	Pitch	Yaw	Roll	
+50	0	-500	0.0	0.0	0.0	
FOR	Loaded – OBSS Mnvr ISSACS, SY Held					
Disp	S1>OBSS Unstow ISSACS					

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

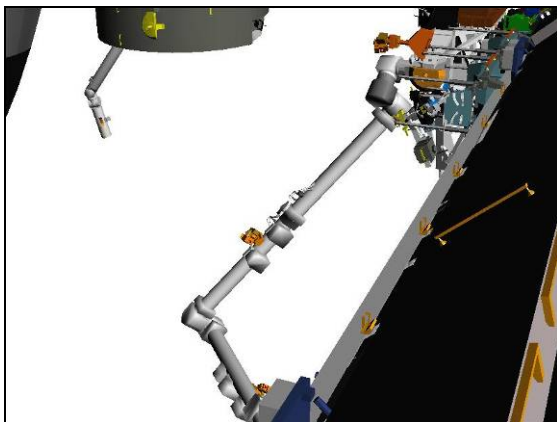


Figure 9.- JOCAS Start
(03: S1 Lower Outboard: +68, -25)
Zoom: 13 mm.



Figure 10.- JOCAS Start
(37: MBS Mast: -150, -20).

1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

Page 7 of 9 pages

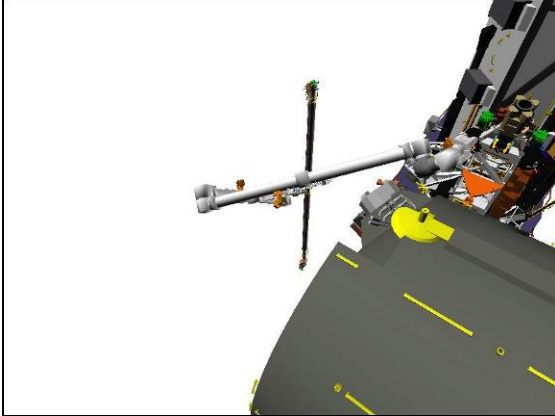


Figure 11.- JOCAS Start
(V10: SRMS Elbow: +90, -30).

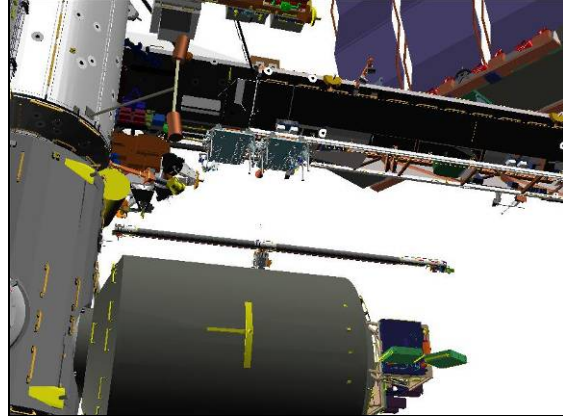


Figure 12.- JOCAS Start
(V10: Camera C: +15, +27)
HFOV: 40 deg.

6. JOINT OCAS TO OBSS HANDOFF POSITION

NOTE

1. The closest clearance is between the SSRMS Shoulder Cluster and the MBS MCAS Assembly during the following JOCAS: 17 cm (7 in) and may be monitored with the Tip Elbow Camera or the MBS Mast Camera.
2. Expect a singularity warning during the following JOCAS.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
24: Tip Elbow (+90, -10) 09: P1 Lower Outboard (+120, -20)	13: LAB Stbd Zenith (-170, +65)	37: MBS Mast (-150, -20)	SRMS Elbow (+90, -30)	Camera C (+15, +27)

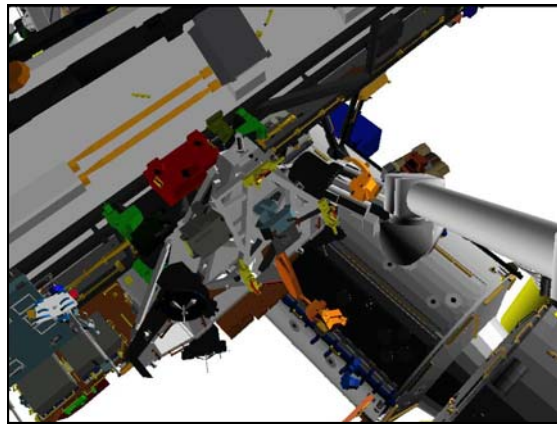


Figure 13.- JOCAS Start
(24: Tip Elbow: +90, -10).

1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

MSS: SSRMS: Rate:

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

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► OBSS ► Mnvr to Handoff

Verify 'Joint Angles' 'Destination' for OBSS Handoff position.

SR	SY	SP	EP	WP	WY	WR
-194.9	+4.8	-74.4	+92.7	-109.6	-3.3	-147.6

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)	-131.0	-159.4	-126.7	+98.1	-126.1	-172.6	-32.3
TGT	-194.9	+4.8	-74.4	+92.7	-109.6	-3.3	-147.6
ERR	+63.9	-164.2	-52.4	+5.4	-16.5	-169.3	+115.3

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)

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS:

Verify Posn Hold – orange

1.102 OBSS UNBERTH AND HANDOFF

(RBT FS/1J/FIN)

Page 9 of 9 pages

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

SR	SY	SP	EP	WP	WY	WR
-194.9	+4.8	-74.4	+92.7	-109.6	-3.3	-147.6
X	Y	Z	Pitch	Yaw	Roll	
+1247	-1058	-638	-104.4	-8.5	+40.7	
FOR	Loaded – OBSS Mnvr ISSACS, SY Held					
Disp	S1>OBSS Unstow ISSACS					

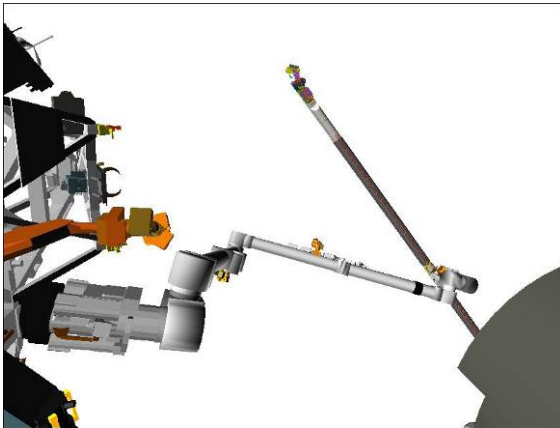


Figure 14.- OBSS Handoff
(13: LAB Stbd Zenith: -170, +5).

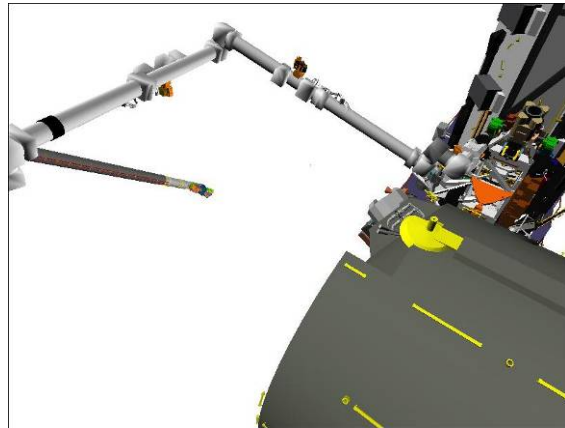


Figure 15.- OBSS Handoff
(V10: SRMS Elbow: +90, -30).

DCP BRAKES SSRMS → ON (Verify ON)

7. SETTING UP CAMERAS FOR SRMS OPERATIONS

Configure Cameras as shown in the following:

Monitor 1	Monitor 2
09: P1 Lower Outboard (+120, -20)	22: Base Elbow (+110, +7)

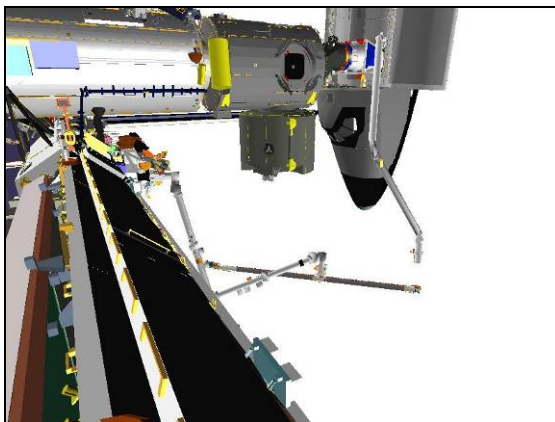


Figure 16.- SRMS Operations
(09: P1 Lower Outboard: +120, -20).

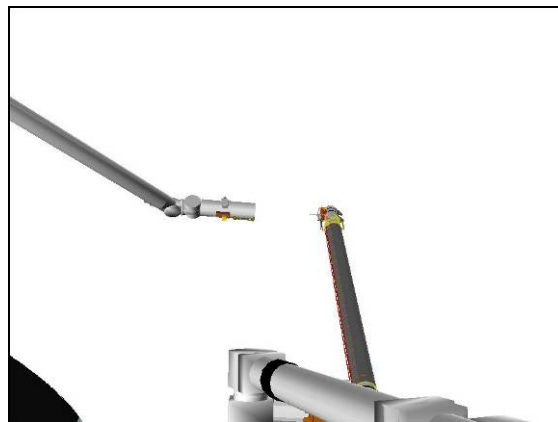


Figure 17.- SRMS Operations
(22: Base Elbow: +110, +7).

Give SRMS operator GO for SRMS OBSS Grapple.

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1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 1 of 14 pages

1. SETUP

On **SRMS operator GO** for OBSS Ungrapple:

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+127, -26) Zoom: 50 mm	25: Tip LEE	37: MBS Mast (-60, +45)	SRMS Elbow (+75, -15)	Camera B (-10, +20)

PCS

MSS: SSRMS:

Verify Loaded Parameters – ✓

Change Unloaded Parameters ► Unloaded ► LEE Tip SRH

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

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

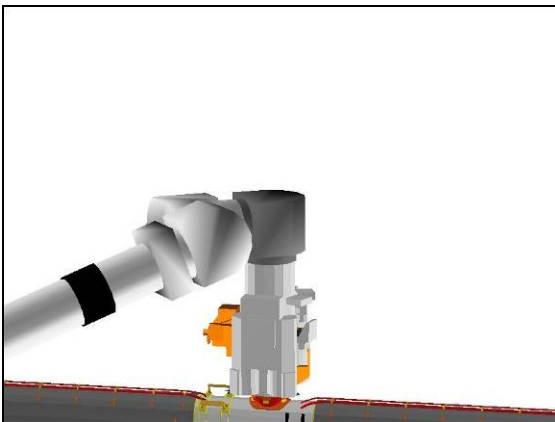


Figure 1.- OBSS Handoff
(09: P1 Lower Outboard: +127, -26)
Zoom: 50 mm.

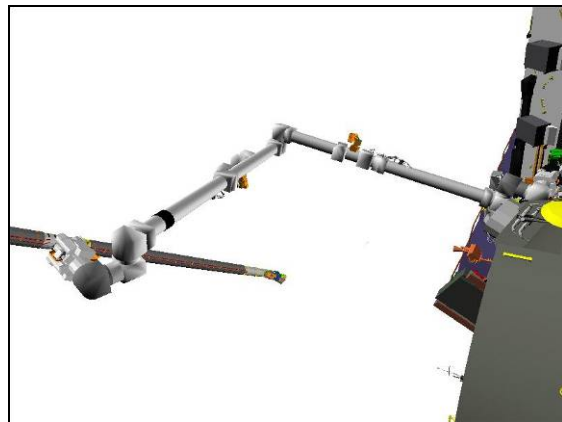


Figure 2.- OBSS Handoff
(V10: SRMS Elbow: +75, -15).

2. OBSS RELEASE (WITH CARRIAGE PUSHOFF)

2.1 SSRMS Limp

DCP

BRAKES SSRMS → OFF (Verify OFF)

PCS

MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 2 of 14 pages

2.2 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)

2.3 SSRMS Backoff

MSS: SSRMS: Limp:

cmd None Limp (Verify Standby – blue)

MSS: SSRMS: Snapshot:

cmd Snapshot

Change Display ► SSRMS ► Snapshot (Verify SSRMS>Snapshot)

√Vernier

MSS: SSRMS: Rate:

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

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 3 of 14 pages

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

THC/
RHC

Maneuver SSRMS to Back-Off position (within 5 cm/1 deg).

Locked						
SR	SY	SP	EP	WP	WY	WR
-194.9	+5.4	-68.0	+100.1	-123.4	-3.3	-148.2
X	Y	Z	Pitch	Yaw	Roll	
-180	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	SSRMS>Snapshot					

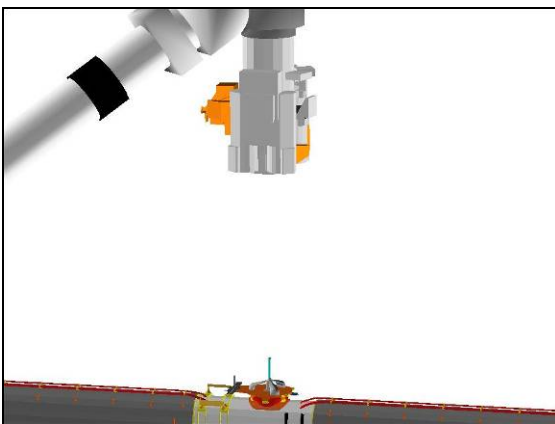


Figure 3.- Back-Off
(09: P1 Lower Outboard: +127, -26)
Zoom: 50 mm.

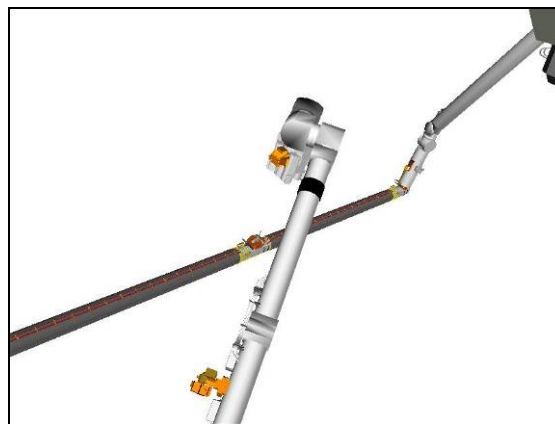


Figure 4.- Back-Off
(37: MBS Mast: -60, +45).



Figure 5.- Back-Off
(V10: SRMS Elbow: +75, -15).

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 4 of 14 pages

3. JOINT OCAS MANEUVER TO INTERMEDIATE POSITION

NOTE

Expect a singularity warning during the following JOCAS.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+120, -20)	13: LAB Stbd Zenith (-170, -15)	22: Base Elbow (+110, -5) 24: Tip Elbow (+110, -10)	SRMS Elbow (+75,-15)	Camera B (-10, +20)

Change Loaded Parameters ► Walk Off ► Node 2 PDGF
Verify 'Loaded Parameters' (two) – Node 2 PDGF, SR Held

Change Display ► Node2 ► PDGF (Verify Node2>PDGF)

MSS: SSRMS: Rate:

Set 'Scale' 'Vern' Rate Scale: 1.0

Verify SSRMS at Back-Off position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-194.9	+5.4	-68.0	+100.1	-123.4	-3.3	-148.2
X	Y	Z	Pitch	Yaw	Roll	
+1357	-611	-305	+20.7	+8.3	+138.2	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>PDGF					

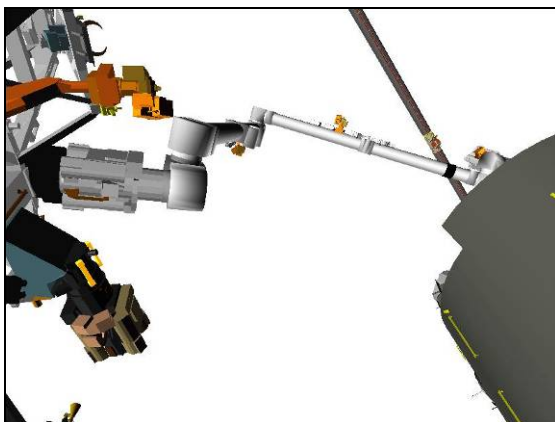


Figure 6.- Back-Off
(13: LAB Stbd Zenith: -170, -15).

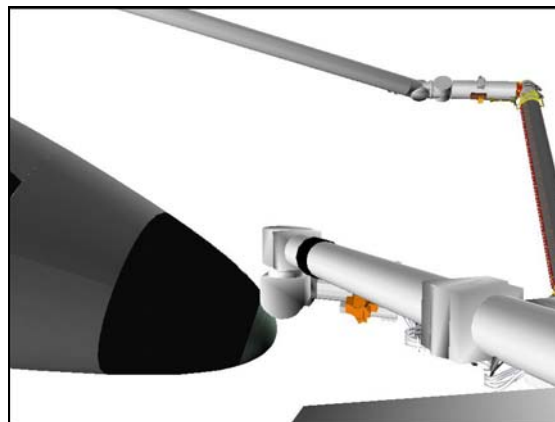


Figure 7.- Back-Off
(22: Base Elbow: +110, -5).

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

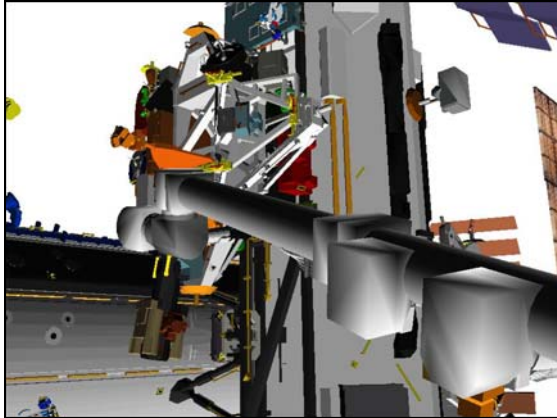


Figure 8.- Back-Off
(24: Tip Elbow: +110, -10).

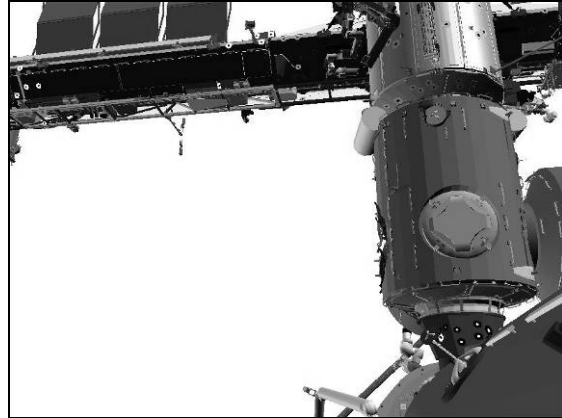


Figure 9.- Back-Off
(V10: Camera B: -10, +20).

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► OBSS ► Intermediate

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

SR	SY	SP	EP	WP	WY	WR
0.0	+125.0	+108.0	+77.0	-122.1	-75.0	+50.0

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)	-194.9	+5.4	-68.0	+100.1	-123.4	-3.3	-148.2
TGT	0.0	+125.0	+108.0	+77.0	-122.1	-75.0	+50.0
ERR	-194.9	-119.6	-176.0	+23.1	-1.3	+71.7	-198.2

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)

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 6 of 14 pages

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
0.0	+125.0	+108.0	+77.0	-122.1	-75.0	+50.0
X	Y	Z	Pitch	Yaw	Roll	
+1357	-334	-851	-48.4	-55.1	+17.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>PDGF					

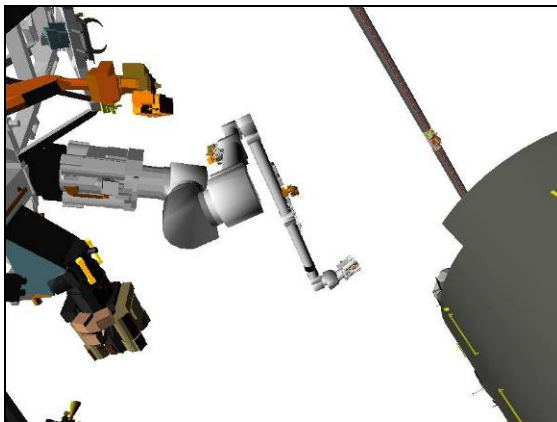


Figure 10.- Intermediate
(13: LAB Stbd Zenith: -170, -15).

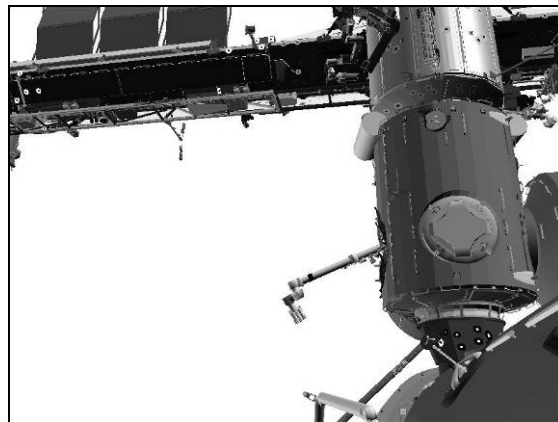


Figure 11.- Intermediate
(V10: Camera B: -10, +20).

4. JOINT OCAS MANEUVER TO NODE 2 APPROACH POSITION

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+120, -10)	13: LAB Stbd Zenith (-170, -35)	24: Tip Elbow (+110, -10) 37: MBS Mast (+15, +15)	SRMS Elbow (+135, +15)	Camera B (-10, +20)

pick File ► OBSS ► Node 2 Approach

Verify 'Joint Angles' 'Destination' for Node 2 Approach position.

SR	SY	SP	EP	WP	WY	WR
+7.2	+118.2	+206.9	+81.4	-31.5	-176.0	+195.4

cmd Load (Verify Sequence Status – Confirm or Cancel)

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 7 of 14 pages

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

	SR	SY	SP	EP	WP	WY	WR
(current)	0.0	+125.0	+108.0	+77.0	-122.1	-75.0	+50.0
TGT	+7.2	+118.2	+206.9	+81.4	-31.5	-176.0	+195.4
ERR	-7.2	+6.8	-98.9	-4.4	-90.6	+101.0	-145.4

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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at Node 2 Approach position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+7.2	+118.2	+206.9	+81.4	-31.5	-176.0	+195.4
X	Y	Z	Pitch	Yaw	Roll	
-110	-47	-180	-11.3	+3.0	+1.1	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>PDGF					

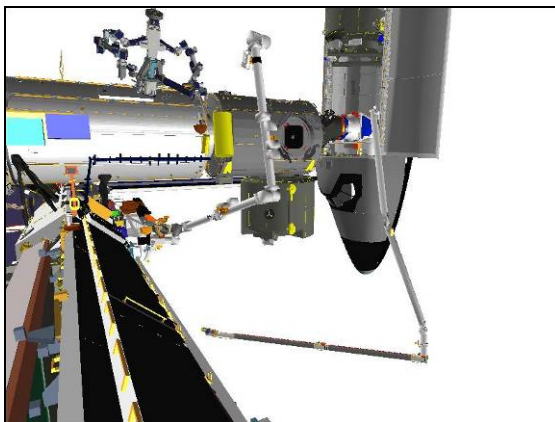


Figure 12.- Node 2 Approach
(09: P1 Lower Outboard: +120, -10).

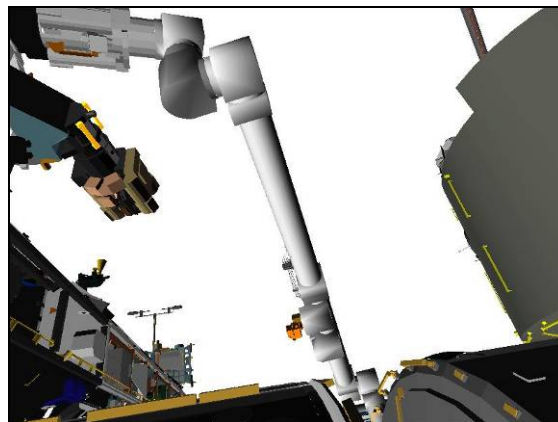


Figure 13.- Node 2 Approach
(13: LAB Stbd Zenith: -170, -35).

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 8 of 14 pages

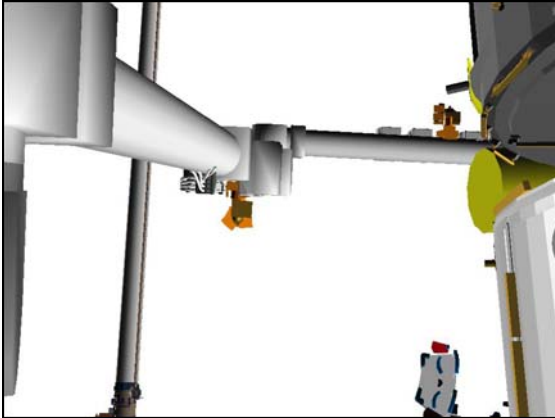


Figure 14.- Node 2 Approach
(37: MBS Mast: +15, +15).

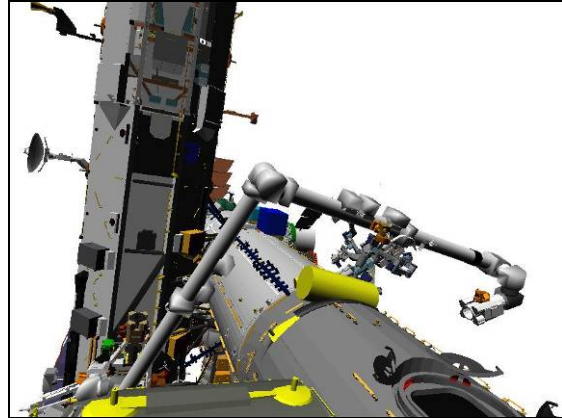


Figure 15.- Node 2 Approach
(V10: SRMS Elbow: +135, +15).

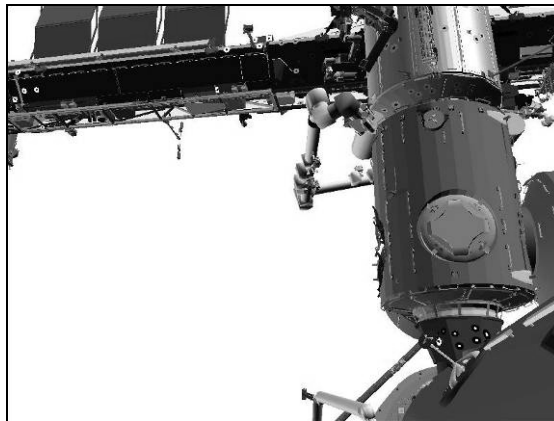


Figure 16.- Node 2 Approach
(V10: Camera B: -10, +20).

5. SINGLE JOINT MANEUVER TO NODE 2 PRE-GRAPPLE POSITION

NOTE

The closest clearances at the end of the maneuver to Node 2 Pre-Grapple position are:

- SSRMS Tip Boom to Node 2 Cables: 70 cm (27 in). May be monitored with P1 Lower Outboard Camera or with the SRMS Elbow Camera.
- SSRMS Base Boom to Node 2 Trunnion Pin: 80 cm (32 in). May be monitored with the MBS Mast Camera or with the SRMS Elbow Camera.
- SSRMS Tip Boom to Node 2 EVA Hand Rails: 83 cm (33 in). May be monitored with the SRMS Elbow Camera or with Camera B.
- SSRMS Base Boom to US Lab: 101 cm (40 in). May be monitored with the MBS Mast Camera or with the P1 Lower Outboard Camera.

MSS: SSRMS:

Enter Mode – Single (Verify blue)

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 9 of 14 pages

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 Node 2 Pre-Grapple position (within 1 deg).

	SR	SY	SP	EP	WP	WY	WR
Node 2 Approach	+7.2	+118.2	+206.9	+81.4	-31.5	-176.0	+195.4
1: SP +			+218.6				
Node 2 Pre-Grapple	+7.2	+118.2	+218.6	+81.4	-31.5	-176.0	+195.4
	X	Y	Z	Pitch	Yaw	Roll	
	-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held						
Disp	Node2>PDGF						

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

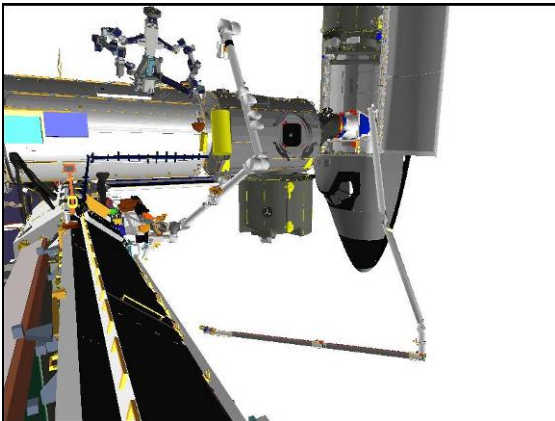


Figure 17.- Node 2 Pre-Grapple (09: P1 Lower Outboard: +120, -10).

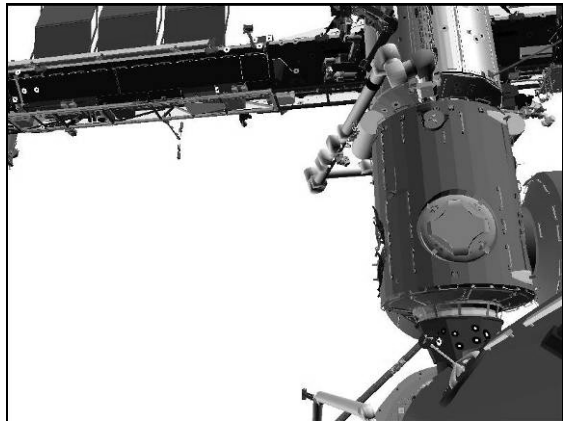


Figure 18.- Node 2 Pre-Grapple (V10: Camera B: -10, +20).

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

6. SETUP FOR NODE 2 GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+111, +13) Zoom: 35 mm	25: Tip LEE	37: MBS Mast (+15, +15)	SRMS Elbow (+135, +15)	Camera B (0, +30) HFOV: 24 deg

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

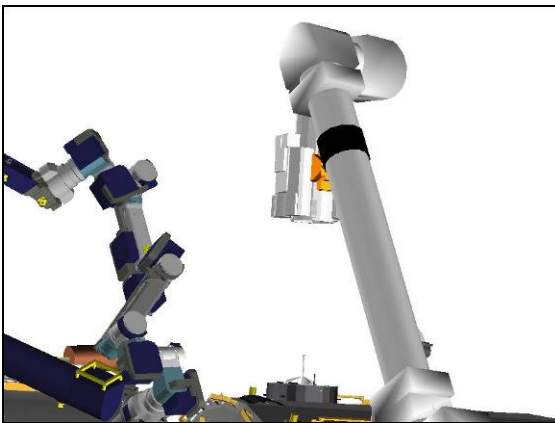


Figure 19.- Node 2 Pre-Grapple
(09: P1 Lower Outboard: +111, +13)
Zoom: 35 mm.

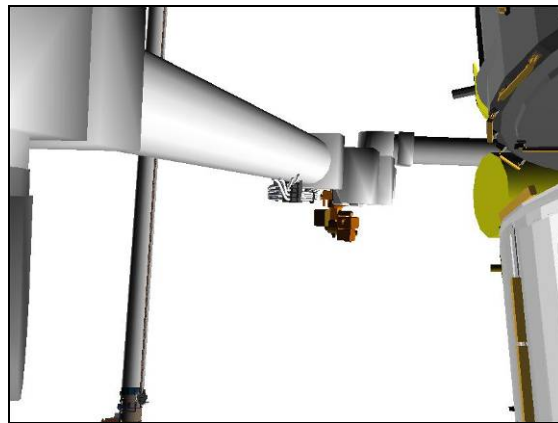


Figure 20.- Node 2 Pre-Grapple
(37: MBS Mast: +15, +15).

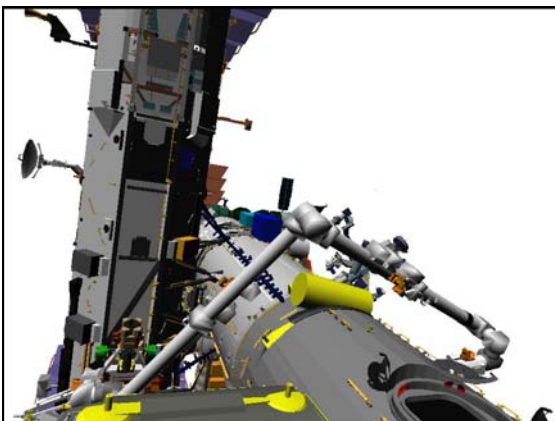


Figure 21.- Node 2 Pre-Grapple
(V10: SRMS Elbow: +135, +15).

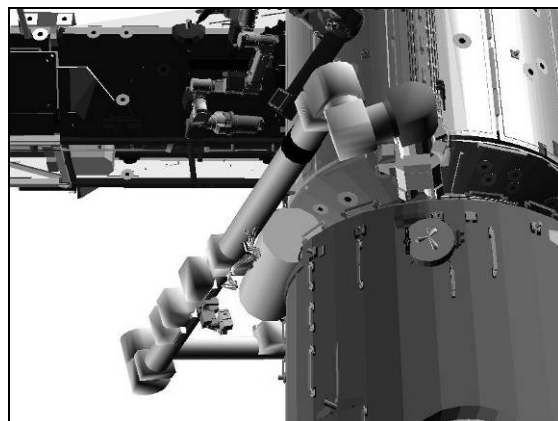


Figure 22.- Node 2 Pre-Grapple
(V10: Camera B: 0, +30)
HFOV: 24 deg.

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 11 of 14 pages

7. GRAPPLE NODE 2 PDGF

NOTE

The closest clearances which occur at the end of the maneuver to the Expected Node 2 Grapple position are:

- a) SSRMS Tip Boom to Node 2 Cables: 53 cm (21 in). This clearance may be monitored with the SRMS Elbow Camera or with the P1 Lower Outboard Camera.
- b) SSRMS Tip Boom to Node 2 EVA Hand Rails: 44 cm (17 in). This clearance may be monitored with the SRMS Elbow Camera.

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

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 12 of 14 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)

√MCC-H - PDGF power inhibits confirmed

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

8. GRAPPLE CLEANUP

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)
- Verify Loaded Parameters – √
- Verify 'Loaded Parameters' (two) – Node 2 PDGF, SR Held
- Verify SSRMS at Node 2 PDGF Grapple position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+7.2	+122.8	+208.2	+97.9	-37.2	-175.9	+200.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – Node 2 PDGF, SR Held					
Disp	Node2>PDGF					

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 13 of 14 pages

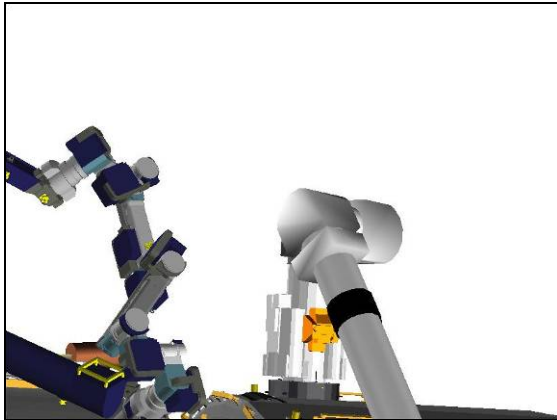


Figure 23.- Node 2 Grapple
(09: P1 Lower Outboard: +111, +13)
Zoom: 35 mm.

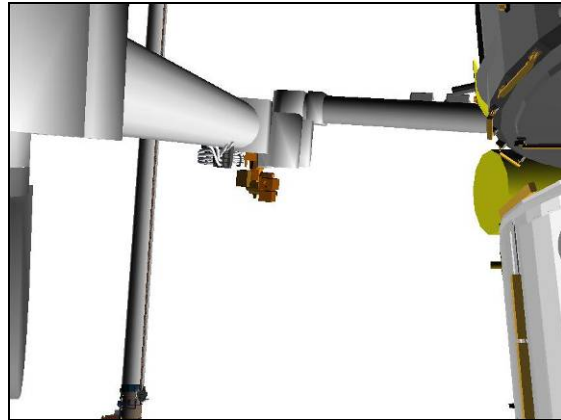


Figure 24.- Node 2 Grapple
(37: MBS Mast: +15, +15).

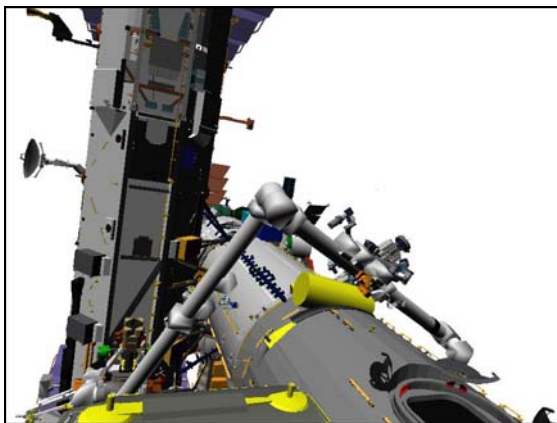


Figure 25.- Node 2 Grapple
(V10: SRMS Elbow: +135, +15).

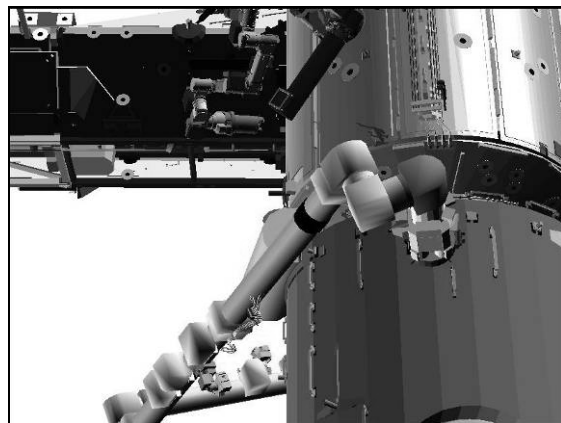


Figure 26.- Node 2 Grapple
(V10: Camera B: 0, +35)
HFOV: 24 deg.

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 14 of 14 pages

9. SETTING UP P1 LOWER OUTBOARD FOR SRMS OPERATIONS

Configure P1 Lower Outboard Camera as shown in the following:



Figure 27.- P1 View for SRMS Operations
(09: P1 Lower Outboard: +140, -10).

Give SRMS operator GO to Maneuver to JPM Install Viewing Position.

Give MCC-H GO for Base change.

JPM

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2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 1 of 12 pages

1. SETUP

NOTE

The closest clearances that occur at the beginning of the maneuver to MBS PDGF 3 Release position are:

- a) SSRMS Base Boom to Node 2 EVA Hand Rails: 44 cm (17 in). This may be monitored with the SRMS Elbow Camera or with Camera B.
- b) SSRMS Base Boom to Node 2 Cables: 53 cm (21 in). This may be monitored with the P1 Lower Outboard Camera.

The closest clearance that occurs at the end of the maneuver to MBS PDGF 3 Release position is between the SSRMS Tip Boom and the JLP: 107 cm (42 in). This may be monitored with the LAB Starboard Zenith Camera.

On MCC GO for MBS PDGF 3 Ungrapple:

Verify that the SRMS is in the JPM Install Viewing position.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+110, +10)	25: Tip LEE	13: Lab Stbd Zenith (-170, -10)	SRMS Elbow (+150, -5)	Camera B (-10, +15)

NOTE

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

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – MBS PDGF 3, SR Held

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

Change Display ► MBS ► PDGF 3 (Verify MBS>PDGF 3)

√Command – SSRMS>Internal

Expected MBS PDGF3 Grapple position

SR	SY	SP	EP	WP	WY	WR
+200.0	+175.9	-37.2	+97.9	+208.2	-122.8	+7.2
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – MBS PDGF 3, SR Held					
Disp	MBS>PDGF 3					

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 2 of 12 pages

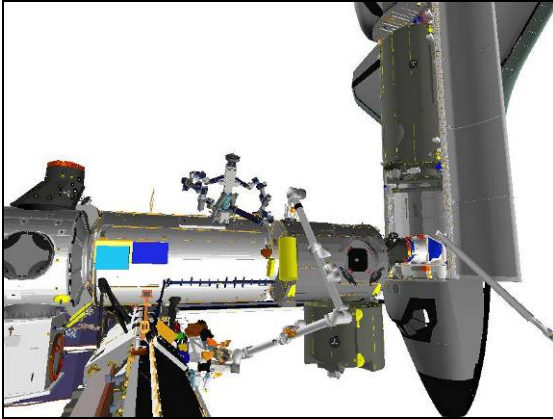


Figure 1.- MBS PDGF 3 Grapple
(09: P1 Lower Outboard: +110, +10).



Figure 2.- MBS PDGF 3 Grapple
(13: LAB Stbd Zenith: -170, -10).

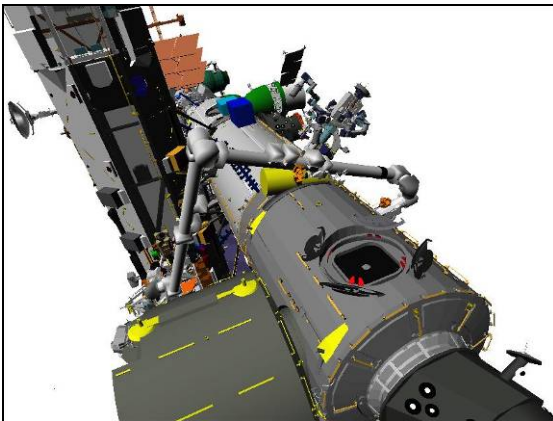


Figure 3.- MBS PDGF 3 Grapple
(V10: SRMS Elbow: +150, -5).

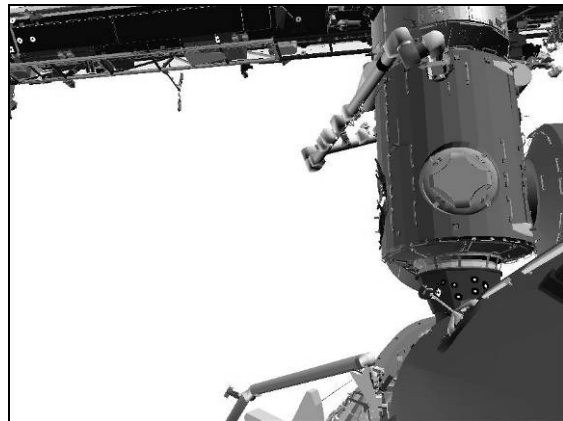


Figure 4.- MBS PDGF 3 Grapple
(V10: Camera B: -10, +15).

2. MBS PDGF 3 RELEASE (WITH CARRIAGE PUSHOFF)

2.1 SSRMS Limp

PCS

MSS: SSRMS: MSS Safing: MSS Safing

cmd 'SSRMS' Remove (Verify Not Safed)

DCP

BRAKES SSRMS → OFF (Verify OFF)

PCS

MSS: SSRMS: Limp: SSRMS Limp

cmd All Limp (Verify Limp – blue)

MSS: SSRMS: SSRMS

Verify all joints – Limped

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 3 of 12 pages

2.2 Carriage Rigidize

MSS: SSRMS: Tip LEE: SSRMS Tip LEE

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

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

CAUTION

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

NOTE

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

cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Rigidize

RHC TRIGGER → press (momentarily) (SCR 19064)

PCS Verify 'Carriage' Tension ~5500 N (90 s max)
Verify 'Carriage' Retract – blue

2.3 Auto Release

MSS: SSRMS: Tip LEE: SSRMS Tip LEE

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

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

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)
Verify 'Carriage' Extend – blue (90 s max)

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 4 of 12 pages

2.4 SSRMS Backoff

MSS: SSRMS: Limp:

cmd None Limp (Verify Standby – blue)

√Vernier

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 Roll (Verify SR – Locked)

THC

Maneuver SSRMS to MBS PDGF 3 Release position
(within 5 cm/1 deg).

Locked						
SR	SY	SP	EP	WP	WY	WR
+200.0	+183.3	-44.4	+100.8	+223.7	-123.3	+20.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	MBS>PDGF 3					

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

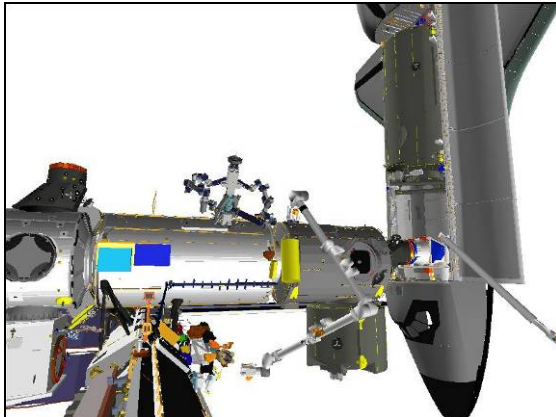


Figure 5.- MBS PDGF 3 Release
(09: P1 Lower Outboard: +110, +10).

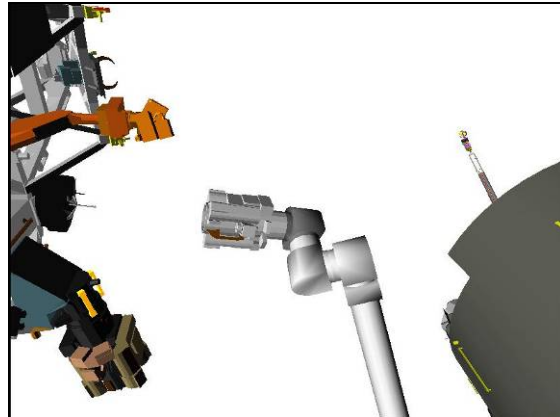


Figure 6.- MBS PDGF 3 Release
(13: LAB Stbd Zenith: -170, -10).

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 5 of 12 pages

3. SINGLE JOINT MANEUVER TO INTERMEDIATE POSITION 1

NOTE

The closest clearance during the maneuver to Intermediate Position 1 is between the SSRMS Tip Boom and the JLP: 95 cm (37 in). This may be monitored with the LAB Starboard Zenith Camera.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+110, +10)	24: Tip Elbow (0, +10)	13: LAB Stbd Zenith (-170, -30)	SRMS Elbow (+150, -5)	Camera B (-10, +15)

Change Loaded Parameters ► JPM ► JPM Unberth OBAS SRH
Verify 'Loaded Parameters' (two) – JPM Unberth OBAS, SR Held

Verify Unloaded Parameters – √

Change Display ► Orbiter ► JPM PDGF (Verify Orbiter>JPM PDGF)

Verify Command – SSRMS>Internal

√Vernier

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.

THC

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

MBS 3
Release
1: SP –
Intermediate
Position 1

SR	SY	SP	EP	WP	WY	WR
+200.0	+183.3	-44.4	+100.8	+223.7	-123.3	+20.7
		-64.0				
+200.0	+183.3	-64.0	+100.8	+223.7	-123.3	+20.7
X	Y	Z	Pitch	Yaw	Roll	
-115	-1006	-1888	+169.9	-46.3	-169.9	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Orbiter>JPM PDGF					

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 6 of 12 pages

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

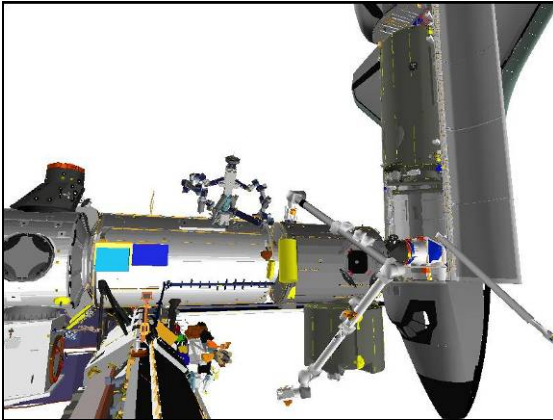


Figure 7.- Intermediate Position 1
(09: P1 Lower Outboard: +110, +10).

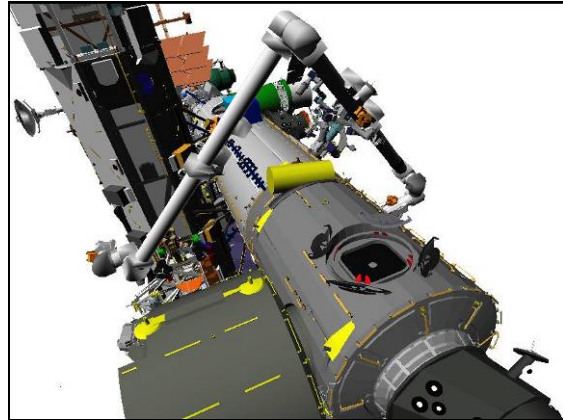


Figure 8.- Intermediate Position 1
(V10: SRMS Elbow: +150, -5).

4. JOINT OCAS TO INTERMEDIATE POSITION 2

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+110, +10)	24: Tip Elbow (0, +10)	13: LAB Stbd Zenith (-170, -30) 03: S1 Lower Outboard (+70, +10)	SRMS Elbow (+150, -5)	Camera B (-10, +30)

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► JPM ► Intermediate 2

Verify 'Joint Angles' 'Destination' for Intermediate Position 2.

SR	SY	SP	EP	WP	WY	WR
+180.0	+183.2	-140.0	+76.7	+75.0	-134.3	+55.0

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)	+200.0	+183.3	-64.0	+100.8	+223.7	-123.3	+20.7
TGT	+180.0	+183.2	-140.0	+76.7	+75.0	-134.3	+55.0
ERR	+20.0	+0.1	+76.0	+24.1	+148.7	+11.0	-34.3

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 7 of 12 pages

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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at Intermediate Position 2 (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+180.0	+183.2	-140.0	+76.7	+75.0	-134.3	+55.0
X	Y	Z	Pitch	Yaw	Roll	
+702	-1654	-749	-104.8	-52.0	-170.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Orbiter>JPM PDGF					

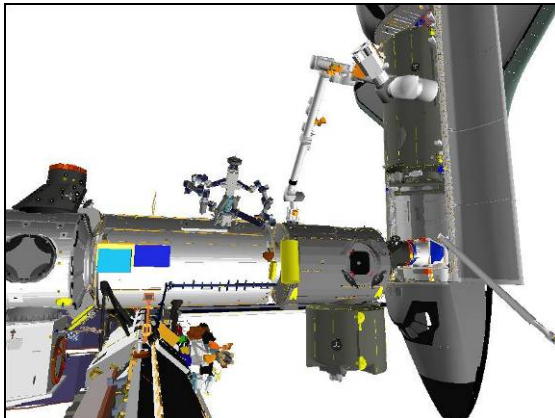


Figure 9.- Intermediate Position 2
 (09: P1 Lower Outboard: +110, +10).

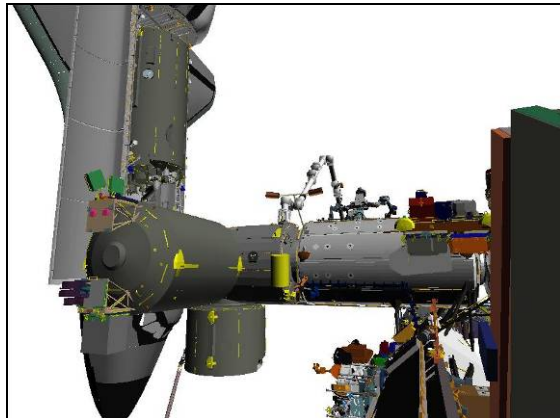


Figure 10.- Intermediate Position 2
 (03: S1 Lower Outboard: +70, +10).

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 8 of 12 pages

5. JOINT OCAS TO JPM PRE-GRAPPLE

NOTE

1. The SRMS Elbow Camera must be panned to the value shown below in order to follow the Joint OCAS motion.
2. The closest clearance during the following maneuver is 144 cm (57 in) between the SSRMS Base Boom and the SPDM Arm 2. This may be monitored using the S1 Lower Outboard Camera.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+110, +10)	24: Tip Elbow (0, +10)	03: S1 Lower Outboard (+70, +10)	SRMS Elbow (-160, +10)	Camera C (0, +20)

SSRMS Joint OCAS

pick File ► JPM ► JPM Pre-Grapple

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

SR	SY	SP	EP	WP	WY	WR
-82.7	+132.1	-183.6	+76.7	-105.0	-134.3	+243.5

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)	+180.0	+183.2	-140.0	+76.7	+75.0	-134.3	+55.0
TGT	-82.7	+132.1	-183.6	+76.7	-105.0	-134.3	+243.5
ERR	+262.7	+51.1	+43.6	0.0	+180.0	0.0	-188.5

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)

DCP

AUTO SEQ → PROC

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 9 of 12 pages

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
-82.7	+132.1	-183.6	+76.7	-105.0	-134.3	+243.5
X	Y	Z	Pitch	Yaw	Roll	
-200	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Orbiter>JPM PDGF					

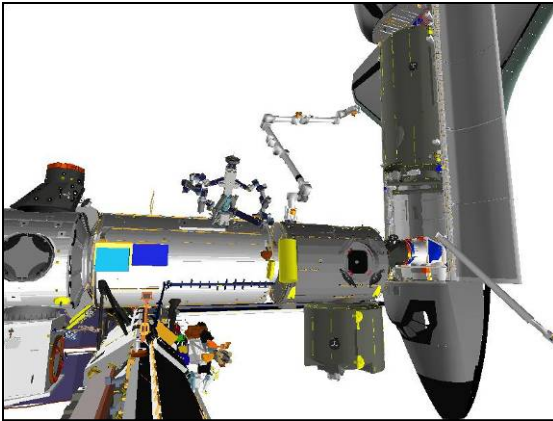


Figure 11.- JPM Pre-Grapple
(09: P1 Lower Outboard: +110, +10).

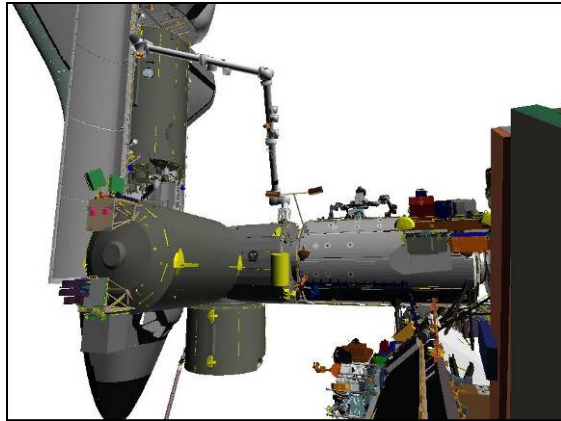


Figure 12.- JPM Pre-Grapple
(03: S1 Lower Outboard: +70, +10).

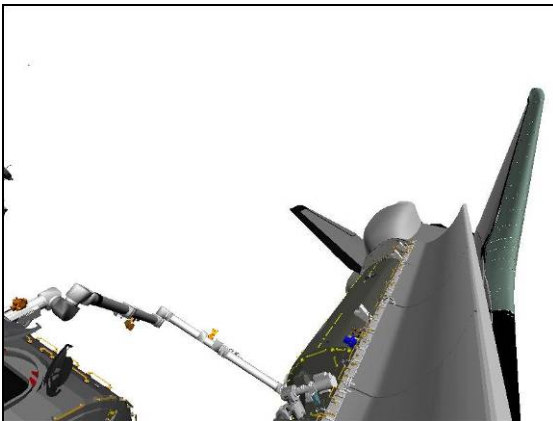


Figure 13.- JPM Pre-Grapple
(V10: SRMS Elbow: -160, +10).

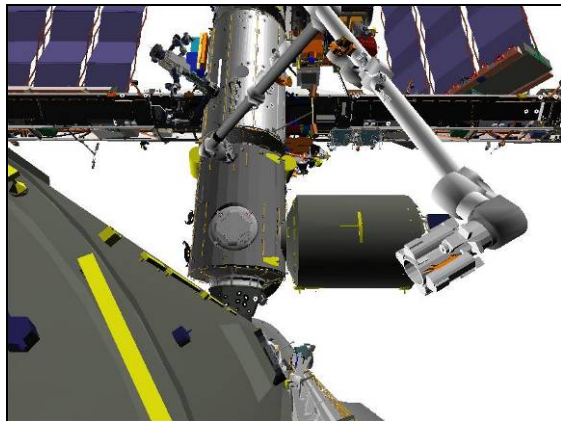


Figure 14.- JPM Pre-Grapple
(V10: Camera C: 0, +20).

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 10 of 12 pages

6. SETUP FOR JPM GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
09: P1 Lower Outboard (+110, +10)	25: Tip LEE	03: S1 Lower Outboard (+70, +10)	SRMS Elbow (-160, +10)	Camera C (0, +20)

NOTE

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

Verify 'Loaded Parameters' (two) – JPM Unberth OBAS, SR Held

Verify Unloaded Parameters – √

Verify Command – SSRMS>Internal

√Vernier

MSS: SSRMS: Rate:

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

7. JPM GRAPPLE

7.1 Maneuver to Grapple

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.

7.2 Auto Capture

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.

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 11 of 12 pages

NOTE

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

cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Capture

RHC TRIGGER → press (momentarily)

PCS Verify 'Snare' Close, Capture (two) – blue (12 s max)
Verify Capture to Latch – Yes (SCR 19282)
Verify 'Carriage' Tension ~5500 N (90 s max)
Verify 'Carriage' Retract – blue
Verify 'Latch' Latch – blue (65 s max)

7.3 Umbilical Mate

√**MCC-H** - PDGF power inhibits confirmed

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

8. GRAPPLE CLEANUP

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

Verify Loaded Parameters – √

Change Display ► Orbiter ► JPM Unberth OBAS (Verify Orbiter>JPM Unberth OBAS)

√Command – SSRMS>Internal

2.101 MNVR TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 12 of 12 pages

Record JPM Grappled joint angles and FOR.

	SR	SY	SP	EP	WP	WY	WR	
Expected	-82.7	+141.6	-178.9	+79.3	-118.8	-126.6	+235.0	
	X	Y	Z	Pitch	Yaw	Roll		
Expected	0	0	0	0.0	0.0	0.0		
	FOR	Loaded – JPM Unberth OBAS, SR Held						
	Disp	Orbiter>JPM Unberth OBAS						

Give MCC GO for JPM Power.

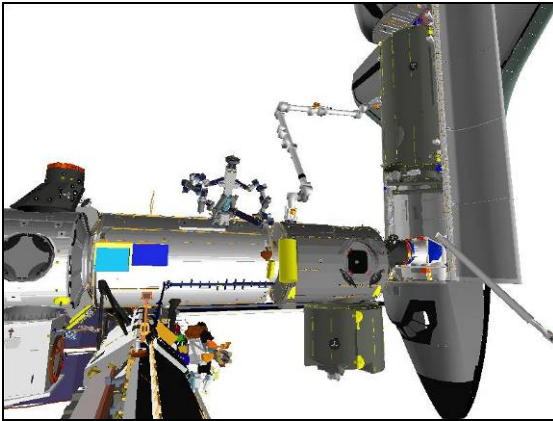


Figure 15.- JPM Grappled
(09: P1 Lower Outboard: +110, +10).

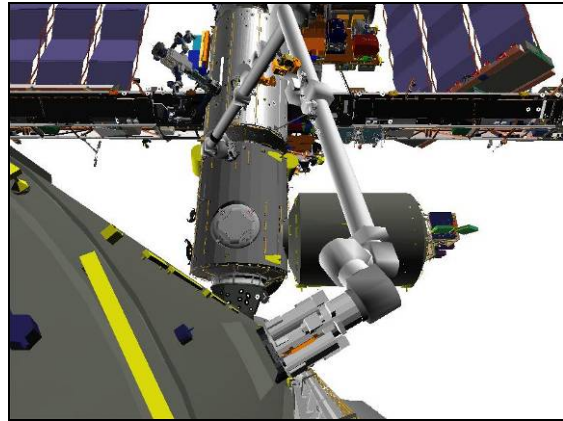


Figure 16.- JPM Grappled
(V10: Camera C: +0, +20).

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 1 of 16 pages

1. SETUP FOR JPM UNBERTH

Verify CBCS Setup complete.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+70, +20)	24: Tip Elbow (+40, -10)	09: P1 Lower Outboard (+115, +35) 22: Base Elbow (+85, -30)	Mux A/D Camera A (0, 0) Camera D (0, 0) (SRMS Elbow (-165, +10))	Mux B/C Camera B (0, 0) Camera C (0, 0)

PCS

MSS: SSRMS:

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – JPM Unberth OBAS, SR Held

√Display – Orbiter>JPM Unberth OBAS

√Command – SSRMS>Internal

MSS: SSRMS: Rate:

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

√Vernier

SSRMS at JPM Grappled position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-82.7	+141.6	-178.9	+79.3	-118.8	-126.6	+235.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter>JPM Unberth OBAS					

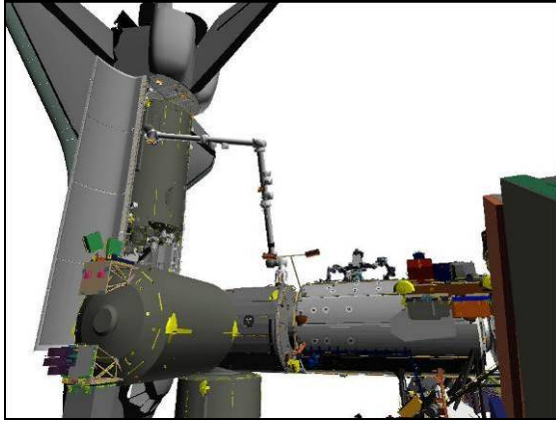


Figure 1.- JPM Grappled
(03: S1 Lower Outboard: +70, +20).

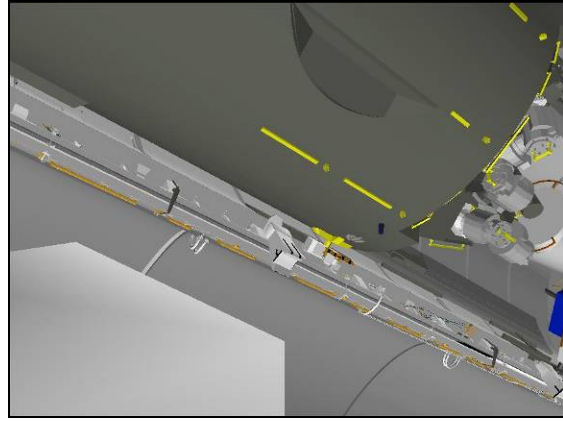


Figure 2.- JPM Grappled
(24: Tip Elbow: +40, -10).

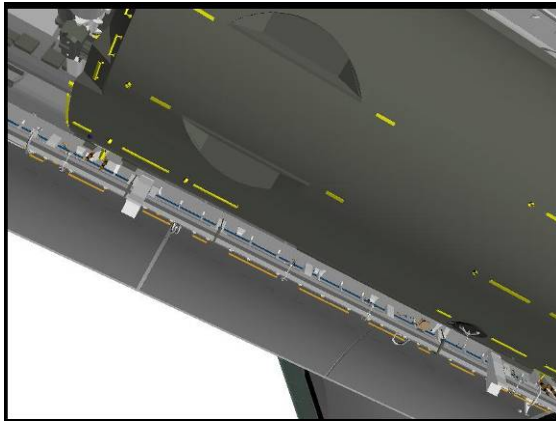


Figure 3.- JPM Grappled
(22: Base Elbow: +85, -30).

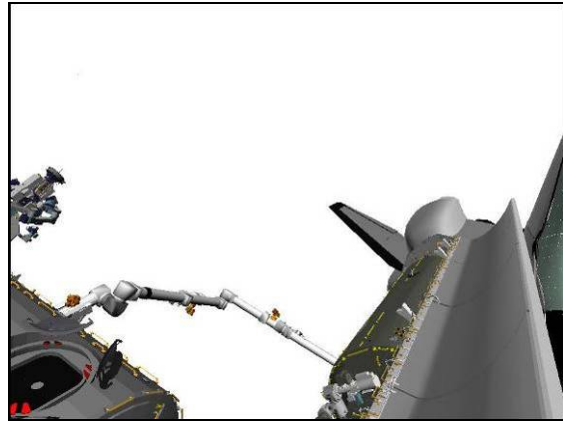


Figure 4.- JPM Grappled
(V10: SRMS Elbow: -165, +10).

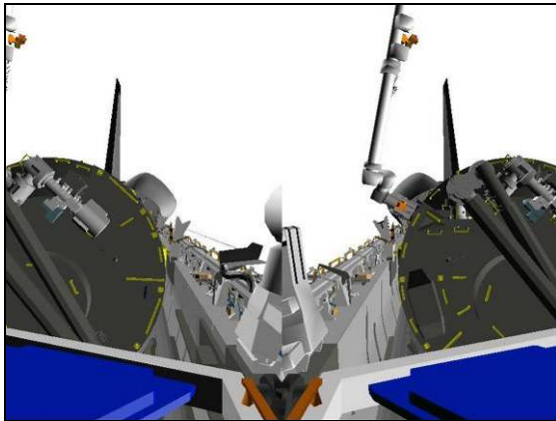


Figure 5.- JPM Grappled
(V10: Mux A/D).

