

# EVA Checklist

## STS-120 Flight Supplement

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**Mission Operations Directorate  
EVA, Robotics, and Crew Systems  
Operations Division**

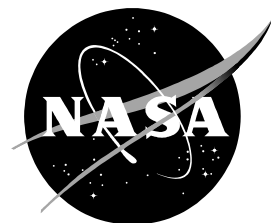
**Final  
June 8, 2007**

**NOTE**

This supplement is to be integrated into the generic edition to provide a complete document for the specific flight. Some pages in the generic edition may be replaced with supplemental pages identified as 'TEMP'. These generic pages, if any, must be retained for use on future flights.

National Aeronautics and  
Space Administration

**Lyndon B. Johnson Space Center**  
Houston, Texas






MISSION OPERATIONS DIRECTORATE


**EVA CHECKLIST  
STS-120 FLIGHT SUPPLEMENT**


FINAL  
June 8, 2007


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EVA CHECKLIST  
STS-120 FLIGHT SUPPLEMENT

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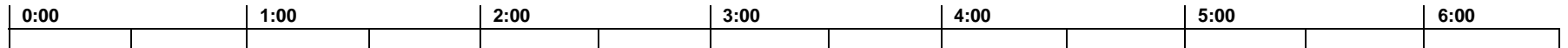
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TIMELINES

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# STS-120 (10A) EVA TIMELINES OVERVIEW



\*Grapple/Unberth Node 2

EVA 1 - FD4

Egress / Setup (0:20)	SASA Retrieve (0:35)	Node 2 Prep for Unberth (0:35)	SASA Stow (0:55)	Node 2 Final Prep for Unberth (2:00)		Disconn Z1 to P6 Fluid (0:50)	AFT Rad Shd (0:30)	SSU Shroud Install (0:30)	C/ Ing (0:15)	
Egress / Setup (0:20)	SASA Retrieve (1:10)		SASA Stow (1:10)		Node 2 Final Prep for Unberth (2:10)		AFT Rad Shroud (0:55)		SSU Shroud Install (0:30)	C/ Ing (0:15)

SSRMS SASA Retrieve - Lab PDGF

SSRMS Node 2 Unberth and Install - Lab PDGF

• OBSS on SRMS for Node 2 unberth

EVA 2 - FD6

Egress / Setup (0:25)	Z1 to P6 Umbilical Disconn (0:40)	Detach P6 from Z1 (1:20)	Node 2 Outfitting (1:35) <i>Trunnion / Keel Pin Covers CBM Restraints Handrails, WIFs, Gap Spanners</i>			Node 2 PDGF Install (0:45)	Node 2 Outfitting (con't) (1:30)	C/ Ing (0:15)
Egress / Setup (0:25)	Z1 to P6 Umbilical Disconn (0:40)	Detach P6 from Z1 (1:20)	SFU for Deploy (0:25)	MBSU Jumper (0:20)	RPCM R&R (0:50)	Node 2 PDGF Install (0:45)	Node 2 Outfitting (con't) (1:30)	C/ Ing (0:15)

SSRMS P6 Release from Z1 - MT WS4

S1 TRRJ Locked at 0

EVA 3 - FD 8

Egress Setup (0:40)	Attach P6 to P5 (1:45)	P5 to P6 Conn (0:35)	O/B Rad Cinch Release (0:30)	SSU Shroud Remove (0:45)	SFU Post Deploy (0:15)	BSP Retrieve (0:45)	MBSU Transfer (0:30)	C/Ing, SAW deploy option (0:45)	
Egress Setup (0:40)	Attach P6 to P5 (2:00)		P5 to P6 Conn (0:20)	O/B Rad Cinch Release (0:30)	SSU Shroud Remove (0:45)	MBSU Transfer (1:15)		SRMS Cleanup (0:40)	C/ Ing (0:20)

\*Deploy Outboard Radiator (o-day)

SSRMS P6 Install - MT WS8

SRMS MBSU Stow on ESP2

Port SARJ locked at 90, P4 2A/4A BGAs locked at 90, P6 2B/4B BGAs locked at 225

Port SARJ TBD  
2B/4B BGAs TBD

P6 Prep and 2B/4B Solar Array Deploy (Deploy o-day)

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## EVA 1 INHIBIT PAD

Orbiter (1)

ALL EVAs	
TCS L12	1. √TCS POWER – OFF
KU-BAND ANTENNA	
MCC-H	1. √KU-BAND Mask – active 2. √KU-BAND EVA Protect Box – active
RCS	
IV O14,15,16	If EV crew < 27 ft from FRCS 1. √DAP: VERN, FREE, LO Z (ftt specific check with GNC) 2. √RJDF F1, F2, F3, F4 MANF DRIVER (four) – OFF LOGIC (four) – OFF
MCC-H IV	3. √Above RCS config 4. √RCS F – ITEM 1 EXEC (*) √RCS FJET DES F1U – ITEM 17 (*) F3U – ITEM 19 (*) F2U – ITEM 21 (*)
<u>NOTE</u> Possible loss of comm when forced LL FWD antenna	
IV A1R	If EV crew < 1.6 ft from S-Band antenna 1. S-BAND FM ANT – XMIT LOWER/RCVR UPPER 2. √MCC, lower antenna selected
C3	If no comm, or on MCC GO 3. S-BAND PM ANT – LL FWD
C3	When EVA crewmember at least 1.6 ft away from all S-Band upper antennas 4. S-BAND PM ANT – GPC

Ground

All EVAs	
Ground Radar MCC-H	1. √TOPO console, ground radar restrictions in place for EVA

USOS (1)

ALL EVAs	
PCU	
<u>NOTE</u> PCUs may require up to 1 hr warm-up period before they are operational	
MCC-H	1. √PCUs (two) operational in discharge mode and one of the following: a. CCS PCU EVA hazard control enabled b. No more than two arrays unshunted c. No more than two arrays pointed < 90° from velocity vector
OR	
	2. One or no PCUs operational in discharge mode and one of the following: a. No more than two arrays unshunted b. No more than two arrays pointed < 90° from velocity vector
<b>LOCATION DEPENDENT INHIBITS</b>	
Lab Window	
IV	If EV crew less than 10 ft from window or in window FOV, close window shutter
KU-BAND (SGANT) Antenna	
MCC-H	If EV crew < 3.3 ft from KU-BAND antenna 1. Park KU-BAND: 1.1 Pointing Mode – Inhibit 1.2 PLC – Reset 1.3 Autotrack Continuous Retry – Inhibit

FS 7-5

EVA/120/FIN

EVA 1

**EVA 1 INHIBIT PAD (Cont)**

USOS (2)

LOCATION DEPENDENT INHIBITS	
S-BAND (SASA) ANTENNAS	
MCC-H	If EV crew < 3.6 ft from S1 SASA [P6 (P1) SASA] <ol style="list-style-type: none"> <li>1. P6 (P1) SASA (S1 SASA) – Active</li> <li>2. S1 SASA [P6 (P1) SASA] – Powered down</li> </ol>
SARJ	
MCC-H	If EV crew working within 2 ft or outboard of SARJ: <ol style="list-style-type: none"> <li>1. √DLA (1) – LOCKED</li> <li>2. All motor setpoints set to zero</li> <li>3. All motors deselected</li> </ol> OR
	4. Both DLAs – LOCKED
TRRJ	
MCC-H	If EV crew working within 2 ft of P1 TRRJ rotation envelope: <ol style="list-style-type: none"> <li>1. √DLA (1) – LOCKED</li> <li>2. RPCM P11A_B RPC 11 – Open, Close Cmd Inhibit P1-1 (Zenith RJMC Ops Pwr)</li> <li>3. RPCM P12B_C RPC 1 – Open, Close Cmd Inhibit P1-2 (Nadir RJMC Ops Pwr)</li> </ol>
MCC-H	If EV crew working within 2 ft of S1 TRRJ rotation envelope: <ol style="list-style-type: none"> <li>1. √DLA (1) – LOCKED</li> <li>2. RPCM S11A_C RPC 1 – Open, Close Cmd Inhibit S1-1 (Zenith RJMC Ops Pwr)</li> <li>3. RPCM S12B_B RPC 11 – Open, Close Cmd Inhibit S1-2 (Nadir RJMC Ops Pwr)</li> </ol>

RSOS (1)

ALL EVAs	
SM Antennas	
IV	<ol style="list-style-type: none"> <li>1. GTS – Deactivate</li> <li>2. ARISS– Deactivate or VHF (144-146 MHz) TX only</li> </ol>

## EVA 1 NOTES, CAUTIONS, AND WARNINGS

### NOTES

1. Bolt install: report torque and turns
2. Bolt release: report torque and turns if different from published range
3. EVA connectors: after disconnection and prior to connection; verify pin and EMI band integrity; verify connector free of FOD
4. Inspect QDs for damage prior to mating
5. Toolbox doors must be closed with one latch per door when EV crew not in immediate vicinity
6. Avoid contact with OBSS striker bars (Vitrolube coating)

### CAUTION

#### **ISS Constraints**

- A. Avoid inadvertent contact with
1. Grapple fixture shafts (drylube)
  2. PIP pins
  3. EVA Crane [PMA1]
  4. TCS Reflectors [PMA2, PMA3]
  5. APAS hardware [PMA2, PMA3]
  6. CETA Lights (Z-93 paint) [LAB, S1, Node 1]
  7. Deployed MISSEs [A/L, P6]
  8. Passive UMAs
  9. MBS VDU, MCU, CRPCMs, and Cameras (taped radiative surfaces, silver Teflon)
  10. Deployed TUS cable
  11. S0 aft face Radiator
  12. GPS Antennas (S13 paint) [S0]
  13. UHF Antennas [LAB, P1]
  14. ETCS Radiators [S1, P1]
  15. EETCS/PV Radiator bellows and panels [P6, P4, S4, S6]
  16. SASA RF Group [Z1, S1, P6]
  17. Heat pipe radiators [Z1]
  18. PCU cathode and HCA ports [Z1]
  19. Ku-Band Antenna (SGANT) dish [Z1]
  20. CMG cover/shells [Z1]
  21. SSRMS Cameras
  22. Open CBM petal covers and LAB window shutter

### CAUTION (Cont)

#### **ISS Constraints (Cont)**

- B. Electrical cables
1. Avoid bend radii < 10 times cable diameter
- C. Fiber optic cables
1. Avoid bend radii < 10 times cable diameter
  2. Avoid pulling on cable during mate/demate
- D. Fluid line flex hoses and QDs
1. Avoid bend radii < 5 in for hoses with diameter < 1 in on LAB, S0, S1, P1, and 10-in for hoses with diameter < 1 in on all other elements
  2. Avoid bend radii < 14 in for hoses with a diameter ≥ 1 in
  3. Additional care should be taken to not exceed bend radii when applying loads at the flexible hose to rigid tube stub interfaces
  4. Ensure fluid QD booties are fully closed prior to leaving worksite; wire tie if reqd
- E. For structural reasons
1. Avoid vigorous body motions, quick grabs and kickoffs against tether restraints
  2. Avoid performing shaking motions (sinusoidal functions) more than four cycles
  3. Avoid kicking S1/P1 radiator beam  
If any of these occur, wait 2 to 5 min to allow structural response to dissipate

## EVA 1 NOTES, CAUTIONS, AND WARNINGS (Cont)

### CAUTION (Cont)

#### **ISS Constraints** (Cont)

##### F. Other

1. ITT Cannon connector: On demated connectors, do not rotate collar or manipulate cable/connector using collar or connector tool
2. WIS Antennas: do not use as handholds [Node 1, P6, Z1]
3. Lubricant from Ku-Band SGANT gimbals [Z1], CMGs [Z1], and RTAS Ground Strap fasteners [P6,P4,S4,S6] can contaminate EMU
4. MLI handholds are not rated for crewmember translation loads
5. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged

### CAUTION (Cont)

#### **Shuttle Constraints**

##### G. Avoid inadvertent contact with

1. OBSS and SRMS Composite Sections and Cable Harnesses
2. LCS (silver Teflon) and LDRI (silver Teflon) and ITVC (gold foil) [OBSS]
3. WVS Antenna [ODS Truss & PLB Sill]
4. Payload Bay wire harnesses, cables, and connectors

##### H. No touch

1. LDRI diffuser [OBSS]
2. OBSS saddle contacts (when OBSS unberthed) [OBSS]
3. Monkey fur [PLB]
4. Cameras: metallic surfaces [PLB]
5. Ku-Band Antenna black dish and gold thermal blankets [PLB]

## EVA 1 NOTES, CAUTIONS, AND WARNINGS (Cont)

### WARNING

#### **ISS Constraints**

- A. Avoid inadvertent contact with
1. Grapple fixture targets and target pins
  2. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless the beta gimbal is locked and the motor is turned off
  3. Stay inboard of SARJ when active
  4. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate
  5. Stay 5 ft from moving MT on face 1
- B. Handrails
1. Handrails previously used for MISSE attachment may not be used as a safety tether point [A/L endcone 564 & 566, A/L Tank 2 nad/fwd & port/fwd, P6 5389]
- C. Pinch
1. NZGL connector linkage. Use caution when mating/locking
  2. ITT Cannon Connector rotating housing
  3. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]
  4. LAB window shutter and CBM petal cover linkages during operation
- D. QDs
1. If QD is in FID when valve is opened (bail fwd), QD will leak and fluid line may whip
  2. Do not rotate if in mated/valve open config

### WARNING (Cont)

#### **ISS Constraints (Cont)**

- E. RF radiation exposure
1. Stay 3.6 ft from S-Band (SASA) high gain Antenna when powered [S1,P1,P6]
  2. Stay 1.3 ft from S-Band (SASA) low gain Antenna when powered [S1,P1,P6]
  3. Stay 1 ft from UHF Antenna when powered [LAB, P1]
- F. Sharp Edges
1. Inner edges of WIF sockets
  2. Mating surfaces of EVA connectors. Avoid side loads during connector mating
  3. Back side of MMOD shield fasteners
  4. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM); the end of the spring may protrude
  5. PMA umbilical launch restraints-exposed bolt threads
  6. Adjustable Fuse Tether (Fish Stringer) buckles stowed in Node Bag
  7. Nickel coated braided copper Ground Straps may contain frayed wires [P6, P4, S4, S6]
  8. Z1 handrail 6061 by the Ku-Band boom launch restraint [Z1]
  9. Solar Array Blanket Box [P6, S6]
  10. Keep hands away from SSRMS LEE opening, and snares
  11. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing

### WARNING (Cont)

#### **ISS Constraints (Cont)**

- G. Thermal
1. EVA connectors with booties may become hot if left uncovered. Handling may need to be limited
  2. PMA handrails may be hot. Handling may need to be limited
  3. Turn off glove heaters when comfortable temp reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on
  4. Uncovered trunnion pins may be hot
  5. SSRMS/MBS operating Cameras and lights may radiate large amounts of heat
  6. Stay 1 ft away from PMAs and MMOD shields > 270 degF if EMU sun visor up
  7. Stay at least 1 ft away for no more than 15 min from PMAs and MMOD shields > 300 degF if EMU sun visor up
  8. Stay 0.5 ft away from PMA and MMOD shields > 325 degF
  9. Do not touch EMU protective visor if temp has been < -134 for > 15 min
  10. No EMU TMG contact of PMAs and MMOD shields when temp > 320 degF
  11. No EMU boot contact with foot restraint when temp < -120 degF or > 200 degF

## EVA 1 NOTES, CAUTIONS, AND WARNINGS (Cont)

### WARNING (Cont)

#### **Shuttle Constraints**

##### H. Arcing/Molten Debris

1. Stay  $\geq$  2 ft from exposed EFGF connector when OBSS berthed, powered, and EFGF not grappled [PLB]
2. Stay  $\geq$  2 ft from exposed Stbd Fwd MPM contacts [PLB]
3. Stay above PLB sill when within 1 ft of powered ROEU connector [PLB]

##### I. Pinch

1. PRLA operation [PLB]

##### J. RF radiation exposure

1. Stay 3.28 ft from S-Band Antenna when powered
2. Stay 1 ft from top and side of UHF PLB Antenna radome surface when in high powered mode [ODS truss]
3. Stay 0.33 ft from top and side of UHF PLB Antenna radome surface when in low powered mode [ODS truss]
4. Remain below the level of the PLB door mold line for first 20 in Aft of Fwd bulkhead when S-Band Antenna powered [PLB]
5. Remain on the inboard side of the Stbd slidewire (sill handrails if slidewire not installed) for first 20 ft Aft of Fwd bulkhead when Ku-Band Antenna powered [PLB]

### WARNING (Cont)

#### **Shuttle Constraints (Cont)**

##### K. Sharp Edges

1. PRLA grounding wipers [PLB]
2. LDRI baffles (Also an entrapment hazard) [OBSS]
3. Keep hands away from SRMS EE opening and snares

##### L. Thermal

1. Illuminated PLB lights; do not touch
2. OBSS grapple fixture shafts/cams may be hot. Limit handling if required

##### M. Thruster Contamination

1. Stay out of the immediate vicinity of leaking jet or APU
2. Stay 27 ft from PRCS when powered
3. Stay 3 ft from VRCS when powered
4. Stay 3 ft from APU when operating



## 10A EVA 1 PRE BRIEF

### ROLES (ALL)

EV1, EV2(3) IV	R1, R2 M1, M2	Pre-EVA support Post-EVA support
-------------------	------------------	-------------------------------------

### MILESTONES (ALL)

XX:XX	Wake-up	XX:XX	Primary tasks, get ahead
XX:XX	EVA Prep Start	XX:XX	tasks
XX:XX	Depress to 10.2	XX:XX	End of EVA
XX:XX	Start Purge	XX:XX	Repress
XX:XX	EMU to batt	XX:XX	Post EVA

### COMM SET-UP (ALL)

<ul style="list-style-type: none"> <li>• Big loop: the whole world</li> <li>• A/G2: ISS</li> <li>• S/G2: TBD</li> <li>• ICOM: Internal shuttle (ISS?)</li> <li>• HL: TBD</li> </ul>
---

### GENERAL EMERGENCIES (ALL)

<ul style="list-style-type: none"> <li>• Call emergency over intercom (Big Loop?), everybody "safes" what it's doing, return to position (who goes where and for what?)</li> <li>• When not in the suit: return to shuttle, drag EMU?</li> <li>• In the suit: suit doff &amp; power down (who helps?)</li> <li>• If A/L depress, repress</li> <li>• Abort &amp; terminate procedures</li> <li>• Incapacitated crewmember</li> <li>• Lost Crewmember: call Code L, HHL reading if possible</li> <li>• Hydrazine/NH3 contamination</li> </ul>
---

### (S)SRMS/EVA JOINT OPS (EV1, EV2, R1, R2, M1, M2, IV)

<ul style="list-style-type: none"> <li>• Review of (S)SRMS general activities</li> <li>• When arm(s) need to move during EVA, R2/M2 calls on Big Loop for initial motion, duration of motion, direction of motion, possible interference with EVA, end of motion</li> <li>• R1(2) or M1(2) will call "(S)SRMS in position xy, Ready for GCA"</li> <li>• Review of sync points</li> <li>• Review of frame(s) of reference</li> <li>• Responsibilities for clearances: with R1/2 &amp; M1/2 unless clearly handed off to EV1(2) and acknowledged</li> </ul>
---

### (S)SRMS/EVA JOINT OPS (EV1, EV2, R1, R2, M1, M2, IV) (Cont)

<ul style="list-style-type: none"> <li>• EV1(2) requests GCA, R1(2) or M1(2) confirms ready for GCA, IV issues GO for GCA</li> <li>• EV1(2) calls for requested motion, acknowledge motion, counts down to stop motion</li> <li>• Anyone can call All Stop in case of impending unsafe situation or emergency (Brakes ON)</li> <li>• At the end of GCA, EV1(2) calls End of GCA, R1(2) or M1(2) acknowledge</li> <li>• IV will verify will EV1(2) and issue "Go for (S)SSRMS maneuver" when joint activities completed</li> </ul>
---

### EVA PREP (EV1, EV2, IV, Pre-EVA support, Post-EVA support)

<ul style="list-style-type: none"> <li>• EV1, EV2, IV, Suit-up support, Post EVA support</li> <li>• Camp-out review</li> <li>• WCS usage, food/drink</li> <li>• Tool config (last minute tools/equipment)</li> <li>• Equipment lock activities</li> <li>• Suit donning plan</li> <li>• SAFER, MWS, tool, bag stowage</li> <li>• A/L depress review</li> </ul>
---

### REPRESS/POST-EVA (EV1, EV2, IV, Pre-EVA support, Post-EVA support)

<ul style="list-style-type: none"> <li>• Coldsoak</li> <li>• A/L repress review</li> <li>• Suit doffing plan</li> <li>• Food/drinks request</li> </ul>
--

## 10A EVA 1 PRE BRIEF (Cont)

### EVA DETAILED REVIEW (EV1, EV2, IV)

- Egress plan
- Task by task review (DOUG) including translation paths
- Get-ahead tasks
- Hazards, Keep out zones
- Warnings/Cautions/Notes/Constraints

### CHICA MANTRAS (EV1, EV2, IV)

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• Day/Night Cycles<ul style="list-style-type: none"><li>○ Lights</li><li>○ Visor</li><li>○ TCV (thermal Control Valve)</li><li>○ Gloves</li><li>○ Bayonets</li></ul></li><li>• Safety Tether Swap<ul style="list-style-type: none"><li>○ Gates closed</li><li>○ Hooks closed</li><li>○ Reel unlocked</li></ul></li><li>• PGT Ops<ul style="list-style-type: none"><li>○ Green light</li><li>○ Torque</li><li>○ Turns</li></ul></li></ul> | <ul style="list-style-type: none"><li>• PGT Extensions<ul style="list-style-type: none"><li>○ XXX installed</li><li>○ Good pull test</li></ul></li><li>• Electrical Connectors<ul style="list-style-type: none"><li>○ Pins straight</li><li>○ No FOD</li><li>○ EMI band intact</li><li>○ Mated</li><li>○ Good bend radius</li></ul></li><li>• APFR Install<ul style="list-style-type: none"><li>○ Black on black</li><li>○ Good pull test</li></ul></li></ul> |
|--|---|

### EMERGENCIES (EV1, EV2, IV)

- Lost comm (show L + thumb up if listening, thumb down if not listening)
- Hand signals between EVs and to IV/ground via WVS
- EMU malfunctions: verbalize, IV leads, challenge-response protocol
- Errors & Lost tools: acknowledge and continue
- DCS: speak up for symptoms, cuff check list
- Abort and terminate scenarios
- Lost crewmember
- Incapacitated crewmember
- Hydrazine/NH3 contamination

### GENERAL REMINDERS (EV1, EV2, IV)

- Suit config: stiffness, heated gloves, EMU TV, EHIP lights
- SAFER: try access in A/L
- Translations: slow & deliberate, avoid feet first, check tethers often, check buddy when able
- Mass handling: one axis trans/rot at a time, watch for inertia
- Tether management, fairleads
- ORU control
- PGT ops: Red light – low torque, Green light – in torque window, Red/Green lights – HI torque. Cal procedure: Ratched collar – Not motor, Speed collar – Cal, Pull trigger
- Video/cameras view: change tapes, adjust WVS at SR/SS

### CRIB SHEET (EV1, EV2, IV)

- TBD

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# EVA 1 SUMMARY TIMELINE

PET HR : MIN	IV/SSRMS	10A EVA 1 EV1 – Pz	EV2 – Wheels	PET HR : MIN
00:00	SSRMS: APFR install/ingress position	<u>A/L EGRESS SETUP (00:20)</u> • Post Depress/Egress	<u>A/L EGRESS SETUP (00:20)</u> • Post Depress/Egress	00:00
01:00	√MCC-H GO for SASA connector demate  SSRMS: GCA to SASA handoff SSRMS: Mnv to SASA sidewall carrier	<u>SASA RETRIEVE (00:35)</u> • Connector Release • SASA Remove • SASA Handoff	<u>SASA RETRIEVE (01:10)</u>  • SASA Handoff • SSMRS Mnv to PLB	01:00
02:00	SSRMS: SASA worksite setup  SSRMS: APFR egress/removal SSRSM: Node 2 pre-grapple	<u>NODE 2 PREP FOR UNBERTH (00:35)</u> • Horseshoe Connector Partial Release • PDGF Partial Release  <u>SASA STOW (00:55)</u> • Soft dock SASA • Hand start fwd launch bolts (2) • Hand start aft launch bolts (2) • Drive launch bolts (4)	<u>SASA STOW (01:10)</u> • Soft dock SASA • Hand start mast bolts (2)  • Drive mast bolts (2) • Egress/remove APFR	02:00
03:00	√MCC-H GO for LTA cable demate  SSRMS: Node 2 grapple SSRMS: Node 2 unberth	<u>NODE 2 FINAL PREP FOR UNBERTH (02:00)</u> • PDGF Temp stow on Node 2 • PCBM Contamination cover remove • LTA Cable disconnect	<u>NODE 2 FINAL PREP FOR UNBERTH (02:10)</u> • PDGF Temp stow on Node 2 • PCBM Contamination cover remove • LTA Cable disconnect	03:00
04:00				04:00
05:00		<u>DISCONNECT Z1 TO P6 FLUID (00:50)</u> • Remove SPDs • Close valves • Demate from P6, mate to Z1 • Install male caps on P6	<u>AFT RADIATOR SHROUD (00:55)</u> • Deploy port long strap • Deploy stbd long strap	05:00
06:00		<u>AFT RADIATOR SHROUD (00:30)</u> • Deploy stbd shroud	• Deploy port shroud	06:00
		<u>SSU SHROUD INSTALL (00:30)</u> • Install long strap on 2B (stbd) array • Install long strap on 4B (port) array	<u>SSU SHROUD INSTALL (00:30)</u> • Install short straps on 2B (stbd) array • Install short straps on 4B (port) array	
		<u>CLEANUP AND A/L INGRESS (00:15)</u>	<u>CLEANUP AND A/L INGRESS (00:15)</u>	
		<u>PRE REPRESS (00:05)</u>	<u>PRE REPRESS (00:05)</u>	

## PRE EVA 1 TOOL CONFIG

### EV1

#### EMU D-Rings

- 1 – Tether Extender on Left
- 2 – Waist Tethers
- 1 – 85' Safety Tether (A/L) on Left

#### MWS

- Small trash bag [left inside]
  - 2 – Caps Size 15 (J4) and 17 (J3) – label IV
  - 2 – Adj (sm-sm)
- 2 – Wire ties
- Socket Caddy [left inside]
  - RAD, w/7/16-2 in ext S/N \_\_\_\_\_
- WIF adapter
  - 1 – RET (with PIP pin) [left]
- 2 – RET (sm-sm) [right]
- Swing Arm [right side]
  - PGT w/7/16-6 in ext S/N \_\_\_\_\_  
(B3, CCW2, 30.5)
  - 1 – RET (sm-sm)
- BRT [left side]
  - 2 – Adjustable tethers (for PDGF)
  - 3 – Wire Ties, short
- SAFER

Prior to EVA, inspect:  
RET cord for damage  
BRT & MWS for loose fittings/screws  
Safety & waist tether load alleviating straps: no red

Total RETs sm-sm used – 10  
RETs with PIP pin – 3  
RETs Lg-sm – 4  
Adj tethers – 10  
Bungees – ?

### EV2

#### EMU D-Rings

- 1 – Tether Extender on Left
- 2 – Waist Tethers
- 1 – 85' Safety Tether (LEE tether) on Left

#### MWS

- Small trash bag [right outside]
  - 1 – Wire Ties, long
  - 1 – Adj (sm-sm)
- 2 – Wire ties
- 2 – RET (with PIP pin) [right, left]
- 1 – RET (sm-sm) [left]
- Swing Arm [right side]
  - PGT w/7/16-6 in ext S/N \_\_\_\_\_  
(B3, CCW2, 30.5)
  - 1 – RET (sm-sm)
- BRT [left side]
  - 1 – RET (sm-sm)
  - 2 – Wire Ties, short
  - 1 – Wire Ties, long
- SAFER

### Additional Items Returned to Airlock

- PCBM Contamination Covers (8 covers)
- LTA Cable with 2 wire ties
- SPDs (4)
- SASA Cap Size 17
- SASA Cap Size 15

### CREWLOCK

#### Staging Bag

- PGT with battery PGT S/N \_\_\_\_\_
- Connector Cleaner Tool Caddy
- Wire Tie Caddy
- Ratchet w/7/16-2 in ext (PRLA cont release)

#### IV Bag

- Contamination Detection Kit
- 2 – towels with wire ties
- 2 – DCM plug (SAFER hardmount) with sm-sm RET
- 2 – GP Caddy with sm-sm RET
  - 2 – Adj Thermal Mittens
- Socket Caddy – hatch contingencies
  - 1/2-8 in extension
  - 7/16-6 in extension

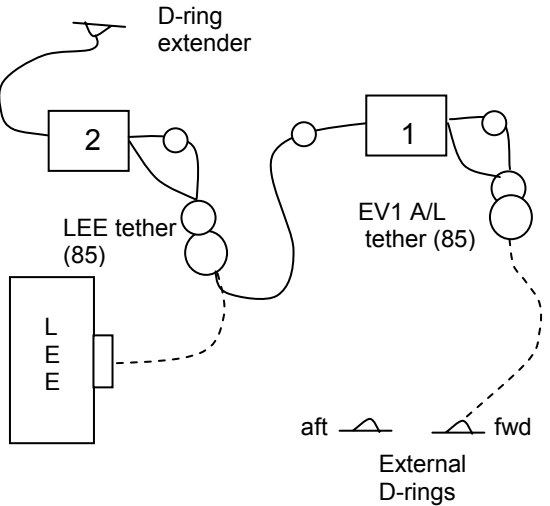
#### 1 – RET (Lg-sm)

- Fish stringer
  - EVA Camera/Bracket
  - Crewlock bag #1
    - 1 – Fish Stringer (for SPDs – sm hooks bundled on Lg hook)
    - 1 – Adj tether on outside
- Lg Trash bag (EV1)
  - 1 – RET (Lg-sm) (inside bag)
  - 1 – Adj (sm-sm) (outside bag)
  - 1 – 85' Safety Tether (EV1 – PLB)
- Lg Trash bag (EV2)
  - 1 – RET (Lg-sm) (inside bag)
  - 1 – Adj (sm-sm) (outside bag)

#### 1 – RET (Lg-sm)

- Med ORU Bag
  - 2 – RET (sm-sm)
    - 2 – SSU shrouds
  - EVA Camera/Bracket on RET
  - 2 – Adj on outside

## EVA 1 A/L EGRESS AND SETUP (00:20)

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)
<p>SSRMS: APFR Install Position</p>  <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>1 – 85' A/L tether – EV1            1 – 85' Payload Bay tether – EV1            1 – 85' LEE/Payload Bay/A/L tether – EV2</p> </div> <p>1. Post crew egress:            WVS Software: Select page – RF Camera            sel 'Advanced controls'            S-Band level (two) – max</p>	<p><u>INITIAL CONFIG</u></p> <ol style="list-style-type: none"> <li>Verify:               <ul style="list-style-type: none"> <li><input type="checkbox"/> Right waist tether connected to EV2's 85' LEE Safety tether</li> <li><input type="checkbox"/> Hook locked</li> </ul> </li> </ol> <p><u>EGRESS/INITIAL SET-UP</u></p> <ol style="list-style-type: none"> <li>Open hatch thermal cover</li> <li>Egress crewlock</li> <li>Attach EV1 85' safety tether to fwd A/L D-ring               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> </ol> <hr style="border-top: 1px dashed black;"/> <ol style="list-style-type: none"> <li>Receive fish stringer</li> <li>Attach fish stringer to HR 0555 and HR 0560</li> <li>Attach EV2 85' safety tether to LEE inboard tether point               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> EV2: √Reel unlocked</li> </ul> </li> </ol> <p>7. Give EV2 GO to release waist tether</p> <ol style="list-style-type: none"> <li>Install WIF adapter (tether point forward) and hitch pin</li> <li>Verify SAFER config               <ul style="list-style-type: none"> <li><input type="checkbox"/> √L Handle down (MAN ISO Vlv – Open)</li> <li><input type="checkbox"/> √R Handle down (HCM – Closed)</li> </ul> </li> <li>Perform translation adaptation</li> </ol>	<p><u>INITIAL CONFIG</u></p> <ol style="list-style-type: none"> <li>Verify:               <ul style="list-style-type: none"> <li><input type="checkbox"/> Right waist tether connected to A/L D-ring extender</li> <li><input type="checkbox"/> Hook locked</li> </ul> </li> </ol> <p><u>EGRESS/INITIAL SET-UP</u></p> <ol style="list-style-type: none"> <li>Transfer fish stringer to EV1</li> </ol> <hr style="border-top: 1px dashed black;"/> <ol style="list-style-type: none"> <li>On EV1 GO release right waist tether, attach to self</li> <li>Egress crewlock</li> <li>Close hatch thermal cover</li> <li>Retrieve Lg trash bag from fish stringer</li> <li>Install Lg trash bag on right swing arm</li> <li>Verify SAFER config               <ul style="list-style-type: none"> <li><input type="checkbox"/> √L Handle down (MAN ISO Vlv – Open)</li> <li><input type="checkbox"/> √R Handle down (HCM – Closed)</li> </ul> </li> <li>Perform translation adaptation</li> </ol>

## SASA RETRIEVE (01:10)

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)
<p><input type="checkbox"/> √MCC-H GO to demate SASA connectors</p>	<p><u>APFR SETUP</u></p> <ol style="list-style-type: none"> <li>Translate to APFR/Ingress aid in A/L WIF 10</li> <li>Configure APFR to (__, <b>PP, F, 6</b>); remove APFR</li> <li>Translate to SSRMS LEE</li> <li>GCA as reqd for APFR install</li> <li>Install APFR in WIF adapter (<b>12, PP, F, 6</b>)               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Locking collar black-on-black</li> <li><input type="checkbox"/> Good pull test</li> </ul> </li> <li>Extend Ingress Aid</li> </ol> <p><u>SASA RELEASE</u></p>	<p><u>APFR SETUP</u></p> <ol style="list-style-type: none"> <li>Translate to Z1 APFR (Z1 WIF 11) via ISS fwd path</li> <li>Verify APFR settings (<b>12, SS, A, 12</b>)           <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p style="text-align: center;"><u>CAUTION</u></p> <p style="text-align: center;">Avoid inadvertent contact with S0 radiator and ONTO tank</p> </div> </li> <li>Ingress Z1 APFR</li> <li>Roll nadir to worksite, √ONTO tank clearances with EV1</li> </ol> <p><u>SASA RELEASE</u></p>
<ol style="list-style-type: none"> <li>Give EV1 GO for P3 and P4 demate</li> </ol> <p><b>SASA dust caps</b></p> <p>J4 – Outboard (size 15) <input type="checkbox"/></p> <p>J3 – Inboard (size 17) <input type="checkbox"/></p>	<ol style="list-style-type: none"> <li>On IV GO, demate P4 from J4, and P3 from J3, temp stow</li> <li>Tether to SASA mast handrail</li> <li>BRT to A/L HR 0523</li> <li>Release <b>Aft Mast bolt</b> (one) PGT, 7/16-6 in ext: B3, CCW2; ~10 turns</li> <li>Transfer PGT to EV2</li> </ol> <hr style="border-top: 1px dashed black;"/> <ol style="list-style-type: none"> <li>Receive PGT from EV2</li> <li>BRT to A/L HR 0537</li> </ol> <hr style="border-top: 1px dashed black;"/> <ol style="list-style-type: none"> <li>Install dust caps onto SASA receptacles J3 (size 17), J4 (size 15)</li> </ol>	<ol style="list-style-type: none"> <li>Receive PGT from EV1</li> <li>Release <b>Fwd Mast bolt</b> (one) PGT, 7/16-6 in ext: B3, CCW2; ~10 turns</li> <li>Transfer PGT back to EV1</li> </ol> <hr style="border-top: 1px dashed black;"/> <ol style="list-style-type: none"> <li>Remove SASA from stowage location (20 lb pull force reqd)</li> <li>Present SASA connector panel end to EV1</li> </ol>

**SASA RETRIEVE (01:10) (Cont)**

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (SSRMS)
<p>SSRMS: APFR Ingress</p>	<p><u>SASA LEAP FROG</u></p> <p>1. Receive SASA from EV2</p>	<p><u>SASA LEAP FROG</u></p> <p>1. Transfer SASA to EV1</p> <p>2. Egress APFR</p> <p>3. Translate to SSRMS LEE</p> <p>4. GCA as reqd for APFR ingress</p> <p>5. Ingress SSRMS APFR, attach MWS EE to ingress aid</p> <p>6. Give IV GO for GCA to SASA handoff position</p>
<p>2. On EV GO, give SSMRS GO to mnvr to SASA handoff position SSRMS: GCA to SASA handoff position</p>	<p>2. Hand off SASA to EV2</p> <p>3. √Tools and tethers clear of worksite</p>	<p>7. Tether to SASA, receive SASA from EV1</p> <p>8. √Tools and tethers clear of worksite</p>
<p>3. Give SSMRS GO to mnvr to SASA sidewall carrier SSRMS: Mnvr to SASA sidewall carrier</p> <p>4. On M1 GO, give EV1 GO to translate to fish stringer</p>	<p>4. Watch clearances between SASA and airlock</p> <p><u>TOOL RETRIEVE</u></p>	
	<p>1. On IV GO, translate to fish stinger at A/L</p> <p>2. Retrieve Lg trash bag (w/85' safety tether) from fish stringer at A/L</p> <p>3. Install Lg trash bag on right swing arm (inside)</p> <p>4. Translate to Shuttle payload bay port side</p>	



## SASA RETRIEVE – TASK DATA

### Tools:

EV1 (FF)	EV2 (SSRMS)
PGT	
7/16 – 6 in	
Size 15 Connector Cap	
Size 17 Connector Cap	

### EVA Fasteners:

Fastener Name	Head Size	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Mast Bolts	7/16"	tbd	12.0	26.6	8.5	30

### EVA Connectors:

Harness	From	To	Conn Size	Function
W07S	SASA J3	Temp Stow	17	Heater Power
W34A	SASA J4	Temp Stow	15	Ops Power