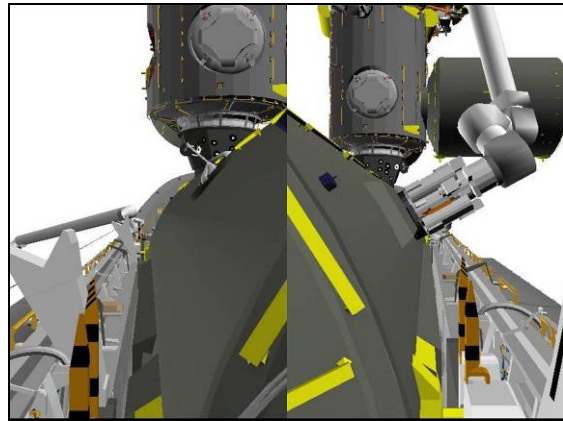


Figure 6.- JPM Grappled
(V10: Mux C/B).

2. PREP FOR JPM UNBERTH

<u>NOTE</u>
MCC-H will verify:
1. Attitude control is in a good config.
2. SSRMS Payload power is applied to the JPM HTCLs.

If using shuttle attitude control, coordinate with shuttle crewmembers
DAP: FREE

On **MCC-H GO** for JPM Unberth:

3. ACTIVATING LATCHES

Give shuttle crew GO for PRLA Ops.

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

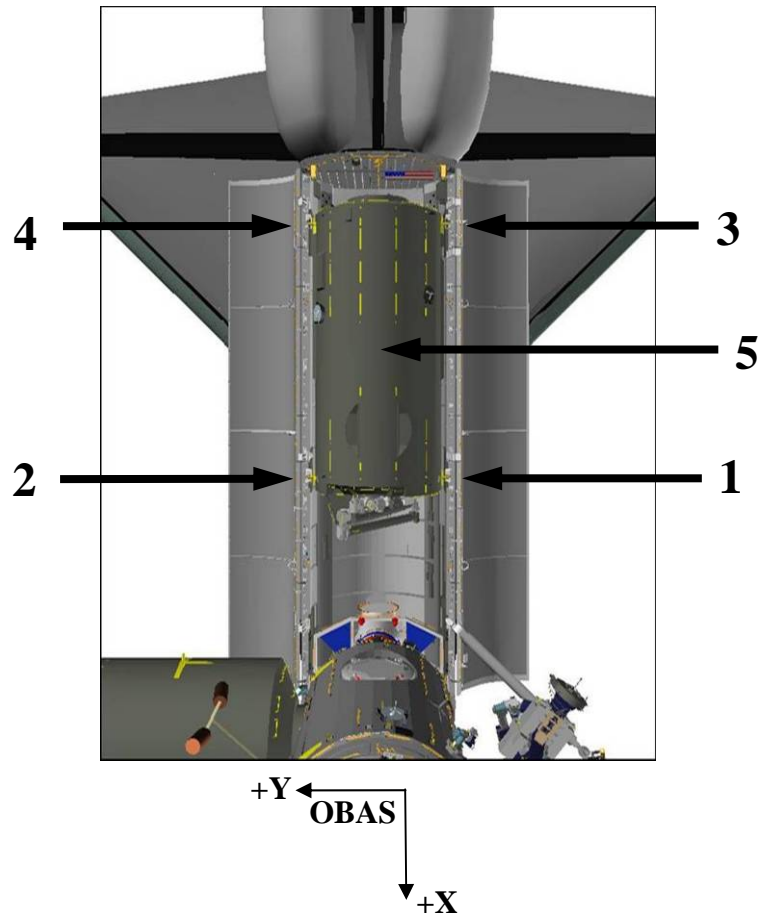


Figure 7.- JPM PRLA Configuration.

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 4 of 16 pages

A6U √PL RETEN LAT (five) – OFF
 √PL SEL – 1
R13L BAY MECH PWR SYS 1,2 (two) – ON
A6U RETEN LOGIC PWR SYS 1,2 (two) – ON

SM 97 PL RETENTION

√PL SEL 1 RDY-FOR-LAT 1,2,3,4,5 (ten) – 1
 √LAT 1,2,3,4,5 (ten) – 1

* If any REL msw shows '1', expect single motor time
* (60 seconds).

4. AKA RELEASE

√PL RETEN LAT 5 tb – LAT
 √RDY 5 tb – gray

Note single motor drive times (> 30 seconds).

PL RETEN LAT 5 – REL (tb-REL), 60 s max
 – OFF

5. PRLA RELEASE

√PL RETEN LAT 1,2,3,4 (four) tb – LAT
 √RDY 1,2,3,4 (four) tb – gray

Note single motor drive times (> 30 seconds)

PL RETEN LAT 1,2 (two) – REL (tb-REL), 60 s max
 – OFF
 3,4 (two) – REL (tb-REL), 60 s max
 – OFF

6. DEACTIVATING LATCHES

R13L PL RETEN LOGIC PWR SYS 1,2 (two) – OFF
 BAY MECH PWR SYS 1,2 (two) – OFF

Give SSRMS operator GO for JPM unberth.

7. JPM UNBERTH

On shuttle crew GO for JPM unberth:

PCS MSS: SSRMS: SSRMS

Enter Mode – Manual (Verify blue)

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 5 of 16 pages

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

cmd Shoulder Roll (Verify SR – Locked)

√Vernier

THC/
RHC

Maneuver JPM to Unberth position (within 5 cm/1 deg).
Expect -Z (THC up).

Locked						
SR	SY	SP	EP	WP	WY	WR
-82.7	+138.3	-224.4	+102.6	-94.1	-129.3	+238.2
X	Y	Z	Pitch	Yaw	Roll	
0	0	-610	0.0	0.0	0.0	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter>JPM Unberth OBAS					

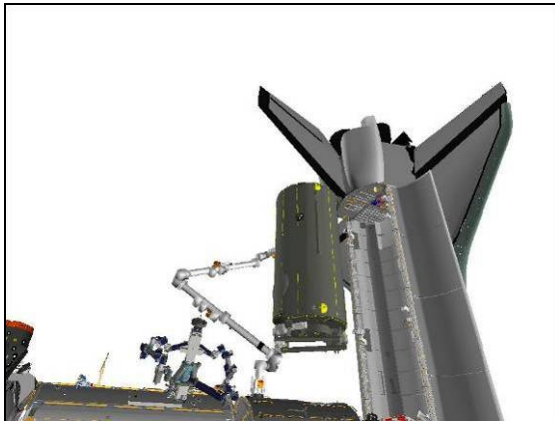


Figure 8.- JPM Unberth
(09: P1 Lower Outboard: +115, +35).

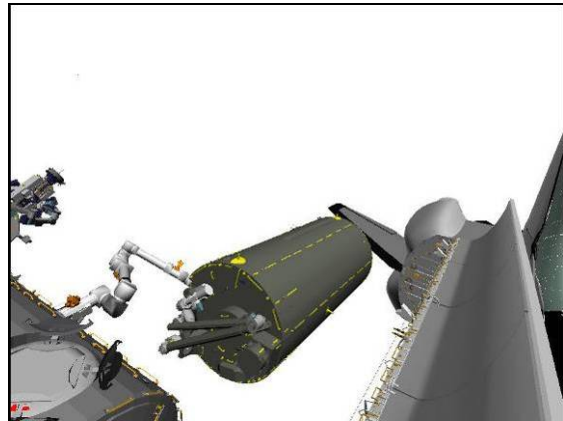


Figure 9.- JPM Unberth
(V10: SRMS Elbow: -165, +10).

PCS

MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

8. ATTITUDE CONTROL

If using shuttle attitude control and attitude maintenance required,
coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

| DAP: FREE > 2 seconds

| DAP: AUTO

When in attitude and rates damped

DAP: FREE

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 6 of 16 pages

9. JOCAS CLEANUP FOR JAUTO START

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+70, +20)	22: Base Elbow (+120, -20)	09: P1 Lower Outboard (+115, +35)	SRMS Elbow (-165, +10)	Camera C (-40, +20)

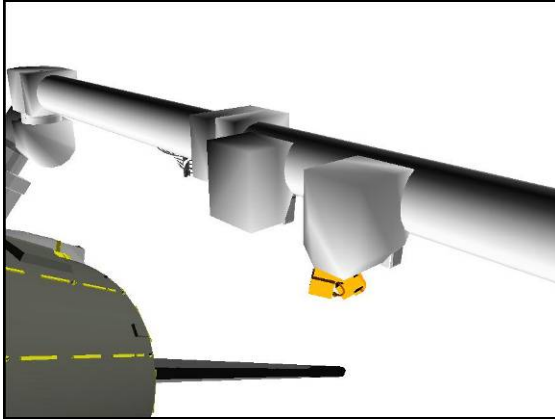


Figure 10.- JPM Unberth
(22: Base Elbow: +120, -20).

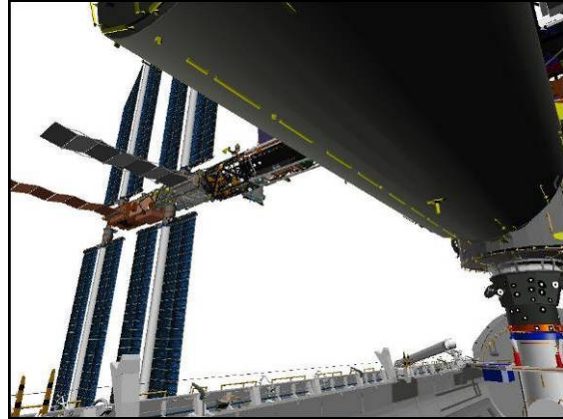


Figure 11.- JPM Unberth
(V10: Camera C: -40, +20).

RHC RATE → COARSE (Verify Coarse on PCS)

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► JPM ► JAUTO Start

Verify 'Joint Angles' 'Destination' for JAUTO Start position.

SR	SY	SP	EP	WP	WY	WR
-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4

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)	-82.7	+138.3	-224.4	+102.6	-94.1	-129.3	+238.2
TGT	-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4
ERR	0.0	-27.7	-0.1	0.0	-0.2	-0.1	-0.2

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 7 of 16 pages

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

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4

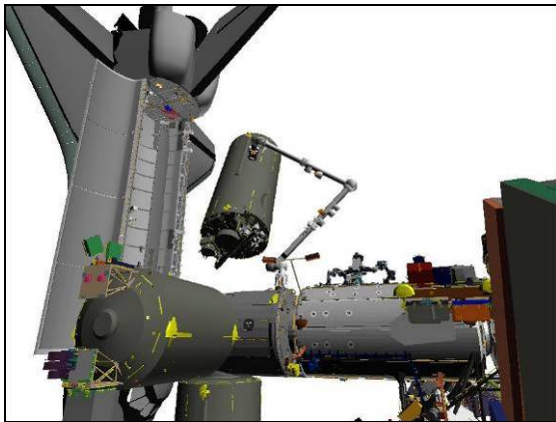


Figure 12.- JAUTO Start
(03: S1 Lower Outboard: +70, +20).

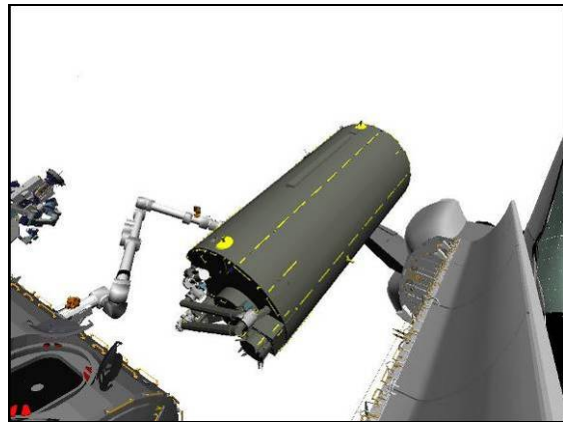


Figure 13.- JAUTO Start
(V10: SRMS Elbow: -165, +10).

10. ATTITUDE CONTROL

If using shuttle attitude control and attitude maintenance required, coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

DAP: FREE > 2 seconds

DAP: AUTO

When in attitude and rates damped

DAP: FREE

11. JAUTO TO JPM PRE-INSTALL

NOTE

1. During the Joint AUTO motion to the JPM Pre-Install position, the closest clearance is between the SSRMS and the JPM: 44 in (112 cm). Monitor with the SRMS Elbow and then the Base Elbow Camera.
2. At the end of the autosequence, the SSRMS will be in a display singularity. As such, the pitch and roll values may not match.

MSS: SSRMS:

Enter Mode – Joint Auto (Verify blue)

pick File ► JPM ► JPM Pre-Install

Verify 'Joint Angle' 'Initial' values per table below.

SR	SY	SP	EP	WP	WY	WR
-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4

Verify 'Joint Angle' 'Final Pt' values per table below.

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9

- Verify File Id – 379
- Verify Grapple Fixture – PDGF
- Verify Relocatable – No
- Verify Base Location – Node2
- Verify Payload – JPM

cmd Load (Verify Sequence Status – Confirm or Cancel)

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

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 9 of 16 pages

NOTE

The following table summarizes the Joint Angles associated with each point along the Joint Auto Sequence trajectory. As each successive point is reached, these values will appear on the SSRMS Joint Angle overlay.

DCP AUTO SEQ → PROC

	SR	SY	SP	EP	WP	WY	WR
JAUTO Start	-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4
1	-125.8	+166.0	-224.3	+84.1	-93.9	-90.0	+200.0
2	-125.8	+166.0	-224.3	+84.1	-93.9	-90.0	+130.0
JPM Pre-Install	-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Sequence Status – Paused

Verify Step Num – 3

Verify SSRMS at JAUTO Point 2 position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-224.3	+84.1	-93.9	-90.0	+130.0
X	Y	Z	Pitch	Yaw	Roll	
-431	-404	-1110	+90.2	+35.2	+34.6	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter>JPM Unberth OBAS					

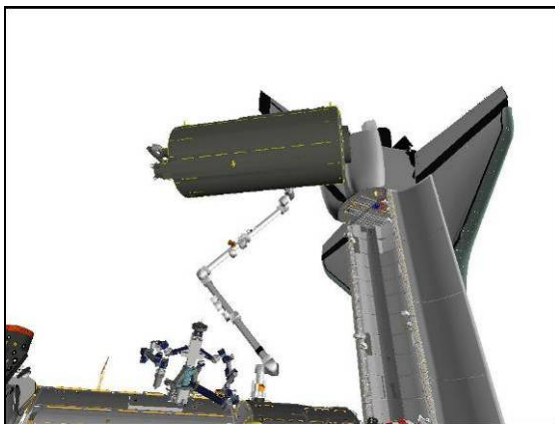


Figure 14.- JAUTO Point 2
(09: P1 Lower Outboard: +115, +35).

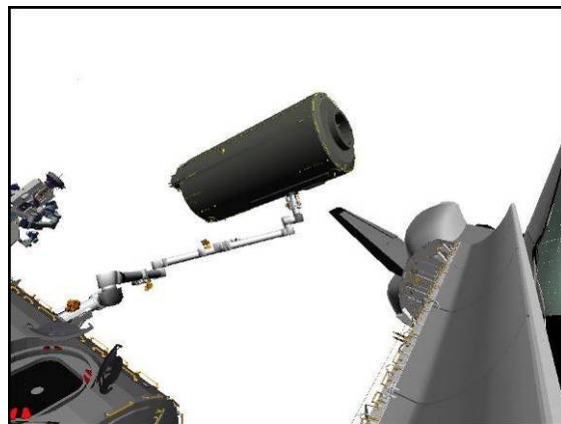


Figure 15.- JAUTO Point 2
(V10: SRMS Elbow: -165, +10).

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 10 of 16 pages

RHC RATE → VERNIER (Verify Vernier on PCS)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at JPM Pre-Install position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9
X	Y	Z	Pitch	Yaw	Roll	
+1147	-915	-568	+111.7	-89.9	-157.2	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter>JPM Unberth OBAS					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

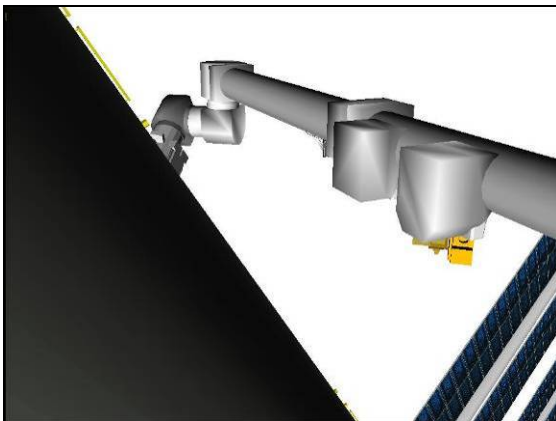


Figure 16.- JPM Pre-Install
(22: Base Elbow: +120, -20).

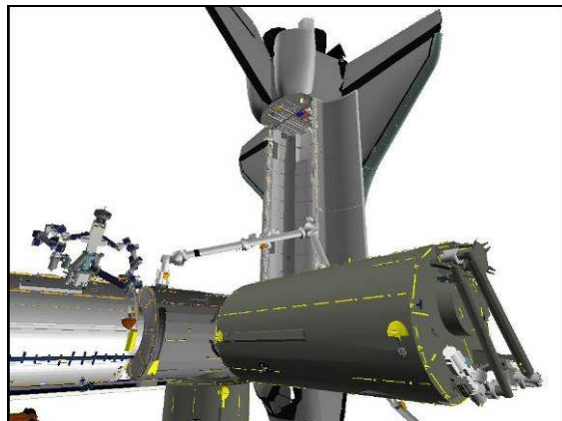


Figure 17.- JPM Pre-Install
(09: P1 Lower Outboard: +130, +20).

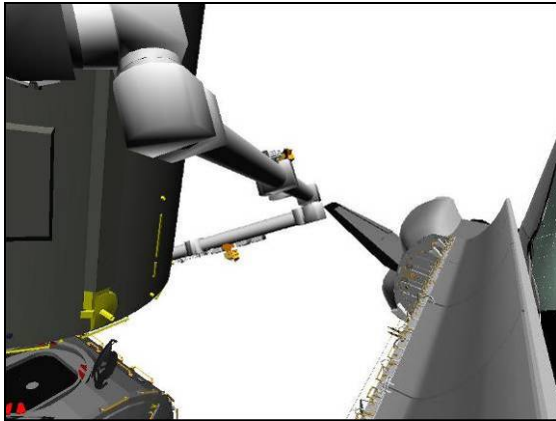


Figure 18.- JPM Pre-Install
(V10: SRMS Elbow: -165, +10).



Figure 19.- JPM Pre-Install
(V10: Camera C: -40, +20).

12. ATTITUDE CONTROL

If using shuttle attitude control and attitude maintenance required, coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

DAP: FREE > 2 seconds

DAP: AUTO

When in attitude and rates damped

DAP: FREE

13. SETUP FOR MANEUVER TO INSTALL

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (+120, -20)	15: CBCS	09: P1 Lower Outboard (+130, +20)	OBSS ITVC (+83, -45)	Camera B (-10, +15)

MSS: SSRMS:

Change Loaded Parameters ► JPM ► JPM Mate CBCS SYH

Verify 'Loaded Parameters' (two) – JPM Mate CBCS, SY Held

Change Display ► Node2 ► JPM Mate CBCS (Verify Node2>JPM Mate CBCS)

√Command – SSRMS>Internal

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 12 of 16 pages

Verify SSRMS at JPM Pre-Install position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9
X	Y	Z	Pitch	Yaw	Roll	
+185	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SY Held					
Disp	Node2>JPM Mate CBCS					

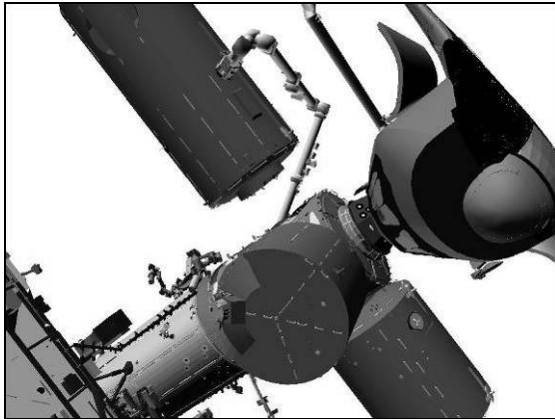


Figure 20.- JPM Pre-Install
(V10: OBSS ITVC: +83, -45).

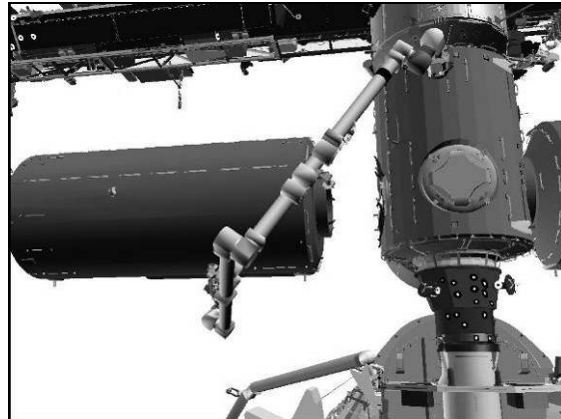


Figure 21.- JPM Pre-Install
(V10: Camera B: -10, +15).

14. MANEUVER TO JPM INSTALL

NOTE

1. **MCC-H** will verify:
 - a) Attitude control is in a good config.
 - b) {1.002 **NODE 2 CBM PORT VERIFY PRE-MATE STATUS**}, all (SODF: 1J: ASSY OPS: S&M), is complete.
2. Node 2 Port CBM RTLs can be monitored using the PCS display:
 PCS Node 2: S&M: Port CBM: RTL Details:

Node 2 Port CBM RTL Details
3. The closest clearance at the end of the maneuver to Ready-To-Latch position is between the SSRMS Tip Boom and the SRMS Shoulder Boom: 119 cm (47 in). This may be monitored with Camera B.

On CBM operator, “GO for maneuver to RTL.”

On MCC-H GO for JPM Install:

√Vernier

2.102 JPM INSTALL

(RBT FS/1J/FIN/SPN)

Page 13 of 16 pages

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)

THC/
RHC

Maneuver JPM to Ready-To-Latch position until RTL (four) – green

	Locked					
SR	SY	SP	EP	WP	WY	WR
-116.1	+166.0	-110.2	+96.5	-51.1	-155.2	+97.4
X	Y	Z	Pitch	Yaw	Roll	
+8	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SY Held					
Disp	Node2>JPM Mate CBCS					

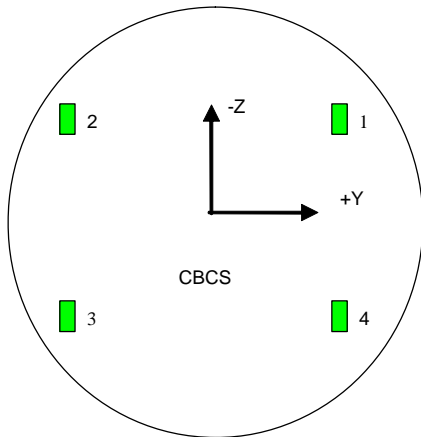


Figure 22.- RTL Diagram.
(Node 2 Port CBM)

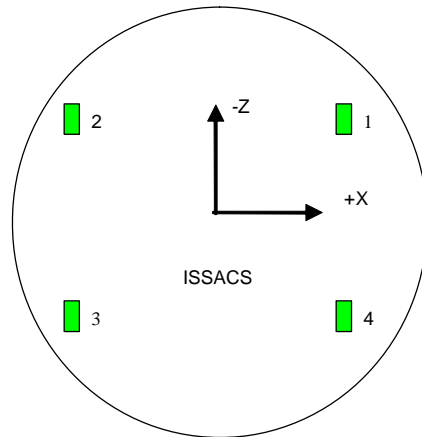


Figure 23.- RTL Diagram.
(Node 2 Port CBM)

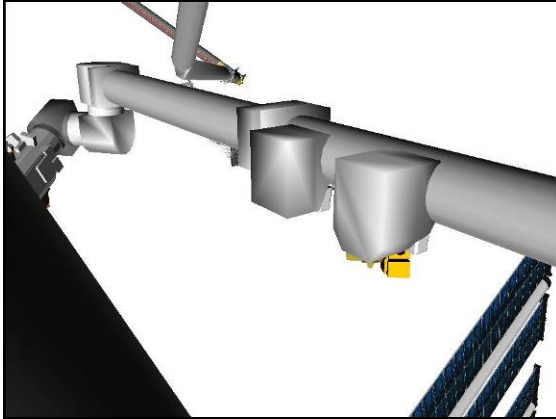


Figure 24.- JPM RTL
(24: Base Elbow: +120, -20).



Figure 25.- JPM RTL
(09: P1 Lower Outboard: +130, +20).

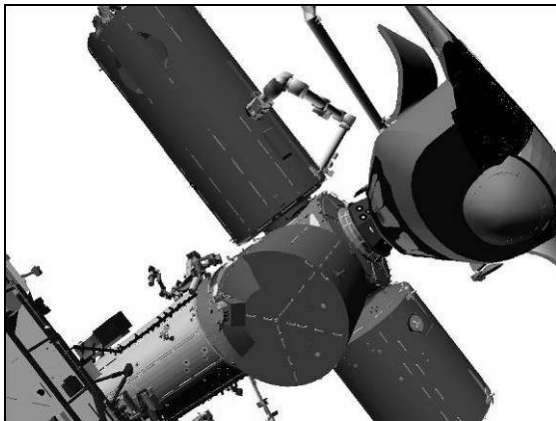


Figure 26.- JPM RTL
(V10: OBSS ITVC: +83, -45).



Figure 27.- JPM RTL
(V10: Camera B: -10, +15).

PCS

MSS: SSRMS:

Verify Posn Hold – orange

Verify RTL (four) – green

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

Notify CBM operator, “Maneuver to RTL complete - GO for first stage capture.”

15. POST FIRST STAGE CAPTURE CLEANUP

On CBM operator, "Go for SSRMS mode to Limp."

NOTE

Following SSRMS Mode to Limp, closed RTLs may open due to RTL spring forces. RTL closed indication is not required prior to execution of second stage capture (for latches used during first stage capture).

MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

WARNING

If SSRMS fails to brakes-on from limp mode, continuation of Second Stage Capture may cause structural failure of SSRMS or primary structure. If CBM stops unexpectedly (and Cmd Code changes to 'Stop') or SSRMS safes during Second Stage Capture, √MCC-H before proceeding.

Notify CBM operator: "SSRMS Mode to Limp complete. GO for Second Stage Capture."

16. POST ABOLT CLEANUP

On CBM operator, "GO for SSRMS Brakes ON."

DCP BRAKES SSRMS → ON (Verify ON)

PCS MSS: SSRMS:

Expected JPM Install position.

SR	SY	SP	EP	WP	WY	WR
-115.6	+166.0	-110.2	+97.0	-51.6	-155.6	+97.1
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SY Held					
Disp	Node2>JPM Mate CBCS					

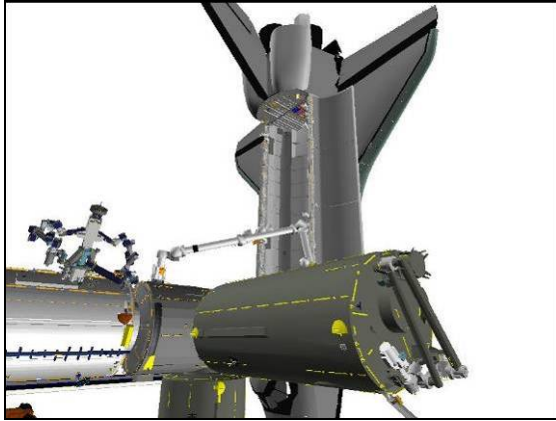


Figure 28.- JPM Install
(09: P1 Lower Outboard: +130, +20)

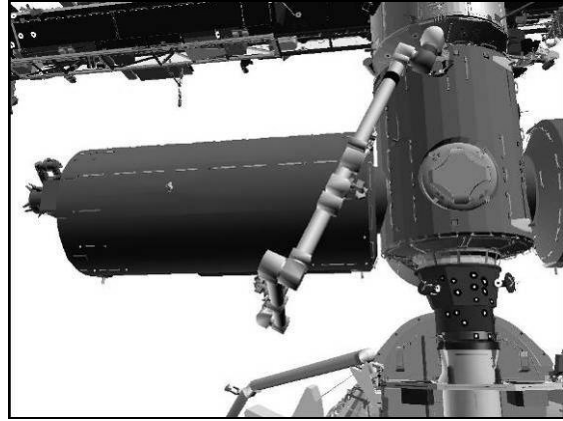


Figure 29.- JPM Install
(V10: Camera B: -10, +15).

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 1 of 21 pages

1. SETUP FOR RELEASE

Verify MT translation from WS 4 to WS 6 complete.

Verify that the SRMS is in the JPM Install Viewing position.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
24: Tip Elbow (+20, +10)	25: Tip LEE	71: OBSS ITVC (+80, -35)	SRMS Elbow (-170, -15)	Camera B (-15, +15)

NOTE

1. The LEE Camera must be fully zoomed out to correspond to the target overlay.
2. Orbiter Ch 2 (ID:72) will be unavailable while the CBCS Camera is setup for the JLP Relocate from Node 2 to JPM.

PCS

MSS: SSRMS:

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – JPM Mate CBCS, SY Held

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

Change Display ► Node2 ► JPM PDGF (Verify Node2> JPM PDGF)

√Command – SSRMS>Internal

Verify SSRMS at JPM Install position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-115.6	+166.0	-110.2	+97.0	-51.6	-155.6	+97.1
X	Y	Z	Pitch	Yaw	Roll	
+238	-1	+369	+90.1	+0.1	-61.2	
FOR	Loaded – JPM Mate CBCS, SY Held					
Disp	Node2>JPM PDGF					

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 2 of 21 pages

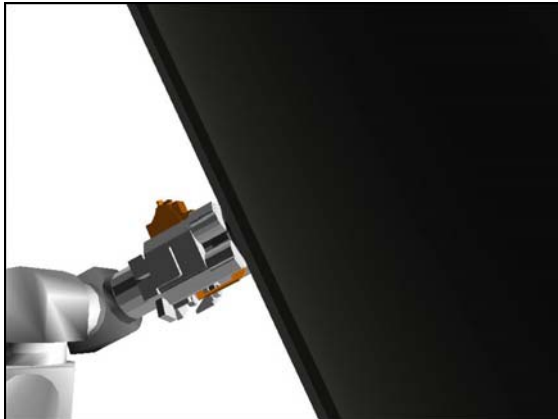


Figure 1.- JPM Install
(24: Tip Elbow +20, +10).

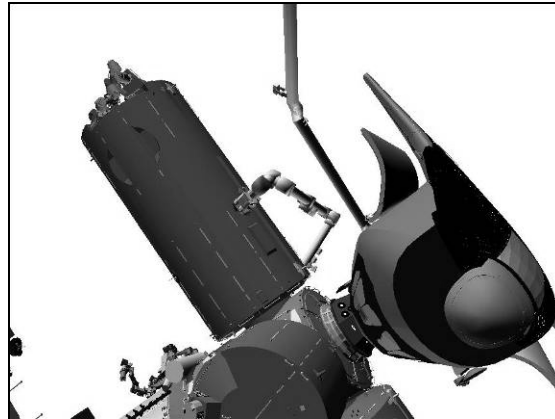


Figure 2.- JPM Install
(71: OBSS ITVC: +80, -35).

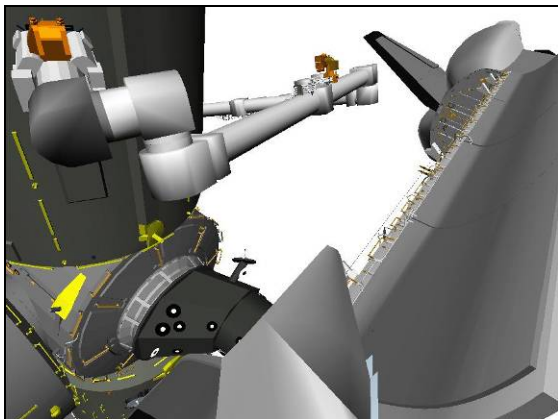


Figure 3.- JPM Install
(V10: SRMS Elbow: -170, -15).

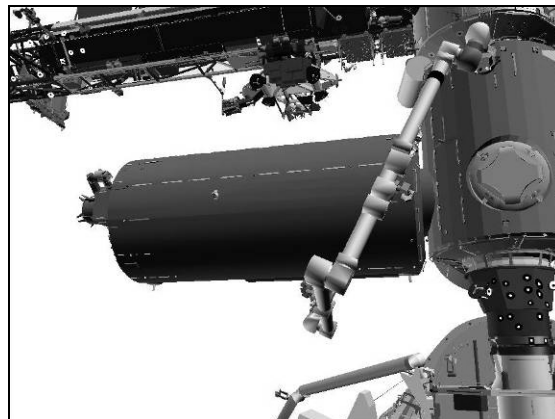


Figure 4.- JPM Install
(V10: Camera B: -15, +15).

2. JPM RELEASE (PUSHOFF)

NOTE

1. **MCC-H** will verify SSRMS Payload power has been removed from the JPM HTCLs.
2. The closest clearance at the end of the release will be between the SSRMS Tip and the SRMS: 18 in (46 cm). This may be monitored with SRMS Elbow Camera.

On MCC-H GO for JPM release:

PCS

MSS: SSRMS: MSS Safing:

cmd SSRMS: Remove (Verify Not Safed)

DCP

BRAKES SSRMS → OFF (Verify OFF)

√Vernier

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 3 of 21 pages

PCS 2.1 SSRMS Limp
MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

2.2 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. (SPN 1892, 3160)

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)
Verify 'Carriage' Extend	– blue (90 s max)

2.3 SSRMS Backoff
MSS: SSRMS: Limp:

cmd None Limp (Verify Standby – blue)

√Vernier

MSS: SSRMS: Rate:

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

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 4 of 21 pages

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

THC/
RHC

Maneuver SSRMS to JPM Release position (within 5 cm/1 deg).

Locked						
SR	SY	SP	EP	WP	WY	WR
-115.6	+169.9	-106.5	+88.2	-44.9	-157.3	+101.0
X	Y	Z	Pitch	Yaw	Roll	
-90	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node 2>JPM PDGF					

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

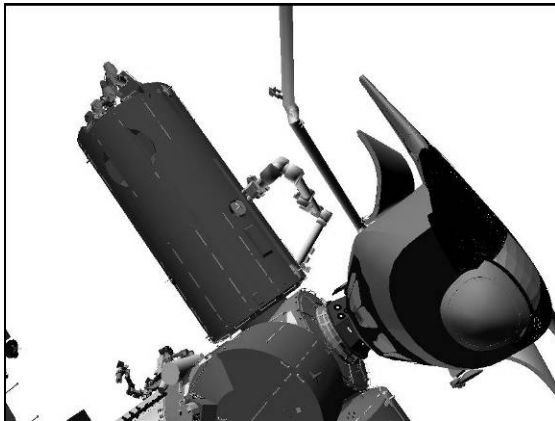


Figure 5.- JPM Release
(71: OBSS ITVC: +80, -35).

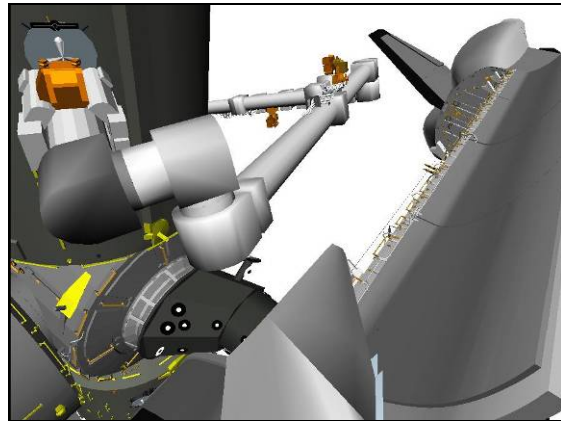


Figure 6.- JPM Release
(V10: SRMS Elbow: -170, -15).

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 5 of 21 pages

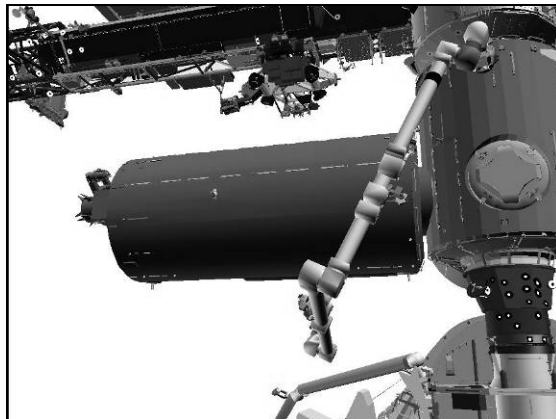


Figure 7.- JPM Release
(V10: Camera B: -15, +15).

3. MANEUVER TO JPM CLEAR POSITION

NOTE

The closest clearances during the maneuver to the JPM Clear position occur at the beginning of the maneuver and are between:

- a). The SSRMS Tip LEE and the JPM PDGF Grapple Pin: 64 cm (25 in). This may be monitored with the Tip Elbow Camera.
- b). The SSRMS and the SRMS: 46 cm (18 in). This may be monitored with the OBSS ITVC, or Camera A, or with Camera B.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
24: Tip Elbow (+20, +10)	03: S1 Lower Outboard (+65, +15)	71: OBSS ITVC (+80, -35)	Camera A (+80, +10)	Camera B (-15, +15)

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)

MSS: SSRMS: Rate:

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

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 6 of 21 pages

Verify SSRMS at JPM Release position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-115.6	+169.9	-106.5	+88.2	-44.9	-157.3	+101.0
X	Y	Z	Pitch	Yaw	Roll	
+1381	-606	+327	-151.2	0.0	-90.3	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

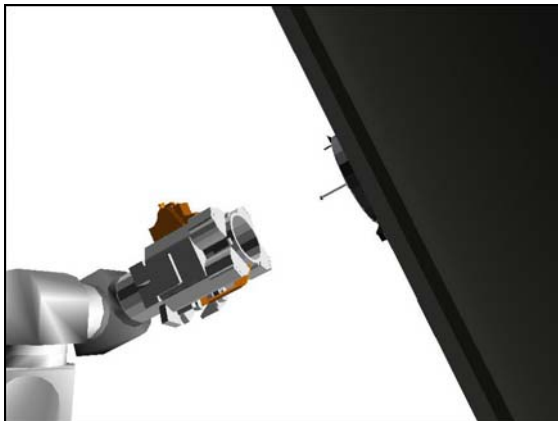


Figure 8.- JPM Release
(24: Tip Elbow: +20, +10).

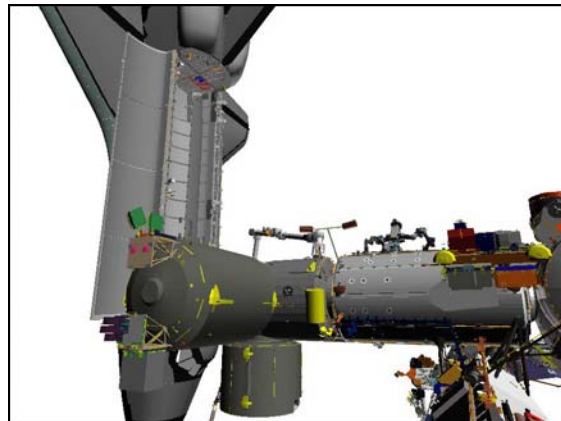


Figure 9.- JPM Release
(03: S1 Lower Outboard: +65, +15).

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Yaw (Verify SY – Locked)

THC/
RHC

Maneuver SSRMS to JPM Clear position (within 5 cm/1 deg).
Expect -Y only, THC left.

	Locked					
SR	SY	SP	EP	WP	WY	WR
-125.2	+169.9	-104.2	+74.2	-32.7	-148.8	+105.8
X	Y	Z	Pitch	Yaw	Roll	
+1381	-800	+327	-151.2	0.0	-90.3	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 7 of 21 pages



Figure 10.- JPM Clear
(24: Tip Elbow: +20, +10).

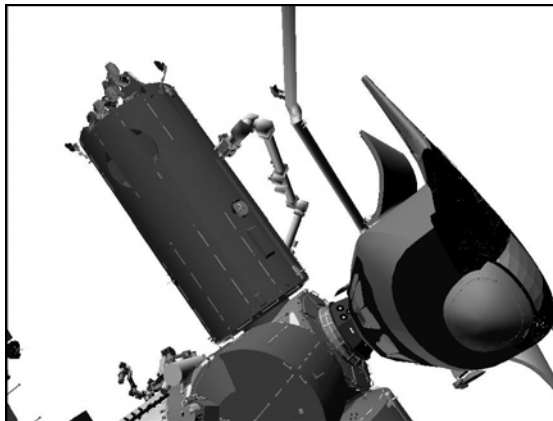


Figure 11.- JPM Clear
(71: OBSS ITVC: +80, -35).

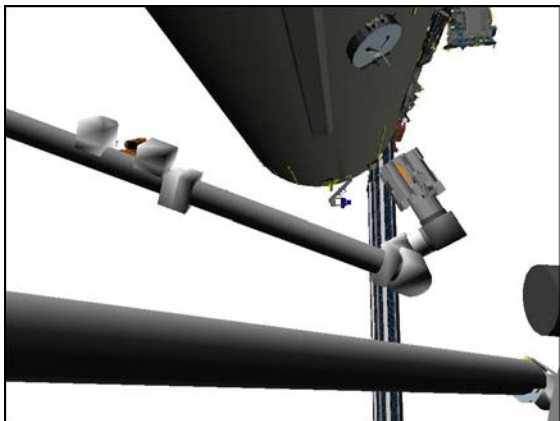


Figure 12.- JPM Clear
(V10: Camera A: +80, +10).

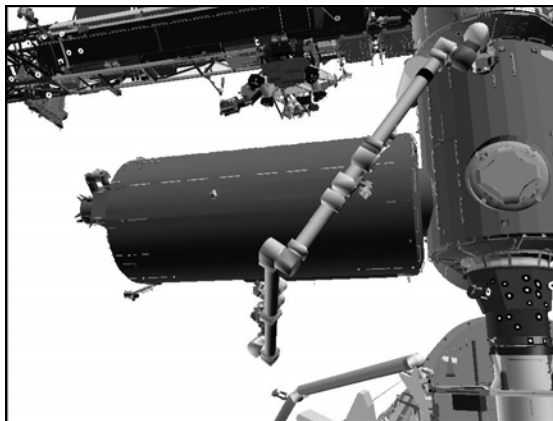


Figure 13.- JPM Clear
(V10: Camera B: -15, +15).

4. MANEUVER TO INTERMEDIATE POSITION

RHC

RATE → COARSE (Verify Coarse 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.

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 8 of 21 pages

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

	SR	SY	SP	EP	WP	WY	WR	
JPM Clear	-125.2	+169.9	-104.2	+74.2	-32.7	-148.8	+105.8	
1: SP -			-160.0					
2: SR -	-180.0							
Intermediate	-180.0	+169.9	-160.0	+74.2	-32.7	-148.8	+105.8	
	X	Y	Z	Pitch	Yaw	Roll		
	+616	-1088	+1225	+162.3	+52.4	-41.4		
	FOR	Unloaded – LEE Tip, SY Held						
	Disp	ISS>ISSACS						

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

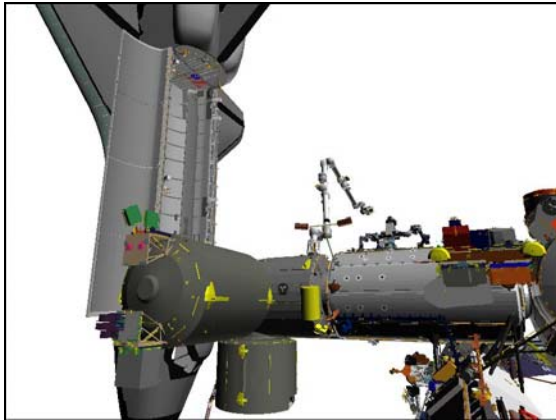


Figure 14.- Intermediate
(03: S1 Lower Outboard: +65, +15).

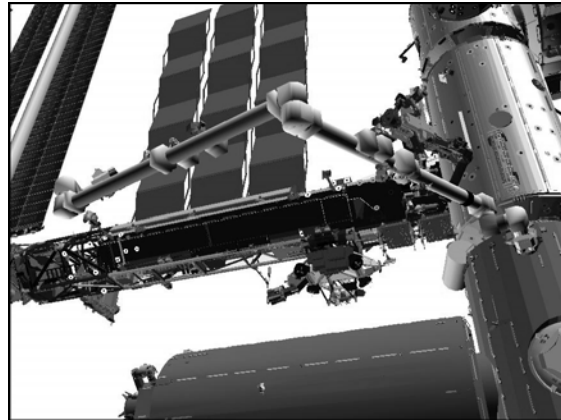


Figure 15.- Intermediate
(V10: Camera B: -20, +35).

5. MANEUVER TO MBS PDGF 3 PRE-GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (+120, -15)	03: S1 Lower Outboard (+65, +15)	37: MBS Mast (+115, +15)	OBSS ITVC (+105, -45)	Camera B (-20, +35)

Change Loaded Parameters ► Walk Off ► MBS PDGF 3
Verify 'Loaded Parameters' (two) – MBS PDGF 3, SR Held

Change Display ► MBS ► PDGF 3 (Verify MBS>PDGF 3)

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

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 9 of 21 pages

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

SR	SY	SP	EP	WP	WY	WR
-180.0	+169.9	-160.0	+74.2	-32.7	-148.8	+105.8
X	Y	Z	Pitch	Yaw	Roll	
-167	+138	+1327	+17.9	-41.1	+132.1	
FOR	Unloaded – LEE Tip, SY Held					
Disp	MBS>PDGF 3					

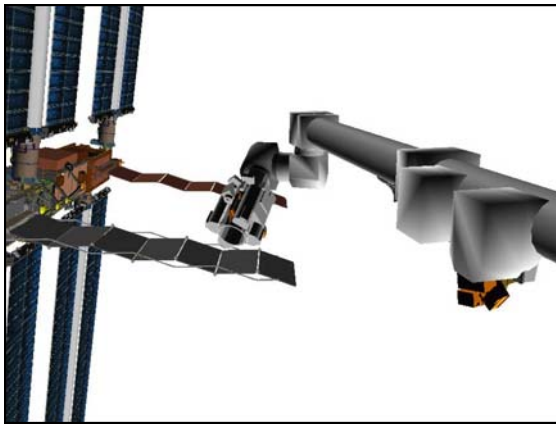


Figure 16.- Intermediate
(22: Base Elbow: +120, -15).

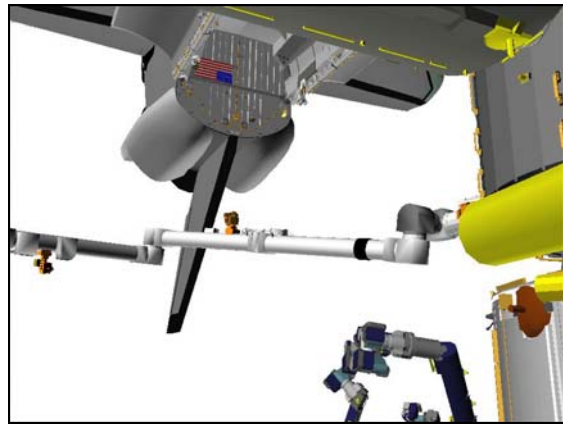


Figure 17.- Intermediate
(37: MBS Mast: +115, +15).

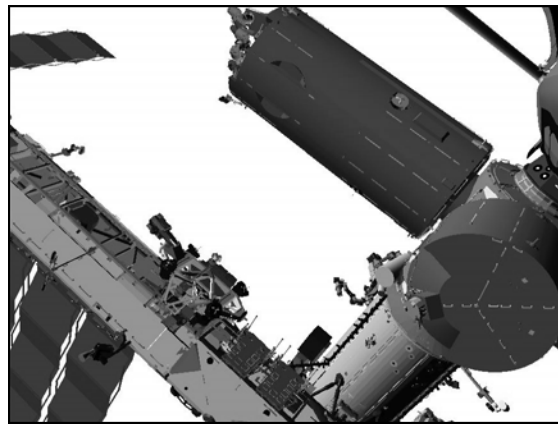


Figure 18.- Intermediate
(V10: OBSS ITVC: +105, -45).

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

5.1 Maneuver to PDGF 3 Approach

RHC RATE → VERNIER (Verify Vernier on PCS)

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

Input 'Joint Angles' 'Destination' for PDGF 3 Approach position.

SR	SY	SP	EP	WP	WY	WR
-180.0	+185.6	-115.0	+52.6	-28.2	-105.3	+43.9

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
-180.0	+169.9	-160.0	+74.2	-32.7	-148.8	+105.8
-180.0	+185.6	-115.0	+52.6	-28.2	-105.3	+43.9
0.0	-15.7	-45.0	+21.6	-4.5	-43.5	+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)

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at PDGF 3 Approach position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-180.0	+185.6	-115.0	+52.6	-28.2	-105.3	+43.9
X	Y	Z	Pitch	Yaw	Roll	
-141	+390	+608	+7.8	-4.0	+32.9	
FOR	Unloaded – LEE Tip, SY Held					
Disp	MBS>PDGF 3					

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 11 of 21 pages

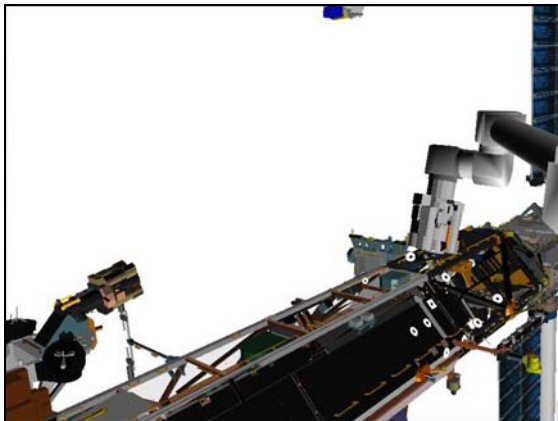


Figure 19.- PDGF 3 Approach
(22: Base Elbow: +120, -15).

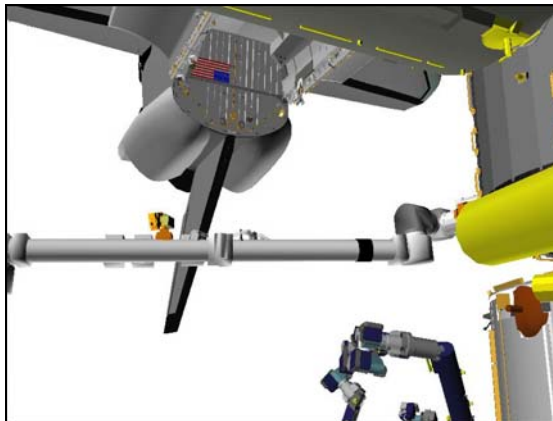


Figure 20.- PDGF 3 Approach
(37: MBS Mast: +115, +15).

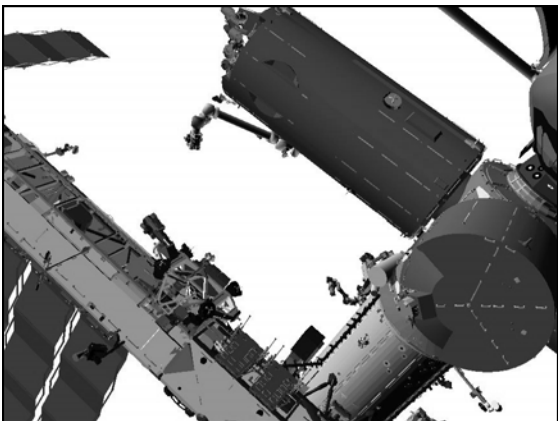


Figure 21.- PDGF 3 Approach
(V10: OBSS ITVC: +105, -45).

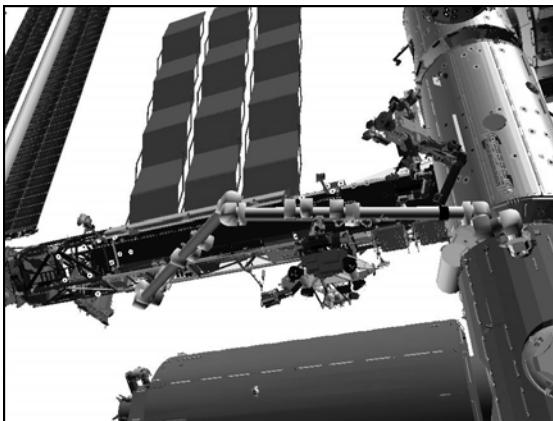


Figure 22.- PDGF 3 Approach
(V10: Camera B: -20, +35).

5.2 Single Joint to Pre-Grapple

NOTE

The closest clearances which occur during the maneuver to MBS PDGF 3 Pre-Grapple are:

- a). SSRMS to JPM EXT AFT Camera: 125 cm (49 in).
- b). SSRMS Tip LEE to POA: 79 cm (31 in).

These clearances may both be monitored with the Base Elbow Camera.

√Vernier

MSS: SSRMS:

Enter Mode – Single (Verify blue)

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 12 of 21 pages

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 MBS PDGF 3 Pre-Grapple position (within 1 deg).

Clear of POA
1: SP +
MBS PDGF 3
Pre-Grapple

SR	SY	SP	EP	WP	WY	WR
-180.0	+185.6	-115.0	+52.6	-28.2	-105.3	+43.9
		-81.2				
-180.0	+185.6	-81.2	+52.6	-28.2	-105.3	+43.9
X	Y	Z	Pitch	Yaw	Roll	
-180	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	MBS>PDGF 3					

PCS

MSS: SSRMS: SSRMS

Enter Mode – Standby (Verify blue)

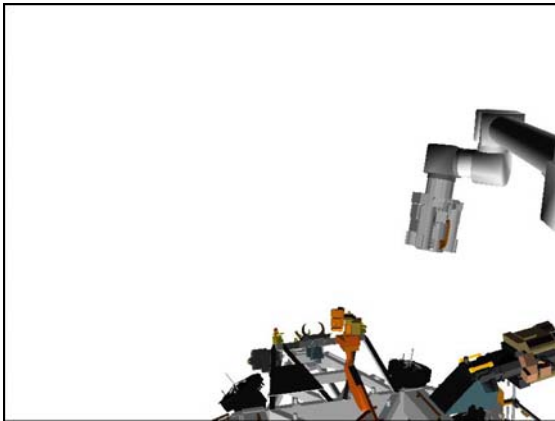


Figure 23.- MBS PDGF 3 Pre-Grapple
(22: Base Elbow: +120, -15).

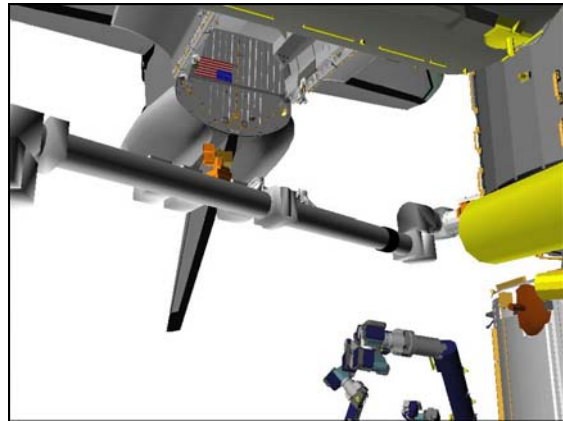


Figure 24.- MBS PDGF 3 Pre-Grapple
(37: MBS Mast: +115, +15).

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 13 of 21 pages

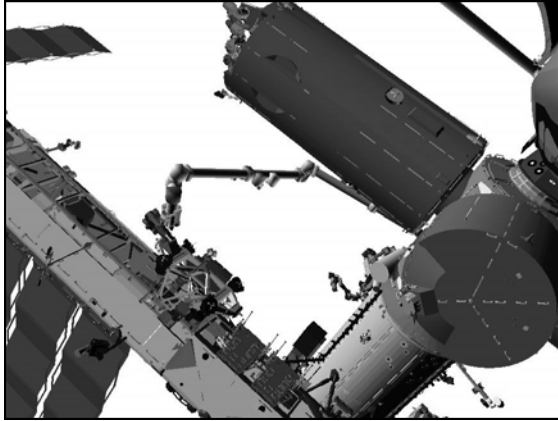


Figure 25.- MBS PDGF 3 Pre-Grapple
(V10: OBSS ITVC: +105, -45).

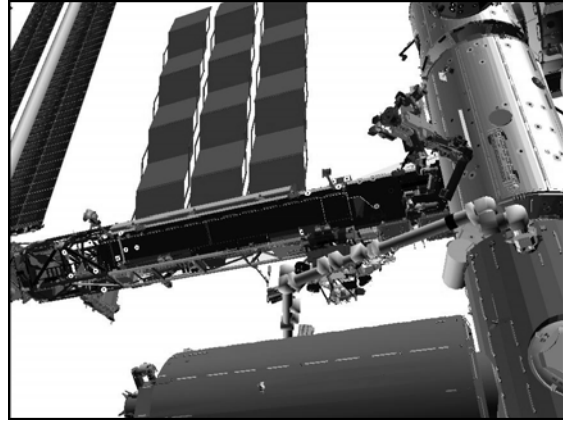


Figure 26.- MBS PDGF 3 Pre-Grapple
(V10: Camera B: -20, +35).

6. SETUP FOR MBS PDGF 3 GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (+135, -20) 37: MBS Mast (-40, -20)	25: Tip LEE	24: Tip Elbow (+145, 0)	OBSS ITVC (+105, -45)	Camera B (-20, +35)

NOTE

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

Verify 'Loaded Parameters' (two) – MBS PDGF 3, SR Held

Change Unloaded Parameters ► Unloaded ► LEE Tip SRH

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

√Display – MBS>PDGF 3

Verify Command – SSRMS>Internal

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 14 of 21 pages

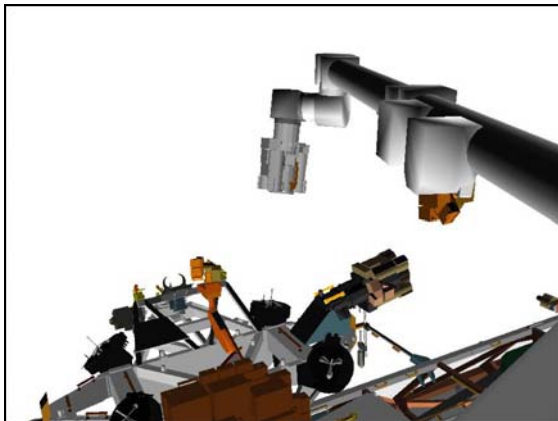


Figure 27.- MBS PDGF 3 Pre-Grapple
(22: Base Elbow: +135, -20).

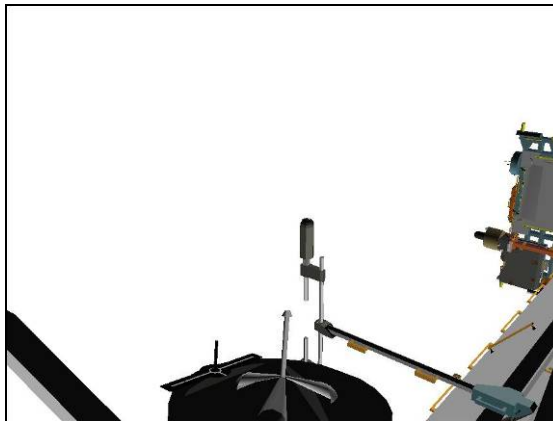


Figure 28.- MBS PDGF 3 Pre-Grapple
(37: MBS Mast: -40, -20).

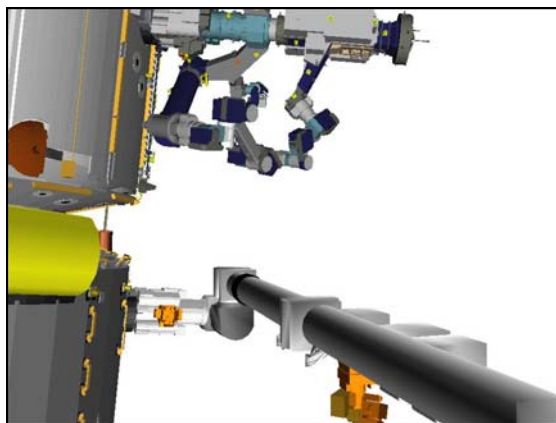


Figure 29.- MBS PDGF 3 Pre-Grapple
(24: Tip Elbow: +145, 0).

7. GRAPPLE MBS PDGF 3

7.1 Maneuver to Grapple

√Vernier

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 Roll (Verify SR – Locked)

Maneuver to within grapple envelope.

RHC/
THC

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 15 of 21 pages

7.2 Auto Capture

PCS

MSS: SSRMS: Tip LEE: SSRMS Tip LEE

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

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

CAUTION

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

NOTE

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

cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Capture

RHC

TRIGGER → press (momentarily)

PCS

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

Verify Capture to Latch – Yes (SCR 19282)

Verify 'Carriage' Tension ~5500 N (90 s max)

Verify 'Carriage' Retract – blue

Verify 'Latch' Latch – blue (65 s max)

7.3 Umbilical Mate

Verify with **MCC-H** - Payload and PDGF power inhibits have been confirmed.

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

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN) Page 16 of 21 pages

7.4 Derigidize

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)

8. GRAPPLE CLEANUP

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)

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – MBS PDGF 3, SR Held

Record MBS PDGF 3 Grapple position joint angles and FOR.

	SR	SY	SP	EP	WP	WY	WR	
Expected	-180.0	+173.1	-83.3	+63.7	-87.4	-103.4	-7.6	
	X	Y	Z	Pitch	Yaw	Roll		
Expected	0	0	0	0.0	0.0	0.0		
	FOR	Loaded – MBS PDGF 3, SR Held						
	Disp	MBS>PDGF 3						

Give MCC-H GO for SSRMS Base Change.

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 17 of 21 pages

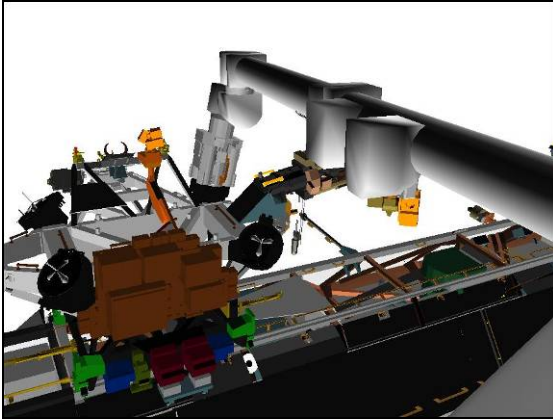


Figure 30.- MBS PDGF 3 Grapple
(22: Base Elbow: +135, -20).

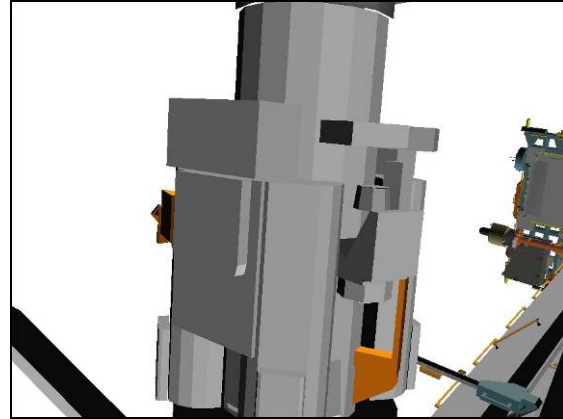


Figure 31.- MBS PDGF 3 Grapple
(37: MBS Mast: -40, -20).

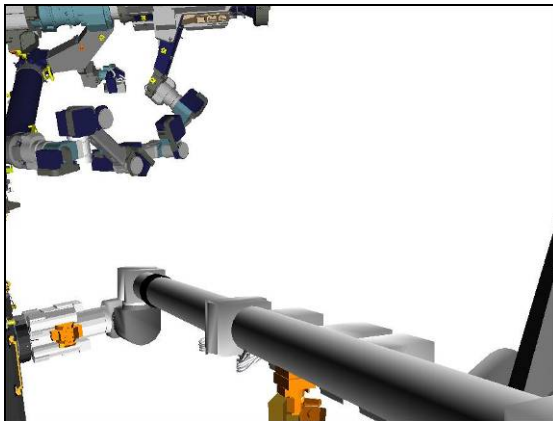


Figure 32.- MBS PDGF 3 Grapple
(24: Tip Elbow: +145, 0).

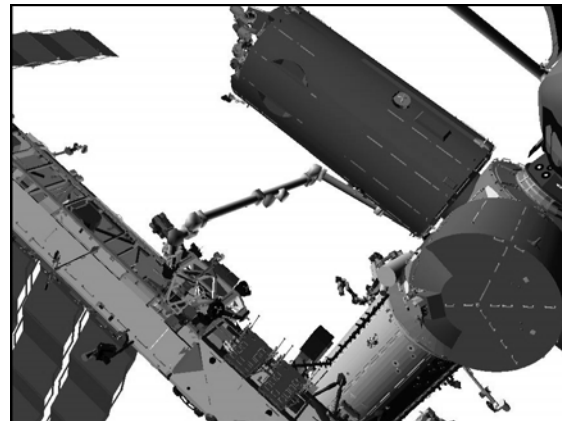


Figure 33.- MBS PDGF 3 Grapple
(V10: OBSS ITVC: +105, -45).