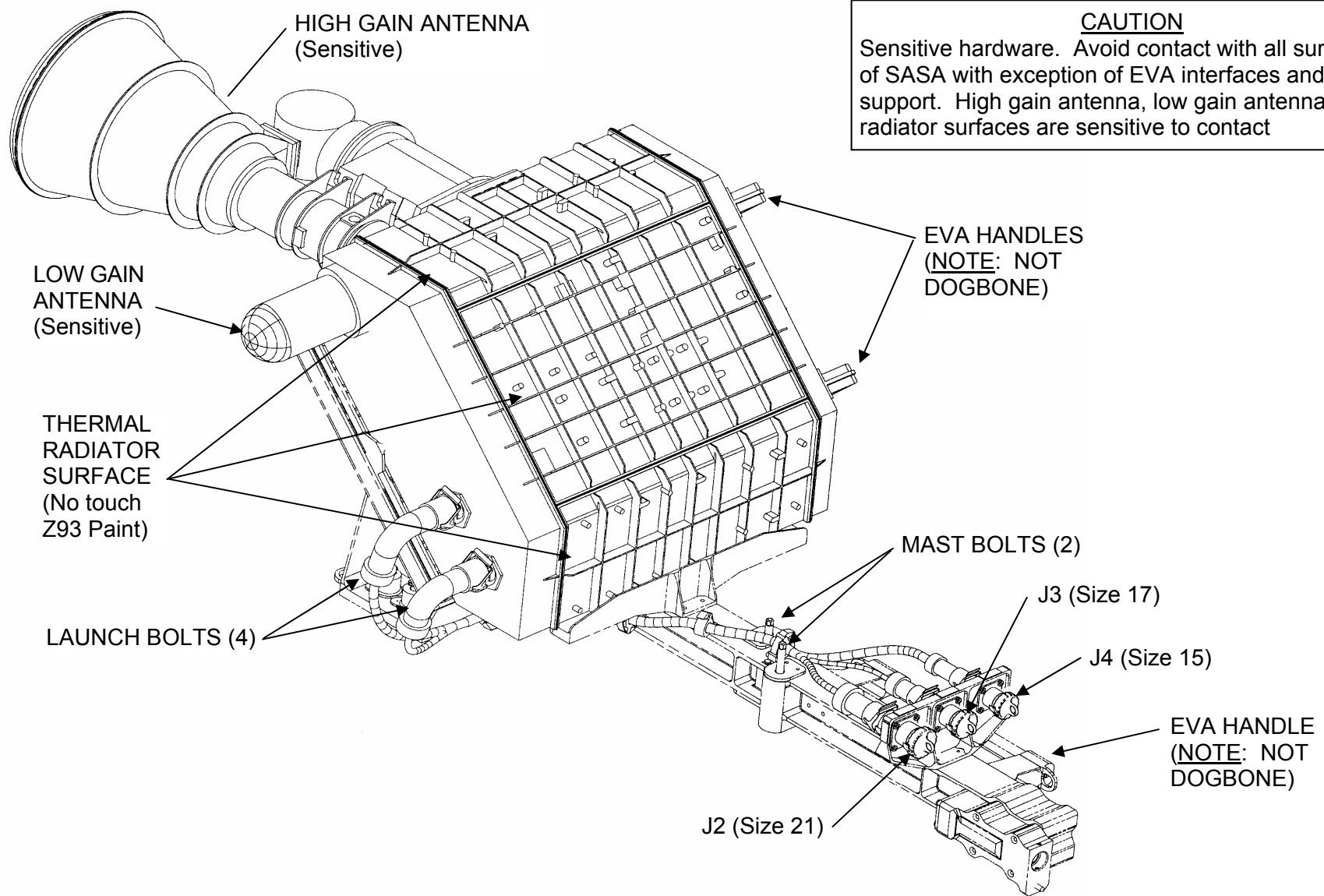
### Foot Restraints:

Task	WIF	APFR Setting
SASA remove from Z1	Z1-11	12, SS, A, 12
SASA Handoff	LEE	12, PP, F, 6

### Cautions:

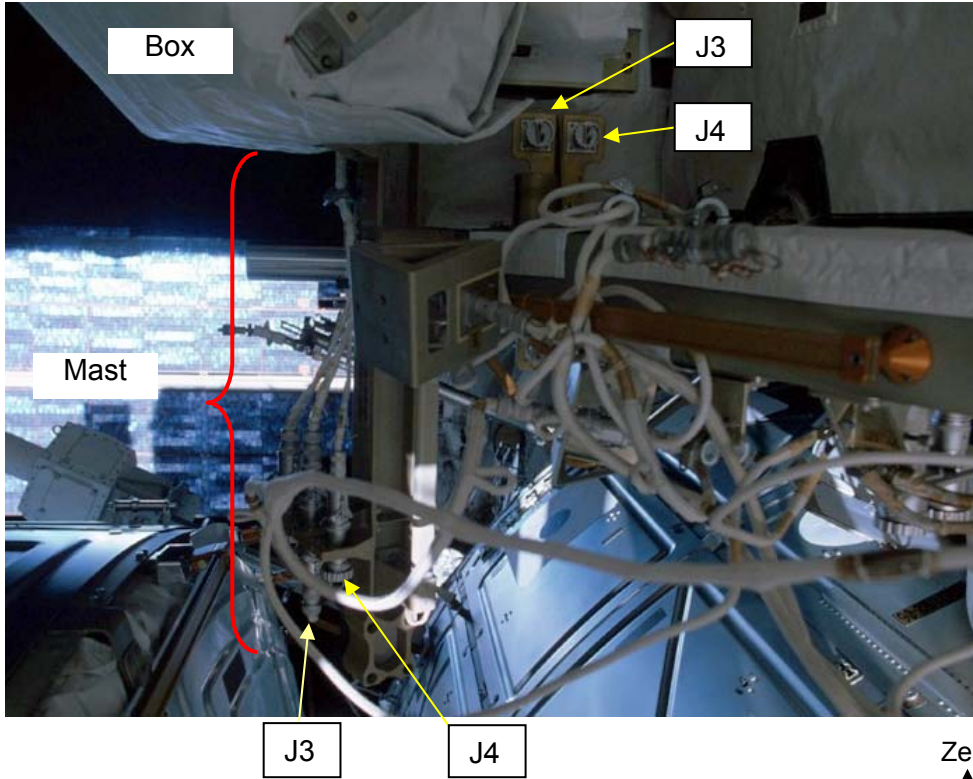
1. Sensitive hardware. Avoid contact with all surfaces of SASA with exception of EVA interfaces and launch support structure. High gain antenna, low gain antenna, and radiator surfaces sensitive to contact

# S-BAND ANTENNA SUPPORT ASSEMBLY

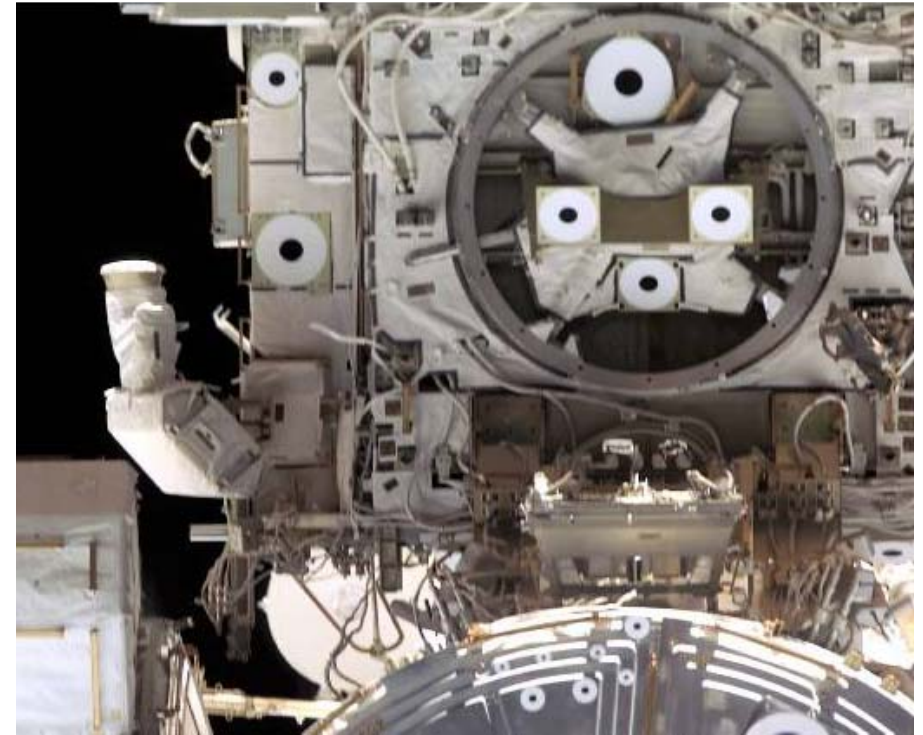


**CAUTION**  
Sensitive hardware. Avoid contact with all surfaces of SASA with exception of EVA interfaces and launch support. High gain antenna, low gain antenna and radiator surfaces are sensitive to contact

# S-BAND ANTENNA



SASA STOWAGE ON Z1 – looking ISS aft



SASA STOWAGE ON Z1 – looking ISS aft  
NOTE: S0 not installed yet



## NODE 2 PREP FOR UNBERTH – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
PGT	
7/16 – 6 in	

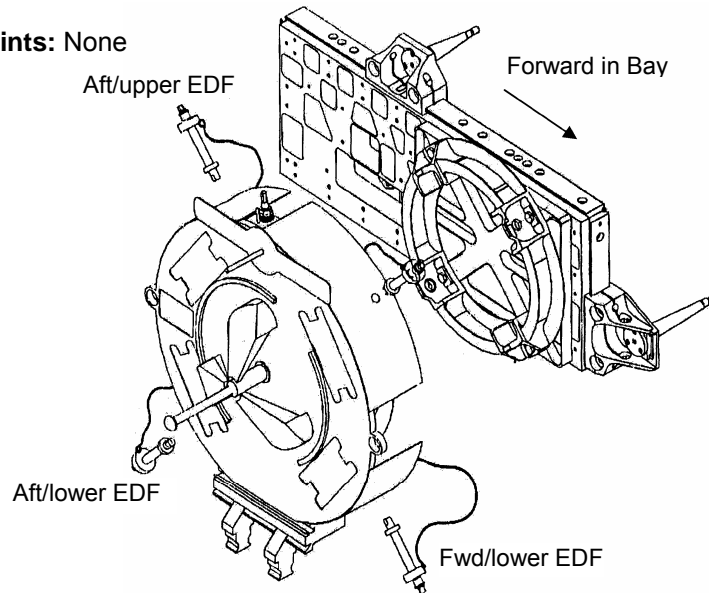
### EVA Fasteners:

Fastener	Head Size	Qty	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
PDGF	7/16	4	25	TBD	Release: 5 turns Install: 4-6 total turns	10
PDGF Conn	7/16	2	6.67-8.33	TBD	16* at KSC	30

### EVA Connectors:

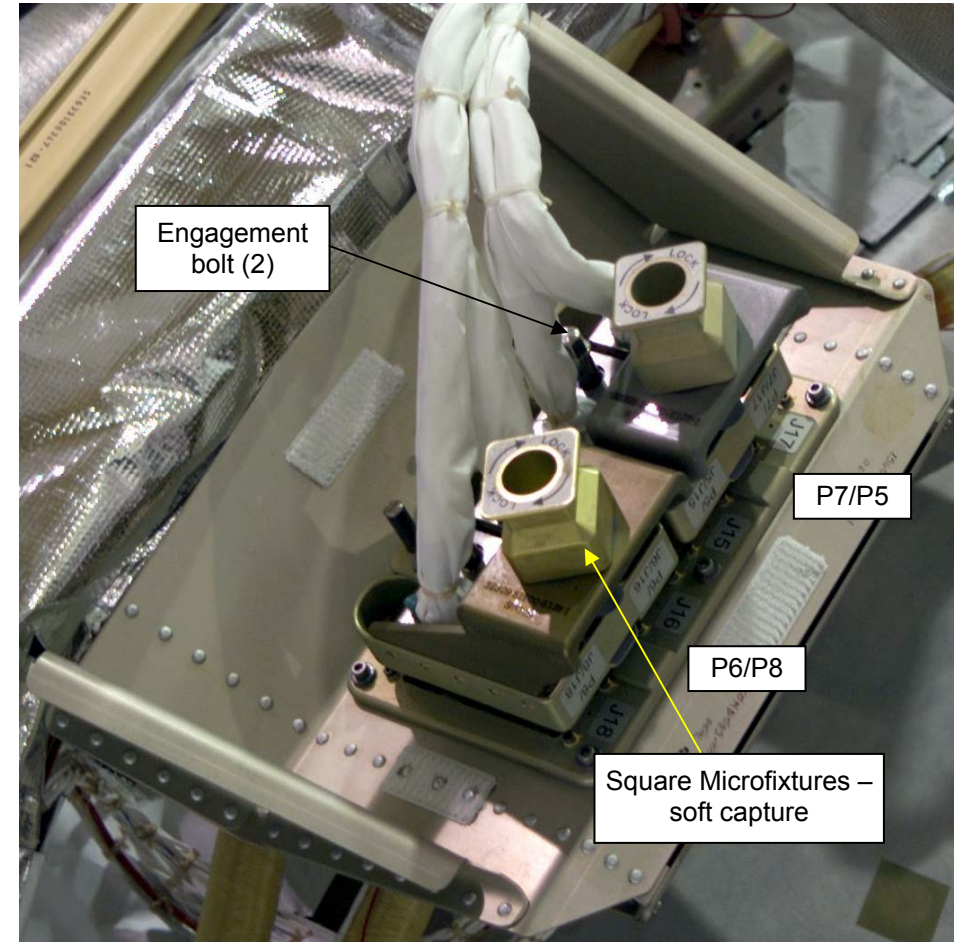
Task	From	To	Clamps (Qty)	Conn Size	Function
P8/P6	Node 2	PDGF	2	----	Data/Power
P5/P7	Node 2	PDGF	2	----	Data/Power

### Foot Restraints: None



### Cautions:

- Avoid touching grapple pin, connector area, underside of PDGF, target
- Avoid touching curvic coupling due to potential sharp edges



Node 2 Horseshoe connector Stowage



## SASA STOW (01:10)

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (SSRMS)																									
SSRMS: SASA Worksite Setup SSRMS: GCA for SASA stow	<ol style="list-style-type: none"> <li>Translate to SASA sidewall carrier (stbd bay 4)</li> <li>GCA SSRMS for SASA soft dock to carrier</li> <li>Assist EV2 with SASA soft dock, remaining clear of interface during mating</li> <li>Engage <b>Aft launch bolts</b> (two) By hand: cw; 2 turns only</li> <li>Engage <b>Fwd launch bolts</b> (two) By hand: cw; 2 turns only</li> </ol>	<ol style="list-style-type: none"> <li>GCA SSRMS for SASA soft dock to carrier</li> <li>Soft dock SASA to carrier</li> <li>GCA as reqd to access bolts</li> <li>Engage <b>Mast bolts</b> (two) By hand: cw; 2 turns only</li> </ol>																									
<p>SASA Bolt Data</p> <table border="1"> <thead> <tr> <th colspan="2">Bolt</th> <th>Final Turns*</th> <th>Torque</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Mast</td> <td>Fwd</td> <td></td> <td></td> </tr> <tr> <td>Aft</td> <td></td> <td></td> </tr> <tr> <td rowspan="2">Launch Fwd</td> <td>Upper</td> <td></td> <td></td> </tr> <tr> <td>Lower</td> <td></td> <td></td> </tr> <tr> <td rowspan="2">Launch Aft</td> <td>Upper</td> <td></td> <td></td> </tr> <tr> <td>Lower</td> <td></td> <td></td> </tr> </tbody> </table> <p>*Turns w/RAD should be counted at the bolt</p> <p>SSRMS: APFR Egress/Remove</p>	Bolt		Final Turns*	Torque	Mast	Fwd			Aft			Launch Fwd	Upper			Lower			Launch Aft	Upper			Lower			<ol style="list-style-type: none"> <li>Swap 7/16-6 in ext for RAD w/7/16-2 in ext on socket caddy on MWS</li> <li>Secure PGT with MWS EE</li> <li>Drive <b>Fwd launch bolts</b> (two) PGT, RAD 7/16-2 in ext: B1,CW2; ~10.5 turns to HS</li> <li>Drive <b>Aft launch bolts</b> (two) PGT, RAD 7/16-2 in ext: B1,CW2; ~10.5 turns to HS</li> <li>Swap RAD w/7/16-2 in ext for 7/16-6 in ext on socket caddy</li> <li>Remove WIF adapter from LEE, stow in trash bag</li> <li>On EV2 GO, transfer EV2's safety tether from LEE to stbd HR on ODS truss <input type="checkbox"/> √Gate closed <input type="checkbox"/> √Hook locked</li> </ol>	<ol style="list-style-type: none"> <li>Once all bolts hand-started, drive <b>Mast bolts</b> (two) PGT, 7/16-6 in ext: B1,CW2; ~6.5 turns to HS</li> <li>GCA SSRMS for APFR egress</li> <li>Egress APFR</li> <li>Give SSRMS "Egress Complete" -----</li> <li>GCA SSRMS for APFR removal</li> <li>Remove APFR from WIF adapter, stow on BRT -----</li> <li>Translate to Node 2; install APFR in WIF 17 <b>(4, TT, F, 12)</b> <input type="checkbox"/> √Locking collar black-on-black <input type="checkbox"/> Good pull test</li> <li>Attach waist tether to structure <input type="checkbox"/> √Hook locked</li> <li>Give EV1 GO for tether swap</li> </ol>
Bolt		Final Turns*	Torque																								
Mast	Fwd																										
	Aft																										
Launch Fwd	Upper																										
	Lower																										
Launch Aft	Upper																										
	Lower																										

**SASA STOW (01:10) (Cont)**

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (SSRMS)
	13. ✓Tools and tethers clear of SSRMS	14. ✓Tools and tethers clear of SSRMS
1. Give SSRMS GO for mnvr to Node 2 pre-grapple SSRMS: Node 2 Pre-grapple Setup	14. Translate to PDGF side wall carrier (port bay 5)	15. Translate to PDGF side wall carrier (port bay 5)

## SASA STOW – TASK DATA

### Tools:

EV1 (FF)	EV2 (SSRMS)
PGT	PGT
7/16 – 6 in	7/16 – 6 in
7/16 – 2 in	
Right Angle Drive	

### EVA Fasteners:

Fastener Name	Head Size	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Launch Bolts	7/16"	tbd	n/a	26.6 17.3 rad	12.5	10*
Mast Bolts	7/16"	tbd	12.0	26.6	8.5	30

\* RAD input limited to 10 RPM due to tool constraint

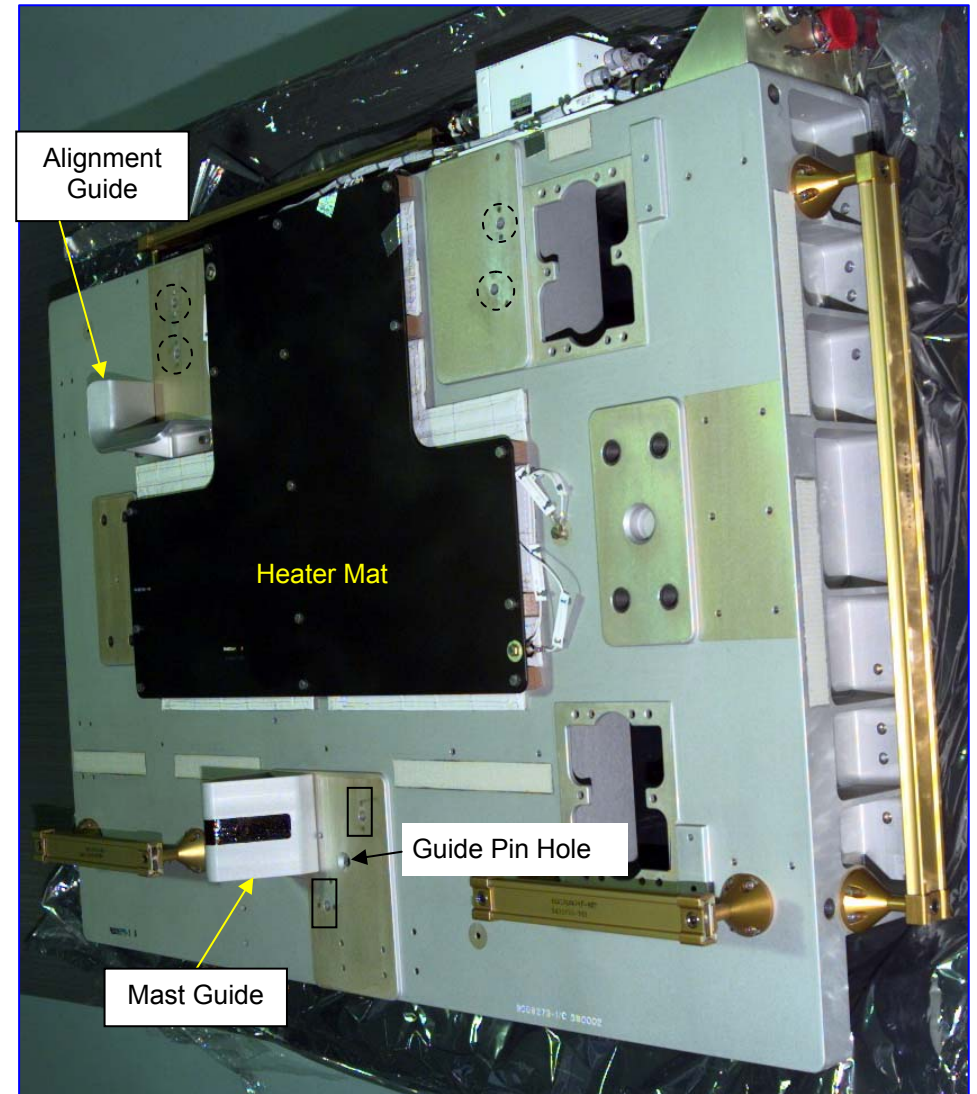
**EVA Connectors:** None

### Foot Restraints:



Task	WIF	APFR Setting
SASA install in PLB	LEE	12, PP, F, 6

### Cautions:

1. Sensitive hardware. Avoid contact with all surfaces of SASA with exception of EVA interfaces and launch support structure. High gain antenna, low gain antenna, and radiator surfaces sensitive to contact



SASA Sidewall Carrier

-  Launch Bolt holes
-  Mast Bolt Holes





**NODE 2 FINAL PREP FOR UNBERTH (02:10) (Cont)**

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)
<input type="checkbox"/> √EV1, EV2 clear of SSRMS 1. Give M1 GO for Node 2 grapple SSRMS: Node 2 Grapple <input type="checkbox"/> √MCC-H GO to demate LTA conn	<u>LTA CABLE DISCONNECT</u> 1. Translate to SPDU (port side, bay 7)  2. Open TA clamps (2) at SPDU sill bracket 3. Tether to and remove cable; close TA clamps	<u>LTA CABLE DISCONNECT</u> 1. Translate to Node 2 LTA cable  2. Open TA clamps (3) on Node 2 3. Remove cable; close TA clamps
2. Give EV GO for LTA cable disconnect  <input type="checkbox"/> √EV1, EV2 clear of Node 2	4. On IV GO, disconnect connectors from J1 and J2 5. Coil cable and restrain with wire tie, stow on BRT  6. Translate to ODS	4. On IV GO, disconnect connectors J6XX and J6YY  5. Close thermal cover 6. Translate to ODS
3. Give M1 GO for Node 2 unberth SSRMS: Node 2 Unberth	7. Tether swap to EV1 A/L tether <input type="checkbox"/> √Gate closed <input type="checkbox"/> √Hook locked <input type="checkbox"/> √Reel unlocked 8. Release 85-ft tether from ODS, attach to self  9. Daisy chain with EV2's 85' safety tether; EV1 right waist tether to EV2's 85-ft safety tether 10. Translate to A/L 11. Attach EV2's 85' safety tether to aft A/L D-ring <input type="checkbox"/> √Gate closed <input type="checkbox"/> √Hook locked	7. Attach waist tether to structure <input type="checkbox"/> √Hook locked  8. Give EV1 GO to release 85' safety tether
	12. Give EV2 GO to release waist tether  13. Stow LTA cable, Lg trash bag with PCBM covers, WIF adapter, and EV1 85' PLB safety tether on A/L fish stringer 14. Retrieve crewlock bag from fish stringer, stow on BRT with RET from MWS 15. Translate to Z1/P6 fluid lines	9. On EV1 GO, release waist tether and translate to A/L 10. Open thermal cover, ingress airlock 11. Stow Lg trash bag with PCBM covers in airlock 12. Retrieve Med ORU bag from airlock, stow on BRT 13. Egress airlock, close thermal cover 14. Translate to P6 aft radiator shroud via Z1 port/aft path

## NODE 2 FINAL PREP FOR UNBERTH – TASK DATA

### EVA Tools:

EV1 (FF)	EV2 (FF)
PGT	PGT
Lg Trash Bag	7/16 – 6 in
Lg-sm RET	Lg Trash Bag
	Lg-sm RET

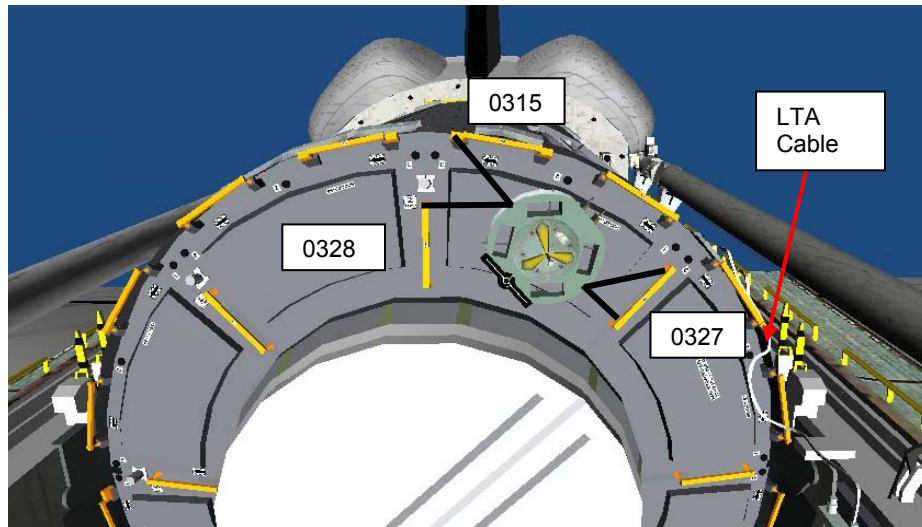
### EVA Fasteners:

Fastener	Head Size	Qty	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
PDGF	7/16	4	25	TBD	Release: 5 turns at bolt	10

### EVA Connectors:

Harness	From	To	Clamps (Qty)	Conn Size	Function
LTA PXX	Node 2 JXX	Remove	3		
LTA PYY	Node 2 JYY	Remove			
LTA P1	SPDU J1	Remove	2		
LTA P2	SPDU J2	Remove			

Foot Restraints: None



FS 7-29

### Warnings:

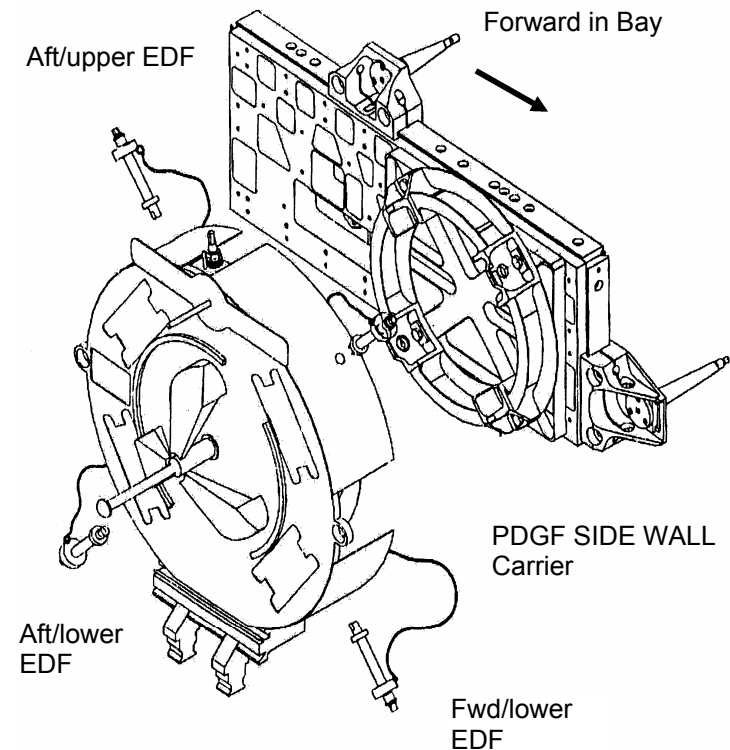
1. Avoid touching curvic coupling due to potential sharp edges

### Cautions:

1. Avoid touching grapple pin, connector area, underside of PDGF, target
2. Avoid contact with PCBM Seal

### Notes:

1. The preferred orientation of the PDGF temp stow on Node 2 is with connectors outboard to protect target. This is not a requirement
2. PCBM contamination covers must be removed prior to Node 2 mate to Node 1
3. Node 2 LTA cable must be disconnected prior to Node 2 removal from PLB



EVA/120/FIN

**Z1-TO-P6 FLUID DISCONNECT (00:50)**

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)																
<p>SPD Removed:</p> <p>QD:</p> <table border="1"> <tr><td><input type="checkbox"/></td><td>F2</td></tr> <tr><td><input type="checkbox"/></td><td>F4</td></tr> <tr><td><input type="checkbox"/></td><td>F6</td></tr> <tr><td><input type="checkbox"/></td><td>F8</td></tr> </table> <p>QD Closed:</p> <p>QD:</p> <table border="1"> <tr><td><input type="checkbox"/></td><td>F2</td></tr> <tr><td><input type="checkbox"/></td><td>F4</td></tr> <tr><td><input type="checkbox"/></td><td>F6</td></tr> <tr><td><input type="checkbox"/></td><td>F8</td></tr> </table>	<input type="checkbox"/>	F2	<input type="checkbox"/>	F4	<input type="checkbox"/>	F6	<input type="checkbox"/>	F8	<input type="checkbox"/>	F2	<input type="checkbox"/>	F4	<input type="checkbox"/>	F6	<input type="checkbox"/>	F8	<ol style="list-style-type: none"> <li>1. Temp stow crewlock bag on top of stbd Z1 toolbox</li> <li>2. Release QD shroud</li> <li>3. Reconfigure “Y”-strap into an “I”-strap</li> <li>4. String out fish stringer from crewlock bag handrail to Z1 HR 6037</li> <li>5. Attach fish stringer to SPDs (4)</li>   <li>6. Translate to Z1 WIF 11 APFR</li> <li>7. Remove APFR, stow on BRT</li> <li>8. Translate to Z1/P6 fluid lines</li> <li>9. Install APFR in Z1 WIF 17 (<b>4, KK, A, 1</b>) <ul style="list-style-type: none"> <li><input type="checkbox"/> √Locking collar black-on-black</li> <li><input type="checkbox"/> Good pull test</li> </ul> </li> <li>10. Open TA clamps as accessible (4 total)</li> </ol> <p><u>REMOVE SPDs</u> – begin with F2</p> <ol style="list-style-type: none"> <li>11. Assess side loads prior to bail movement</li> </ol> <div style="border: 1px solid black; padding: 5px; text-align: center; margin: 10px 0;"> <p><b>CAUTION</b> Minimize QD torsional and side loads during bail operations and QD demating</p> </div> <ol style="list-style-type: none"> <li>12. Push bail fwd with significant force (unstick male sleeve seals)</li> <li>13. Pull bail aft against SPD</li> <li>14. Push bail fwd again</li> <li>15. Remove SPD</li> <li>16. Verify detent button is fully installed</li> <li>17. <b>Repeat steps 11-16 for remaining QD SPDs: F4, F6, and F8</b></li> </ol> <p><u>CLOSE VALVES</u> – begin with F2</p> <ol style="list-style-type: none"> <li>18. To close valve: <ul style="list-style-type: none"> <li>√Aft white band – visible</li> <li>√Detent button can be depressed</li> <li>Depress detent button</li> <li>Pull bail to aft position (QD mated; valve closed)</li> <li>√FWD white band – visible</li> <li>√Detent button – up</li> </ul> </li> <li>19. Rotate locking collar to locked position</li> <li>20. <b>Repeat steps 18 and 19 for remaining QDs: F4, F6, and F8</b></li> </ol>	<p>Perform <b>P6 AFT RADIATOR SHROUD DEPLOY (00:55)</b></p>
<input type="checkbox"/>	F2																	
<input type="checkbox"/>	F4																	
<input type="checkbox"/>	F6																	
<input type="checkbox"/>	F8																	
<input type="checkbox"/>	F2																	
<input type="checkbox"/>	F4																	
<input type="checkbox"/>	F6																	
<input type="checkbox"/>	F8																	

**Z1-TO-P6 FLUID DISCONNECT (00:50) (Cont)**

IV	EV1 – Pz (FF)																												
<p>QD Demated from P6 and Mated to Z1:  Demated from P6    Mated to Z1</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">QD:</td> <td style="text-align: center;">QD:</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td> <td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td> </tr> <tr> <td style="text-align: center;">F2</td> <td style="text-align: center;">F2</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td> <td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td> </tr> <tr> <td style="text-align: center;">F4</td> <td style="text-align: center;">F4</td> </tr> <tr> <td colspan="2"> </td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td> <td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td> </tr> <tr> <td style="text-align: center;">F6</td> <td style="text-align: center;">F6</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td> <td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td> </tr> <tr> <td style="text-align: center;">F8</td> <td style="text-align: center;">F8</td> </tr> </table> <p style="margin-top: 20px;">Caps Installed on Z1:</p> <table style="border: none;"> <tr><td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td><td style="padding-left: 5px;">M2</td></tr> <tr><td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td><td style="padding-left: 5px;">M4</td></tr> <tr><td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td><td style="padding-left: 5px;">M6</td></tr> <tr><td style="border: 1px solid black; width: 30px; height: 15px; display: inline-block;"></td><td style="padding-left: 5px;">M8</td></tr> </table> <p style="margin-top: 20px;"> WVS of Z1 fluid lines and QDs</p>	QD:	QD:			F2	F2			F4	F4					F6	F6			F8	F8		M2		M4		M6		M8	<p><u>DEMATE QDs</u> – begin with F2</p> <ol style="list-style-type: none"> <li>21. Assess side load potential prior to demate</li> <li>22. To demate QD:  Pull back on release ring  √Release ring – retracted (FWD white band not visible)</li> <li>23. Inspect male and female QD for debris, damage, or anomalous conditions</li> </ol> <p><u>MATE QDs</u></p> <ol style="list-style-type: none"> <li>24. Mate QD to Z1  √FWD white band – visible</li> <li>25. Snapback Test  Verify release ring snaps forward (forward white band still visible)</li> <li>26. Pull Test  Stay clear of button and release ring</li> <li>27. Gap Check  For FID – visual</li> <li><b>28. Repeat steps 21-27 for QDs F4</b></li> <li>29. Relocate APFR to Z1 WIF 20 (6, PP, F, 12)  <input type="checkbox"/> √Locking collar black-on-black  <input type="checkbox"/> Good pull test</li> <li><b>30. Repeat steps 21-27 for QDs F6 and F8</b></li> <li>31. Install dust caps to P6 fluid fittings</li> </ol> <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">Dust caps are wire tied to Z1 HR 6049. Two caps will be released when 1 twist of wire tie released.  Remaining two caps will be released when remaining twist is released</p> <ol style="list-style-type: none"> <li>32. Verify lock tab is engaged</li> <li>33. Verify cap lanyards are not in separation plane</li> <li>34. Take WVS survey of QD worksite</li> <li>35. Install thermal blanket:  <input type="checkbox"/> Stbd strap to HR 6049  <input type="checkbox"/> Port strap and itsy-bitsy corner strap to HR 6048</li> <li>36. Stow fish stringer with SPDs in crewlock bag</li> <li>37. Inspect Z1/P6 interface for demate</li> <li>38. Translate to P6 aft radiator</li> </ol>
QD:	QD:																												
F2	F2																												
F4	F4																												
F6	F6																												
F8	F8																												
	M2																												
	M4																												
	M6																												
	M8																												

## Z1-TO-P6 FLUID DISCONNECT – TASK DATA

### EVA Tools:

EV1 (FF)	EV2 (FF)
N/A	N/A

EVA Fasteners: None

EVA Connectors: None

### Foot Restraints:

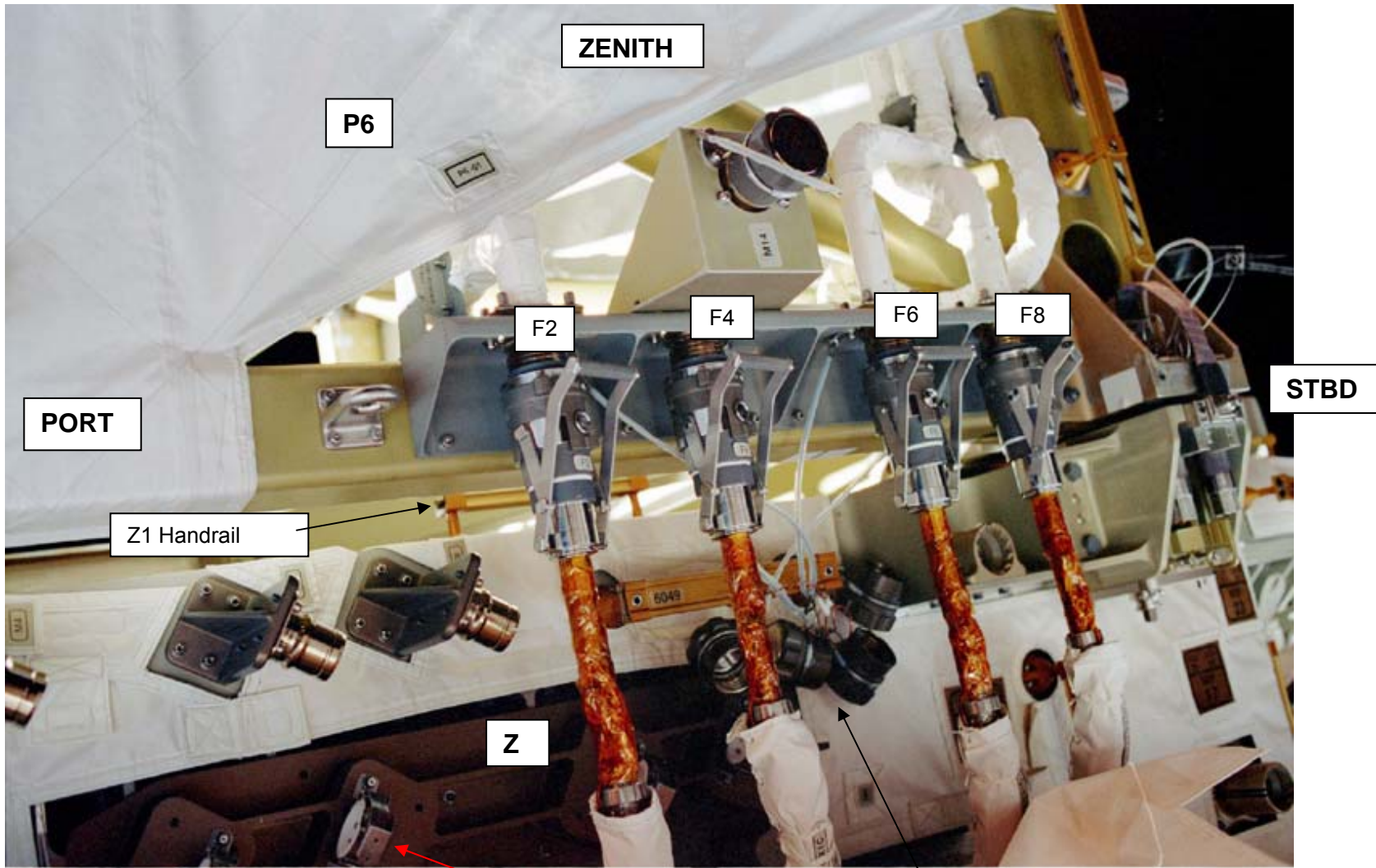
Task	WIF	APFR Setting
F2, F4 Mate	Z1-17	4, KK, A, 1
F6, F8 Mate	Z1-20	6, PP, F, 12

### Warnings:

### Cautions:

### Notes:

Z1-TO-P6 FLUID DISCONNECT – TASK DATA (Cont)



Aft view looking forward

TA Clamps (4)

Dust caps wire tied to Z1 HR 6049

Z1-TO-P6 FLUID LINES



Z1-TO-P6 FLUID DISCONNECT – TASK DATA (Cont)