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 18 of 21 pages

9. SETUP FOR NODE 2 RELEASE

On **MCC-H GO** for Node 2 Release:

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
24: Tip Elbow (0, 0) 03: S1 Lower Outboard (+73, +2) Zoom: 15 mm	25: Tip LEE	37: MBS Mast (+110, +20)	OBSS ITVC (+105, -45)	Camera B (-20, +35)

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) – Node 2 PDGF, SR Held

Change Unloaded Parameters ► Unloaded ► LEE Tip SYH

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

Change Display ► Node2 ► PDGF (Verify Node2>PDGF)

√Command – SSRMS>Internal

Expected Node 2 Grapple position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-7.6	+103.4	-87.4	+63.7	-83.3	-173.1	-180.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – Node 2 PDGF, SR Held					
Disp	Node2>PDGF					

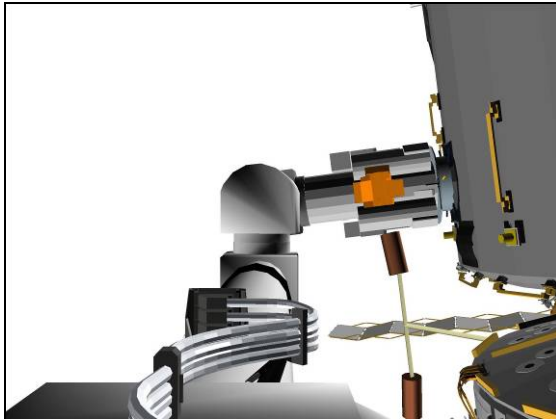


Figure 34.- Node 2 Grapple
(24: Tip Elbow: 0, 0).

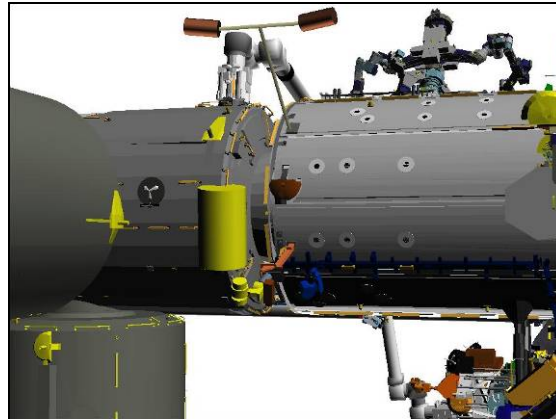


Figure 35.- Node 2 Grapple
(03: S1 Lower Outboard: +73, +2)
Zoom: 15 mm.

10. NODE 2 RELEASE (WITH CARRIAGE PUSHOFF)

MSS: SSRMS: MSS Safing:

cmd 'SSRMS' Remove (Verify Not Safed)

DCP BRAKES SSRMS → OFF (Verify OFF)

10.1 SSRMS Limp

PCS MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

10.2 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.

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

(RBT FS/1J/FIN/SPN)

Page 20 of 21 pages

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)
 Verify 'Carriage' Extend – blue (90 s max)

10.3 SSRMS Backoff

MSS: SSRMS: Limp:

cmd None Limp (Verify Standby – blue)

√Vernier

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Yaw (Verify SY – Locked)

THC Maneuver SSRMS to Node 2 Release position (within 5 cm/1 deg).

	<input type="text" value="Locked"/>					
SR	SY	SP	EP	WP	WY	WR
-3.9	+103.4	-80.2	+46.7	-69.9	-173.9	-179.8
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>PDGF					

DCP BRAKES SSRMS → ON (Verify ON)

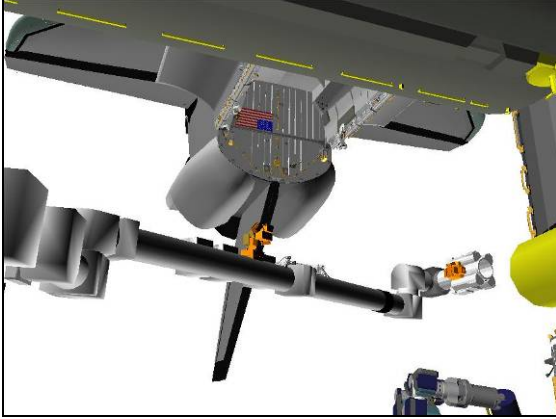


Figure 36.- Node 2 Release
(37: MBS Mast: +110, +20).

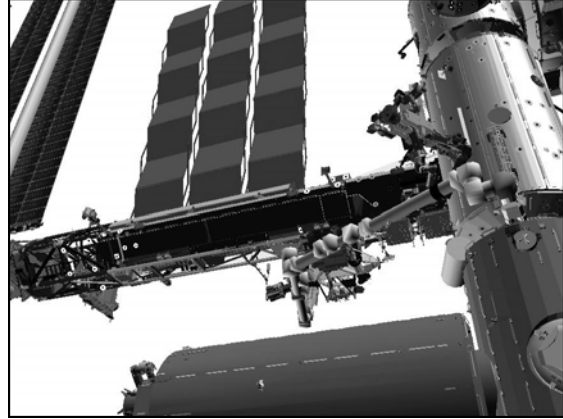


Figure 37.- Node 2 Release
(V10: Camera B: -20, +35).

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FOCUSED INSPECTION SUPPORT

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INSPECTION
SUPPORT

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3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

Page 1 of 9 pages

1. SETUP

Verify that the SRMS is in the JPM Install Viewing position.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (0, 0)	37: MBS Mast (+115, +20)	71: OBSS ITVC (+120, -35)	Camera C (-40, +20)	Camera B (-15, +15)

NOTE

Orbiter Ch 2 (ID:72) will be unavailable while the CBCS Camera is setup for the JLP Relocate from Node 2 to JPM.

PCS

MSS: SSRMS:

Verify Unloaded Parameters – √

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

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

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

Verify SSRMS at Node 2 Release position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-3.9	+103.4	-80.2	+46.7	-69.9	-173.9	-179.8
X	Y	Z	Pitch	Yaw	Roll	
+757	-63	+869	+89.9	+9.3	-90.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

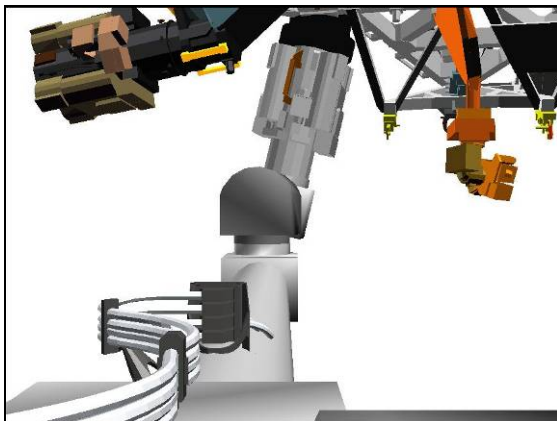


Figure 1.- Node 2 Release
(22: Base Elbow: 0, 0).

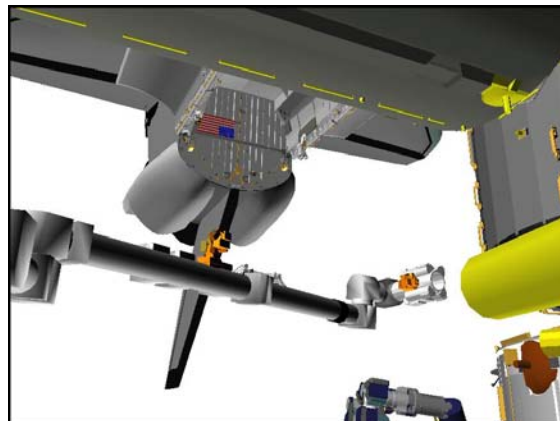


Figure 2.- Node 2 Release
(37: MBS Mast: +115, +20).

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

Page 2 of 9 pages

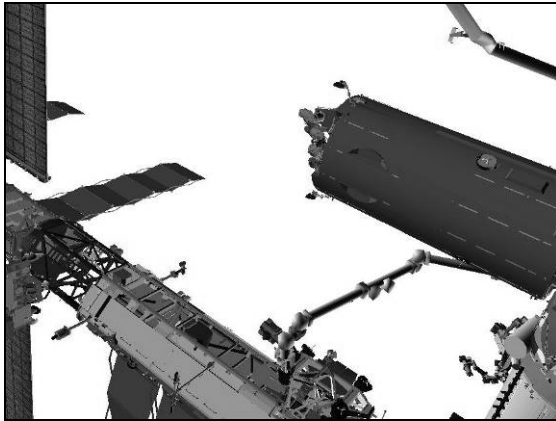


Figure 3.- Node 2 Release
(71: OBSS ITVC: +120, -35).



Figure 4.- Node 2 Release
(V10: Camera C: -40, +20).

2. MANEUVER TO JPM CLEAR

NOTE

The closest clearance during the maneuver to the Clear of JPM position is between the SSRMS SY Joint and the MBS POA: 41 cm (16 in). This may be monitored with the Base Elbow Camera.

DCP BRAKES SSRMS → OFF (Verify OFF)

√Vernier

PCS MSS: SSRMS: Rate:

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

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► Focused Insp ► Clear of JPM

Verify 'Joint Angles' 'Destination' for Clear of JPM position.

SR	SY	SP	EP	WP	WY	WR
+120.0	+80.0	-30.0	+46.7	-87.0	-200.0	-169.0

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)	-3.9	+103.4	-80.2	+46.7	-69.9	-173.9	-179.8
TGT	+120.0	+80.0	-30.0	+46.7	-87.0	-200.0	-169.0
ERR	-123.9	+23.4	-50.2	0.0	+17.1	+26.1	-10.8

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

Page 3 of 9 pages

```

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

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+120.0	+80.0	-30.0	+46.7	-87.0	-200.0	-169.0

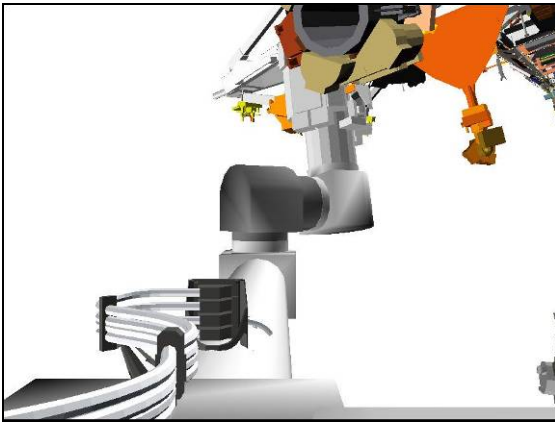


Figure 5.- Clear of JPM
(22: Base Elbow: 0, 0).

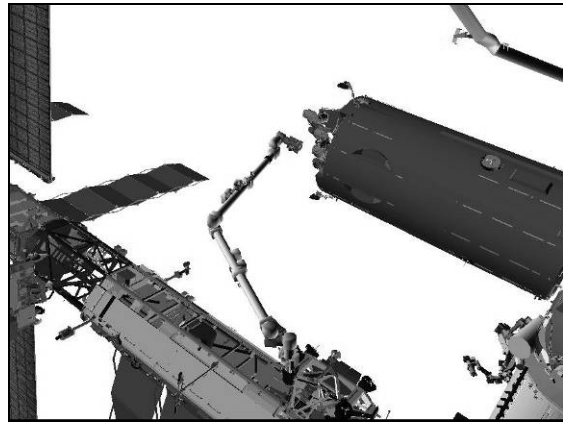


Figure 6.- Clear of JPM
(71: OBSS ITVC: +120, -35).

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

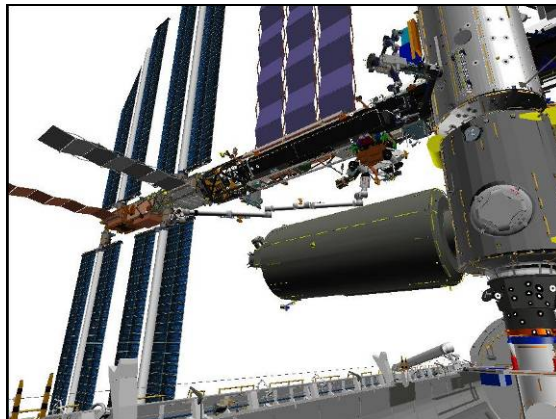


Figure 7.- Clear of JPM
(V10: Camera C: -40, +20).

3. MANEUVER TO FOCUS INSPECTION SUPPORT

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (0, 0)	37: MBS Mast (+25, +30)	71: OBSS ITVC (+120, -35)	Camera C (-40, +20)	Camera B (-35, +10)

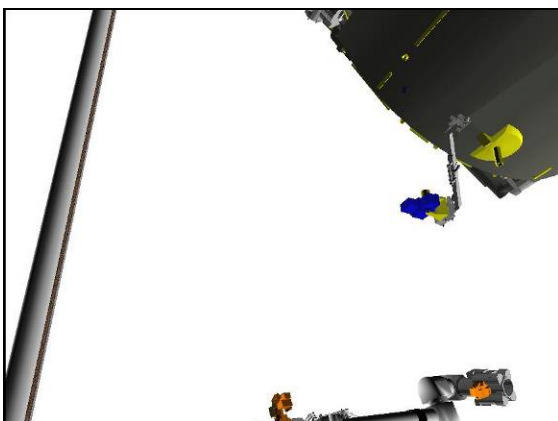


Figure 8.- Clear of JPM
(37: MBS Mast: +25, +30).



Figure 9.- Clear of JPM
(V10: Camera B: -35, +10).

SSRMS Joint OCAS

pick File ► Focused Insp ► FI Support Posn

Verify 'Joint Angles' 'Destination' for Focus Inspection Support position.

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0

cmd Load (Verify Sequence Status – Confirm or Cancel)

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

Page 5 of 9 pages

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+120.0	+80.0	-30.0	+46.7	-87.0	-200.0	-169.0
TGT	+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0
ERR	0.0	+70.0	0.0	+21.7	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.

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at Focus Inspection Support position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0
X	Y	Z	Pitch	Yaw	Roll	
+1776	-1617	-274	-77.0	+39.6	+166.4	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)

Give SRMS operator GO for Focused Inspection.

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

Page 6 of 9 pages

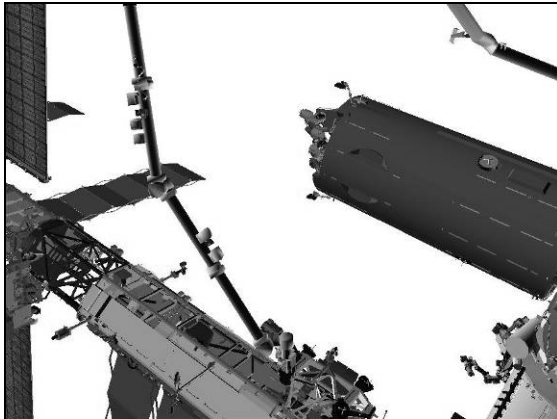


Figure 10.- Focus Inspection Support
(71: OBSS ITVC: +120, -35).

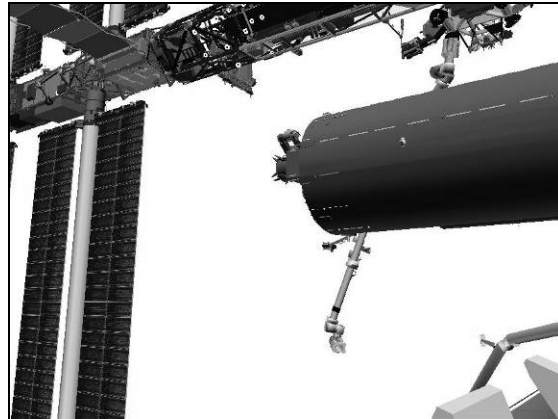


Figure 11.- Focus Inspection Support
(V10: Camera B: -35, +10).

4. FOCUS INSPECTION SURVEY SUPPORT

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (0, 0)	25: Tip LEE	71: OBSS ITVC (+120, -35)	Camera C (-40, +20)	Camera B (-35, +10)

The survey support position provides mid area of orbiter viewing.

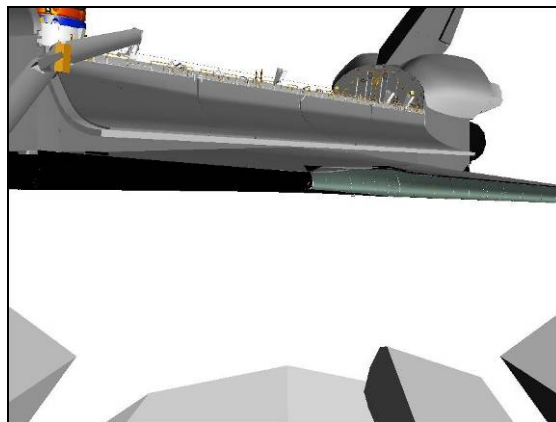


Figure 12.- Orbiter Mid Viewing Position
(25: Tip LEE).

4.1 Viewing Areas of Orbiter with Tip LEE Camera (Optional)

NOTE

To view other areas of the orbiter with the Tip LEE Camera, the WY joint can be reconfigured in single joint mode.

- a. Orbiter Forward: Positive WY
- b. Orbiter Aft: Negative WY

DCP

BRAKES SSRMS → OFF (Verify OFF)

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

Page 7 of 9 pages

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 viewing the aft area of orbiter

THC

Perform Single Joint maneuver to Orbiter Aft Viewing position.

Survey
Support
1: WY -
Orbiter Aft

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0
					-215.0	
+120.0	+10.0	-30.0	+25.0	-87.0	-215.0	-169.0
X	Y	Z	Pitch	Yaw	Roll	
+1766	-1644	-254	-83.8	+25.7	+170.2	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

DCP

BRAKES SSRMS → ON (Verify ON)

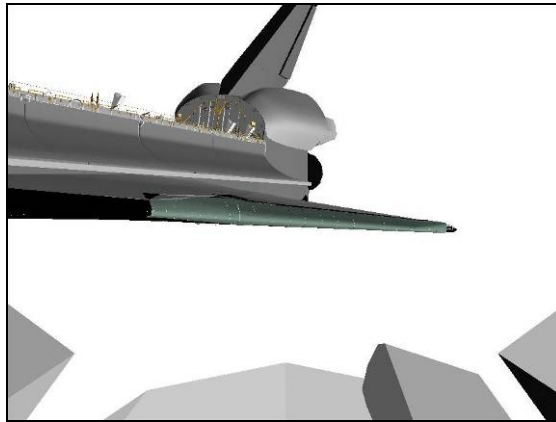


Figure 13.- Orbiter Aft Viewing Position
(25: Tip LEE).

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

Page 8 of 9 pages

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 If viewing fwd area of orbiter
Perform Single Joint maneuver to Orbiter Fwd Viewing position.

Survey Support
1: WY +
Orbiter Fwd

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0
					-165.0	
+120.0	+10.0	-30.0	+25.0	-87.0	-165.0	-169.0
X	Y	Z	Pitch	Yaw	Roll	
+1793	-1578	-344	-38.4	+67.5	+134.1	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)

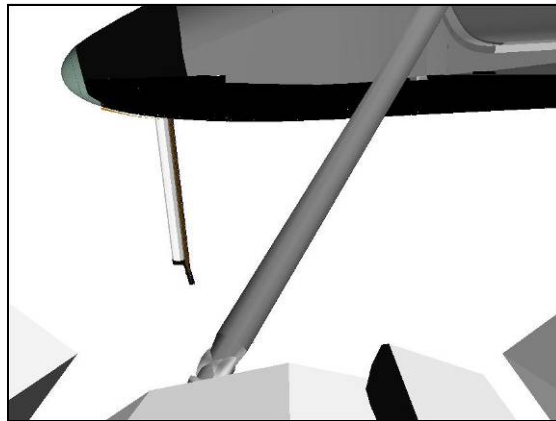


Figure 14.- Orbiter Fwd Viewing Position
(25: Tip LEE).

4.2 Returning to Survey Support Viewing Position
On SRMS operator GO for SSRMS maneuver, Focused Inspection complete:

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.

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

(RBT FS/1J/FIN/SPN)

Page 9 of 9 pages

If WY not -200.0

DCP JOINT SELECT → WRIST YAW (Verify WY – Selected on PCS)

THC Perform Single Joint maneuver to WY: -200.0

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

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0
X	Y	Z	Pitch	Yaw	Roll	
+1776	-1617	-274	-77.0	+39.6	+166.4	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)

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JLP

JLP

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JLP

4.101 MNVR FROM FI SUPPORT TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 1 of 5 pages

1. SETUP

Verify that the SRMS and the OBSS are in the JLP Relocate viewing position.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-155, -55)	37: MBS Mast (-30, +60)	71: OBSS ITVC (0, -20)	SRMS Elbow (+30, +10)	Camera B (-15, +10)

NOTE

Orbiter Ch 2 (ID:72) will be unavailable while the CBCS Camera is setup for the JLP Relocate from Node 2 to JPM.

PCS

MSS: SSRMS:

Verify Unloaded Parameters – √

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

Change Display ► Node2 ► JLP Port FRGF (Verify Node2>JLP Port FRGF)

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

Verify SSRMS at Focus Inspection Support position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0
X	Y	Z	Pitch	Yaw	Roll	
-557	+1573	+333	+51.5	-16.4	-63.9	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>JLP Port FRGF					

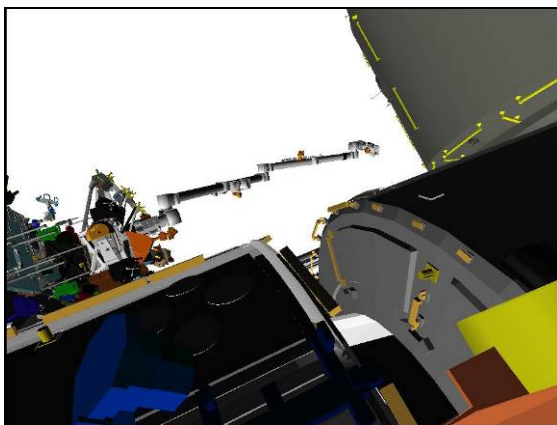


Figure 1.- Focus Inspection Support
(13: LAB Stbd Zenith: -155, -55).

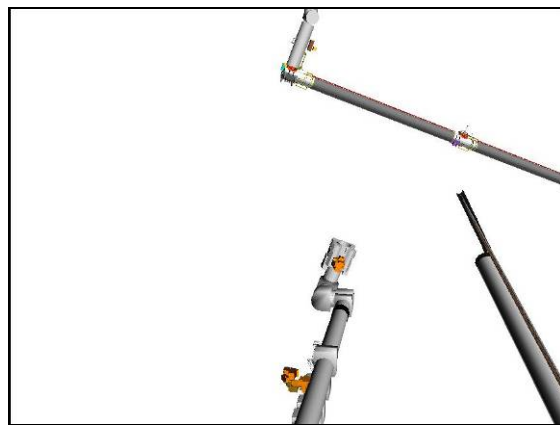


Figure 2.- Focus Inspection Support
(37: MBS Mast: -30, +60).

4.101 MNVR FROM FI SUPPORT TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 2 of 5 pages

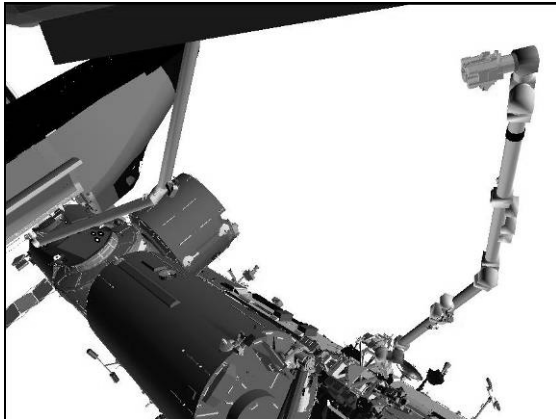


Figure 3.- Focus Inspection Support
(71: OBSS ITVC: 0, -20).

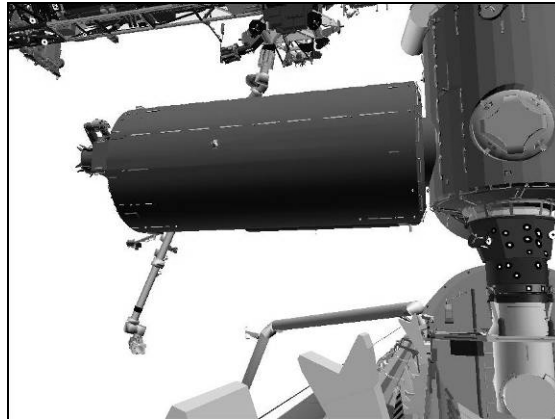


Figure 4.- Focus Inspection Support
(V10: Camera B: -15, +10).

2. MANEUVER TO JLP APPROACH

DCP BRAKES SSRMS → OFF (Verify OFF)

√Vernier

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► JLP ► JLP Approach

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

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+123.7	-75.8	-100.0	-69.0

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)	+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0
TGT	+120.0	+10.0	-30.0	+123.7	-75.8	-100.0	-69.0
ERR	0.0	0.0	0.0	-98.7	-11.2	-100.0	-100.0

4.101 MNVR FROM FI SUPPORT TO JLP PRE-GRAPPLE

```

*****
* 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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+123.7	-75.8	-100.0	-69.0
X	Y	Z	Pitch	Yaw	Roll	
-266	+480	+213	-68.9	-15.5	-111.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>JLP Port FRGF					



Figure 5.- JLP Approach (37: MBS Mast: -30, +80).

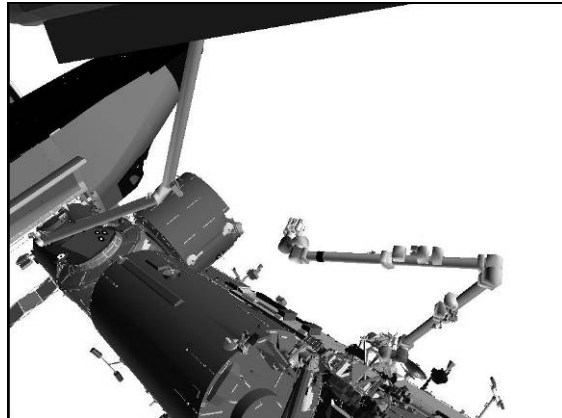


Figure 6.- JLP Approach (71: OBSS ITVC: 0, -20).

4.101 MNVR FROM FI SUPPORT TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN) Page 4 of 5 pages

3. MANEUVER TO JLP PRE-GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-170, -50)	37: MBS Mast (+95, +85)	24: Tip Elbow (0, 0)	SRMS Elbow (+120, -5)	Camera B (-15, +10)

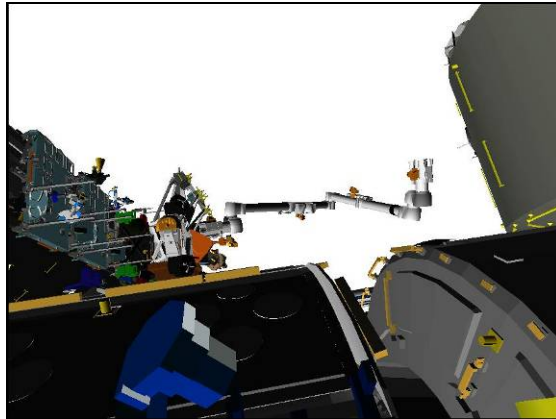


Figure 7.- JLP Approach
(13: LAB Stbd Zenith: -170, -50).

SSRMS Joint OCAS

pick File ► JLP ► JLP Pre-Grapple

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

SR	SY	SP	EP	WP	WY	WR
+120.0	+7.6	+14.1	+123.7	-75.8	-26.4	+78.7

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)	+120.0	+10.0	-30.0	+123.7	-75.8	-100.0	-69.0
TGT	+120.0	+7.6	+14.1	+123.7	-75.8	-26.4	+78.7
ERR	0.0	+2.4	-44.1	0.0	0.0	-73.6	-147.7

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.

4.101 MNVR FROM FI SUPPORT TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 5 of 5 pages

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
+120.0	+7.6	+14.1	+123.7	-75.8	-26.4	+78.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>JLP Port FRGF					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

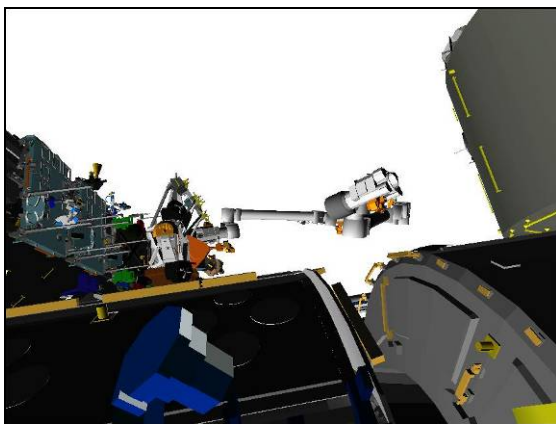


Figure 8.- JLP Pre-Grapple
(13: LAB Stbd Zenith: -170, -50).

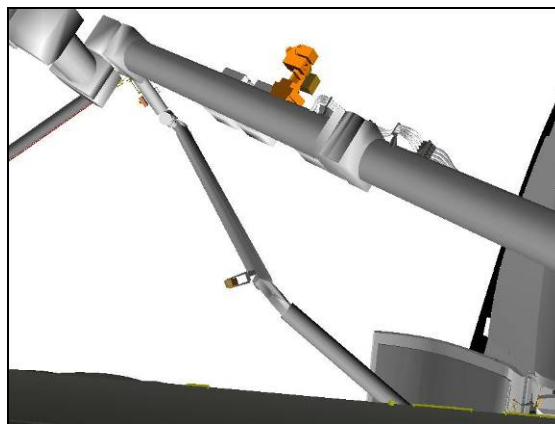


Figure 9.- JLP Pre-Grapple
(37: MBS Mast: +95, +85).



Figure 10.- JLP Pre-Grapple
Bird's Eye View.

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4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 1 of 14 pages

1. SETUP FOR JLP GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-150, -40)	25: Tip LEE	03: S1 Lower Outboard (+70, -5)	SRMS Elbow (+125, +5)	Camera B (-20, +15)

NOTE

1. The LEE Camera must be fully zoomed out to correspond to the target overlay.
2. Orbiter Ch 2 (ID:72) will be unavailable while the CBCS Camera is setup for the JLP Relocate from Node 2 to JPM.

PCS

MSS: SSRMS:

Change Loaded Parameters ► JLP ► JLP Mate ISSACS SRH
Verify 'Loaded Parameters' (two) – JLP Mate ISSACS, SR Held

Change Unloaded Parameters ► Unloaded ► LEE Tip SRH
Verify 'Unloaded Parameters' (two) – LEE Tip, SR Held

Verify Display – Node2>JLP Port FRGF

Verify Command – SSRMS>Internal

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

SR	SY	SP	EP	WP	WY	WR
+120.0	+7.6	+14.1	+123.7	-75.8	-26.4	+78.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2> JLP Port FRGF					

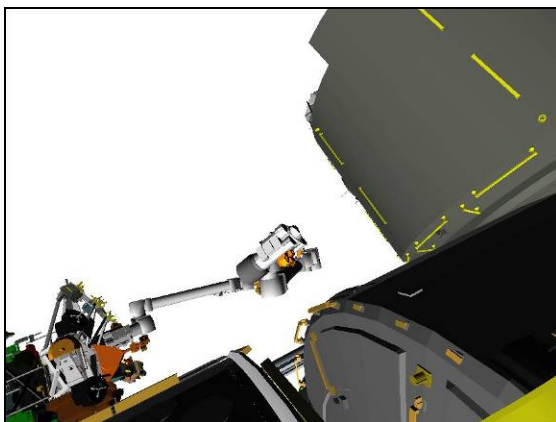


Figure 1.- JLP Pre-Grapple
(13: LAB Stbd Zenith: -150, -40).

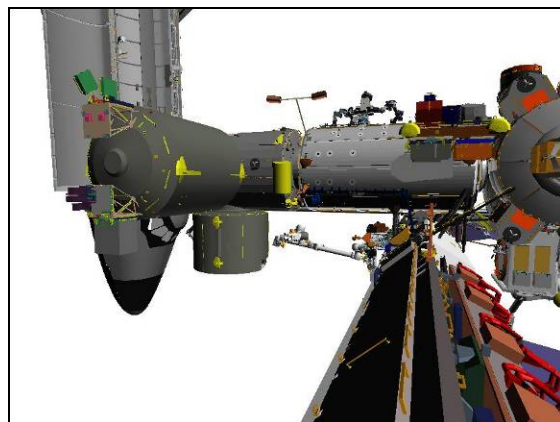


Figure 2.- JLP Pre-Grapple
(03: S1 Lower Outboard: +70, -5).

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 2 of 14 pages

2. GRAPPLE JLP

√Vernier

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

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

Expected SSRMS JLP Grappled position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	-11.7	+14.3	+110.1	-68.9	-16.3	+61.0
X	Y	Z	Pitch	Yaw	Roll	
+226	+1	-227	-0.2	+49.2	-179.8	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	Node2> JLP Port FRGF					

DCP

BRAKES SSRMS → ON (Verify ON)

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 3 of 14 pages

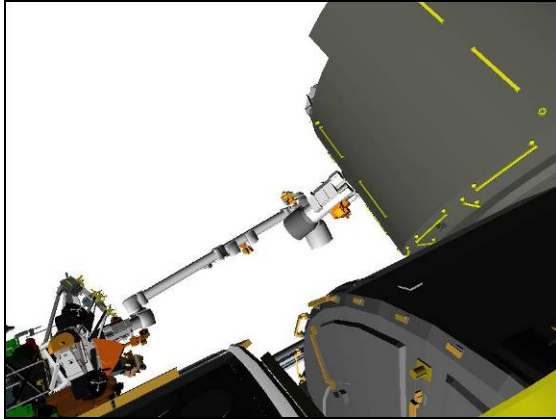


Figure 3.- JLP Grappled
(13: LAB Stbd Zenith: -150, -40).

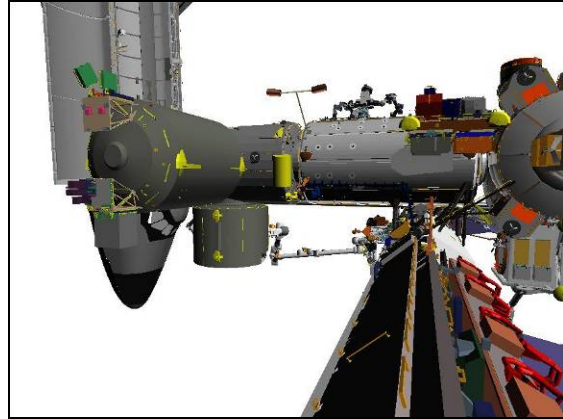


Figure 4.- JLP Grappled
(03: S1 Lower Outboard: +70, -5).

3. PREP FOR JLP DEMATE

If using shuttle attitude control, coordinate with shuttle crewmembers
DAP: FREE

NOTE

MCC-H will verify Attitude control and SSRMS are in a good config.

On MCC-H GO for JLP Demate:

Notify CBM operator, "SSRMS Capture complete - GO for CBM Demate."

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

4. SETUP FOR JLP UNBERTH

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-150, -30)	71: OBSS ITVC (0, -30)	03: S1 Lower Outboard (+70, -5)	SRMS Elbow (+125, -35)	Camera B (-20, +15)

Change Display ► Node2 ► JLP Demate ISSACS (Verify Node 2> JLP Demate ISSACS)

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

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 4 of 14 pages

Verify SSRMS at JLP Grappled position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	-11.7	+14.3	+110.1	-68.9	-16.3	+61.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	Node2> JLP Demate ISSACS					

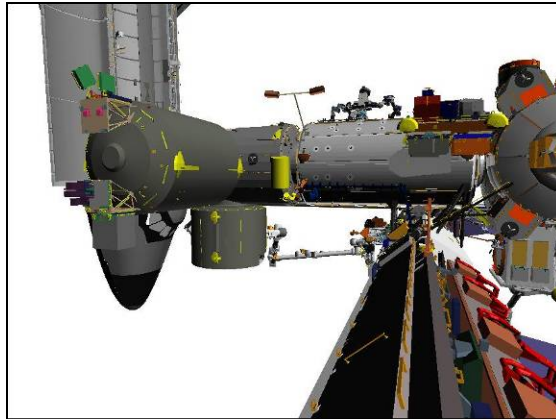


Figure 5.- JLP Grappled
(03: S1 Lower Outboard: +70, -5).

5. JLP UNBERTH

NOTE

The closest clearance is at the beginning of the maneuver to the JLP Unberth position, and is between the JLP and the Orbiter Crew Cabin: 115 cm (41 in). This may be monitored with the SRMS Elbow Camera, the OBSS ITVC, or the S1 Lower Outboard Camera.

On CBM operator, “Go for JLP Unberth.”

On MCC-H GO for JLP Unberth:

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)

√Vernier

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 5 of 14 pages

THC/
RHC

Maneuver JLP to Unberth position (within 5 cm/1 deg).
Expect -Z (THC up).

Locked						
SR	SY	SP	EP	WP	WY	WR
+120.0	-39.3	0.0	+110.9	-58.7	+0.2	+38.5
X	Y	Z	Pitch	Yaw	Roll	
0	0	-200	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	Node2> JLP Demate ISSACS					

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

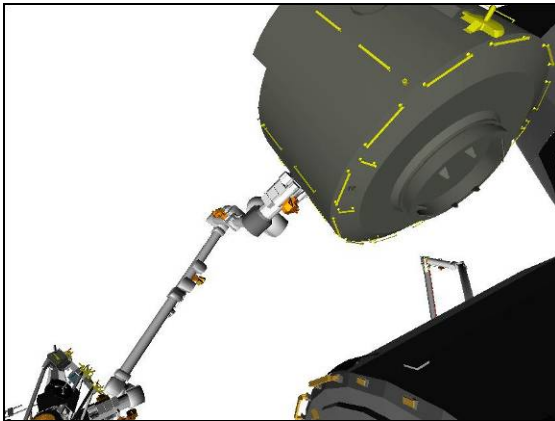


Figure 6.- JLP Unberth
(13: LAB Stbd Zenith: -150, -30).

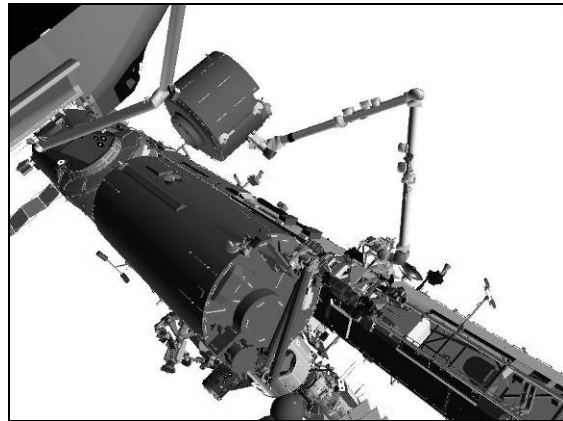


Figure 7.- JLP Unberth
(71: OBSS ITVC: 0, -30).

6. ATTITUDE CONTROL

If using shuttle attitude control and attitude maintenance required,
coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

 DAP: FREE > 2 seconds

 DAP: AUTO

When in attitude and rates damped

 DAP: FREE

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 6 of 14 pages

7. CBM INTERFACE INSPECTION

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
13: LAB Stbd Zenith (-122, -23) Zoom: 23 mm	71: OBSS ITVC (+22, -24) HFOV: 5 deg	03: S1 Lower Outboard (+61, -8) Zoom: 50 mm

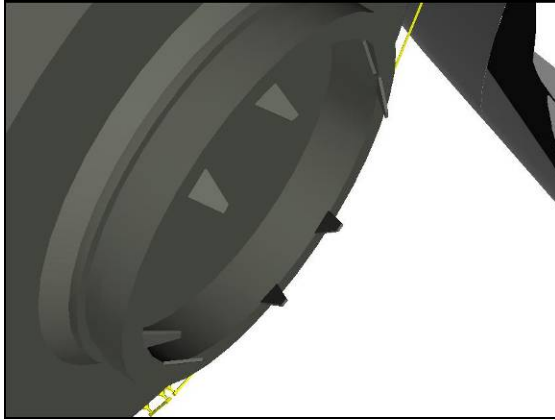


Figure 8.- CBM Interface Inspection
(13: LAB Stbd Zenith: -122, -23)
Zoom: 23 mm.

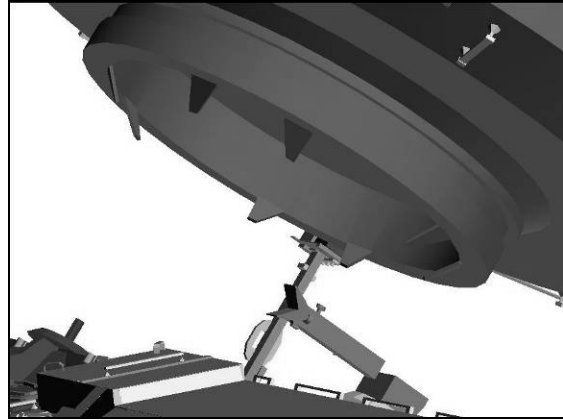


Figure 9.- CBM Interface Inspection
(71: OBSS ITVC: +22, -24)
HFOV: 5 deg.

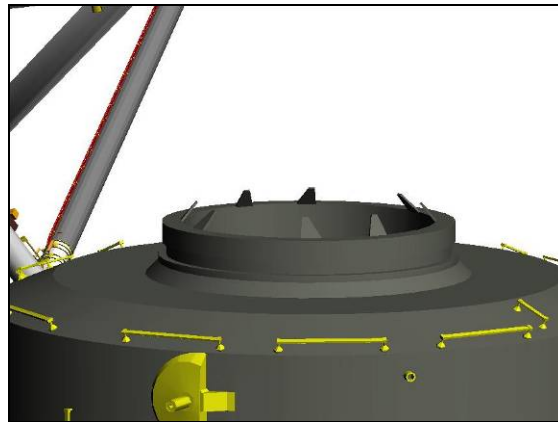


Figure 10.- CBM Interface Inspection
(03: S1 Lower Outboard: +61, -8)
Zoom: 50 mm.

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 7 of 14 pages

7.1 JLP PCBM Inspection

NOTE

1. Even with best available views, some small percentage of PCBM ring may be obstructed (this lack of 100 % coverage is acceptable risk).
2. For a permanent element (JLP), there must be a very high degree of confidence in the ability of at least two PCBM seals to completely seal against the ACBM interface.

Verify Mating corridor clear of obstructions and in expected configuration.

The image below provides a good indication of a "clean" PCBM in the nominal expected configuration for a mating event.

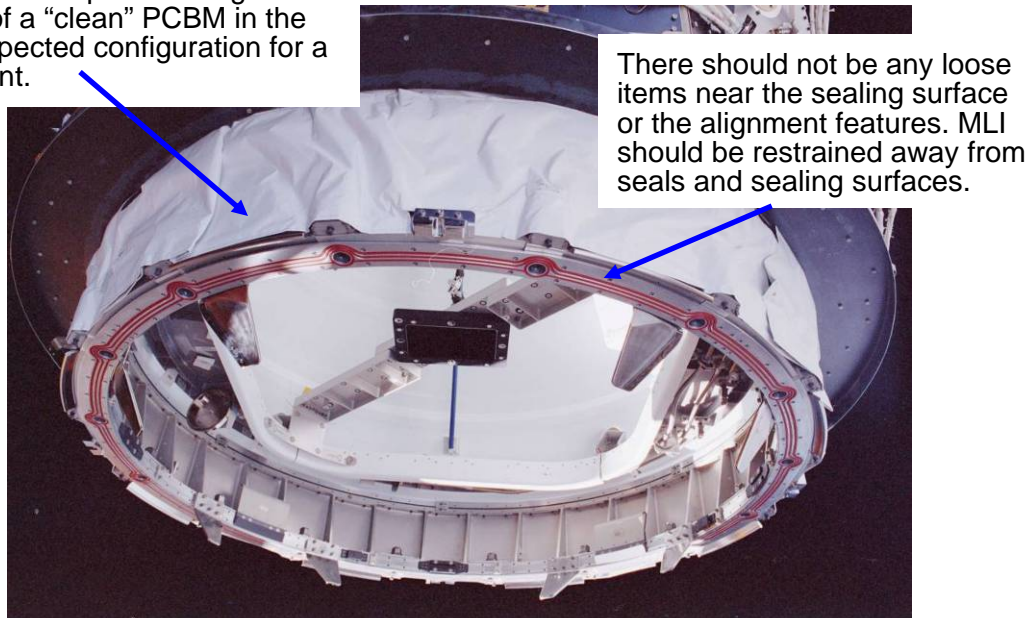


Figure 11.- Example PMA3 PCBM Inspection View.

7.2 PCBM FOD Inspection

If possible, verify seals and surfaces clear of FOD (debris or damage).

7.3 PCBM Inspection Complete

If steps 7.1 and 7.2 can not be verified, √**MCC-H**.

Notify **MCC-H** when survey complete.

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 8 of 14 pages

8. SETUP FOR MANEUVER TO PRE-INSTALL

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-160, -40)	71: OBSS ITVC (0, -30) 37: MBS Mast (-155, +50)	03: S1 Lower Outboard (+60, -15)	SRMS Elbow (+125, -20)	Camera B (-20, +15)

PCS MSS: SSRMS:

Change Loaded Parameters ► JLP ► JLP Mate CBCS SRH
Verify 'Loaded Parameters' (two) – JLP Mate CBCS, SR Held

Change Display ► JPM ► JLP Mate CBCS (Verify JPM>JLP Mate CBCS)

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

Verify SSRMS at JLP Unberth position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	-39.3	0.0	+110.9	-58.7	+0.2	+38.5
X	Y	Z	Pitch	Yaw	Roll	
+200	0	+995	0.0	0.0	0.0	
FOR	Loaded – JLP Mate CBCS, SR Held					
Disp	JPM>JLP Mate CBCS					

9. MANEUVER TO JLP PRE-INSTALL ON JPM

RHC RATE → COARSE (Verify Coarse on PCS)

PCS MSS: SSRMS:

Enter Mode – FOR OCAS (Verify blue)

MSS: SSRMS: SSRMS FOR OCAS: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

pick File ► JLP ► JLP Pre-Install

Verify 'FOR' 'Destination' for JLP Pre-Install position.

X	Y	Z	Pitch	Yaw	Roll
+200	0	0	0.0	0.0	0.0

cmd Load (Verify Sequence Status – Confirm or Cancel)

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

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

	X	Y	Z	Pitch	Yaw	Roll
FOR	+200	0	+995	0.0	0.0	0.0
TGT	+200	0	0	0.0	0.0	0.0
ERR	0	0	+995	0.0	0.0	0.0

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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at JLP Pre-Install on JPM position (within 5 cm/1 deg).

Locked						
SR	SY	SP	EP	WP	WY	WR
+120.0	+35.6	-87.7	+139.5	+26.6	-36.2	+109.5
X	Y	Z	Pitch	Yaw	Roll	
+200	0	0	0.0	0.0	0.0	
FOR	Loaded – JLP Mate CBCS, SR Held					
Disp	JPM> JLP Mate CBCS					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 10 of 14 pages

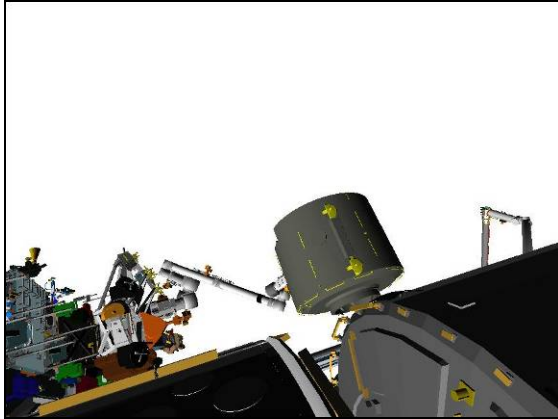


Figure 12.- JLP Pre-Install
(13: LAB Stbd Zenith: -160, -40).

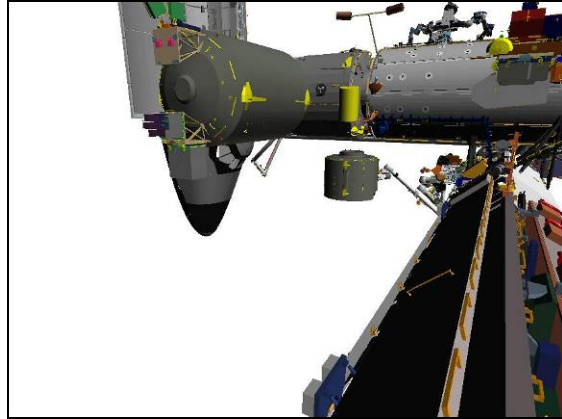


Figure 13.- JLP Pre-Install
(03: S1 Lower Outboard: +60, -15).

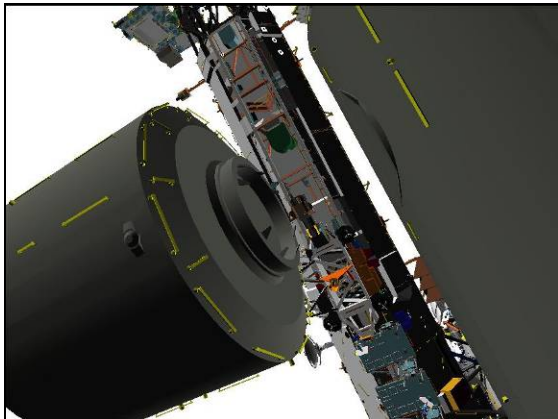


Figure 14.- JLP Pre-Install
(V10: SRMS Elbow: +125, +20).

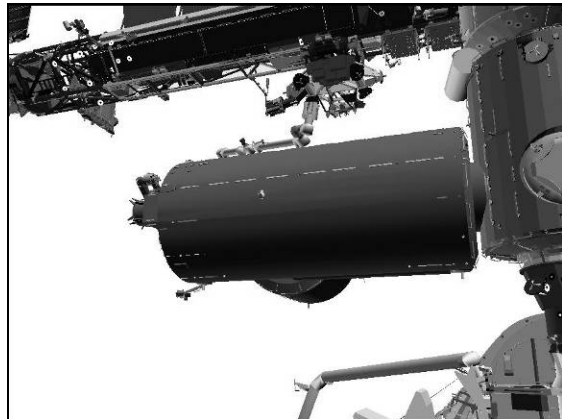


Figure 15.- JLP Pre-Install
(V10: Camera B: -20, +15).

10. SETUP FOR MANEUVER TO INSTALL

Verify CBCS setup complete.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-180, -50)	72: CBCS	03: S1 Lower Outboard (+60, -15) (37: MBS Mast (+20, +70))	SRMS Elbow (+130, +25)	Camera B (-20, +15)

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 11 of 14 pages

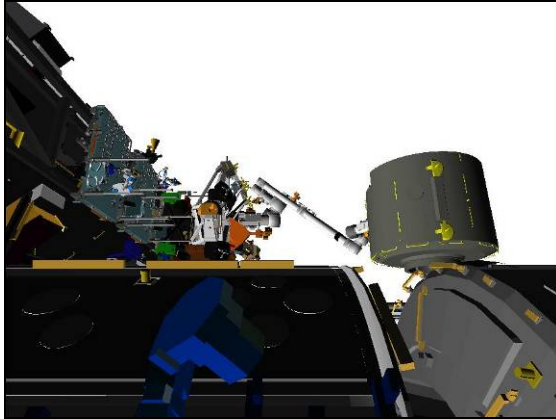


Figure 16.- JLP Pre-Install
(13: LAB Stbd Zenith: -180, -50).

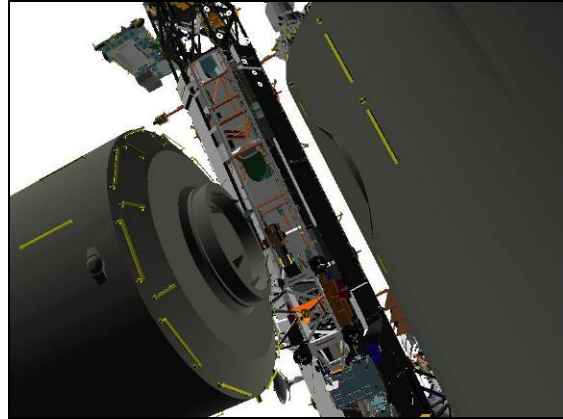


Figure 17.- JLP Pre-Install
(V10: SRMS Elbow: +130, +25).

11. VERIFYING ATTITUDE CONTROL CONFIGURATION

If using shuttle attitude control and attitude maintenance required,
coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

DAP: FREE > 2 seconds

DAP: AUTO

When in attitude and rates damped

DAP: FREE

12. MANEUVER TO JLP INSTALL ON JPM

NOTE

JEM Zenith CBM RTLs can be monitored using the PCS display:

PCS JEM: S&M: Zenith CBM: RTL Details

JEM Zenith CBM RTL Details

On CBM operator, "Go for Maneuver to RTL."

On MCC-H GO for JLP Install:

RHC RATE → VERNIER (Verify Vernier on PCS)

MSS: SSRMS: Rate:

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

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

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

cmd Shoulder Roll (Verify SR – Locked)

THC/
RHC

Maneuver JLP to Ready-To-Latch position until RTL (four) – green

Expected RTL position.

Locked							
SR	SY	SP	EP	WP	WY	WR	
+120.0	+53.2	-73.0	+136.3	+28.3	-37.7	+131.5	
X	Y	Z	Pitch	Yaw	Roll		
+8	0	0	0.0	0.0	0.0		
FOR	Loaded – JLP Mate CBCS, SR Held						
Disp	JPM> JLP Mate CBCS						

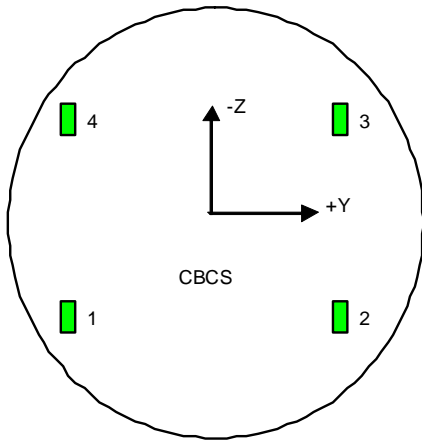


Figure 18.- RTL Diagram.
(JEM Zenith CBM)

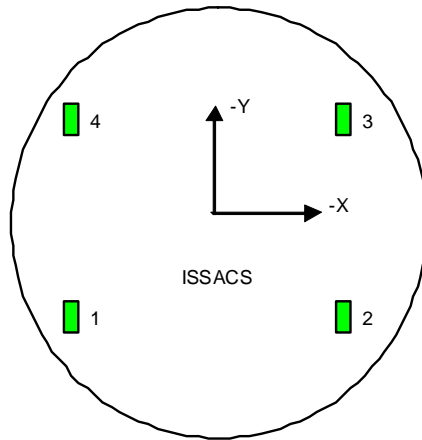


Figure 19.- RTL Diagram.
(JEM Zenith CBM)

PCS

MSS: SSRMS: SSRMS

Verify Posn Hold – orange

Verify RTL (four) – green

Enter Mode – Standby (Verify blue)

Notify CBM operator, “Maneuver to RTL complete - GO for first stage capture.”

4.102 JLP RELOCATE

(RBT FS/1J/FIN/SPN)

Page 13 of 14 pages

13. POST FIRST STAGE CAPTURE CLEANUP

On CBM operator, "Go for SSRMS mode to Limp."

NOTE

Following SSRMS Mode to Limp, closed RTLs may open due to RTL spring forces. RTL closed indication is not required prior to execution of second stage capture (for latches used during first stage capture).

MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

WARNING

If SSRMS fails to brakes-on from limp mode, continuation of Second Stage Capture may cause structural failure of SSRMS or primary structure. If CBM stops unexpectedly (and Cmd Code changes to 'Stop') or SSRMS safes during Second Stage Capture, \surd **MCC-H** before proceeding.

Notify CBM operator: "SSRMS Mode to Limp complete. GO for Second Stage Capture."

14. POST ABOLT CLEANUP

On CBM operator, "GO for SSRMS Brakes ON."

DCP BRAKES SSRMS → ON (Verify ON)

PCS MSS: SSRMS:

Expected JLP Install on JPM position.

SR	SY	SP	EP	WP	WY	WR
+120.0	+53.8	-72.3	+136.0	+28.4	-37.7	+132.3
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JLP Mate CBCS, SR Held					
Disp	JPM> JLP Mate CBCS					

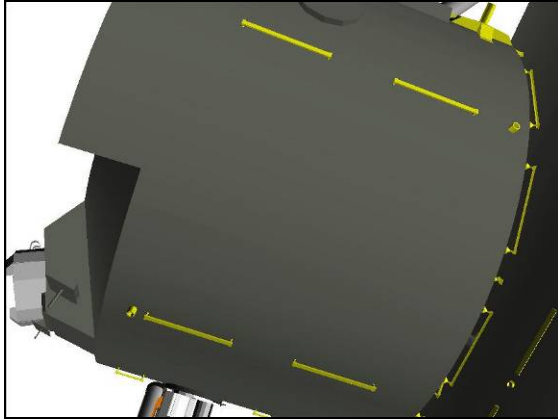


Figure 20.- JLP Install on JPM
(37: MBS Mast: +20, +70).

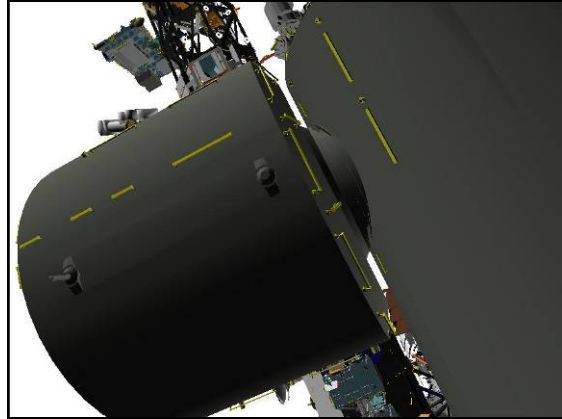


Figure 21.- JLP Install on JPM
(V10: SRMS Elbow: +130, +25).

4.103 JLP UNGRAPPLE TO JEM RMS Viewing

(RBT FS/1J/FIN/SPN)

Page 1 of 7 pages

1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (+175, +5)	25: Tip LEE	37: MBS Mast (0, +42)	Camera B (-30, +15)	OBSS ITVC (+165, -300)

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – JLP Mate CBCS, SR Held

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

Change Display ► JPM ► JLP Port FRGF (Verify JPM>JLP Port FRGF)

√Command – SSRMS>Internal

Verify SSRMS at JLP Install on JPM position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	+53.8	-72.3	+136.0	+28.4	-37.7	+132.3
X	Y	Z	Pitch	Yaw	Roll	
+226	+1	-190	-90.0	-0.1	+139.2	
FOR	Loaded – JLP>JLP Mate CBCS, SR Held					
Disp	JPM>JLP Port FRGF					

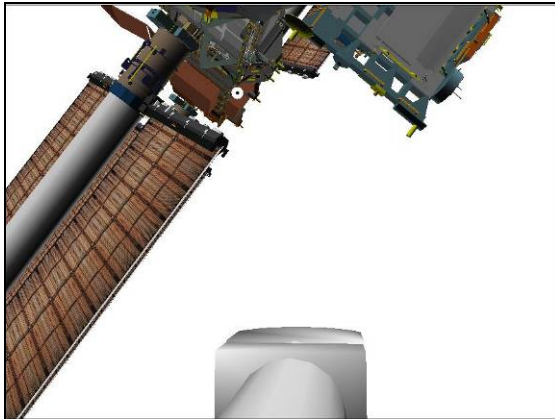


Figure 1.- JLP Install on JPM
(22: Base Elbow: +175, +5).



Figure 2.- JLP Install on JPM
(37: MBS Mast: 0, +42).

4.103 JLP UNGRAPPLE TO JEM RMS Viewing

(RBT FS/1J/FIN/SPN)

Page 2 of 7 pages

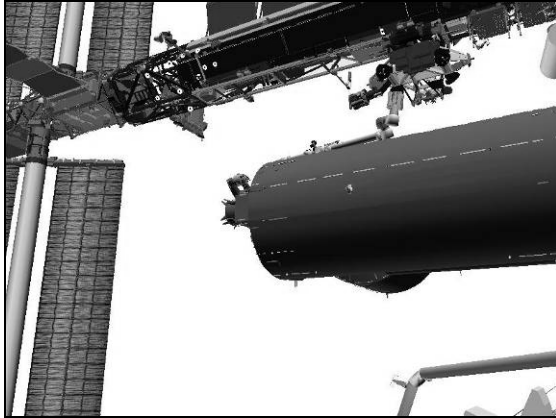


Figure 3.- JLP Install on JPM
(V10: Camera B: -30, +15).

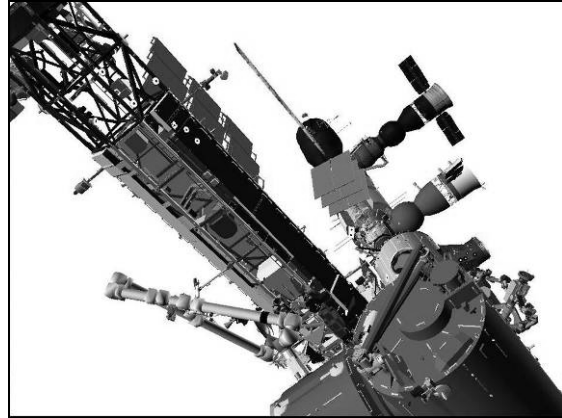


Figure 4.- JLP Install on JPM
(V10: OBSS ITVC: +165, -300).

2. JLP RELEASE (WITH CARRIAGE PUSHOFF)

2.1 SSRMS Limp

On CBM operator GO for JLP Ungrapple:

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

2.2 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)

4.103 JLP UNGRAPPLE TO JEM RMS Viewing

(RBT FS/1J/FIN/SPN)

Page 3 of 7 pages

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)

2.3 SSRMS Backoff

MSS: SSRMS: Limp:

cmd None Limp (Verify Standby – blue)

√Vernier

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 Roll (Verify SR – Locked)

THC/
RHC

Maneuver SSRMS to JLP Release position (within 5 cm/1 deg).

Locked						
SR	SY	SP	EP	WP	WY	WR
+120.0	+67.7	-86.3	+135.7	+53.1	-35.9	+149.5
X	Y	Z	Pitch	Yaw	Roll	
-180	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	JPM>JLP Port FRGF					

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

4.103 JLP UNGRAPPLE TO JEM RMS Viewing

(RBT FS/1J/FIN/SPN)

Page 4 of 7 pages

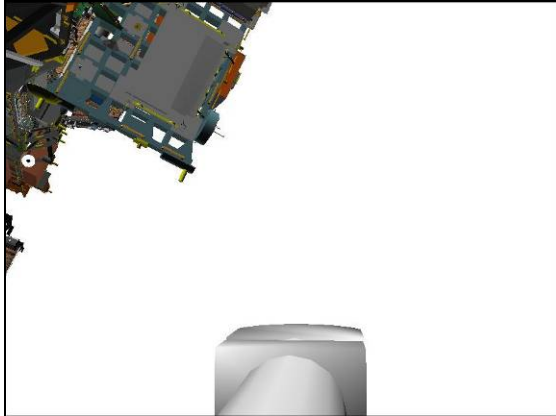


Figure 5.- JLP Release
(22: Base Elbow: +175, +5).

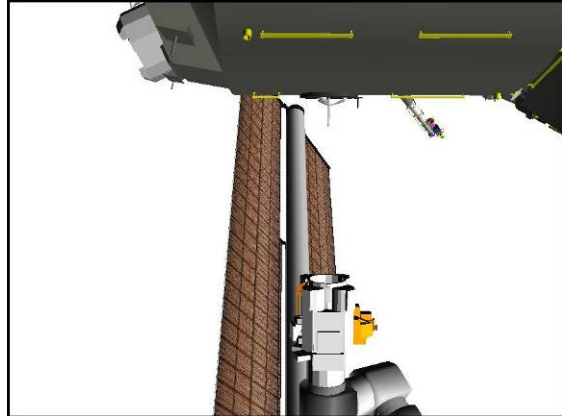


Figure 6.- JLP Release
(37: MBS Mast: 0, +42).

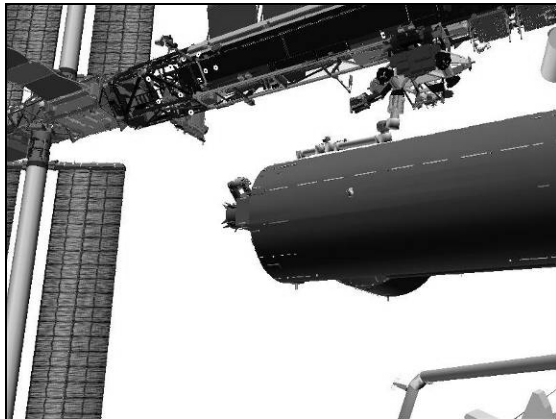


Figure 7.- JLP Release
(V10: Camera B: -30, +15).

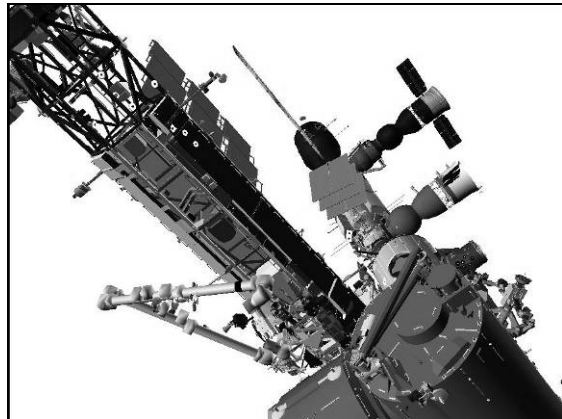


Figure 8.- JLP Release
(V10: OBSS ITVC: +165, -300).

3. JOCAS TO JEM RMS VIEWING POSITION

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (+10, 0)	24: Tip Elbow (+10, +10)	37: MBS Mast (-20, +5)	Camera B (-30, +15)	OBSS ITVC (+165, -300)

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

MSS: SSRMS: Rate:

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

4.103 JLP UNGRAPPLE TO JEM RMS Viewing

(RBT FS/1J/FIN/SPN)

Page 5 of 7 pages

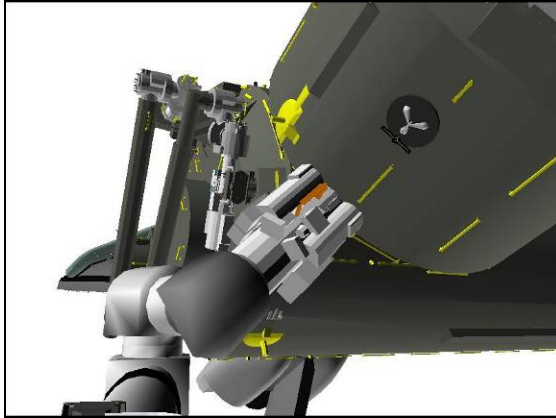


Figure 9.- JLP Release
(24: Tip Elbow: +10, +10).

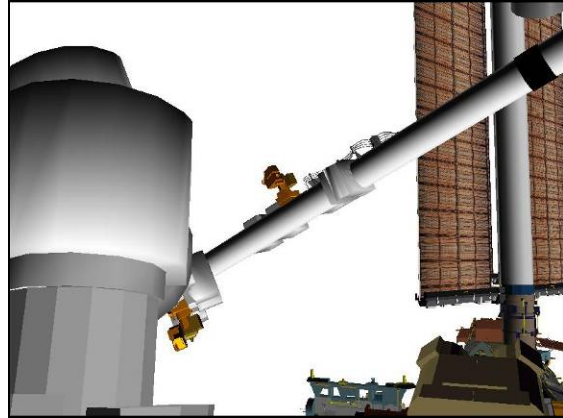


Figure 10.- JLP Release
(37: MBS Mast: -20, +5).

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► JLP ► JEM RMS Viewing

Verify 'Joint Angles' 'Destination' for JEM RMS Viewing position.

SR	SY	SP	EP	WP	WY	WR
+101.5	+47.6	-71.4	+58.4	-68.0	-185.0	+97.5

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)	+120.0	+67.7	-86.3	+135.7	+53.1	-35.9	+149.5
TGT	+101.5	+47.6	-71.4	+58.4	-68.0	-185.0	+97.5
ERR	+18.5	+20.1	-14.9	+77.3	+121.1	+149.1	+52.0

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.

PCS

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

4.103 JLP UNGRAPPLE TO JEM RMS Viewing

(RBT FS/1J/FIN/SPN)

Page 6 of 7 pages

DCP AUTO SEQ → PROC

PCS MSS: SSRMS: SSRMS

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
+101.5	+47.6	-71.4	+58.4	-68.0	-185.0	+97.5
X	Y	Z	Pitch	Yaw	Roll	
+1101	-1958	+307	-69.0	+81.8	+32.4	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)

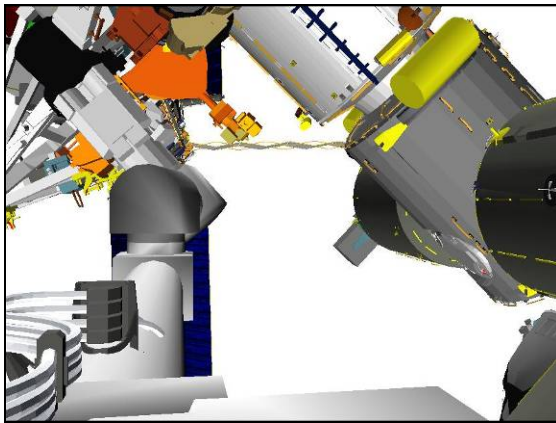


Figure 11.- JEM RMS Viewing
(22: Base Elbow: +10, 0).

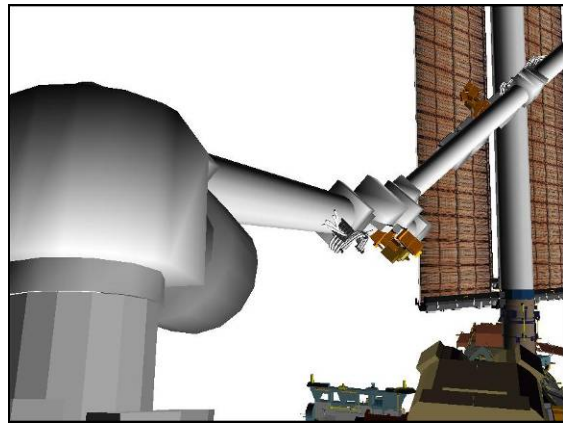


Figure 12.- JEM RMS Viewing
(37: MBS Mast: -20, +5).

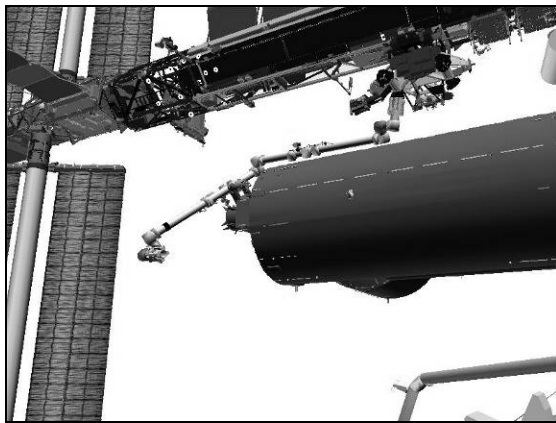


Figure 13.- JEM RMS Viewing
(V10: Camera B: -30, +15).

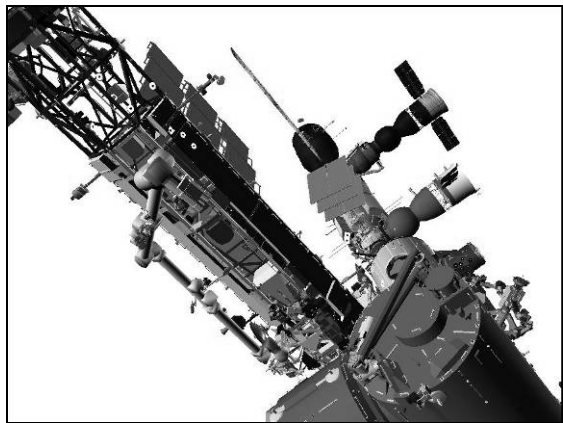


Figure 14.- JEM RMS Viewing
(V10: OBSS ITVC: +165, -300).

4. SETUP CAMERAS FOR JEM RMS OPERATIONS

Configure Cameras as shown below.

Monitor 1	Monitor 2	Monitor 3
24: Tip Elbow (+76, -5)	25: Tip LEE	22: Base Elbow (+75, -2)

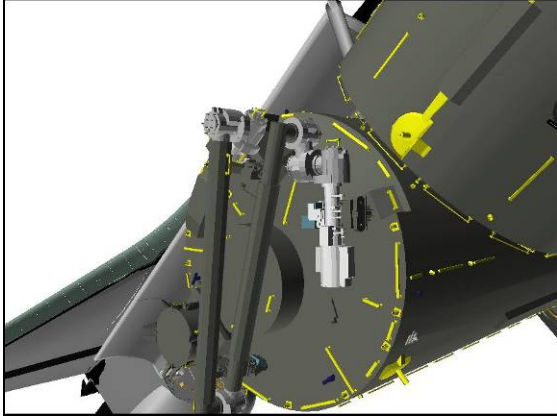


Figure 15.- JEM RMS Viewing
(24: Tip Elbow: +76, -5).

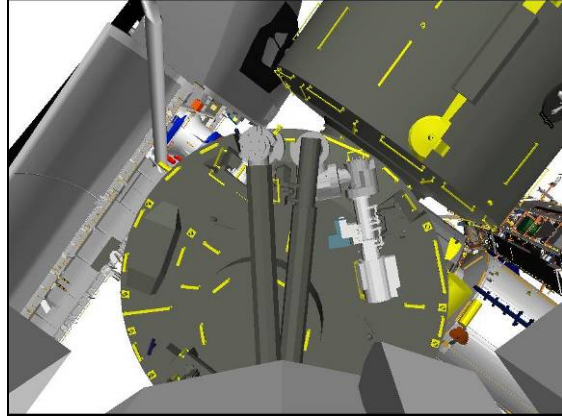


Figure 16.- JEM RMS Viewing
(25: Tip LEE).

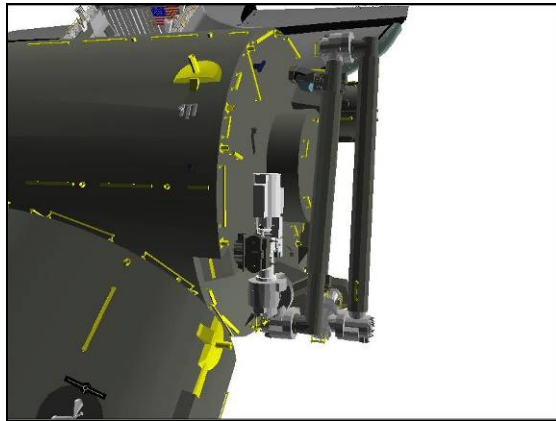


Figure 17.- JEM RMS Viewing
(22: Base Elbow: +75, -2).

Give JEM RMS operator GO for JEM RMS Deploy.

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EVA SUPPORT

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5.101 JEM RMS VIEWING TO EVA 3 START

(RBT FS/1J/FIN) Page 1 of 4 pages

1. SETUP

Verify that the SRMS is in the EVA 3 Viewing position.

Verify that the JEM RMS is in the Initial Deploy position.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+80, -15)	13: LAB Stbd Zenith (-170, -35)	24: Tip Elbow (0, 0) 37: MBS Mast (-170, -10) (51: JPM EXT-A)	Camera B (-30, +15)	OBSS ITVC (+175, -290) SRMS Elbow (+110, -15)

PCS MSS: SSRMS:

Verify Unloaded Parameters – √

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

√Display – ISS>ISSACS

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

SR	SY	SP	EP	WP	WY	WR
+101.5	+47.6	-71.4	+58.4	-68.0	-185.0	+97.5
X	Y	Z	Pitch	Yaw	Roll	
+1101	-1958	+307	-69.0	+81.8	+32.4	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

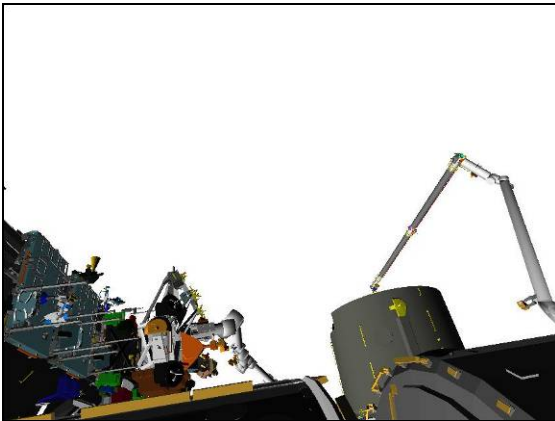


Figure 1.- JEM RMS Viewing
(13: LAB Stbd Zenith: -170, -35).

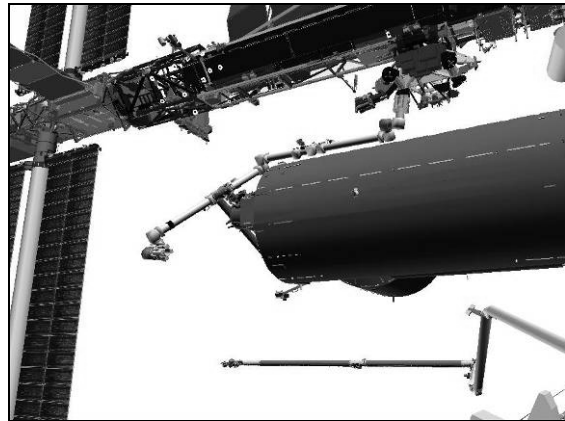


Figure 2.- JEM RMS Viewing
(V10: Camera B: -30, +15).

5.101 JEM RMS VIEWING TO EVA 3 START

(RBT FS/1J/FIN) Page 2 of 4 pages

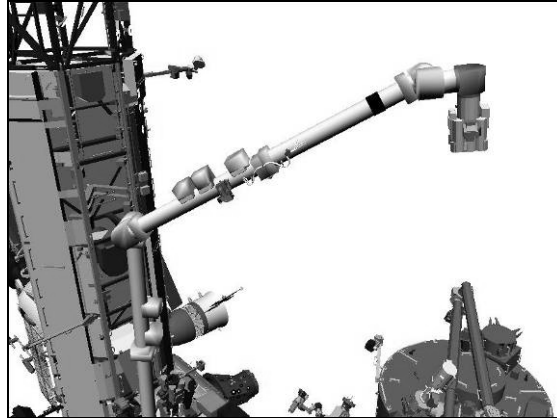


Figure 3.- JEM RMS Viewing
(V10: OBSS ITVC: +175, -290).

2. JOCAS TO EVA 3 START POSITION

NOTE

1. During the maneuver to EVA 3 Start position, the closest clearance is between the SSRMS Shoulder Boom and the MBS Mast Camera, and is approximately 42 cm (17 in). This clearance may be monitored with Camera B.
2. Expect singularity warning for EP between -15 and +15 deg.
3. Expect the Joint Angle Overlay bars to appear as the Shoulder Roll angle approaches +250 deg (20 deg from its soft stop).

DCP BRAKES SSRMS → OFF (Verify OFF)

√Vernier

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► EVA 3 ► EVA 3 Start

Verify 'Joint Angles' 'Destination' for EVA 3 Start position.

SR	SY	SP	EP	WP	WY	WR
+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0

cmd Load (Verify Sequence Status – Confirm or Cancel)

5.101 JEM RMS VIEWING TO EVA 3 START

(RBT FS/1J/FIN) Page 3 of 4 pages

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+101.5	+47.6	-71.4	+58.4	-68.0	-185.0	+97.5
TGT	+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
ERR	-158.0	+27.7	+24.0	+88.1	+88.9	-11.1	-135.5

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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at EVA 3 Start position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
X	Y	Z	Pitch	Yaw	Roll	
+358	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)

5.101 JEM RMS VIEWING TO EVA 3 START

(RBT FS/1J/FIN) Page 4 of 4 pages

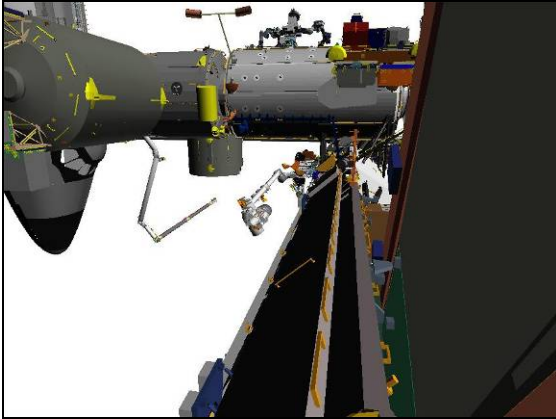


Figure 4.- EVA 3 Start
(03: S1 Lower Outboard: +80, -15).

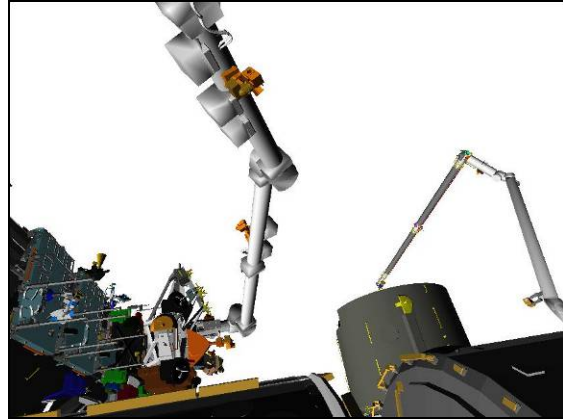


Figure 5.- EVA 3 Start
(13: LAB Stbd Zenith: -170, -35).

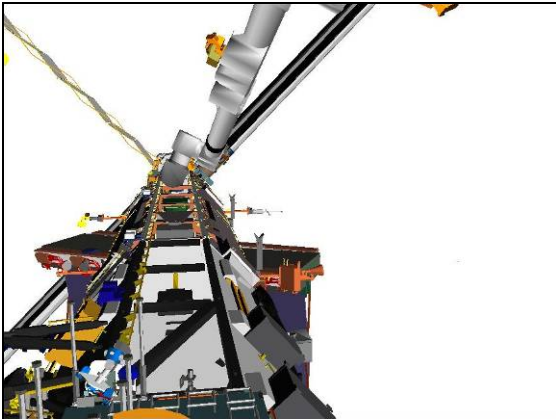


Figure 6.- EVA 3 Start
(37: MBS Mast: -170, -10).

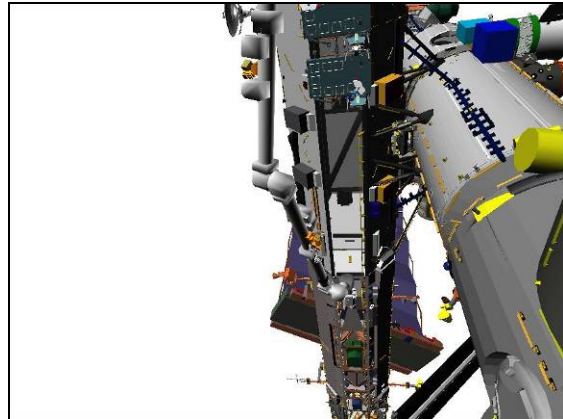


Figure 7.- EVA 3 Start
(V10: SRMS Elbow: +110, -15).

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN) Page 1 of 13 pages

1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+80, -15) Zoom: 25 mm	13: LAB Stbd Zenith (+140, +50)	37: MBS Mast (-170, -10)	Camera B (-11, +28) HFOV: 20 deg	SRMS Elbow (+110, -15)

PCS MSS: SSRMS:

Verify Unloaded Parameters – √

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

√Display – ISS>ISSACS

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

Verify SSRMS at EVA 3 Start position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
X	Y	Z	Pitch	Yaw	Roll	
+358	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					



Figure 1.- EVA 3 Start
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

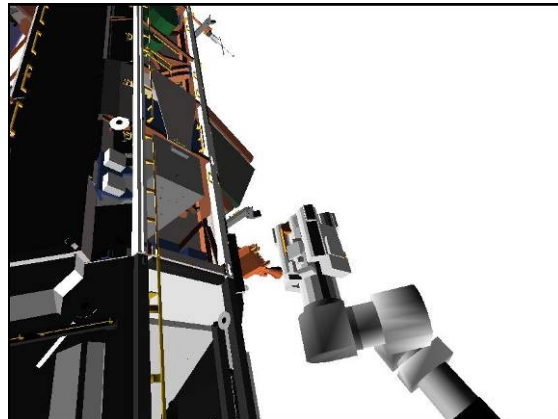


Figure 2.- EVA 3 Start
(13: LAB Stbd Zenith: +140, +50).

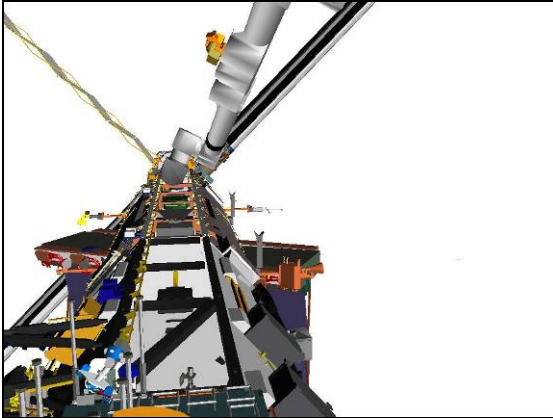


Figure 3.- EVA 3 Start
(37: MBS Mast: -170, -10)

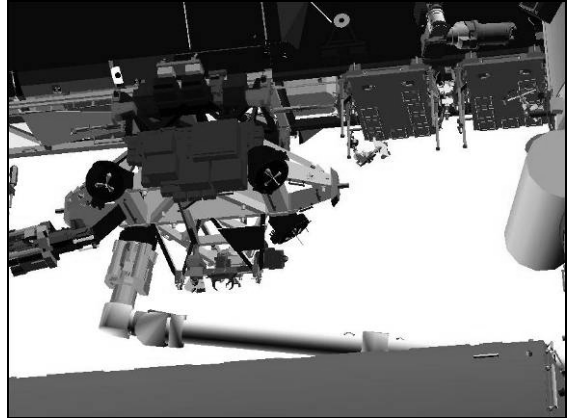


Figure 4.- EVA 3 Start
(V10: Camera B: -11, +28)
HFOV: 20 deg.

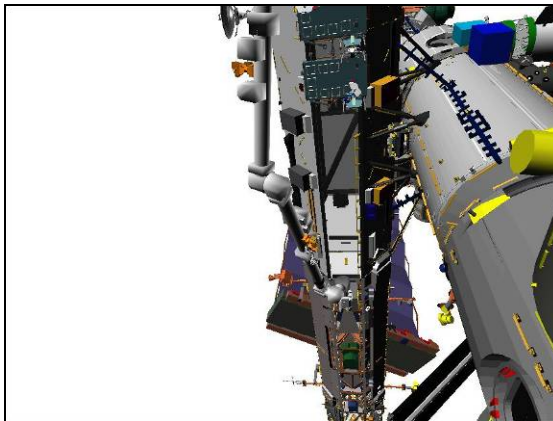


Figure 5.- EVA 3 Start
(V10: SRMS Elbow: +110, -15).

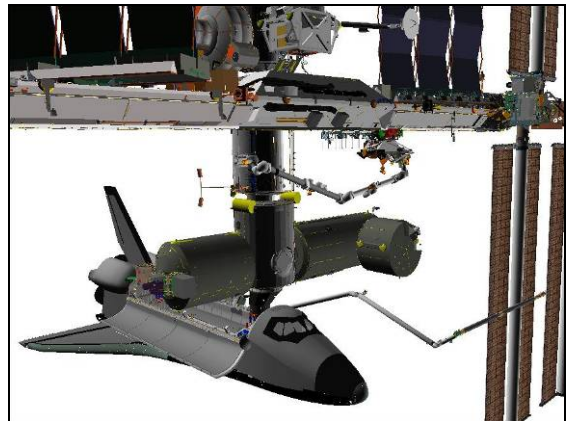


Figure 6.- EVA 3 Start
(Bird's Eye View).

5.102 S1 NTA RETRIEVE

2. MANEUVER TO WIF EXTENDER/APFR INSTALL

<u>NOTE</u>	
1.	During this procedure, the closest clearance between the SSRMS Shoulder Boom and the MBS Mast Camera is approximately 38 cm (15 in), and occurs at the end of the maneuver in Step 2. This clearance may be monitored with Camera B.
2.	At the end of the maneuver to WIF Extender/APFR Install position, the closest clearance is between the Tip LEE and the S0 Truss: approximately 109 cm (43 in). This may be monitored with the S1 Lower Outboard Camera.
3.	When the WIF Extender and APFR are installed, the closest clearance is between the APFR and the S1 Truss: 61 cm (24 in). This may be monitored with the S1 Lower Outboard Camera.

On EV GO to Maneuver to WIF Extender/APFR Install position:

DCP BRAKES SSRMS → OFF (Verify OFF)

√Vernier

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

THC/
RHC Maneuver per EV GCA to WIF Extender/APFR install position.
Expect “-X” motion, THC out.

Expected WIF Extender/APFR install position.

Locked						
SR	SY	SP	EP	WP	WY	WR
+259.5	+17.9	-97.5	-28.4	-155.9	-173.5	+235.0
X	Y	Z	Pitch	Yaw	Roll	
+312	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

BRAKES SSRMS → ON (Verify ON)

Notify EV that SSRMS is ready for WIF Extender and APFR install.

5.102 S1 NTA RETRIEVE

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

NOTE

1. WIF Extender settings are 6/A/7.
2. APFR Settings are 12/NN/F/6.

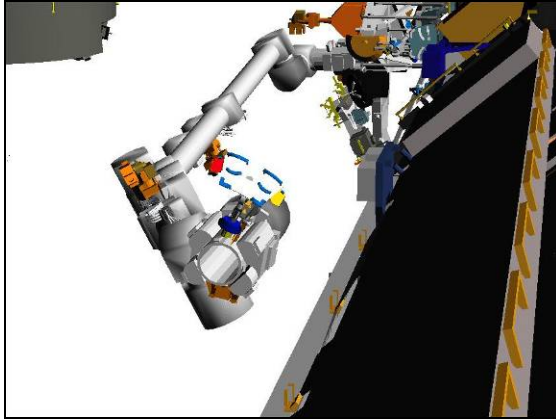


Figure 7.- WIF/APFR Install
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.



Figure 8.- WIF/APFR Install
(13: LAB Stbd Zenith: +140, +50).

3. MANEUVER TO APFR ROTATE POSITION

On EV GO, "WIF/APFR Installed", maneuver to APFR Rotate position:

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)

THC/
RHC Maneuver to APFR Rotate position (within 5 cm/1 deg).
Expect "+X" motion, THC in.

Locked						
SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+232.4
X	Y	Z	Pitch	Yaw	Roll	
+370	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

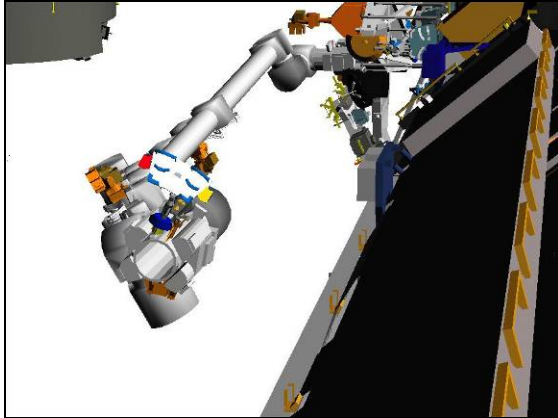


Figure 9.- APFR Rotate
 (03: S1 Lower Outboard: +80, -15)
 Zoom: 25 mm.

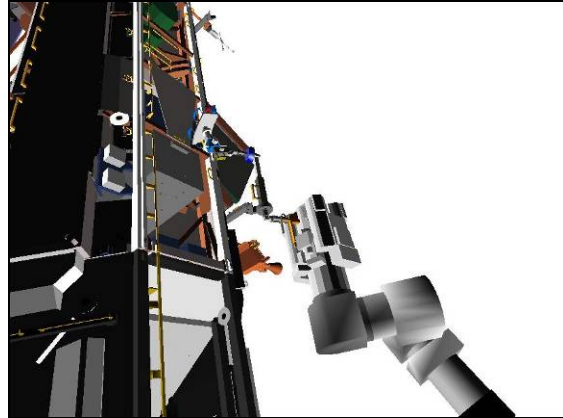


Figure 10.- APFR Rotate
 (13: LAB Stbd Zenith: +140, +50).

4. MANEUVER TO APFR INGRESS

NOTE

During the WR single joint maneuver, the closest clearance is between the APFR Footplate and the S1 Truss: 77 cm (30 in), and may be monitored with the S1 Lower Outboard Camera.

Notify EV that SSRMS is Ready to Begin WR Maneuver.

MSS: SSRMS:

Enter Mode – Single (Verify blue)

WARNING

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

THC Perform Single Joint maneuver to APFR Backoff position (within 1 deg).

	SR	SY	SP	EP	WP	WY	WR
APFR Rotate	+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+232.4
1: WR –							+170.5
APFR	+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
Backoff	X	Y	Z	Pitch	Yaw	Roll	
	+370	+633	-7	+20.0	+86.9	-92.6	
FOR	Unloaded – LEE Tip, SR Held						
Disp	ISS>ISSACS						

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN) Page 6 of 13 pages

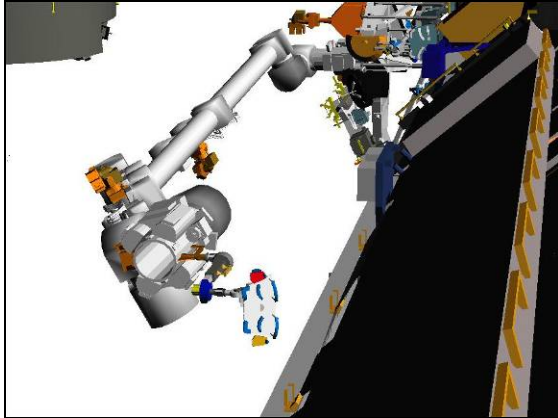


Figure 11.- APFR Backoff
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

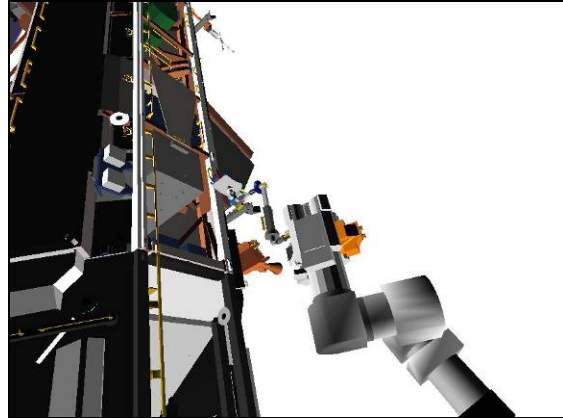


Figure 12.- APFR Backoff
(13: LAB Stbd Zenith: +140, +50).

PCS

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

Notify EV that SSRMS is ready for GCA to APFR Ingress position.

THC/
RHC

Maneuver per EV GCA to APFR ingress position.

Expected APFR Ingress position.

Locked						
SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+370	+633	-7	+20.0	+86.9	-92.6	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

DCP

BRAKES SSRMS → ON (Verify ON)

Notify EV that SSRMS is ready for APFR ingress.

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN) Page 7 of 13 pages

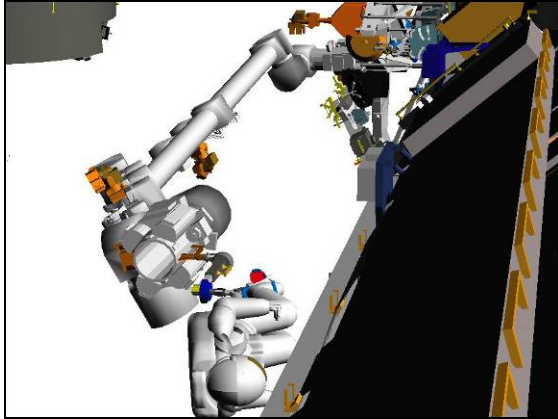


Figure 13.- APFR Ingress
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

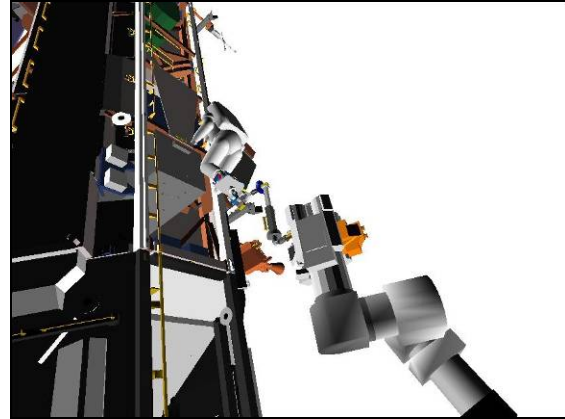


Figure 14.- APFR Ingress
(13: LAB Stbd Zenith: +140, +50).

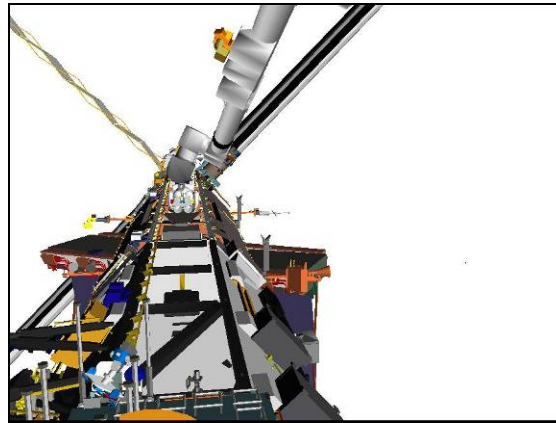


Figure 15.- APFR Ingress
(37: MBS Mast: -170, -10).

PCS

MSS: SSRMS:

Verify Unloaded Parameters – √

Change Unloaded Parameters ► EVA ► Chest WIF 12/NN/F/6 SRH
Verify 'Unloaded Parameters' (two) – Chest WIF 12/NN/F/6, SR Held

Expected APFR Ingress position.

SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+211	+879	-9	-179.2	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN) Page 8 of 13 pages

5. MANEUVER TO S1 NTA RETRIEVE POSITION

NOTE

During the following GCA maneuver, the EP may come close to a singularity warning...

- Performing “-Z” or “+Pitch” motion will improve the EP joint angle.
- The reach limit is at a Y value of +925, when at the expected X and Z values of the S1 NTA Retrieve position.
- During EV GCA, stop EV GCA motion and scale rate to Vern = 0.1 when EP < 16 deg.

On EV GO to Maneuver to S1 NTA Retrieve position:

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)

THC/
RHC Maneuver per EV GCA to S1 NTA Retrieve position.

Expected S1 NTA Retrieve position.

Locked	SR	SY	SP	EP	WP	WY	WR
	+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
	X	Y	Z	Pitch	Yaw	Roll	
	+211	+879	-9	-179.2	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held						
Disp	ISS>ISSACS						

DCP BRAKES SSRMS → ON (Verify ON)

Notify EV that SSRMS is ready for S1 NTA Retrieve

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN) Page 9 of 13 pages

6. MANEUVER TO JOCAS START POSITION

On EV GO to Maneuver to JOCAS Start position:

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)

Notify EV when the NTA is clear of the Truss.

THC/
RHC Maneuver SSRMS to JOCAS Start position (within 5 cm/1 deg).
Expect “+X” motion, THC in.

Locked						
SR	SY	SP	EP	WP	WY	WR
+259.5	+42.5	-89.4	-26.9	-167.2	-178.9	+148.9
X	Y	Z	Pitch	Yaw	Roll	
+495	+879	-9	-179.3	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)



Figure 16.- JOCAS Start
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

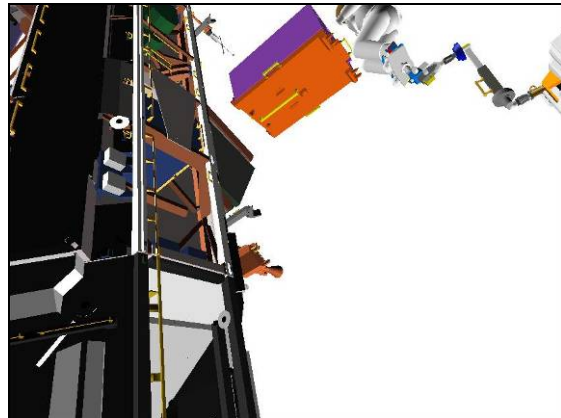


Figure 17.- JOCAS Start
(13: LAB Stbd Zenith: +140, +50).

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN)

Page 10 of 13 pages

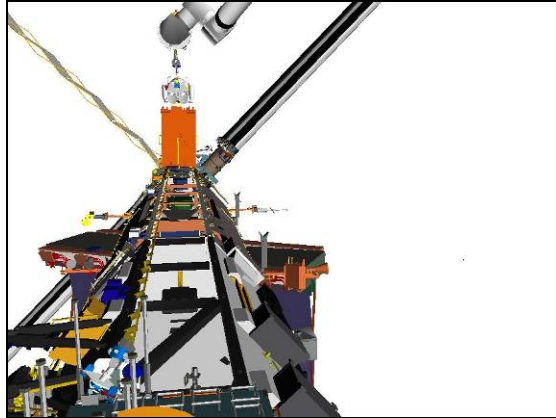


Figure 18.- JOCAS Start
(37: MBS Mast: -170, -10).

7. JOCAS TO ESP3 BACKOFF POSITION

NOTE

1. The LAB Stbd Zenith Camera must be Panned to the value shown below in order to follow the Joint OCAS motion.
2. The JEM EXT-A Camera (ID: 51) was installed on FD6, during EVA2. If available, this Camera may be used in place of the LAB Stbd Zenith Camera on Monitor 2.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+80, -25) 24: Tip Elbow (+135, -10)	13: LAB Stbd Zenith (-175, -25) (51: JEM EXT-A)	37: MBS Mast (-15, -15)	Camera B (-15, +15)	OBSS ITVC (+135, -275)

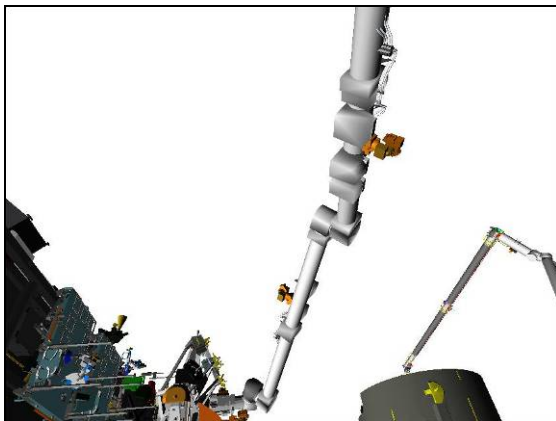


Figure 19.- JOCAS Start
(13: LAB Stbd Zenith: -175, -25).



Figure 20.- JOCAS Start
(37: MBS Mast: -15, -15).

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN) Page 11 of 13 pages



Figure 21.- JOCAS Start
(V10: Camera B: -15, +15).

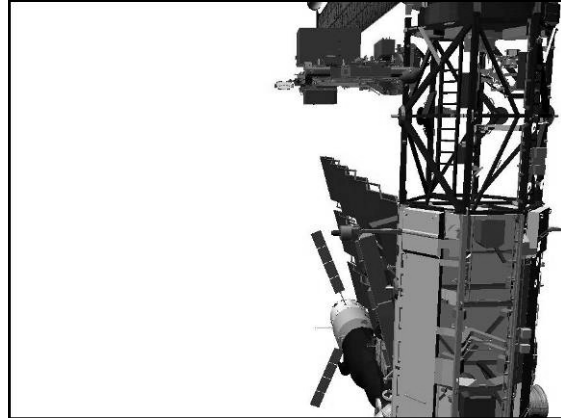


Figure 22.- JOCAS Start
(V10: OBSS ITVC: +135, -275).

NOTE

1. The closest clearances which occur during the maneuver to the ESP3 Backoff position are:
 - (a) SSRMS Shoulder Boom to P1 UHF Antenna: 167 cm (66 in). May be monitored with the Tip Elbow Camera or with Camera B.
 - (b) SSRMS Shoulder Boom to POA: 41 cm (16 in). May be monitored with the MBS Mast Camera, or with the Tip Elbow Camera, or with Camera B.
2. Expect singularity warning for EP between -15 and +15 deg.

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► EVA 3 ► Mnvr to ESP3

Verify 'Joint Angles' 'Destination' for ESP3 Backoff position.

SR	SY	SP	EP	WP	WY	WR
+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2

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)	+259.5	+42.5	-89.4	-26.9	-167.2	-178.9	+148.9
TGT	+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2
ERR	+133.7	-191.3	+21.1	-90.9	-88.2	-168.5	+98.7

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN) Page 12 of 13 pages

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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2
X	Y	Z	Pitch	Yaw	Roll	
-79	-2208	-749	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

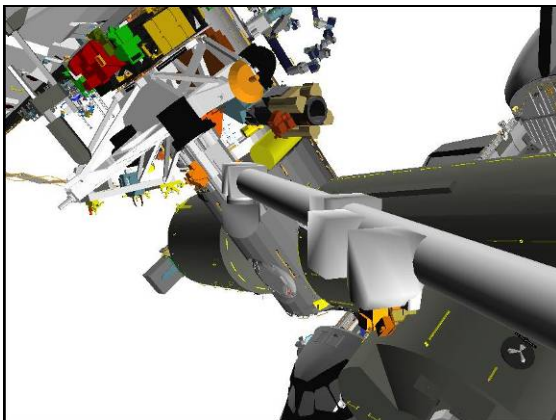


Figure 23.- ESP3 Backoff
(24: Tip Elbow: +135, -10).

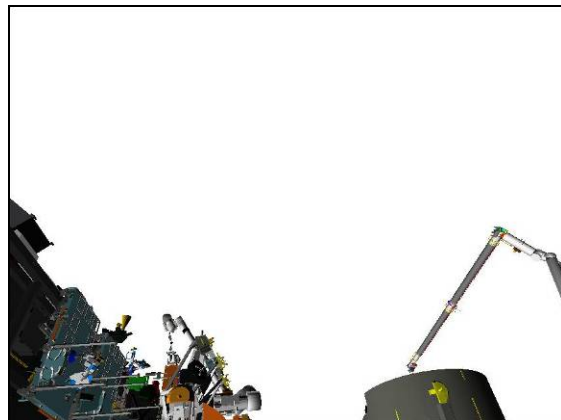


Figure 24.- ESP3 Backoff
(13: LAB Stbd Zenith: -175, -25).

5.102 S1 NTA RETRIEVE

(RBT FS/1J/FIN) Page 13 of 13 pages



Figure 25.- ESP3 Backoff
(37: MBS Mast: -15, -15).

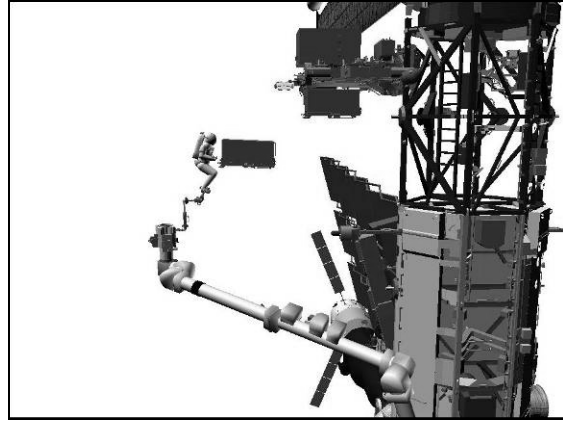


Figure 26.- ESP3 Backoff
(V10: OBSS ITVC: +135, -275).

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5.103 NTA RETRIEVE AT ESP3

(RBT FS/1J/FIN)

Page 1 of 8 pages

1. SETUP

NOTE

The JEM EXT-A Camera (ID: 51) was installed on FD6, during EVA2. If available, this Camera may be used in place of the LAB Stbd Zenith Camera on Monitor 2.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
24: Tip Elbow (+150, -5)	13: LAB Stbd Zenith (-175, -25) (51: JPM EXT-A)	37: MBS Mast (-15, -15)	Camera B (-15, +15)	OBSS ITVC (+135, -275)

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

SR	SY	SP	EP	WP	WY	WR
+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2
X	Y	Z	Pitch	Yaw	Roll	
-79	-2208	-749	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

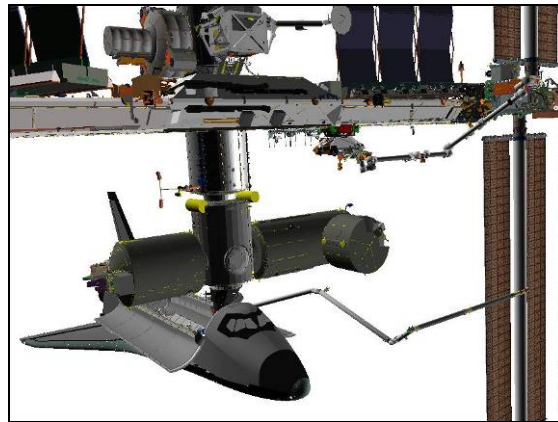


Figure 1.- ESP3 Backoff
(Bird's Eye View).

5.103 NTA RETRIEVE AT ESP3

(RBT FS/1J/FIN)

Page 2 of 8 pages

2. MANEUVER TO OLD NTA PRE-STOW

NOTE

1. The closest clearance between the SSRMS shoulder Boom and the POA is approximately 41 cm (16 in) during this procedure. This clearance may be monitored with the MBS Mast Camera or with Camera B.
2. The closest clearances which occur during the maneuver to the Old NTA Pre-Stow position are:
 - (a) Old NTA to ESP3: 61 cm (24 in). May be monitored with the OBSS ITVC Camera.
 - (b) SSRMS Shoulder Boom to P1 UHF Antenna: 124 cm (49 in). May be monitored with the Tip Elbow Camera.

On EV GO to Maneuver to Old NTA Pre-Stow position:

√Vernier

PCS

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

THC/
RHC

Maneuver to Old NTA Pre-Stow position (within 5 cm/1 deg).
Expect “-Y” motion, THC left.

Locked						
SR	SY	SP	EP	WP	WY	WR
+125.8	+221.3	-98.0	+27.6	-52.5	-17.5	+61.0
X	Y	Z	Pitch	Yaw	Roll	
-79	-2446	-749	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

Verify Posn Hold – orange

Notify EV SSRMS ready for GCA to Final Stow of Old NTA.

5.103 NTA RETRIEVE AT ESP3

(RBT FS/1J/FIN)

Page 3 of 8 pages

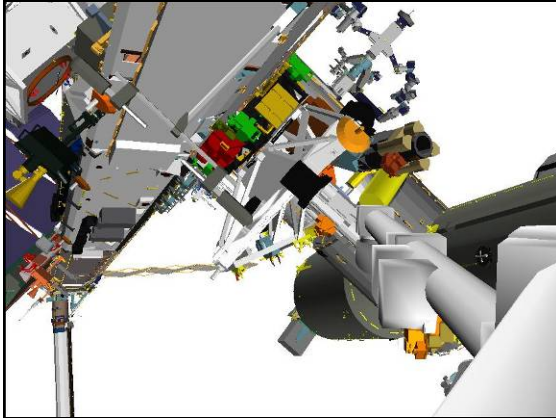


Figure 2.- Old NTA Pre-Stow
(24: Tip Elbow: +150, -5).



Figure 3.- Old NTA Pre-Stow
(37: MBS Mast: -15, -15).

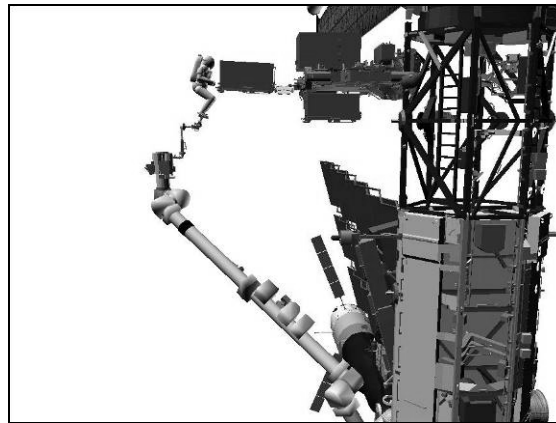


Figure 4.- Old NTA Pre-Stow
(V10: OBSS ITVC: +135, -275).

5.103 NTA RETRIEVE AT ESP3

(RBT FS/1J/FIN)

Page 4 of 8 pages

3. MANEUVER TO OLD NTA FINAL STOW

NOTE

1. The closest clearance which occurs at the end of the maneuver to the Old NTA Final Stow position is between the APFR and ESP3: 103 cm (41 in). This may be monitored with the OBSS ITVC Camera.
2. During the following GCA maneuver, the EP may come close to a singularity warning...
 - a) Performing "+Z" or "+Pitch" motion will improve the EP joint angle.
 - b) The reach limit is at a Y value of -2495, when at the X and Z values of the Old NTA Pre-Stow position at the beginning of the GCA maneuver.
 - c) During EV GCA, stop EV GCA motion and scale rate to Vern = 0.1 when EP < 16 deg.

THC/
RHC

Maneuver per EV GCA to Old NTA Final Stow position.
Expect "+Z" motion, THC down.

Expected Old NTA Final Stow position.

Locked	SR	SY	SP	EP	WP	WY	WR
	+125.8	+179.1	-105.4	+49.2	-46.5	-34.8	+104.3
	X	Y	Z	Pitch	Yaw	Roll	
	-79	-2446	-536	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held						
Disp	ISS>ISSACS						

Verify Posn Hold – orange

Notify EV SSRMS ready for Final Stow of Old NTA.

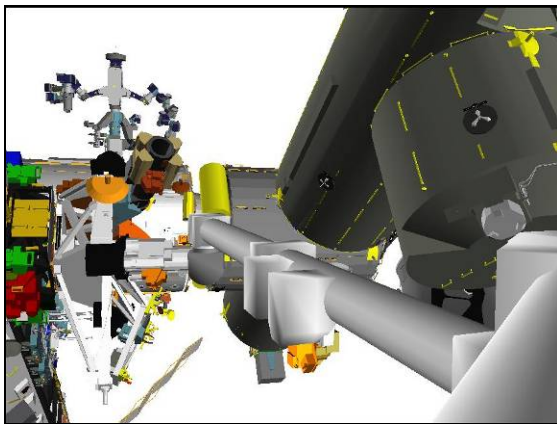


Figure 5.- Final Stow
(24: Tip Elbow: +150, -5).



Figure 6.- Final Stow
(37: MBS Mast: -15, -15).

5.103 NTA RETRIEVE AT ESP3

(RBT FS/1J/FIN)

Page 5 of 8 pages

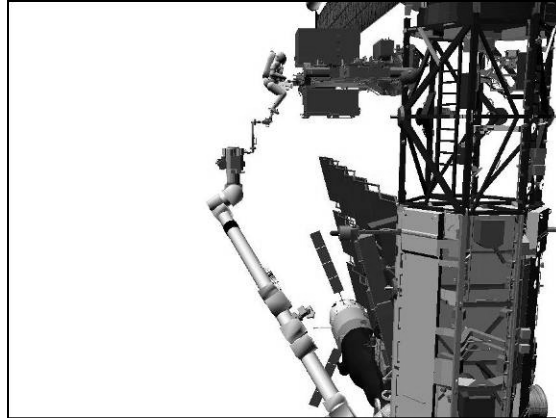


Figure 7.- Final Stow
(V10: OBSS ITVC: +135, -275).

4. MANEUVER TO NEW NTA RETRIEVE

NOTE

The closest clearance during this maneuver is between the APFR and ESP3: 66 cm (26 in). This clearance may be monitored with the OBSS ITVC Camera.

THC/
RHC

Maneuver per EV GCA to New NTA Retrieve position.
Expect “+Z” and “+Y” motion, THC down and right.

Expected New NTA Retrieve position.

Locked						
SR	SY	SP	EP	WP	WY	WR
+125.8	+192.7	-114.3	+69.0	-66.0	-30.8	+88.7
X	Y	Z	Pitch	Yaw	Roll	
-79	-2312	-526	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

Verify Posn Hold – orange

Notify EV SSRMS ready to Retrieve the New NTA.

5.103 NTA RETRIEVE AT ESP3

(RBT FS/1J/FIN)

Page 6 of 8 pages

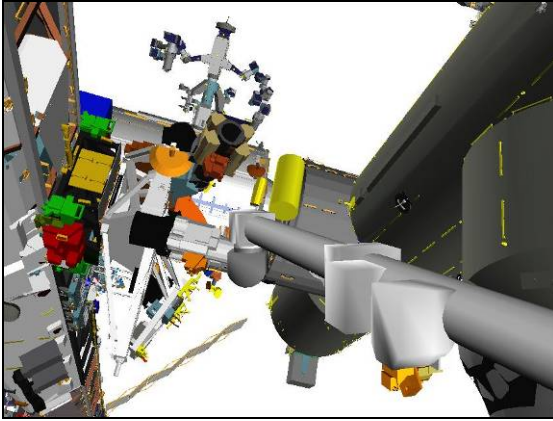


Figure 8.- New NTA Retrieve
(24: Tip Elbow: +130, -5).



Figure 9.- New NTA Retrieve
(37: MBS Mast: -15, -15).

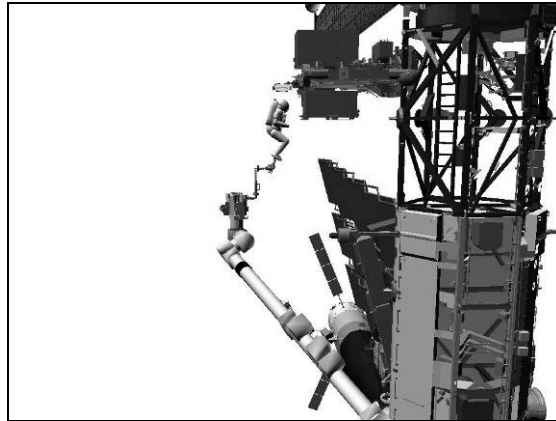


Figure 10.- New NTA Retrieve
(V10: OBSS ITVC: +135, -275).

5.103 NTA RETRIEVE AT ESP3

(RBT FS/1J/FIN)

Page 7 of 8 pages

5. MANEUVER TO RETURN JOCAS START POSITION

NOTE

The closest clearance during this maneuver is between the SSRMS Shoulder Boom and the P1 UHF Antenna: 186 cm (73 in). This clearance may be monitored with the Tip Elbow Camera.

On EV GO to Maneuver to Return JOCAS Start position:

THC/
RHC

Maneuver to Return JOCAS Start position (within 5 cm/1 deg).
Expect “-Z” and “+Y” motion, THC up and right.

Locked						
SR	SY	SP	EP	WP	WY	WR
+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2
X	Y	Z	Pitch	Yaw	Roll	
-79	-2208	-749	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

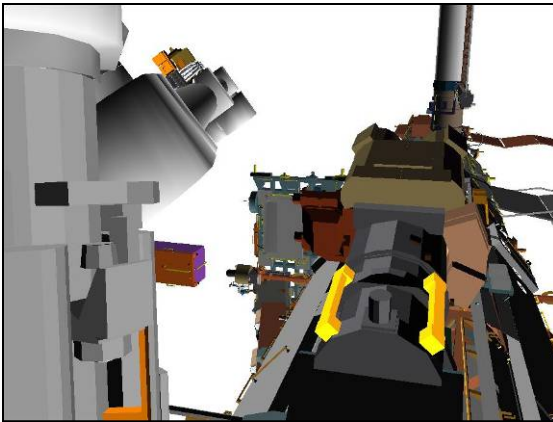


Figure 11.- Return JOCAS Start
(37: MBS Mast: -15, -15).

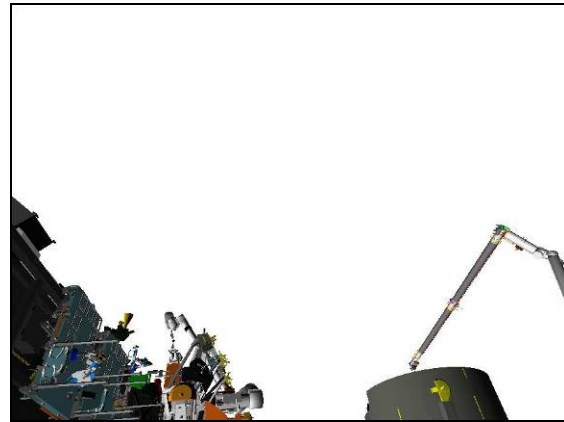


Figure 12.- Return JOCAS Start
(13: LAB Stbd Zenith: -175, -25).

5.103 NTA RETRIEVE AT ESP3

(RBT FS/1J/FIN)

Page 8 of 8 pages

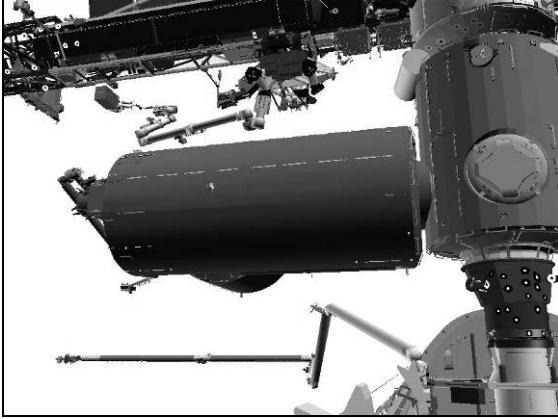


Figure 13.- Return JOCAS Start
(V10: Camera B: -15, +15).

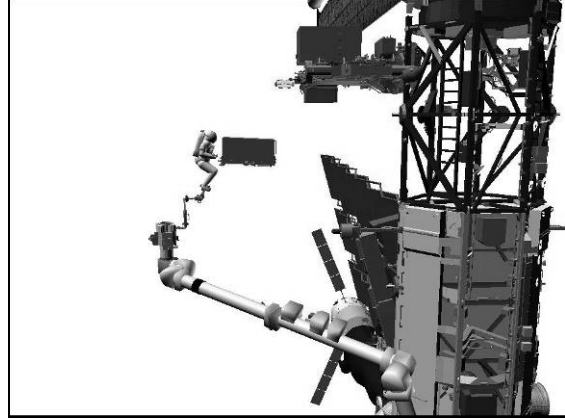


Figure 14.- Return JOCAS Start
(V10: OBSS ITVC: +135, -275).

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 1 of 13 pages

1. SETUP

NOTE

The JEM EXT-A Camera (ID: 51) was installed on FD6, during EVA 2. If available, this Camera may be used in place of the LAB Stbd Zenith Camera on Monitor 2.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
24: Tip Elbow (+135, -10) 03: S1 Lower Outboard (+80, -25)	13: LAB Stbd Zenith (-175, -25) (51: JEM EXT-A)	37: MBS Mast (-15, -15)	Camera B (-15, +15)	OBSS ITVC (+135, -275)

Verify SSRMS at Return JOCAS Start position (within 5 cm/1 deg).

Locked	SR	SY	SP	EP	WP	WY	WR
	+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2
	X	Y	Z	Pitch	Yaw	Roll	
	-79	-2208	-749	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held						
Disp	ISS>ISSACS						

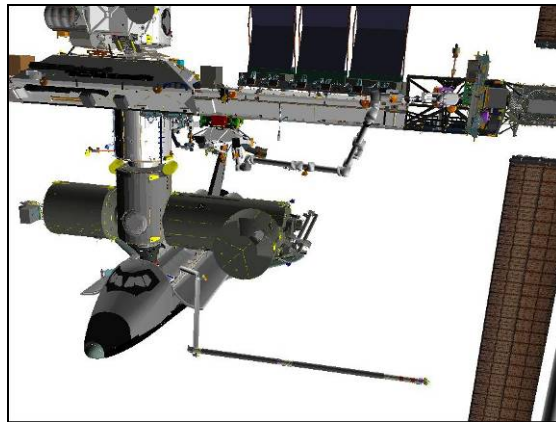


Figure 1.- Return JOCAS Start
(Bird's Eye View).

5.104 S1 NTA INSTALL

2. JOCAS TO S1 NTA PRE-INSTALL POSITION

NOTE

1. During this procedure, the closest clearance between the SSRMS Shoulder Boom and the MBS Mast camera is approximately 38 cm (15 in), and occurs during Step 5. This clearance may be monitored with Camera B.
2. Expect singularity warning for EP between -15 and +15 deg.
3. Expect the Joint Angle Overlay bars to appear as the Shoulder Roll angle approaches +250 deg (20 deg from its soft stop).

√Vernier

PCS

MSS: SSRMS: Rate:

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

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

pick File ► EVA 3 ► Mnvr to S1 Pre-Inst

Verify 'Joint Angles' 'Destination' for S1 Pre-Install position.

SR	SY	SP	EP	WP	WY	WR
+259.5	+42.5	-89.4	-26.9	-167.2	-178.9	+148.9

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)	+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2
TGT	+259.5	+42.5	-89.4	-26.9	-167.2	-178.9	+148.9
ERR	-133.7	+191.3	-21.1	+90.9	+88.2	+168.5	-98.7

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.
 *

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 3 of 13 pages

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at S1 NTA Pre-Install position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+259.5	+42.5	-89.4	-26.9	-167.2	-178.9	+148.9
X	Y	Z	Pitch	Yaw	Roll	
+495	+879	-10	-179.3	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

Give MCC GO to perform JTVE power inhibits.

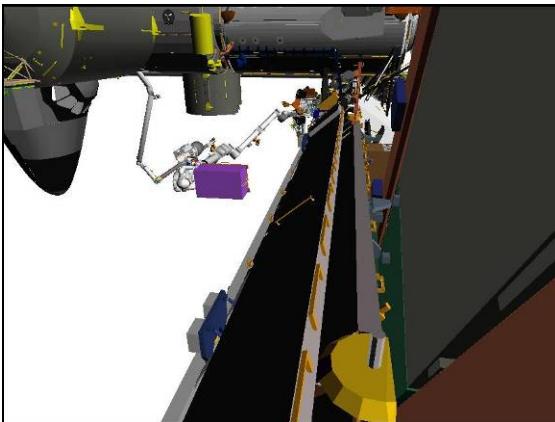


Figure 2.- S1 NTA Pre-Install
(03: S1 Lower Outboard: +80, -25).



Figure 3.- S1 NTA Pre-Install
(13: LAB Stbd Zenith: -175, -25).

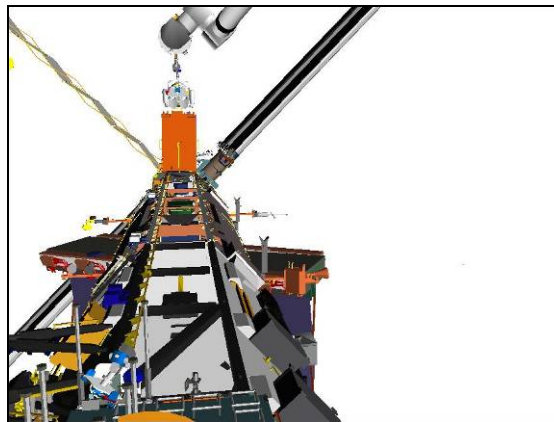


Figure 4.- S1 NTA Pre-Install
(37: MBS Mast: -170, -10).

5.104 S1 NTA INSTALL

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

3. MANEUVER TO S1 NTA INSTALL

NOTE

1. During the following maneuver, the EP may come close to a singularity warning...
 - a. Performing “-Z” or “+Pitch” motion will improve the EP joint angle.
 - b. The reach limit is at a Y value of +925, when at the expected X and Z values of the S1 NTA Install position.
 - c. During EV GCA, stop EV GCA motion and scale rate to Vern = 0.1 when EP < 16 deg.
2. At the expected S1 NTA Install position the closest clearance is between the APFR Footplate and the S1 Truss: 80 cm (32 in). This may be monitored with the S1 Lower Outboard Camera.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+80, -15) Zoom: 25 mm	13: LAB Stbd Zenith (+140, +50)	37: MBS Mast (-170, -10)	Camera B (-11, +28) HFOV: 20 deg	SRMS Elbow (+110, -15)

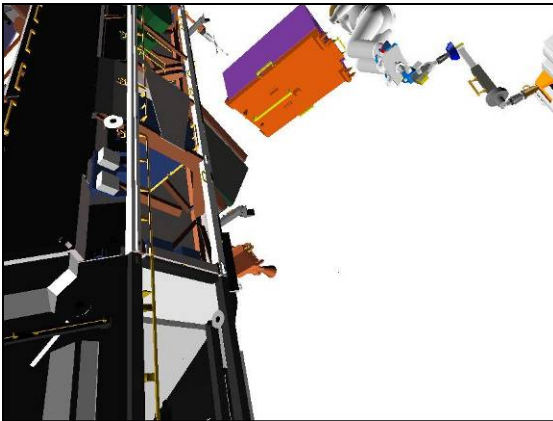


Figure 5.- S1 NTA Pre-Install
(13: LAB Stbd Zenith: +140, +50).

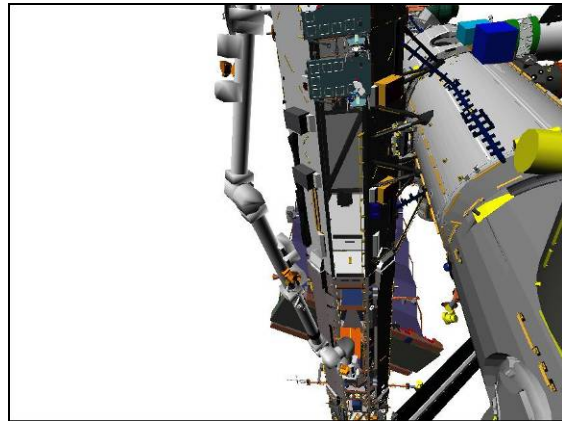


Figure 6.- S1 NTA Pre-Install
(V10: SRMS Elbow: +110, -15).