ZENITH



Z1/02/03-19A – aft view looking fwd

Z1-TO-P6 FLUID LINE SHROUD



**P6 AFT RADIATOR SHROUD DEPLOY (00:55)**

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)
	<div style="border: 1px solid black; padding: 2px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;"><u>CAUTION</u> Avoid contact with radiator bellows and thermal outer coating</p> </div>	<p>1. Temp stow Med ORU bag on P6 HR 5314 (port keel)</p> <p><u>PORT SHROUD INITIAL DEPLOY</u></p> <ol style="list-style-type: none"> <li>1. Release Velcro straps (3) on port shroud boot and feed through belt loops</li> <li>2. Release black belt strap by pulling black loops on corners of boot (2) to open shroud pouch</li> <li>3. Remove long guide strap hook from black loop, unstow strap from pouch</li> <li>4. Translate with long strap to zenith end of PVR</li> <li>5. Attach strap hook to P6 HR 5341</li> <li>6. Translate nadir, then stbd to stbd pouch</li> </ol> <p><u>STARBOARD SHROUD INITIAL DEPLOY</u></p> <ol style="list-style-type: none"> <li>1. Release Velcro straps (3) on stbd shroud boot and feed through belt loops</li> <li>2. Release black belt strap by pulling black loops on corners of boot (2) to open shroud pouch</li> <li>3. Remove long guide strap hook from black loop, unstow strap from pouch</li> <li>4. Translate with long strap to zenith end of PVR</li> <li>5. Attach strap hook to P6 HR 5303</li> <li>6. Translate nadir, then port to port side of shroud</li> </ol> <hr style="border-top: 1px dashed black;"/> <p><u>STARBOARD SHROUD DEPLOY</u></p> <ol style="list-style-type: none"> <li>1. Deploy stbd side of shroud over radiator partially</li> <li>2. Return to shroud pouch (nadir) deploy remaining shroud</li> <li>3. Attach short strap hook to P6 HR 5331</li> <li>4. Release long guide strap from HR 5303, wrap around P6 HR 5331 and attach to P6 HR 5326, cinch tight</li> <li>5. Translate to nadir end of shroud</li> <li>6. Release black-tipped Velcro strap on end of shroud, thread through 2<sup>nd</sup> guide strap belt loop on shroud and refasten Velcro</li> <li>7. Stow any remaining pouch Velcro straps and stow black belt strap in inside boot pocket</li> <li>8. Translate to stbd SSU (2B)</li> </ol>
		<p><u>PORT SHROUD DEPLOY</u></p> <ol style="list-style-type: none"> <li>1. Deploy port side of shroud over radiator partially</li> <li>2. Return to shroud pouch (nadir) deploy remaining shroud</li> <li>3. Attach short strap hook to P6 HR 5338</li> <li>4. Release long guide strap from HR 5341, wrap around P6 HR 5338 and attach to P6 HR 5329, cinch tight</li> <li>5. Translate to nadir end of shroud</li> <li>6. Release black-tipped Velcro strap on end of shroud, thread through 2<sup>nd</sup> guide strap belt loop on shroud and refasten Velcro</li> <li>7. Stow any remaining pouch Velcro straps and stow black belt strap in inside boot pocket</li> <li>8. Retrieve Med ORU bag from HR 5314, stow on BRT</li> <li>9. Translate to stbd SSU (2B)</li> </ol>

## P6 AFT RADIATOR SHROUD DEPLOY – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
N/A	N/A

**EVA Fasteners:** None

**EVA Connectors:** None

**Foot Restraints:** None

### Cautions:

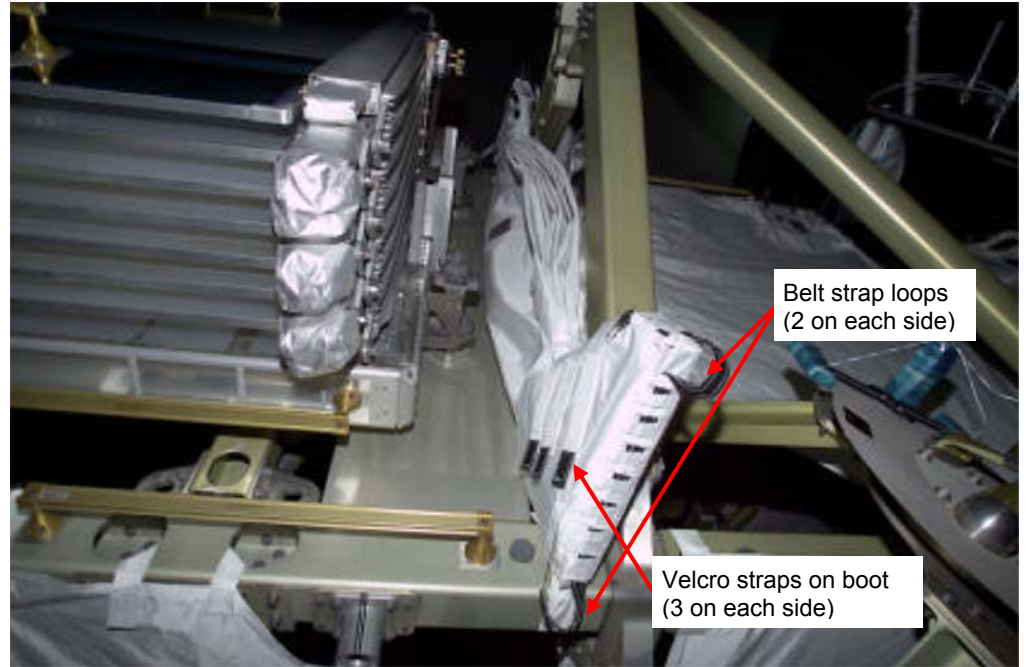
1. N/A

### Notes:

1. Ground-installed gap spanners: 1 - from nadir standoff of HR 5303 to zenith standoff of HR 5326. 1 – from nadir standoff of HR 5341 to zenith standoff of HR 5329

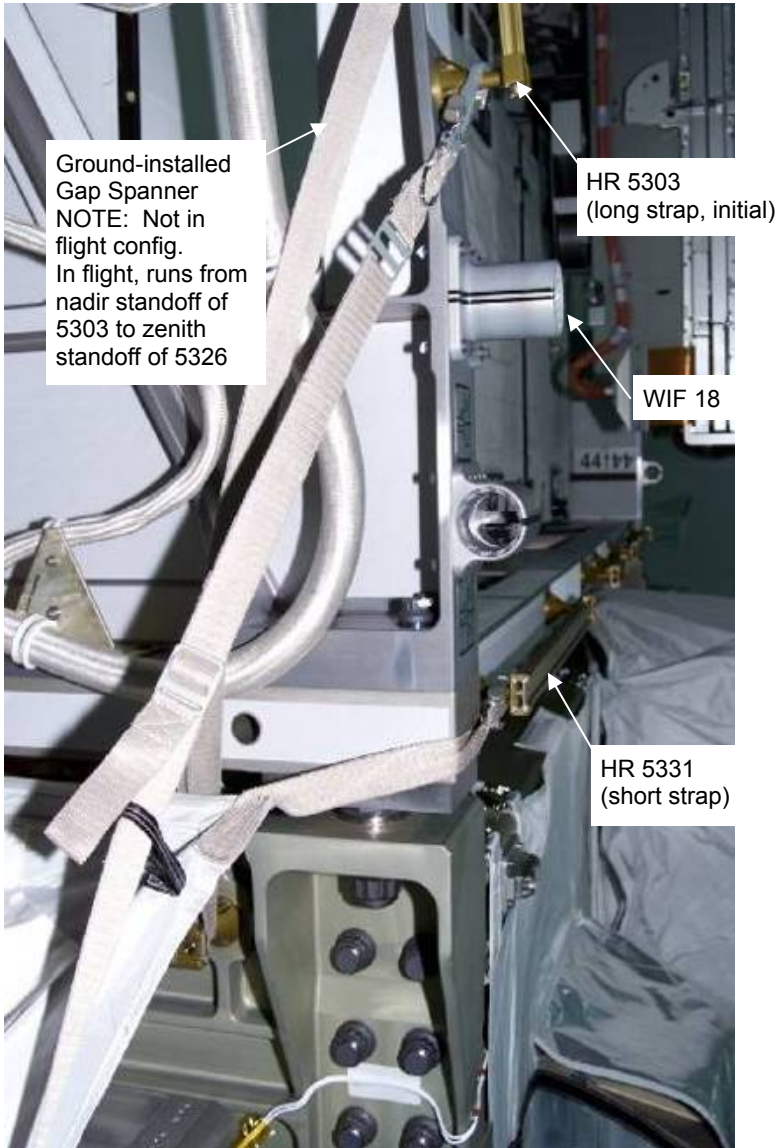


**Shroud Boot – belt strap release**

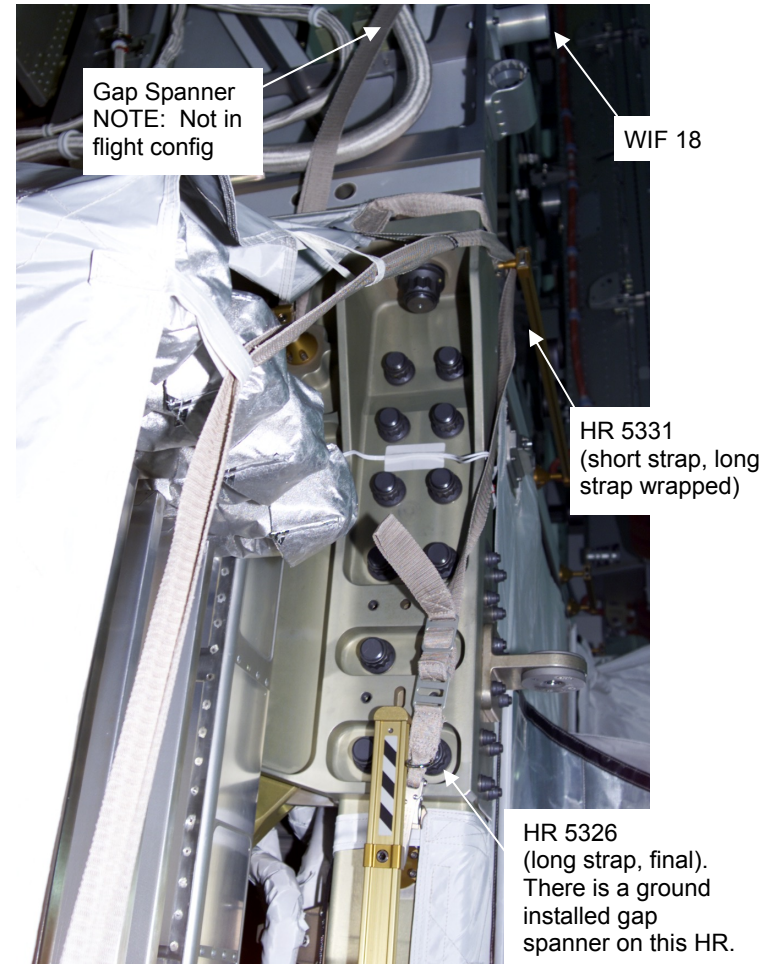


**P6 AFT PVR Shroud – stowed**

## P6 AFT RADIATOR SHROUD DEPLOY – TASK DATA (Cont)



**Stbd Strap Initial Routing**



**Stbd Strap Final Routing**



**P6 AFT RADIATOR SHROUD DEPLOY – TASK DATA (Cont)**



**Shroud Installed**



**Final Step – black Velcro strap on nadir end of shroud routed through 2nd guide strap belt loop**

**SSU MLI SHROUD INSTALL (00:30)**

IV	EV1 – Scott (FF)	EV2 – Wheels (FF)						
<table border="1"> <tr> <th colspan="2">SASA Connector Mate to Z1</th> </tr> <tr> <td>P4→ ←J4 – Inboard</td> <td></td> </tr> <tr> <td>P3→ ←J3 – Outboard</td> <td></td> </tr> </table>	SASA Connector Mate to Z1		P4→ ←J4 – Inboard		P3→ ←J3 – Outboard		<p><u>2B (STBD) SHROUD INSTALL</u></p> <hr style="border-top: 1px dashed black;"/> <ol style="list-style-type: none"> <li>1. Retrieve shroud from Med ORU bag</li> <li>2. Install shroud over SSU; verify crescent alignment mark toward mast canister</li> <li>3. Release long strap from pouch</li> <li>4. Install long strap on right side of SSU (electrical cable side), routing strap beneath electrical connectors</li> <li>5. Translate to Med ORU bag; retrieve other shroud</li> </ol> <p><u>4B (PORT) SHROUD INSTALL</u></p> <ol style="list-style-type: none"> <li>1. Install shroud over SSU; verify crescent alignment mark toward mast canister</li> <li>2. Release long strap from pouch</li> <li>3. Install long strap on right side of SSU, routing strap beneath electrical connectors</li> <li>4. Translate to stbd Z1 toolbox</li> <li>5. Retrieve crewlock bag from stbd Z1 toolbox</li> <li>6. Translate to SASA dummy panel</li> </ol> <p><u>SASA CONNECTOR MATE</u></p> <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">√Connectors for straight pins, no FOD, EMI band intact, and good bend radius</p> <ol style="list-style-type: none"> <li>1. BRT to HR 6001</li> <li>2. Remove caps from Z1 J3 and J4, stow in trash bag</li> <li>3. Mate SASA connectors P3 and P4 to Z1 dummy bracket J3 and J4</li> <li>4. Translate to A/L</li> </ol>	<p><u>2B (STBD) SHROUD INSTALL</u></p> <hr style="border-top: 1px dashed black;"/> <ol style="list-style-type: none"> <li>1. Temp stow Med ORU bag on HR 5368 and 5360</li> <li>2. Assist EV1 as reqd</li> <li>3. Secure Velcro flaps (2)</li> <li>4. Install short straps (2) on left side of SSU (ECU side)</li> <li>5. Translate to 4B (port) shroud</li> </ol> <p><u>4B (PORT) SHROUD INSTALL</u></p> <ol style="list-style-type: none"> <li>1. Assist EV1 as reqd</li> <li>2. Secure Velcro flaps (2)</li> <li>3. Install short straps (2) on left side of SSU</li> <li>4. Translate to Med ORU bag on HR 5368 and 5360</li> <li>5. Verify contents of Med ORU bag: <ul style="list-style-type: none"> <li><input type="checkbox"/> EVA Camera</li> <li><input type="checkbox"/> 2 – RET (sm-sm)</li> <li><input type="checkbox"/> 2 – Adj (on outside of bag)</li> </ul> </li> <li>6. Retrieve Med ORU bag; stow on BRT</li> <li>7. Translate to A/L</li> </ol>
SASA Connector Mate to Z1								
P4→ ←J4 – Inboard								
P3→ ←J3 – Outboard								

## SSU MLI SHROUD INSTALL – TASK DATA

### EVA Tools:

EV1 (FF)	EV2 (FF)
N/A	N/A

### EVA Fasteners:

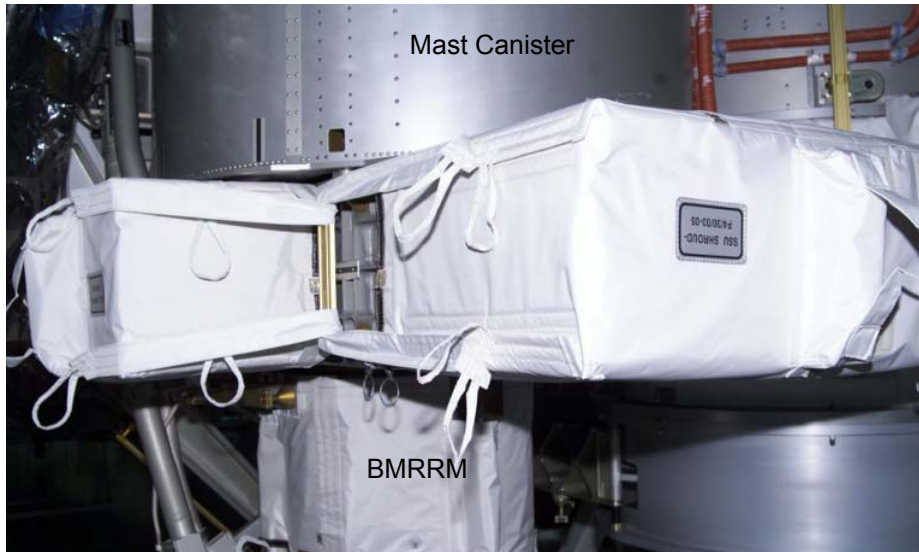
### EVA Connectors:

Harness	From	To	Conn Size
W07S	Temp Stow	Z1 J3	17
W34A	Temp Stow	Z1 J4	15

Foot Restraints: None

### Cautions:

1. N/A



Left side of SSU shroud – 2 short straps



Right side of SSU shroud – 1 long strap

**EVA 1 CLEANUP AND A/L INGRESS (00:15)**

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)
<p>1. Perform prior to ingress: WVS PWRDN (PHOTO/TV, <u>WVS CUE CARD</u>)</p>	<p>1. Translate to airlock                  2. Stow C/L bag on fish stringer                  3. Perform tool inventory                  4. Transfer Med ORU bag to EV2                  5. Transfer fish stringer to EV2</p>	<p>1. Translate to airlock                  2. Temp stow Med ORU bag at airlock                  3. Perform tool inventory                  4. Ingress airlock                  5. Receive Med ORU bag from EV1                  6. Receive fish stringer from EV1                  7. Connect right waist tether to A/L D-ring ext  <input type="checkbox"/> √Hook locked</p>
	<p>6. On EV2 GO, disconnect EV2's airlock tether attach to right waist tether  <input type="checkbox"/> √Hooks locked                  7. Disconnect EV1 A/L safety tether from A/L, attach to self                  8. Ingress airlock                  DCM 9. Retrieve SCU, remove DCM cover                  10. Connect SCU to DCM, √Locked                  11. Water – OFF                  12. Hatch thermal cover – close                  13. Secure thermal cover Velcro strap</p>	<p>8. Give EV1 GO to disconnect EV2 safety tether                  DCM 9. Retrieve SCU, remove DCM cover                  10. Connect SCU to DCM, √Locked                  11. Water – OFF</p>
<p><b>CAUTION</b>                  Do not close hatch until EMU water – OFF for 2 min</p>		
	<p>14. √EV Hatch clear of FOD and obstructions                  15. EV Hatch – close and lock                  16. Go to PRE REPRESS portion of {CREWLOCK DEPRESS/REPRESS CUE CARD} (SODF: ISS EVA SYS: EVA PREP/POST)</p>	<p>12. Go to PRE REPRESS portion of {CREWLOCK DEPRESS/REPRESS CUE CARD} (SODF: ISS EVA SYS: EVA PREP/POST)</p>

## POST EVA 1 TOOL CONFIG

### EV1

#### EMU D-Rings

- 1 – Tether Extender on Left
- 2 – Waist Tethers
- 1 – 85' Safety Tether (A/L) on Left

#### MWS

- Small trash bag [left inside]
  - 2 – Caps Size 15 (J4) and 17 (J3)
  - 2 – RET (sm-sm)
- 2 – Wire ties
- Socket Caddy [left inside]
  - RAD, w/7/16-2 in ext
- Swing Arm [right side]
  - PGT w/7/16-6 in ext (B3, CCW2, 30.5)
    - 1 – RET (sm-sm)
- BRT [left side]
  - 1 – RET (with PIP pin)
  - 3 – Wire Ties, short (3 if on LTA already)
- SAFER

### EV2

#### EMU D-Rings

- 1 – Tether Extender on Left
- 2 – Waist Tethers
- 1 – 85' Safety Tether (LEE tether) on Left

#### MWS

- Small trash bag [left outside]
  - 1 – Wire Ties, long
  - 1 – Adj (sm-sm)
- 2 – Wire ties
- 2 – RET (with PIP pin) [right, left]
- 1 – RET (sm-sm) [right]
- Swing Arm [right side]
  - PGT w/7/16-6 in ext S/N \_\_\_\_\_ (B3, CCW2, 30.5)
    - 1 – RET (sm-sm)
- BRT [left side]
  - 1 – RET (sm-sm)
  - 2 – Wire Ties, short
  - 1 – Wire Ties, long
- SAFER

### Additional Items Returned to Airlock

- PCBM Contamination Covers (8 covers)
- LTA Cable with 2 wire ties
- SPDs (4)
- SASA Cap Size 17
- SASA Cap Size 15

### CREWLOCK

#### Staging Bag

- PGT with battery PGT S/N \_\_\_\_\_
- Connector Cleaner Tool Caddy
- Wire Tie Caddy
- Ratchet w/7/16-2 in ext (PRLA cont release)

#### IV Bag

- Contamination Detection Kit
- 2 – towels with wire ties
- 2 – DCM plug (safer hardmount) with sm-sm RET
- 2 – GP Caddy with sm-sm RET
  - 2 – Adj Thermal Mittens
- Socket Caddy – hatch contingencies
  - 1/2 – 8 in extension
  - 7/16 – 6 in extension

#### Fish stringer

- WIF adapter
- EVA Camera/Bracket
- Crewlock bag #1
  - 1 – Fish Stringer w/4 SPDs
  - Adj tether on outside
- LTA Cable with 2 wire ties
- 1 – 85' Safety Tether (EV1 – PLB)
- Lg Trash bag (EV1)
  - 1 – RET (Lg-sm) (inside bag)
  - 1 – Adj (sm-sm) (outside bag)
  - PCBM Contamination Covers (4)
- Lg Trash bag (EV2)
  - 1 – RET (Lg-sm) (inside bag)
  - 1 – Adj (sm-sm) (outside bag)
  - PCBM Contamination Covers (4)

#### Med ORU Bag

- 2 – RET (sm-sm)
- EVA Camera/Bracket on RET
- 2 – Adj on outside

Total RETs sm-sm used – 10
RETs with PIP pin – 3
RETs Lg-sm – 4
Adj tethers – 10
Bungees – ?



## EVA 2 INHIBIT PAD

Orbiter (1)

ALL EVAs	
TCS L12	1. √TCS POWER – OFF
KU-BAND ANTENNA	
MCC-H	1. √KU-BAND Mask – active 2. √KU-BAND EVA Protect Box – active
RCS	
	If EV crew < 27 ft from FRCS
IV O14,15,16	1. √DAP: VERN, FREE, LO Z (ft specific check with GNC) 2. √RJDF F1, F2, F3, F4 MANF DRIVER (four) – OFF LOGIC (four) – OFF
MCC-H	3. √Above RCS config
IV	4. √RCS F – ITEM 1 EXEC (*) √RCS FJET DES F1U – ITEM 17 (*) F3U – ITEM 19 (*) F2U – ITEM 21 (*)
<u>NOTE</u> Possible loss of comm when forced LL FWD antenna	
IV A1R	If EV crew < 1.6 ft from S-Band antenna 1. S-BAND FM ANT – XMIT LOWER/RCVR UPPER 2. √MCC, lower antenna selected
C3	If no comm, or on MCC GO 3. S-BAND PM ANT – LL FWD
C3	When EVA crewmember at least 1.6 ft away from all S-Band upper antennas 4. S-BAND PM ANT – GPC

Ground

All EVAs	
Ground Radar	
MCC-H	1. √TOPO console, ground radar restrictions in place for EVA

USOS (1)

ALL EVAs	
PCU	
<u>NOTE</u> PCUs may require up to 1 hr warm-up period before they are operational	
MCC-H	1. √PCUs (two) operational in discharge mode and one of the following: a. CCS PCU EVA hazard control enabled b. No more than two arrays unshunted c. No more than two arrays pointed < 90° from velocity vector
OR	
	2. One or no PCUs operational in discharge mode and one of the following: a. No more than two arrays unshunted b. No more than two arrays pointed < 90° from velocity vector
<b>LOCATION DEPENDENT INHIBITS</b>	
Lab Window	
IV	If EV crew less than 10 ft from window or in window FOV, close window shutter
KU-BAND (SGANT) Antenna	
MCC-H	If EV crew < 3.3 ft from KU-BAND antenna 1. Park KU-BAND: 1.1 Pointing Mode – Inhibit 1.2 PLC – Reset 1.3 Autotrack Continuous Retry – Inhibit

FS 7-43

EVA/120/FIN

## EVA 2

### EVA 2 INHIBIT PAD (Cont)

#### USOS (2)

##### LOCATION DEPENDENT INHIBITS

###### S-BAND (SASA) ANTENNAS

- MCC-H If EV crew < 3.6 ft from S1 SASA [P6 (P1) SASA]
1. P6 (P1) SASA (S1 SASA) – Active
  2. S1 SASA [P6 (P1) SASA] – Powered down

###### SARJ

- MCC-H If EV crew working within 2 ft or outboard of SARJ:
1. √DLA (1) – LOCKED
  2. All motor setpoints set to zero
  3. All motors deselected
- OR
4. Both DLAs – LOCKED

###### TRRJ

- MCC-H If EV crew working within 2 ft of P1 TRRJ rotation envelope:
1. √DLA (1) – LOCKED
  2. RPCM P11A\_B RPC 11 – Open, Close Cmd Inhibit P1-1 (Zenith RJMC Ops Pwr)
  3. RPCM P12B\_C RPC 1 – Open, Close Cmd Inhibit P1-2 (Nadir RJMC Ops Pwr)

- MCC-H If EV crew working within 2 ft of S1 TRRJ rotation envelope:
1. √DLA (1) – LOCKED
  2. RPCM S11A\_C RPC 1 – Open, Close Cmd Inhibit S1-1 (Zenith RJMC Ops Pwr)
  3. RPCM S12B\_B RPC 11 – Open, Close Cmd Inhibit S1-2 (Nadir RJMC Ops Pwr)

#### RSOS (1)

##### ALL EVAs

###### SM Antennas

- IV
1. GTS – Deactivate
  2. ARISS – Deactivate or VHF (144-146 MHz) TX only

## EVA 2 NOTES, CAUTIONS, AND WARNINGS

### NOTES

1. Bolt install: report torque and turns
2. Bolt release: report torque and turns if different from published range
3. EVA connectors: after disconnection and prior to connection; verify pin and EMI band integrity; verify connector free of FOD
4. Inspect QDs for damage prior to mating
5. Toolbox doors must be closed with one latch per door when EV crew not in immediate vicinity
6. Avoid contact with OBSS striker bars (Vitrolube coating)

### CAUTION

#### **ISS Constraints**

- A. Avoid inadvertent contact with
1. Grapple fixture shafts (drylube)
  2. PIP pins
  3. EVA Crane [PMA1]
  4. TCS Reflectors [PMA2, PMA3]
  5. APAS hardware [PMA2, PMA3]
  6. CETA Lights (Z-93 paint) [LAB, S1, Node 1]
  7. Deployed MISSEs [A/L, P6]
  8. Passive UMAs
  9. MBS VDU, MCU, CRPCMs, and Cameras (taped radiative surfaces, silver Teflon)
  10. Deployed TUS cable
  11. S0 aft face Radiator
  12. GPS Antennas (S13 paint) [S0]
  13. UHF Antennas [LAB, P1]
  14. ETCS Radiators [S1, P1]
  15. EETCS/PV Radiator bellows and panels [P6, P4, S4, S6]
  16. SASA RF Group [Z1, S1, P6]
  17. Heat pipe radiators [Z1]
  18. PCU cathode and HCA ports [Z1]
  19. Ku-Band Antenna (SGANT) dish [Z1]
  20. CMG cover/shells [Z1]
  21. SSRMS Cameras
  22. Open CBM petal covers and LAB window shutter

### CAUTION (Cont)

#### **ISS Constraints (Cont)**

- B. Electrical cables
1. Avoid bend radii < 10 times cable diameter
- C. Fiber optic cables
1. Avoid bend radii < 10 times cable diameter
  2. Avoid pulling on cable during mate/demate
- D. Fluid line flex hoses and QDs
1. Avoid bend radii < 5 in for hoses with diameter < 1 in on LAB, S0, S1, P1, and 10-in for hoses with diameter < 1 in on all other elements
  2. Avoid bend radii < 14 in for hoses with a diameter ≥ 1 in
  3. Additional care should be taken to not exceed bend radii when applying loads at the flexible hose to rigid tube stub interfaces
  4. Ensure fluid QD booties are fully closed prior to leaving worksite; wire tie if reqd
- E. For structural reasons
1. Avoid vigorous body motions, quick grabs and kickoffs against tether restraints
  2. Avoid performing shaking motions (sinusoidal functions) more than four cycles
  3. Avoid kicking S1/P1 radiator beam  
If any of these occur, wait 2 to 5 min to allow structural response to dissipate

## EVA 2 NOTES, CAUTIONS, AND WARNINGS (Cont)

### CAUTION (Cont)

#### **ISS Constraints** (Cont)

##### F. Other

1. ITT Cannon connector: On demated connectors, do not rotate collar or manipulate cable/connector using collar or connector tool
2. WIS Antennas: do not use as handholds [Node 1, P6, Z1]
3. Lubricant from Ku-Band SGANT gimbals [Z1], CMGs [Z1], and RTAS Ground Strap fasteners [P6,P4,S4,S6] can contaminate EMU
4. MLI handholds are not rated for crewmember translation loads
5. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged

### CAUTION (Cont)

#### **Shuttle Constraints**

##### G. Avoid inadvertent contact with

1. OBSS and SRMS Composite Sections and Cable Harnesses
2. LCS (silver Teflon) and LDRI (silver Teflon) and ITVC (gold foil) [OBSS]
3. WVS Antenna [ODS Truss & PLB Sill]
4. Payload Bay wire harnesses, cables, and connectors

##### H. No touch

1. LDRI diffuser [OBSS]
2. OBSS saddle contacts (when OBSS unberthed) [OBSS]
3. Monkey fur [PLB]
4. Cameras: metallic surfaces [PLB]
5. Ku-Band Antenna black dish and gold thermal blankets [PLB]

## EVA 2 NOTES, CAUTIONS, AND WARNINGS (Cont)

### WARNING

#### ISS Constraints

- A. Avoid inadvertent contact with
1. Grapple fixture targets and target pins
  2. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless the beta gimbal is locked and the motor is turned off
  3. Stay inboard of SARJ when active
  4. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate
  5. Stay 5 ft from moving MT on face 1
- B. Handrails
1. Handrails previously used for MISSE attachment may not be used as a safety tether point [A/L endcone 564 & 566, A/L Tank 2 nad/fwd & port/fwd, P6 5389]
- C. Pinch
1. NZGL connector linkage. Use caution when mating/locking
  2. ITT Cannon Connector rotating housing
  3. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]
  4. LAB window shutter and CBM petal cover linkages during operation
- D. QDs
1. If QD is in FID when valve is opened (bail fwd), QD will leak and fluid line may whip
  2. Do not rotate if in mated/valve open config

### WARNING (Cont)

#### ISS Constraints (Cont)

- E. RF radiation exposure
1. Stay 3.6 ft from S-Band (SASA) high gain Antenna when powered [S1,P1,P6]
  2. Stay 1.3 ft from S-Band (SASA) low gain Antenna when powered [S1,P1,P6]
  3. Stay 1 ft from UHF Antenna when powered [LAB, P1]
- F. Sharp Edges
1. Inner edges of WIF sockets
  2. Mating surfaces of EVA connectors. Avoid side loads during connector mating
  3. Back side of MMOD shield fasteners
  4. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM); the end of the spring may protrude
  5. PMA umbilical launch restraints-exposed bolt threads
  6. Adjustable Fuse Tether (Fish Stringer) buckles stowed in Node Bag
  7. Nickel coated braided copper Ground Straps may contain frayed wires [P6, P4, S4, S6]
  8. Z1 handrail 6061 by the Ku-Band boom launch restraint [Z1]
  9. Solar Array Blanket Box [P6, S6]
  10. Keep hands away from SSRMS LEE opening, and snares
  11. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing

### WARNING (Cont)

#### ISS Constraints (Cont)

- G. Thermal
1. EVA connectors with booties may become hot if left uncovered. Handling may need to be limited
  2. PMA handrails may be hot. Handling may need to be limited
  3. Turn off glove heaters when comfortable temp reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on
  4. Uncovered trunnion pins may be hot
  5. SSRMS/MBS operating Cameras and lights may radiate large amounts of heat
  6. Stay 1 ft away from PMAs and MMOD shields > 270 degF if EMU sun visor up
  7. Stay at least 1 ft away for no more than 15 min from PMAs and MMOD shields > 300 degF if EMU sun visor up
  8. Stay 0.5 ft away from PMA and MMOD shields > 325 degF
  9. Do not touch EMU protective visor if temp has been < -134 for > 15 min
  10. No EMU TMG contact of PMAs and MMOD shields when temp > 320 degF
  11. No EMU boot contact with foot restraint when temp < -120 degF or > 200 degF

## EVA 2 NOTES, CAUTIONS, AND WARNINGS (Cont)

### WARNING (Cont)

#### **Shuttle Constraints**

##### H. Arcing/Molten Debris

1. Stay  $\geq$  2 ft from exposed EFGF connector when OBSS berthed, powered, and EFGF not grappled [PLB]
2. Stay  $\geq$  2 ft from exposed Stbd Fwd MPM contacts [PLB]
3. Stay above PLB sill when within 1 ft of powered ROEU connector [PLB]

##### I. Pinch

1. PRLA operation [PLB]

##### J. RF radiation exposure

1. Stay 3.28 ft from S-Band Antenna when powered
2. Stay 1 ft from top and side of UHF PLB Antenna radome surface when in high powered mode [ODS truss]
3. Stay 0.33 ft from top and side of UHF PLB Antenna radome surface when in low powered mode [ODS truss]
4. Remain below the level of the PLB door mold line for first 20 in Aft of Fwd bulkhead when S-Band Antenna powered [PLB]
5. Remain on the inboard side of the Stbd slidewire (sill handrails if slidewire not installed) for first 20 ft Aft of Fwd bulkhead when Ku-Band Antenna powered [PLB]

### WARNING (Cont)

#### **Shuttle Constraints** (Cont)

##### K. Sharp Edges

1. PRLA grounding wipers [PLB]
2. LDRI baffles (Also an entrapment hazard) [OBSS]
3. Keep hands away from SRMS EE opening and snares

##### L. Thermal

1. Illuminated PLB lights; do not touch
2. OBSS grapple fixture shafts/cams may be hot. Limit handling if required

##### M. Thruster Contamination

1. Stay out of the immediate vicinity of leaking jet or APU
2. Stay 27 ft from PRCS when powered
3. Stay 3 ft from VRCS when powered
4. Stay 3 ft from APU when operating

## 10A EVA 2 PRE BRIEF

### ROLES (ALL)

EV1, EV2(3) IV	R1, R2 M1, M2	Pre-EVA support Post-EVA support
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### MILESTONES (ALL)

XX:XX	Wake-up	XX:XX	Primary tasks, get ahead
XX:XX	EVA Prep Start	XX:XX	tasks
XX:XX	Depress to 10.2	XX:XX	End of EVA
XX:XX	Start Purge	XX:XX	Repress
XX:XX	EMU to batt	XX:XX	Post EVA

### COMM SET-UP (ALL)

<ul style="list-style-type: none"> <li>• Big loop: the whole world</li> <li>• A/G2: ISS</li> <li>• S/G2: TBD</li> <li>• ICOM: Internal shuttle (ISS?)</li> <li>• HL: TBD</li> </ul>
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### GENERAL EMERGENCIES (ALL)

<ul style="list-style-type: none"> <li>• Call emergency over intercom (Big Loop?), everybody "safes" what it's doing, return to position (who goes where and for what?)</li> <li>• When not in the suit: return to shuttle, drag EMU?</li> <li>• In the suit: suit doff &amp; power down (who helps?)</li> <li>• If A/L depress, repress</li> <li>• Abort &amp; terminate procedures</li> <li>• Incapacitated crewmember</li> <li>• Lost Crewmember: call Code L, HHL reading if possible</li> <li>• Hydrazine/NH3 contamination</li> </ul>
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### (S)SRMS/EVA JOINT OPS (EV1, EV2, R1, R2, M1, M2, IV)

<ul style="list-style-type: none"> <li>• Review of (S)SRMS general activities</li> <li>• When arm(s) need to move during EVA, R2/M2 calls on Big Loop for initial motion, duration of motion, direction of motion, possible interference with EVA, end of motion</li> <li>• R1(2) or M1(2) will call "(S)SRMS in position xy, Ready for GCA"</li> <li>• Review of sync points</li> </ul>
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### (S)SRMS/EVA JOINT OPS (EV1, EV2, R1, R2, M1, M2, IV) (Cont)

<ul style="list-style-type: none"> <li>• Review of frame(s) of reference</li> <li>• Responsibilities for clearances: with R1/2 &amp; M1/2 unless clearly handed off to EV1(2) and acknowledged</li> <li>• EV1(2) requests GCA, R1(2) or M1(2) confirms ready for GCA, IV issues GO for GCA</li> <li>• EV1(2) calls for requested motion, acknowledge motion, counts down to stop motion</li> <li>• Anyone can call All Stop in case of impending unsafe situation or emergency (Brakes ON)</li> <li>• At the end of GCA, EV1(2) calls End of GCA, R1(2) or M1(2) acknowledge</li> <li>• IV will verify will EV1(2) and issue "Go for (S)SSRMS maneuver" when joint activities completed</li> </ul>
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### EVA PREP (EV1, EV2, IV, Pre-EVA support, Post-EVA support)

<ul style="list-style-type: none"> <li>• EV1, EV2, IV, Suit-up support, Post EVA support</li> <li>• Camp-out review</li> <li>• WCS usage, food/drink</li> <li>• Tool config (last minute tools/equipment)</li> <li>• Equipment lock activities</li> <li>• Suit donning plan</li> <li>• SAFER, MWS, tool, bag stowage</li> <li>• A/L depress review</li> </ul>
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### REPRESS/POST-EVA (EV1, EV2, IV, Pre-EVA support, Post-EVA support)

<ul style="list-style-type: none"> <li>• Coldsoak</li> <li>• A/L repress review</li> <li>• Suit doffing plan</li> <li>• Food/drinks request</li> </ul>
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## 10A EVA 2 PRE BRIEF (Cont)

### EVA DETAILED REVIEW (EV1, EV2, IV)

- Egress plan
- Task by task review (DOUG) including translation paths
- Get ahead tasks
- Hazards, Keep out zones
- Warnings/Cautions/Notes/Constraints

### CHICA MANTRAS (EV1, EV2, IV)

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• Day/Night Cycles<ul style="list-style-type: none"><li>○ Lights</li><li>○ Visor</li><li>○ TCV (thermal Control Valve)</li><li>○ Gloves</li><li>○ Bayonets</li></ul></li><li>• Safety Tether Swap<ul style="list-style-type: none"><li>○ Gates closed</li><li>○ Hooks closed</li><li>○ Reel unlocked</li></ul></li><li>• PGT Ops<ul style="list-style-type: none"><li>○ Green light</li><li>○ Torque</li><li>○ Turns</li></ul></li></ul> | <ul style="list-style-type: none"><li>• PGT Extensions<ul style="list-style-type: none"><li>○ XXX installed</li><li>○ Good pull test</li></ul></li><li>• Electrical Connectors<ul style="list-style-type: none"><li>○ Pins straight</li><li>○ No FOD</li><li>○ EMI band intact</li><li>○ Mated</li><li>○ Good bend radius</li></ul></li><li>• APFR Install<ul style="list-style-type: none"><li>○ Black on black</li><li>○ Good pull test</li></ul></li></ul> |
|--|---|

### EMERGENCIES (EV1, EV2, IV)

- Lost comm. (show L + thumb up if listening, thumb down if not listening)
- Hand signals between EVs and to IV/ground via WVS
- EMU malfunctions: verbalize, IV leads, challenge-response protocol
- Errors & Lost tools: acknowledge and continue
- DCS: speak up for symptoms, cuff check list
- Abort and terminate scenarios
- Lost crewmember
- Incapacitated crewmember
- Hydrazine/NH3 contamination

### GENERAL REMINDERS (EV1, EV2, IV)

- Suit config: stiffness, heated gloves, EMU TV, EHIP lights
- SAFER: try access in A/L
- Translations: slow & deliberate, avoid feet first, check tethers often, check buddy when able
- Mass handling: one axis trans/rot at a time, watch for inertia
- Tether management, fairleads
- ORU control
- PGT ops: Red light – low torque, Green light – in torque window, Red/Green lights – HI torque. Cal procedure: Ratched collar – Not motor, Speed colar – Cal, Pull trigger
- Video/cameras view: change tapes, adjust WVS at SR/SS

### CRIB SHEET (EV1, EV2, IV)

- TBD



## EVA 2 SUMMARY TIMELINE

PET HR : MIN	IV/SSRMS	10A EVA 2 EV1 – Pz	EV3 – Tani	PET HR : MIN
00:00	SSRMS: P6 GRAPPLE	<u>EVA 2 A/L EGRESS &amp; SETUP</u> (00:25) <ul style="list-style-type: none"> <li>Post Depress/Egress</li> <li>Setup</li> </ul>	<u>EVA 2 A/L EGRESS &amp; SETUP</u> (00:25) <ul style="list-style-type: none"> <li>Post Depress/Egress</li> <li>Setup</li> </ul>	00:00
	√MCC-H GO for Z1 to P6 Umbilical disconnects	<u>Z1 TO P6 UMBILICAL DISCONNECT</u> (00:40) <ul style="list-style-type: none"> <li>Disconnect Umbilicals (9)</li> </ul>	<u>Z1 TO P6 UMBILICAL DISCONNECT</u> (00:40) <ul style="list-style-type: none"> <li>Disconnect Umbilicals (9)</li> </ul>	
01:00				01:00
		<u>DETACH P6 FROM Z1</u> (01:20) <ul style="list-style-type: none"> <li>Engage CLA</li> <li>Break torque on RTAS bolts (4)</li> <li>Release bolt 4</li> <li>Release bolt 2</li>   <li>Release CLA</li> </ul>	<u>DETACH P6 FROM Z1</u> (01:20) <ul style="list-style-type: none"> <li>Release ground straps</li>   <li>Release bolt 3</li>   <li>Release bolt 1</li> </ul>	
02:00	SSRMS: Demate P6 from Z1 SSRMS: MnvR to Handoff Posn			02:00
	√MCC-H GO for SFU Reconfig	<u>NODE 2 OUTFITTING</u> (01:35) <ul style="list-style-type: none"> <li>Install Node 2 Handrails (11)</li> <li>Install Node 2 WIFs (3)</li> <li>Install Node 2 trunnion (4) and keel covers (1)</li> <li>Install gap spanners (2)</li> <li>Install J408 loopback connector</li> <li>Release CBM PIP pins (4)</li> <li>Release zenith CBM petal restraints (8)</li> </ul>	<u>SFU CONFIG FOR RAD DEPLOY</u> (00:25) <ul style="list-style-type: none"> <li>Swap connectors</li> </ul>	
03:00	√MCC-H GO for MBSU Jumper Reconfig		<u>MBSU JUMPER</u> (00:20) <ul style="list-style-type: none"> <li>Swap connectors</li> </ul>	03:00
	√MCC-H GO for RPCM R&R		<u>RPCM R&amp;R</u> (00:50) <ul style="list-style-type: none"> <li>Remove S04B-C RPCM</li> <li>Install new RPCM</li> <li>Stow failed in ORU bag</li> </ul>	
04:00		<u>NODE 2 PDGF INSTALL</u> (00:45) <ul style="list-style-type: none"> <li>Relocate APFR</li> <li>Retrieve PDGF</li> <li>Soft dock PDGF</li> <li>Torque EDFs (4)</li> <li>Release horseshoe connectors (2)</li> </ul>	<u>NODE 2 PDGF INSTALL</u> (00:45) <ul style="list-style-type: none"> <li>Remove thermal cover</li> <li>Retrieve PDGF</li> <li>Soft dock PDGF</li> <li>Torque EDFs (4)</li> <li>Install horseshoe connectors (2)</li> </ul>	04:00
05:00		<u>NODE 2 OUTFITTING (CONT)</u> (01:30) <ul style="list-style-type: none"> <li>Complete remaining Node 2 outfitting</li> </ul>	<u>NODE 2 OUTFITTING (CONT)</u> (01:30) <ul style="list-style-type: none"> <li>Complete remaining Node 2 outfitting</li> </ul>	05:00
06:00		<u>CLEANUP AND A/L INGRESS</u> (00:15) <u>PRE REPRESS</u> (00:05)	<u>CLEANUP AND A/L INGRESS</u> (00:15) <u>PRE REPRESS</u> (00:05)	06:00

## PRE EVA 2 TOOL CONFIG

### EV1

#### EMU D-Rings

- 1 – Tether Extender on Left
- 2 – Waist Tethers
- 1 – 85' Safety Tether on Left

#### MWS

- Small trash bag
  - Connector Tool
    - RET (sm-sm)
  - MMOD T-Tool
    - RET (sm-sm)
- 1 – Adj tether
- 1 – RET (sm-sm) [right]
- 1 – RET (with PIP pin) [left]
- 2 – Wire ties
- Socket caddy
  - 5/8-7.8 in ext
- Swing Arm [right side]
  - PGT w/7/16-6 in ext S/N \_\_\_\_\_
    - (BX, CW2, 30.5)
    - RET (sm-sm)
- BRT [left side]
  - 3 Wire Ties
  - RET (sm-sm)

#### SAFER

### CREWLOCK

- Fish stringer/OIH Carrier BOJ 1(w/ C-lk bag #2)
  - HR 0371 (18.9")
  - HR 0372 (18.9")
  - HR 0332 (24")
    - 72" gap spanner (on exposed HR end)
  - HR 0361(24")
  - Adj tether
    - HR 0359 (24")
    - HR 0352 (12")
  - HR 0345 (24")
  - 45" gap spanner (daisy chain)

### EV3

#### EMU D-Rings

- 1 – Tether Extender on Left
- 2 – Waist Tethers
- 1 – 85' Safety Tether on Left

#### MWS

- Small trash bag
  - Connector Tool
    - RET (sm-sm)
  - MMOD T-Tool
    - RET (sm-sm)
- 1 – Adj tether
- 1 – RET (sm-sm) [right]
- 1 – RET (with PIP pin) [left]
- 2 – Wire ties
- Socket caddy
- Swing Arm [right side]
  - PGT w/7/16-6 in ext S/N \_\_\_\_\_
    - (BX, CCW2, 30.5)
    - RET (sm-sm)
- BRT [left side]
  - 3 Wire Ties
  - RET (sm-sm)

#### SAFER

### CREWLOCK (Cont)

- Fish stringer/OIH Carrier BOJ 2 (w/C-lk bag #1)
  - HR 0346 (24")
  - HR 0353 (12")
  - HR 0360 (24")
  - HR 0358 (24")
  - WI – 09

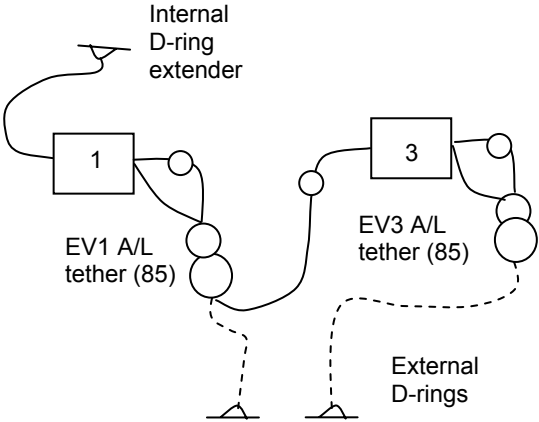
Prior to EVA, inspect:  
RET cord for damage  
BRT & MWS for loose fittings/screws  
Safety & waist tether load alleviating straps:  
no red

Total RETs sm-sm used – 12  
RETs with PIP pin – 2  
RETs Lg-sm – TBD  
Adj tethers – 6

### CREWLOCK (Cont)

- Staging Bag
  - PGT with battery PGT S/N \_\_\_\_\_
  - Connector Cleaner Tool Caddy
  - DCM Plug
  - Wire Tie Caddy
  - Round TM w/5/8 in socket
  - Socket Caddy
    - 7/16-12 in ext
    - 7/16-9 in ext (Z1 CLA release)
- IV Bag
  - EVA Ratchet (bilateral)
  - 2 – Adj Thermal Mittens
  - Hydrazine Detector Kit
  - 1 – wire tie caddy
  - 4 – waist tethers
- Lg-sm RET on A/L D-ring ext
  - Small ORU Bag
    - RPCM S/N \_\_\_\_\_
    - RET (sm-sm)
- Fish stringer (internal)
  - EVA Camera/Bracket
  - Fish stringer/OIH Carrier BOJ 2
    - Crewlock bag #1 (RTAS) – adj tether outside
      - Umbilical routing diagram on door
      - EVA Camera/Bracket on RET
      - Ratchet w/5/8-7.8 in ext
      - Cheater bar on RET
      - RAD w/5/8-7.8 in ext S/N \_\_\_\_\_
      - Keel cover on RET
        - 2 – Trunnion covers (aft/port, fwd/port)
  - Fish stringer/OIH Carrier BOJ 1
    - Crewlock bag #2 (Node 2) – adj tether outside
      - 2 – Trunnion covers (aft/stbd, fwd/stbd)
      - Loop-back connector for J408 on RET
      - Adj tether and RET (sm-sm)
        - WIF 07
        - WIF 13

## EVA 2 A/L EGRESS AND SETUP (00:25)

IV	EV1 – Pz (FF)	EV3 – Tani (FF)
 <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>1 – 85' A/L tether – EV3 1 – 85' A/L tether – EV1</p> </div> <p>1. Post crew egress: WVS Software: Select page – RF Camera sel 'Advanced controls' S-Band level (two) – max</p>	<p><u>INITIAL CONFIG</u></p> <p>1. Verify:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Right waist tether connected to A/L D-ring extender</li> <li><input type="checkbox"/> Hook locked</li> </ul> <p><u>EGRESS/INITIAL SET-UP</u></p> <hr/> <p>1. Release EV1 right waist tether from A/L D-ring extender, attach to self</p> <p>2. Transfer BOJ 2 w/ C/L bag #1 to EV3</p> <hr style="border-top: 1px dashed black;"/> <p>3. Egress crewlock 4. Close hatch thermal cover</p> <p>5. Verify SAFER config</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> √L Handle down (MAN ISO Vlv – Open)</li> <li><input type="checkbox"/> √R Handle down (HCM – Closed)</li> </ul> <p>6. Translate to Z1/P6 connector worksite via forward translation path</p>	<p><u>INITIAL CONFIG</u></p> <p>1. Verify:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Right waist tether connected to EV1's 85' Safety tether</li> <li><input type="checkbox"/> Hook locked</li> </ul> <p><u>EGRESS/INITIAL SET-UP</u></p> <ol style="list-style-type: none"> <li>1. Open hatch thermal cover</li> <li>2. Egress crewlock</li> <li>3. Attach EV3 safety tether to aft A/L D-Ring <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>4. Attach EV1 safety tether to fwd A/L D-Ring <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>5. Give EV1 GO to release EV1 waist tether from A/L D-ring extender</li> </ol> <hr/> <p>6. Receive BOJ 2 w/ C/L bag #1 from EV1 7. Stow BOJ 2 w/ C/L bag #1 on BRT</p> <p>8. Verify SAFER config</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> √L Handle down (MAN ISO Vlv – Open)</li> <li><input type="checkbox"/> √R Handle down (HCM – Closed)</li> </ul> <p>9. Translate to Z1/P6 connector worksite via aft translation path</p>

**Z1-TO-P6 UMBILICAL DISCONNECT (00:40)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)																								
<input type="checkbox"/> √With MCC all inhibits in place	<p style="text-align: center;"><b>CAUTION</b> Avoid inadvertent contact with S0 radiator</p> <p style="text-align: center;"><b>NOTE</b> For each connector: √Connectors for straight pins, no FOD, EMI band intact, and good bend radius</p> <p>1. Open TA clamps as required</p> <p><u>P254 1553 BUS B DATA DISCONNECT</u></p>	<p style="text-align: center;"><b>NOTE</b> 1. Stow BOJ 2/C/L bag on Z1 HR 6041 or 6040 (zenith/fwd/stbd)</p> <p><u>P254 1553 BUS B DATA DISCONNECT</u></p>																								
<p>1. Give EV GO for P254 demate</p>	<p>2. On IV GO, perform following demate, swap with dust cap from Z1:</p> <table border="1" style="width: 100%; text-align: center;"> <tr> <th style="width: 50%;">EV1 – Demate from P6</th> <th style="width: 50%;">EV1 – Mate to Z1</th> </tr> <tr> <td>Z1 P254 ←   → P6 J154</td> <td>Z1 P254 →   ← Z1 J254</td> </tr> </table>	EV1 – Demate from P6	EV1 – Mate to Z1	Z1 P254 ←   → P6 J154	Z1 P254 →   ← Z1 J254	<p style="text-align: center;"><b>NOTE</b> Soft dock – align white to white or tool white 90° out from white.</p> <p>Mate – align white to black or tool white to white</p>																				
EV1 – Demate from P6	EV1 – Mate to Z1																									
Z1 P254 ←   → P6 J154	Z1 P254 →   ← Z1 J254																									
<p><input type="checkbox"/> Notify MCC-H P254 demated (GO for data string reconfig)</p>	<p><u>POWER AND INST UMBILICAL DISCONNECTS</u></p> <p>3. Receive EV3 connector tool</p> <p>4. Remove cap with connector tool, transfer to EV3</p> <p>5. Receive connector from EV3</p> <p>6. Install connector on Z1</p> <p>7. Repeat steps 3-6 for the following connectors (7):</p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th style="width: 33%;">EV3 – Demate from P6</th> <th style="width: 33%;">EV1 – Mate to Z1</th> <th style="width: 33%;">EV3 – Mate Cap on P6</th> </tr> </thead> <tbody> <tr> <td>Z1 P255 ←   → P6 J155</td> <td>Z1 P255 →   ← Z1 J255</td> <td>P6 cap →   ← P6 J155</td> </tr> <tr> <td>Z1 P256 ←   → P6 J156</td> <td>Z1 P256 →   ← Z1 J256</td> <td>P6 cap →   ← P6 J156</td> </tr> <tr> <td>Z1 P257 ←   → P6 J157</td> <td>Z1 P257 →   ← Z1 J257</td> <td>P6 cap →   ← P6 J157</td> </tr> <tr> <td>Z1 P258 ←   → P6 J158</td> <td>Z1 P258 →   ← Z1 J258</td> <td>P6 cap →   ← P6 J158</td> </tr> <tr> <td>Z1 P259 ←   → P6 J159</td> <td>Z1 P259 →   ← Z1 J259</td> <td>P6 cap →   ← P6 J159</td> </tr> <tr> <td>Z1 P260 ←   → P6 J160</td> <td>Z1 P260 →   ← Z1 J260</td> <td>P6 cap →   ← P6 J160</td> </tr> <tr> <td>Z1 P261 ←   → P6 J161</td> <td>Z1 P261 →   ← Z1 J261</td> <td>P6 cap →   ← P6 J161</td> </tr> </tbody> </table>	EV3 – Demate from P6	EV1 – Mate to Z1	EV3 – Mate Cap on P6	Z1 P255 ←   → P6 J155	Z1 P255 →   ← Z1 J255	P6 cap →   ← P6 J155	Z1 P256 ←   → P6 J156	Z1 P256 →   ← Z1 J256	P6 cap →   ← P6 J156	Z1 P257 ←   → P6 J157	Z1 P257 →   ← Z1 J257	P6 cap →   ← P6 J157	Z1 P258 ←   → P6 J158	Z1 P258 →   ← Z1 J258	P6 cap →   ← P6 J158	Z1 P259 ←   → P6 J159	Z1 P259 →   ← Z1 J259	P6 cap →   ← P6 J159	Z1 P260 ←   → P6 J160	Z1 P260 →   ← Z1 J260	P6 cap →   ← P6 J160	Z1 P261 ←   → P6 J161	Z1 P261 →   ← Z1 J261	P6 cap →   ← P6 J161	<p><u>POWER AND INST UMBILICAL DISCONNECTS</u></p> <p>2. Transfer connector tool to EV1</p> <p>3. Receive connector tool and cap</p> <p>4. Remove connector on P6, transfer to EV1</p> <p>5. Install cap on P6</p> <p>6. Repeat steps 2-6 for the following connectors (7):</p>
EV3 – Demate from P6	EV1 – Mate to Z1	EV3 – Mate Cap on P6																								
Z1 P255 ←   → P6 J155	Z1 P255 →   ← Z1 J255	P6 cap →   ← P6 J155																								
Z1 P256 ←   → P6 J156	Z1 P256 →   ← Z1 J256	P6 cap →   ← P6 J156																								
Z1 P257 ←   → P6 J157	Z1 P257 →   ← Z1 J257	P6 cap →   ← P6 J157																								
Z1 P258 ←   → P6 J158	Z1 P258 →   ← Z1 J258	P6 cap →   ← P6 J158																								
Z1 P259 ←   → P6 J159	Z1 P259 →   ← Z1 J259	P6 cap →   ← P6 J159																								
Z1 P260 ←   → P6 J160	Z1 P260 →   ← Z1 J260	P6 cap →   ← P6 J160																								
Z1 P261 ←   → P6 J161	Z1 P261 →   ← Z1 J261	P6 cap →   ← P6 J161																								

**Z1-TO-P6 UMBILICAL DISCONNECT (00:40) (Cont)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)					
<input type="checkbox"/> √With MCC: GO for P253 demate	<u>P253 1553 BUS A DATA DISCONNECT</u>	<u>P253 1553 BUS A DATA DISCONNECT</u>					
2. Give EV GO for P253 demate	8. Translate to Z1 CLA	7. On IV GO, perform following demate, swap with dust cap from Z1: <table border="1"> <thead> <tr> <th>EV3 – Demate from P6</th> <th>EV1 – Mate to Z1</th> </tr> </thead> <tbody> <tr> <td>Z1 P253← →P6 J153</td> <td>Z1 P253→ ←Z1 J253</td> </tr> </tbody> </table> 8. Close remaining TA clamps 9. Translate to C/L bag on Z1		EV3 – Demate from P6	EV1 – Mate to Z1	Z1 P253← →P6 J153	Z1 P253→ ←Z1 J253
EV3 – Demate from P6	EV1 – Mate to Z1						
Z1 P253← →P6 J153	Z1 P253→ ←Z1 J253						

## Z1-TO-P6 UMBILICAL DISCONNECT – TASK DATA

### Tools:

EV1 (FF)	EV3 (FF)
Cannon Connector tool	Cannon Connector tool

**EVA Fasteners:** None

### EVA Connectors:

Harness	From (P6)	To (Z1)	Size	Function
W204A-P253	J153	J253		1553 bus A data
W704A-P254	J154	J254		1553 bus B data
W120C-P255	J155	J255		Operational power to S-Band XPDR and S-Band SASA from SPDA Z1-3B
W140C-P256	J156	J256		Heater power to S-Band XPDR and S-Band SASA from SPDA Z1-4B
W42-P257	J157	J257		P6 type IV to Z1 X2 patch (SPDA 3B-Z1 loads and RS) (Secondary Power)
W46-P258	J158	J258		P6 type IV to Z1 X2 patch (SPDA 4B-Z1 loads and RS) (Secondary Power)
W01A-P259	J159	J259		Upper power channel 2B (P6 to IDA-2B and S0) Channel 2B1 and channel 2B2 (primary power)
W08A-P260	J160	J260		Upper power channel 4B (P6 to IDA-4B and S0) Channel 4B1 and channel 4B2 (primary power)
W11A-P261	J161	J261		Provide data to and from S-Band ACBSP (Z1) and S-Band XPDR-2 (P6) (Data/Instrumentation)

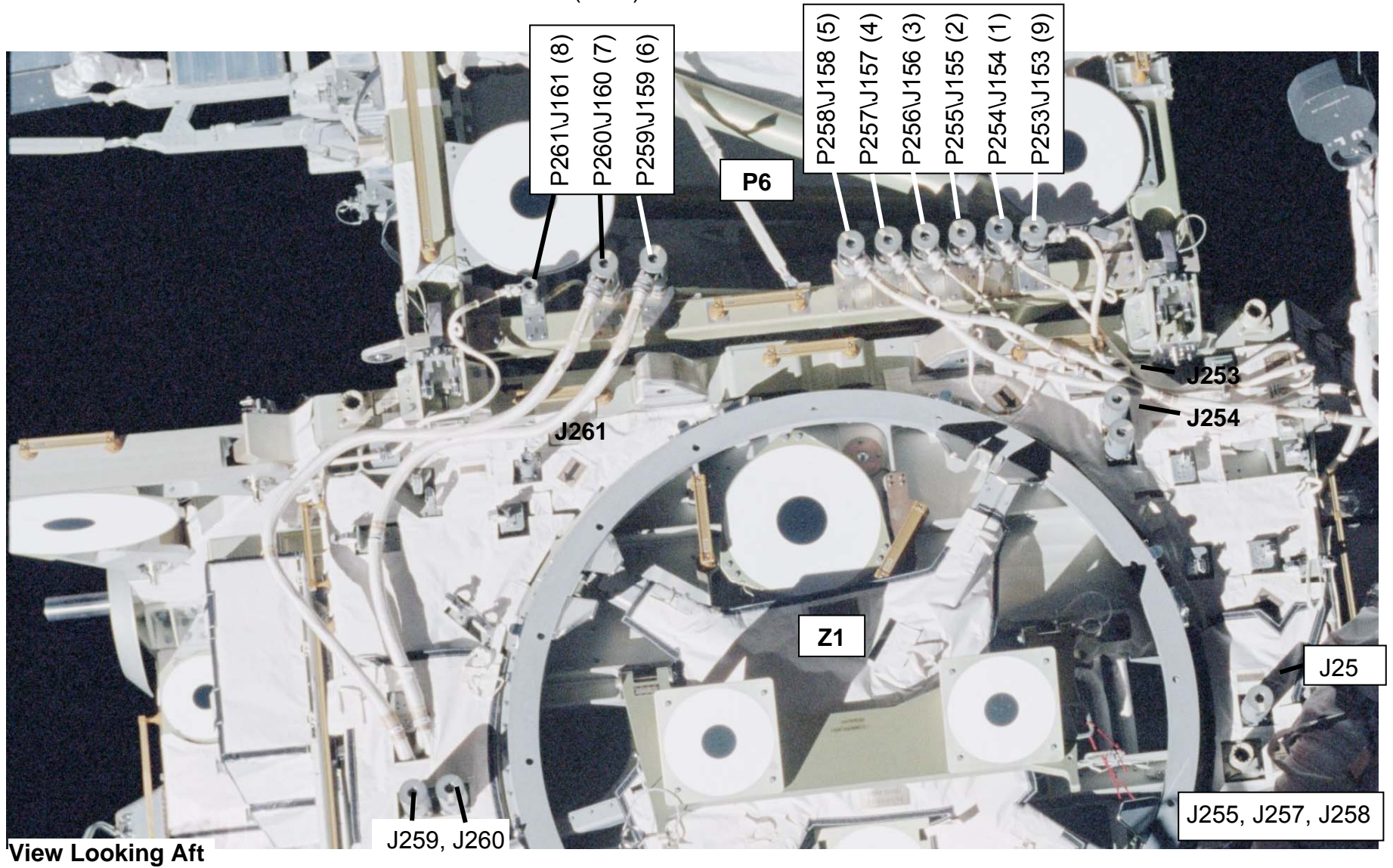
**Foot Restraints:** None

### Cautions:

1. Data strings must be reconfigured between bus A and B connector demates

**Warnings:** None

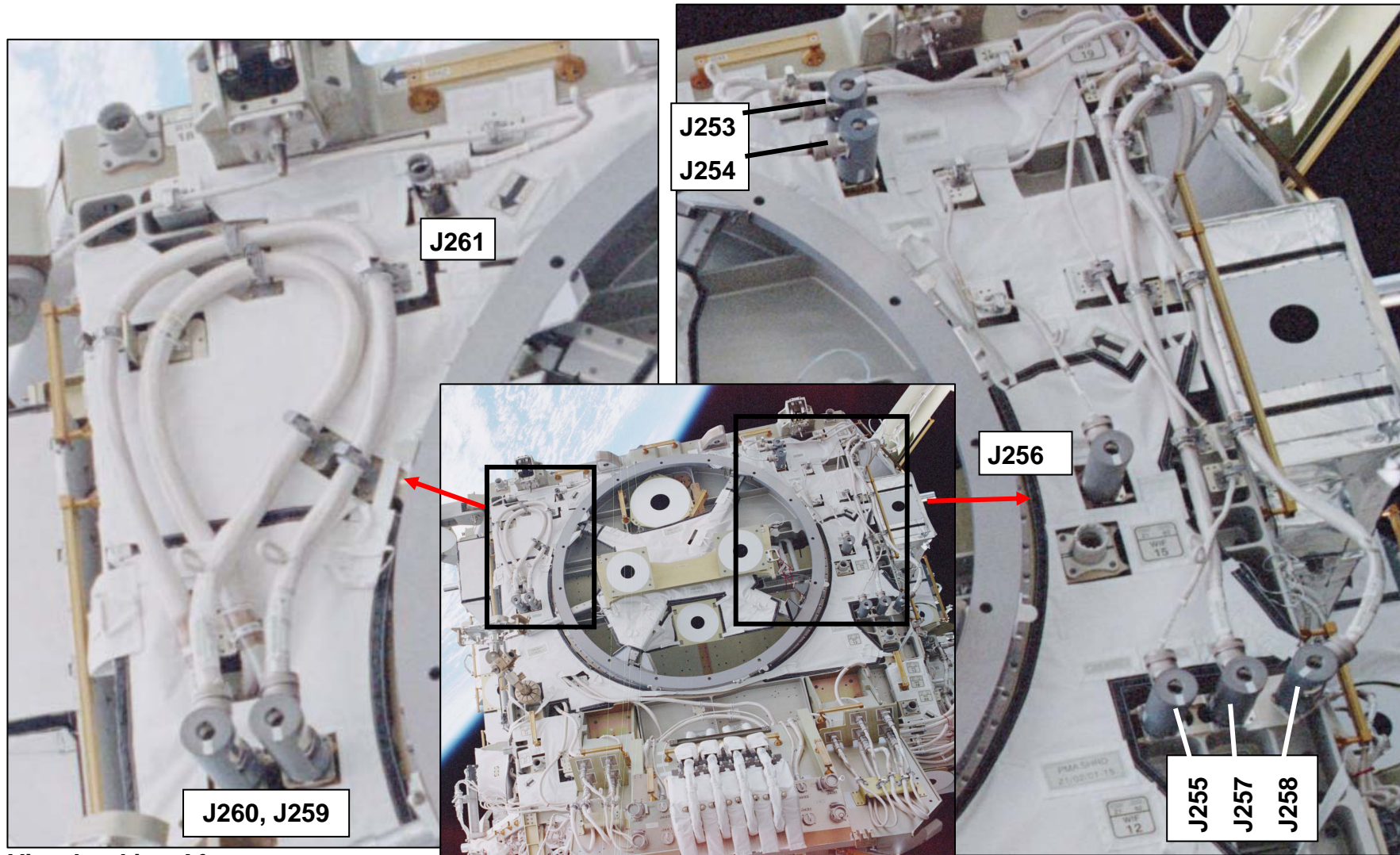
Z1-TO-P6 UMBILICALS DISCONNECT – TASK DATA (Cont)



Z1-TO-P6 UMBILICALS – MATED



Z1-TO-P6 UMBILICALS DISCONNECT – TASK DATA (Cont)

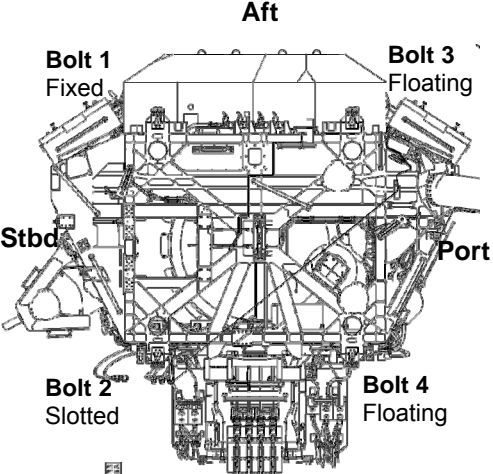


View Looking Aft

Z1-TO-P6 UMBILICALS – STOWED



# DETACH P6 FROM Z1 (01:20)

IV/SSRMS	EV1 – Pz (FF)	EV3 – Tani (FF)																																															
<p>SSRMS: P6 GRAPPLE</p> <table border="1"> <thead> <tr> <th>Hardware</th> <th>Z1 location</th> </tr> </thead> <tbody> <tr> <td>RTAS bolt 1 – fixed</td> <td>Aft, Stbd</td> </tr> <tr> <td>RTAS bolt 2 – slotted</td> <td>Fwd, Stbd</td> </tr> <tr> <td>RTAS bolt 3 – floating</td> <td>Aft, Port</td> </tr> <tr> <td>RTAS bolt 4 – floating</td> <td>Fwd, Port</td> </tr> <tr> <td>Capture claw drive</td> <td>Fwd side</td> </tr> </tbody> </table>  <p><b>Z1 – Zenith side looking nadir</b> Bolts on Z1 side</p>	Hardware	Z1 location	RTAS bolt 1 – fixed	Aft, Stbd	RTAS bolt 2 – slotted	Fwd, Stbd	RTAS bolt 3 – floating	Aft, Port	RTAS bolt 4 – floating	Fwd, Port	Capture claw drive	Fwd side	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Avoid inadvertent contact with S0 radiator</p> </div> <p><u>ENGAGE Z1 CAPTURE LATCH</u></p> <ol style="list-style-type: none"> <li>BRT to Z1 HR 6033</li> <li>Drive <b>Z1 capture latch</b> PGT, 7/16-6in ext: B1, CW2; ~126 turns to HS</li> </ol> <p><u>BREAK TORQUE ON BOLTS 2, 4, 3 &amp; 1</u></p> <ol style="list-style-type: none"> <li>Retrieve ratchet wrench and cheater bar from C/L bag</li> <li>Break torque on <b>RTAS Bolt 2</b> Ratchet w/cheater bar, 5/8-7.8 in ext; at least 1 turn</li> <li>Repeat step 4 for <b>corners 4, 3, and 1</b></li> <li>Fairlead safety tether nadir</li> </ol> <table border="1"> <thead> <tr> <th>Bolt Order</th> <th>BRT HR</th> <th></th> </tr> </thead> <tbody> <tr> <td>Bolt 2 – Fwd, Stbd</td> <td>6039</td> <td></td> </tr> <tr> <td>Bolt 4 – Fwd, Port</td> <td>6044</td> <td></td> </tr> <tr> <td>Bolt 3 – Aft, Port</td> <td>6035</td> <td></td> </tr> <tr> <td>Bolt 1 – Aft, Stbd</td> <td>6038</td> <td></td> </tr> </tbody> </table> <ol style="list-style-type: none"> <li>Stow ratchet/cheater bar in C/L bag</li> <li>Perform PGT socket swap; remove 7/16-6 in ext, stow on socket caddy, install 5/8-7.8 in ext on PGT</li> </ol> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Primary bolt hardware sensitive to crew loads. Do not apply a push force on the RTAS primary bolt. Damage to self feeding nut may occur</p> </div>	Bolt Order	BRT HR		Bolt 2 – Fwd, Stbd	6039		Bolt 4 – Fwd, Port	6044		Bolt 3 – Aft, Port	6035		Bolt 1 – Aft, Stbd	6038		<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Avoid inadvertent contact with S0 radiator</p> </div> <ol style="list-style-type: none"> <li>Stow cannon connector tool in C/L bag</li> <li>Retrieve RAD with 5/8-7.8 in ext from C/L bag</li> <li>Temp stow RAD near Corner 3 on HR 6047</li> </ol> <p><u>RELEASE GROUND STRAPS ON CORNERS 1, 2, 4 &amp; 3</u></p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Ground straps may present sharp edge hazard</p> </div> <ol style="list-style-type: none"> <li>Release <b>Corner 1 Ground Strap from Z1</b> PGT, 7/16-6 in ext: B1, CCW2; ~6 turns</li> <li>Install <b>Ground Strap on P6</b> By hand: cw; ~3 turns</li> <li>Repeat steps 4 and 5 for <b>corners 2, 4, and 3</b></li> <li>Fairlead safety tether zenith</li> </ol> <table border="1"> <thead> <tr> <th>Ground Strap Order</th> <th>BRT HR</th> <th>Remove</th> <th>Stow</th> </tr> </thead> <tbody> <tr> <td>Corner 1 – Aft, Stbd</td> <td>6038</td> <td></td> <td></td> </tr> <tr> <td>Corner 2 – Fwd, Stbd</td> <td>6039</td> <td></td> <td></td> </tr> <tr> <td>Corner 4 – Fwd, Port</td> <td>6044</td> <td></td> <td></td> </tr> <tr> <td>Corner 3 – Aft, Port</td> <td>6035</td> <td></td> <td></td> </tr> </tbody> </table> <ol style="list-style-type: none"> <li>Translate to RAD at Corner 3</li> <li>Perform PGT socket swap; remove 7/16-6 in ext, stow on socket caddy, install RAD w/5/8-7.8 in ext on PGT</li> </ol>	Ground Strap Order	BRT HR	Remove	Stow	Corner 1 – Aft, Stbd	6038			Corner 2 – Fwd, Stbd	6039			Corner 4 – Fwd, Port	6044			Corner 3 – Aft, Port	6035		
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**DETACH P6 FROM Z1 (01:20) (Cont)**

IV/SSRMS	EV1 – Pz (FF)	EV3 – Tani (FF)
<p>1. Notify M1 approaching P6 demate</p> <p>2. Prior to giving M1 go for P6 demate, verify:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Tools and tethers clear</li> <li><input type="checkbox"/> Electrical Connectors &amp; QDs Demated</li> <li><input type="checkbox"/> RTAS bolts released</li> <li><input type="checkbox"/> Ground straps released</li> <li><input type="checkbox"/> CLA released</li> </ul> <p>3. Once verification complete, give M1 GO for P6 demate SSRMS: Demate P6 from Z1</p>	<p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">Bolt 1 must be released last, preceded by bolt 2. The order of bolts 3 and 4 is not critical</p> <p><u>RELEASE FWD/PORT RTAS BOLT 4</u></p> <p>9. BRT to HR 6044</p> <p>10. Release <b>RTAS Bolt 4</b> PGT, 5/8-7.8 in ext: B7,CCW2; ~26 turns</p> <p><u>RELEASE FWD/STBD RTAS BOLT 2</u></p> <p>11. BRT to HR 6039</p>	<p><u>RELEASE AFT/PORT RTAS BOLT 3</u></p> <p>10. BRT to HR 6035</p> <p>11. Release <b>RTAS Bolt 3</b> PGT, RAD, 5/8-7.8 in ext: B1,CCW2; ~ 26 turns at bolt</p> <p>12. Once bolt 3 released, give EV1 GO to release RTAS bolt 2</p>
	<p>12. On EV3 GO, release <b>RTAS Bolt 2</b> PGT, 5/8-7.8 in ext: B7,CCW2; ~26 turns</p> <p>13. Give EV3 GO to release RTAS Bolt 1</p>	<p><u>RELEASE AFT/STBD RTAS BOLT 1</u></p> <p>13. BRT to HR 6038</p>
	<p>14. Install 7/16-6 in ext on PGT, stow 5/8-7.8 in ext socket on socket caddy</p> <p><u>RELEASE Z1 CAPTURE LATCH</u></p> <p>15. BRT to Z1 HR 6033</p> <p>16. On EV3 GO, release <b>Z1 capture latch</b> PGT, 7/16-6 in ext: B1, CCW2; ~127 turns to HS</p> <p>17. Verify separation plane clear</p>	<p>14. On EV1 GO, Release <b>RTAS Bolt 1</b> PGT, RAD, 5/8-7.8 in ext: B1,CCW2; ~ 26 turns at bolt</p> <p>15. Remove RAD, translate to C/L bag at Corner 3</p> <p>16. Stow RAD w/5/8-7.8 in ext in C/L bag</p> <p>17. Give EV1 GO for capture claw release</p> <p>18. Retrieve BOJ 2/C/L bag</p> <p>19. Verify separation plane clear</p>
	<p>18. Verify pins out of cups and capture bar clear of CLA</p> <p>19. Translate to airlock</p>	<p>20. Verify pins out of cups and capture bar clear of CLA</p> <p>21. Translate to Node 2</p>

## DETACH P6 FROM Z1 – TASK DATA

### Tools:

EV1 (FF)	EV3 (FF)
Cheater bar	PGT
Ratchet	5/8 -7.8 in ext
PGT	RAD
5/8 - 7.8 in ext	7/16 - 6 in ext
7/16 - 6 in ext	

### EVA Fasteners:

Fastener Name	Label	Head Size	Run-ning (ft-lb)	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
RTAS bolt	1,2,3,4	5/8"		57	57	427	14	30
Grounding Strap		7/16"		10	10	38	6	30
Z1 capture latch		7/16"	9.2	TBS	TBS	TBS	127	

**EVA Connectors:** None

### Foot Restraints:

Task	WIF	APFR Setting
Bolt 1	Z1-21	4, PP, H, 12
Bolt 2	Z1-11	2, OO, D, 1
Bolt 3	Z1-22	10, PP, H, 12
Bolt 4	Z1-12	9, PP, F, 12

### Cautions:

1. Primary bolt hardware sensitive to crew loads. Do not apply push force on bolt or damage to self feeding nut could occur

### Warnings:

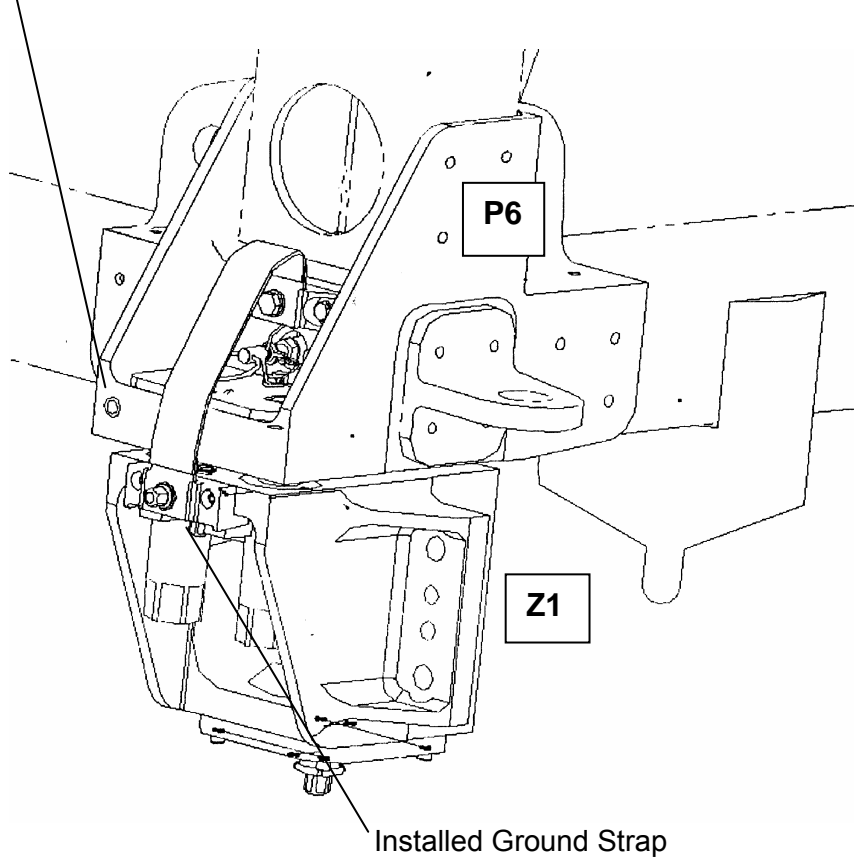
1. P6 ground straps may present sharp edge hazards near the bolt interface