On EV GO to Maneuver to the S1 Install position:

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

5.104 S1 NTA INSTALL

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

THC/
RHC Maneuver per EV GCA to S1 NTA Install position.
Expect “-X” motion, THC out.

Expected S1 NTA Install position.

Locked						
SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+211	+879	-10	-179.3	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)

Notify EV that SSRMS is ready for S1 NTA Install.

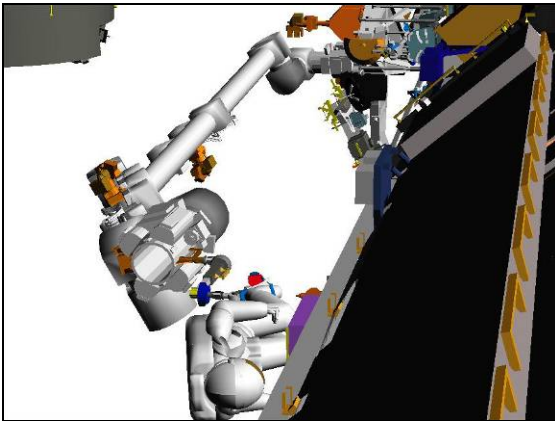


Figure 7.- S1 NTA Install
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

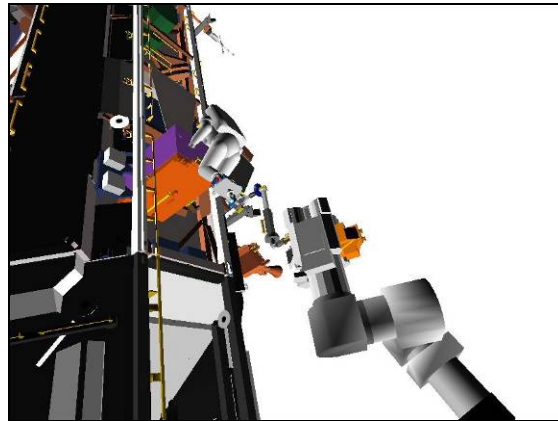


Figure 8.- S1 NTA Install
(13: LAB Stbd Zenith: +140, +50).

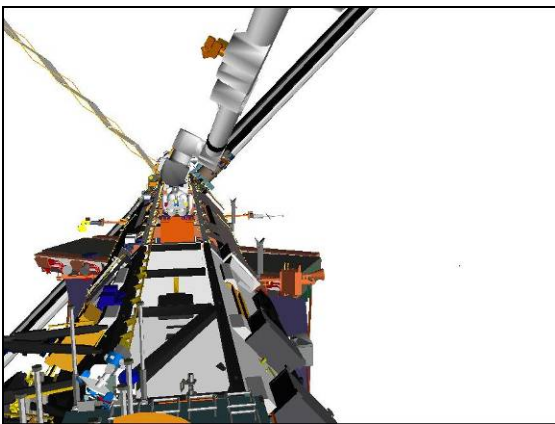


Figure 9.- S1 NTA Install
(37: MBS Mast: -170, -10).

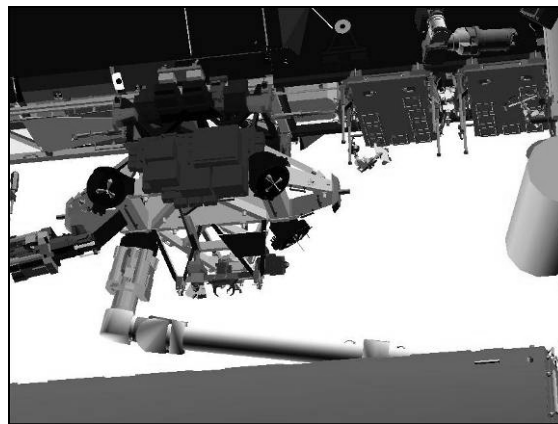


Figure 10.- S1 NTA Install
(V10: Camera B: -11, +28)
HFOV: 20 deg.

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 6 of 13 pages

4. MANEUVER TO APFR EGRESS

On EV GO to Maneuver to APFR Egress position:

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)

THC/
RHC Maneuver per EV GCA to APFR Egress position.

Expected APFR Egress position.

Locked	SR	SY	SP	EP	WP	WY	WR
	+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
	X	Y	Z	Pitch	Yaw	Roll	
	+211	+879	-10	-179.3	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held						
Disp	ISS>ISSACS						

DCP BRAKES SSRMS → ON (Verify ON)

Notify EV that SSRMS is ready for APFR Egress.

PCS MSS: SSRMS:

Change Unloaded Parameters ► Unloaded ► LEE Tip SRH
Verify 'Unloaded Parameters' (two) – LEE Tip, SR Held

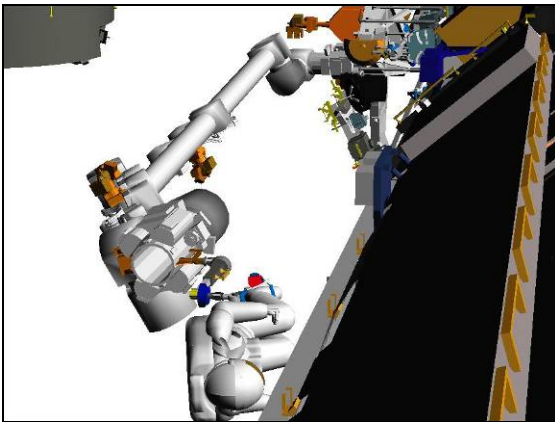


Figure 11.- APFR Egress
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

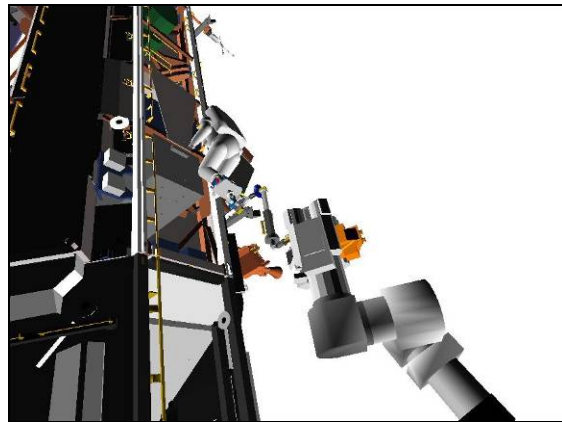


Figure 12.- APFR Egress
(13: LAB Stbd Zenith: +140, +50).

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 7 of 13 pages

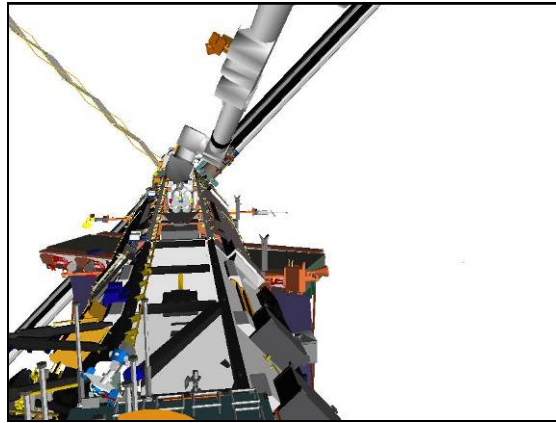


Figure 13.- APFR Egress
(37: MBS Mast: -170, -10).

5. MANEUVER TO WIF EXTENDER/APFR REMOVAL

On EV GO to Maneuver to APFR Backoff position:

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)

THC/
RHC Maneuver to APFR Backoff position (within 5 cm/1 deg).
Expect “+X” motion, THC in.

Locked						
SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+370	+633	-7	+20.0	+86.9	-92.6	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

Notify EV that SSRMS is ready to Begin WR Maneuver.

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 8 of 13 pages

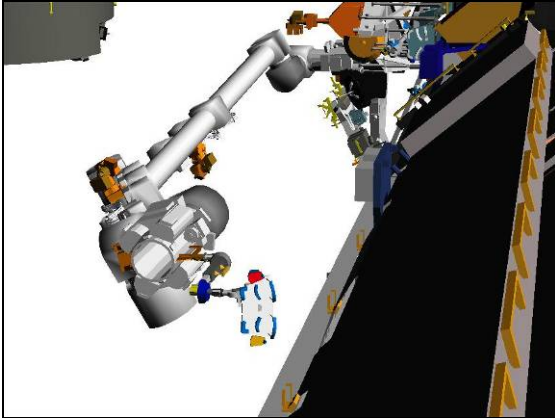


Figure 14.- APFR Backoff
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

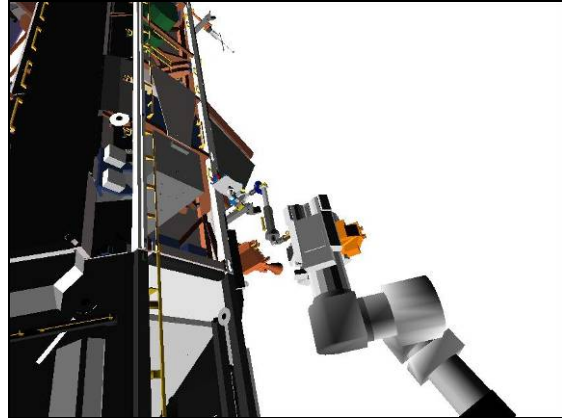


Figure 15.- APFR Backoff
(13: LAB Stbd Zenith: +140, +50).

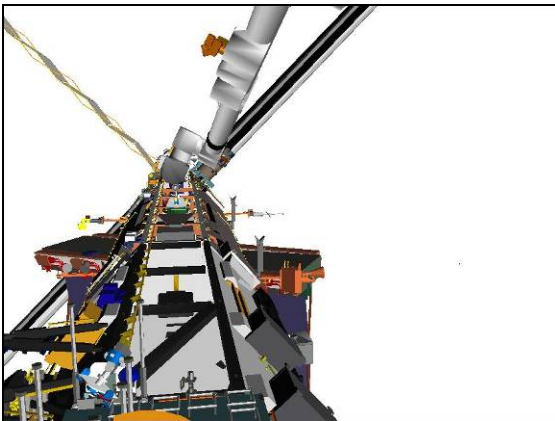


Figure 16.- APFR Backoff
(37: MBS Mast: -170, -10).

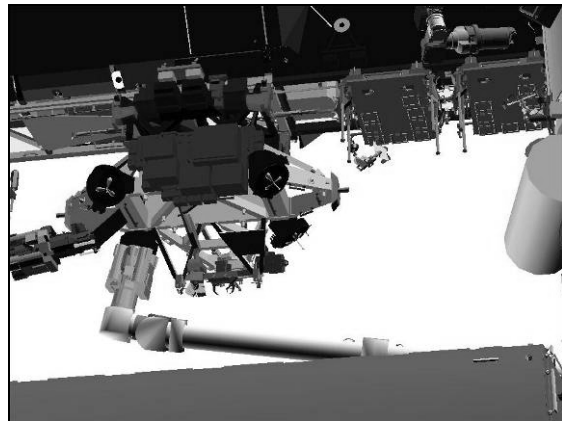


Figure 17.- APFR Backoff
(V10: Camera B: -11, +28)
HFOV: 20 deg.

NOTE

During the maneuver to the APFR Rotate position, the closest clearance is between the SSRMS Shoulder Boom and the MBS Mast Camera and is approximately 77 cm (30 in). This clearance may be monitored with the S1 lower Outboard Camera.

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.

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 9 of 13 pages

THC Perform Single Joint maneuver to APFR Rotate position (within 1 deg).

	SR	SY	SP	EP	WP	WY	WR
APFR Backoff	+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
1: WR +							+232.4
APFR Rotate	+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+232.4
	X	Y	Z	Pitch	Yaw	Roll	
	+370	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held						
Disp	ISS>ISSACS						

Notify EV that SSRMS is ready for GCA to WIF Extender/APFR Removal position.

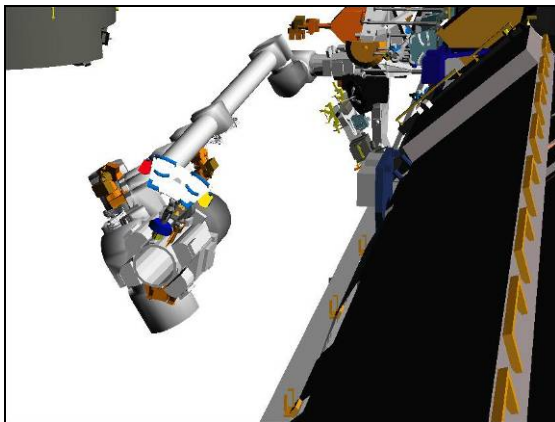


Figure 18.- APFR Rotate
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

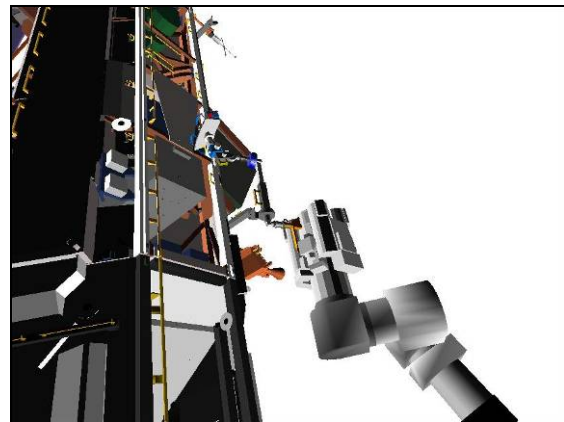


Figure 19.- APFR Rotate
(13: LAB Stbd Zenith: +140, +50).

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

NOTE

At the end of the following maneuver, the closest clearance is between the APFR and the S1 Truss: 61 cm (24 in). This may be monitored with the S1 Lower Outboard Camera.

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 10 of 13 pages

THC/
RHC Maneuver per EV GCA to WIF/APFR Removal position.
Expect “-X” motion, THC out.

Expected WIF/APFR Removal position.

Locked						
SR	SY	SP	EP	WP	WY	WR
+259.5	+17.9	-97.5	-28.4	-155.9	-173.5	+235.0
X	Y	Z	Pitch	Yaw	Roll	
+312	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)

Notify EV that SSRMS is ready for WIF/APFR Removal.

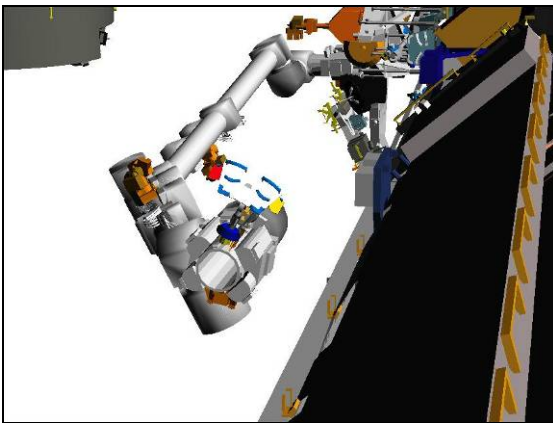


Figure 20.- WIF/APFR Removal
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

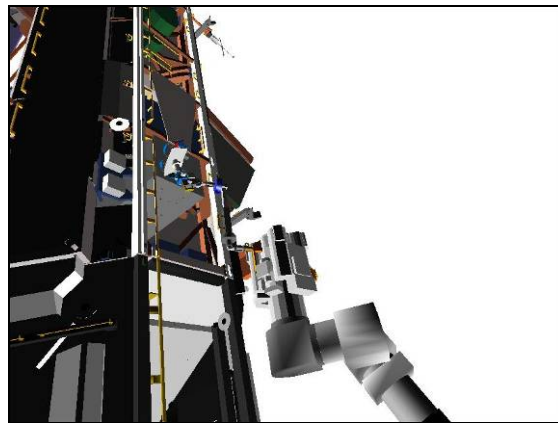


Figure 21.- WIF/APFR Removal
(13: LAB Stbd Zenith: +140, +50).

6. MANEUVER TO CLEAR

On EV GO to Maneuver to Clear position:

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)

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 11 of 13 pages

THC/
RHC Maneuver SSRMS to Clear position (within 5 cm/1 deg).
Expect "+X" motion, THC in.

Locked						
SR	SY	SP	EP	WP	WY	WR
+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
X	Y	Z	Pitch	Yaw	Roll	
+358	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

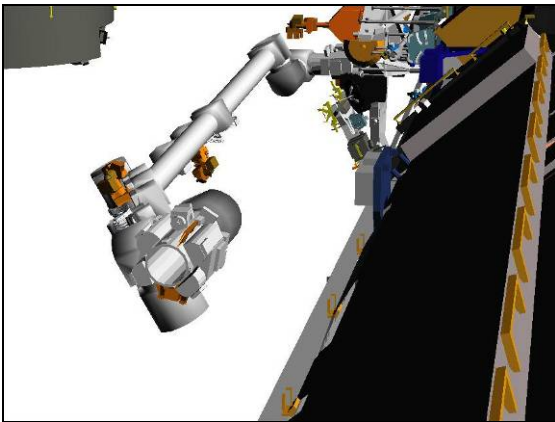


Figure 22.- Clear
(03: S1 Lower Outboard: +80, -15)
Zoom: 25 mm.

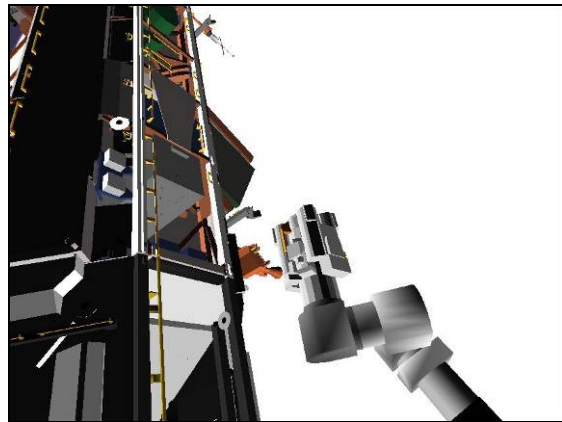


Figure 23.- Clear
(13: LAB Stbd Zenith: +140, +50).

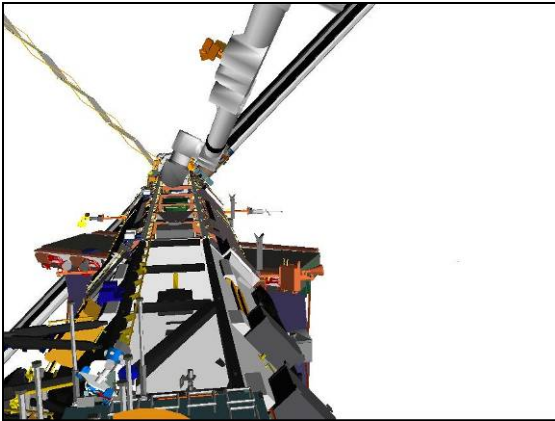


Figure 24.- Clear
(37: MBS Mast: -170, -10).

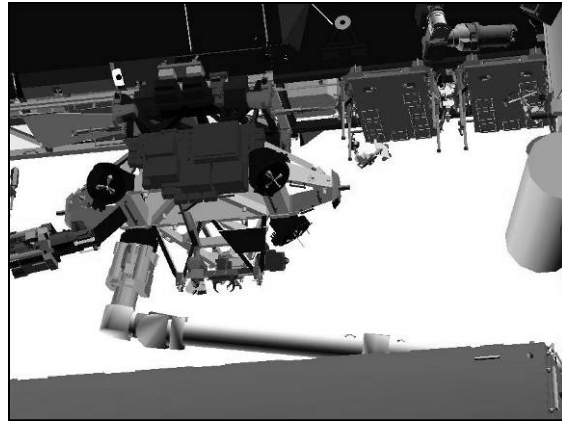


Figure 25.- Clear
(V10: Camera B: -11, +28)
HFOV: 20 deg.

5.104 S1 NTA INSTALL

7. JOCAS TO STAGE PARK

NOTE

The closest clearance during the maneuver to Stage Park position is between the SSRMS WR Joint and the S0 Truss: 135 cm (53 in). This may be monitored with the S1 Lower Outboard Camera.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+80, -15)	13: LAB Stbd Zenith (-175, -25)	37: MBS Mast (-170, -10)	Camera B (+5, +20)	SRMS Elbow (+110, -15)

√Vernier

MSS: SSRMS: Rate:

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

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

pick File ► EVA 3 ► Stage Park

Verify 'Joint Angles' 'Destination' for Stage Park position.

SR	SY	SP	EP	WP	WY	WR
+150.0	+60.0	-62.0	-135.0	-90.0	-163.0	0.0

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)	+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
TGT	+150.0	+60.0	-62.0	-135.0	-90.0	-163.0	0.0
ERR	+109.5	-40.1	-33.4	+105.3	-66.9	-10.9	+233.0

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.
 *

5.104 S1 NTA INSTALL

(RBT FS/1J/FIN) Page 13 of 13 pages

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
+150.0	+60.0	-62.0	-135.0	-90.0	-163.0	0.0
X	Y	Z	Pitch	Yaw	Roll	
+410	-819	-853	+90.0	-8.4	+72.6	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

DCP BRAKES SSRMS → ON (Verify ON)



Figure 26.- Stage Park
(13: LAB Stbd Zenith: -175, -25).

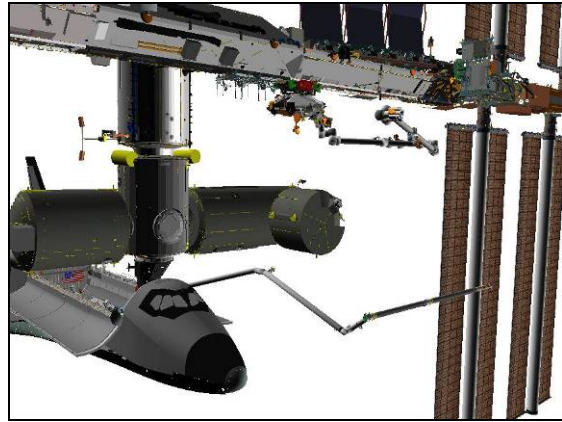


Figure 27.- Stage Park
(Bird's Eye View).

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CONTINGENCY

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6.101 CBM LATCH STALL RECOVERY

(RBT FS/1J/FIN)

Page 1 of 1 page

1. SSRMS SAFING AND BRAKES STATUS

On CBM operator, "Go for CBM Latch Stall Recovery."

PCS

MSS: SSRMS:

√SSRMS Safing – Not Safed

DCP

√BRAKES SSRMS – OFF

2. SSRMS MODE ENTRY

PCS

If Limp – blue

MSS: SSRMS: Limp:

cmd None Limp (Verify Standby – blue)

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Yaw (Verify SY – Locked)

3. SSRMS SETUP

MSS: SSRMS:

√Command – SSRMS>Internal

√Vernier

MSS: SSRMS: Rate:

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

4. CBM MATING

THC

Apply Full -X deflection (THC out) for 5 s.

PCS

MSS: SSRMS:

Verify Posn Hold – orange

Enter Mode – Standby (Verify blue)

MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

Give CBM operator GO to reattempt CBM Second Stage Capture.

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6.201 JPM INSTALL - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 1 of 16 pages

1. SETUP FOR JPM UNBERTH

Verify CBCS Setup complete.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+70, +20)	24: Tip Elbow (+40, -10)	09: P1 Lower Outboard (+115, +35) 22: Base Elbow (+85, -30)	Mux A/D Camera A (0, 0) Camera D (0, 0) (SRMS Elbow (-165, +10))	Mux B/C Camera B (0, 0) Camera C (0, 0)

PCS

MSS: SSRMS:

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – JPM Unberth OBAS, SR Held

√Display – Orbiter>JPM Unberth OBAS

√Command – SSRMS>Internal

MSS: SSRMS: Rate:

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

√Vernier

SSRMS at JPM Grappled position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-82.7	+141.6	-178.9	+79.3	-118.8	-126.6	+235.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter>JPM Unberth OBAS					

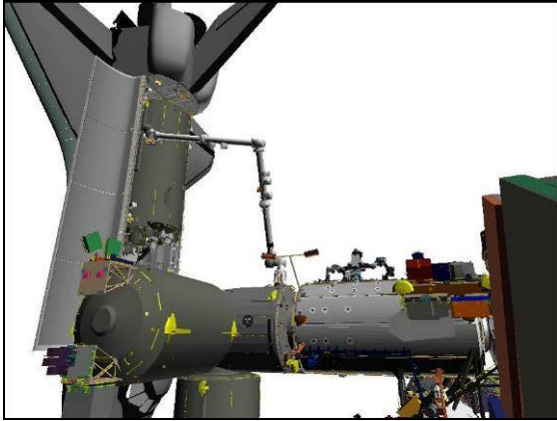


Figure 1.- JPM Grappled
(03: S1 Lower Outboard: +70, +20).

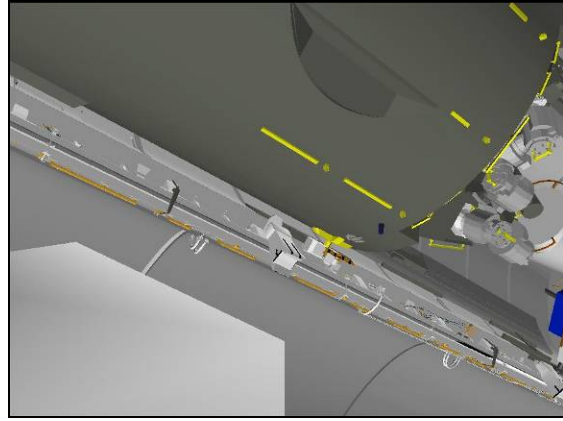


Figure 2.- JPM Grappled
(24: Tip Elbow: +40, -10).

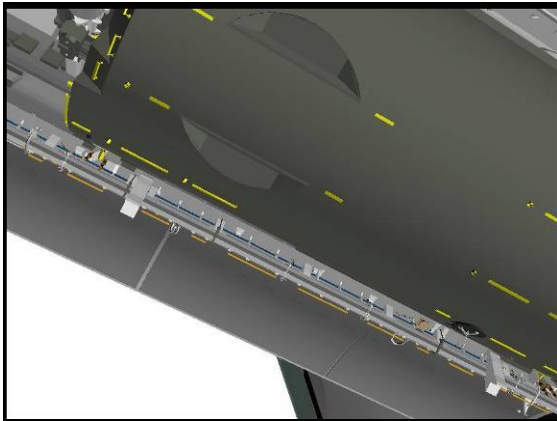


Figure 3.- JPM Grappled
(22: Base Elbow: +85, -30).

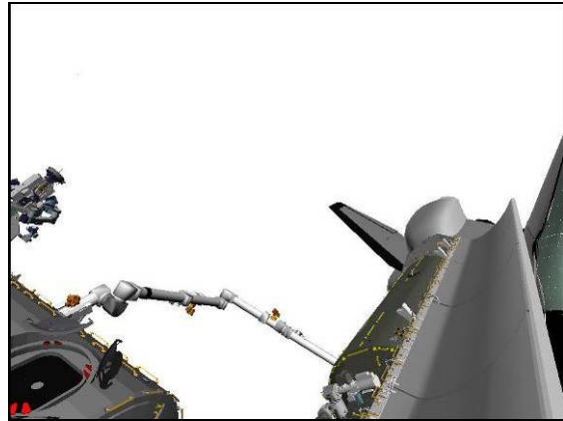


Figure 4.- JPM Grappled
(V10: SRMS Elbow: -165, +10).

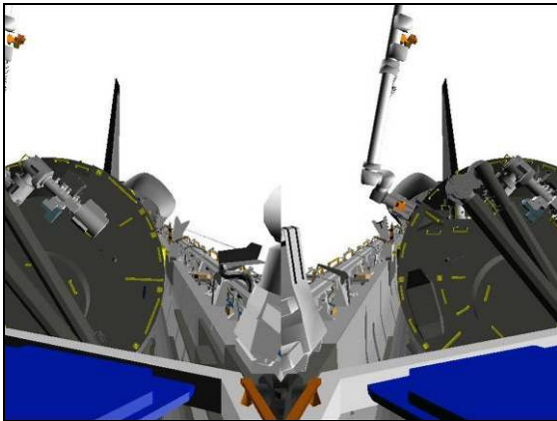


Figure 5.- JPM Grappled
(V10: Mux A/D).

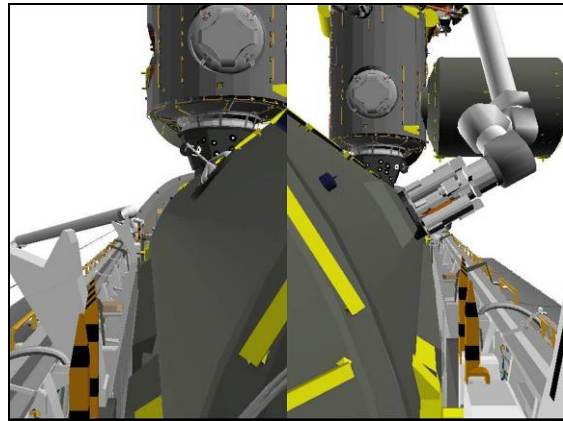


Figure 6.- JPM Grappled
(V10: Mux C/B).

2. PREP FOR JPM UNBERTH

NOTE

MCC-H will verify:

1. Attitude control is in a good config.
2. SSRMS Payload power is applied to the JPM HTCLs.

If using shuttle attitude control, coordinate with shuttle crewmembers
DAP: FREE

On **MCC-H GO** for JPM Unberth:

3. ACTIVATING LATCHES

Give shuttle crew GO for PRLA Ops.

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

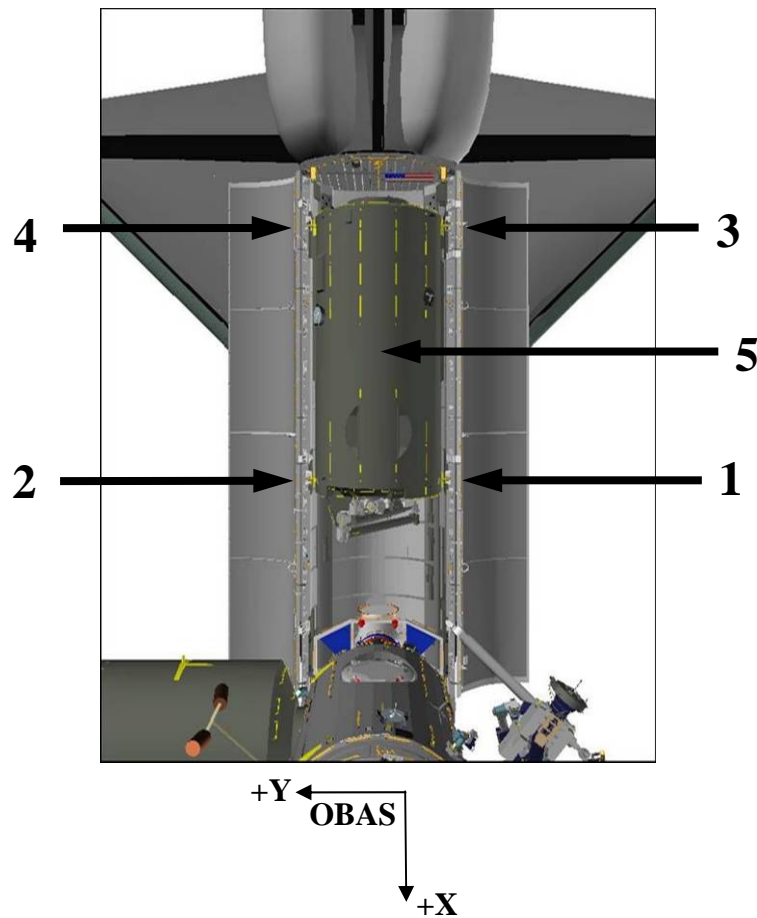


Figure 7.- JPM PRLA Configuration.

6.201 JPM INSTALL - CBCS FAILED

A6U	√PL RETEN LAT (five)	– OFF
	√PL SEL	– 1
R13L	BAY MECH PWR SYS 1,2 (two)	– ON
A6U	RETEN LOGIC PWR SYS 1,2 (two)	– ON

SM 97 PL RETENTION

√PL SEL 1 RDY-FOR-LAT 1,2,3,4,5 (ten)	– 1
√LAT 1,2,3,4,5 (ten)	– 1

 * If any REL msw shows '1', expect single motor time
 * (60 seconds)

4. AKA RELEASE

√PL RETEN LAT 5 tb – LAT
√RDY 5 tb – gray

Note single motor drive times (> 30 seconds)

PL RETEN LAT 5 – REL (tb-REL), 60 s max
– OFF

5. PRLA RELEASE

√PL RETEN LAT 1,2,3,4 (four) tb – LAT
√RDY 1,2,3,4 (four) tb – gray

Note single motor drive times (> 30 seconds)

PL RETEN LAT 1,2 (two) – REL (tb-REL), 60 s max
– OFF
3,4 (two) – REL (tb-REL), 60 s max
– OFF

6. DEACTIVATING LATCHES

R13L	PL RETEN LOGIC PWR SYS 1,2 (two) – OFF
	BAY MECH PWR SYS 1,2 (two) – OFF

Give SSRMS operator GO for JPM unberth.

7. JPM UNBERTH

On shuttle crew GO for JPM unberth:

PCS MSS: SSRMS:

Enter Mode – Manual (Verify blue)

6.201 JPM INSTALL - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 5 of 16 pages

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

√Vernier

THC/
RHC

Maneuver JPM to Unberth position (within 5 cm/1 deg).
Expect -Z (THC up).

Locked	SR	SY	SP	EP	WP	WY	WR
	-82.7	+138.3	-224.4	+102.6	-94.1	-129.3	+238.2
	X	Y	Z	Pitch	Yaw	Roll	
	0	0	-610	0.0	0.0	0.0	
FOR	Loaded – JPM Unberth OBAS, SR Held						
Disp	Orbiter>JPM Unberth OBAS						

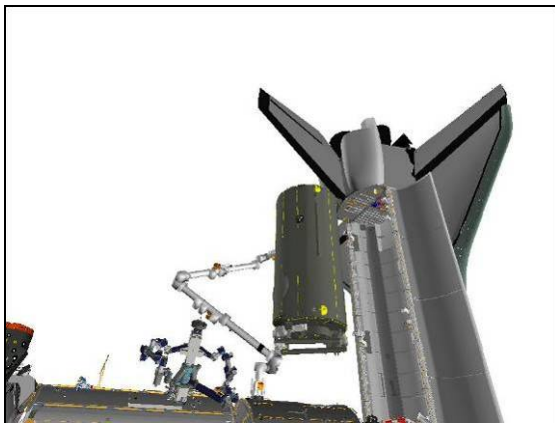


Figure 8.- JPM Unberth
(09: P1 Lower Outboard: +115, +35).

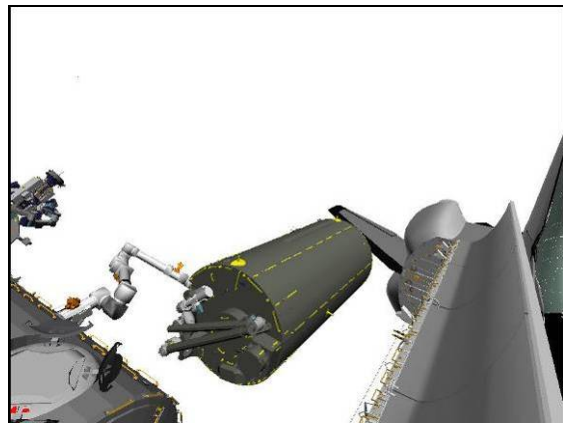


Figure 9.- JPM Unberth
(V10: SRMS Elbow: -165, +10).

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

8. ATTITUDE CONTROL

If using shuttle attitude control and attitude maintenance required,
coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

| DAP: FREE > 2 seconds

| DAP: AUTO

When in attitude and rates damped

DAP: FREE

9. JOCAS CLEANUP FOR JAUTO START

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+70, +20)	22: Base Elbow (+120, -20)	09: P1 Lower Outboard (+115, +35)	SRMS Elbow (-165, +10)	Camera C (-40, +20)

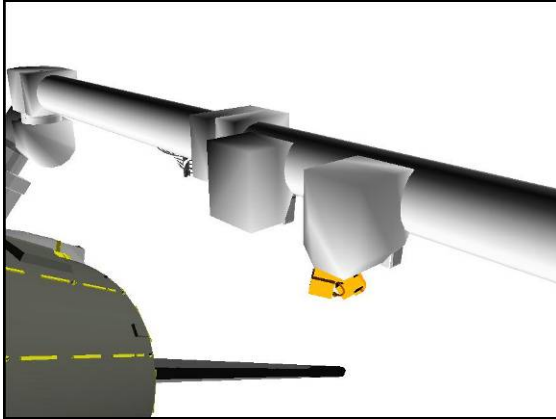


Figure 10.- JPM Unberth (22: Base Elbow: +120, -20).

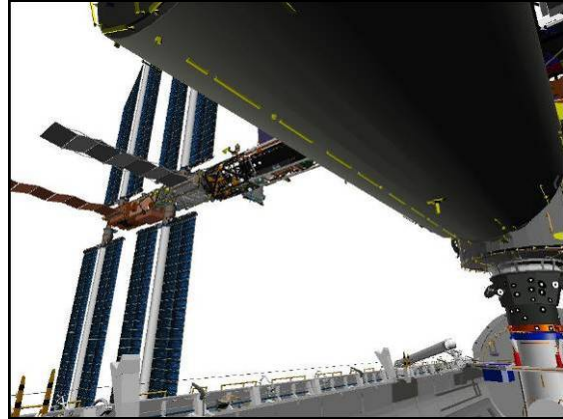


Figure 11.- JPM Unberth (V10: Camera C: -40, +20).

RHC RATE → COARSE (Verify Coarse on PCS)

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► JPM ► JAUTO Start

Verify 'Joint Angles' 'Destination' for JAUTO Start position.

SR	SY	SP	EP	WP	WY	WR
-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4

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)	-82.7	+138.3	-224.4	+102.6	-94.1	-129.3	+238.2
TGT	-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4
ERR	0.0	-27.7	-0.1	0.0	-0.2	-0.1	-0.2

6.201 JPM INSTALL - CBCS FAILED
 (RBT FS/1J/FIN/SPN) Page 7 of 16 pages

```

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

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4

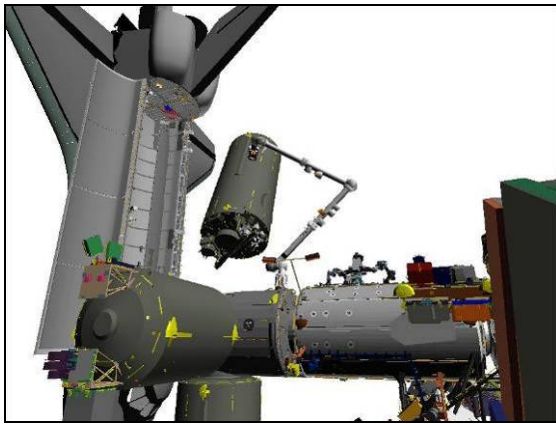


Figure 12.- JAUTO Start
 (03: S1 Lower Outboard: +70, +20).

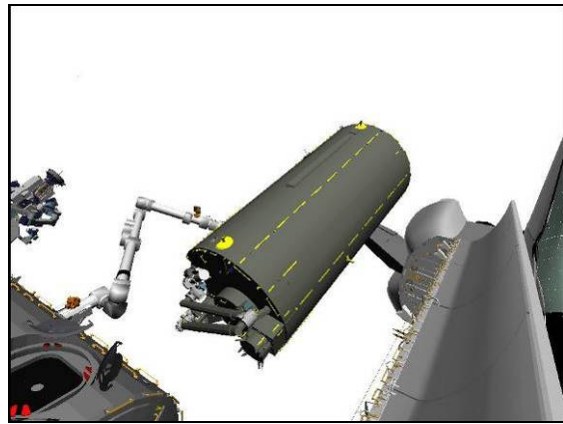


Figure 13.- JAUTO Start
 (V10: SRMS Elbow: -165, +10).

6.201 JPM INSTALL - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 8 of 16 pages

10. ATTITUDE CONTROL

If using shuttle attitude control and attitude maintenance required, coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

DAP: FREE > 2 seconds

DAP: AUTO

When in attitude and rates damped

DAP: FREE

11. JAUTO TO JPM PRE-INSTALL

NOTE

1. During the Joint AUTO motion to the JPM Pre-Install position, the closest clearance is between the SSRMS and the JPM: 44 in (112 cm). Monitor with the SRMS Elbow and then the Base Elbow Camera.
2. At the end of the autosequence the SSRMS will be in a display singularity. As such, the pitch and roll values may not match.

MSS: SSRMS:

Enter Mode – Joint Auto (Verify blue)

pick File ► JPM ► JPM Pre-Install

Verify 'Joint Angle' 'Initial' values per table below.

SR	SY	SP	EP	WP	WY	WR
-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4

Verify 'Joint Angle' 'Final Pt' values per table below.

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9

Verify File Id – 379
Verify Grapple Fixture – PDGF
Verify Relocatable – No
Verify Base Location – Node2
Verify Payload – JPM

cmd Load (Verify Sequence Status – Confirm or Cancel)

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

6.201 JPM INSTALL - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 9 of 16 pages

NOTE

The following table summarizes the Joint Angles associated with each point along the Joint Auto Sequence trajectory. As each successive point is reached, these values will appear on the SSRMS Joint Angle overlay.

DCP AUTO SEQ → PROC

	SR	SY	SP	EP	WP	WY	WR
JAUTO Start	-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4
1	-125.8	+166.0	-224.3	+84.1	-93.9	-90.0	+200.0
2	-125.8	+166.0	-224.3	+84.1	-93.9	-90.0	+130.0
JPM Pre-Install	-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Sequence Status – Paused

Verify Step Num – 3

Verify SSRMS at JAUTO Point 2 position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-224.3	+84.1	-93.9	-90.0	+130.0
X	Y	Z	Pitch	Yaw	Roll	
-431	-404	-1110	+90.2	+35.2	+34.6	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter>JPM Unberth OBAS					

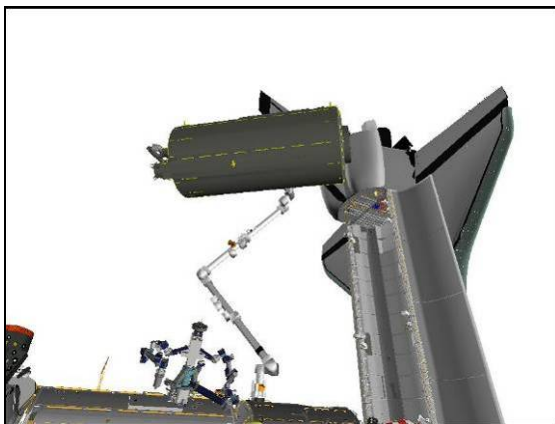


Figure 14.- JAUTO Point 2
(09: P1 Lower Outboard: +115, +35).

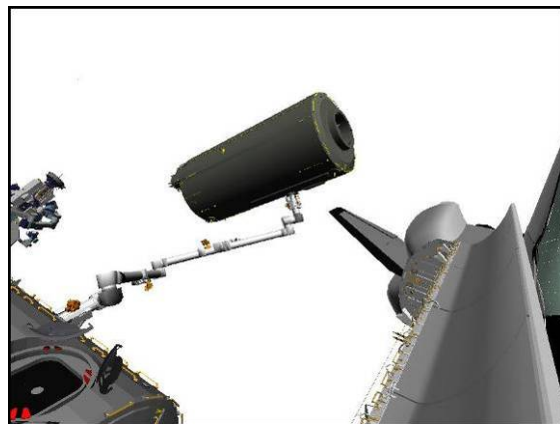


Figure 15.- JAUTO Point 2
(V10: SRMS Elbow: -165, +10).

6.201 JPM INSTALL - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 10 of 16 pages

RHC RATE → VERNIER (Verify Vernier on PCS)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at JPM Pre-Install position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9
X	Y	Z	Pitch	Yaw	Roll	
+1147	-915	-568	+111.7	-89.9	-157.2	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter>JPM Unberth OBAS					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

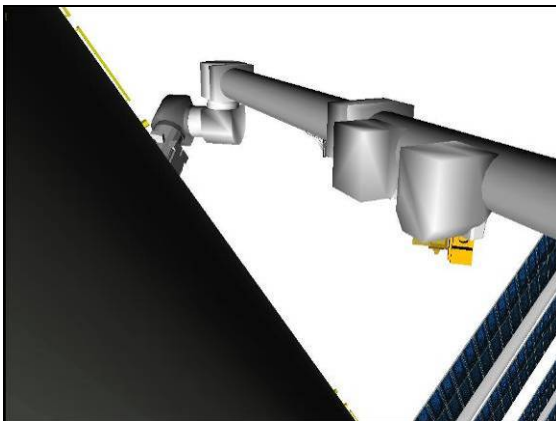


Figure 16.- JPM Pre-Install
(22: Base Elbow: +120, -20).

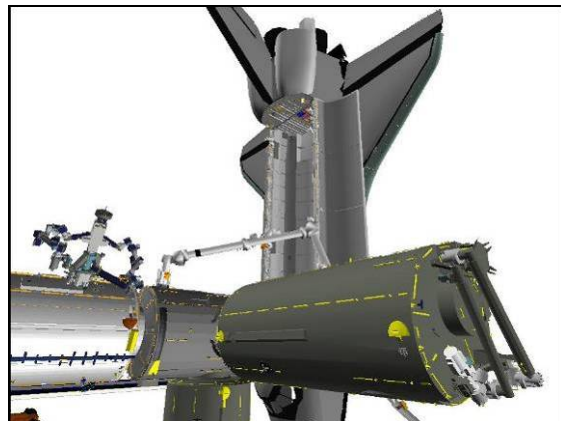


Figure 17.- JPM Pre-Install
(09: P1 Lower Outboard: +130, +20).

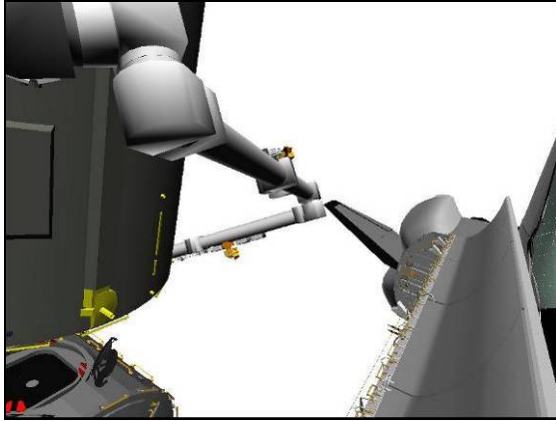


Figure 18.- JPM Pre-Install
 (V10: SRMS Elbow: -165, +10).

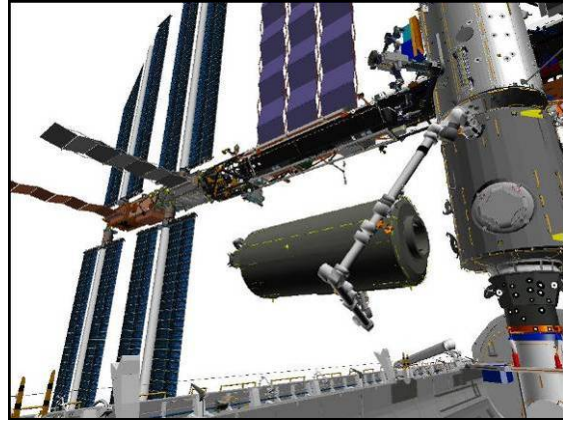


Figure 19.- JPM Pre-Install
 (V10: Camera C: -40, +20).

12. ATTITUDE CONTROL

If using shuttle attitude control and attitude maintenance required,
 coordinate with shuttle crewmembers
 DAP: LVLH

When rates damped
 | DAP: FREE > 2 seconds
 | DAP: AUTO

When in attitude and rates damped
 DAP: FREE

13. SETUP FOR MANEUVER TO INSTALL

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (+120, -20)	71: Camera A (0, +80)	09: P1 Lower Outboard (+130, +20)	OBSS ITVC (+83, -45)	Camera B (-10, +15)

MSS: SSRMS:

Change Loaded Parameters ► JPM ► JPM Mate OBAS SYH
 Verify 'Loaded Parameters' (two) – JPM Mate OBAS, SY Held

Change Display ► Node2 ► JPM Mate OBAS (Verify Node2>JPM Mate
 OBAS)

√Command – SSRMS>Internal

6.201 JPM INSTALL - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 12 of 16 pages

Verify SSRMS at JPM Pre-Install position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9
X	Y	Z	Pitch	Yaw	Roll	
0	-185	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate OBAS, SY Held					
Disp	Node2>JPM Mate OBAS					

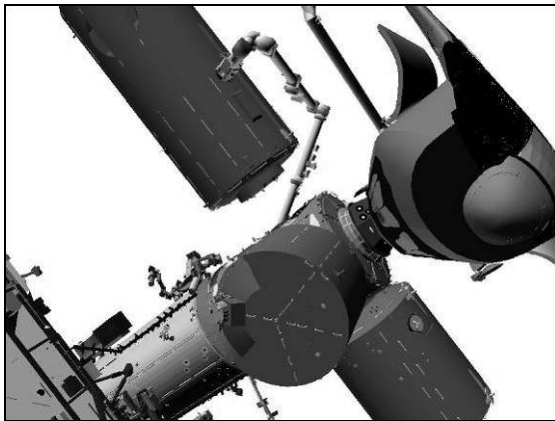


Figure 20.- JPM Pre-Install
(V10: OBSS ITVC: +83, -45).

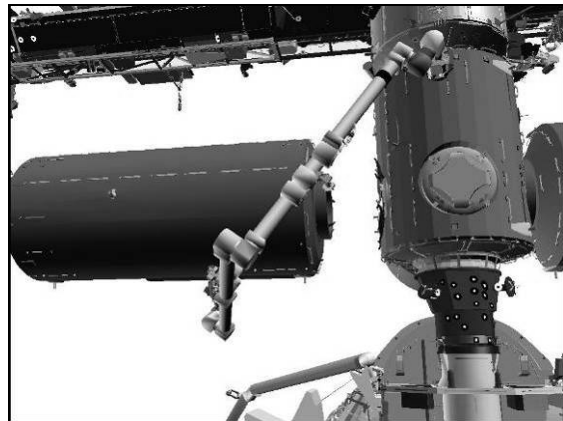


Figure 21.- JPM Pre-Install
(V10: Camera B: -10, +15).

14. MANEUVER TO JPM INSTALL

NOTE

1. **MCC-H** will verify:
 - a) Attitude control is in a good config.
 - b) {1.002 **NODE 2 CBM PORT VERIFY PRE-MATE STATUS**}, all (SODF: 1J: ASSY OPS: S&M), is complete.
2. Node 2 Port CBM RTLs can be monitored using the PCS display:
 PCS Node 2: S&M: Port CBM: RTL
 Details:

Node 2 Port CBM RTL Details
3. The closest clearance at the end of the maneuver to Ready-To-Latch position is between the SSRMS Tip Boom and the SRMS Shoulder Boom: 119 cm (47 in). This may be monitored with Camera B.

On CBM operator, "GO for maneuver to RTL."

On MCC-H GO for JPM Install:

√Vernier

6.201 JPM INSTALL - CBCS FAILED
 (RBT FS/1J/FIN/SPN) Page 13 of 16 pages

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)

THC/
RHC

Maneuver JPM to Ready-To-Latch position until RTL (four) – green

	Locked					
SR	SY	SP	EP	WP	WY	WR
-116.1	+166.0	-110.2	+96.5	-51.1	-155.2	+97.4
X	Y	Z	Pitch	Yaw	Roll	
0	-8	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate OBAS, SY Held					
Disp	Node2>JPM Mate OBAS					

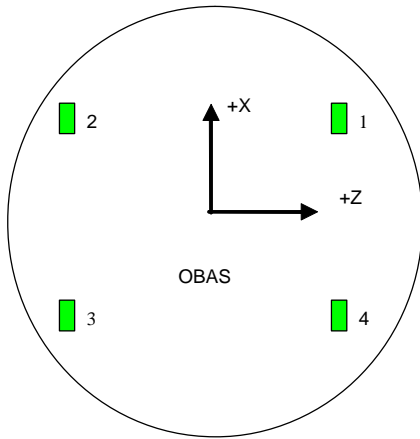


Figure 22.- RTL Diagram.
(Node 2 Port CBM)

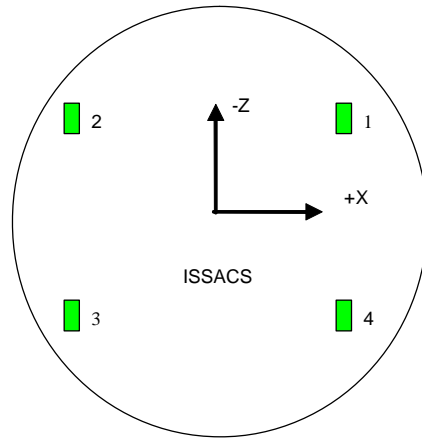


Figure 23.- RTL Diagram.
(Node 2 Port CBM)

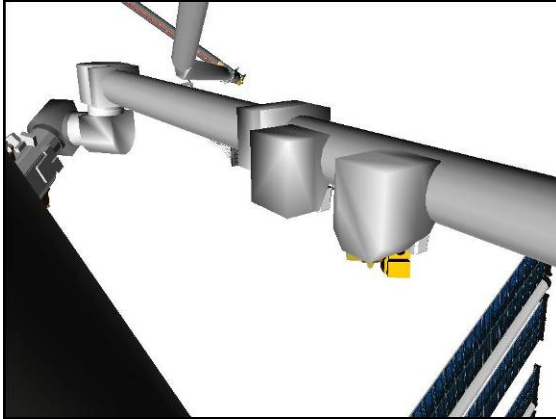


Figure 24.- JPM RTL
(22: Base Elbow: +120, -20).



Figure 25.- JPM RTL
(09: P1 Lower Outboard: +130, +20).

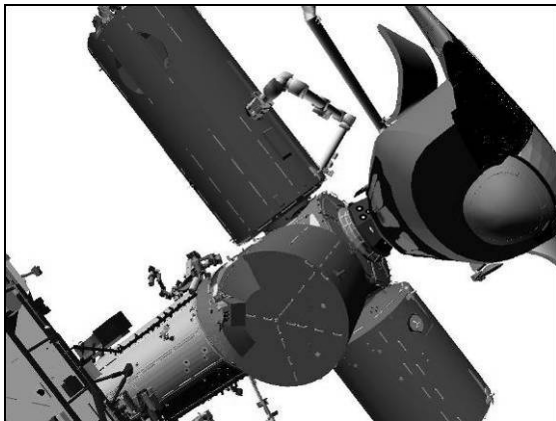


Figure 26.- JPM RTL
(V10: OBSS ITVC: +83, -45).



Figure 27.- JPM RTL
(V10: Camera B: -10, +15).

PCS

MSS: SSRMS:

Verify Posn Hold – orange

Verify RTL (four) – green

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

Notify CBM operator, “Maneuver to RTL complete - GO for first stage capture.”

6.201 JPM INSTALL - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 15 of 16 pages

15. POST FIRST STAGE CAPTURE CLEANUP

On CBM operator, "Go for SSRMS mode to Limp."

NOTE

Following SSRMS Mode to Limp, closed RTLs may open due to RTL spring forces. RTL closed indication is not required prior to execution of second stage capture (for latches used during first stage capture).

MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

WARNING

If SSRMS fails to brakes-on from limp mode, continuation of Second Stage Capture may cause structural failure of SSRMS or primary structure. If CBM stops unexpectedly (and Cmd Code changes to 'Stop') or SSRMS safes during Second Stage Capture, **√MCC-H** before proceeding.

Notify CBM operator: "SSRMS Mode to Limp complete. GO for Second Stage Capture."

16. POST ABOLT CLEANUP

On CBM operator, "GO for SSRMS Brakes ON."

DCP BRAKES SSRMS → ON (Verify ON)

PCS MSS: SSRMS:

Expected JPM Install position.

SR	SY	SP	EP	WP	WY	WR
-115.6	+166.0	-110.2	+97.0	-51.6	-155.6	+97.1
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate OBAS, SY Held					
Disp	Node2>JPM Mate OBAS					

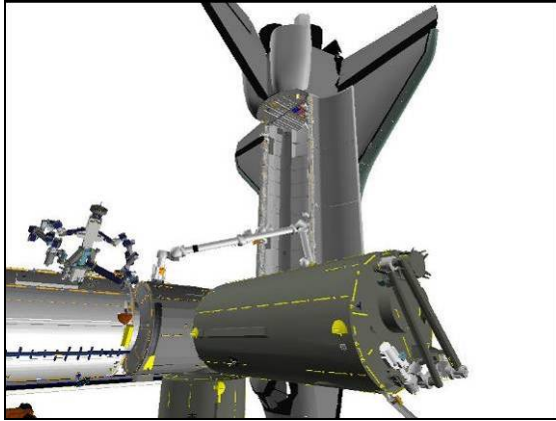


Figure 28.- JPM Install
(09: P1 Lower Outboard: +130, +20)

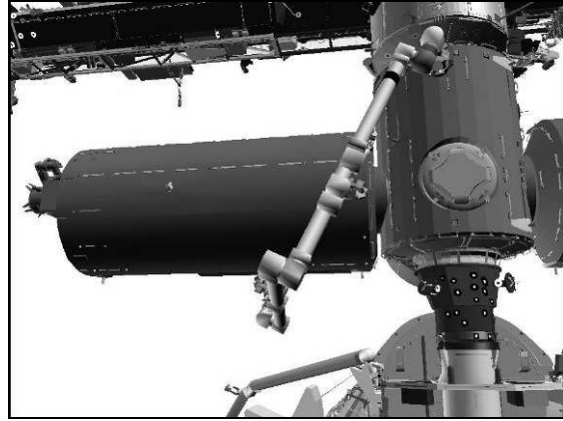


Figure 29.- JPM Install
(V10: Camera B: -10, +15).

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 1 of 13 pages

1. SETUP FOR JLP GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-150, -40)	25: Tip LEE	03: S1 Lower Outboard (+70, -5)	SRMS Elbow (+125, +5)	Camera B (-20, +15)

NOTE

1. The LEE Camera must be fully zoomed out to correspond to the target overlay.
2. Orbiter Ch 2 (ID:72) will be unavailable while the CBCS Camera is setup for the JLP Relocate from Node 2 to JPM.

PCS

MSS: SSRMS:

Change Loaded Parameters ► JLP ► JLP Mate ISSACS SRH
Verify 'Loaded Parameters' (two) – JLP Mate ISSACS, SR Held

Change Unloaded Parameters ► Unloaded ► LEE Tip SRH
Verify 'Unloaded Parameters' (two) – LEE Tip, SR Held

Verify Display – Node2>JLP Port FRGF

Verify Command – SSRMS>Internal

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

SR	SY	SP	EP	WP	WY	WR
+120.0	+7.6	+14.1	+123.7	-75.8	-26.4	+78.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2> JLP Port FRGF					

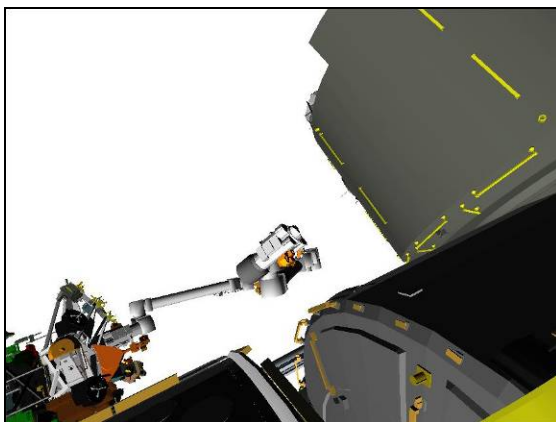


Figure 1.- JLP Pre-Grapple
(13: LAB Stbd Zenith: -150, -40).

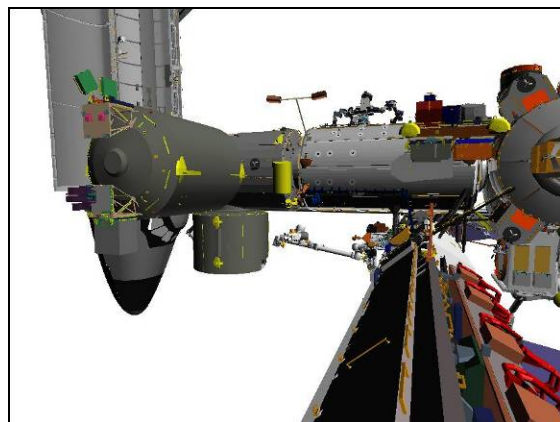


Figure 2.- JLP Pre-Grapple
(03: S1 Lower Outboard: +70, -5).

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 2 of 13 pages

2. GRAPPLE JLP

√Vernier

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

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

Expected SSRMS JLP Grappled position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	-11.7	+14.3	+110.1	-68.9	-16.3	+61.0
X	Y	Z	Pitch	Yaw	Roll	
+226	+1	-227	-0.2	+49.2	-179.8	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	Node2> JLP Port FRGF					

DCP

BRAKES SSRMS → ON (Verify ON)

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 3 of 13 pages

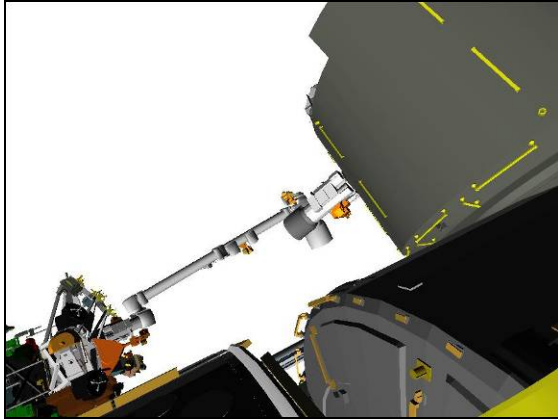


Figure 3.- JLP Grappled
(13: LAB Stbd Zenith: -150, -40).

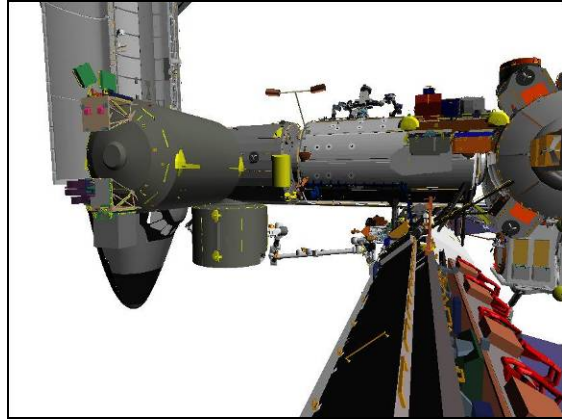


Figure 4.- JLP Grappled
(03: S1 Lower Outboard: +70, -5).

3. PREP FOR JLP DEMATE

If using shuttle attitude control, coordinate with shuttle crewmembers
DAP: FREE

NOTE

MCC-H will verify Attitude control and SSRMS are in a good config.

On MCC-H GO for JLP Demate:

Notify CBM operator, "SSRMS Capture complete - GO for CBM Demate."

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

4. SETUP FOR JLP UNBERTH

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-150, -30)	71: OBSS ITVC (0, -30)	03: S1 Lower Outboard (+70, -5)	SRMS Elbow (+125, -35)	Camera B (-20, +15)

Change Display ► Node2 ► JLP Demate ISSACS (Verify Node 2> JLP Demate ISSACS)

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

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 4 of 13 pages

Verify SSRMS at JLP Grappled position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	-11.7	+14.3	+110.1	-68.9	-16.3	+61.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	Node2> JLP Demate ISSACS					

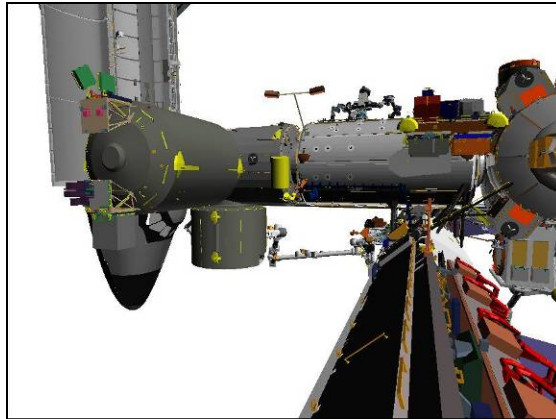


Figure 5.- JLP Grappled
(03: S1 Lower Outboard: +70, -5).

5. JLP UNBERTH

NOTE

The closest clearance is at the beginning of the maneuver to the JLP Unberth position, and is between the JLP and the Orbiter Crew Cabin: 115 cm (41 in). This may be monitored with the SRMS Elbow Camera, the OBSS ITVC, or the S1 Lower Outboard Camera.

On CBM operator, “Go for JLP Unberth.”

On MCC-H GO for JLP Unberth:

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)

√Vernier

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 5 of 13 pages

THC/
RHC

Maneuver JLP to Unberth position (within 5 cm/1 deg).
Expect -Z (THC up).

Locked						
SR	SY	SP	EP	WP	WY	WR
+120.0	-39.3	0.0	+110.9	-58.7	+0.2	+38.5
X	Y	Z	Pitch	Yaw	Roll	
0	0	-200	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	Node2> JLP Demate ISSACS					

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

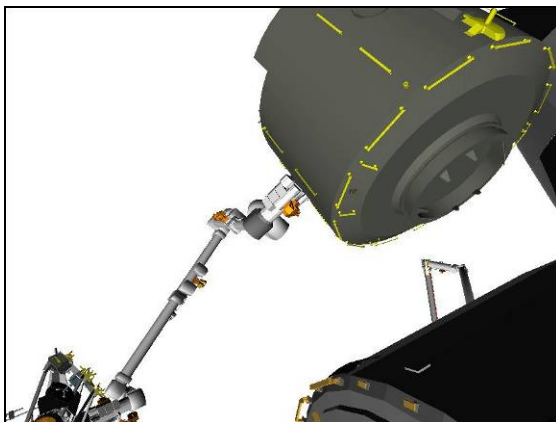


Figure 6.- JLP Unberth
(13: LAB Stbd Zenith: -150, -30).

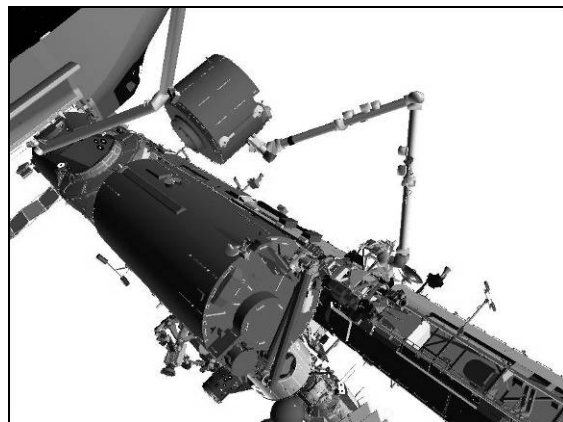


Figure 7.- JLP Unberth
(71: OBSS ITVC: 0, -30).

6. ATTITUDE CONTROL

If using shuttle attitude control and attitude maintenance required,
coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

| DAP: FREE > 2 seconds

| DAP: AUTO

When in attitude and rates damped

DAP: FREE

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 6 of 13 pages

7. CBM INTERFACE INSPECTION

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3
13: LAB Stbd Zenith (-122, -23) Zoom: 23 mm	71: OBSS ITVC (+22, -24) HFOV: 5 deg	03: S1 Lower Outboard (+61, -8) Zoom: 50 mm

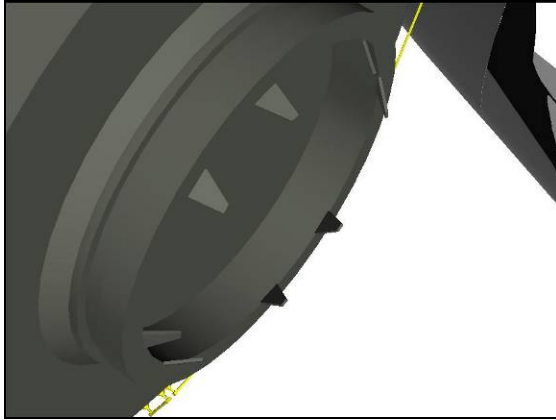


Figure 8.- CBM Interface Inspection
(13: LAB Stbd Zenith: -122, -23)
Zoom: 23 mm.

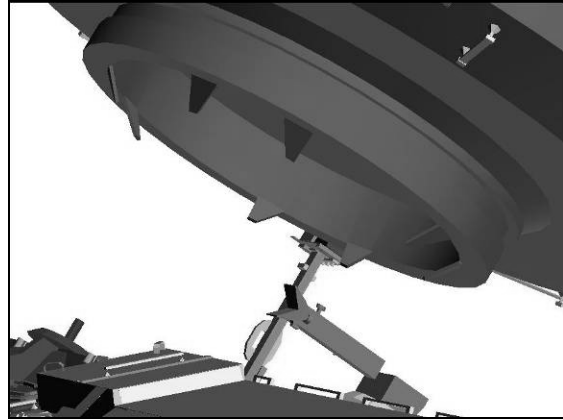


Figure 9.- CBM Interface Inspection
(71: OBSS ITVC: +22, -24)
HFOV: 5 deg.

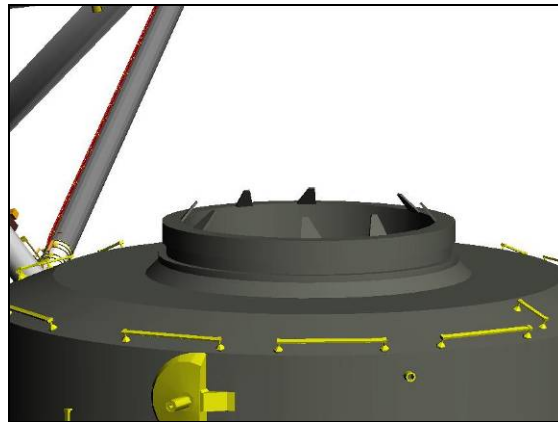


Figure 10.- CBM Interface Inspection
(03: S1 Lower Outboard: +61, -8)
Zoom: 50 mm.

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 7 of 13 pages

7.1 JLP PCBM Inspection

NOTE

1. Even with best available views, some small percentage of PCBM ring may be obstructed (this lack of 100 % coverage is acceptable risk).
2. For a permanent element (JLP), there must be a very high degree of confidence in the ability of at least two PCBM seals to completely seal against the ACBM interface.

Verify Mating corridor clear of obstructions and in expected configuration.

The image below provides a good indication of a "clean" PCBM in the nominal expected configuration for a mating event.

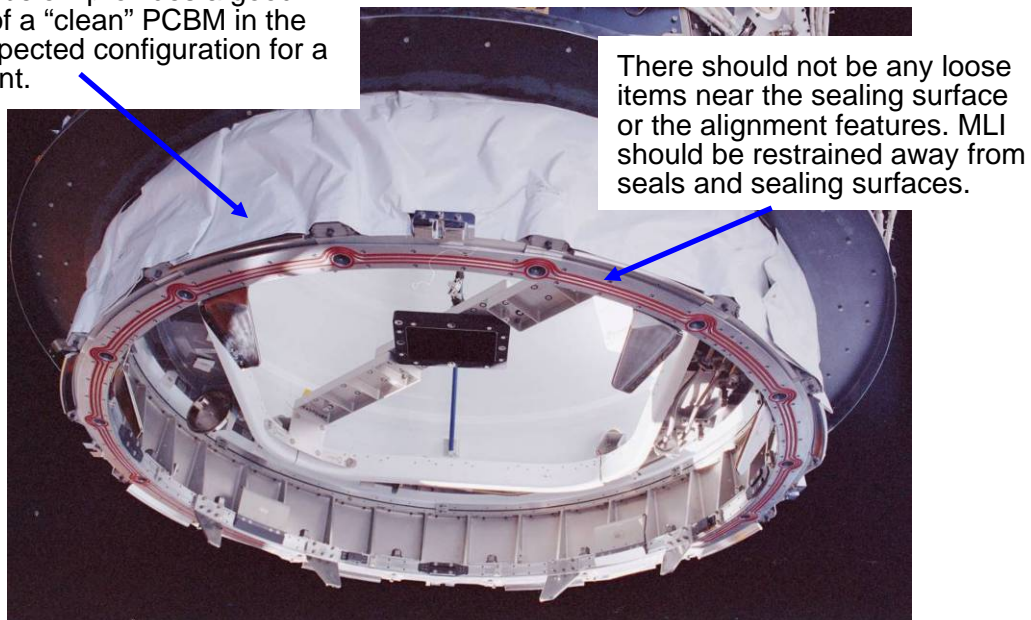


Figure 11.- Example PMA3 PCBM Inspection View.

7.2 PCBM FOD Inspection

If possible, verify seals and surfaces clear of FOD (debris or damage).

7.3 PCBM Inspection Complete

If steps 7.1 and 7.2 can not be verified, √**MCC-H**.

Notify **MCC-H** when survey complete.

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN) Page 8 of 13 pages

8. SETUP FOR MANEUVER TO PRE-INSTALL

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-160, -40)	71: OBSS ITVC (0, -30) 37: MBS Mast (-155, +50)	03: S1 Lower Outboard (+60, -15)	SRMS Elbow (+125, -20)	Camera B (-20, +15)

MSS: SSRMS:

Change Display ► JPM ► JLP Mate ISSACS (Verify JPM>JLP Mate ISSACS)

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

Verify SSRMS at JLP Unberth position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	-39.3	0.0	+110.9	-58.7	+0.2	+38.5
X	Y	Z	Pitch	Yaw	Roll	
0	+995	-200	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	JPM>JLP Mate ISSACS					

9. MANEUVER TO JLP PRE-INSTALL ON JPM

RHC RATE → COARSE (Verify Coarse on PCS)

PCS MSS: SSRMS:

Enter Mode – FOR OCAS (Verify blue)

MSS: SSRMS: SSRMS FOR OCAS: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

Input 'FOR' 'Destination' for JLP Pre-Install position.

X	Y	Z	Pitch	Yaw	Roll
0	0	-200	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	+995	-200	0.0	0.0	0.0
TGT	0	0	-200	0.0	0.0	0.0
ERR	0	+995	0	0.0	0.0	0.0

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 9 of 13 pages

```

*****
* 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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at JLP Pre-Install on JPM position (within 5 cm/1 deg).