### Notes:

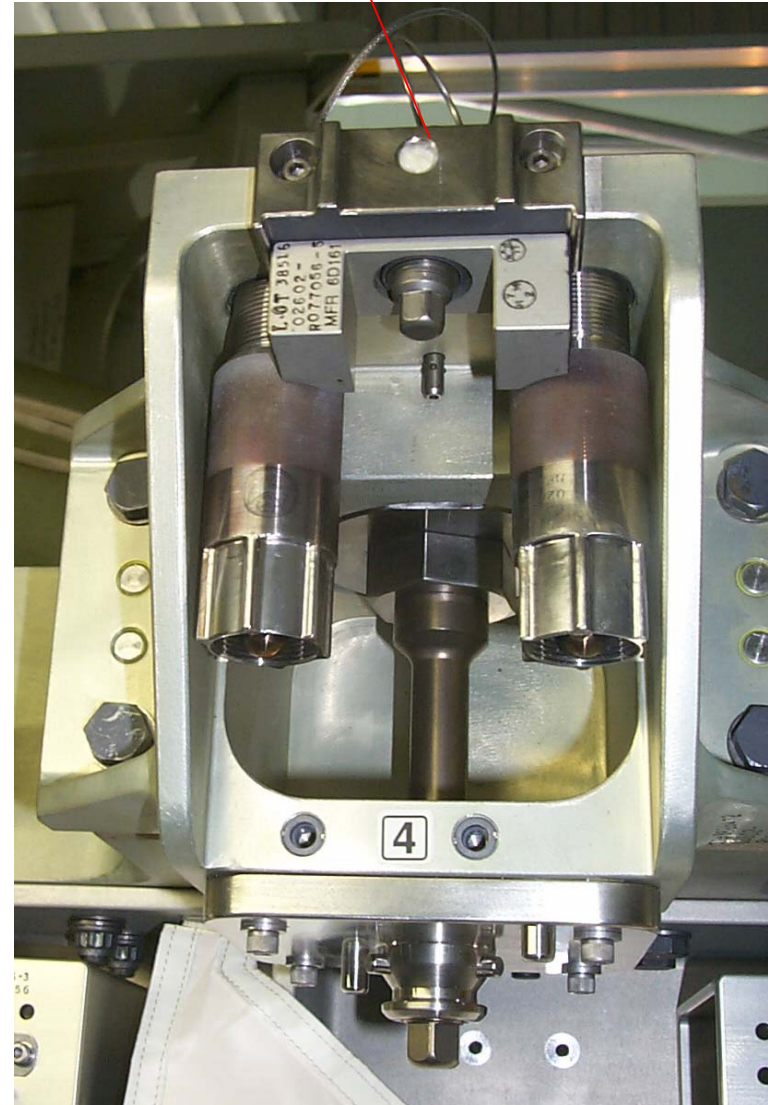
1. Gap Check Tools (2) are located on Z1 Corners 1 and 4.
2. P6 is safe for EVA translation as torque is broken on each bolt, and safe until 1RTAS bolt has been fully released (safe with 3/4 bolts at "running" torque)

# DETACH P6 FROM Z1 – TASK DATA (Cont)

Ground strap stowage spot



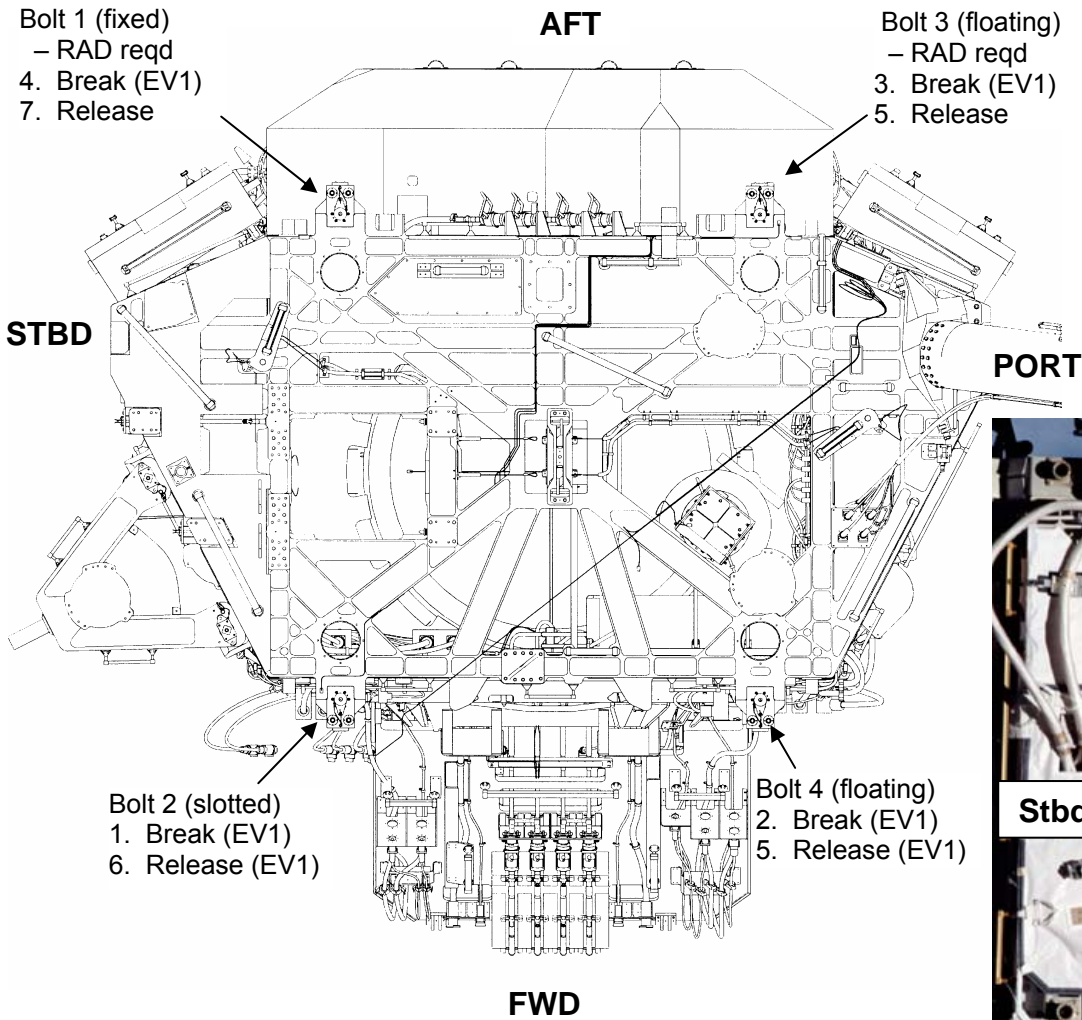
Ground Strap Installation spot



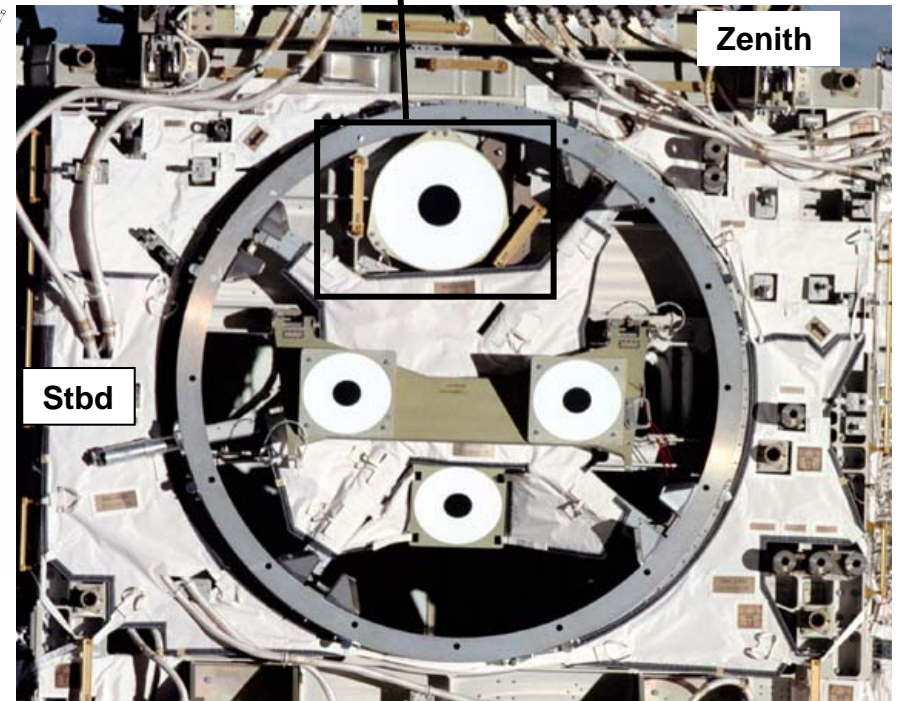
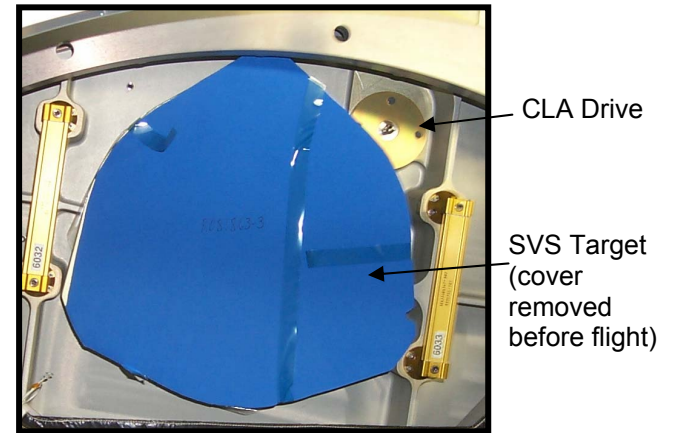
Z1 RTAS Primary Bolt (5/8 in)



**DETACH P6 FROM Z1 – TASK DATA (Cont)**



**Z1 Zenith View Looking Nadir**

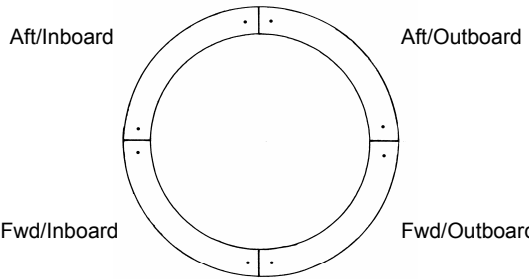


**Z1 FWD View Looking Aft**

**NODE 2 OUTFITTING (03:05)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)																																																																																																																																			
<p><u>Handrail Install</u></p> <ol style="list-style-type: none"> <li>√ Handrail soft dock armed (push both buttons)</li> <li>Install handrail (direction arrow on bottom)</li> <li>Tighten <b>handrail bolts</b> (two) PGT, 7/16–6 in ext: A3, CW2; ~8 turns</li> <li>Report turns and torque</li> </ol> <p><u>WIF Install</u></p> <ol style="list-style-type: none"> <li>Slide WIF into dove fitting</li> <li>Secure tabs (2)</li> </ol> <p><u>Trunnion Cover Install</u></p> <ol style="list-style-type: none"> <li>Engage grounding fasteners (2) w/MMOD T-tool</li> <li>Verify Velcro mate</li> </ol> <p><u>Gap Spanner Install</u></p> <ol style="list-style-type: none"> <li>Verify sufficient slack via 90° in plane buckle twist</li> </ol> <p><u>Keel Cover Install</u></p> <ol style="list-style-type: none"> <li>Verify good mate of hi-mag Velcro</li> </ol> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th colspan="2">Bolt 1 (left)</th> <th colspan="2">Bolt 2 (right)</th> </tr> <tr> <th>HR</th> <th>Turns</th> <th>Torque</th> <th>Turns</th> <th>Torque</th> </tr> </thead> <tbody> <tr><td>0371</td><td></td><td></td><td></td><td></td></tr> <tr><td>0372</td><td></td><td></td><td></td><td></td></tr> <tr><td>0332</td><td></td><td></td><td></td><td></td></tr> <tr><td>0361</td><td></td><td></td><td></td><td></td></tr> <tr><td>0359</td><td></td><td></td><td></td><td></td></tr> <tr><td>0352</td><td></td><td></td><td></td><td></td></tr> <tr><td>0345</td><td></td><td></td><td></td><td></td></tr> <tr><td>0360</td><td></td><td></td><td></td><td></td></tr> <tr><td>0353</td><td></td><td></td><td></td><td></td></tr> <tr><td>0346</td><td></td><td></td><td></td><td></td></tr> <tr><td>0358</td><td></td><td></td><td></td><td></td></tr> </tbody> </table>		Bolt 1 (left)		Bolt 2 (right)		HR	Turns	Torque	Turns	Torque	0371					0372					0332					0361					0359					0352					0345					0360					0353					0346					0358					<ol style="list-style-type: none"> <li>Translate to airlock</li> <li>Ingress airlock, retrieve BOJ 1/C/L bag #2 from fish stringer</li> <li>Egress airlock, close hatch thermal cover</li> <li>Translate to Node 2</li> <li>Temp stow BOJ 1 on Node 2 HR 0370</li> </ol> <p>6. Install:</p> <table style="width: 100%;"> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>HR 0371 inbrd end cone near WIF 07</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>HR 0372 inbrd end cone near M1, M2</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>WIF – 07 zenith/inbrd (tether pnt outboard)</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>HR 0332 zenith/inbrd near M2</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>WIF – 13 zenith/inbrd near HR 0332 (tether point outboard)</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>“I/F” Inboard/fwd trunnion cover (aft/stbd)</td></tr> <tr><td><input type="checkbox"/></td><td></td><td>Install gap spanner 1 between HR 0342 and 0347 (inboard standoffs)</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>HR 0361 outbrd, near port/nadir trunnion</td></tr> <tr><td><input type="checkbox"/></td><td></td><td>Loop back connector on J408 (outboard/fwd) (remove MLI strap, remove MLI, remove protective cap, install connector, reinstall MLI)</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>“O/F” Outboard/fwd trunnion cover (fwd/stbd)</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>HR 0359 zenith/fwd</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>HR 0352 zenith/fwd</td></tr> <tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td>HR 0345 zenith/fwd</td></tr> <tr><td><input type="checkbox"/></td><td></td><td>Install gap spanner 2 between HR 0332 &amp; 0345</td></tr> </table> <ol style="list-style-type: none"> <li>Stow contents of trash bag (cannon connector tool, MMOD handling tool, J408 protective cap, MLI strap ) in C/L bag #2</li> </ol>	<input type="checkbox"/>	<input type="checkbox"/>	HR 0371 inbrd end cone near WIF 07	<input type="checkbox"/>	<input type="checkbox"/>	HR 0372 inbrd end cone near M1, M2	<input type="checkbox"/>	<input type="checkbox"/>	WIF – 07 zenith/inbrd (tether pnt outboard)	<input type="checkbox"/>	<input type="checkbox"/>	HR 0332 zenith/inbrd near M2	<input type="checkbox"/>	<input type="checkbox"/>	WIF – 13 zenith/inbrd near HR 0332 (tether point outboard)	<input type="checkbox"/>	<input type="checkbox"/>	“I/F” Inboard/fwd trunnion cover (aft/stbd)	<input type="checkbox"/>		Install gap spanner 1 between HR 0342 and 0347 (inboard standoffs)	<input type="checkbox"/>	<input type="checkbox"/>	HR 0361 outbrd, near port/nadir trunnion	<input type="checkbox"/>		Loop back connector on J408 (outboard/fwd) (remove MLI strap, remove MLI, remove protective cap, install connector, reinstall MLI)	<input type="checkbox"/>	<input type="checkbox"/>	“O/F” Outboard/fwd trunnion cover (fwd/stbd)	<input type="checkbox"/>	<input type="checkbox"/>	HR 0359 zenith/fwd	<input type="checkbox"/>	<input type="checkbox"/>	HR 0352 zenith/fwd	<input type="checkbox"/>	<input type="checkbox"/>	HR 0345 zenith/fwd	<input type="checkbox"/>		Install gap spanner 2 between HR 0332 & 0345	<ol style="list-style-type: none"> <li>Temp stow BOJ 2/C/L bag #1 on Node 2 HR 0331, translate under CETA light</li> <li>Translate to airlock</li> <li>Ingress airlock, retrieve RPCM ORU bag</li> <li>Egress airlock, close hatch thermal cover</li> </ol> <p><b>Perform S1 SFU CONFIG FOR CINCH FIRING (00:25)</b></p> <p><b>Perform MBSU BYPASS JUMPER RECONFIG (00:20)</b></p> <p><b>Perform RPCM S04B-C R&amp;R (00:50)</b></p> <ol style="list-style-type: none"> <li>Translate to BOJ 2 at Node 2 HR 0368; staying under CETA light</li> </ol> <p>2. 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<input type="checkbox"/>	<input type="checkbox"/>	“O/A” Outboard/aft trunnion cover (fwd/port)																																																																																																																																			
<input type="checkbox"/>		Keel cover nadir/aft																																																																																																																																			
<input type="checkbox"/>	<input type="checkbox"/>	WIF – 09 near PDGF (tether point outboard)																																																																																																																																			
<input type="checkbox"/>	<input type="checkbox"/>	“I/A” Inboard/aft trunnion cover (aft/port)																																																																																																																																			

**NODE 2 OUTFITTING (03:05) (Cont)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)								
<p><u>CBM Hatch PIP Release</u></p> <ol style="list-style-type: none"> <li>Open hatch cover</li> <li>Remove pin, stow in trash bag</li> <li>Close hatch cover</li> </ol>	<p><input type="checkbox"/> Remove Zenith CBM PIP pin</p> <p>8. Remove Zenith CBM petal restraints:</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><b>CAUTION</b></p> <p style="text-align: center;">Be prepared for CBM petal movement, when releasing launch restraint pins</p> <p style="text-align: center;">If using petal for translation at least one launch restraint must be engaged</p> </div> <p>CBM petal restraints:</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Aft/Inboard</td> <td style="text-align: center;">Aft/Outboard</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/> <input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/> <input type="checkbox"/></td> </tr> <tr> <td style="text-align: center;">Fwd/Inboard</td> <td style="text-align: center;">Fwd/Outboard</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/> <input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/> <input type="checkbox"/></td> </tr> </table> <p><input type="checkbox"/> Remove Fwd CBM PIP pin  <input type="checkbox"/> Remove Nadir CBM PIP pin  <input type="checkbox"/> Remove Aft CBM PIP pin</p> <ol style="list-style-type: none"> <li>Retrieve BOJ 1/C/L bag #2</li> <li>Stow BOJ 1/C/L bag on BRT</li> <li>Translate to A/L</li> </ol>	Aft/Inboard	Aft/Outboard	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	Fwd/Inboard	Fwd/Outboard	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<ol style="list-style-type: none"> <li>Stow BOJ 2/C/L bag #2 on HR 0368</li> <li>Translate to A/L</li> </ol> <div style="text-align: center; margin: 20px 0;">  <p><b>ZENITH CBM RESTRAINTS</b></p> </div>
Aft/Inboard	Aft/Outboard									
<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>									
Fwd/Inboard	Fwd/Outboard									
<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>									

## NODE 2 OUTFITTING – TASK DATA

### Tools:

EV1 (FF)	EV3 (FF)
PGT	PGT
7/16 - 6 in ext	7/16 - 6 in ext

### EVA Fasteners:

Fastener	Head size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Handrail	7/16	2	4.6-5.4	-----	TBD	8	30

### EVA Connectors:

Harness	From	To	Size	Function
Loopback connector	N/A	Node 2 J408		PDGF terminator

**Foot Restraints:** None

**Warnings:** Inside of WIF is sharp edge hazard

**Cautions:** None



Grounding Fastener (2)



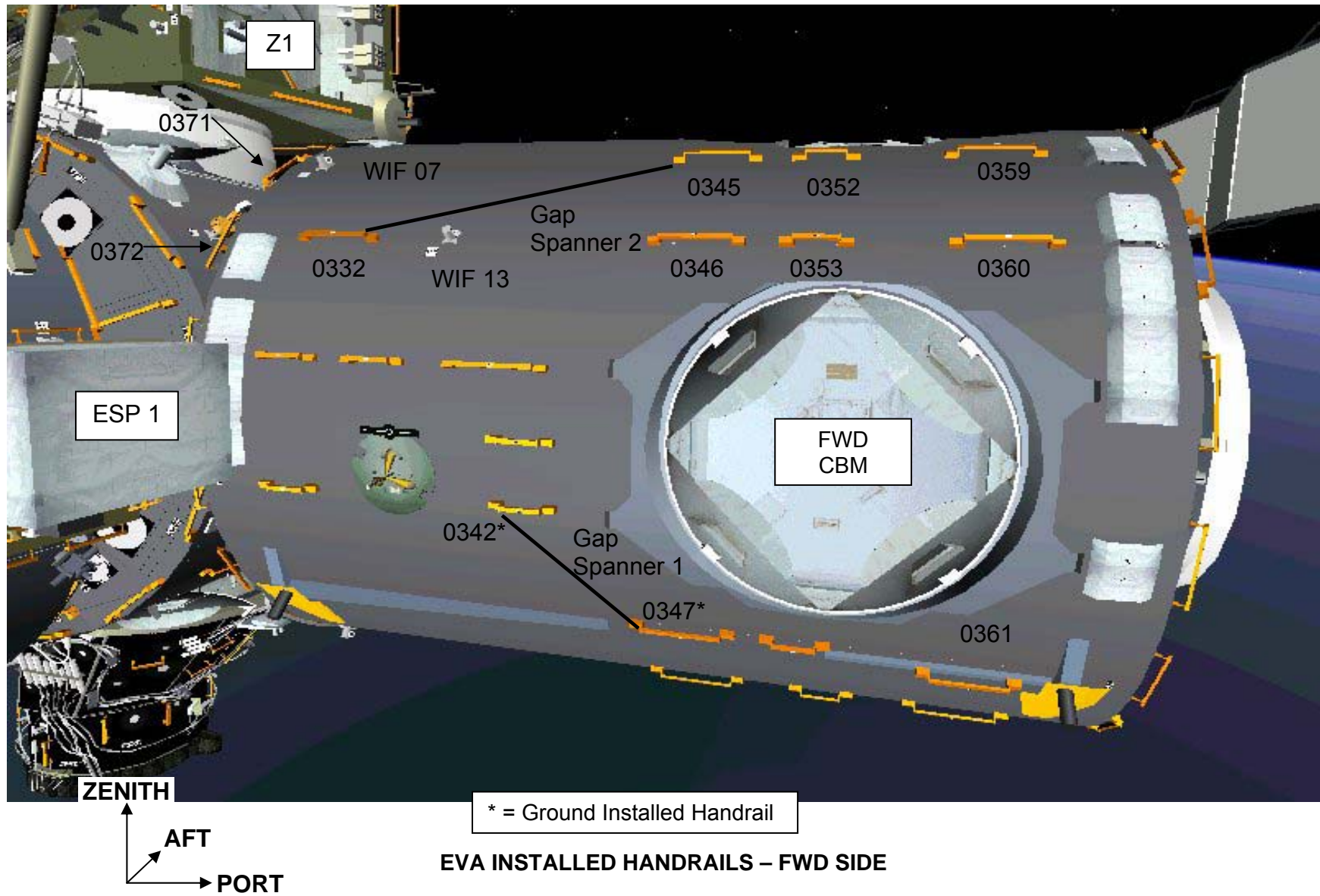
KEEL COVER – Bottom view

Hi-mag Velcro

TRUNNION COVER –  
mounted to test fixture

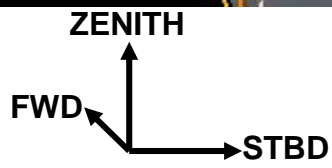
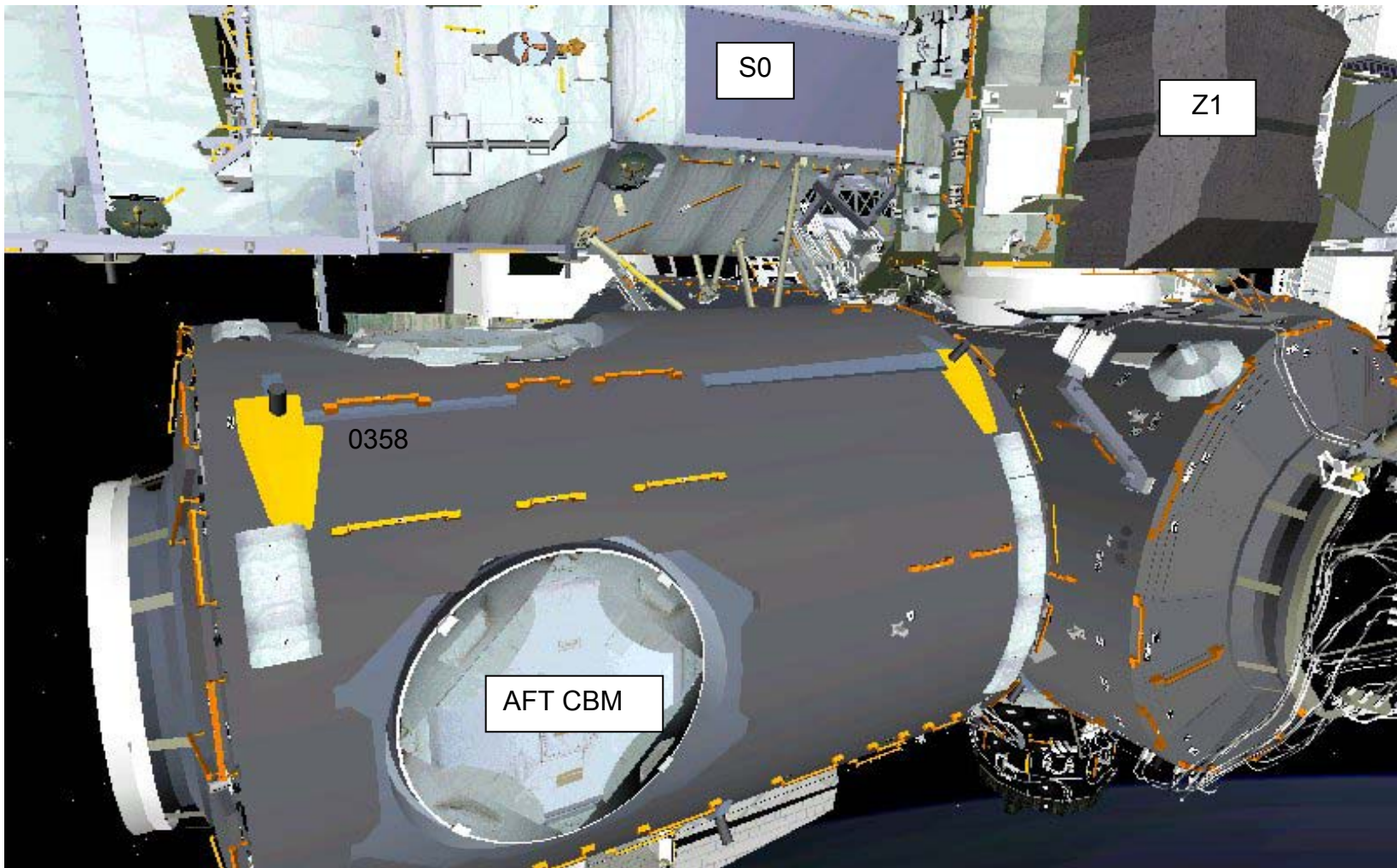


# NODE 2 OUTFITTING – TASK DATA (Cont)



\* = Ground Installed Handrail  
**EVA INSTALLED HANDRAILS – FWD SIDE**

**NODE 2 OUTFITTING – TASK DATA (Cont)**



**EVA INSTALLED HANDRAILS – AFT SIDE**

**S1 SFU CONFIG FOR CINCH FIRING (00:25)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)																								
<p><u>SFU RECONFIG INHIBITS</u>                      ✓RPCM S1-1A-C RPC 4 – OPEN                          5 – OPEN                          6 – OPEN                          7 – OPEN</p> <p><input type="checkbox"/> ✓With MCC all inhibits in place for SFU Configure</p>		<p>1. Translate to CETA spur                      2. Temp stow RPCM ORU Bag at CETA spur, HR 3413                      3. Translate to S1 SFU Panel A123 on nadir radiator beam (CETA marker 6330)                      4. BRT HR 3258</p> <p style="text-align: center;"><u>NOTE</u></p> <p>✓Connectors for straight pins, no FOD, EMI band intact, and good bend radius</p>																								
<p>1. Give EV GO for SFU Configure</p>		<p>5. On IV GO, swap the following:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="4" style="text-align: center;">PNL A123 – Demate</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">P752</td> <td style="text-align: center;">← →</td> <td style="text-align: center;">J752</td> <td></td> </tr> <tr> <td style="text-align: center;">Dust cap</td> <td style="text-align: center;">← →</td> <td style="text-align: center;">J703</td> <td></td> </tr> <tr> <th colspan="4" style="text-align: center;">PNL A123 – Mate</th> </tr> <tr> <td style="text-align: center;">P752</td> <td style="text-align: center;">→ ←</td> <td style="text-align: center;">J703</td> <td></td> </tr> <tr> <td style="text-align: center;">Dust cap</td> <td style="text-align: center;">→ ←</td> <td style="text-align: center;">J752</td> <td></td> </tr> </tbody> </table>	PNL A123 – Demate				P752	← →	J752		Dust cap	← →	J703		PNL A123 – Mate				P752	→ ←	J703		Dust cap	→ ←	J752	
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PNL A123 – Mate																										
P752	→ ←	J703																								
Dust cap	→ ←	J752																								
<p><input type="checkbox"/> Notify MCC-H SFU connector swap complete (GO for Cinch firing)</p>		<p>6. Retrieve RPCM ORU Bag from CETA spur, stow on BRT                      7. Translate to RPCM R&amp;R worksite (CETA marker 8130, S0, Bay 2)                      8. Temp stow RPCM ORU bag on HR 3523                      9. Translate to MBSU Jumper worksite (CETA marker 8190, S0, Bay 4)</p>																								

## S1 SFU CONFIG FOR CINCH FIRING – TASK DATA

### Tools:

EV1 (FF)	EV3 (FF)
N/A	

**EVA Fasteners:** None

### EVA Connectors:

Harness	From	To	Clamps	Size	Function
S1P752-WXX	S1 J752	S1 J703	0	TBD	SFU Power
J703-Dust Cap	S1 J703	S1 J752	0	TBD	Protection

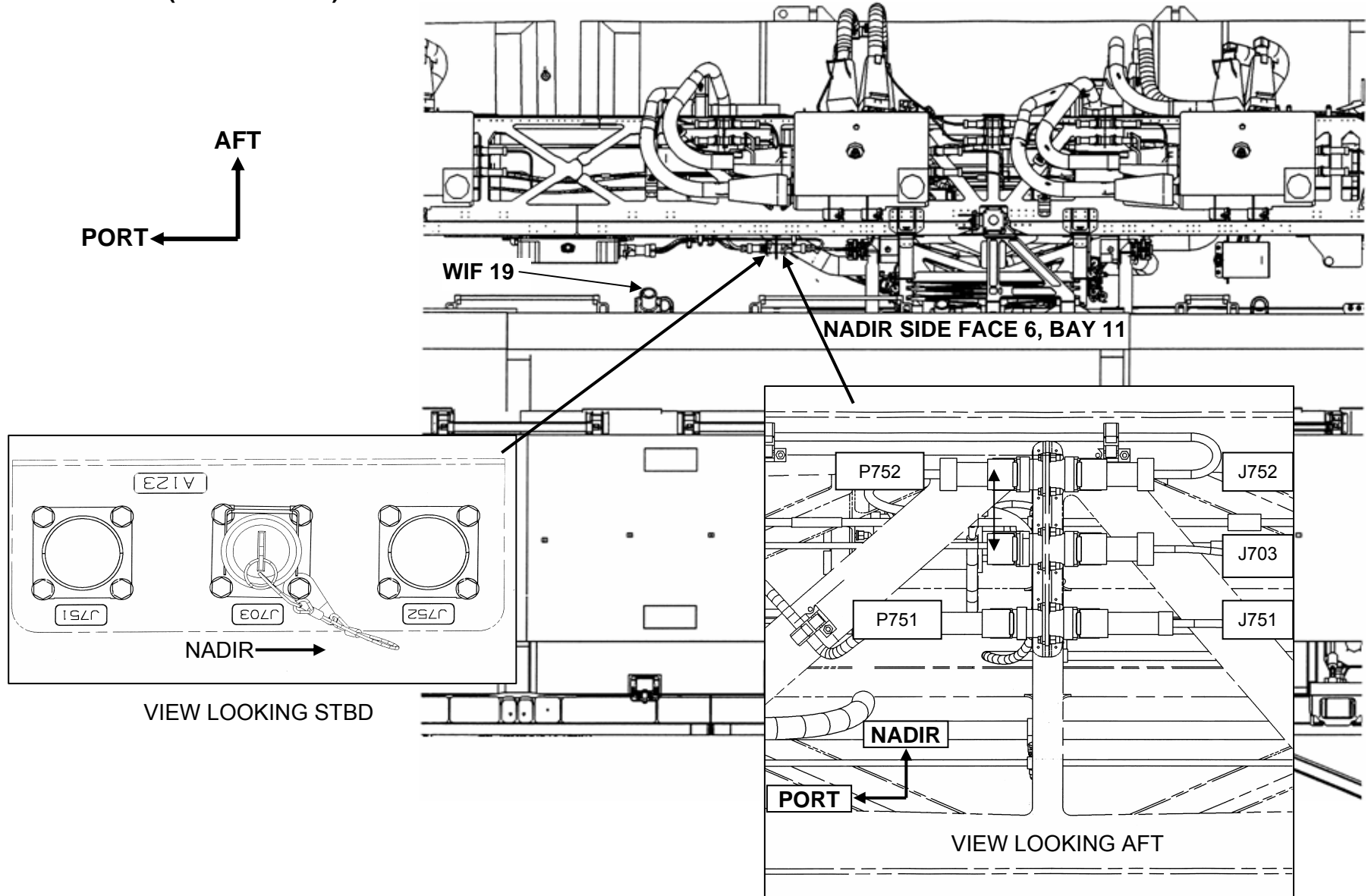
**Foot Restraints:** None

### Warnings:

**Cautions:** None

### Note:

SFU PANEL A123 (PRE DEPLOY)



**MBSU BYPASS JUMPER RECONFIG (00:20)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)																																																
<p><input type="checkbox"/> √With MCC all inhibits in place for MBSU Bypass Jumper Reconfig</p>		<p>1. Translate to CETA marker 8190                  2. Enter S0 bay 4 through forward face                  3. Release TA clamps as reqd</p> <p style="text-align: center;"><u>NOTE</u></p> <p>√Connectors for straight pins, no FOD, EMI band intact, and good bend radius</p> <p><u>A260 PANEL RECONFIG (NADIR)</u></p>																																																
<p>1. Give EV GO for SFU Configure</p>		<p>4. On IV GO, swap P489 with P491:</p> <table border="1"> <thead> <tr> <th colspan="4">PNL A260 - Demate</th> </tr> </thead> <tbody> <tr> <td>P489</td> <td>← →</td> <td>J491</td> <td></td> </tr> <tr> <td>P491</td> <td>← →</td> <td>J489</td> <td></td> </tr> <tr> <th colspan="4">PNL A260 - Mate</th> </tr> <tr> <td>P489</td> <td>→ ←</td> <td>J489</td> <td></td> </tr> <tr> <td>P491</td> <td>→ ←</td> <td>J491</td> <td></td> </tr> </tbody> </table> <p>5. Install wire harness of P491 into TA clamp as reqd</p> <p><u>A200 PANEL RECONFIG (ZENITH)</u></p> <p>6. Swap P486 with P483:</p> <table border="1"> <thead> <tr> <th colspan="4">PNL A200 - Demate</th> </tr> </thead> <tbody> <tr> <td>P486</td> <td>← →</td> <td>J483</td> <td></td> </tr> <tr> <td>P483</td> <td>← →</td> <td>J486</td> <td></td> </tr> <tr> <th colspan="4">PNL A200 - Mate</th> </tr> <tr> <td>P486</td> <td>→ ←</td> <td>J486</td> <td></td> </tr> <tr> <td>P483</td> <td>→ ←</td> <td>J483</td> <td></td> </tr> </tbody> </table> <p>7. Install wire harness of P483 into TA clamp as reqd</p>	PNL A260 - Demate				P489	← →	J491		P491	← →	J489		PNL A260 - Mate				P489	→ ←	J489		P491	→ ←	J491		PNL A200 - Demate				P486	← →	J483		P483	← →	J486		PNL A200 - Mate				P486	→ ←	J486		P483	→ ←	J483	
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<p>2. Notify MCC-H MBSU Bypass Jumper Config complete (GO for MBSU powerup)</p>		<p>8. Translate to RPCM Worksite (Bay 2)</p>																																																

## MBSU BYPASS JUMPER RECONFIG – TASK DATA

### Tools:

EV1 (FF)	EV3 (FF)
N/A	N/A

**EVA Fasteners:** None

### EVA Connectors:

Harness	From	To	Size	Function
W4007-P486	A200-J483 (dummy)	W4039-J486		Primary power for MBSU channel 4B
W4033-P483	W4039-J486	A200-J483		Primary power for MBSU channel 2B
W4002-P489	A260-J491	W4002-P489		Primary power for MBSU channel TBS
W4032-P491	W4038-J489	A260-J491		Primary power for MBSU channel TBS

**Foot Restraints:** None

### Cautions:

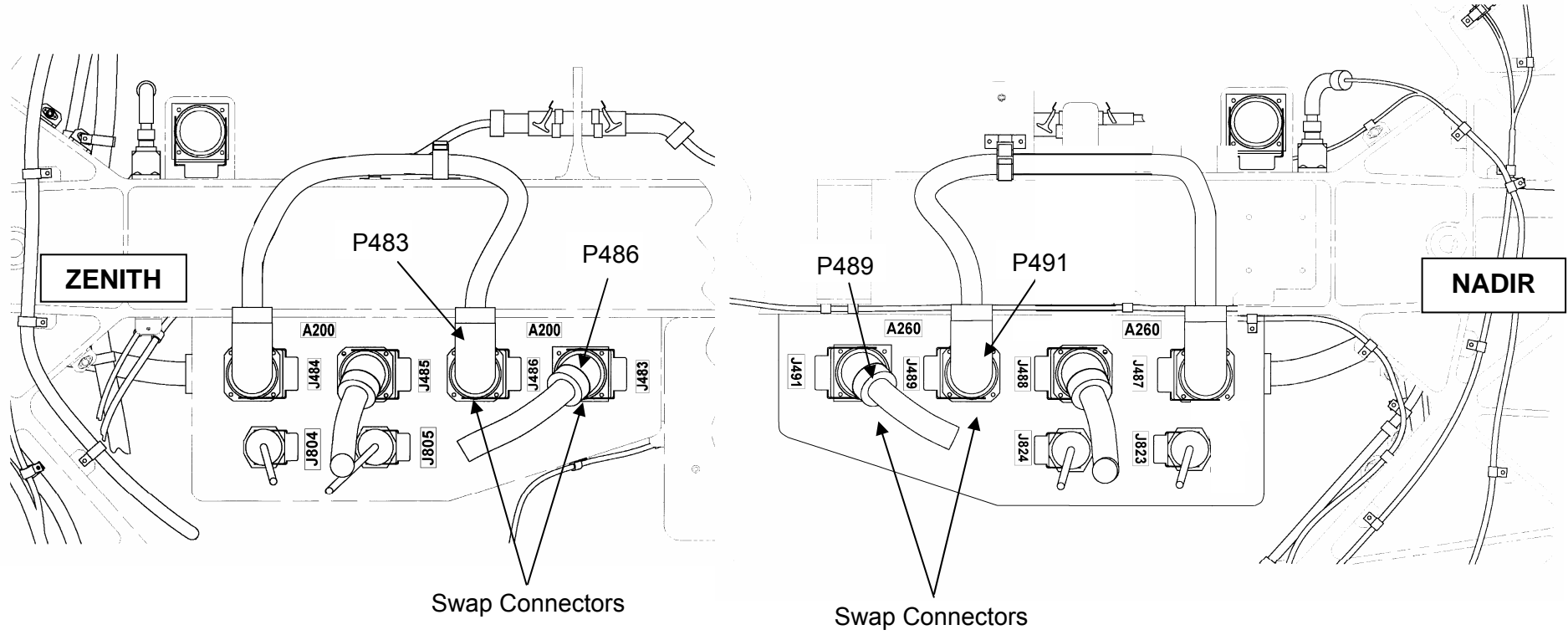
### Warnings:

1. Electrical inhibit must be in place prior to demating/mating to avoid electrical shock



**MBSU BYPASS JUMPER RECONFIG – TASK DATA (Cont)**

**AFT**



**PNL A200 – Bay 4 View looking STBD**

**PNL A260 – Bay 4 View looking STBD**



### RPCM S04B-C R&R (00:50)

IV	EV1 – Pz (FF)	EV3 – Tani (FF)						
<p><input type="checkbox"/> ✓MCC-H Power down DDCU S14B for RPCM S04B-C R&amp;R</p>		<p>1. Translate to RPCM S04B-C (S0 Bay 2), retrieve RPCM from temp stow location</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>WARNING</b> Edges of RPCM housing may be sharp, use caution while handling</p> </div> <p><u>RPCM R&amp;R</u></p> <p>2. Verify RPCM S04B-C S/N 9000 (3rd from outboard)</p> <p>3. Tether to failed RPCM (hook pointed toward RPCM)</p>						
<p>1. Give EV3 GO for RPCM R&amp;R</p>  <p>RPCM Install data</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">Bolt</th> <th style="width: 33%;">Turns</th> <th style="width: 33%;">Torque</th> </tr> </thead> <tbody> <tr> <td>Drive Screw</td> <td></td> <td></td> </tr> </tbody> </table>  <p>2. Notify MCC-H new RPCM installed (GO for RPCM power up and Checkout)</p>	Bolt	Turns	Torque	Drive Screw				<p>4. On IV GO, release <b>RPCM Drive Screw</b> PGT, 7/16-6 in ext: A7, CCW2; ~8 turns to HS, push while turning</p> <p><input type="checkbox"/> ✓Status indicator – UNLOCK</p> <p>5. Remove failed RPCM, temp stow</p> <p>6. Inspect guide rail for debris/damage</p> <p>7. Remove new RPCM from ORU bag</p> <p>8. Inspect RPCM connector interface for debris/damage</p> <p>9. Install RPCM on guide rail and slide into softdock</p> <p><input type="checkbox"/> ✓Status indicator – not below UNLOCK</p> <p>10. Install <b>RPCM Drive Screw</b> PGT, 7/16-6 in ext: A2, CW2; 6-7 turns to HS, push while turning</p> <p><input type="checkbox"/> ✓Status Indicator – LOCK</p> <hr style="border-top: 1px dashed black;"/> <p>11. Stow failed RPCM in ORU bag</p> <p><input type="checkbox"/> ✓MT translation path outboard is clear of EVA hardware</p> <p>12. Translate to airlock</p> <p>13. Stow ORU bag in airlock</p> <p>14. Egress airlock, close hatch thermal cover</p> <p>15. Translate to Node 2 via Z1 aft path</p>
Bolt	Turns	Torque						
Drive Screw								

## RPCM S04B-C R&R – TASK DATA

### Tools:

EV1 (FF)	EV3 (FF)
	PGT
	7/16 - 6 in ext

### EVA Fasteners:

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
RPCM Drive Screw	7/16	1	5.5 grnd 3.8 orbit	4.5	18.6 rmv 8.5 install	8 rmv 6-7 install

**EVA Connectors:** None

**Foot Restraints:** None

### ORU Identification:

	Serial Number
Spare RPCM	
Failed RPCM	9000

### RPCM Tether Orientation



### Note:

1. Installation of tether on RPCM tether point must be oriented such that the hook is facing the body of the RPCM. Otherwise interference between the SPDA frame and the RPCM will not allow hook removal

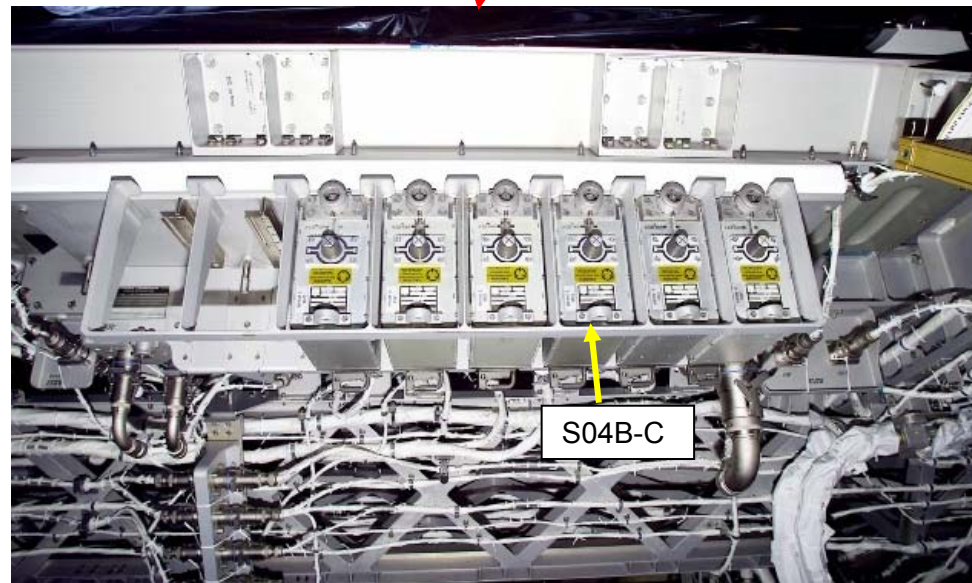
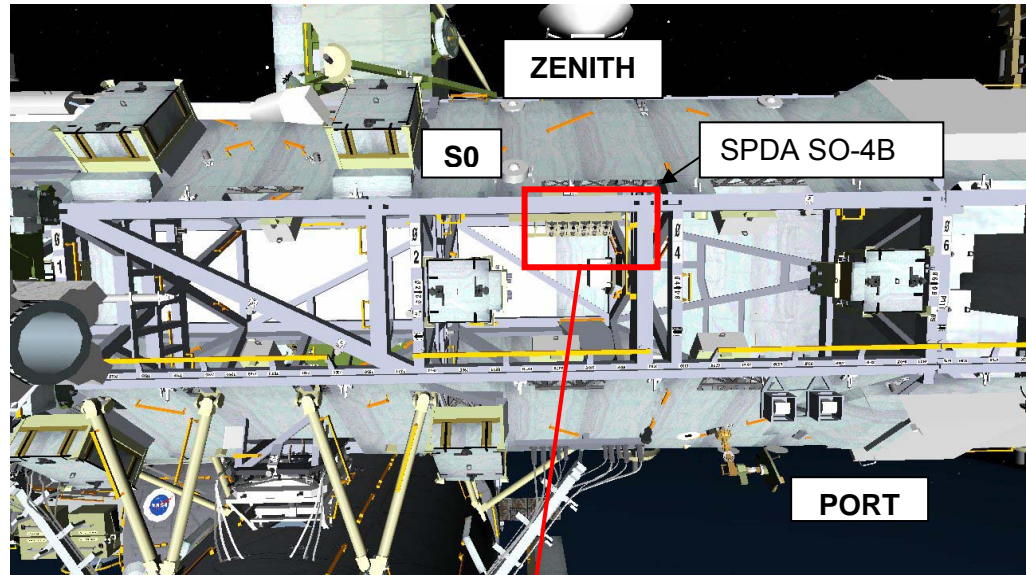
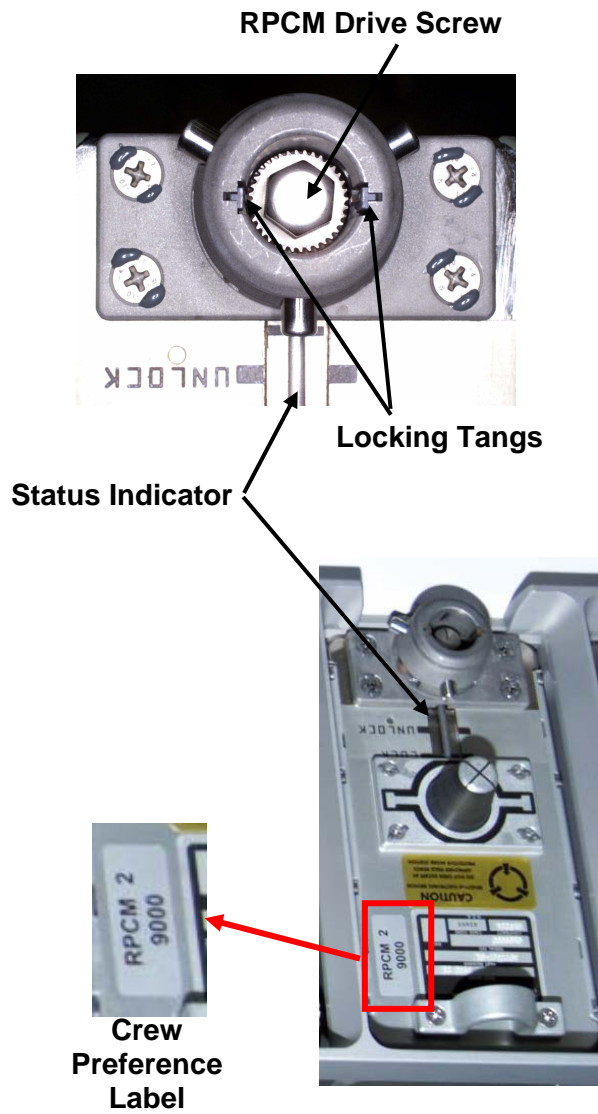
### Caution:

1. Failure to use wobble socket, or socket with equivalent outer diameter, to release lock springs can result in damage to the RPCM Drive Screw Assembly
2. Do not operate drive screw with scoop attached to microconical. The wobble socket feature will not extend thru the round scoop
3. Failure to align and fully seat socket until lock springs have released can result in damage to RPCM Drive Screw Assembly
4. Combined linear and rotational motion on the socket while inserting, can result in damage to RPCM Drive Screw Assembly

### Warning:

1. RPCM may have sharp edges, use caution while handling

RPCM S04B-C R&R – TASK DATA (Cont)



**PDGF INSTALL ON NODE 2 (00:45)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)		
Backup APFR APFR: WIF 06 (10, RR, H, 12)	1. Retrieve APFR from Node 2 WIF 17 2. Translate to WIF 08, install APFR ( <b>2, QQ, C, 12</b> )			
	<table border="1"> <tr> <td style="text-align: center;"><b>WARNING</b></td> </tr> <tr> <td style="text-align: center;">Avoid touching curvic coupling due to potential sharp edges</td> </tr> </table>	<b>WARNING</b>	Avoid touching curvic coupling due to potential sharp edges	
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	<table border="1"> <tr> <td style="text-align: center;"><b>CAUTION</b></td> </tr> <tr> <td style="text-align: center;">Avoid touching grapple pin, target, and underside of PDGF</td> </tr> </table>	<b>CAUTION</b>	Avoid touching grapple pin, target, and underside of PDGF	
<b>CAUTION</b>				
Avoid touching grapple pin, target, and underside of PDGF				
	<u>PDGF RETRIEVE</u> 3. Retrieve PDGF from Node 2 port endcone 4. Translate to PDGF install location	<u>PDGF RETRIEVE</u> 1. Retrieve PDGF from Node 2 port endcone 2. Translate to PDGF install location		
	<u>PDGF INSTALL</u> 5. BRT HR XXXX  6. Engage aft EDFs (two) (lanyard washer flush to retaining ring)	<u>PDGF INSTALL</u> 3. Ingress APFR – roll to “D” as reqd for EDFs 4. Ensure all EDFs (four) fully retracted and lanyards clear, install PDGF onto mounting ring (target aft, align with arrow on ring) 5. Engage fwd EDFs (two) (lanyard washer flush to retaining ring)		
	<u>NOTE</u> EDFs must be driven in a cross pattern (order not critical)			
	<u>INITIAL TORQUE</u> 7. Drive <b>Aft/Inboard EDF</b> PGT, 7/16-6 in ext: XX, CW1; ~ 5 turns to torque stall	<u>INITIAL TORQUE</u> 6. Drive <b>Fwd/Outboard EDF</b> PGT, 7/16-6 in ext: XX, CW1; ~ 5 turns to torque stall		
	8. Drive <b>Aft/Outboard EDF</b> PGT, 7/16-6 in ext: XX, CW1; ~ 5 turns to torque stall	7. Drive <b>Fwd/Inboard EDF</b> PGT, 7/16-6 in ext: XX, CW1; ~ 5 turns to torque stall		

TURNS INITIAL TORQUE	
EDF	Turns
Fwd/Outboard	
Aft/Inboard	
Fwd/Inboard	
Aft/Outboard	

**PDGF INSTALL ON NODE 2 (00:45) (Cont)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)
	<u>FINAL TORQUE</u>	<u>FINAL TORQUE</u>
		<u>NOTE</u>
		Tighten EDFs until at least 5 turns total and 25.5 ft-lb repeatable torque reached. Repeatable is less than a 1/4 turn before reaching torque
TURNS FINAL TORQUE		
EDF	Turns	Torque
Fwd/Inboard		
Aft/Outboard		
Fwd/Outboard		
Aft/Inboard		
	9. Drive <b>Aft/Outboard EDF</b> PGT, 7/16-6 in ext: B7, CW1; ~0.5 turns repeatable	8. Drive <b>Fwd/Inboard EDF</b> PGT, 7/16-6 in ext: B7, CW1; ~0.5 turns repeatable
	10. Drive <b>Aft/Inboard EDF</b> PGT, 7/16-6 in ext: B7, CW1; ~0.5 turns repeatable	9. Drive <b>Fwd/Outboard EDF</b> PGT, 7/16-6 in ext: B7, CW1; ~0.5 turns repeatable
	<u>HORSESHOE CONNECTOR RELEASE</u>	<u>HORSESHOE CONNECTOR MATE</u>
	11. Translate to horseshoe connector launch bracket 12. Release TA clamps as reqd 13. Open MLI cover 14. Rotate square microfixtures (two) – unlock, 60 deg ccw 15. Remove horseshoe connectors (P6/P8 first due to cable interference) 16. Reinstall MLI cover over launch bracket	10. Release horseshoe connector receptacle MLI cover  11. Release <b>horseshoe connector receptacles engagement bolt</b> (two) PGT, 7/16-6 in ext: A6, CCW2; 15-17 turns <input type="checkbox"/> √Yellow band visible on both receptacles
	17. <u>Transfer horseshoe connectors to EV3</u>	
HORSESHOE CONNECTOR		
Connector	Turns	Torque
P6/P8		
P7/P5		
	18. Route cable through wire-tie on HR 0335 19. Install cable into first 3 TA clamps for appropriate cable length  20. Retrieve BOJ 1/C/L #2 bag 21. Translate to airlock	12. Receive horseshoe connectors from EV1 13. Install horseshoe connector onto PDGF 14. P6/P8 → J6/J8 15. Rotate square microfixture – LOCK, 60 deg cw 16. P7/P5 → J7/J5 17. Rotate square microfixture – LOCK, 60 deg cw  18. Drive <b>horseshoe connector receptacles engagement bolt (two)</b> PGT, 7/16-6 in ext: A6, CW2; 20 turns to HS  19. Reinstall MLI cover 20. Retrieve BOJ 2/C/L #1 bag  21. Translate to airlock

## PDGF INSTALL ON NODE 2 – TASK DATA

### EVA Tools:

EV1 (FF)	EV3 (FF)
PGT	MMOD T-tool
7/16 - 6 in ext	PGT
	7/16 - 6 in ext

### EVA Fasteners:

Fastener	Head Size	Qty	Install Torque (ft-lb)	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
PDGF	7/16	4	9.2 Initial 24 Final	9.8 (w/RAD Initial) 25.8 (w/RAD final)	25	145	Release: 5 turns at bolt Install: 4-6 total turns at bolt	10
PDGF Connector	7/16	2	6.67-8.33		6.67-8.33	TBD	20	30

### EVA Connectors:

Task	From	To	Clamps (Qty)	Conn Size	Function
P8/P6	Node 2	PDGF	2	---	Data/Power ?
P5/P7	Node 2	PDGF	2	----	Data/Power ?

### Foot Restraints:

Task	WIF	APFR Setting
PDGF Install	Node2-08	2,QQ,C,12

### Cautions:

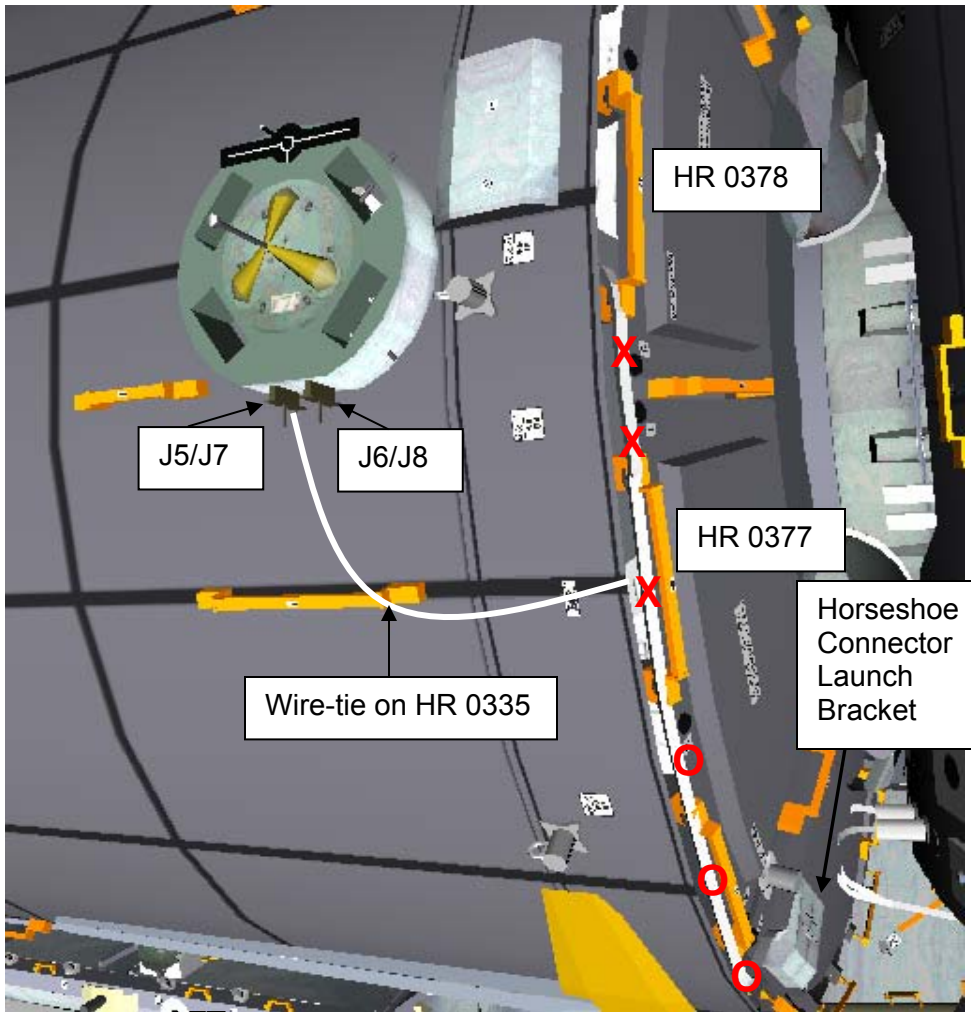
- Avoid touching grapple pin, connector area, underside of PDGF, target

### Warning:

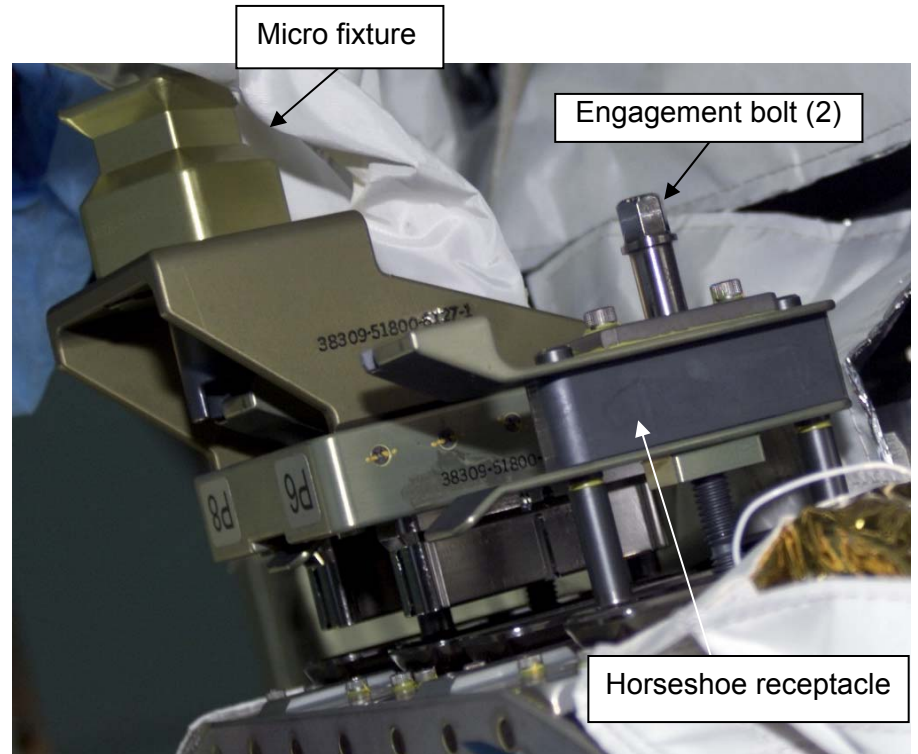
- Avoid touching curvic coupling due to potential sharp edges



PDGF INSTALL ON NODE 2 – TASK DATA (Cont)



Node 2 PDGF Horseshoe Connectors Installed



- – Cable Removed from TA Clamp
- ✗ – Cable Installed in TA Clamp

PDGF OVERVIEW

**EVA 2 CLEANUP AND A/L INGRESS (00:15)**

IV	EV1 – Pz (FF)	EV3 – Tani (FF)
<p>1. Perform prior to ingress: WVS PWRDN (PHOTO/TV, <u>WVS CUE CARD</u>)</p>	<p>1. Translate to airlock                  2. Perform tool inventory                  3. Ingress airlock                  4. Stow BOJ 1/C/L bag #2 on fish stringer                  5. Receive BOJ 2/C/L bag #1 from EV3, stow on fish stringer                  6. Connect right waist tether to A/L D-ring ext  <input type="checkbox"/> ✓/Hook locked                  7. Give EV3 GO to disconnect EV1 safety tether</p> <p>DCM 8. Retrieve SCU, remove DCM cover                  9. Connect SCU to DCM, ✓/Locked                  10. Water – OFF</p>	<p>1. Translate to airlock                  2. Perform tool inventory                  3. Transfer BOJ 2/C/L bag #1 to EV1</p> <p>4. On EV1 GO disconnect EV1's A/L tether attach to right waist tether                  5. Disconnect EV3 A/L safety tether from A/L, attach to self                  6. Ingress airlock</p> <p>DCM 7. Retrieve SCU, remove DCM cover                  8. Connect SCU to DCM, ✓/Locked                  9. Water – OFF                  10. Hatch thermal cover – close                  11. Secure thermal cover Velcro strap</p>
<p><b>CAUTION</b>                  Do not close hatch until EMU water – OFF for 2 min</p>		
	<p>11. Go to PRE REPRESS portion of {CREWLOCK DEPRESS/REPRESS CUE CARD} (SODF: ISS EVA SYS: EVA PREP/POST)</p>	<p>12. ✓EV Hatch clear of FOD and obstructions                  13. EV Hatch – close and lock                  14. Go to PRE REPRESS portion of {CREWLOCK DEPRESS/REPRESS CUE CARD} (SODF: ISS EVA SYS: EVA PREP/POST)</p>



## POST EVA 2 TOOL CONFIG

### EV1

#### EMU D-Rings

- 1 – Tether Extender on left
- 2 – Waist Tethers

#### MWS

- Small trash bag
    - PIP pins (4)
      - RET (sm-sm)
  - 1 – Adj tether
  - 1 – RET (sm-sm)
  - 1 – RET (with PIP pin)
  - 2 – Wire ties
  - Socket caddy
    - 5/8-7.8 in ext
  - Swing Arm [right side]
    - PGT w/7/16-6 in ext (BX, CW2, 30.5) S/N \_\_\_\_\_
      - RET (sm-sm)
  - BRT [left side]
    - 3 Wire Ties
    - RET
- SAFER

### EV3

#### EMU D-Rings

- 1 – Tether Extender on left
- 2 – Waist Tethers

#### MWS

- Small trash bag
    - 1 – Adj tether
    - 1 – RET (sm-sm)
    - 1 – RET (with PIP pin)
    - 2 – Wire ties
    - Socket caddy
    - Swing Arm [right side]
      - PGT w/7/16-6 in ext (BX, CCW2, 30.5) S/N \_\_\_\_\_
        - RET (sm-sm)
    - BRT [left side]
      - 3 Wire Ties
      - RET
- SAFER

#### Additional Items Returned to Airlock

- J408 protective cover
- J408 MLI strap
- PDGF mounting ring thermal cover
- Node 2 CBM hatch PIP pins (4)

Total RETs sm-sm used – 12  
 RETs with PIP pin – 2  
 RETs Lg-sm – TBD  
 Adj tethers – 6

### CREWLOCK (Cont)

- Staging Bag
  - PGT with battery PGT S/N \_\_\_\_\_
  - Connector Cleaner Tool Caddy
  - DCM Plug
  - Wire Tie Caddy
  - Round TM w/5/8 in socket
  - Socket Caddy
    - 7/16-12 in ext
    - 7/16-9 in ext (Z1 CLA release)
- IV Bag
  - EVA Ratchet (bilateral)
  - 2 – Adj Thermal Mittens
  - Hydrazine Detector Kit
    - 1 – wire tie caddy
    - 4 – waist tethers
- Small ORU Bag
  - RPCM S/N \_\_\_\_\_
  - RET (sm-sm)
- Fish stringer
  - EVA Camera/Bracket
  - Crewlock bag #1 (RTAS) – adj tether on outside
    - Umbilical routing diagram on door
    - EVA Camera/Bracket on RET
    - Ratchet w/5/8-7.8 in ext
    - Cheater bar on RET
    - RAD w/5/8-7.8 in ext S/N \_\_\_\_\_
    - MMOD T-Tool on RET
    - Connector Tool on RET
  - Crewlock bag #2 (Node 2) – adj tether on outside
    - MMOD T-Tool on RET
    - Fish stringer BOJ 2
    - Fish stringer BOJ 1
    - Connector Tool on RET

# EVA 3

## EVA 3 INHIBIT PAD

Orbiter (1)

ALL EVAs	
TCS L12	1. √TCS POWER – OFF
KU-BAND ANTENNA	
MCC-H	1. √KU-BAND Mask – active 2. √KU-BAND EVA Protect Box – active
RCS	
If EV crew < 27 ft from FRCS	
IV O14,15,16	1. √DAP: VERN, FREE, LO Z (ft specific check with GNC) 2. √RJDF F1, F2, F3, F4 MANF DRIVER (four) – OFF LOGIC (four) – OFF
MCC-H	3. √Above RCS config
IV	4. √RCS F – ITEM 1 EXEC (*) √RCS FJET DES F1U – ITEM 17 (*) F3U – ITEM 19 (*) F2U – ITEM 21 (*)
<u>NOTE</u> Possible loss of comm when forced LL FWD antenna	
IV A1R	If EV crew < 1.6 ft from S-Band antenna 1. S-BAND FM ANT – XMIT LOWER/RCVR UPPER 2. √MCC, lower antenna selected
C3	If no comm, or on MCC GO 3. S-BAND PM ANT – LL FWD
When EVA crewmember at least 1.6 ft away from all S-Band upper antennas	
C3	4. S-BAND PM ANT – GPC

Ground

All EVAs	
Ground Radar	
MCC-H	1. √TOPO console, ground radar restrictions in place for EVA

USOS (1)

ALL EVAs	
PCU	
<u>NOTE</u> PCUs may require up to 1 hr warm-up period before they are operational	
MCC-H	1. √PCUs (two) operational in discharge mode and one of the following: a. CCS PCU EVA hazard control enabled b. No more than two arrays unshunted c. No more than two arrays pointed < 90° from velocity vector
OR	
	2. One or no PCUs operational in discharge mode and one of the following: a. No more than two arrays unshunted b. No more than two arrays pointed < 90° from velocity vector
<b>LOCATION DEPENDENT INHIBITS</b>	
Lab Window	
IV	If EV crew less than 10 ft from window or in window FOV, close window shutter
KU-BAND (SGANT) Antenna	
MCC-H	If EV crew < 3.3 ft from KU-BAND antenna 1. Park KU-BAND: 1.1 Pointing Mode – Inhibit 1.2 PLC – Reset 1.3 Autotrack Continuous Retry – Inhibit

## EVA 3 INHIBIT PAD (Cont)

### USOS (2)

#### LOCATION DEPENDENT INHIBITS

##### S-BAND (SASA) ANTENNAS

- MCC-H If EV crew < 3.6 ft from S1 SASA [P6 (P1) SASA]
1. P6 (P1) SASA (S1 SASA) – Active
  2. S1 SASA [P6 (P1) SASA] – Powered down

##### SARJ

- MCC-H If EV crew working within 2 ft or outboard of SARJ:
1. √DLA (1) – LOCKED
  2. All motor setpoints set to zero
  3. All motors deselected
- OR
4. Both DLAs – LOCKED

##### TRRJ

- MCC-H If EV crew working within 2 ft of P1 TRRJ rotation envelope:
1. √DLA (1) – LOCKED
  2. RPCM P11A\_B RPC 11 – Open, Close Cmd Inhibit P1-1 (Zenith RJMC Ops Pwr)
  3. RPCM P12B\_C RPC 1 – Open, Close Cmd Inhibit P1-2 (Nadir RJMC Ops Pwr)

- MCC-H If EV crew working within 2 ft of S1 TRRJ rotation envelope:
1. √DLA (1) – LOCKED
  2. RPCM S11A\_C RPC 1 – Open, Close Cmd Inhibit S1-1 (Zenith RJMC Ops Pwr)
  3. RPCM S12B\_B RPC 11 – Open, Close Cmd Inhibit S1-2 (Nadir RJMC Ops Pwr)

### RSOS (1)

#### ALL EVAs

##### SM Antennas

- IV
1. GTS – Deactivate
  2. ARISS – Deactivate or VHF (144-146 MHz) TX only

## EVA 3 NOTES, CAUTIONS, AND WARNINGS

### NOTES

1. Bolt install: report torque and turns
2. Bolt release: report torque and turns if different from published range
3. EVA connectors: after disconnection and prior to connection; verify pin and EMI band integrity; verify connector free of FOD
4. Inspect QDs for damage prior to mating
5. Toolbox doors must be closed with one latch per door when EV crew not in immediate vicinity
6. Avoid contact with OBSS striker bars (Vitrolube coating)

### CAUTION

#### **ISS Constraints**

- A. Avoid inadvertent contact with
1. Grapple fixture shafts (drylube)
  2. PIP pins
  3. EVA Crane [PMA1]
  4. TCS Reflectors [PMA2, PMA3]
  5. APAS hardware [PMA2, PMA3]
  6. CETA Lights (Z-93 paint) [LAB, S1, Node 1]
  7. Deployed MISSEs [A/L, P6]
  8. Passive UMAs
  9. MBS VDU, MCU, CRPCMs, and Cameras (taped radiative surfaces, silver Teflon)
  10. Deployed TUS cable
  11. S0 aft face Radiator
  12. GPS Antennas (S13 paint) [S0]
  13. UHF Antennas [LAB, P1]
  14. ETCS Radiators [S1, P1]
  15. EETCS/PV Radiator bellows and panels [P6, P4, S4, S6]
  16. SASA RF Group [Z1, S1, P6]
  17. Heat pipe radiators [Z1]
  18. PCU cathode and HCA ports [Z1]
  19. Ku-Band Antenna (SGANT) dish [Z1]
  20. CMG cover/shells [Z1]
  21. SSRMS Cameras
  22. Open CBM petal covers and LAB window shutter

### CAUTION (Cont)

#### **ISS Constraints (Cont)**

- B. Electrical cables
1. Avoid bend radii < 10 times cable diameter
- C. Fiber optic cables
1. Avoid bend radii < 10 times cable diameter
  2. Avoid pulling on cable during mate/demate
- D. Fluid line flex hoses and QDs
1. Avoid bend radii < 5 in for hoses with diameter < 1 in on LAB, S0, S1, P1, and 10-in for hoses with diameter < 1 in on all other elements
  2. Avoid bend radii < 14 in for hoses with a diameter ≥ 1 in
  3. Additional care should be taken to not exceed bend radii when applying loads at the flexible hose to rigid tube stub interfaces
  4. Ensure fluid QD booties are fully closed prior to leaving worksite; wire tie if reqd
- E. For structural reasons
1. Avoid vigorous body motions, quick grabs and kickoffs against tether restraints
  2. Avoid performing shaking motions (sinusoidal functions) more than four cycles
  3. Avoid kicking S1/P1 radiator beam  
If any of these occur, wait 2 to 5 min to allow structural response to dissipate

## EVA 3 NOTES, CAUTIONS, AND WARNINGS (Cont)

### CAUTION (Cont)

#### **ISS Constraints** (Cont)

##### F. Other

1. ITT Cannon connector: On demated connectors, do not rotate collar or manipulate cable/connector using collar or connector tool
2. WIS Antennas: do not use as handholds [Node 1, P6, Z1]
3. Lubricant from Ku-Band SGANT gimbals [Z1], CMGs [Z1], and RTAS Ground Strap fasteners [P6,P4,S4,S6] can contaminate EMU
4. MLI handholds are not rated for crewmember translation loads
5. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged

### CAUTION (Cont)

#### **Shuttle Constraints**

##### G. Avoid inadvertent contact with

1. OBSS and SRMS Composite Sections and Cable Harnesses
2. LCS (silver Teflon) and LDRI (silver Teflon) and ITVC (gold foil) [OBSS]
3. WVS Antenna [ODS Truss & PLB Sill]
4. Payload Bay wire harnesses, cables, and connectors

##### H. No touch

1. LDRI diffuser [OBSS]
2. OBSS saddle contacts (when OBSS unberthed) [OBSS]
3. Monkey fur [PLB]
4. Cameras: metallic surfaces [PLB]
5. Ku-Band Antenna black dish and gold thermal blankets [PLB]

## EVA 3 NOTES, CAUTIONS, AND WARNINGS (Cont)

### WARNING

#### ISS Constraints

- A. Avoid inadvertent contact with
1. Grapple fixture targets and target pins
  2. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless the beta gimbal is locked and the motor is turned off
  3. Stay inboard of SARJ when active
  4. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate
  5. Stay 5 ft from moving MT on face 1
- B. Handrails
1. Handrails previously used for MISSE attachment may not be used as a safety tether point [A/L endcone 564 & 566, A/L Tank 2 nad/fwd & port/fwd, P6 5389]
- C. Pinch
1. NZGL connector linkage. Use caution when mating/locking
  2. ITT Cannon Connector rotating housing
  3. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]
  4. LAB window shutter and CBM petal cover linkages during operation
- D. QDs
1. If QD is in FID when valve is opened (bail fwd), QD will leak and fluid line may whip
  2. Do not rotate if in mated/valve open config

### WARNING (Cont)

#### ISS Constraints (Cont)

- E. RF radiation exposure
1. Stay 3.6 ft from S-Band (SASA) high gain Antenna when powered [S1,P1,P6]
  2. Stay 1.3 ft from S-Band (SASA) low gain Antenna when powered [S1,P1,P6]
  3. Stay 1 ft from UHF Antenna when powered [LAB, P1]
- F. Sharp Edges
1. Inner edges of WIF sockets
  2. Mating surfaces of EVA connectors. Avoid side loads during connector mating
  3. Back side of MMOD shield fasteners
  4. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM); the end of the spring may protrude
  5. PMA umbilical launch restraints-exposed bolt threads
  6. Adjustable Fuse Tether (Fish Stringer) buckles stowed in Node Bag
  7. Nickel coated braided copper Ground Straps may contain frayed wires [P6, P4, S4, S6]
  8. Z1 handrail 6061 by the Ku-Band boom launch restraint [Z1]
  9. Solar Array Blanket Box [P6, S6]
  10. Keep hands away from SSRMS LEE opening, and snares
  11. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing

### WARNING (Cont)

#### ISS Constraints (Cont)

- G. Thermal
1. EVA connectors with booties may become hot if left uncovered. Handling may need to be limited
  2. PMA handrails may be hot. Handling may need to be limited
  3. Turn off glove heaters when comfortable temp reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on
  4. Uncovered trunnion pins may be hot
  5. SSRMS/MBS operating Cameras and lights may radiate large amounts of heat
  6. Stay 1 ft away from PMAs and MMOD shields > 270 degF if EMU sun visor up
  7. Stay at least 1 ft away for no more than 15 min from PMAs and MMOD shields > 300 degF if EMU sun visor up
  8. Stay 0.5 ft away from PMA and MMOD shields > 325 degF
  9. Do not touch EMU protective visor if temp has been < -134 for > 15 min
  10. No EMU TMG contact of PMAs and MMOD shields when temp > 320 degF
  11. No EMU boot contact with foot restraint when temp < -120 degF or > 200 degF

## EVA 3 NOTES, CAUTIONS, AND WARNINGS (Cont)

### WARNING (Cont)

#### **Shuttle Constraints**

##### H. Arcing/Molten Debris

1. Stay  $\geq$  2 ft from exposed EFGF connector when OBSS berthed, powered, and EFGF not grappled [PLB]
2. Stay  $\geq$  2 ft from exposed Stbd Fwd MPM contacts [PLB]
3. Stay above PLB sill when within 1 ft of powered ROEU connector [PLB]