Locked	SR	SY	SP	EP	WP	WY	WR
	+120.0	+35.6	-87.7	+139.5	+26.6	-36.2	+109.5
	X	Y	Z	Pitch	Yaw	Roll	
	0	0	-200	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held						
Disp	JPM> JLP Mate ISSACS						

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

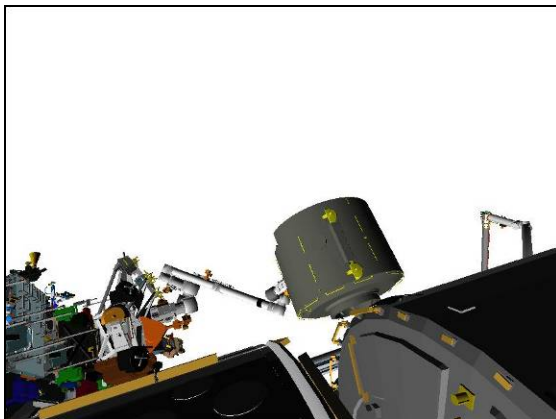


Figure 12.- JLP Pre-Install
(13: LAB Stbd Zenith: -160, -40).

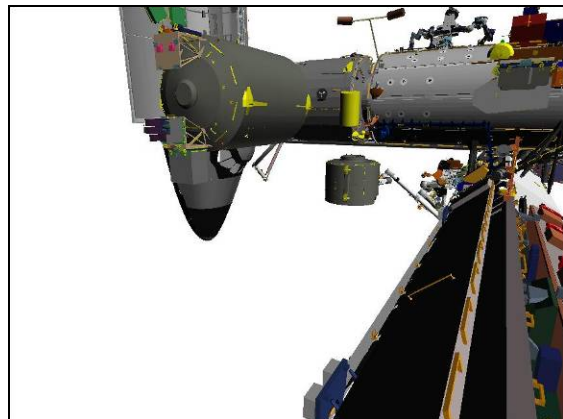


Figure 13.- JLP Pre-Install
(03: S1 Lower Outboard: +60, -15).

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 10 of 13 pages

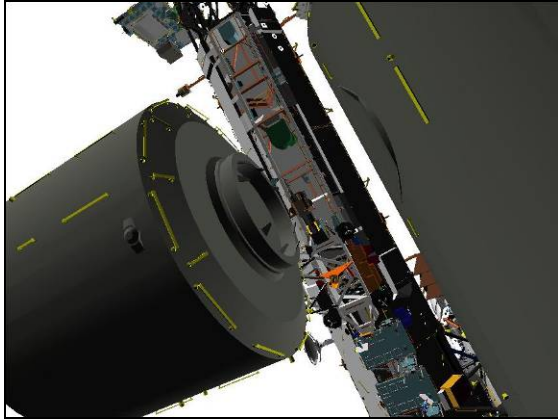


Figure 14.- JLP Pre-Install
(V10: SRMS Elbow: +125, +20).

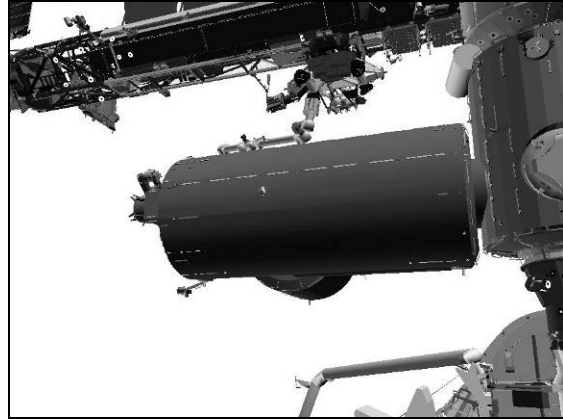


Figure 15.- JLP Pre-Install
(V10: Camera B: -20, +15).

10. SETUP FOR MANEUVER TO INSTALL

Verify CBCS setup complete.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
13: LAB Stbd Zenith (-180, -50)	37: MBS Mast (+20, +70)	03: S1 Lower Outboard (+60, -15)	SRMS Elbow (+130, +25)	Camera B (-20, +15)

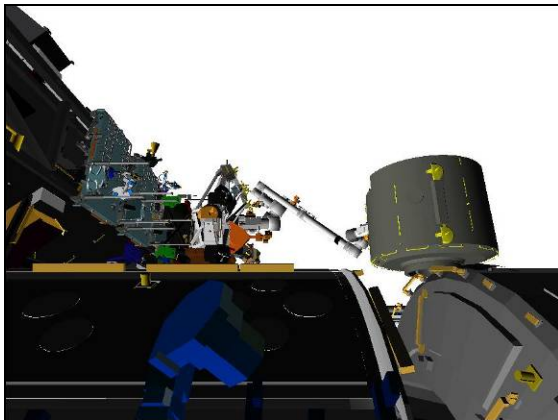


Figure 16.- JLP Pre-Install
(13: LAB Stbd Zenith: -180, -50).

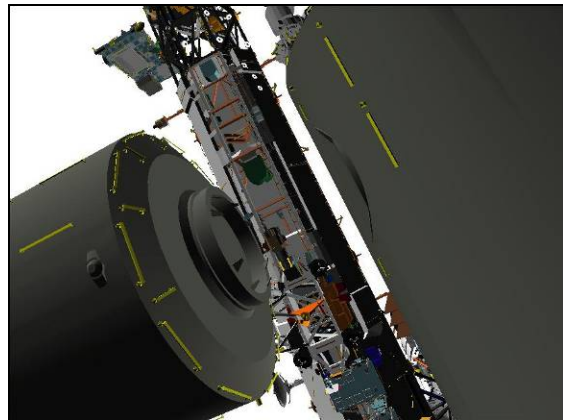


Figure 17.- JLP Pre-Install
(V10: SRMS Elbow: +130, +25).

6.202 JLP RELOCATE - CBCS FAILED

11. VERIFYING ATTITUDE CONTROL CONFIGURATION

If using shuttle attitude control and attitude maintenance required, coordinate with shuttle crewmembers

DAP: LVLH

When rates damped

DAP: FREE > 2 seconds

DAP: AUTO

When in attitude and rates damped

DAP: FREE

12. MANEUVER TO JLP INSTALL ON JPM

NOTE		
JEM Zenith CBM RTLs can be monitored using the PCS display:		
PCS	JEM: S&M: Zenith CBM: RTL Details	
	JEM Zenith CBM RTL Details	

On CBM operator, "Go for Maneuver to RTL."

On MCC-H GO for JLP Install:

RHC

RATE → VERNIER (Verify Vernier on 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 Roll (Verify SR – Locked)

THC/
RHC

Maneuver JLP to Ready-To-Latch position until RTL (four) – green

Expected RTL position.

Locked						
SR	SY	SP	EP	WP	WY	WR
+120.0	+53.2	-73.0	+136.3	+28.3	-37.7	+131.5
X	Y	Z	Pitch	Yaw	Roll	
0	0	-8	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	JPM> JLP Mate ISSACS					

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 12 of 13 pages

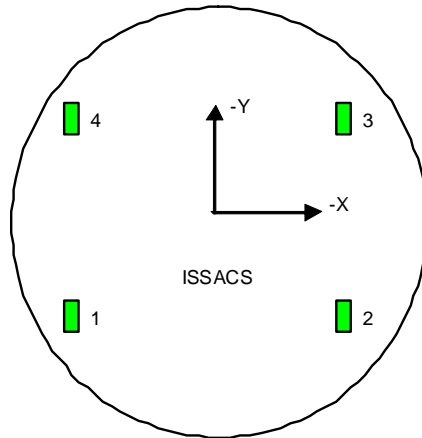


Figure 18.- RTL Diagram.
(JEM Zenith CBM)

PCS

MSS: SSRMS:

Verify Posn Hold – orange
Verify RTL (four) – green

Enter Mode – Standby (Verify blue)

Notify CBM operator, “Maneuver to RTL complete - GO for first stage capture.”

13. POST FIRST STAGE CAPTURE CLEANUP

On CBM operator, “Go for SSRMS mode to Limp.”

NOTE

Following SSRMS Mode to Limp, closed RTLs may open due to RTL spring forces. RTL closed indication is not required prior to execution of second stage capture (for latches used during first stage capture).

MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

6.202 JLP RELOCATE - CBCS FAILED

(RBT FS/1J/FIN/SPN)

Page 13 of 13 pages

WARNING

If SSRMS fails to brakes-on from limp mode, continuation of Second Stage Capture may cause structural failure of SSRMS or primary structure. If CBM stops unexpectedly (and Cmd Code changes to 'Stop') or SSRMS safes during Second Stage Capture, $\sqrt{\text{MCC-H}}$ before proceeding.

Notify CBM operator: "SSRMS Mode to Limp complete. GO for Second Stage Capture."

14. POST ABOLT CLEANUP

On CBM operator, "GO for SSRMS Brakes ON."

DCP BRAKES SSRMS → ON (Verify ON)

PCS MSS: SSRMS:

Expected JLP Install on JPM position.

SR	SY	SP	EP	WP	WY	WR
+120.0	+53.8	-72.3	+136.0	+28.4	-37.7	+132.3
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	JPM> JLP Mate ISSACS					

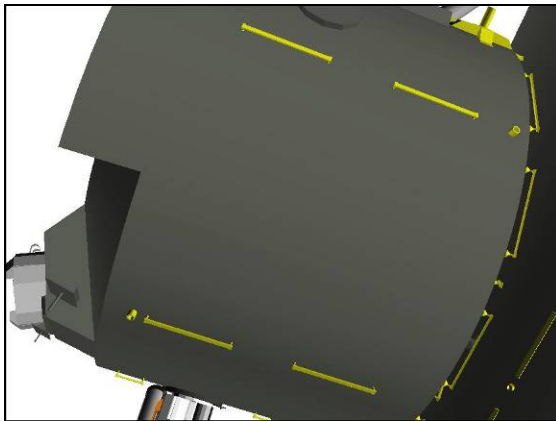


Figure 19.- JLP Install on JPM
(37: MBS Mast: +20, +70).

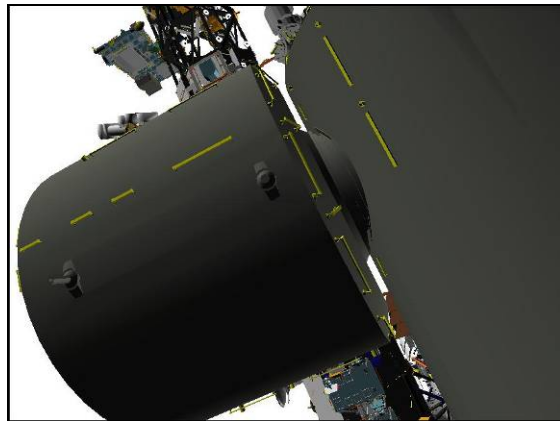


Figure 20.- JLP Install on JPM
(V10: SRMS Elbow: +130, +25).

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6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 1 of 10 pages

1. SETUP FOR NODE 2 RELEASE

Verify that the SRMS is in the JLP Relocate viewing position.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
24: Tip Elbow (0, 0)	25: Tip LEE	37: MBS Mast (+110, +20)	Camera C (-20, +20)	Camera B (-15, +30)

NOTE

1. The LEE Camera must be fully zoomed out to correspond to the target overlay.
2. Orbiter Ch 2 (ID:72) will be unavailable while the CBCS Camera is setup for the JLP Relocate from Node 2 to JPM.

PCS

MSS: SSRMS:

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – Node 2 PDGF, SR Held

Change Unloaded Parameters ► Unloaded ► LEE Tip SYH

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

Change Display ► Node2 ► PDGF (Verify Node2>PDGF)

√Command – SSRMS>Internal

Expected Node 2 Grapple position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-7.6	+103.4	-87.4	+63.7	-83.3	-173.1	-180.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – Node 2 PDGF, SR Held					
Disp	Node2>PDGF					

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 2 of 10 pages

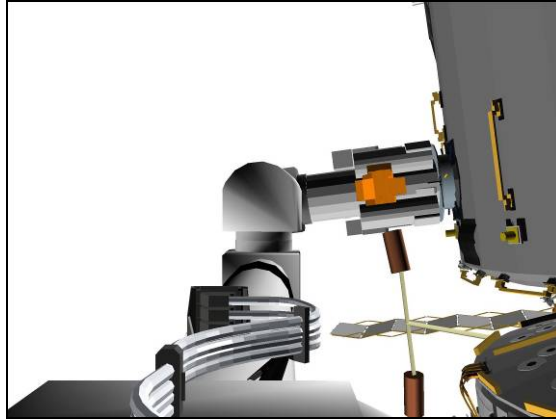


Figure 1.- Node 2 Grapple
(24: Tip Elbow: 0, 0).

2. NODE 2 RELEASE (WITH CARRIAGE PUSHOFF)

MSS: SSRMS: MSS Safing: MSS Safing

cmd 'SSRMS' Remove (Verify Not Safed)

DCP

BRAKES SSRMS → OFF (Verify OFF)

PCS

2.1 SSRMS Limp

MSS: SSRMS: Limp: SSRMS Limp

cmd All Limp (Verify Limp – blue)

MSS: SSRMS: SSRMS

Verify all joints – Limped

2.2 Auto Release

MSS: SSRMS: Tip LEE: SSRMS Tip LEE

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

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

CAUTION

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

NOTE

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

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN) Page 3 of 10 pages

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)
 Verify 'Carriage' Extend – blue (90 s max)

2.3 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)

√Vernier

THC Maneuver SSRMS to Node 2 Release position (within 5 cm/1 deg).

	<input type="text" value="Locked"/>					
SR	SY	SP	EP	WP	WY	WR
-3.9	+103.4	-80.2	+46.7	-69.9	-173.9	-179.8
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>PDGF					

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 4 of 10 pages

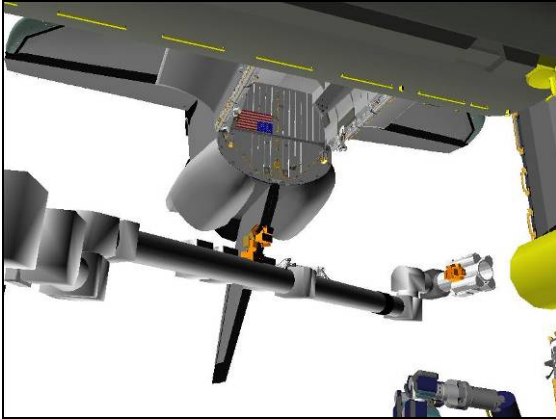


Figure 2.- Node 2 Release
(37: MBS Mast: +110, +20).

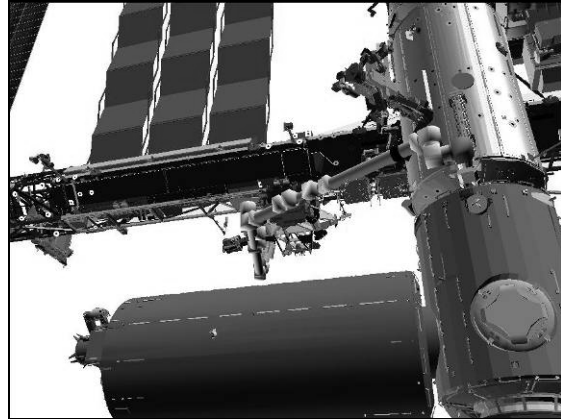


Figure 3.- Node 2 Release
(V10: Camera B: -15, +30).

3. SETUP FOR CLEAR OF JEM

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
24: Tip Elbow (+160, 0)	22: Base Elbow (0, 0)	37: MBS Mast (+125, +20)	Camera C (-40, +20)	Camera B (-15, +15)

MSS: SSRMS:

Verify Unloaded Parameters – ✓

Change Display ► Node 2 ► JLP Port FRGF (Verify Node2>JLP Port FRGF)

Verify SSRMS at Node 2 Release position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
-3.9	+103.4	-80.2	+46.7	-69.9	-173.9	-179.8
X	Y	Z	Pitch	Yaw	Roll	
-42	-212	-811	-82.9	-6.1	+139.6	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>JLP Port FRGF					

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)



Figure 4.- Node 2 Release
(22: Base Elbow: 0, 0).



Figure 5.- Node 2 Release
(V10: Camera C: -40, +20).

4. MANEUVER TO CLEAR OF JEM RMS POSITION 1

NOTE

The closest clearance during the maneuver to the Clear of JPM position is between the SSRMS SY Joint and the MBS POA: 41 cm (16 in). This may be monitored with the Base Elbow Camera.

MSS: SSRMS: Rate:

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

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

SSRMS Joint OCAS

Input 'Joint Angles' 'Destination' for Clear of JEM RMS position 1.

SR	SY	SP	EP	WP	WY	WR
+120.0	+80.0	-30.0	+46.7	-75.8	-100.0	-69.0

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)	-3.9	+103.4	-80.2	+46.7	-69.9	-173.9	-179.8
TGT	+120.0	+80.0	-30.0	+46.7	-75.8	-100.0	-69.0
ERR	-123.9	+23.4	-50.2	0.0	+5.9	-73.9	-110.8

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 6 of 10 pages

```

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

```

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify Joint Angle values.

SR	SY	SP	EP	WP	WY	WR
+120.0	+80.0	-30.0	+46.7	-75.8	-100.0	-69.0

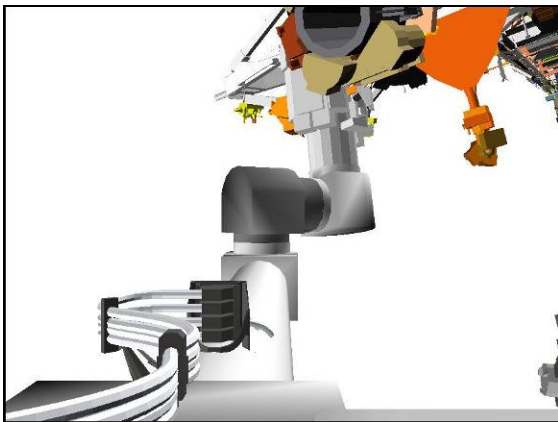


Figure 6.- Clear of JEM RMS Position 1
(22: Base Elbow: 0, 0).

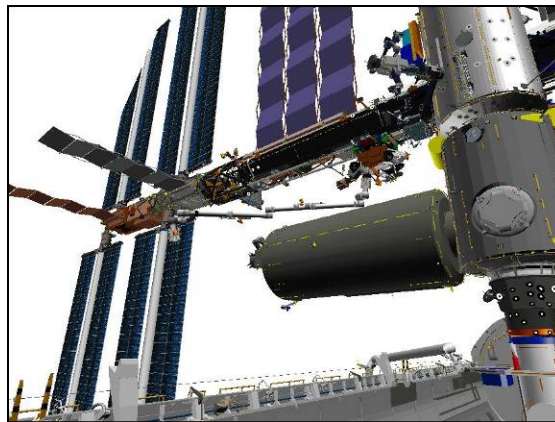


Figure 7.- Clear of JEM RMS Position 1
(V10: Camera C: -40, +20).

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN) Page 7 of 10 pages

5. MANEUVER TO CLEAR OF JEM RMS POSITION 2

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
71: OBSS ITVC (0, -30)	13: LAB Stbd Zenith (-155, -55)	37: MBS Mast (+25, +30)	Camera C (-40, +20)	Camera B (-35, +15)

SSRMS Joint OCAS

Input 'Joint Angles' 'Destination' for Clear of JEM RMS position 2.

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+46.7	-75.8	-26.4	0.0

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)	+120.0	+80.0	-30.0	+46.7	-75.8	-100.0	-69.0
TGT	+120.0	+10.0	-30.0	+46.7	-75.8	-26.4	0.0
ERR	0.0	+70.0	0.0	0.0	0.0	-73.6	-69.0

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.

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at Clear of JEM RMS position 2 (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+46.7	-75.8	-26.4	0.0
X	Y	Z	Pitch	Yaw	Roll	
-441	+1549	+391	-106.7	+40.8	+50.8	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>JLP Port FRGF					

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 8 of 10 pages

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

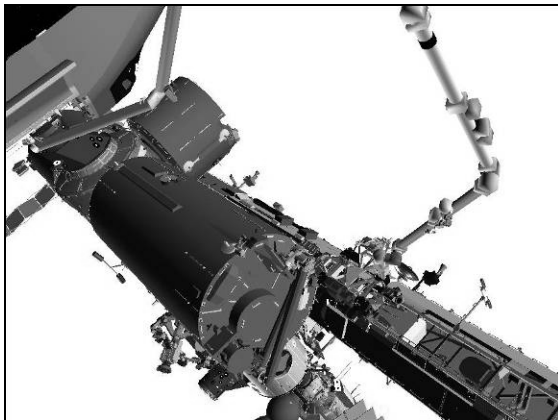


Figure 8.- Clear of JEM RMS Position 2
(71: OBSS ITVC: 0, -30).

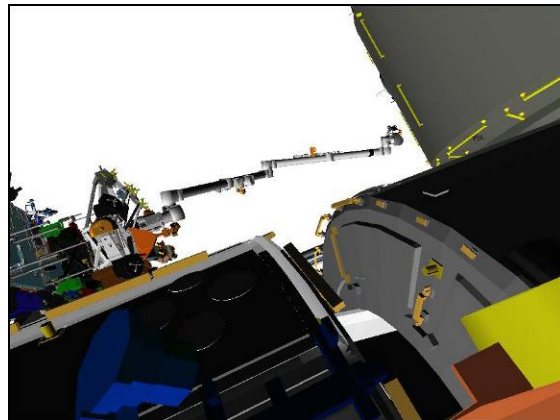


Figure 9.- Clear of JEM RMS Position 2
(13: LAB Stbd Zenith: -155, -55).

6. MANEUVER TO JLP PRE-GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+70, -5)	13: LAB Stbd Zenith (-155, -55)	37: MBS Mast (-30, +60)	Camera C (-40, +20)	Camera B (-15, +10)

MSS: SSRMS:

Change Unloaded Parameters ► Unloaded ► LEE Tip SRH
Verify 'Unloaded Parameters' (two) – LEE Tip, SR Held

Enter Mode – FOR OCAS (Verify blue)

MSS: SSRMS: SSRMS FOR OCAS: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

Input 'FOR' 'Destination' for JLP Pre-Grapple position.

X	Y	Z	Pitch	Yaw	Roll
-150	0	0	0.0	0.0	0.0

cmd Load (Verify Sequence Status – Confirm or Cancel)

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 9 of 10 pages

MON

Verify FOR and errors are correct on FOR Position overlay.

	X	Y	Z	Pitch	Yaw	Roll
FOR	-441	+1549	+391	-106.7	+40.8	+50.8
TGT	-150	0	0	0.0	0.0	0.0
ERR	-291	+1549	+391	-106.7	+40.8	+50.8

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)

DCP

AUTO SEQ → PROC

PCS

MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
+120.0	+7.6	+14.1	+123.7	-75.8	-26.4	+78.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JLP Port FRGF					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

6.301 NODE 2 RELEASE TO JLP PRE-GRAPPLE
(RBT FS/1J/FIN/SPN) Page 10 of 10 pages

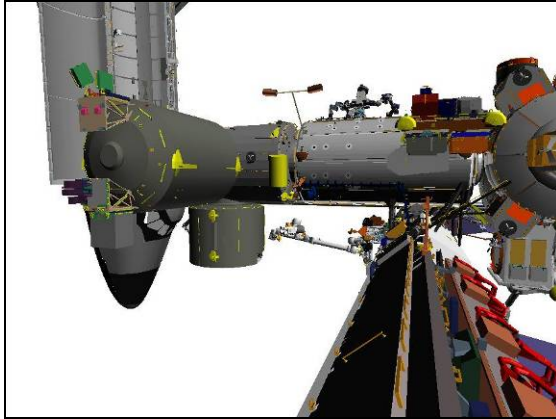


Figure 10.- JLP Pre-Grapple
(03: S1 Lower Outboard: +70, -5).

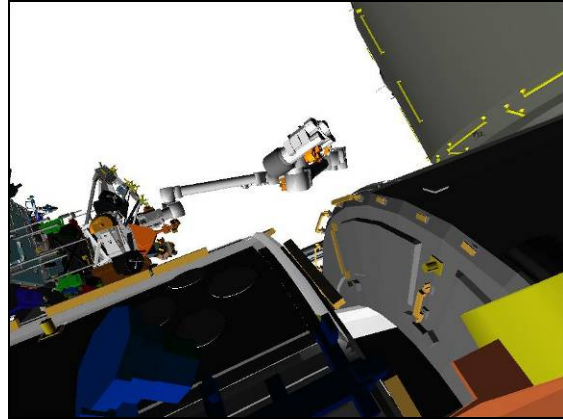


Figure 11.- JLP Pre-Grapple
(13: LAB Stbd Zenith: -155, -55).

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 1 of 11 pages

1. SETUP

Verify that the SRMS is in the JLP Relocate Viewing position.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (+175, +5)	25: Tip LEE	37: MBS Mast (0, +42)	Camera B (-10, +15)	OBSS ITVC (+165, -300)

NOTE

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

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – JLP Mate CBCS, SR Held

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

Change Display ► JPM ► JLP Port FRGF (Verify JPM>JLP Port FRGF)

√Command – SSRMS>Internal

Verify SSRMS at JLP Install on JPM position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+120.0	+53.8	-72.3	+136.0	+28.4	-37.7	+132.3
X	Y	Z	Pitch	Yaw	Roll	
+226	+1	-190	-90.0	-0.1	+139.2	
FOR	Loaded – JLP>JLP Mate CBCS, SR Held					
Disp	JPM>JLP Port FRGF					

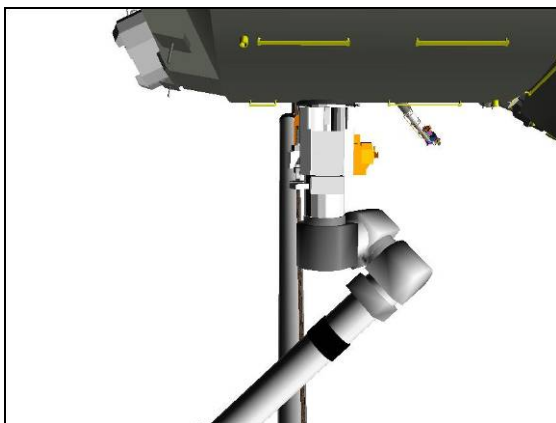


Figure 1.- JLP Install on JPM
(37: MBS Mast: 0, +42).

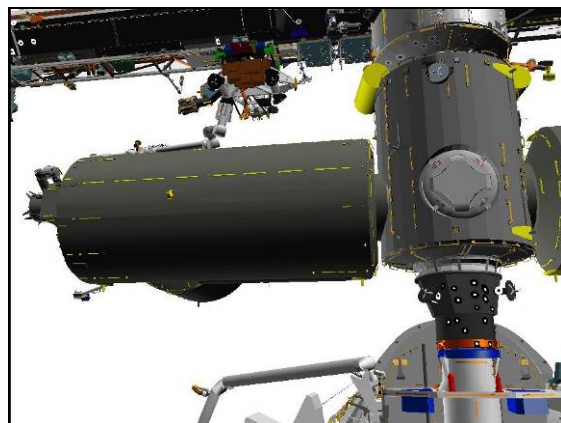


Figure 2.- JLP Install on JPM
(V10: Camera B: -10, +15).

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 2 of 11 pages

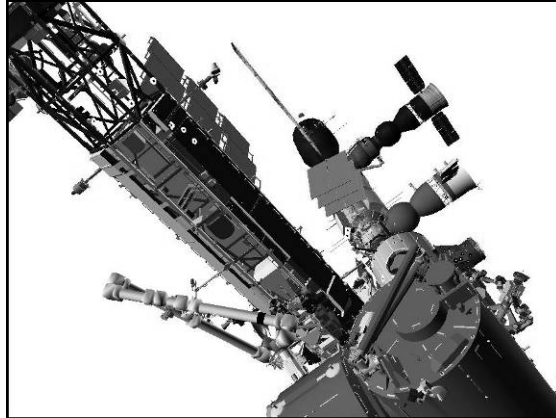


Figure 3.- JLP Install on JPM
(V10: OBSS ITVC: +165, -300).

2. JLP RELEASE (WITH CARRIAGE PUSHOFF)

2.1 SSRMS Limp

On CBM operator GO for JLP Ungrapple:

DCP BRAKES SSRMS → OFF (Verify OFF)

PCS MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

2.2 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

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 3 of 11 pages

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)

2.3 SSRMS Backoff

MSS: SSRMS: Limp:

cmd None Limp (Verify Standby – blue)

√Vernier

MSS: SSRMS:

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

THC/
RHC

Maneuver SSRMS to JLP Release position (within 5 cm/1 deg).

Locked						
SR	SY	SP	EP	WP	WY	WR
+120.0	+67.7	-86.3	+135.7	+53.1	-35.9	+149.5
X	Y	Z	Pitch	Yaw	Roll	
-180	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	JPM>JLP Port FRGF					

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

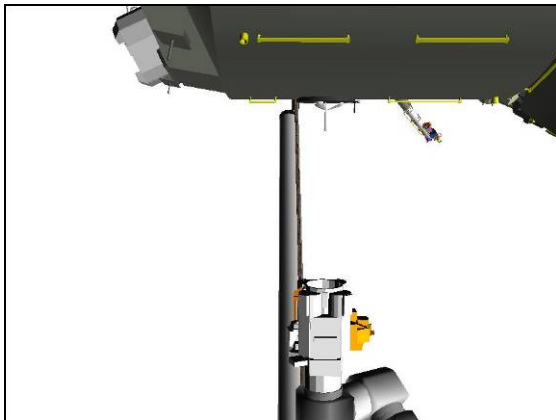


Figure 4.- JLP Release
(37: MBS Mast: 0, +42).

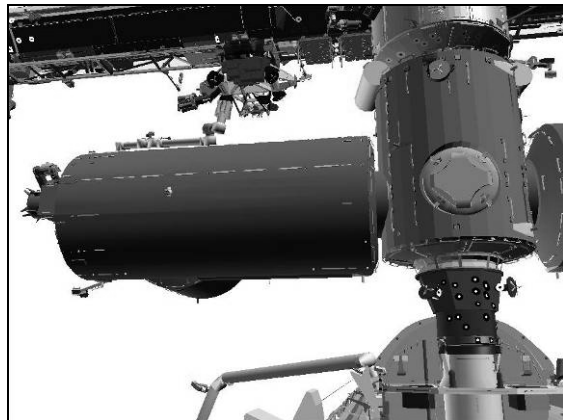


Figure 5.- JLP Release
(V10: Camera B: -10, +15).

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 4 of 11 pages

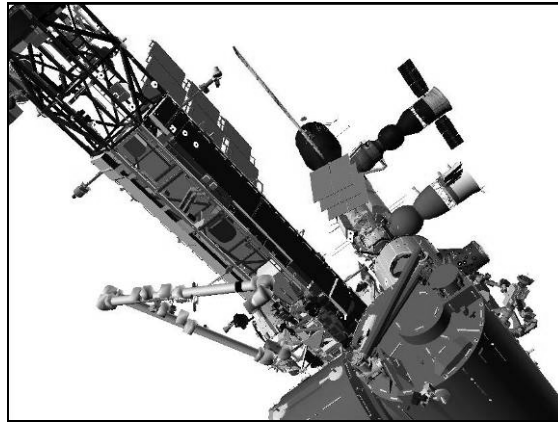


Figure 6.- JLP Release
(V10: OBSS: +165, -300).

3. JOCAS TO JPM CLEAR POSITION

NOTE

The OBSS ITVC Camera must be Panned to the value shown below in order to follow the Joint OCAS motion.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+60, -15) Zoom: 7.5 mm	13: LAB Stbd Zenith (-170, -35)	37: MBS Mast (0, 0)	Camera B (-10, +15)	OBSS ITVC (0, -30)

Change Display ► Node2 ► JPM PDGF (Verify Node2>JPM PDGF)

MSS: SSRMS: Rate:

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

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 5 of 11 pages

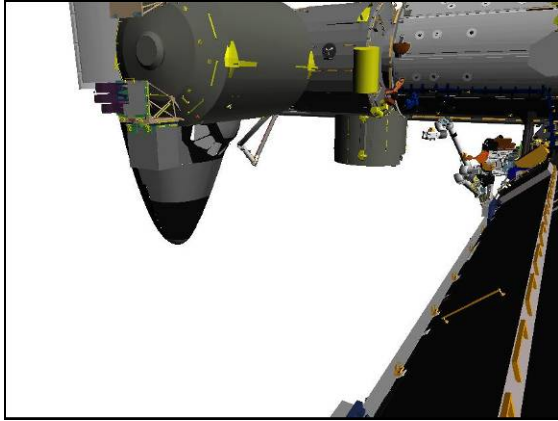


Figure 7.- JLP Release
(03: S1 Lower Outboard: +60, -15)
Zoom: 7.5 mm.

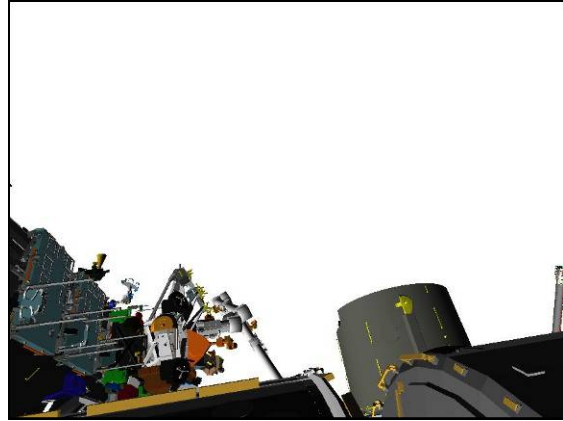


Figure 8.- JLP Release
(13: LAB Stbd Zenith: -170, -35).

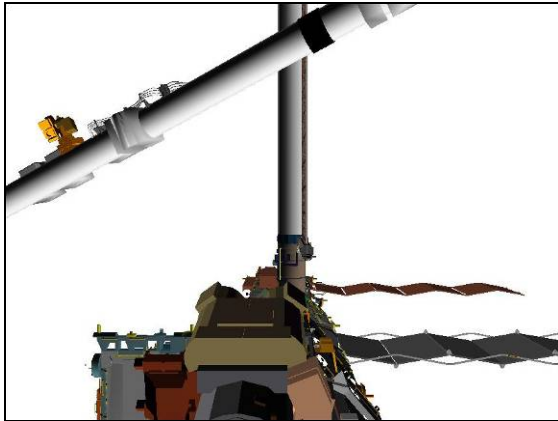


Figure 9.- JLP Release
(37: MBS Mast: 0, 0).

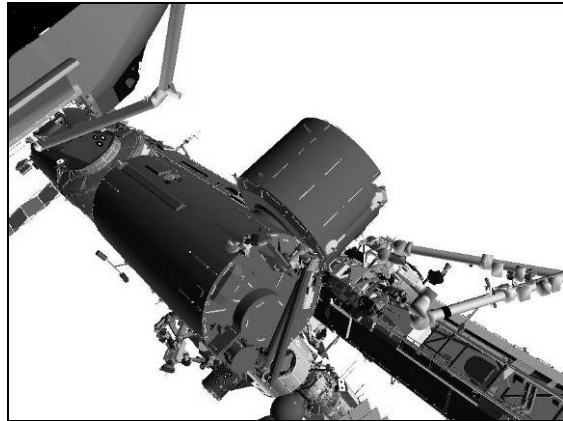


Figure 10.- JLP Release
(V10: OBSS ITVC: 0, -30).

NOTE

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

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

Input 'Joint Angles' 'Destination' for JPM Clear position.

SR	SY	SP	EP	WP	WY	WR
+225.0	+135.3	-94.0	-78.6	-106.2	+47.3	-71.2

cmd Load (Verify Sequence Status – Confirm or Cancel)

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 6 of 11 pages

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

	SR	SY	SP	EP	WP	WY	WR
(current)	+120.0	+67.7	-86.3	+135.7	+53.1	-35.9	+149.5
TGT	+225.0	+135.3	-94.0	-78.6	-106.2	+47.3	-71.2
ERR	-105.0	-67.6	+7.7	+214.3	+159.3	-83.2	+220.7

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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
+225.0	+135.3	-94.0	-78.6	-106.2	+47.3	-71.2
X	Y	Z	Pitch	Yaw	Roll	
-322	-636	+415	+1.5	+28.5	+31.6	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JPM PDGF					

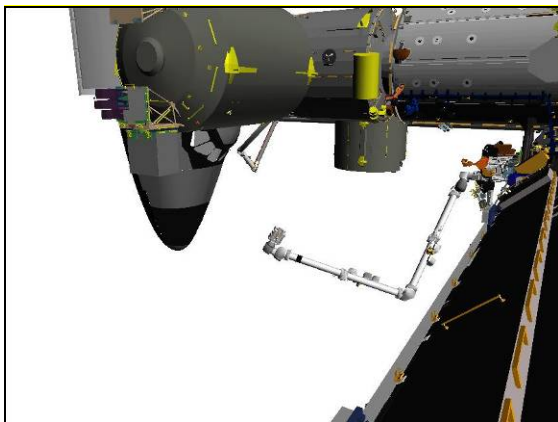


Figure 11.- JPM Clear
(03: S1 Lower Outboard: +60, -15)
Zoom: 7.5 mm.

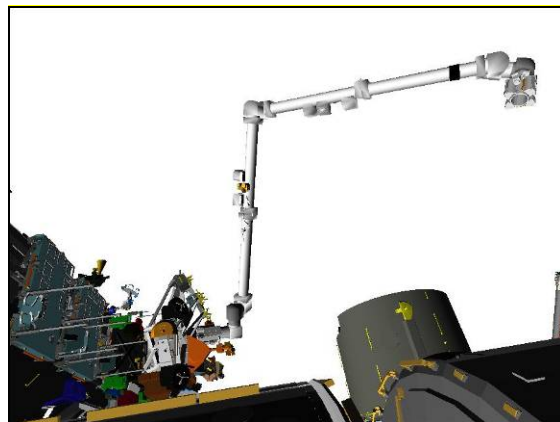


Figure 12.- JPM Clear
(13: LAB Stbd Zenith: -170, -35).

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 7 of 11 pages

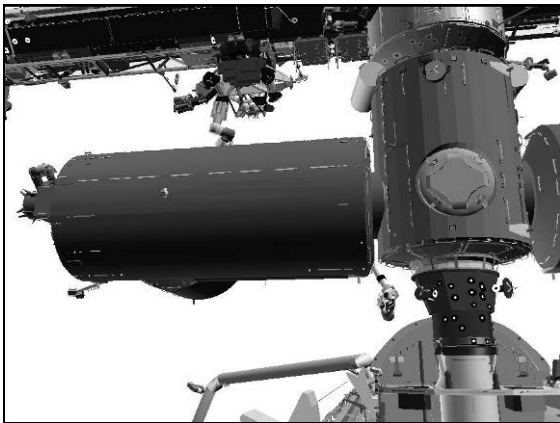


Figure 13.- JPM Clear
(V10: Camera B: -10, +15).

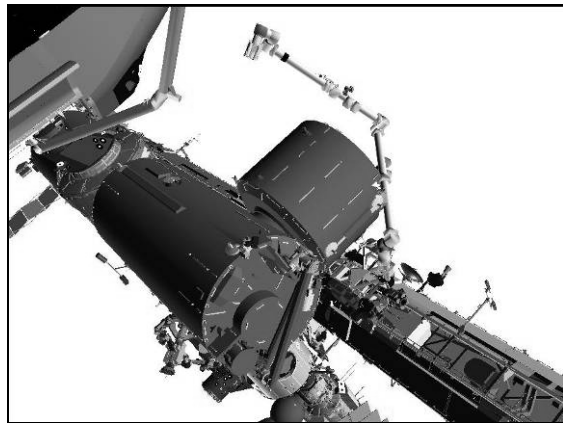


Figure 14.- JPM Clear
(V10: OBSS ITVC: 0, -30).

4. SINGLE JOINT MANEUVER TO JPM PDGF PRE-GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+60, -15) Zoom: 7.5 mm	13: LAB Stbd Zenith (-170, -35)	22: Base Elbow (-100, 0)	Camera B (-10, +15)	Camera A (+90, +10)

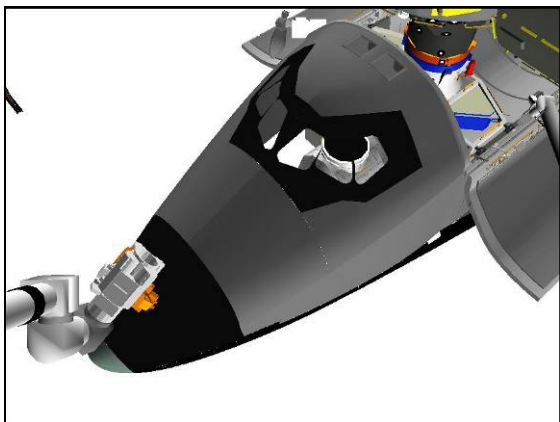


Figure 15.- JPM Clear
(22: Base Elbow: -100, 0).

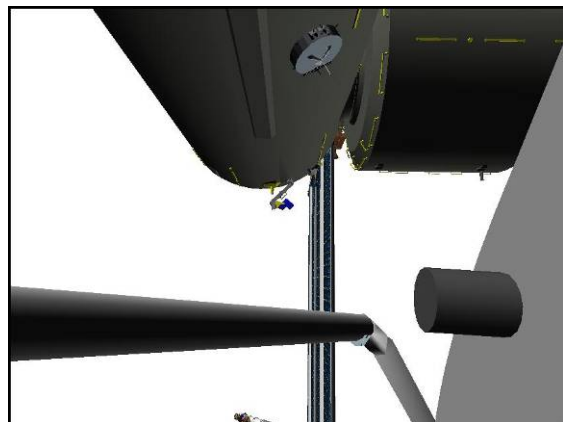


Figure 16.- JPM Clear
(V10: Camera A: +90, +10).

NOTE

The closest clearance during the maneuver to the JPM PDGF Pre-Grapple position is between the SSRMS Tip Boom and the SRMS Shoulder Boom: 115 cm (45 in). This clearance may be monitored with Camera A.

MSS: SSRMS:

Enter Mode – Single (Verify blue)

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 8 of 11 pages

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 JPM PDGF Pre-Grapple position (within 1 deg).

	SR	SY	SP	EP	WP	WY	WR
JPM Clear	+225.0	+135.3	-94.0	-78.6	-106.2	+47.3	-71.2
1: SP –			-136.7				
JPM PDGF Pre-Grapple	+225.0	+135.3	-136.7	-78.6	-106.2	+47.3	-71.2
	X	Y	Z	Pitch	Yaw	Roll	
	-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held						
Disp	Node 2>JPM PDGF						

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

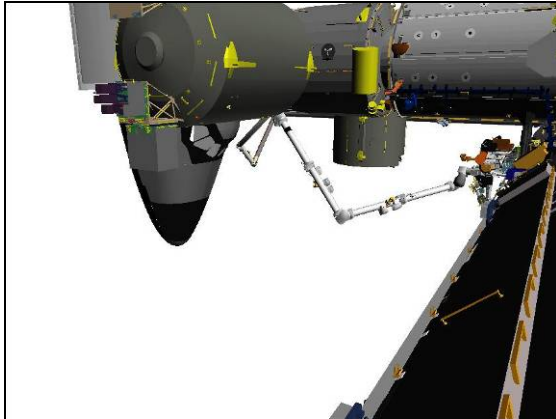


Figure 17.- JPM PDGF Pre-Grapple
(03: S1 Lower Outboard: +60, -15)
Zoom: 7.5 mm.

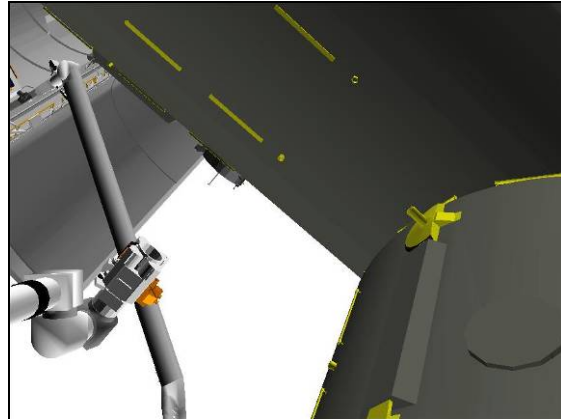


Figure 18.- JPM PDGF Pre-Grapple
(22: Base Elbow: -100, 0).

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 9 of 11 pages

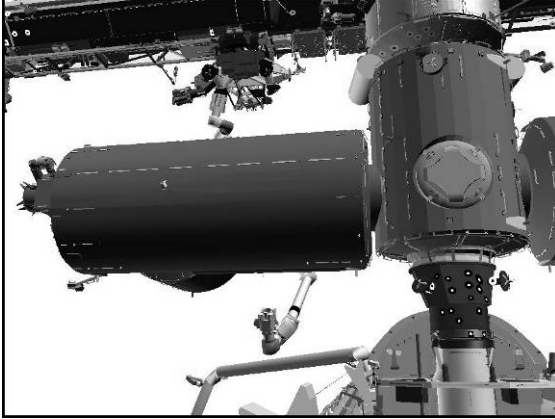


Figure 19.- JPM PDGF Pre-Grapple
(V10: Camera B: -10, +15).

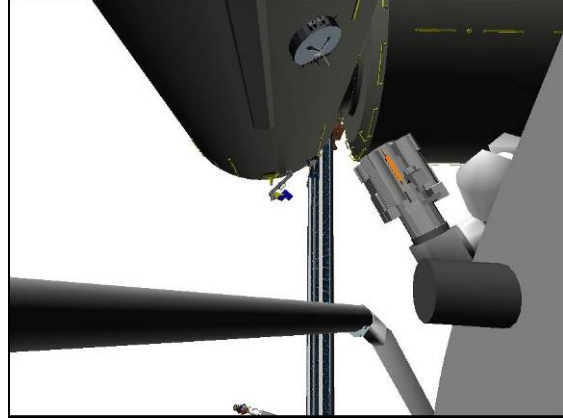


Figure 20.- JPM PDGF Pre-Grapple
(V10: Camera A: +90, +10).

5. GRAPPLE JPM PDGF

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+60, -15) Zoom: 7.5 mm	25: Tip LEE	22: Base Elbow (-100, 0)	Camera B (-10, +15)	Camera A (+90, +10)

NOTE

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

MSS: SSRMS:

Change Loaded Parameters ► JPM ► JPM Mate CBCS SRH
Verify 'Loaded Parameters' (two) – JPM Mate CBCS, SR Held

Enter Mode – Manual (Verify blue)

MSS: SSRMS: SSRMS Manual: Joint Lock:

cmd Shoulder Roll (Verify SR – Locked)

RHC/
THC
PCS

Maneuver to within grapple envelope.

MSS: SSRMS: Tip LEE:

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

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

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 10 of 11 pages

CAUTION

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

NOTE

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

cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Auto Capture

RHC TRIGGER → press (momentarily)

PCS Verify 'Snare' Close, Capture (two) – blue (12 s max)
Verify Capture to Latch – Yes (SCR 19282)
Verify 'Carriage' Tension ~5500 N (90 s max)
Verify 'Carriage' Retract – blue
Verify 'Latch' Latch – blue (65 s max)

√**MCC-H** - PDGF power inhibits confirmed

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

6. GRAPPLE CLEANUP

DCP BRAKES SSRMS → ON (Verify ON)

Verify Loaded Parameters – √

Change Display ► Node2 ► JPM Mate CBCS (Verify Node2>JPM Mate CBCS)

√Command – SSRMS>Internal

6.401 JLP RELEASE TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 11 of 11 pages

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

Locked	SR	SY	SP	EP	WP	WY	WR
	+225.0	+129.4	-134.2	-90.4	-92.3	+51.8	-77.2
	X	Y	Z	Pitch	Yaw	Roll	
	0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SR Held						
Disp	Node2>JPM Mate CBCS						

Give MCC GO for JPM Power.

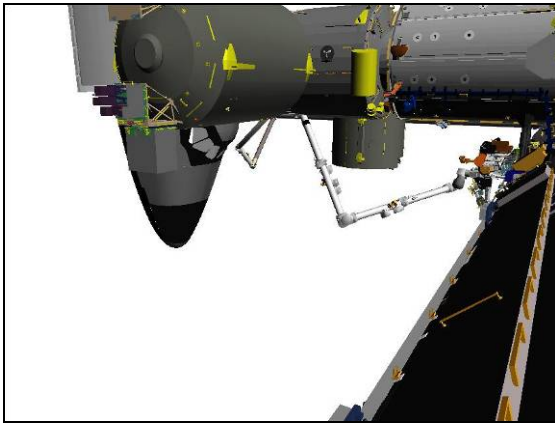


Figure 21.- JPM Grapple
(03: S1 Lower Outboard: +60, -15)
Zoom: 7.5 mm.

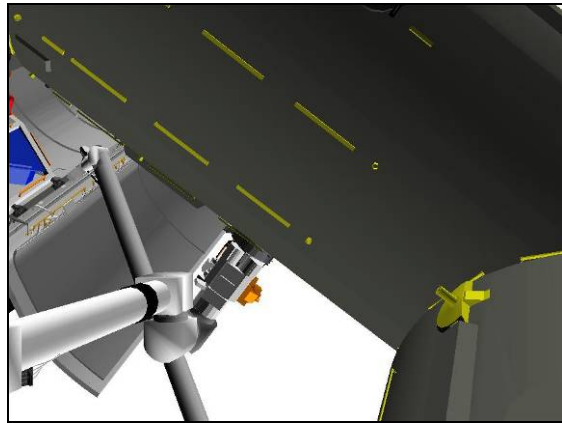


Figure 22.- JPM Grapple
(22: Base Elbow: -100, 0).

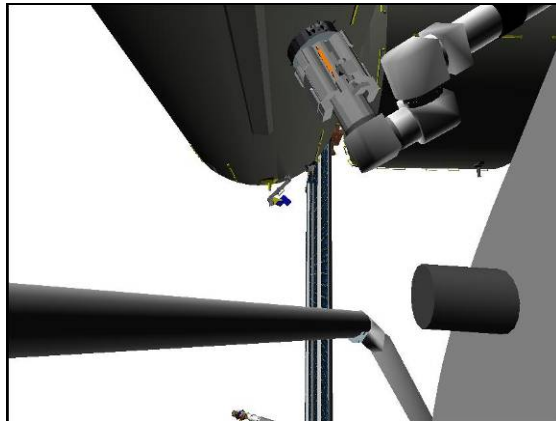


Figure 23.- JPM Grapple
(V10: Camera A: +90, +10).

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6.402 JPM RELEASE TO EVA 3 START

(RBT FS/1J/FIN/SPN)

Page 1 of 8 pages

1. SETUP

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+60, -15) Zoom: 7.5 mm	25: Tip LEE	22: Base Elbow (-100, 0)	Camera B (-10, +15)	Camera A (+90, +10)

NOTE

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

Verify Loaded Parameters – √

Verify 'Loaded Parameters' (two) – JPM Mate CBCS, SR Held

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

Change Display ► Node2 ► JPM PDGF (Verify Node2>JPM PDGF)

√Command – SSRMS>Internal

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

SR	SY	SP	EP	WP	WY	WR
+225.0	+129.4	-134.2	-90.4	-92.3	+51.8	-77.2
X	Y	Z	Pitch	Yaw	Roll	
+238	-2	+369	+90.0	+0.1	-61.3	
FOR	Loaded – JPM Mate CBCS, SR Held					
Disp	Node 2>JPM PDGF					

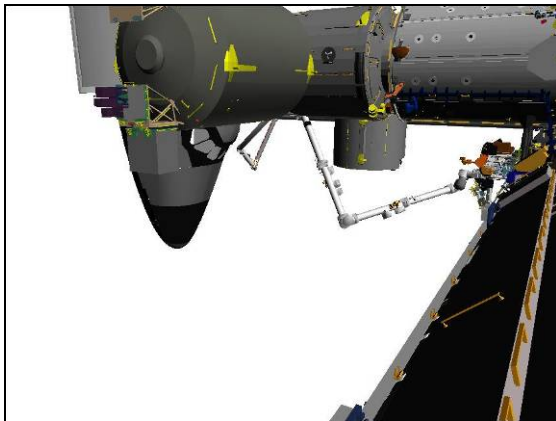


Figure 1.- JPM Grapple
(03: S1 Lower Outboard: +60, -15)
Zoom: 7.5 mm.

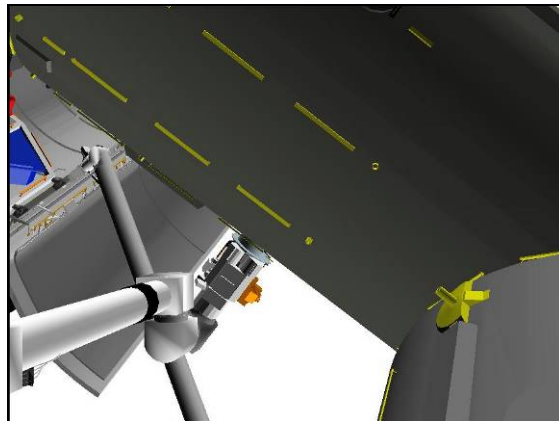


Figure 2.- JPM Grapple
(22: Base Elbow: -100, 0).

6.402 JPM RELEASE TO EVA 3 START

(RBT FS/1J/FIN/SPN)

Page 2 of 8 pages

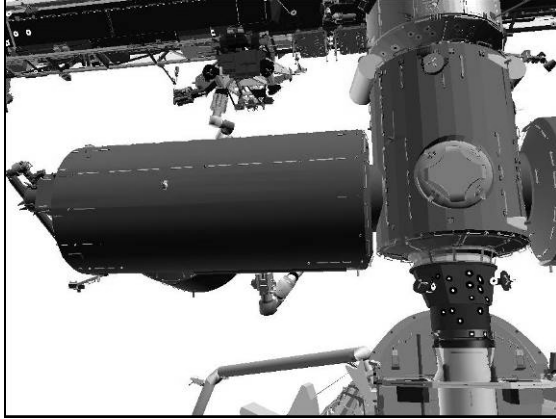


Figure 3.- JPM Grapple
(V10: Camera B: -10, +15).

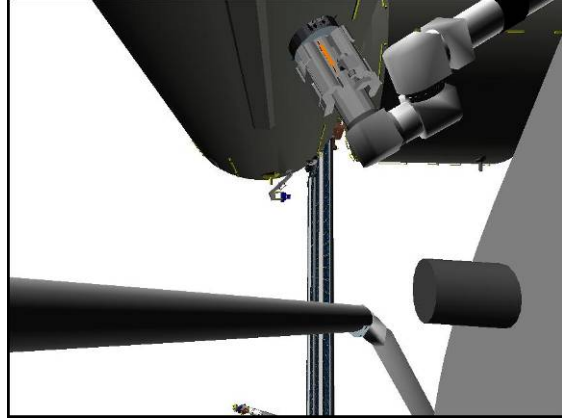


Figure 4.- JPM Grapple
(V10: Camera A: +90, +10).

2. JPM RELEASE (WITH CARRIAGE PUSHOFF)

NOTE

1. **MCC-H** will verify SSRMS Payload power has been removed from the JPM HTCLs.
2. The closest clearance at the end of the release will be between the SSRMS Tip and the SRMS Shoulder Boom: 115 cm (45 cm). This may be monitored with Camera A.

On **MCC-H GO** for JPM release:

DCP BRAKES SSRMS → OFF (Verify OFF)

√Vernier

PCS 2.1 SSRMS Limp
 MSS: SSRMS: Limp:

cmd All Limp (Verify Limp – blue)

MSS: SSRMS:

Verify all joints – Limped

2.2 Auto Release
MSS: SSRMS: Tip LEE:

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

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

6.402 JPM RELEASE TO EVA 3 START

(RBT FS/1J/FIN/SPN)

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)
- Verify 'Carriage' Extend – blue (90 s max)

2.3 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 Roll (Verify SR – Locked)

THC/
RHC Maneuver SSRMS to JPM Release position (within 5 cm/1 deg).

Locked						
SR	SY	SP	EP	WP	WY	WR
+225.0	+135.3	-136.7	-78.6	-106.2	+47.3	-71.2
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node 2>JPM PDGF					

PCS MSS: SSRMS:

Enter Mode – Standby (Verify blue)

6.402 JPM RELEASE TO EVA 3 START

(RBT FS/1J/FIN/SPN)

Page 4 of 8 pages

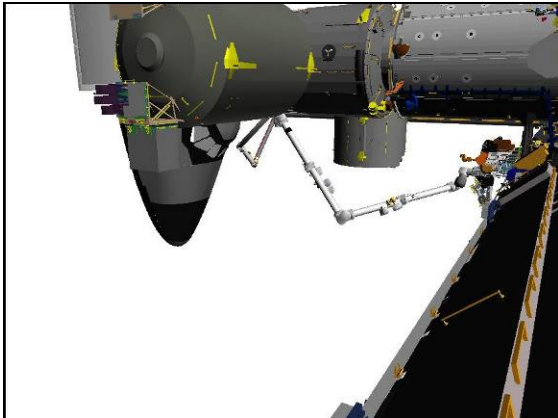


Figure 5.- JPM Release
(03: S1 Lower Outboard: +60, -15)
Zoom: 7.5 mm.

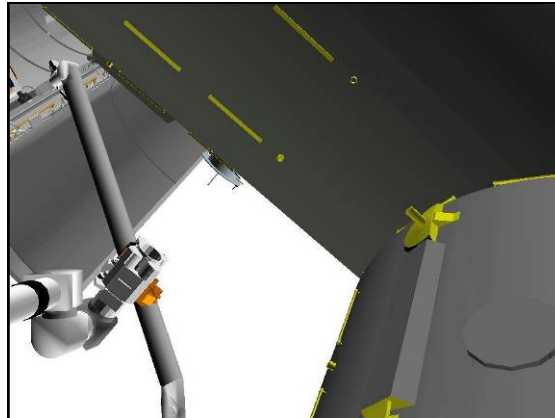


Figure 6.- JPM Release
(22: Base Elbow: -100, 0).

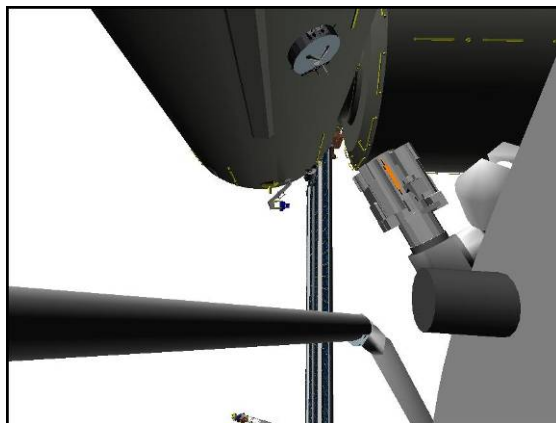


Figure 7.- JPM Release
(V10: Camera A: +90, +10).

3. SINGLE JOINT MANEUVER TO JPM CLEAR

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+60, -15) Zoom: 7.5 mm	13: LAB Stbd Zenith (-170, -35)	22: Base Elbow (-100, 0)	Camera B (-10, +15)	Camera A (+90, +10)

6.402 JPM RELEASE TO EVA 3 START

(RBT FS/1J/FIN/SPN)

Page 5 of 8 pages

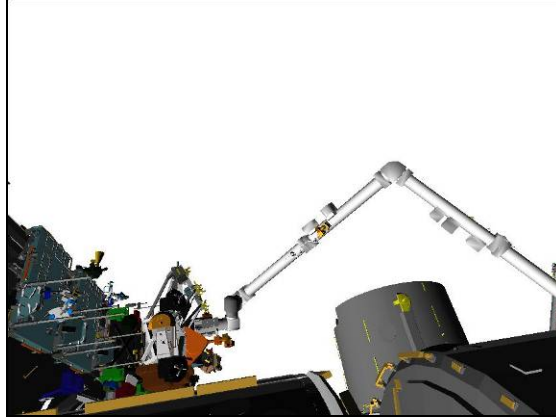


Figure 8.- JPM Release
(13: LAB Stbd Zenith: -170, -35).

MSS: SSRMS:

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

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 JPM Clear position (within 1 deg).

	SR	SY	SP	EP	WP	WY	WR	
JPM Release	+225.0	+135.3	-136.7	-78.6	-106.2	+47.3	-71.2	
1: SP +			-94.0					
JPM Clear	+225.0	+135.3	-94.0	-78.6	-106.2	+47.3	-71.2	
	X	Y	Z	Pitch	Yaw	Roll		
	+1279	-188	-341	-122.7	-1.4	-57.9		
	FOR	Unloaded – LEE Tip, SR Held						
	Disp	ISS>ISSACS						

PCS

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

6.402 JPM RELEASE TO EVA 3 START

(RBT FS/1J/FIN/SPN)

Page 6 of 8 pages

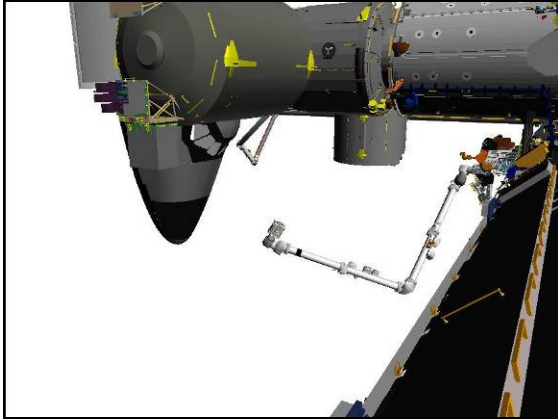


Figure 9.- JPM Clear
(03: S1 Lower Outboard: +60, -15)
Zoom: 7.5 mm.

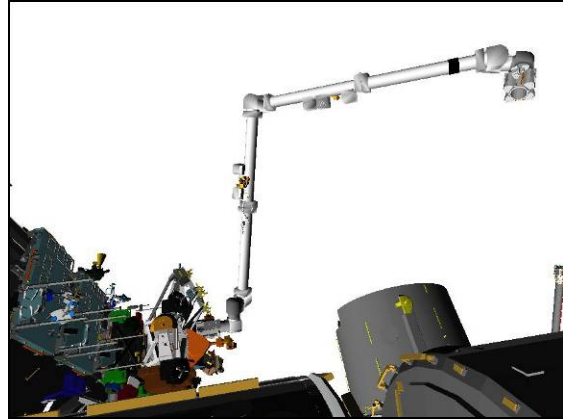


Figure 10.- JPM Clear
(13: LAB Stbd Zenith: -170, -35).

4. JOCAS TO EVA 3 START

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10
03: S1 Lower Outboard (+60, -15) Zoom: 7.5 mm	13: LAB Stbd Zenith (-170, -25)	22: Base Elbow (-140, 0)	Camera B (+10, +15)

MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

pick File ► EVA 3 ► EVA 3 Start

Verify 'Joint Angles' 'Destination' for EVA 3 Start position.

SR	SY	SP	EP	WP	WY	WR
+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0

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)	+225.0	+135.3	-94.0	-78.6	-106.2	+47.3	-71.2
TGT	+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
ERR	-34.5	+115.4	+1.4	-48.9	+50.7	+221.2	-304.2

6.402 JPM RELEASE TO EVA 3 START

(RBT FS/1J/FIN/SPN)

Page 7 of 8 pages

```

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

```

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

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

Verify SSRMS at EVA 3 Start position (within 5 cm/1 deg).

SR	SY	SP	EP	WP	WY	WR
+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
X	Y	Z	Pitch	Yaw	Roll	
+358	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

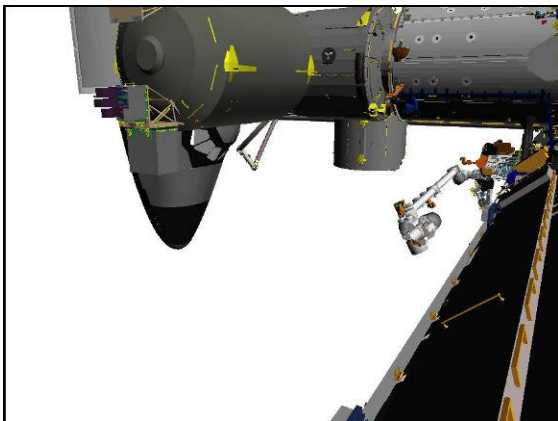


Figure 11.- EVA 3 Start
(03: S1 Lower Outboard: +60, -15)
Zoom: 7.5 mm.

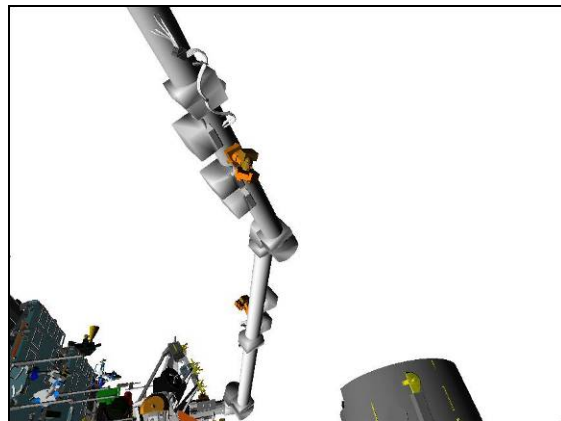


Figure 12.- EVA 3 Start
(13: LAB Stbd Zenith: -170, -25).

6.402 JPM RELEASE TO EVA 3 START

(RBT FS/1J/FIN/SPN)

Page 8 of 8 pages

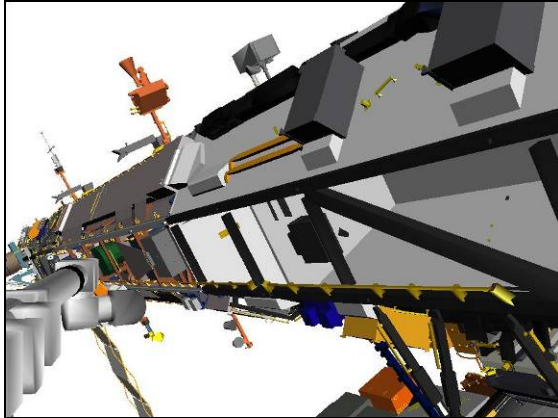


Figure 13.- EVA 3 Start
(22: Base Elbow: -140, 0).

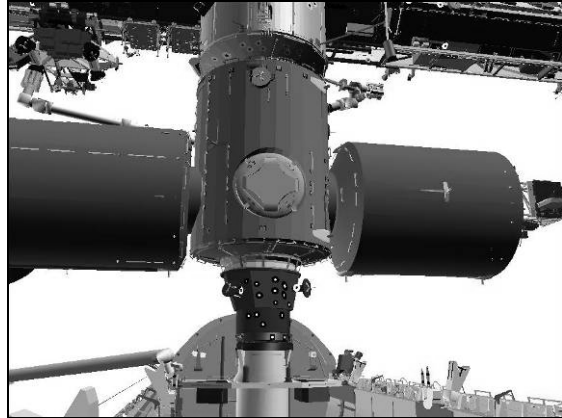


Figure 14.- EVA 3 Start
(V10: Camera B: +10, +15).

6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 1 of 7 pages

1. SETUP

Verify that the SRMS and the OBSS are in the Undock position.

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
03: S1 Lower Outboard (+70, -15) Zoom: 13 mm	22: Base Elbow (-80, -10)	13: LAB Stbd Zenith (-150, -35)	Camera B (0, +10)	SRMS Elbow (+130, +5)

Verify Unloaded Parameters – √

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

Change Display ► Node2 ► JPM PDGF (Verify Node2>JPM PDGF)

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

SR	SY	SP	EP	WP	WY	WR
+150.0	+60.0	-62.0	-135.0	-90.0	-163.0	0.0
X	Y	Z	Pitch	Yaw	Roll	
+192	-1500	-221	+162.5	-60.0	-32.9	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JPM PDGF					

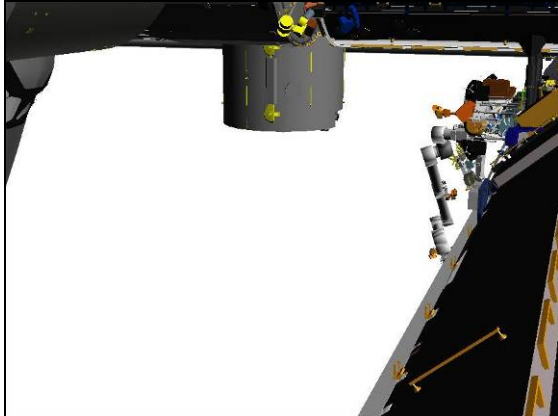


Figure 1.- Stage Park
(03: S1 Lower Outboard: +70, -15)
Zoom: 13 mm.

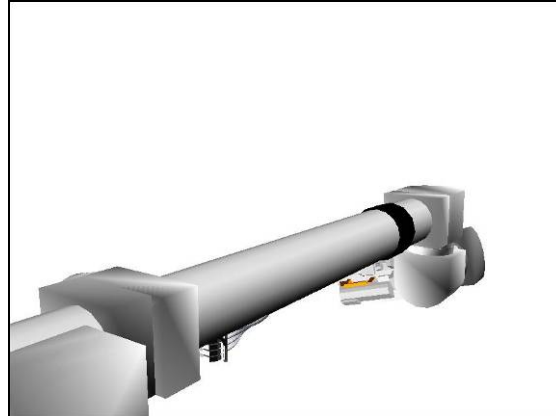


Figure 2.- Stage Park
(22: Base Elbow: -80, -10).

6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 2 of 7 pages

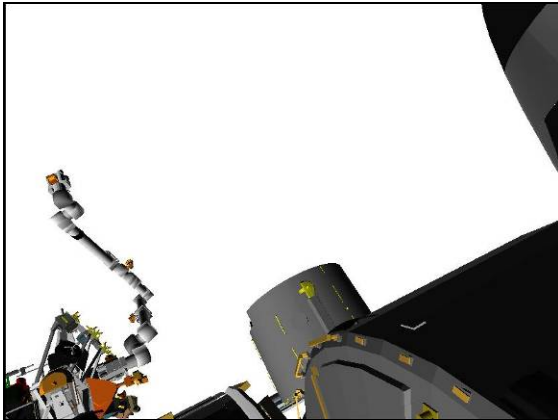


Figure 3.- Stage Park
(13: LAB Stbd Zenith: -150, -35).

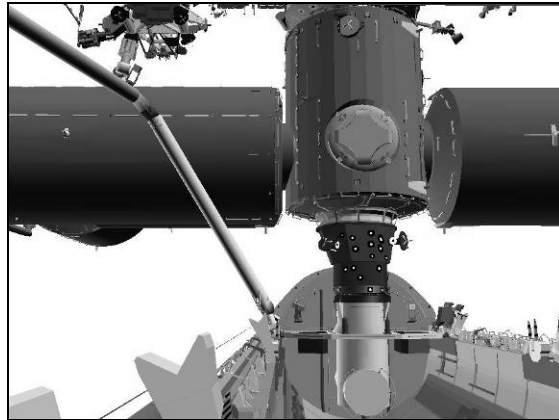


Figure 4.- Stage Park
(V10: Camera B: 0, +10).

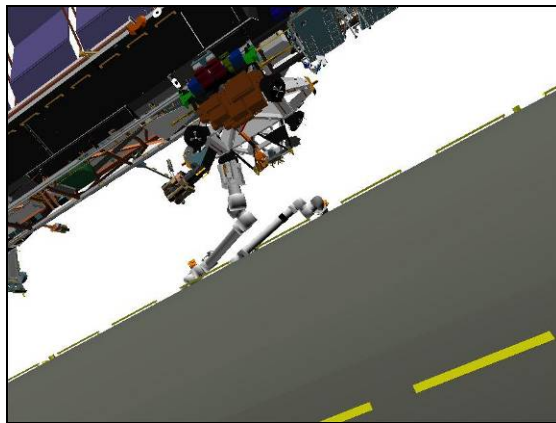


Figure 5.- Stage Park
(V10: SRMS Elbow: +130, +5).

2. JOCAS TO JPM PRE-GRAPPLE

NOTE

Expect a singularity warning during the following JOCAS.

DCP BRAKES SSRMS → OFF (Verify OFF)

√Vernier

PCS MSS: SSRMS:

Enter Mode – Joint OCAS (Verify blue)

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

SR	SY	SP	EP	WP	WY	WR
+196.6	+137.6	-155.1	-74.6	-98.2	+33.4	-91.4

6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 3 of 7 pages

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)	+150.0	+60.0	-62.0	-135.0	-90.0	-163.0	0.0
TGT	+196.6	+137.6	-155.1	-74.6	-98.2	+33.4	-91.4
ERR	-46.6	-77.6	+93.1	-60.4	+8.2	-196.4	+91.4

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)

DCP AUTO SEQ → PROC

PCS MSS: SSRMS:

Verify Posn Hold – orange

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

SR	SY	SP	EP	WP	WY	WR
+196.6	+137.6	-155.1	-74.6	-98.2	+33.4	-91.4
X	Y	Z	Pitch	Yaw	Roll	
-180	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JPM PDGF					

MSS: SSRMS:

Enter Mode – Standby (Verify blue)

6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 4 of 7 pages

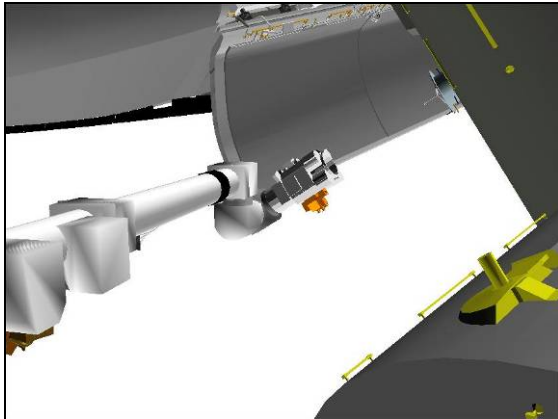


Figure 6.- JPM Pre-Grapple
(22: Base Elbow: -120, -10).

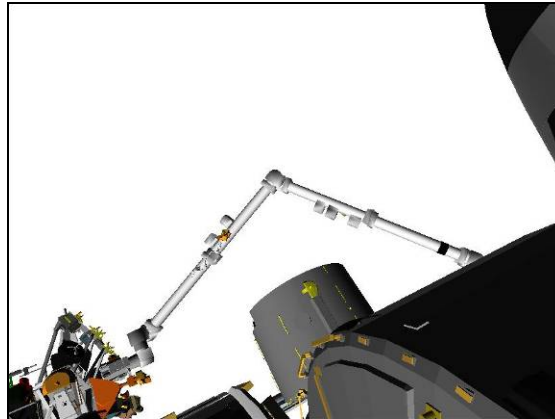


Figure 7.- JPM Pre-Grapple
(13: LAB Stbd Zenith: -150, -35).

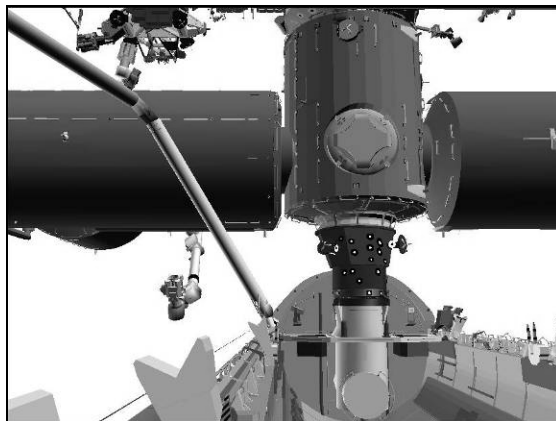


Figure 8.- JPM Pre-Grapple
(V10: Camera B: 0, +10).

3. JPM GRAPPLE

Configure Cameras and overlays as required.

Monitor 1	Monitor 2	Monitor 3	V10 L	V10 R
22: Base Elbow (-120, -10)	25: Tip LEE	13: LAB Stbd Zenith (-150, -35)	Camera B (0, +10)	SRMS Elbow (+130, +5)

NOTE

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

Change Loaded Parameters ► JPM ► JPM Mate CBCS SRH
Verify 'Loaded Parameters' (two) – JPM Mate CBCS, SR Held

Verify Command – SSRMS>Internal

6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN)

Page 5 of 7 pages

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

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)

√**MCC-H** - PDGF power inhibits confirmed

cmd 'Umbilical' Mate (Verify '**Confirm or Terminate**' prompt)

cmd Confirm (Verify RHC Trigger Hot icon)

Verify LEE Mode – Mate

6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE

(RBT FS/1J/FIN/SPN) Page 6 of 7 pages

RHC TRIGGER → press (momentarily)

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

4. GRAPPLE CLEANUP

DCP BRAKES SSRMS → ON (Verify ON)

Verify Loaded Parameters – √

Change Display ► Node2 ► JPM Mate CBCS (Verify Node2>JPM Mate CBCS)

√Command – SSRMS>Internal

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

Locked	SR	SY	SP	EP	WP	WY	WR
	+196.6	+132.0	-154.2	-88.7	-82.8	+38.2	-95.2
	X	Y	Z	Pitch	Yaw	Roll	
	0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SR Held						
Disp	Node2>JPM Mate CBCS						

Give MCC GO for JPM Power.

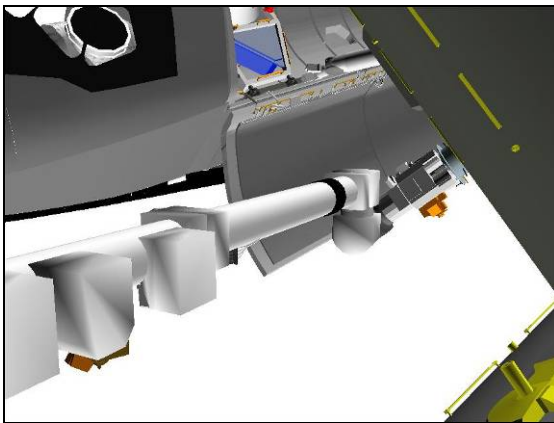


Figure 9.- JPM Grapple
(22: Base Elbow: -120, -10).

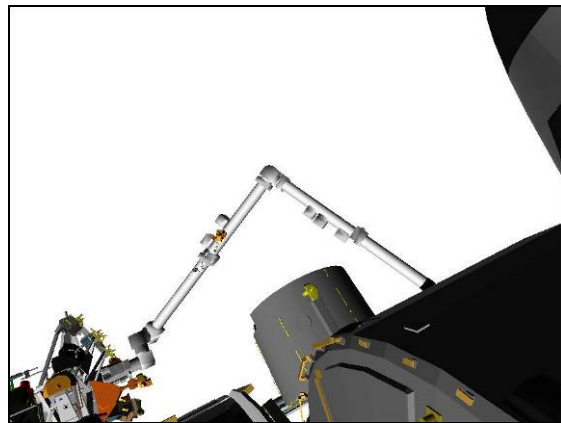


Figure 10.- JPM Grapple
(13: LAB Stbd Zenith: -150, -35).

6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE
(RBT FS/1J/FIN/SPN) Page 7 of 7 pages

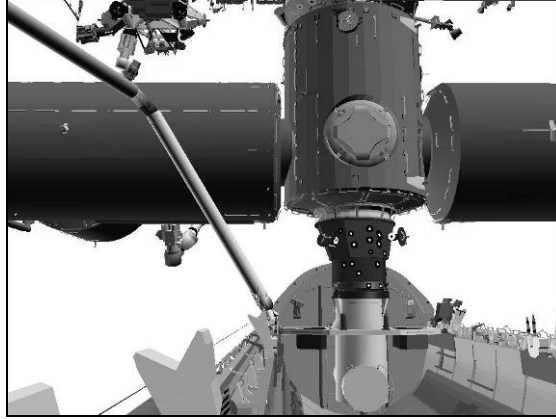


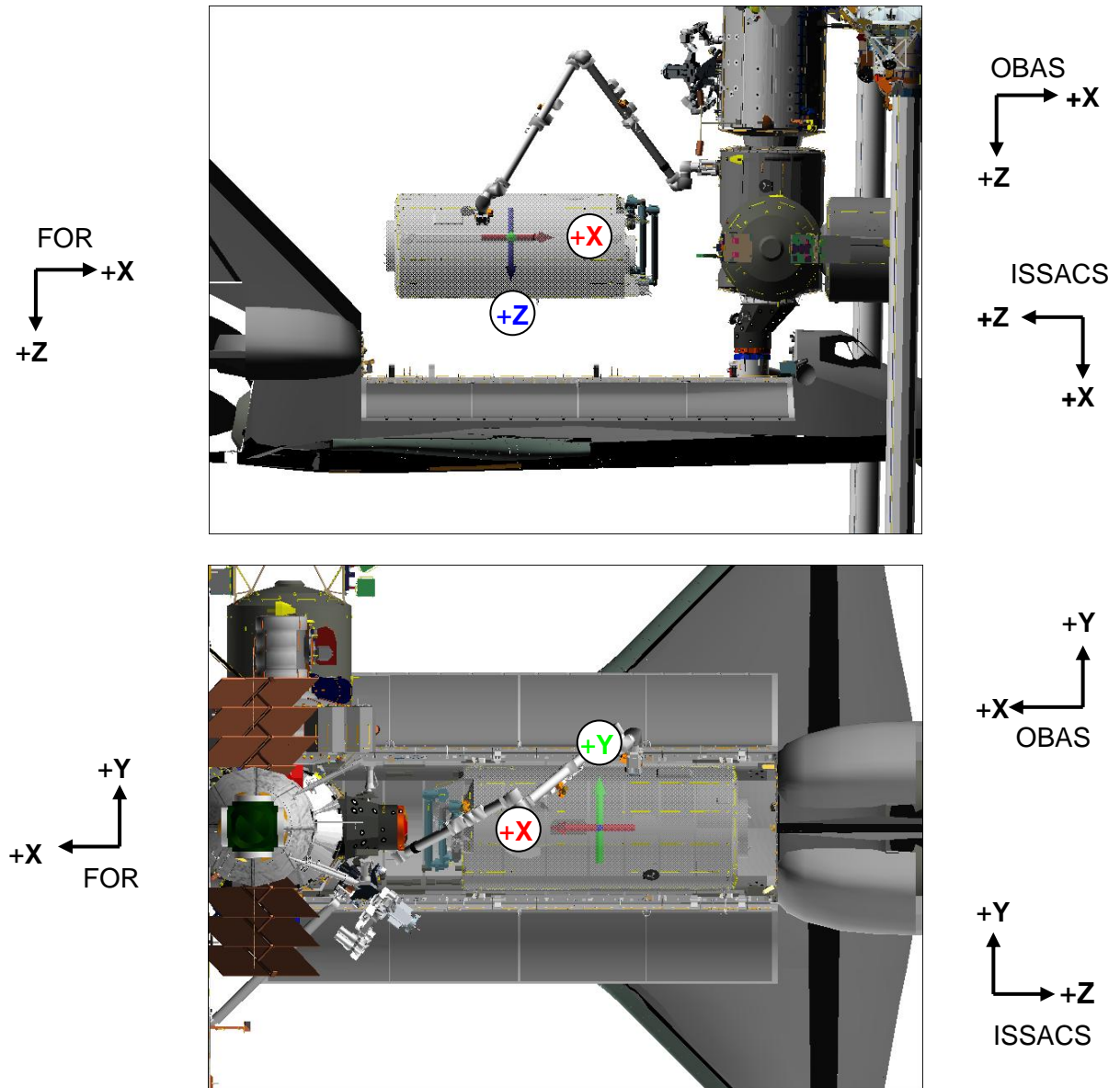
Figure 11.- JPM Grapple
(V10: Camera B: 0, +10).

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REFERENCE

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7.101 FRAME OF REFERENCE (FOR): JPM UNBERTH OBAS
 (RBT FS/1J/FIN) Page 1 of 1 page



Location:

Located at center of the plane formed by the four trunnion pins of the JEM-PM.
 Orientation matches OBAS when JPM is berthed in P/L Bay.

Table 1. SSRMS Loaded JPM Rate Limits

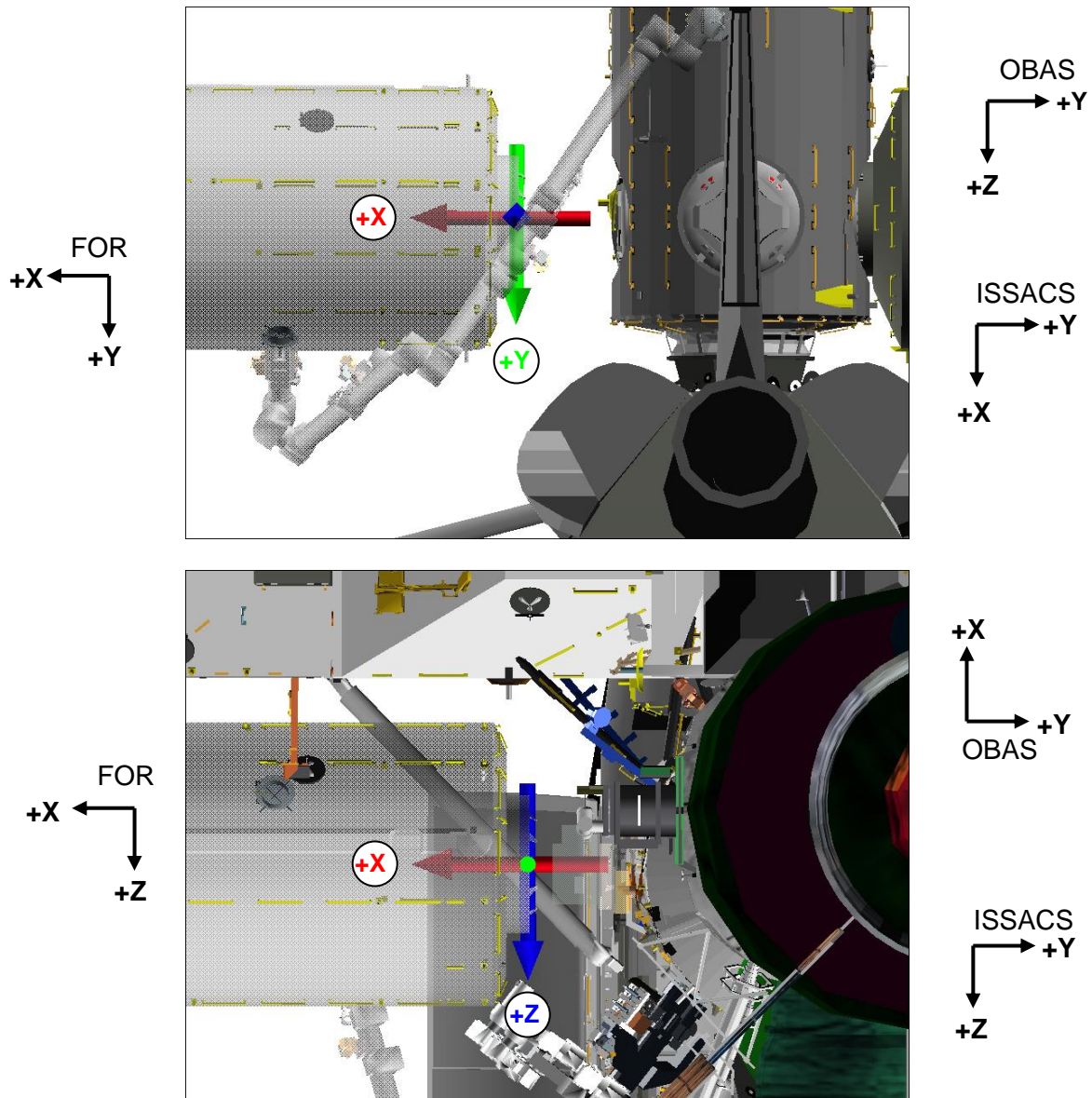
	Translation		Rotation		Pitch Plane		EP Linear Vel		All Joints	
	m/s	cm/s	Rad/s	Deg/s	Rad/s	Deg/s	m/s	cm/s	Rad/s	Deg/s
Coarse	0.023	2.3	0.003	0.172	0.008	0.458	0.15	15	0.007	0.401
Vernier	0.011	1.1	0.002	0.115	0.008	0.458	0.15	15	0.004	0.229

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7.102 FRAME OF REFERENCE (FOR): JPM MATE CBCS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

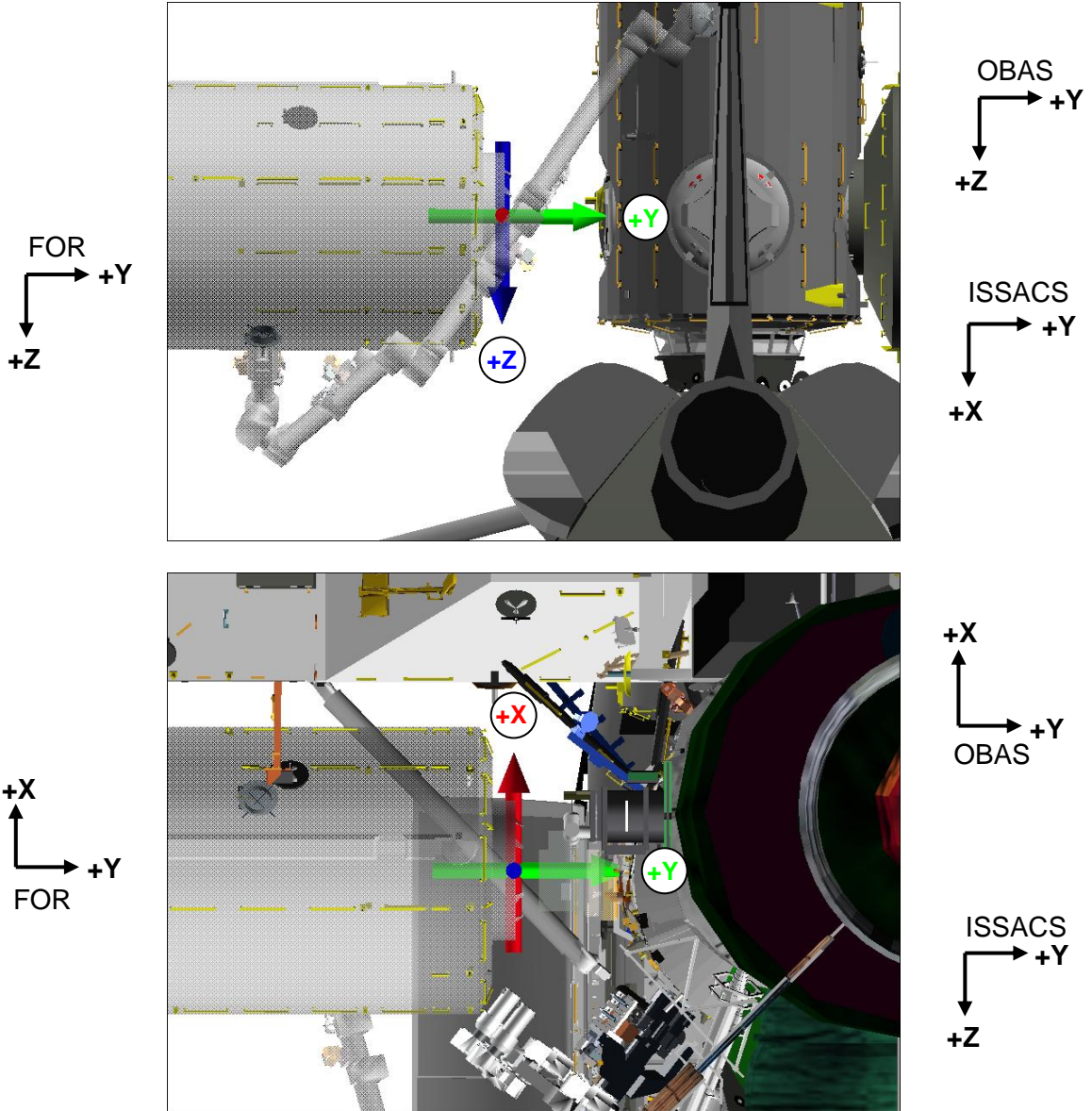
Located at the CBCS target origin when JPM is fully mated to Node 2 Port CBM. Orientation matches ISSACS yawed -90 degrees (+X into the payload and +Y ISS Fwd) when JPM is fully mated.

Table 1. SSRMS Loaded JPM Rate Limits

	Translation		Rotation		Pitch Plane		EP Linear Vel		All Joints	
	m/s	cm/s	Rad/s	Deg/s	Rad/s	Deg/s	m/s	cm/s	Rad/s	Deg/s
Coarse	0.023	2.3	0.003	0.172	0.008	0.458	0.15	15	0.007	0.401
Vernier	0.011	1.1	0.002	0.115	0.008	0.458	0.15	15	0.004	0.229

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7.103 FRAME OF REFERENCE (FOR): JPM MATE OBAS
 (RBT FS/1J/FIN) Page 1 of 1 page



Location:

Located at the CBM geometrical center when JPM is fully mated to Node 2 Port CBM.
 The orientation matches OBAS when JPM is fully mated.

Table 1. SSRMS Loaded JPM Rate Limits

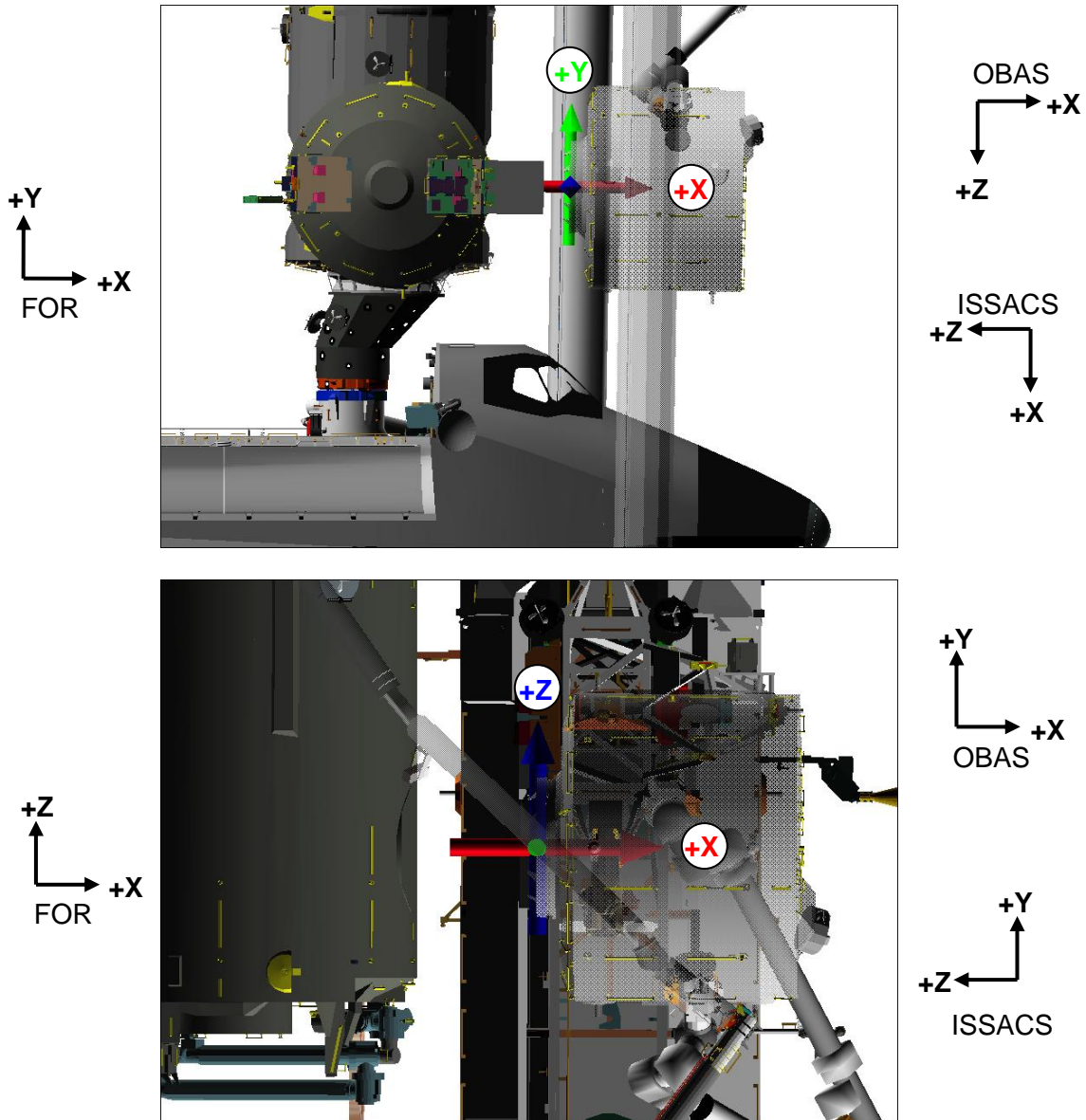
	Translation		Rotation		Pitch Plane		EP Linear Vel		All Joints	
	m/s	cm/s	Rad/s	Deg/s	Rad/s	Deg/s	m/s	cm/s	Rad/s	Deg/s
Coarse	0.023	2.3	0.003	0.172	0.008	0.458	0.15	15	0.007	0.401
Vernier	0.011	1.1	0.002	0.115	0.008	0.458	0.15	15	0.004	0.229

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7.104 FRAME OF REFERENCE (FOR): JLP MATE CBCS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

Located at the CBCS target origin when JLP is fully mated to Node 2 Zenith CBM.

Orientation is such that when JLP is fully mated to Node 2 Zenith CBM:

- +X = -Z ISSACS,
- +Y = -X ISSACS,
- +Z = +Y ISSACS.

Table 1. SSRMS Loaded JLP Rate Limits

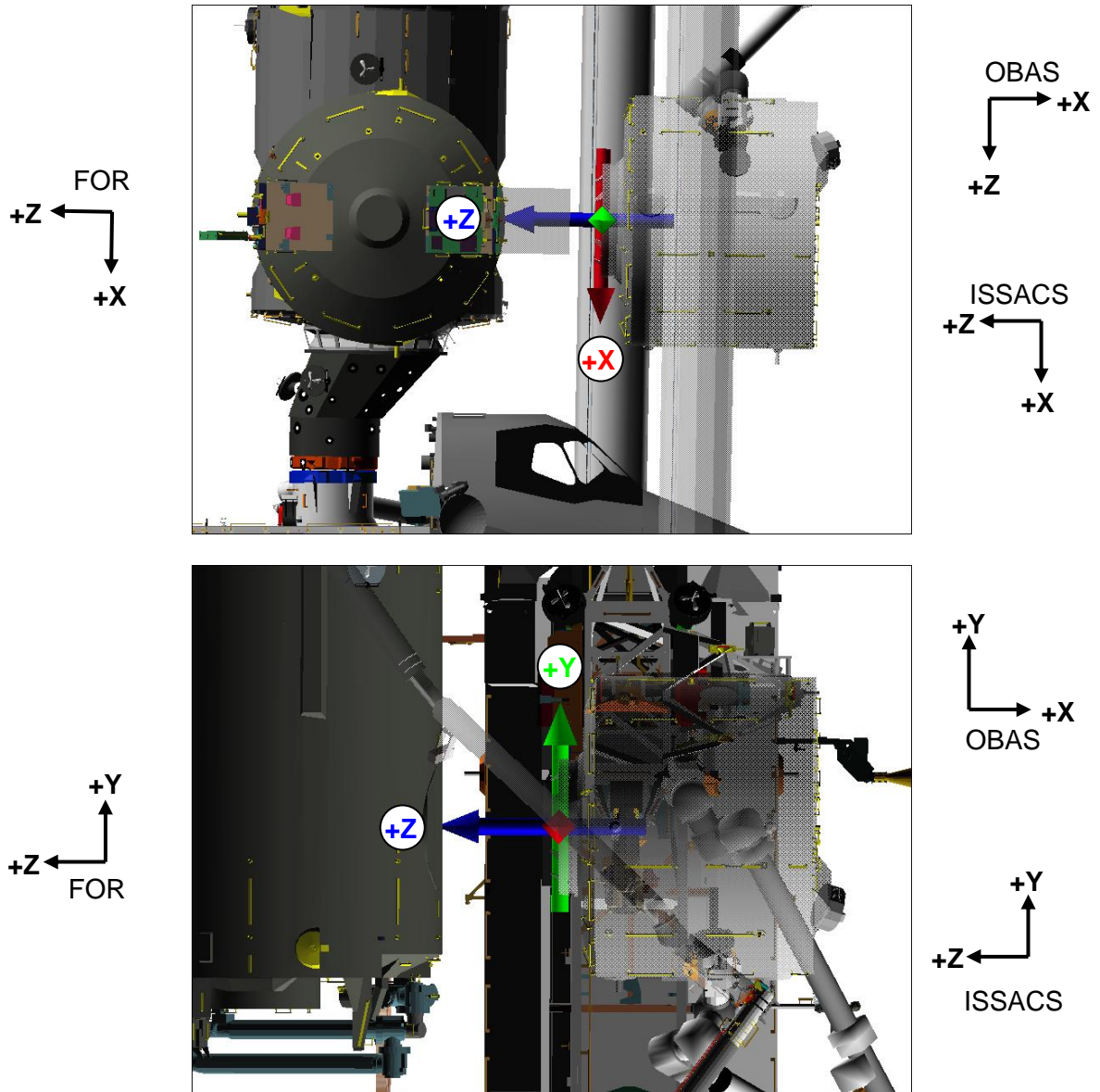
	Translation		Rotation		Pitch Plane		EP Linear Vel		All Joints	
	m/s	cm/s	Rad/s	Deg/s	Rad/s	Deg/s	m/s	cm/s	Rad/s	Deg/s
Coarse	0.044	4.4	0.006	0.344	0.012	0.688	0.15	15	0.016	0.917
Vernier	0.022	2.2	0.003	0.172	0.012	0.688	0.15	15	0.008	0.458

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7.105 FRAME OF REFERENCE (FOR): JLP MATE ISSACS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

Located at the CBM geometrical center when JLP is fully mated to Node 2 Zenith CBM. The orientation matches ISSACS when JLP is fully mated to the JPM Zenith CBM.

Table 1. SSRMS Loaded JLP Rate Limits

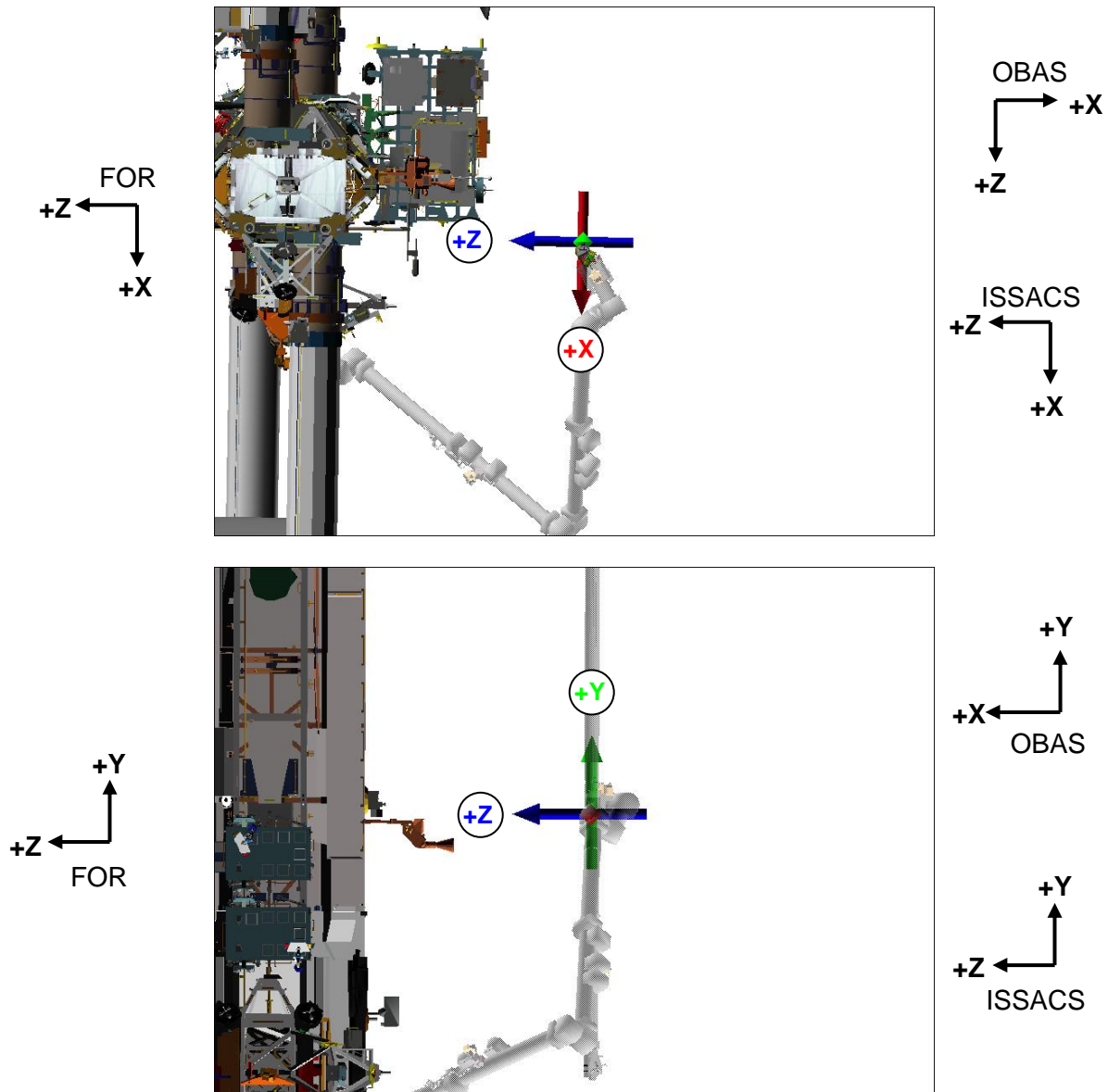
	Translation		Rotation		Pitch Plane		EP Linear Vel		All Joints	
	m/s	cm/s	Rad/s	Deg/s	Rad/s	Deg/s	m/s	cm/s	Rad/s	Deg/s
Coarse	0.044	4.4	0.006	0.344	0.012	0.688	0.15	15	0.016	0.917
Vernier	0.022	2.2	0.003	0.172	0.012	0.688	0.15	15	0.008	0.458

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7.106 FRAME OF REFERENCE (FOR): OBSS MNVR ISSACS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

Located at the midpoint of the middle striker bar centerline of the OBSS when the OBSS is stowed on S1.

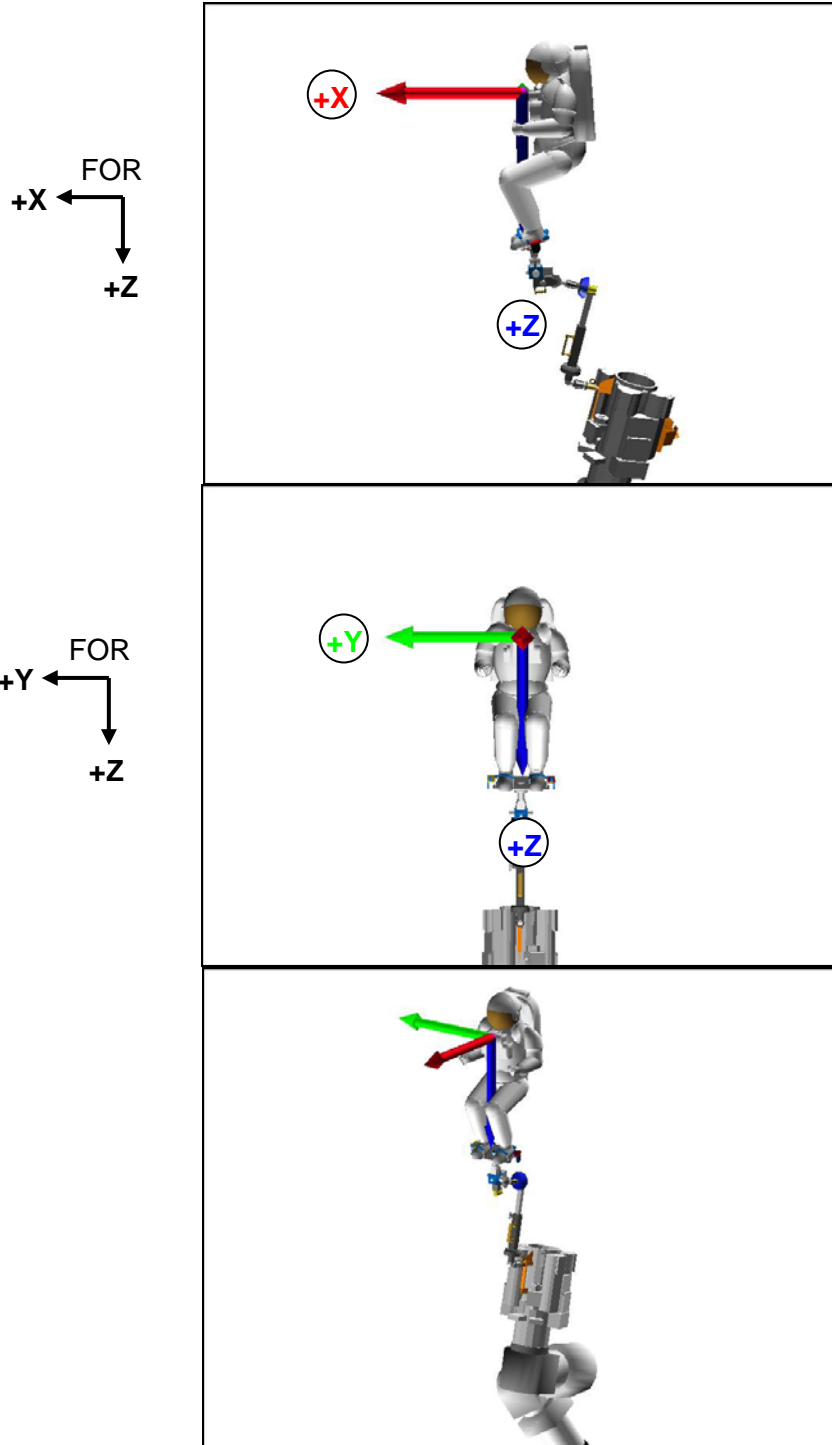
Orientation matches ISSACS when OBSS stowed on S1.

Table 1. SSRMS Loaded OBSS Rate Limits

	Translation		Rotation		Pitch Plane		EP Linear Vel		SR to EP	
	m/s	cm/s	Rad/s	Deg/s	Rad/s	Deg/s	m/s	cm/s	Rad/s	Deg/s
Coarse	0.130	13.02	0.018	1.031	0.017	0.974	0.256	25.61	0.035	2.005
Vernier	0.065	6.510	0.009	0.516	0.017	0.974	0.256	25.61	0.017	0.974

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7.107 FRAME OF REFERENCE (FOR): CHEST WIF 12/NN/F/6
(RBT FS/1J/FIN) Page 1 of 1 page



Location:

Located at center of the EVA chest.

WIF extender settings are 6/A/7, and APFR settings are 12/NN/F/6.

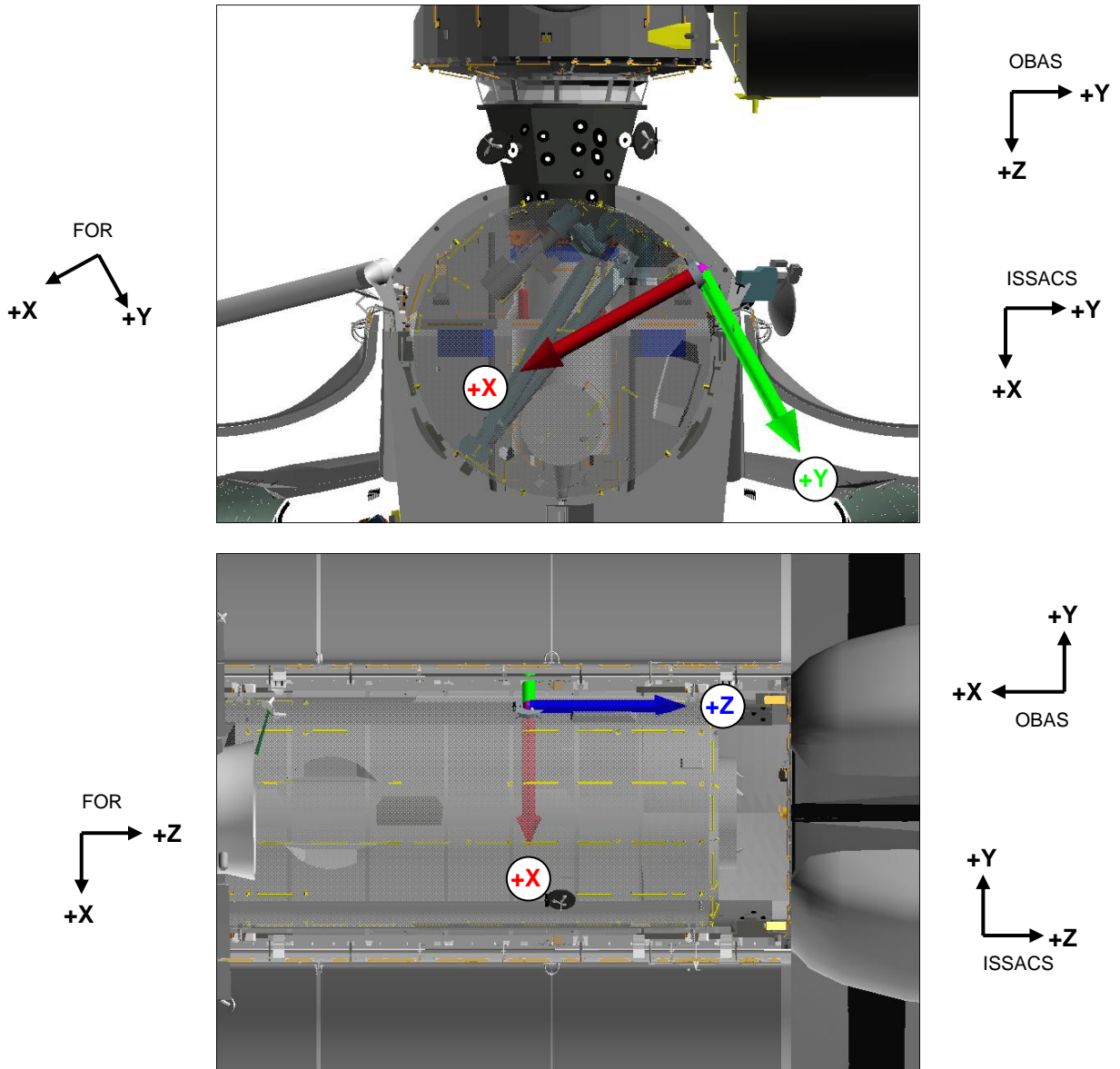
From the perspective of the EVA crewmember, +X points out (from chest to arms),

+Y points right and +Z points down (from head to feet)

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7.201 DISPLAY FRAME: ORBITER>JPM PDGF

(RBT FS/1J/FIN) Page 1 of 1 page



Location:

Located at JPM PDGF origin when JPM is berthed in Cargo Bay.

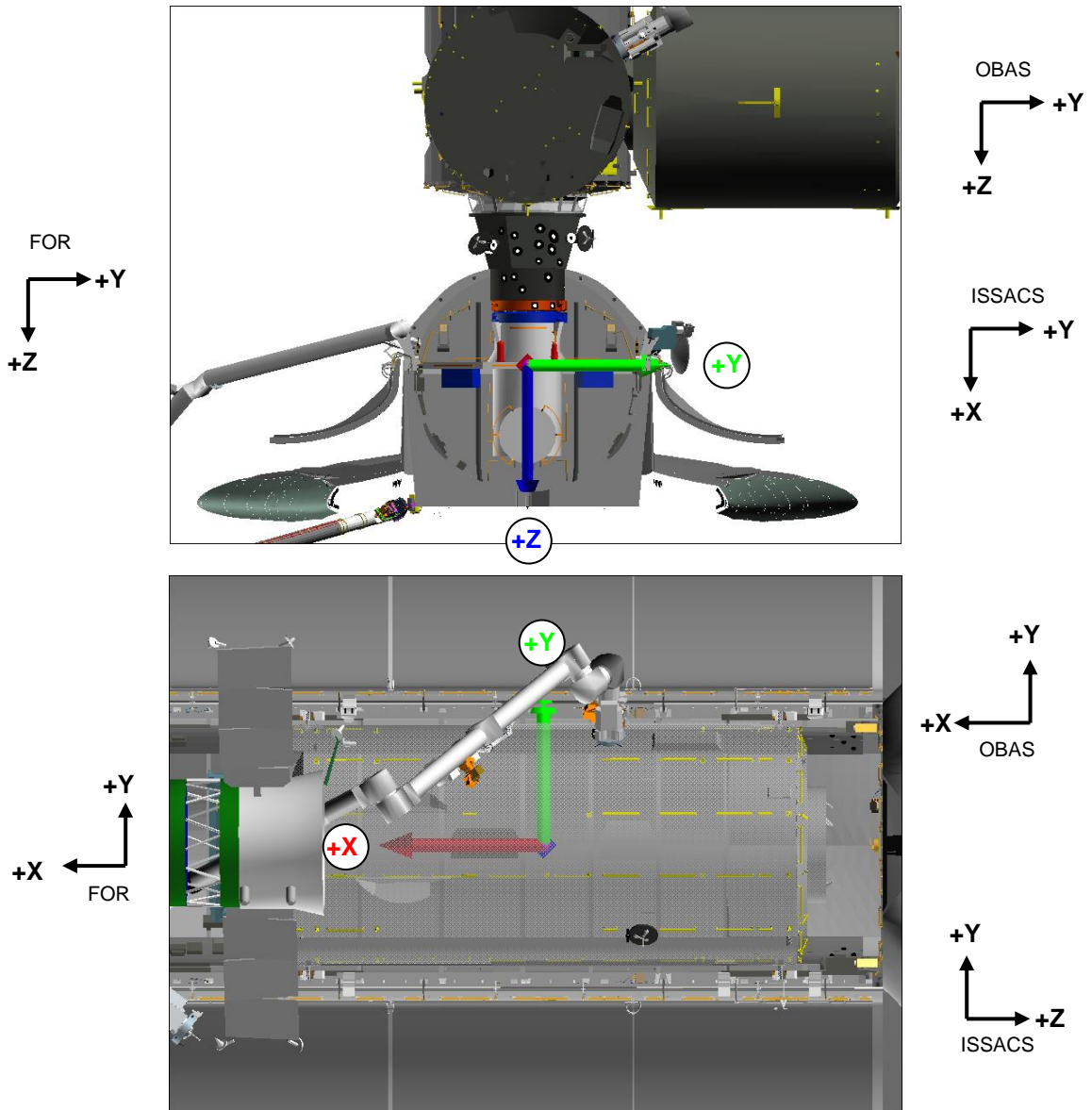
Orientation matches EEOCS when SSRMS TIP LEE is grappled at the JPM PDGF and when JPM is berthed in Cargo Bay.

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7.202 DISPLAY FRAME: ORBITER>JPM UNBERTH OBAS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

Located at JPM Trunnion plane center, midway between FWD and AFT trunnion pins, at trunnion level, when JPM is berthed in Cargo Bay.

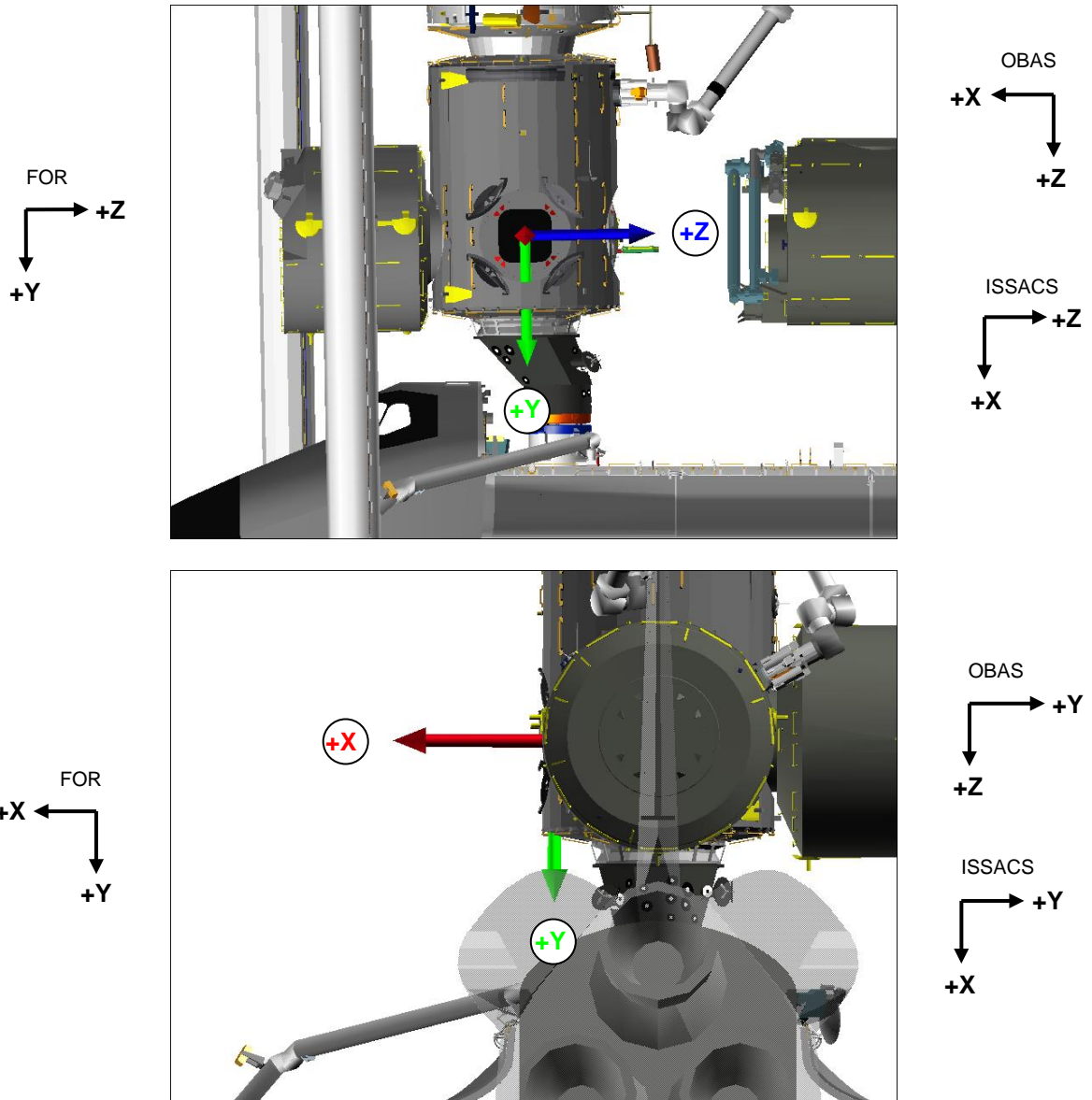
Orientation matches OBAS when JPM is berthed in P/L Bay.