##### I. Pinch

1. PRLA operation [PLB]

##### J. RF radiation exposure

1. Stay 3.28 ft from S-Band Antenna when powered
2. Stay 1 ft from top and side of UHF PLB Antenna radome surface when in high powered mode [ODS truss]
3. Stay 0.33 ft from top and side of UHF PLB Antenna radome surface when in low powered mode [ODS truss]
4. Remain below the level of the PLB door mold line for first 20 in Aft of Fwd bulkhead when S-Band Antenna powered [PLB]
5. Remain on the inboard side of the Stbd slidewire (sill handrails if slidewire not installed) for first 20 ft Aft of Fwd bulkhead when Ku-Band Antenna powered [PLB]

### WARNING (Cont)

#### **Shuttle Constraints (Cont)**

##### K. Sharp Edges

1. PRLA grounding wipers [PLB]
2. LDRI baffles (Also an entrapment hazard) [OBSS]
3. Keep hands away from SRMS EE opening and snares

##### L. Thermal

1. Illuminated PLB lights; do not touch
2. OBSS grapple fixture shafts/cams may be hot. Limit handling if required

##### M. Thruster Contamination

1. Stay out of the immediate vicinity of leaking jet or APU
2. Stay 27 ft from PRCS when powered
3. Stay 3 ft from VRCS when powered
4. Stay 3 ft from APU when operating

## 10A EVA 3 PRE BRIEF

### ROLES (ALL)

EV1, EV2(3) IV	R1, R2 M1, M2	Pre-EVA support Post-EVA support
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### MILESTONES (ALL)

XX:XX	Wake-up	XX:XX	Primary tasks, get ahead
XX:XX	EVA Prep Start	XX:XX	tasks
XX:XX	Depress to 10.2	XX:XX	End of EVA
XX:XX	Start Purge	XX:XX	Repress
XX:XX	EMU to batt	XX:XX	Post EVA

### COMM SET-UP (ALL)

<ul style="list-style-type: none"> <li>• Big loop: the whole world</li> <li>• A/G2: ISS</li> <li>• S/G2: TBD</li> <li>• ICOM: Internal shuttle (ISS?)</li> <li>• HL: TBD</li> </ul>
---

### GENERAL EMERGENCIES (ALL)

<ul style="list-style-type: none"> <li>• Call emergency over intercom (Big Loop?), everybody "safes" what it's doing, return to position (who goes where and for what?)</li> <li>• When not in the suit: return to shuttle, drag EMU?</li> <li>• In the suit: suit doff &amp; power down (who helps?)</li> <li>• If A/L depress, repress</li> <li>• Abort &amp; terminate procedures</li> <li>• Incapacitated crewmember</li> <li>• Lost Crewmember: call Code L, HHL reading if possible</li> <li>• Hydrazine/NH3 contamination</li> </ul>
---

### (S)SRMS/EVA JOINT OPS (EV1, EV2, R1, R2, M1, M2, IV)

<ul style="list-style-type: none"> <li>• Review of (S)SRMS general activities</li> <li>• When arm(s) need to move during EVA, R2/M2 calls on Big Loop for initial motion, duration of motion, direction of motion, possible interference with EVA, end of motion</li> <li>• R1(2) or M1(2) will call "(S)SRMS in position xy, Ready for GCA"</li> <li>• Review of sync points</li> </ul>
--

### (S)SRMS/EVA JOINT OPS (EV1, EV2, R1, R2, M1, M2, IV) (Cont)

<ul style="list-style-type: none"> <li>• Review of frame(s) of reference</li> <li>• Responsibilities for clearances: with R1/2 &amp; M1/2 unless clearly handed off to EV1(2) and acknowledged</li> <li>• EV1(2) requests GCA, R1(2) or M1(2) confirms ready for GCA, IV issues GO for GCA</li> <li>• EV1(2) calls for requested motion, acknowledge motion, counts down to stop motion</li> <li>• Anyone can call All Stop in case of impending unsafe situation or emergency (Brakes ON)</li> <li>• At the end of GCA, EV1(2) calls End of GCA, R1(2) or M1(2) acknowledge</li> <li>• IV will verify will EV1(2) and issue "Go for (S)SSRMS maneuver" when joint activities completed</li> </ul>
--

### EVA PREP (EV1, EV2, IV, Pre-EVA support, Post-EVA support)

<ul style="list-style-type: none"> <li>• EV1, EV2, IV, Suit-up support, Post EVA support</li> <li>• Camp-out review</li> <li>• WCS usage, food/drink</li> <li>• Tool config (last minute tools / equipment)</li> <li>• Equipment lock activities</li> <li>• Suit donning plan</li> <li>• SAFER, MWS, tool, bag stowage</li> <li>• A/L depress review</li> </ul>
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### REPRESS/POST-EVA (EV1, EV2, IV, Pre-EVA support, Post-EVA support)

<ul style="list-style-type: none"> <li>• Coldsoak</li> <li>• A/L repress review</li> <li>• Suit doffing plan</li> <li>• Food/drinks request</li> </ul>
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## 10A EVA 3 PRE BRIEF (Cont)

### EVA DETAILED REVIEW (EV1, EV2, IV)

- Egress plan
- Task by task review (DOUG) including translation paths
- Get ahead tasks
- Hazards, Keep out zones
- Warnings/Cautions/Notes/Constraints

### CHICA MANTRAS (EV1, EV2, IV)

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• Day/Night Cycles<ul style="list-style-type: none"><li>○ Lights</li><li>○ Visor</li><li>○ TCV (thermal Control Valve)</li><li>○ Gloves</li><li>○ Bayonets</li></ul></li><li>• Safety Tether Swap<ul style="list-style-type: none"><li>○ Gates closed</li><li>○ Hooks closed</li><li>○ Reel unlocked</li></ul></li><li>• PGT Ops<ul style="list-style-type: none"><li>○ Green light</li><li>○ Torque</li><li>○ Turns</li></ul></li></ul> | <ul style="list-style-type: none"><li>• PGT Extensions<ul style="list-style-type: none"><li>○ XXX installed</li><li>○ Good pull test</li></ul></li><li>• Electrical Connectors<ul style="list-style-type: none"><li>○ Pins straight</li><li>○ No FOD</li><li>○ EMI band intact</li><li>○ Mated</li><li>○ Good bend radius</li></ul></li><li>• APFR Install<ul style="list-style-type: none"><li>○ Black on black</li><li>○ Good pull test</li></ul></li></ul> |
|--|---|

### EMERGENCIES (EV1, EV2, IV)

- Lost comm. (show L + thumb up if listening, thumb down if not listening)
- Hand signals between EVs and to IV/ground via WVS
- EMU malfunctions: verbalize, IV leads, challenge-response protocol
- Errors & Lost tools: acknowledge and continue
- DCS: speak up for symptoms, cuff check list
- Abort and terminate scenarios
- Lost crewmember
- Incapacitated crewmember
- Hydrazine/NH3 contamination

### GENERAL REMINDERS (EV1, EV2, IV)

- Suit config: stiffness, heated gloves, EMU TV, EHIP lights
- SAFER: try access in A/L
- Translations: slow & deliberate, avoid feet first, check tethers often, check buddy when able
- Mass handling: one axis trans/rot at a time, watch for inertia
- Tether management, fairleads
- ORU control
- PGT ops: Red light – low torque, Green light – in torque window, Red/Green lights – HI torque. Cal procedure: Ratched collar – Not motor, Speed colar – Cal, Pull trigger
- Video/cameras view: change tapes, adjust WVS at SR/SS

### CRIB SHEET (EV1, EV2, IV)

- TBD

# EVA 3 SUMMARY TIMELINE

PET HR : MIN	IV/SSRMS	10A EVA 3 EV1 – Pz	EV2 – Wheels	PET HR : MIN
00:00		<u>EVA 3 A/L EGRESS AND SETUP</u> (00:40) <ul style="list-style-type: none"> <li>Post Depress/Egress</li> <li>Setup</li> </ul>	<u>EVA 3 A/L EGRESS AND SETUP</u> (00:40) <ul style="list-style-type: none"> <li>Post Depress/Egress</li> <li>Setup</li> </ul>	00:00
01:00	SSRMS: P6 Pre-install set-up  SSRMS: GCA to first contact  SSRMS: Limp after initial CLA contact  SSRMS: P6 ungrapple	<u>ATTACH P6 to P5</u> (01:45) <ul style="list-style-type: none"> <li>GCA at 130 cm</li> <li>GCA at 30 cm</li> <li>GCA at 15 cm</li> <li>GCA to first contact</li> <li>Back off Bolt 1</li> <li>Bolt initial torque</li> <li>Bolt 1 and 3 final torque</li> </ul>	<u>ATTACH P6 to P5</u> (02:00) <ul style="list-style-type: none"> <li>Open CLA</li> <li>GCA at 130 cm</li> <li>GCA at 30 cm</li> <li>GCA at 15 cm</li> <li>GCA to first contact</li> <li>Drive CLA</li> <li>Ground strap install</li> <li>Bolt 2 and 4 final torque</li> <li>Release CLA</li> </ul>	01:00
02:00	√MCC-H GO for P5 to P6 umbilicals	<u>CONNECT P5 to P6 UMBILICALS</u> (00:35) <ul style="list-style-type: none"> <li>Connect umbilicals (4)</li> </ul>	<u>CONNECT P5 to P6 UMBILICALS</u> (00:20) <ul style="list-style-type: none"> <li>Connect umbilicals (4)</li> </ul>	02:00
03:00		<u>OUTBD RADIATOR CINCH RELEASE</u> (00:30) <ul style="list-style-type: none"> <li>Release cinches (3)</li> <li>Release winch PIP pin</li> </ul>	<u>OUTBD RADIATOR CINCH RELEASE</u> (00:30) <ul style="list-style-type: none"> <li>Release cinches (3)</li> <li>Release winch PIP pin</li> </ul>	03:00
04:00	SRMS: APFR install √MCC-H GO for SFU Reconfig SRMS: APFR ingress SRMS: MBSU retrieval	<u>SSU SHROUD REMOVE</u> (00:45)	<u>SSU SHROUD REMOVE</u> (00:45)	04:00
05:00	SRMS: MBSU handoff	<u>SFU POST DEPLOY</u> (00:15)	<u>MBSU TRANSFER</u> (01:15) <ul style="list-style-type: none"> <li>Set up SRMS</li> <li>Mnvr to PLB</li> <li>Retrieve MBSU from PLB</li> <li>Mnvr to ESP-2</li> </ul>	05:00
06:00	SRMS: APFR egress SRMS: APFR removal	<u>BSP RETRIEVE SETUP</u> (00:45) <ul style="list-style-type: none"> <li>Remove BSP</li> <li>Install BSP on cover</li> </ul>	<ul style="list-style-type: none"> <li>Hand off MBSU</li> <li>Egress APFR</li> </ul>	06:00
		<u>MBSU TRANSFER</u> (00:30) <ul style="list-style-type: none"> <li>Set up APFR at ESP-2</li> <li>Receive MBSU</li> <li>Install MBSU</li> </ul>	<u>SRMS CLEAN-UP</u> (00:30) <ul style="list-style-type: none"> <li>Clean up SRMS</li> </ul>	
		<u>SAW DEPLOY CLEANUP AND A/L INGRESS</u> (00:45)	<u>CLEANUP AND A/L INGRESS</u> (00:20)	
		<u>PRE REPRESS</u> (00:05)	<u>PRE REPRESS</u> (00:05)	

## PRE EVA 3 TOOL CONFIG

### EV1

#### EMU D-Rings

- 1 – Tether Extender on Left
- 2 – Waist Tethers
- 1 – 85' Safety Tether (TS)

#### MWS

- Small trash bag [right inside]
  - Connector tool
    - 1 – RET (sm-sm)
- 1 – Adj tether [right]
- 1 – RET (with PIP pin) [left]
- 1 – RET (sm-sm) [right]
- 2 – Wire ties
- Socket caddy [left inside]
  - 5/8-7.8 in ext
  - 7/16-6 in ext
  - RAD S/N \_\_\_\_\_
- Swing Arm [right side] S/N \_\_\_\_\_
  - PGT S/N \_\_\_\_\_
    - (B1, CW2, 30.5)
    - 1 – RET (sm-sm)
- BRT [left side]
  - 3 Wire Ties
  - 1 – RET (sm-sm)
- SAFER

Prior to EVA, inspect:  
 RET cord for damage  
 BRT & MWS for loose fittings/screws  
 Safety & waist tether load alleviating straps: no red

Total RETs sm-sm used – 11  
 RETs with PIP pin – 2  
 RETs Lg-sm – 2  
 Adj tethers – 9

### EV2

#### EMU D-Rings

- 1 – Tether Extender on Left
- 2 – Waist Tethers
- 1 – 85' Safety Tether (TS)

#### MWS

- Small trash bag [right inside]
  - Connector tool
    - 1 – RET (sm-sm)
- 1 – Adj tether [left]
- 1 – RET (with PIP pin) [left]
- 1 – RET (sm-sm) [right]
- 2 – Wire ties
- Socket caddy [left inside]
  - 5/8-7.8 in ext
- Swing Arm [right side] S/N \_\_\_\_\_
  - PGT w/7/16-6 in ext S/N \_\_\_\_\_
    - (B1, CCW1, 30.5)
    - 1 – RET (sm-sm)
- BRT [left side]
  - 3 Wire Ties
  - 1 – RET (sm-sm)
- SAFER

### CREWLOCK

- C/L Bag#3 (Solar Array Tools)
  - BRS Pin Contingency Tool (w/Tape)
  - Loop Pin Puller (w/Tape)
  - TPS Scraper (w/Tape)
  - Compound Cutter/Needle Nose Pliers Caddy (w/Tape)
- Cheater Bar (w/Kapton Tape)
  - 1.5" Bail Drive Lever (taped to Cheater Bar)

### JOINT A/L EXTERNAL

- 2 – Crewlock Safety Tethers (55 ft)

### CREWLOCK (cont)

- Staging Bag
  - PGT with battery PGT S/N \_\_\_\_\_
  - Connector Cleaner Tool Caddy
  - DCM Plug
  - Wire Tie Caddy
  - Socket Caddy
    - 7/16-12 in ext (radiator contingency winch)
- IV Bag
  - EVA Ratchet (bilateral)
  - 2 – Adj Thermal Mittens
  - Hydrazine Detector Kit
    - 1 – wire tie caddy
    - 4 – waist tethers
- Fish stringer (internal)
  - C/L bag #1 – adj tether on outside
    - Torque Wrench (set to 57 ft-lb) (outside of bag) w/2 wire ties
      - 1 – RET (sm-sm)
      - EV1 85' safety tether (P5)
      - EV2 85' safety tether (P5)
      - Ratchet
  - C/L bag #2 – adj tether on outside
    - PAD (√ in SD)
      - WIF Adapter
    - EVA Camera/Bracket
- 1 - RET (Lg-sm)
  - 6B Box Cover (BSP)
    - Adj tether
    - Dummy box
- 1 – RET (Lg-sm)
  - Med ORU bag (SSU shrouds)
    - 4 – Adj tether
    - EVA Camera/Bracket
- 2 – RET (sm-sm)

### ADDITIONAL ITEMS RETURNED TO AIRLOCK

- BSP
- SSU MLI (2)

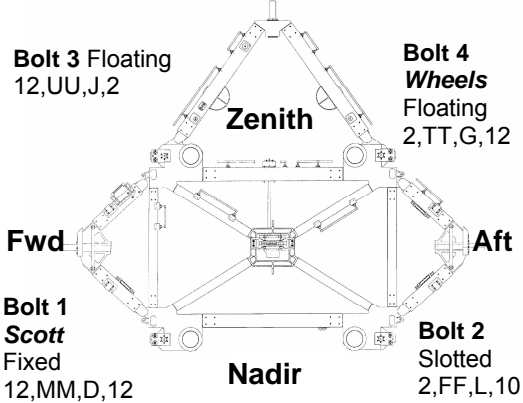
## EVA 3 A/L EGRESS AND SETUP (00:40)

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)
<p>Internal D-ring extender</p> <p>EV1 A/L tether (55')</p> <p>EV2 A/L tether (55')</p> <p>External D-rings</p> <p>fwd aft</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>1 – 55' A/L tether - EV1 → Outside</p> <p>1 – 55' A/L tether - EV2 → Outside</p> <p>1 – 85' TS tether – EV1 → On CM</p> <p>1 – 85' TS tether – EV2 → On CM</p> <p>1 – 85' P5 tether – EV1 → C/L bag #1</p> <p>1 – 85' P5 tether – EV2 → C/L bag #1</p> </div> <p>Start Torque Wrench thermal clock (3:30)            PET = _____</p> <p>1. Post crew egress:            WVS Software: Select page – RF Camera                              sel 'Advanced controls'                              S-Band level (two) – max</p>	<p><b>INITIAL CONFIG</b></p> <p>1. Verify:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Right waist tether connected to A/L D-ring extender</li> <li><input type="checkbox"/> Hook locked</li> </ul> <p><b>EGRESS/INITIAL SET-UP</b></p> <hr style="border-top: 1px dashed black;"/> <p>1. Receive 55' safety tether from EV2</p> <p>2. Attach to left D-ring ext</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Inspect load alleviating strap</li> <li><input type="checkbox"/> √Gate closed, hook locked and reel unlocked</li> </ul> <p>3. Release R waist tether from A/L D-ring ext</p> <p>4. Attach to self</p> <p>5. <u>Transfer C/L bag #2 (w/PAD) to EV2</u></p> <hr style="border-top: 1px dashed black;"/> <p>6. <u>Transfer 6B box cover/dummy box to EV2</u></p> <hr style="border-top: 1px dashed black;"/> <p>7. <u>Transfer Med ORU bag to EV2</u></p> <hr style="border-top: 1px dashed black;"/> <p>8. Attach C/L bag #1 (w/torque wrench) to MWS</p> <p>9. Egress crewlock</p> <p>10. Close hatch thermal cover</p> <p>11. Stow C/L bag #1 on BRT</p>	<p><b>INITIAL CONFIG</b></p> <p>1. Verify:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Right waist tether connected to EV1's 85' Safety tether</li> <li><input type="checkbox"/> Hook locked</li> </ul> <p><b>EGRESS/INITIAL SET-UP</b></p> <p>1. Open hatch thermal cover</p> <p>2. Egress crewlock</p> <p>3. Retrieve 55' safety tether anchored on aft A/L D-ring</p> <p>4. Attach to left D-ring ext</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Inspect load alleviating strap</li> <li><input type="checkbox"/> √Gate closed, hooks locked and reel unlocked</li> </ul> <p>5. Retrieve 55' safety tether anchored on fwd A/L D-ring</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> √Anchor hook locked</li> </ul> <p>6. Attach to EV1's 85' safety tether</p> <p>7. <u>Pass tether to EV1 into A/L</u></p> <hr style="border-top: 1px dashed black;"/> <p>8. Verify SAFER config</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> √L Handle down (MAN ISO Vlv – Open)</li> <li><input type="checkbox"/> √R Handle down (HCM – Closed)</li> </ul> <hr style="border-top: 1px dashed black;"/> <p>9. Receive C/L bag #2</p> <p>10. Temp stow on A/L HR 0559</p> <hr style="border-top: 1px dashed black;"/> <p>11. Receive 6B box cover/dummy box</p> <p>12. Temp stow on A/L HR 0554</p> <hr style="border-top: 1px dashed black;"/> <p>13. Receive Med ORU bag</p> <p>14. Stow Med ORU bag on BRT</p> <p>15. Translate to tether shuttles via aft crewlock path</p>

**EVA 3 A/L EGRESS AND SETUP (00:40) (Cont)**

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)
	<ul style="list-style-type: none"> <li>12. Verify SAFER config                             <ul style="list-style-type: none"> <li><input type="checkbox"/> √L Handle down (MAN ISO Vlv – Open)</li> <li><input type="checkbox"/> √R Handle down (HCM – Closed)</li> </ul> </li> <li>13. Translate to tether shuttles</li> <li>14. Retrieve tether shuttle</li> <li>15. Install on CETA rail                             <ul style="list-style-type: none"> <li><input type="checkbox"/> √Locked</li> </ul> </li> <li>16. Attach 85' safety tether to tether shuttle                             <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>17. Remove A/L 55' tether</li> <li>18. Stow on HR 3413</li> <li>19. Translate along nadir CETA rail to P5 Corner 1 (P5 nadir/fwd)</li> </ul>	<ul style="list-style-type: none"> <li>16. Retrieve tether shuttle</li> <li>17. Install on CETA rail                             <ul style="list-style-type: none"> <li><input type="checkbox"/> √Locked</li> </ul> </li> <li>18. Attach 85' safety tether to tether shuttle                             <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>19. Remove A/L 55' tether</li> <li>20. Stow on HR 3444 (port of HR bridge)</li> <li>21. Translate to CETA cart 1 (outboard)</li> <li>22. Stow Med ORU bag on APFR boot plate</li> <li>23. Retrieve APFR and stow on BRT</li> <li>24. Translate along zenith CETA rail to P5 WIF 05 (P5 aft)</li> </ul>

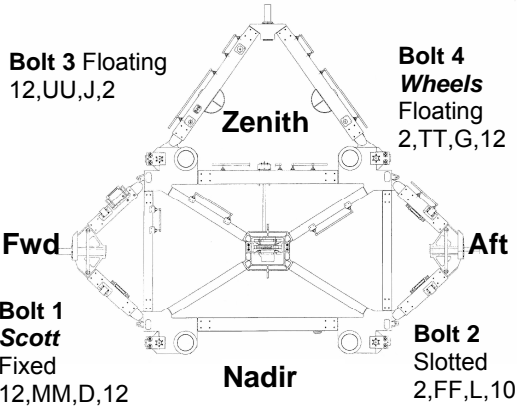
**ATTACH P6 TO P5 (01:45)**

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)																														
 <p><b>P5 – Port side looking stbd Bolts on P5 side</b></p>	<ol style="list-style-type: none"> <li>Temp stow C/L bag #1 at corner 1, HR 5203</li> <li>Temp stow EV2 85' P5 safety tether near corner 2</li> <li>Swap to 85' P5 safety tether on P5 HR 5202 <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>Stow 85' TS safety tether on P5 HR 5201</li> </ol> <p><u>RELEASE BOLT AT CORNER 1</u></p> <div style="border: 2px solid black; padding: 5px; text-align: center;"> <p><b>WARNING</b> Avoid contact with exposed bolt tip, potential sharp edge</p> </div> <ol style="list-style-type: none"> <li>Translate to corner 1</li> <li>Retract <b>RTAS Bolt 1</b> By hand: ccw; ~3-5 turns until no threads showing above fine alignment cone plane</li> </ol> <p><u>READY TO MATE VERIFICATION</u></p> <ol style="list-style-type: none"> <li>Perform following steps for <b>Bolts 1 and 3</b>:</li> </ol> <table border="1"> <thead> <tr> <th></th> <th>Bolt 1 EV1</th> <th>Bolt 2 EV2</th> <th>Bolt 3 EV1</th> <th>Bolt 4 EV2</th> </tr> </thead> <tbody> <tr> <td>√P5 RTAS Primary bolt below fine alignment cone plane</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>√P5 RTAS 2-7 threads visible by bolt shoulder</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>√P6 RTAS Primary ball/bearing centered</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>√P6 RTAS Contingency ball/nuts (2) centered</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>√P5 - P6 mating I/F free of debris</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <ol style="list-style-type: none"> <li>Translate to corner 1</li> </ol>		Bolt 1 EV1	Bolt 2 EV2	Bolt 3 EV1	Bolt 4 EV2	√P5 RTAS Primary bolt below fine alignment cone plane					√P5 RTAS 2-7 threads visible by bolt shoulder					√P6 RTAS Primary ball/bearing centered					√P6 RTAS Contingency ball/nuts (2) centered					√P5 - P6 mating I/F free of debris					<ol style="list-style-type: none"> <li>Install APFR in <b>P5-05 (10,QQ,C,11)</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> √Locking collar black-on-black</li> <li><input type="checkbox"/> Good pull test</li> </ul> </li> <li>Temp stow Med ORU bag on P5 HR 5215</li> </ol> <hr style="border-top: 1px dashed black;"/> <ol style="list-style-type: none"> <li>Retrieve EV2 85' P5 safety tether</li> <li>Swap to 85' P5 safety tether on P5 HR 5210 <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>Stow 85' TS safety tether on P5 HR 5201</li> </ol> <p><u>OPEN P5 CAPTURE LATCH TO HARD STOP (ZENITH)</u></p> <ol style="list-style-type: none"> <li>BRT to HR 5239</li> <li>Drive <b>P5 capture latch</b> PGT, 7/16-6 in ext: B1, CCW1; ~1 turn to HS Turns: _____</li> </ol> <p><u>READY TO MATE VERIFICATION</u></p> <ol style="list-style-type: none"> <li>Translate to corner 2</li> <li>Perform following steps for <b>Bolts 2 and 4</b>:</li> </ol> <ol style="list-style-type: none"> <li>Remain at corner 4</li> </ol>
	Bolt 1 EV1	Bolt 2 EV2	Bolt 3 EV1	Bolt 4 EV2																												
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ATTACH P6 TO P5 (01:45) (Cont)

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)								
<p><b>Conduct IV GCA Pre-brief:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Call desired motion in cm, according to coordinate system: “backing the airplane into the hangar” (P6 “in” or “out”)</li> <li><input type="checkbox"/> GCA calls from EV1 only</li> <li><input type="checkbox"/> Acknowledge arm motion: “Good [Stop] Motion”</li> <li><input type="checkbox"/> Intermediate GCA stop points are at 30 cm and 15 cm</li> <li><input type="checkbox"/> Countdown to stop: “3, 2, 1, stop [first contact]”</li> <li><input type="checkbox"/> Call “First contact” at first observed or suspected physical contact between cup and cone</li> <li><input type="checkbox"/> Call “Stop Motion” if off-nominal cup/cone contact</li> </ul>	<p>1. Participate in IV GCA pre-brief, acknowledge items</p>									
<p><input type="checkbox"/> √EV1, EV2 ready for GCA</p>	<p>2. Verify tools and tethers clear from P5 &amp; P6 I/F</p>									
<p>Give M1/M2 GO for “SSRMS GCA to First Contact”</p>	<p>3. GCA SSRMS to 30 cm            4. GCA SSRMS to 15 cm, call for final alignment corrections as reqd            5. GCA to first contact            6. √All four alignment pins are within alignment cups</p> <div style="display: flex; justify-content: space-between;"> <p>ENGAGE P5 CAPTURE LATCH</p> <p>ENGAGE P5 CAPTURE LATCH</p> </div> <div style="border: 2px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;"><b>WARNING</b>              EV crewmembers must remain clear of P6/P5 mating interface</p> </div>									
<p><input type="checkbox"/> √M1 GO to drive CLA to first contact</p>	<p>1. BRT HR 5239</p>									
	<p>1. Position to monitor capture latch motion</p> <p>2. Report “CLA First Contact”</p>	<p>2. Drive <b>P5 CLA</b>            PGT, 7/16-6 in ext: B1, CW2; until EV1 call “CLA First contact” (~20 turns) Turns: _____</p>								
<p><input type="checkbox"/> √SSRMS in Limp Mode</p>										
<p style="text-align: center;"><u>NOTE:</u>            Gap between all four P6 and P5 housing surfaces must be &lt; 0.6 in prior to primary bolt driving</p>	<p>3. Monitor CLA motion</p> <p>4. √Gap with small equip hook on corners 1 and 2</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Corner 1</td> <td style="width: 25%;"></td> <td style="width: 25%; text-align: center;">Corner 2</td> <td style="width: 25%;"></td> </tr> </table>	Corner 1		Corner 2		<p>3. Drive <b>P5 CLA</b>            PGT, 7/16-6 in ext: B1, CW2; to HS (~107 turns)            Turns / Torque: _____</p> <p>4. √Gap with small equip hook on corners 3 and 4</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; text-align: center;">Corner 3</td> <td style="width: 25%;"></td> <td style="width: 25%; text-align: center;">Corner 4</td> <td style="width: 25%;"></td> </tr> </table>	Corner 3		Corner 4	
Corner 1		Corner 2								
Corner 3		Corner 4								

**ATTACH P6 TO P5 (01:45) (Cont)**

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)																																																		
<p><u>NOTE</u> Gap between all four P6 and P5 housing surfaces must be &lt; .478 in after primary bolt seating</p>  <p><b>Bolt 3 Floating</b> 12,UU,J,2</p> <p><b>Bolt 4 Wheels Floating</b> 2,TT,G,12</p> <p><b>Bolt 1 Scott Fixed</b> 12,MM,D,12</p> <p><b>Bolt 2 Slotted</b> 2,FF,L,10</p> <p><b>P5 – Port side looking stbd</b> Bolts on P5 side</p>	<p><u>RTAS BOLTS INITIAL TORQUE</u></p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><u>CAUTION</u></p> <p>Primary bolt hardware sensitive to crew loads. Do not apply a push force on the RTAS primary bolt. Damage to self feeding nut may result</p> </div> <p style="text-align: center;"><u>NOTE</u></p> <p>EV1: Bolt 1 must be fastened first, followed by Bolt 2. The order of Bolt 3 and 4 is not critical EV2: Ground strap retaining washer may fully release if cross threaded EV1 and EV2: P6 is approved for translation loads once 3 of 4 RTAS bolts have initial torque</p> <ol style="list-style-type: none"> <li>1. Install RAD w/5/8-7.8 in socket on PGT</li> <li>2. Drive <b>RTAS Bolt 1</b> PGT, RAD, 5/8-7.8 in ext: B1,CW2; ~ 27 turns cw to HS <ul style="list-style-type: none"> <li><input type="checkbox"/> √Bolt shoulder is seated against housing</li> <li><input type="checkbox"/> √Gap with small equip hook</li> </ul> </li> <li>3. Drive <b>RTAS Bolt 2</b> PGT, RAD, 5/8-7.8 in ext: B1,CW2; ~ 27 turns to HS <ul style="list-style-type: none"> <li><input type="checkbox"/> √Bolt shoulder is seated against housing</li> <li><input type="checkbox"/> √Gap with small equip hook</li> </ul> </li> <li>4. Perform PGT socket swap; stow RAD on socket caddy, install 5/8-7.8 in ext on PGT</li> <li>5. Drive <b>RTAS Bolts 4 and 3</b> PGT, 5/8-7.8 in ext: B1,CW2; ~ 27 turns to HS <ul style="list-style-type: none"> <li><input type="checkbox"/> √Bolt shoulder is seated against housing</li> <li><input type="checkbox"/> √Gap with small equip hook</li> </ul> </li> </ol> <table border="1"> <thead> <tr> <th>Bolt Order</th> <th>BRT</th> <th>Turns</th> <th>Torque</th> <th>Seated</th> <th>Gap√</th> </tr> </thead> <tbody> <tr> <td>Bolt 1 – nadir /fwd</td> <td>5203</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Bolt 2 – nadir/aft</td> <td>5226</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Bolt 4 – zenith/aft</td> <td>5237</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Bolt 3 – zenith/fwd</td> <td>5233</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Bolt Order	BRT	Turns	Torque	Seated	Gap√	Bolt 1 – nadir /fwd	5203					Bolt 2 – nadir/aft	5226					Bolt 4 – zenith/aft	5237					Bolt 3 – zenith/fwd	5233					<p><u>RTAS GROUND STRAPS</u></p> <ol style="list-style-type: none"> <li>1. Release <b>Corner 4 P6 Ground Strap</b> from P6 PGT, 7/16-6 in ext: B1, CCW2; 3 turns</li> <li>2. Install <b>P6 Ground Strap</b> on P5 Start by hand then; PGT, 7/16-6 in ext: B1, CW1; ~6 turns to HS</li> <li>3. Repeat steps 1 and 2 for <b>corners 3, 1, and 2</b></li> </ol> <table border="1"> <thead> <tr> <th>Grnd Strap Order</th> <th>BRT HR</th> <th>Turns</th> <th>Torque</th> </tr> </thead> <tbody> <tr> <td>Corner 4</td> <td>5237</td> <td></td> <td></td> </tr> <tr> <td>Corner 3</td> <td>5233</td> <td></td> <td></td> </tr> <tr> <td>Corner 1</td> <td>5203</td> <td></td> <td></td> </tr> <tr> <td>Corner 2</td> <td>5226</td> <td></td> <td></td> </tr> </tbody> </table>	Grnd Strap Order	BRT HR	Turns	Torque	Corner 4	5237			Corner 3	5233			Corner 1	5203			Corner 2	5226		
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**ATTACH P6 TO P5 (01:45) (Cont)**

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)																								
	<p>6. Translate to C/L bag at corner 1 (backtrack to unwind safety tether)</p> <p>7. Retrieve torque wrench from C/L bag</p> <p>8. Transfer 5/8-7.8 in ext from PGT to torque wrench</p> <p>9. Transfer 7/16-6 in ext from socket caddy to PGT</p> <p><u>RTAS BOLT 1 AND 3 FINAL TORQUE</u></p> <p>1. Torque RTAS Bolts 1 and 3 Torque Wrench, 5/8-7.8 in ext: 57 ft-lb cw, to torque √Gap with small equip hook</p> <table border="1"> <thead> <tr> <th>Bolt Order</th> <th>BRT</th> <th>Turns to torque</th> <th>Gap √</th> </tr> </thead> <tbody> <tr> <td>Bolt 1 – nadir /fwd</td> <td>5203</td> <td></td> <td></td> </tr> <tr> <td>Bolt 3 – zenith/fwd</td> <td>5224</td> <td></td> <td></td> </tr> </tbody> </table> <p>2. Transfer torque wrench to EV2</p> <p>3. Translate to P6 umbilical worksite</p>	Bolt Order	BRT	Turns to torque	Gap √	Bolt 1 – nadir /fwd	5203			Bolt 3 – zenith/fwd	5224			<p><u>RTAS BOLT 2 AND 4 FINAL TORQUE</u></p> <p>1. Receive torque wrench from EV1</p> <p>2. Torque <b>RTAS Bolts 2 and 4</b> Torque Wrench, 5/8-7.8 in ext: 57 ft-lb cw, to torque √Gap with small equip hook</p> <table border="1"> <thead> <tr> <th>Bolt Order</th> <th>BRT</th> <th>Turns to torque</th> <th>Gap √</th> </tr> </thead> <tbody> <tr> <td>Bolt 2 – nadir/fwd</td> <td>5226</td> <td></td> <td></td> </tr> <tr> <td>Bolt 4 – zenith/fwd</td> <td>5236</td> <td></td> <td></td> </tr> </tbody> </table>	Bolt Order	BRT	Turns to torque	Gap √	Bolt 2 – nadir/fwd	5226			Bolt 4 – zenith/fwd	5236		
Bolt Order	BRT	Turns to torque	Gap √																							
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Bolt Order	BRT	Turns to torque	Gap √																							
Bolt 2 – nadir/fwd	5226																									
Bolt 4 – zenith/fwd	5236																									
<p>6. Once all 4 RTAS bolts mated, give SSRMS GO for P6 Ungrapple</p>		<p>3. Remove 5/8-7.8 in socket, stow on socket caddy</p> <p>4. Stow torque wrench in torque wrench bag on C/L bag with RET</p> <p><u>RELEASE P5 CAPTURE LATCH PRE-LOAD</u></p> <p>1. Once all 4 RTAS bolts torqued, Drive <b>P5 CLA</b> PGT, 7/16-6 in ext: B1, CCW2; 20 turns Turns: _____</p>																								

## ATTACH P6 TO P5 (RTAS) – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
PGT	PGT
5/8 - 7.8 in ext	5/8 - 7.8 in ext
Torque Wrench	Torque Wrench
7/16 - 6 in ext	7/16 - 6 in ext

### EVA Fasteners:

Fastener Name	Label	Head Size	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
RTAS bolts (Initial)	1,2,3,4	5/8"	10.0	N/A	427	24 turns min	30
RTAS bolts (final)	1,2,3,4	5/8"	57	N/A	427	Until torque reached	N/A
Grounding Strap		7/16"	10	10	38	6 inst 13 rel	10 inst 30 rel
Gap Check Tool Bolts	N/A	7/16"		Release: 8.3	Release: 12.2	12-14	30
P5 capture latch		7/16"	2.0	10.0	TBS	127	30

### EVA Connectors: None

### Foot Restraints:

Task	WIF	APFR Setting
Capture CLA drive	P5-03	P,QQ,D,1
RTAS bolt 1	P5-04	11,PP,C,12
RTAS bolt 2	P5-05	2,FF,L,10
RTAS bolt 3	P5-04	11,XX,E,2
RTAS bolt 4	P5-05	2,TT,G,12

### Cautions:

1. Primary bolt hardware sensitive to crew loads. Do not apply push force on bolt or damage to self feeding nut could occur
2. Due to fault currents and EMI, 2 ground straps are required prior to activation, all 4 are required for activation

### Warnings:

1. Avoid contact with exposed bolt tip on corner 1 due to potential sharp edge
2. When captive EVA fasteners are released then engaged, the pop-up spring could protrude out between the bolt head and housing producing a puncture hazard
3. EMU collision hazard. EV1 and EV2 must stay below the plane defined by P5/P6 interface until needed for verification of ready to latch condition
4. Pinch Hazard. Area between P6 and P5 must be clear prior to latch actuation to prevent crew injury
5. Bolt 2 APFR position is within sweep of SSU for beta angles 240-15 degrees on SA 4A