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7.203 DISPLAY FRAME: NODE2>JPM MATE CBCS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

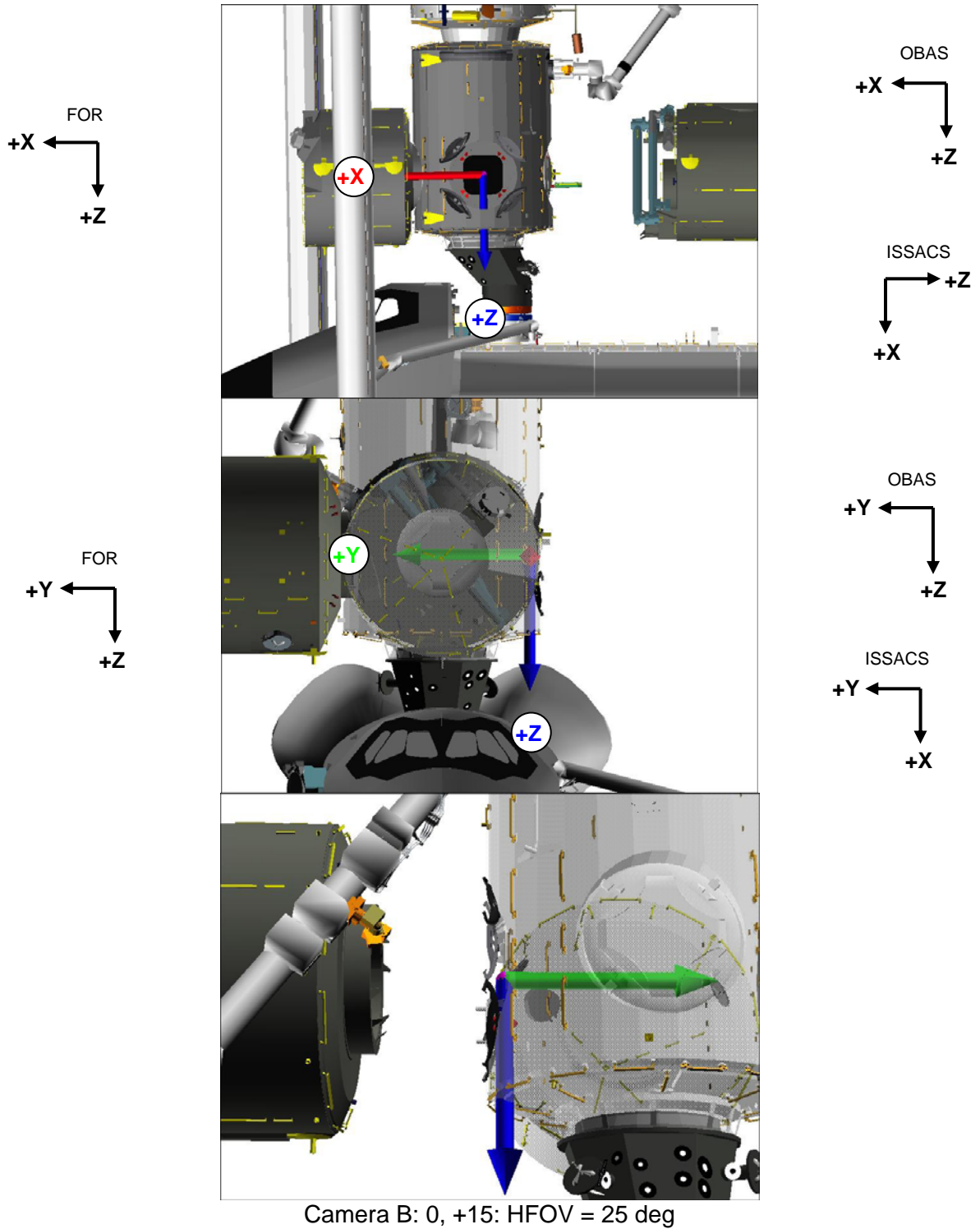
Located at the CBCS target origin when JPM is fully mated to Node 2 Port CBM. Orientation matches ISSACS yawed -90 degrees (+X into the payload and +Y ISS Fwd) when JPM is fully mated.

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7.204 DISPLAY FRAME: NODE2>JPM MATE OBAS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

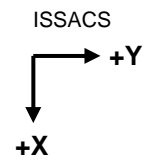
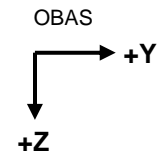
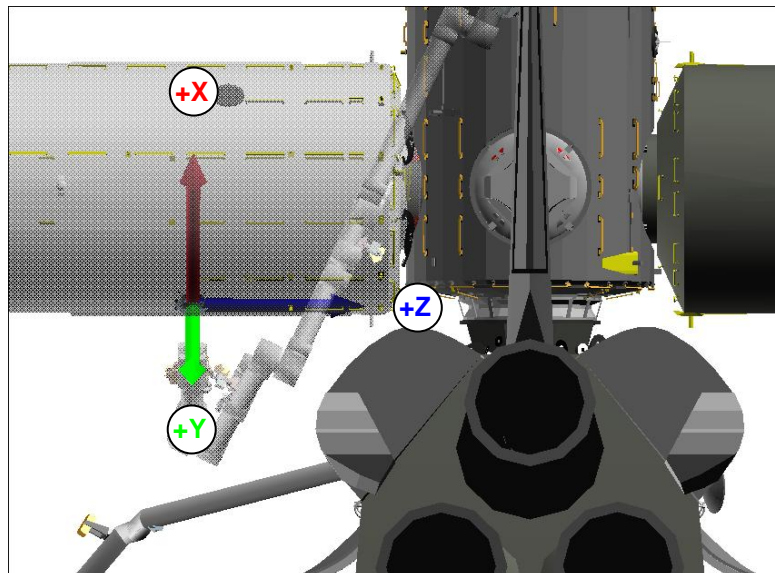
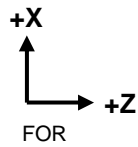
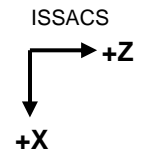
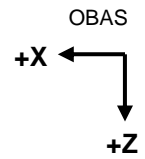
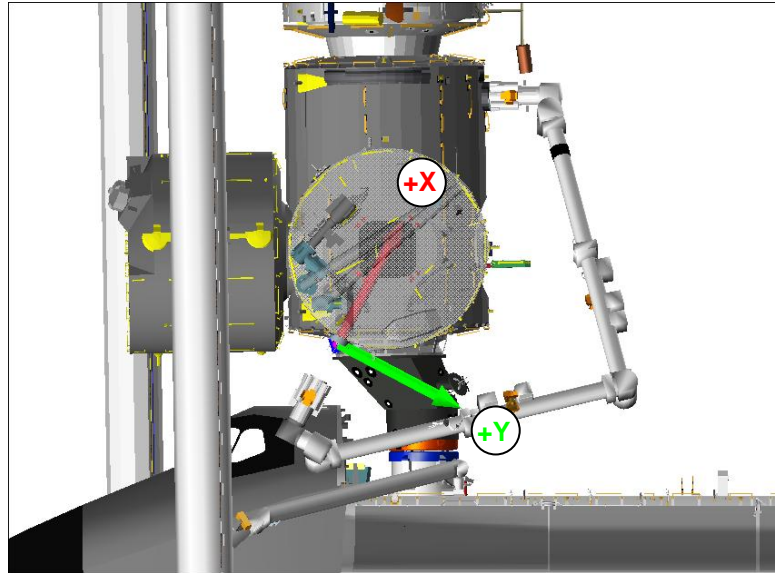
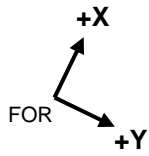
Located at the CBM geometrical center when JPM is fully mated to Node 2 Port CBM. Orientation matches OBAS when JPM is fully mated.

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7.205 DISPLAY FRAME: NODE2>JPM PDGF

(RBT FS/1J/FIN)

Page 1 of 1 page

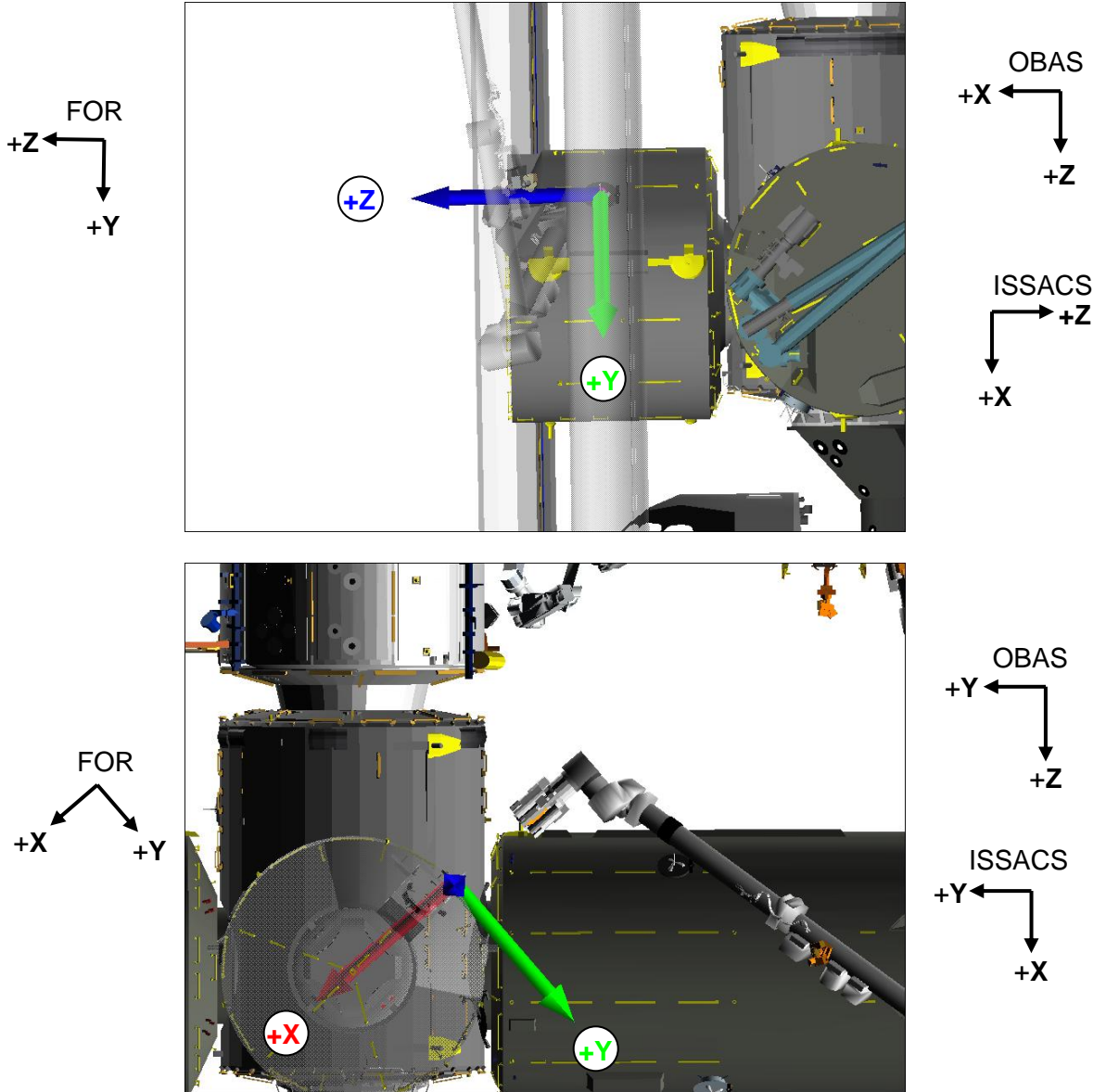


Location:

Located at JPM PDGF origin when JPM is mated to Node 2 Port CBM.

Orientation matches EEOCS when SSRMS TIP LEE is grappled at the JPM PDGF and when JPM is mated to Node 2 Port CBM.

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Location:

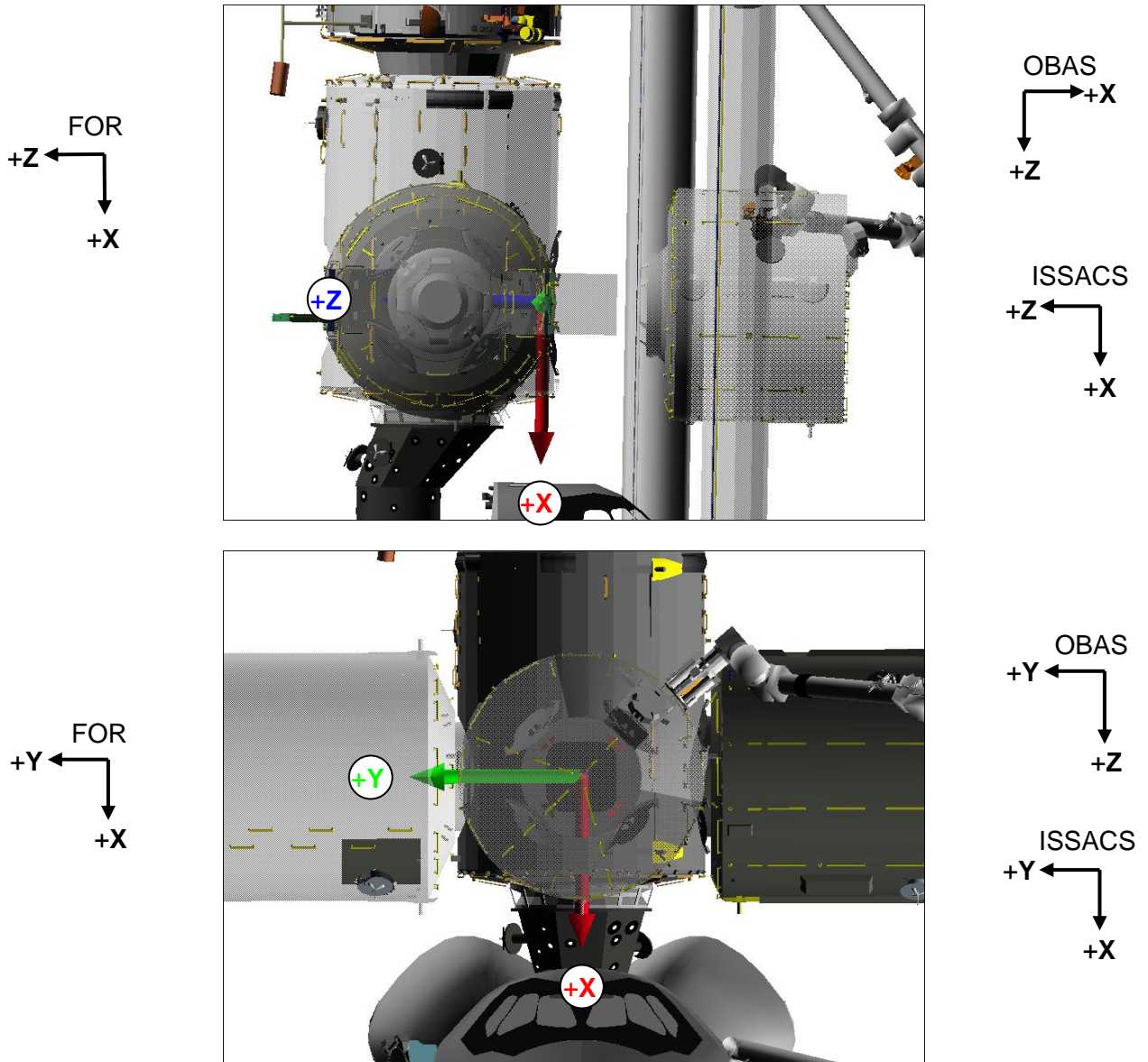
Located at JLP Port FRGF (FRGF 2) origin when JLP is mated to Node 2 Zenith CBM.
 Orientation matches EEOCS when SSRMS TIP LEE is grappled at the JLP FRGF when JLP is mated to Node 2 Zenith CBM.

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7.207 DISPLAY FRAME: NODE2>JLP DEMATE ISSACS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

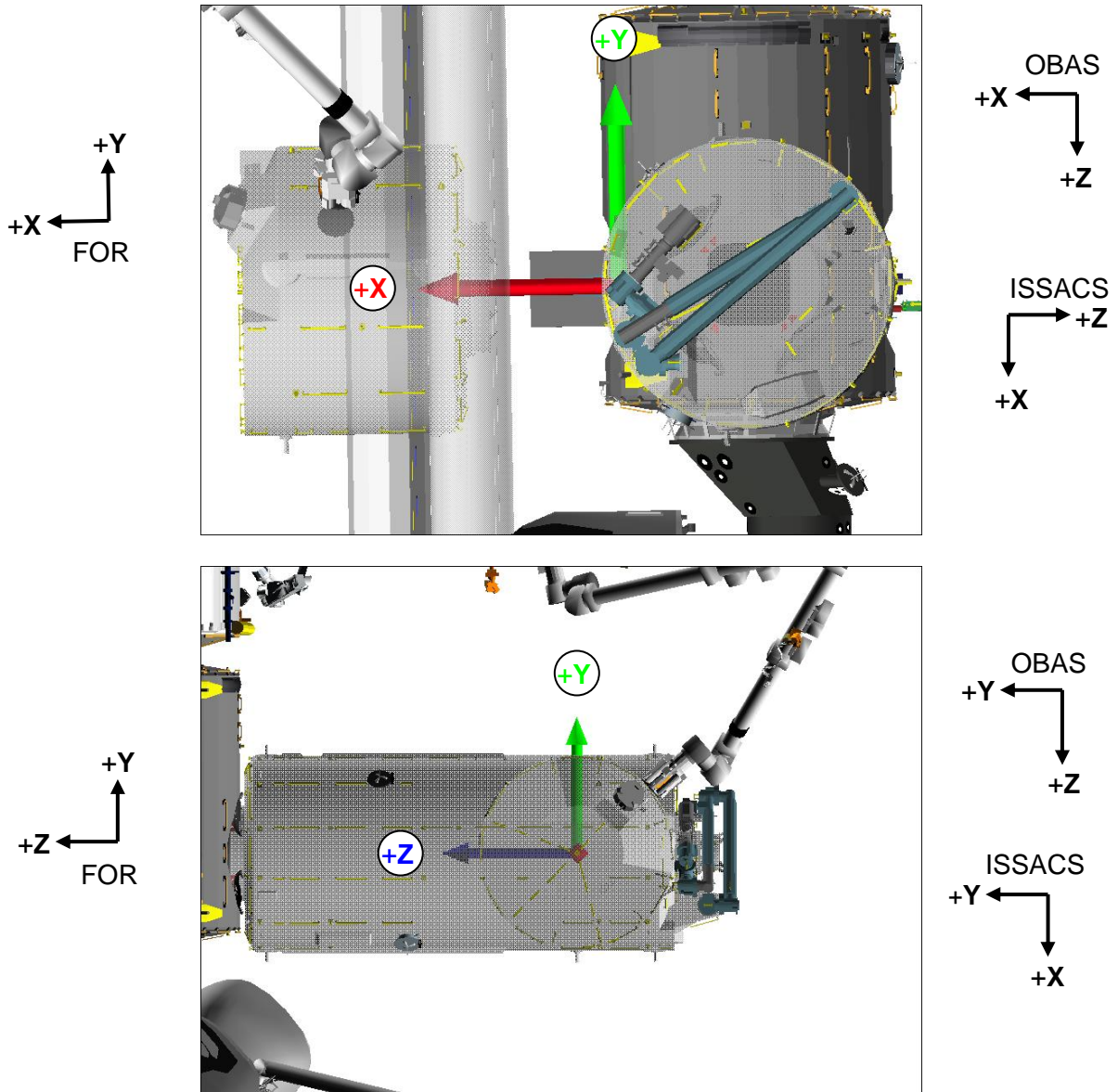
Located at the CBM geometrical center when JLP is fully mated to Node 2 Zenith CBM. Orientation matches ISSACS when JLP is fully mated to Node 2 Zenith CBM.

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7.208 DISPLAY FRAME: JPM>JLP MATE CBCS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

Located at the CBCS target origin when JLP is fully mated to the JPM Zenith CBM.

Aligned so that when JLP is fully mated to the JPM Zenith CBM:

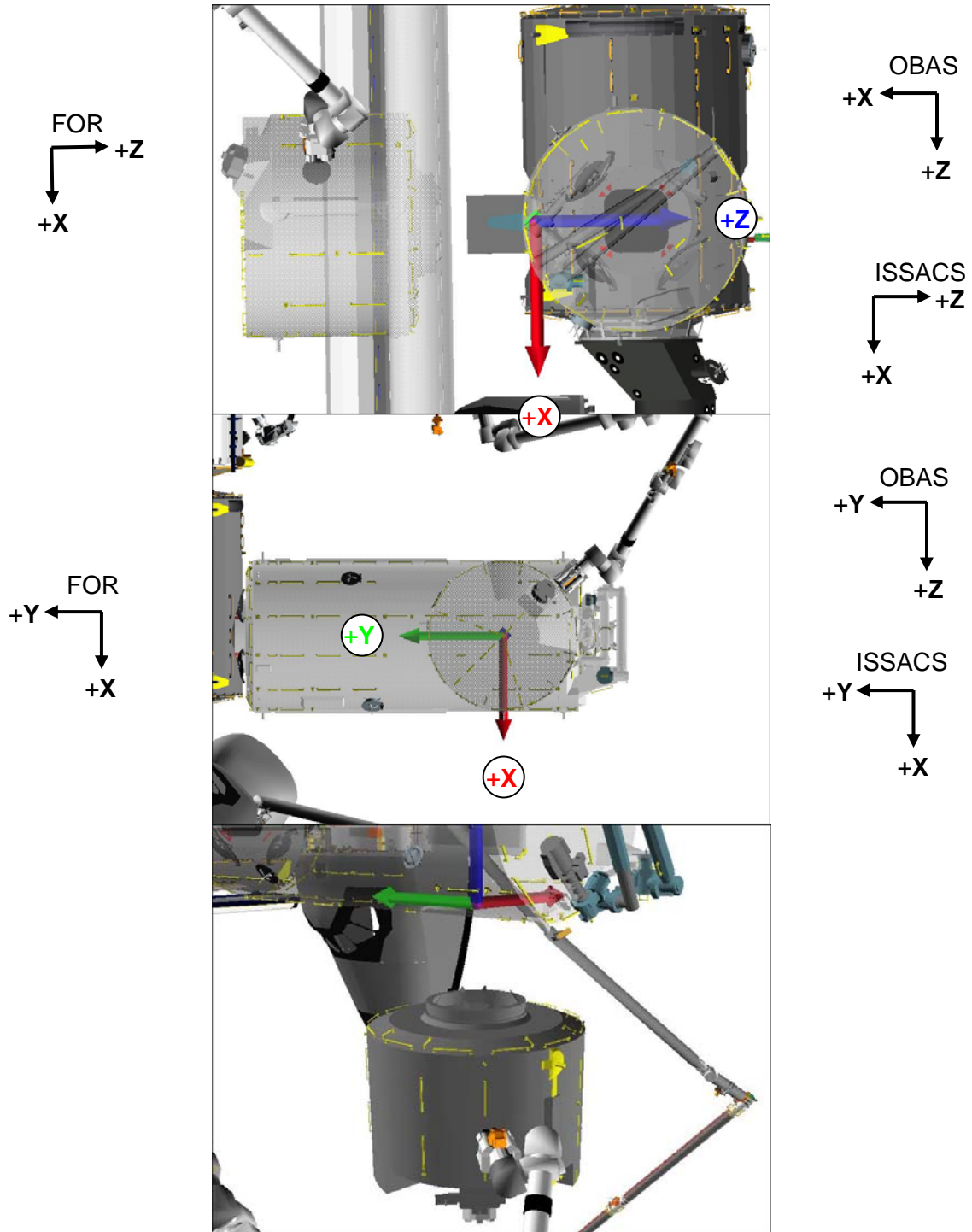
- +X = -Z ISSACS
- +Y = -X ISSACS
- +Z = +Y ISSACS.

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7.209 DISPLAY FRAME: JPM>JLP MATE ISSACS

(RBT FS/1J/FIN)

Page 1 of 1 page



09: P1 Lower Outboard: +140, -15: Zoom = 11 mm

Location:

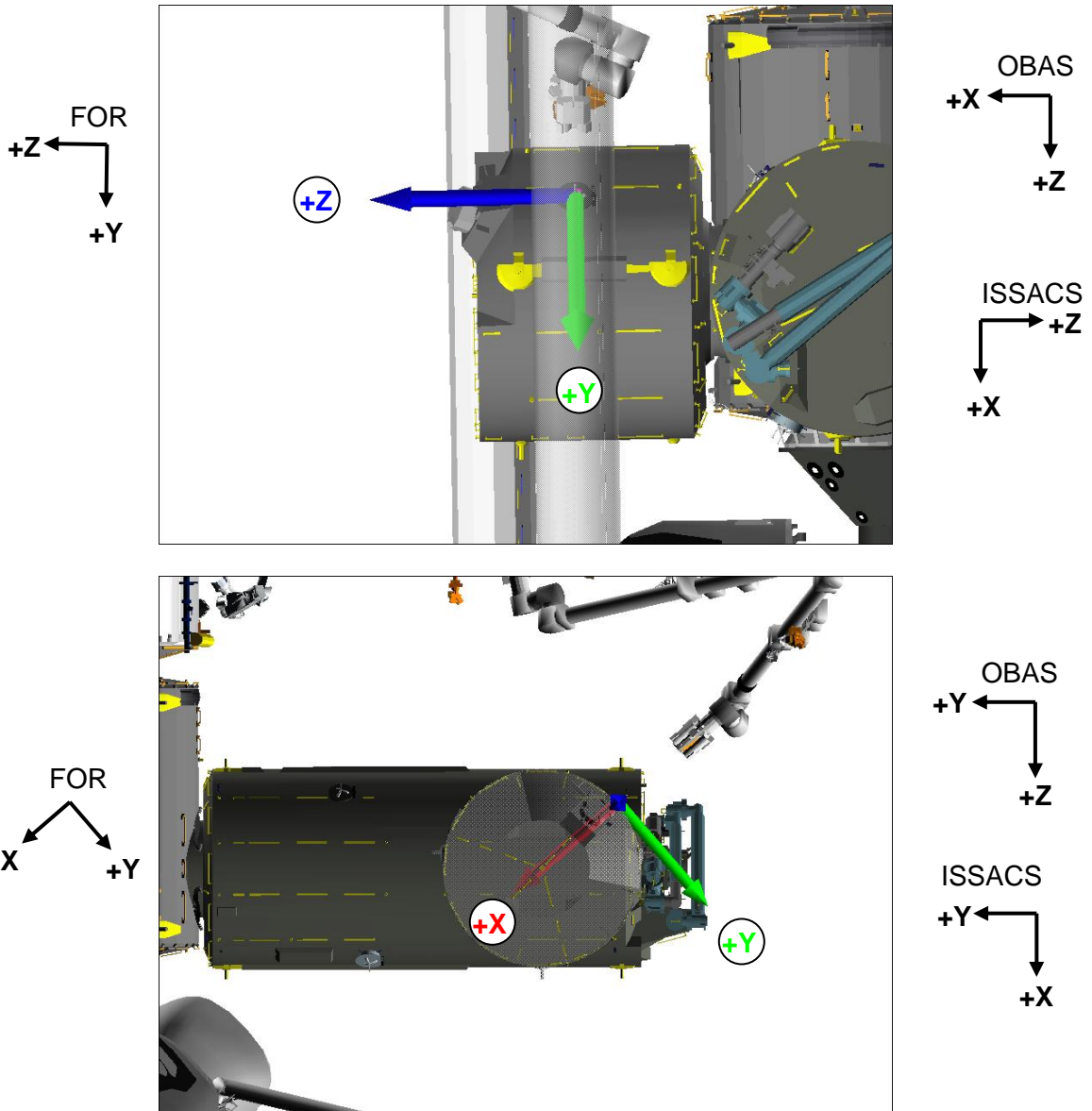
Located at the CBM geometrical center when JLP is fully mated to the JPM Zenith CBM. Orientation matches ISSACS when JLP is fully mated to the JPM Zenith CBM.

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7.210 DISPLAY FRAME: JPM>JLP PORT FRGF

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

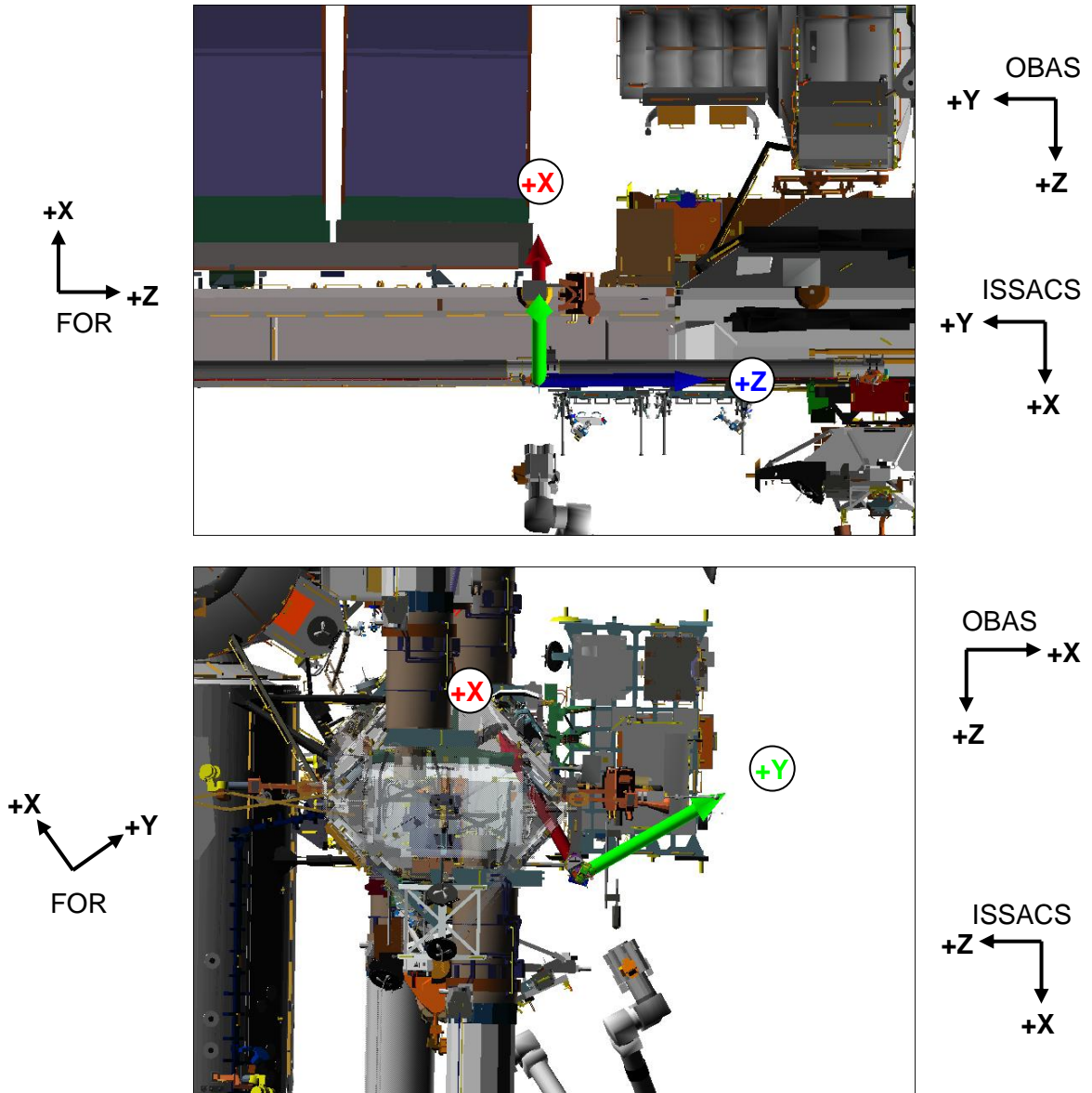
Located at JLP Port FRGF (FRGF 2) origin when JLP is mated to JPM CBM.

Orientation matches EEOCS when SSRMS TIP LEE is grappled at the JLP Port FRGF (FRGF 2) when JLP is mated to JPM Zenith CBM.

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7.211 DISPLAY FRAME: S1>OBSS FRGF

(RBT FS/1J/FIN) Page 1 of 1 page



Location:

Located at OBSS FRGF origin when OBSS is stowed on S1.

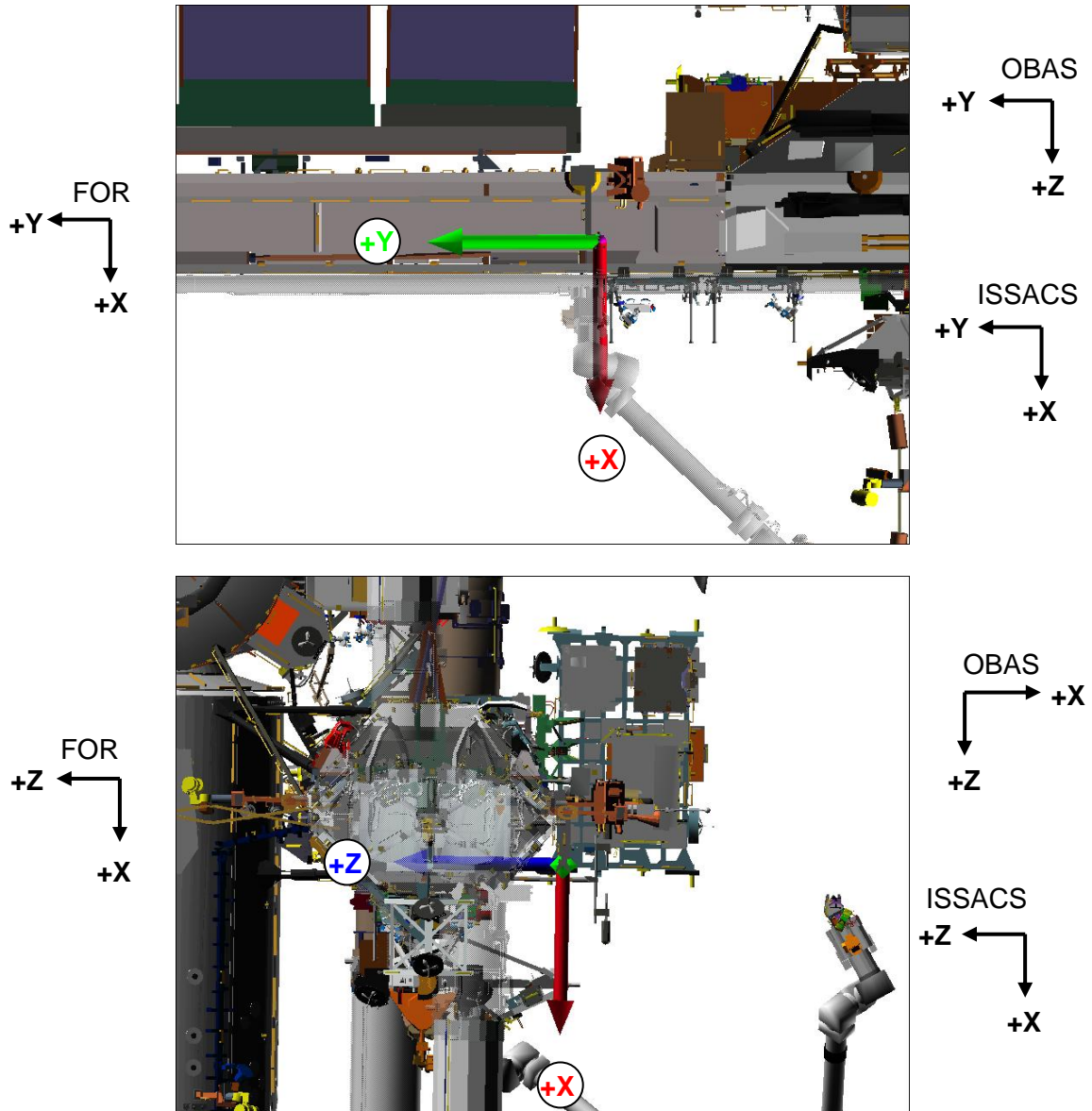
Orientation matches EEOCS when SSRMS TIP LEE is grappled to the OBSS FRGF, when the OBSS is stowed on S1.

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7.212 DISPLAY FRAME: S1>OBSS UNSTOW ISSACS

(RBT FS/1J/FIN)

Page 1 of 1 page



Location:

Located on S1 between the two S1 trunnions when OBSS is stowed on S1.
Orientation matches ISSACS when OBSS is stowed on S1.

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7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 1 of 13 pages

1.101 MNVR TO OBSS GRAPPLE

Park

SR	SY	SP	EP	WP	WY	WR
-106.2	-159.4	-137.5	+122.2	-86.0	-36.0	-10.7
X	Y	Z	Pitch	Yaw	Roll	
-279	+89	-44	+124.4	+44.5	+160.6	
FOR	Unloaded – LEE Tip, SY Held					
Disp	S1>OBSS FRGF					

OBSS Pre-Grapple

SR	SY	SP	EP	WP	WY	WR
-106.2	-159.4	-137.5	+122.2	-147.0	-181.2	-10.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	S1>OBSS FRGF					

1.102 OBSS UNBERTH AND HANDOFF

OBSS Grapple

SR	SY	SP	EP	WP	WY	WR
-106.0	-159.4	-124.9	+121.7	-159.3	-181.3	-10.4
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – OBSS Mnvr ISSACS, SY Held					
Disp	S1>OBSS Unstow ISSACS					

Cable Removal

SR	SY	SP	EP	WP	WY	WR
-104.1	-159.4	-129.7	+123.0	-156.5	-181.8	-8.8
X	Y	Z	Pitch	Yaw	Roll	
+50	0	0	0.0	0.0	0.0	
FOR	Loaded – OBSS Mnvr ISSACS, SY Held					
Disp	S1>OBSS Unstow ISSACS					

JOCAS Start

SR	SY	SP	EP	WP	WY	WR
-131.0	-159.4	-126.7	+98.1	-126.1	-172.6	-32.3
X	Y	Z	Pitch	Yaw	Roll	
+50	0	-500	0.0	0.0	0.0	
FOR	Loaded – OBSS Mnvr ISSACS, SY Held					
Disp	S1>OBSS Unstow ISSACS					

OBSS Handoff

SR	SY	SP	EP	WP	WY	WR
-194.9	+4.8	-74.4	+92.7	-109.6	-3.3	-147.6
X	Y	Z	Pitch	Yaw	Roll	
+1247	-1058	-638	-104.4	-8.5	+40.7	
FOR	Loaded – OBSS Mnvr ISSACS, SY Held					
Disp	S1>OBSS Unstow ISSACS					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 2 of 13 pages

1.103 OBSS UNGRAPPLE TO NODE 2 GRAPPLE

Back-Off

SR	SY	SP	EP	WP	WY	WR
-194.9	+5.4	-68.0	+100.1	-123.4	-3.3	-148.2
X	Y	Z	Pitch	Yaw	Roll	
+1370	-119	-666	+98.4	-11.3	+49.8	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

Intermediate

SR	SY	SP	EP	WP	WY	WR
0.0	+125.0	+108.0	+77.0	-122.1	-75.0	+50.0
X	Y	Z	Pitch	Yaw	Roll	
+1357	-334	-851	-48.4	-55.1	+17.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>PDGF					

Node 2 Approach

SR	SY	SP	EP	WP	WY	WR
+7.2	+118.2	+206.9	+81.4	-31.5	-176.0	+195.4
X	Y	Z	Pitch	Yaw	Roll	
-110	-47	-180	-11.3	+3.0	+1.1	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>PDGF					

Node 2 Pre-Grapple

SR	SY	SP	EP	WP	WY	WR
+7.2	+118.2	+218.6	+81.4	-31.5	-176.0	+195.4
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>PDGF					

Node 2 Grapple

SR	SY	SP	EP	WP	WY	WR
+7.2	+122.8	+208.2	+97.9	-37.2	-175.9	+200.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – Node 2 PDGF, SR Held					
Disp	Node2>PDGF					

2.101 MNVR TO JPM GRAPPLE

MBS PDGF 3 Grapple

SR	SY	SP	EP	WP	WY	WR
+200.0	+175.9	-37.2	+97.9	+208.2	-122.8	+7.2
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – MBS PDGF 3, SR Held					
Disp	MBS>PDGF 3					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 3 of 13 pages

MBS PDGF 3 Release

SR	SY	SP	EP	WP	WY	WR
+200.0	+183.3	-44.4	+100.8	+223.7	-123.3	+20.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	MBS>PDGF 3					

Intermediate Position 1

SR	SY	SP	EP	WP	WY	WR
+200.0	+183.3	-64.0	+100.8	+223.7	-123.3	+20.7
X	Y	Z	Pitch	Yaw	Roll	
-115	-1006	-1888	+169.9	-46.3	-169.9	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Orbiter>JPM PDGF					

Intermediate Position 2

SR	SY	SP	EP	WP	WY	WR
+180.0	+183.2	-140.0	+76.7	+75.0	-134.3	+55.0
X	Y	Z	Pitch	Yaw	Roll	
+702	-1654	-749	-104.8	-52.0	-170.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Orbiter>JPM PDGF					

JPM Pre-Grapple

SR	SY	SP	EP	WP	WY	WR
-82.7	+132.1	-183.6	+76.7	-105.0	-134.3	+243.5
X	Y	Z	Pitch	Yaw	Roll	
-200	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Orbiter>JPM PDGF					

JPM Grappled

SR	SY	SP	EP	WP	WY	WR
-82.7	+141.6	-178.9	+79.3	-118.8	-126.6	+235.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter>JPM Unberth OBAS					

2.102 JPM INSTALL

JPM Unberth

SR	SY	SP	EP	WP	WY	WR
-82.7	+138.3	-224.4	+102.6	-94.1	-129.3	+238.2
X	Y	Z	Pitch	Yaw	Roll	
0	0	-610	0.0	0.0	0.0	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter> JPM Unberth OBAS					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

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

JAUTO Start

SR	SY	SP	EP	WP	WY	WR
-82.7	+166.0	-224.3	+102.6	-93.9	-129.2	+238.4
X	Y	Z	Pitch	Yaw	Roll	
+76	-343	-563	+4.1	+27.5	-2.1	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter> JPM Unberth OBAS					

JPM Pre-Install

SR	SY	SP	EP	WP	WY	WR
-125.8	+166.0	-109.0	+84.1	-40.1	-146.8	+101.9
X	Y	Z	Pitch	Yaw	Roll	
+1147	-915	-568	+111.7	-89.9	-157.2	
FOR	Loaded – JPM Unberth OBAS, SR Held					
Disp	Orbiter> JPM Unberth OBAS					

JPM Ready-To-Latch

SR	SY	SP	EP	WP	WY	WR
-116.1	+166.0	-110.2	+96.5	-51.1	-155.2	+97.4
X	Y	Z	Pitch	Yaw	Roll	
+8	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SY Held					
Disp	Node2>JPM Mate CBCS					

JPM Install

SR	SY	SP	EP	WP	WY	WR
-115.6	+166.0	-110.2	+97.0	-51.6	-155.6	+97.1
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SY Held					
Disp	Node 2> JPM Mate CBCS					

2.103 JPM RELEASE AND WALKOFF TO MBS PDGF 3

JPM Release

SR	SY	SP	EP	WP	WY	WR
-115.6	+169.9	-106.5	+88.2	-44.9	-157.3	+101.0
X	Y	Z	Pitch	Yaw	Roll	
-90	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node 2>JPM PDGF					

JPM Clear

SR	SY	SP	EP	WP	WY	WR
-117.0	+169.9	-159.9	+100.7	-4.1	-156.1	+101.7
X	Y	Z	Pitch	Yaw	Roll	
+1381	-606	+1100	-151.2	0.0	-90.3	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

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

Intermediate

SR	SY	SP	EP	WP	WY	WR
-180.0	+169.9	-110.0	+100.7	-4.1	-156.1	+101.7
X	Y	Z	Pitch	Yaw	Roll	
+483	-756	+426	-104.2	+3.1	-165.1	
FOR	Unloaded – LEE Tip, SY Held					
Disp	ISS>ISSACS					

Clear of POA

SR	SY	SP	EP	WP	WY	WR
-180.0	+183.5	-110.0	+54.9	-36.6	-104.3	+36.8
X	Y	Z	Pitch	Yaw	Roll	
-146	+348	+489	+6.3	-2.7	+27.3	
FOR	Unloaded – LEE Tip, SY Held					
Disp	MBS>PDGF 3					

MBS PDGF 3 Pre-Grapple

SR	SY	SP	EP	WP	WY	WR
-180.0	+183.5	-82.0	+54.9	-36.6	-104.3	+36.8
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	MBS>PDGF 3					

MBS PDGF 3 Grapple

SR	SY	SP	EP	WP	WY	WR
-180.0	+173.1	-83.3	+63.7	-87.4	-103.4	-7.6
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – MBS PDGF 3, SR Held					
Disp	MBS>PDGF 3					

Node 2 Grapple

SR	SY	SP	EP	WP	WY	WR
-7.6	+103.4	-87.4	+63.7	-83.3	-173.1	-180.0
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – Node 2 PDGF, SR Held					
Disp	Node2>PDGF					

Node 2 Release

SR	SY	SP	EP	WP	WY	WR
-3.9	+103.4	-80.2	+46.7	-69.9	-173.9	-179.8
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>PDGF					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 6 of 13 pages

3.101 MNVR TO FOCUSED INSPECTION SUPPORT

Clear of JPM

SR	SY	SP	EP	WP	WY	WR
+120.0	+80.0	-30.0	+46.7	-87.0	-200.0	-169.0
X	Y	Z	Pitch	Yaw	Roll	
+46	+936	+1368	+21.4	+16.7	-65.4	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

Focus Inspection Support

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+25.0	-87.0	-200.0	-169.0
X	Y	Z	Pitch	Yaw	Roll	
+1776	-1617	-274	-77.0	+39.6	+166.4	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

4.101 MNVR FROM FI SUPPORT TO JLP PRE-GRAPPLE

JLP Approach

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+123.7	-75.8	-100.0	-69.0
X	Y	Z	Pitch	Yaw	Roll	
-266	+480	+213	-68.9	-15.5	-111.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JLP Port FRGF					

JLP Pre-Grapple

SR	SY	SP	EP	WP	WY	WR
+120.0	+7.6	+14.1	+123.7	-75.8	-26.4	+78.7
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JLP Port FRGF					

4.102 JLP RELOCATE

JLP Grapple

SR	SY	SP	EP	WP	WY	WR
+120.0	-11.7	+14.3	+110.1	-68.9	-16.3	+61.0
X	Y	Z	Pitch	Yaw	Roll	
+226	+1	-227	-0.2	+49.2	-179.8	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	Node2> JLP Port FRGF					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 7 of 13 pages

JLP Unberth

SR	SY	SP	EP	WP	WY	WR
+120.0	-39.3	0.0	+110.9	-58.7	+0.2	+38.5
X	Y	Z	Pitch	Yaw	Roll	
0	0	-200	0.0	0.0	0.0	
FOR	Loaded – JLP Mate ISSACS, SR Held					
Disp	Node2> JLP Demate ISSACS					

JLP Pre-Install on JPM

SR	SY	SP	EP	WP	WY	WR
+120.0	+35.6	-87.7	+139.5	+26.6	-36.2	+109.5
X	Y	Z	Pitch	Yaw	Roll	
+200	0	0	0.0	0.0	0.0	
FOR	Loaded – JLP Mate CBCS, SR Held					
Disp	JPM>JLP Mate CBCS					

JLP Ready-To-Latch

SR	SY	SP	EP	WP	WY	WR
+120.0	+53.2	-73.0	+136.3	+28.3	-37.7	+131.5
X	Y	Z	Pitch	Yaw	Roll	
+8	0	0	0.0	0.0	0.0	
FOR	Loaded – JLP Mate CBCS, SR Held					
Disp	JPM> JLP Mate CBCS					

JLP Install on JPM

SR	SY	SP	EP	WP	WY	WR
+120.0	+53.8	-72.3	+136.0	+28.4	-37.7	+132.3
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JLP Mate CBCS, SR Held					
Disp	JPM>JLP Mate CBCS					

4.103 JLP UNGRAPPLE TO JEM RMS VIEWING

JLP Release

SR	SY	SP	EP	WP	WY	WR
+120.0	+67.7	-86.3	+135.7	+53.1	-35.9	+149.5
X	Y	Z	Pitch	Yaw	Roll	
-180	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	JPM>JLP Port FRGF					

JEM RMS Viewing

SR	SY	SP	EP	WP	WY	WR
+101.5	+47.6	-71.4	+58.4	-68.0	-185.0	+97.5
X	Y	Z	Pitch	Yaw	Roll	
+1101	-1958	+307	-69.0	+81.8	+32.4	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 8 of 13 pages

5.101 JEM RMS VIEWING TO EVA 3 START

EVA 3 Start

SR	SY	SP	EP	WP	WY	WR
+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
X	Y	Z	Pitch	Yaw	Roll	
+358	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

5.102 S1 NTA RETRIEVE

WIF Extender/APFR Install

SR	SY	SP	EP	WP	WY	WR
+259.5	+17.9	-97.5	-28.4	-155.9	-173.5	+235.0
X	Y	Z	Pitch	Yaw	Roll	
+312	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

APFR Rotate

SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+232.4
X	Y	Z	Pitch	Yaw	Roll	
+370	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

APFR Backoff

SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+370	+633	-7	+20.0	+86.9	-92.6	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

APFR Ingress

SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+370	+633	-7	+20.0	+86.9	-92.6	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 9 of 13 pages

S1 NTA Retrieve

SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+211	+879	-9	-179.2	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

JOCAS Start

SR	SY	SP	EP	WP	WY	WR
+259.5	+42.5	-89.4	-26.9	-167.2	-178.9	+148.9
X	Y	Z	Pitch	Yaw	Roll	
+495	+879	-9	-179.3	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

ESP3 Backoff

SR	SY	SP	EP	WP	WY	WR
+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2
X	Y	Z	Pitch	Yaw	Roll	
-79	-2208	-749	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

5.103 NTA RETRIEVE AT ESP3

Old NTA Pre-Stow

SR	SY	SP	EP	WP	WY	WR
+125.8	+221.3	-98.0	+27.6	-52.5	-17.5	+61.0
X	Y	Z	Pitch	Yaw	Roll	
-79	-2446	-749	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

Old NTA Final Stow

SR	SY	SP	EP	WP	WY	WR
+125.8	+179.1	-105.4	+49.2	-46.5	-34.8	+104.3
X	Y	Z	Pitch	Yaw	Roll	
-79	-2446	-536	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 10 of 13 pages

New NTA Retrieve

SR	SY	SP	EP	WP	WY	WR
+125.8	+192.7	-114.3	+69.0	-66.0	-30.8	+88.7
X	Y	Z	Pitch	Yaw	Roll	
-79	-2312	-526	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

Return JOCAS Start

SR	SY	SP	EP	WP	WY	WR
+125.8	+233.8	-110.5	+64.0	-79.0	-10.4	+50.2
X	Y	Z	Pitch	Yaw	Roll	
-79	-2208	-749	-88.7	+17.9	-91.1	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

5.104 S1 NTA INSTALL

S1 NTA Pre-Install

SR	SY	SP	EP	WP	WY	WR
+259.5	+42.5	-89.4	-26.9	-167.2	-178.9	+148.9
X	Y	Z	Pitch	Yaw	Roll	
+495	+879	-10	-179.3	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

S1 NTA Install

SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+211	+879	-10	-179.3	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

APFR Egress

SR	SY	SP	EP	WP	WY	WR
+259.5	+20.5	-94.9	-29.9	-157.3	-174.0	+170.5
X	Y	Z	Pitch	Yaw	Roll	
+211	+879	-10	-179.3	-15.1	+91.0	
FOR	Unloaded – Chest WIF 12/NN/F/6, SR Held					
Disp	ISS>ISSACS					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 11 of 13 pages

WIF/APFR Removal

SR	SY	SP	EP	WP	WY	WR
+259.5	+17.9	-97.5	-28.4	-155.9	-173.5	+235.0
X	Y	Z	Pitch	Yaw	Roll	
+312	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

Clear

SR	SY	SP	EP	WP	WY	WR
+259.5	+19.9	-95.4	-29.7	-156.9	-173.9	+233.0
X	Y	Z	Pitch	Yaw	Roll	
+358	+633	-7	+20.1	+86.9	-30.7	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

Stage Park

SR	SY	SP	EP	WP	WY	WR
+150.0	+60.0	-62.0	-135.0	-90.0	-163.0	0.0
X	Y	Z	Pitch	Yaw	Roll	
+410	-819	-853	+90.0	-8.4	+72.6	
FOR	Unloaded – LEE Tip, SR Held					
Disp	ISS>ISSACS					

6.301 NODE 2 RELEASE to JLP PRE-GRAPPLE

Clear of JEM RMS 1

SR	SY	SP	EP	WP	WY	WR
+120.0	+80.0	-30.0	+46.7	-75.8	-100.0	-69.0
X	Y	Z	Pitch	Yaw	Roll	
-1257	+1070	-835	-19.4	+44.6	-54.1	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>JLP Port FRGF					

Clear of JEM RMS 2

SR	SY	SP	EP	WP	WY	WR
+120.0	+10.0	-30.0	+46.7	-75.8	-26.4	0.0
X	Y	Z	Pitch	Yaw	Roll	
-441	+1549	+391	-106.7	+40.8	+50.8	
FOR	Unloaded – LEE Tip, SY Held					
Disp	Node2>JLP Port FRGF					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 12 of 13 pages

6.401 JLP RELEASE TO JPM GRAPPLE

JPM Clear

SR	SY	SP	EP	WP	WY	WR
+225.0	+135.3	-94.0	-78.6	-106.2	+47.3	-71.2
X	Y	Z	Pitch	Yaw	Roll	
-322	-636	+415	+1.5	+28.5	+31.6	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JPM PDGF					

JPM PDGF Pre-Grapple

SR	SY	SP	EP	WP	WY	WR
+225.0	+135.3	-136.7	-78.6	-106.2	+47.3	-71.2
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JPM PDGF					

JPM Grapple

SR	SY	SP	EP	WP	WY	WR
+225.0	+129.4	-134.2	-90.4	-92.3	+51.8	-77.2
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SR Held					
Disp	Node2>JPM Mate CBCS					

6.402 JPM RELEASE TO EVA 3 START

JPM Release

SR	SY	SP	EP	WP	WY	WR
+225.0	+135.3	-136.7	-78.6	-106.2	+47.3	-71.2
X	Y	Z	Pitch	Yaw	Roll	
-150	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JPM PDGF					

6.403 MNVR FROM STAGE PARK TO JPM GRAPPLE

JPM Pre-Grapple

SR	SY	SP	EP	WP	WY	WR
+196.6	+137.6	-155.1	-74.6	-98.2	+33.4	-91.4
X	Y	Z	Pitch	Yaw	Roll	
-180	0	0	0.0	0.0	0.0	
FOR	Unloaded – LEE Tip, SR Held					
Disp	Node2>JPM PDGF					

7.301 SSRMS JOINT ANGLES AND FOR COORDINATES

(RBT FS/1J/FIN) Page 13 of 13 pages

JPM Grapple

SR	SY	SP	EP	WP	WY	WR
+196.6	+132.0	-154.2	-88.7	-82.8	+38.2	-95.2
X	Y	Z	Pitch	Yaw	Roll	
0	0	0	0.0	0.0	0.0	
FOR	Loaded – JPM Mate CBCS, SR Held					
Disp	Node2>JPM Mate CBCS					

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7.401 JPM PRLA CONFIGURATION

(RBT FS/1J/FIN)

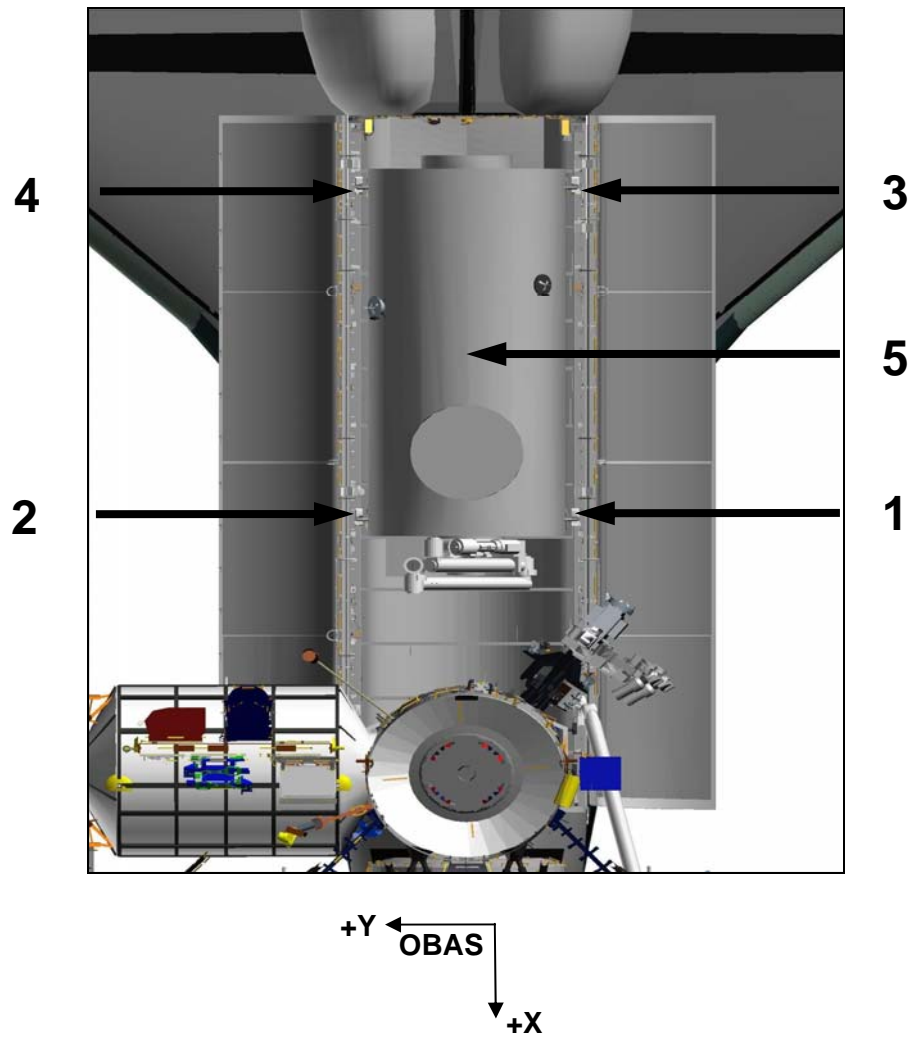


Figure 1.- JPM PRLA Configuration.

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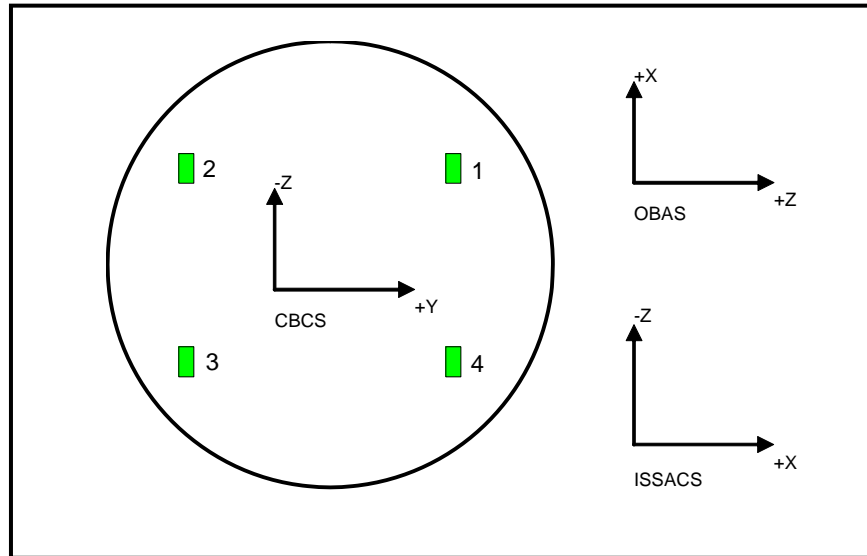


Figure 1.- RTL Positions and Reference Frames.

Missing RTLs	RHC Input (CBCS)	RHC Input (OBAS)	RHC Input (ISSACS)
1	+ Pitch, + Yaw	+ Yaw, - Roll	+ Yaw, + Roll
2	+ Pitch, - Yaw	+ Yaw, + Roll	- Yaw, + Roll
3	- Pitch, - Yaw	- Yaw, + Roll	- Yaw, - Roll
4	- Pitch, + Yaw	- Yaw, - Roll	+ Yaw, - Roll
1, 2	+ Pitch	+ Yaw	+ Roll
2, 3	- Yaw	+ Roll	- Yaw
3, 4	- Pitch	- Yaw	- Roll
1, 4	+ Yaw	- Roll	+ Yaw

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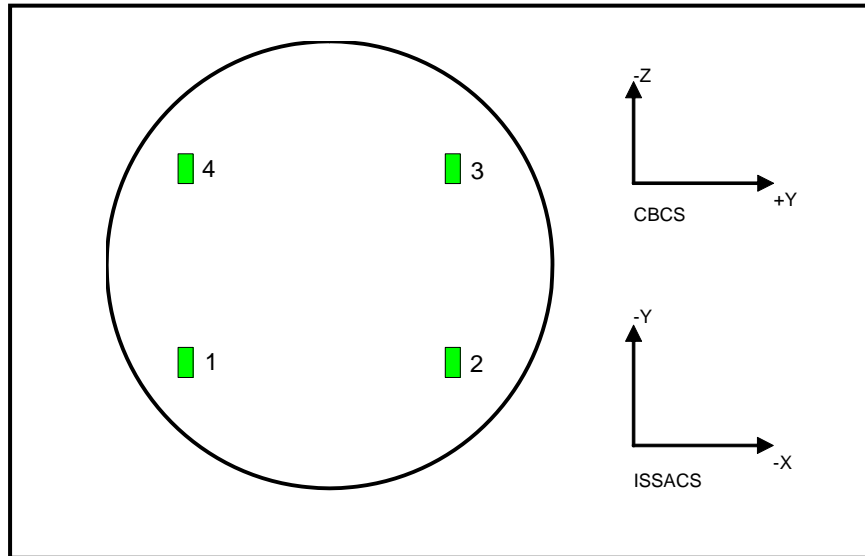


Figure 1.- RTL Positions and Reference Frames.

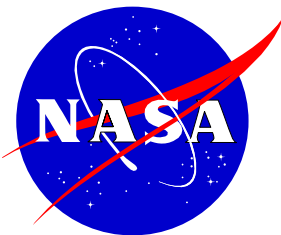
Missing RTLs	RHC Input (CBCS)	RHC Input (ISSACS)
1	- Pitch, - Yaw	- Pitch, + Roll
2	- Pitch, + Yaw	+ Pitch, + Roll
3	+ Pitch, + Yaw	+ Pitch, - Roll
4	+ Pitch, - Yaw	- Pitch, - Roll
1, 2	- Pitch	+ Roll
2, 3	+ Yaw	+ Pitch
3, 4	+ Pitch	- Roll
1, 4	- Yaw	- Pitch

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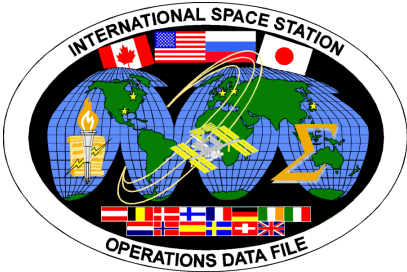
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