### Notes:

#### RTAS GAP CHECK:

Minimum: 0.330 inches

Nominal: 0.406 inches

Maximum before primary bolt driving: 0.576 inches

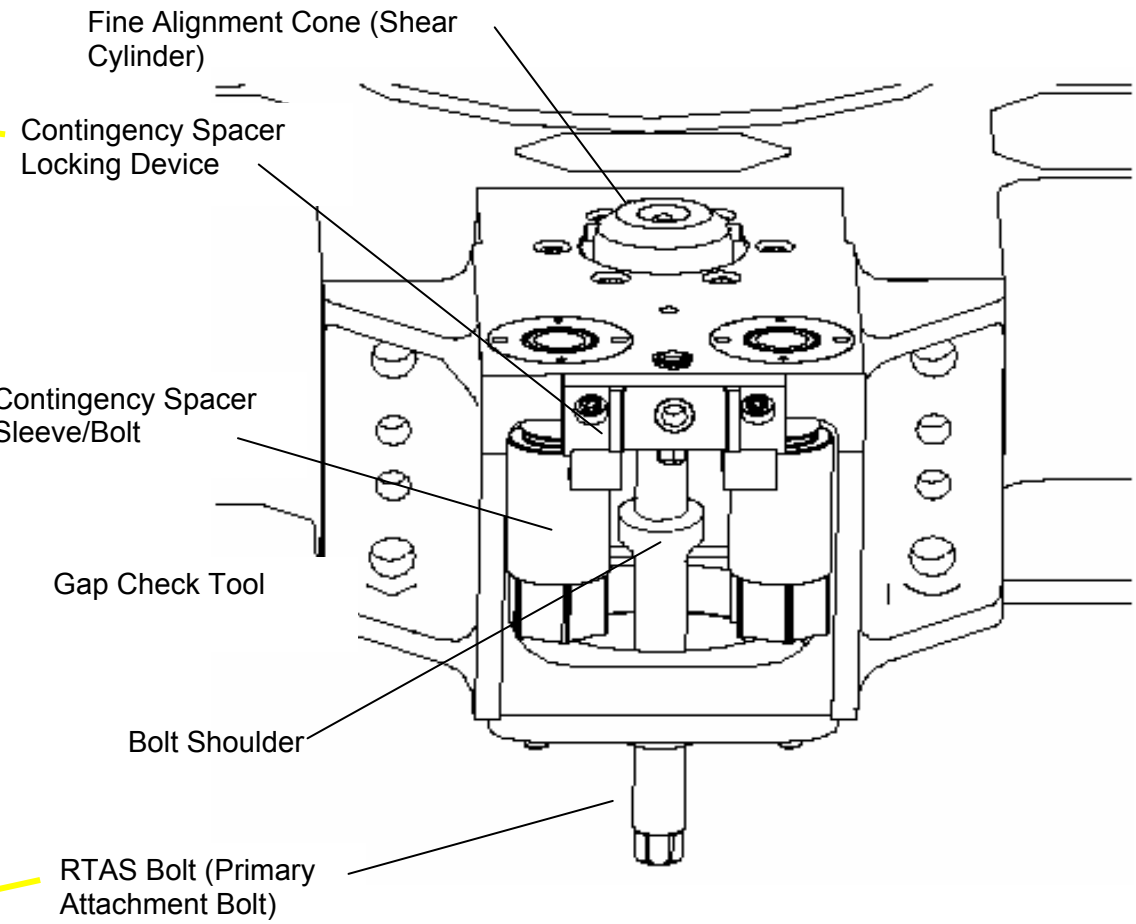
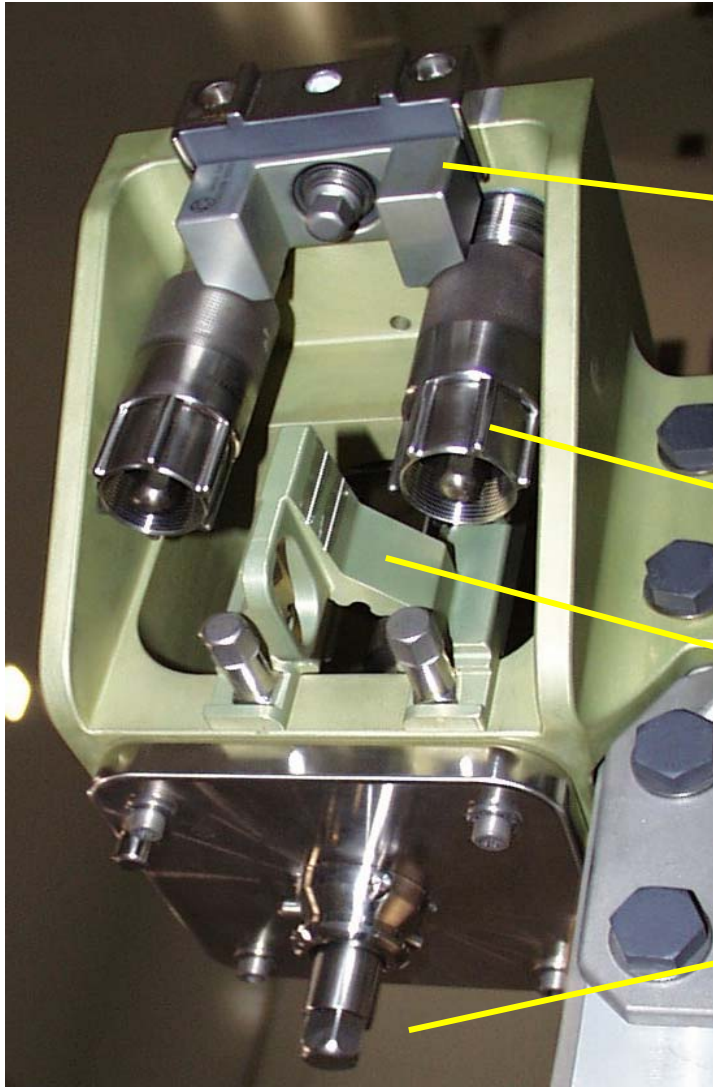
Maximum after primary bolt seating: 0.478 inches

RET hook: 0.43 inches

7/16-6 in ext drop-proof tether end: 0.66 inches

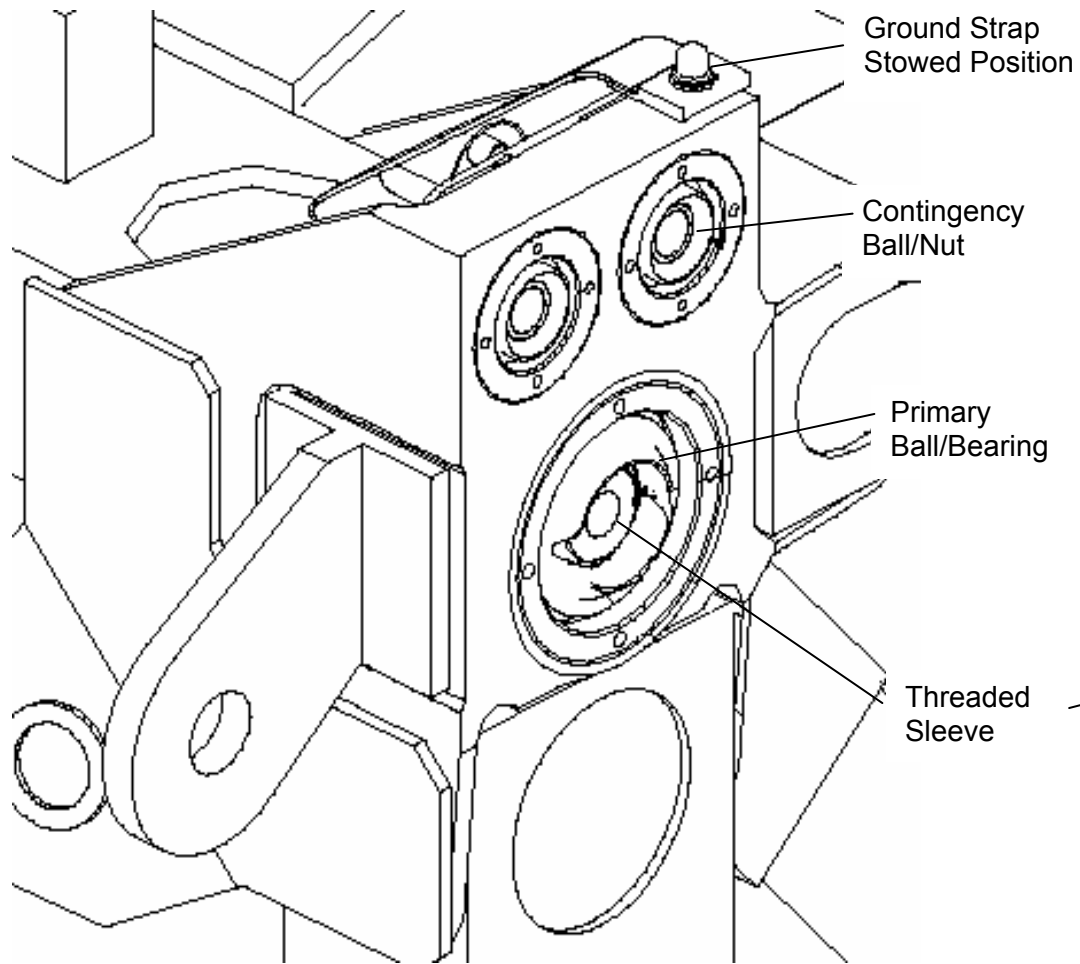
1. Gap Check Tools (2) are located on P5 inboard and outboard Corner 1
2. P6 is safe for EVA translation once 3 of 4 RTAS bolts are engaged to initial torque

**ATTACH P6 TO P5 (RTAS) – TASK DATA (Cont)**



**RTAS P5 SIDE**

**ATTACH P6 TO P5 (RTAS) – TASK DATA (Cont)**



**RTAS P6 SIDE**

## CONNECT P5 TO P6 UMBILICALS (00:35)

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)																								
<input type="checkbox"/> √With MCC-H all inhibits in place	<b>CONNECT P6 UMBILICALS</b> 1. Open TA clamps (x10: 2–P253, 2–P254, 3–P259, 3–P260)  <b>NOTE</b> √Connectors for straight pins, no FOD, EMI band intact, and good bend radius	<b>CONNECT P6 UMBILICALS</b> 1. Assist EV1 as reqd																								
1. Give EV GO to demate P253  <hr style="border-top: 1px dashed black;"/> <input type="checkbox"/> Notify MCC-H P253 mated (GO for data string reconfig)  <input type="checkbox"/> √With MCC-H GO for P254 demate (data reconfiguration complete)	2. On IV GO, perform following demate/mates, swap connector cap from P5 to P6:  <table border="1"> <thead> <tr> <th>Demate cap from P6</th> <th>Demate cable from P5</th> <th>Mate cable to P6</th> <th>Mate Cap on P5</th> </tr> </thead> <tbody> <tr> <td>P6 cap ← →P6 J153</td> <td>P5 P253 ← →P5 J153</td> <td>P5 P253 → ←P6 J153</td> <td>P6 cap → ← P5 J153</td> </tr> </tbody> </table> <hr style="border-top: 1px dashed black;"/> 3. Ingress APFR  <table border="1"> <thead> <tr> <th>Demate cap from P6</th> <th>Demate cable from P5</th> <th>Demate cable from P5</th> <th>Mate Cap on P5</th> </tr> </thead> <tbody> <tr> <td>P6 cap ← →P6 J160</td> <td>P5 P260 ← →P5 J160</td> <td>P5 P259 ← →P5 J159</td> <td>P6 cap → ← P5 J160</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Mate cable to P6</th> <th>Demate cap from P6</th> <th>Mate cable to P6</th> <th>Mate Cap on P5</th> </tr> </thead> <tbody> <tr> <td>P5 P260 → ←P6 J160</td> <td>P6 cap ← →P6 J159</td> <td>P5 P259 → ←P6 J159</td> <td>P6 cap → ← P5 J159</td> </tr> </tbody> </table>	Demate cap from P6	Demate cable from P5	Mate cable to P6	Mate Cap on P5	P6 cap ← →P6 J153	P5 P253 ← →P5 J153	P5 P253 → ←P6 J153	P6 cap → ← P5 J153	Demate cap from P6	Demate cable from P5	Demate cable from P5	Mate Cap on P5	P6 cap ← →P6 J160	P5 P260 ← →P5 J160	P5 P259 ← →P5 J159	P6 cap → ← P5 J160	Mate cable to P6	Demate cap from P6	Mate cable to P6	Mate Cap on P5	P5 P260 → ←P6 J160	P6 cap ← →P6 J159	P5 P259 → ←P6 J159	P6 cap → ← P5 J159	
Demate cap from P6	Demate cable from P5	Mate cable to P6	Mate Cap on P5																							
P6 cap ← →P6 J153	P5 P253 ← →P5 J153	P5 P253 → ←P6 J153	P6 cap → ← P5 J153																							
Demate cap from P6	Demate cable from P5	Demate cable from P5	Mate Cap on P5																							
P6 cap ← →P6 J160	P5 P260 ← →P5 J160	P5 P259 ← →P5 J159	P6 cap → ← P5 J160																							
Mate cable to P6	Demate cap from P6	Mate cable to P6	Mate Cap on P5																							
P5 P260 → ←P6 J160	P6 cap ← →P6 J159	P5 P259 → ←P6 J159	P6 cap → ← P5 J159																							
2. Give EV GO to demate P254	4. On IV GO, EV2 perform:  <table border="1"> <thead> <tr> <th>Demate cap from P6</th> <th>Demate cable from P5</th> <th>Mate cable to P6</th> <th>Mate Cap on P5</th> </tr> </thead> <tbody> <tr> <td>P6 cap ← →P6 J154</td> <td>P5 P254 ← →P5 J154</td> <td>P5 P254 → ←P6 J154</td> <td>P6 cap → ← P5 J154</td> </tr> </tbody> </table> 5. Cleanup worksite, verify TA clamps closed as reqd 6. Stow cannon connector tool in C/L bag 7. Retrieve EVA camera from C/L bag 8. Translate to outboard radiator for cinch release, via corner 1 path (fwd/nadir)	Demate cap from P6	Demate cable from P5	Mate cable to P6	Mate Cap on P5	P6 cap ← →P6 J154	P5 P254 ← →P5 J154	P5 P254 → ←P6 J154	P6 cap → ← P5 J154	2. Stow cannon connector tool in C/L bag 3. Retrieve Med ORU bag from HR 5209 4. Translate to outboard radiator for cinch release, via corner 2 path (nadir/aft) 5. Temp stow Med ORU bag on P6 HR 5358 (outboard of radiator)																
Demate cap from P6	Demate cable from P5	Mate cable to P6	Mate Cap on P5																							
P6 cap ← →P6 J154	P5 P254 ← →P5 J154	P5 P254 → ←P6 J154	P6 cap → ← P5 J154																							

## CONNECT P5 TO P6 UMBILICALS – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
Cannon Connector tool	Cannon Connector tool
APFR	

**EVA Fasteners:** None

### EVA Connectors:

Harness	From	To	Clamps	Size	Function
P253-W02	P5 J153	P6 J153	1		1553 Bus A (Data)
P254-W07	P5 J154	P6 J154	1		1553 Bus B (Data)
P259-W01	P5 J159	P6 J159	4		UPR Primary Power
P260-W08	P5 J160	P6 J160	4		LWR Primary Power

### Foot Restraints:

Task	WIF	APFR Setting
Power connector mate	P5-05	10, QQ, C, 11
Data connector mate (optional)	P5-06	9, SS, A, 11

### Cautions:

### Timeline Considerations:

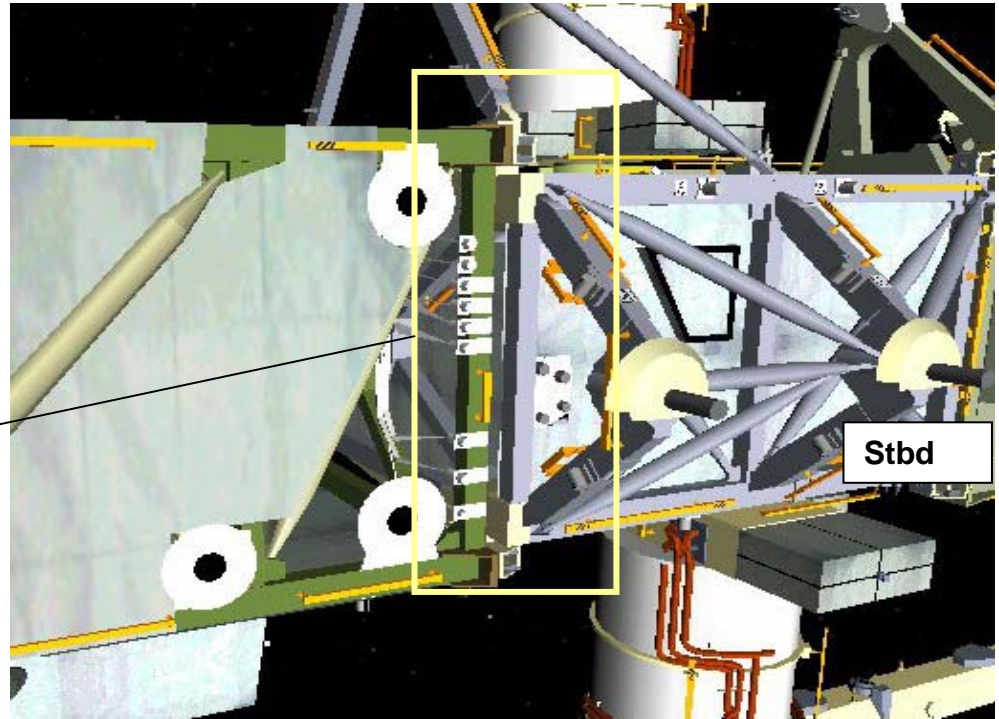
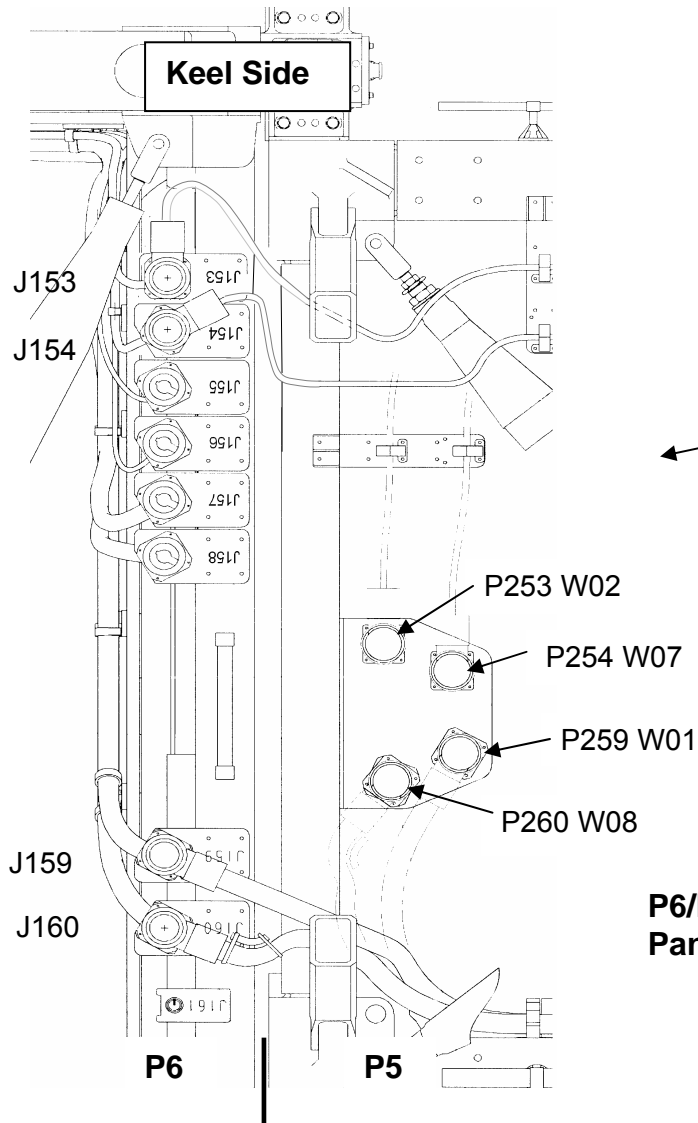
1. Due to cable interference, P260 must be demated from P5 prior to P259. P260 must also be mated to P6 prior to P259

### Note:

1. Tool interference exists on the P5 P260 connector
2. In order to prevent side-loads on connectors, will need to react cable stiffness



# CONNECT P5 TO P6 UMBILICALS – TASK DATA (Cont)

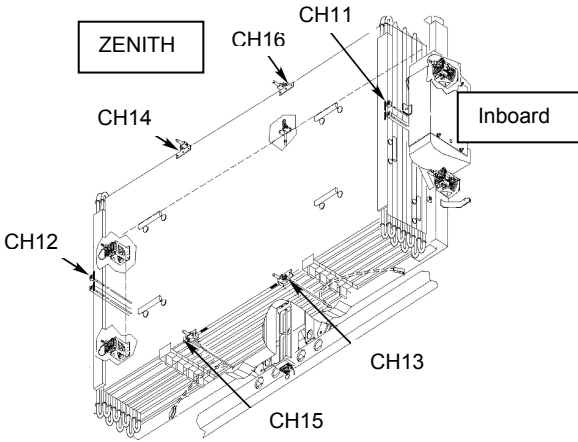


View Radiator Side

P6/P5 Connector Panels

P5 TO P6 UMBILICALS

# OUTBOARD RADIATOR CINCH RELEASE (00:30)

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)																		
 <p> <input type="checkbox"/> With MCC-H in CMG control/thrusters inhibited         </p>	<p><u>RELEASE PVR CINCHES</u></p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Avoid contact with radiator bellows and thermal outer coating</p> </div> <ol style="list-style-type: none"> <li>Release <b>PVR Cinches</b> (3) PGT, 7/16-6 in ext: B7, CCW2; 8-14 turns as reqd to disengage</li> <li>Stow cinch in clip, verify positive retention</li> <li>Assist EV2 with H15 release by compressing radiator</li> </ol> <table border="1"> <tr> <td>Cinch</td> <td>BRT – HR</td> </tr> <tr> <td>H12 outboard</td> <td>5362</td> </tr> </table> <table border="1"> <tr> <td>H14 zenith</td> <td>5354</td> </tr> <tr> <td>H16 zenith</td> <td>5343</td> </tr> <tr> <td>Assist EV2 with H15</td> <td>5362</td> </tr> </table> <p><u>RELEASE OUTBOARD PVR WINCH PIP PIN</u></p>	Cinch	BRT – HR	H12 outboard	5362	H14 zenith	5354	H16 zenith	5343	Assist EV2 with H15	5362	<p><u>RELEASE PVR CINCHES</u></p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> Avoid contact with radiator bellows and thermal outer coating</p> </div> <ol style="list-style-type: none"> <li>Release <b>PVR Cinches</b> (3) PGT, 7/16-6 in ext: B7, CCW2; 8-14 turns as reqd to disengage</li> <li>Stow cinch in clip, verify positive retention</li> <li>Release last cinch, H15, with assistance of EV1</li> </ol> <table border="1"> <tr> <td>Cinch</td> <td>BRT – HR</td> </tr> <tr> <td>H11 inboard</td> <td>5334</td> </tr> </table> <table border="1"> <tr> <td>H13 nadir</td> <td>5342</td> </tr> <tr> <td>H15 nadir</td> <td>5353</td> </tr> </table> <p><u>RELEASE INBOARD PVR WINCH PIP PIN</u></p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>WARNING</b> Moving hardware hazard. PVR panels are free to move after winch release</p> </div> <ol style="list-style-type: none"> <li>Verify tools and tethers clear of deploy envelope</li> </ol>	Cinch	BRT – HR	H11 inboard	5334	H13 nadir	5342	H15 nadir	5353
Cinch	BRT – HR																			
H12 outboard	5362																			
H14 zenith	5354																			
H16 zenith	5343																			
Assist EV2 with H15	5362																			
Cinch	BRT – HR																			
H11 inboard	5334																			
H13 nadir	5342																			
H15 nadir	5353																			
<ol style="list-style-type: none"> <li>Give EV1 and EV2 GO to pull winch PIP pins simultaneously</li> <li>Once winches released and EV crew clear of radiator deploy envelope, give MCC-H GO for radiator deploy</li> </ol>	<ol style="list-style-type: none"> <li>On IV GO, EV1 and EV2 perform simultaneous “3, 2, 1, pull” count</li> <li>Release outboard (EV1) and inboard (EV2) winch bar PIP pin from winch clevis</li> <li>Remove winch bar from radiator panel, reinsert PIP pin into winch clevis</li> <li>Verify PIP pin, lanyard and winch bar clear of radiator deploy envelope</li> <li>Translate to SSUs, avoiding contact with deploying radiator</li> </ol>																			



## OUTBOARD RADIATOR CINCH RELEASE – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
PGT	PGT
7/16 - 6 in ext	7/16 - 6 in ext

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
Cinch	H11-H16	7/16	6	15.8 H11-H12 24.6 H13-H16	35.7 H11-H12 39.7 H13-H16	8-14

### EVA Connectors: None

### Foot Restraints:

Task	WIF	APFR Setting
Cinch H12	P6-31	2, VV, H, 1
Cinch H14	P6-36	1, PP, L, 9
Cinch H16	P6-20	1, SS, E, 1
Cinch H11	P6-20	6, WW, G, 1
Cinch H15	P6-35	1, PP, C, 3
Cinch H33	P6-16	3, PP, A, 1
Cinch H13	P6-19	12, SS, H, 11

### Warnings:

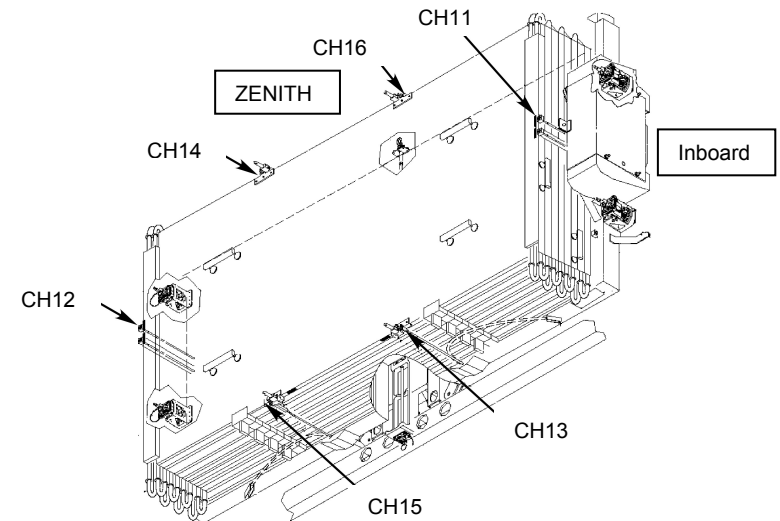
1. Moving hardware hazard. Radiators are free to move after winches released
2. ISS must be CMG-Thruster inhibited during partial deployment when unwinded to avoid damage to PV radiator

### Notes:

1. Incidental contact with silver radiator surface is acceptable
2. H11 and H12 must be released prior to the others

### Constraints:

1. APFR ingress/egress cannot happen concurrently with radiator deploy



## SSU MLI SHROUD REMOVAL (00:45)

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)
<p>1. Record APFR settings: CETA 1, WIF ___ (___, ___, ___, ___)</p>	<p><u>SSU SHROUD REMOVAL</u></p> <ol style="list-style-type: none"> <li>1. Position near nadir SSU (2B)</li> <li>2. Release long strap</li> <li>3. Remove shroud</li> <li>4. Bundle shroud</li>   <li>5. Translate to zenith SSU (4B)</li> <li>6. Repeat steps 3-5 for zenith shroud</li>   <li>7. Translate to tether swap location, P5 5203</li>   <li>8. Swap from P5 85' to tether shuttle 85' Safety tether               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>9. Stow P5 85' Safety tether in C/L bag</li> <li>10. Retrieve APFR from P5 WIF 5, stow on BRT</li> <li>11. Install APFR on CETA 1 (outboard), report settings</li> <li>12. Translate to S1 SFU worksite, CETA marker 6330</li> </ol>	<p><u>SSU SHROUD REMOVAL</u></p> <ol style="list-style-type: none"> <li>1. Position near nadir SSU (2B)</li> <li>2. Release short straps (2)</li> <li>3. Assist EV1</li> <li>4. Bundle shroud</li> <li>5. Stow SSU shroud in Med ORU bag (on P6 HR 5358)</li>   <li>6. Translate to zenith SSU (4B)</li> <li>7. Repeat steps 3-6 for zenith shroud</li> <li>8. Retrieve Med ORU bag, stow on BRT</li>   <li>9. Translate to tether swap location, P5 5107</li>   <li>10. Swap from P5 85' to tether shuttle 85' Safety tether               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>11. Stow P5 85' Safety tether in C/L bag</li> <li>12. Retrieve C/L bag from corner 1</li> <li>13. Attach C/L bag and Med ORU bag, stow bundle on BRT</li> <li>14. Translate to CETA spur</li> <li>15. Swap from TS 85' to A/L 55' Safety tether on HR XXX               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>16. Stow TS 85' safety tether on MWS</li> <li>17. Remove tether shuttle, stow on stowage location               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Locked</li> </ul> </li> <li>18. Translate to airlock</li> </ol>

## SSU MLI SHROUD INSTALL – TASK DATA

### EVA Tools:

EV1 (FF)	EV2 (FF)
N/A	N/A

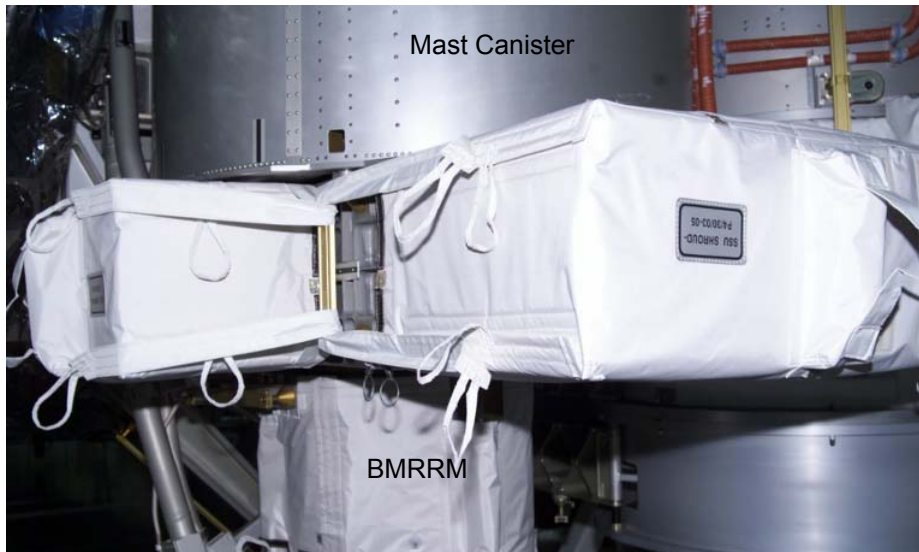
**EVA Fasteners:** None

**EVA Connectors:** None

**Foot Restraints:** None

### Cautions:

1. N/A



Left side of SSU shroud – 2 short straps



Right side of SSU shroud – 1 long strap

**S1 SFU CONFIG POST DEPLOY (00:15)**

IV	EV1 – Pz (FF)	EV2 – Wheels																								
<p><u>SFU RECONFIG INHIBITS</u>                      ✓RPCM S1-1A-C RPC 4 – OPEN                      5 – OPEN                      6 – OPEN                      7 – OPEN</p> <p><input type="checkbox"/> ✓With MCC-H all inhibits in place for SFU Configure</p>	<p>1. Translate to S1 SFU Panel A123 on nadir radiator Beam (CETA marker 6330)                      2. BRT HR 3258</p> <p style="text-align: center;"><u>NOTE</u></p> <p>✓Connectors for straight pins, no FOD, EMI band intact, and good bend radius</p>																									
<p>1. Give EV GO for SFU Configure</p> <hr style="border-top: 1px dashed black;"/> <p>2. Notify MCC-H SFU connector swap complete (GO for heater powerup)</p>	<p>3. On IV GO, swap the following:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="4" style="text-align: center;">PNL A123 - Demate</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Dust cap</td> <td style="text-align: center;">← →</td> <td style="text-align: center;">J752</td> <td></td> </tr> <tr> <td style="text-align: center;">P752</td> <td style="text-align: center;">← →</td> <td style="text-align: center;">J703</td> <td></td> </tr> <tr> <th colspan="4" style="text-align: center;">PNL A123 - Mate</th> </tr> <tr> <td style="text-align: center;">P752</td> <td style="text-align: center;">→ ←</td> <td style="text-align: center;">J752</td> <td></td> </tr> <tr> <td style="text-align: center;">Dust cap</td> <td style="text-align: center;">→ ←</td> <td style="text-align: center;">J703</td> <td></td> </tr> </tbody> </table> <hr style="border-top: 1px dashed black;"/> <p>4. Translate to CETA spur for tether swap</p>	PNL A123 - Demate				Dust cap	← →	J752		P752	← →	J703		PNL A123 - Mate				P752	→ ←	J752		Dust cap	→ ←	J703		
PNL A123 - Demate																										
Dust cap	← →	J752																								
P752	← →	J703																								
PNL A123 - Mate																										
P752	→ ←	J752																								
Dust cap	→ ←	J703																								

## S1 SFU CONFIG POST DEPLOY – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
N/A	

**EVA Fasteners:** None

### EVA Connectors:

Harness	From	To	Clamps	Size	Function
S0P752-WXX	S1 J03	S1 J752	0	TBD	Heater Power
J703-Dust Cap	S1 J752	S1J703	0	TBD	Protection

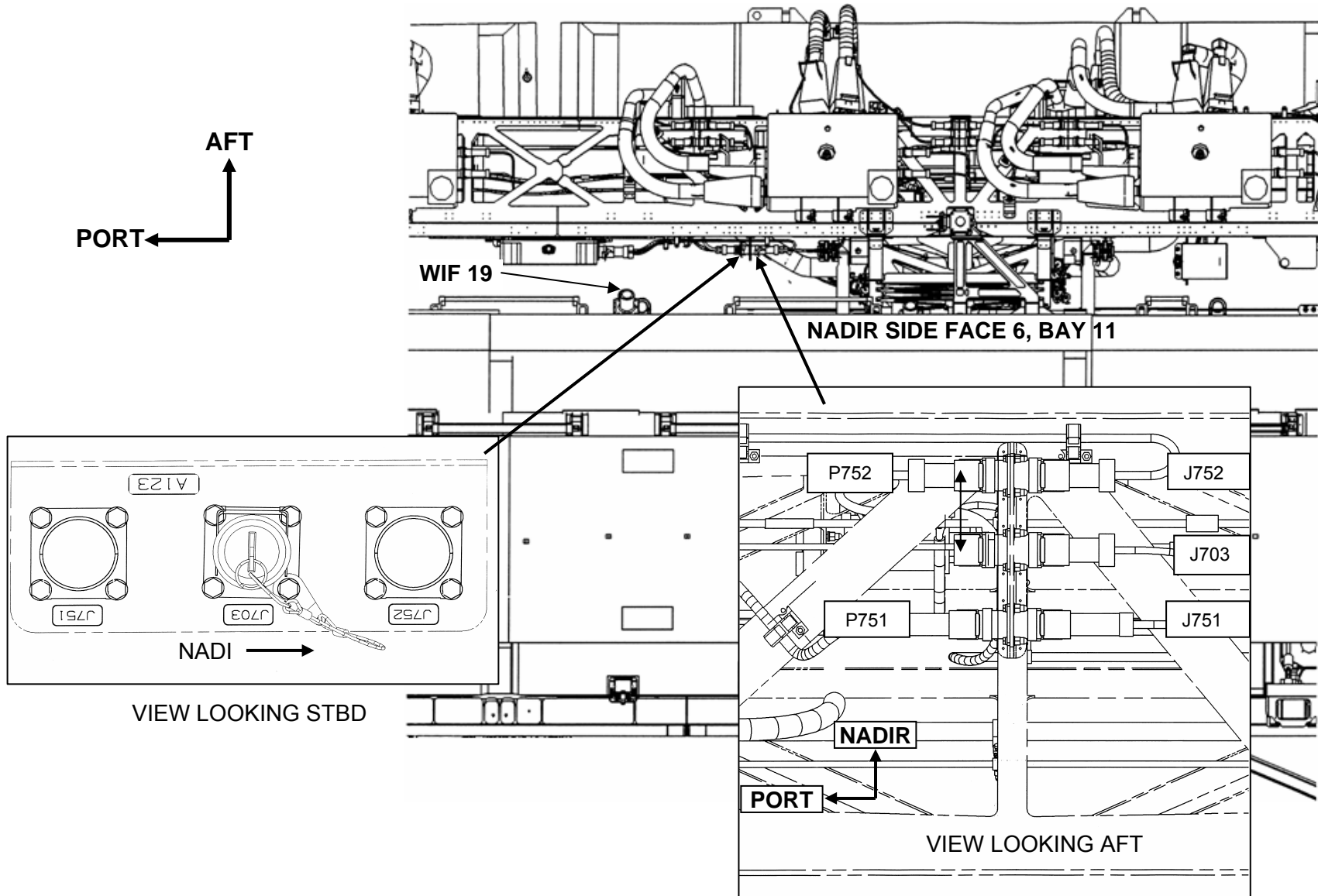
**Foot Restraints:** None

### Warnings:

**Cautions:** None

### Note:

S1 SFU CONFIG POST DEPLOY – TASK DATA (Cont)



SFU PANEL A123 (FINAL CONFIG)

## MSBU TRANSFER (01:15)

IV/SRMS	EV1 – Pz (FF)	EV2 – Wheels (SRMS)
<p><input type="checkbox"/> √SRMS at PAD/APFR Install/Ingress location</p> <p>SRMS: GCA to APFR Ingress</p>	<ol style="list-style-type: none"> <li>1. Translate to CETA spur for tether swap</li> <li>2. Swap from TS 85' safety tether to A/L 55' safety tether               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>3. Stow 85' safety tether on MWS</li> <li>4. Remove tether shuttle, stow on stowage location               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Locked</li> </ul> </li> <li>5. Translate to airlock</li> <li>6. Temp stow 85' safety tether at airlock</li> <li>7. Retrieve 6B box cover/dummy box</li> <li>8. Translate to Z1 BSP worksite</li> </ol> <p>Perform <b>BSP RETRIEVE (00:30)</b></p>	<ol style="list-style-type: none"> <li>1. Translate to airlock; temp stow C/L Bag #1/Med ORU bag bundle at airlock</li> <li>2. Retrieve C/L bag #2; stow on BRT</li> <li>3. Translate to nadir side of Lab</li> <li>4. Temp stow C/L bag on Lab HR 0232</li> </ol> <p><u>PAD/APFR INSTALL</u></p> <ol style="list-style-type: none"> <li>1. Remove PAD/WIF adapter from C/L bag</li> <li>2. <input type="checkbox"/> √PAD in SD (soft dock)</li> <li>3. Install PAD w/WIF adapter onto SRMS, PFR socket toward end effector</li> <li>4. Rotate knob to CL (closed)</li> <li>5. Lock knob</li> <li>6. Translate to Node 2 WIF 8</li> <li>7. Remove APFR, stow on BRT</li> <li>8. Translate to SRMS</li> <li>9. Install APFR onto PAD (4,II,F,6)               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Locking collar black-on-black</li> <li><input type="checkbox"/> Good pull test</li> </ul> </li> <li>10. Perform safety tether swap onto SRMS black D-ring               <ul style="list-style-type: none"> <li><input type="checkbox"/> √Gate closed</li> <li><input type="checkbox"/> √Hook locked</li> <li><input type="checkbox"/> √Reel unlocked</li> </ul> </li> <li>11. Stow EV2 A/L safety tether on handrail <b>TBD</b></li> <li>12. GCA as reqd for APFR ingress, ingress APFR</li> <li>13. Attach MWS EE to ingress aid</li> </ol> <p><u>MBSU RETRIEVE</u></p> <ol style="list-style-type: none"> <li>1. √Tools and tethers clear of worksite</li> </ol>
<ol style="list-style-type: none"> <li>1. Give SRMS GO to mnvr to PLB SRMS: MBSU Retrieval Setup (PLB, stbd bay 6)</li> </ol>		<ol style="list-style-type: none"> <li>2. Prior to entering payload bay, stow Ingress Aid between knees</li> <li>3. GCA SRMS for MBSU Retrieval</li> <li>4. Tether to MBSU</li> <li>5. Release <b>FRAM Primary Bolt</b> PGT, 7/16-6in ext: A4, CCW2, <b>10.5</b>; ~11 turns to HS, push while turning to release anti-rotation device (~10 lb)</li> </ol>

**MSBU TRANSFER (01:15) (Cont)**

IV/SRMS	EV1 – Pz (FF)	EV2 – Wheels (SRMS)						
	9. Translate to ESP2 (or A/L) retrieve APFR 10. Translate to ESP2 Nadir Site 6 11. Install APFR in WIF 5 (4, PP, G, 1)	6. ✓Status indicator “in” 7. Remove MBSU, from magnetic soft dock (15-20 lb reqd for removal) 8. When FRAM clear or coarse alignment guides, give “MBSU clear” command						
SRMS: MBSU Clearance		9. ✓Tools and tethers clear of worksite						
2. Give SRMS GO to mnvr to MBSU handoff SRMS: MBSU Handoff  <table border="1"> <thead> <tr> <th></th> <th>Turns</th> <th>Torque</th> </tr> </thead> <tbody> <tr> <td>FRAM Primary Bolt</td> <td></td> <td></td> </tr> </tbody> </table>		Turns	Torque	FRAM Primary Bolt			<u>MBSU STOW ON ESP2</u> 1. Ingress APFR 2. GCA SRMS for MBSU handoff 3. Rotate MBSU for correct alignment  4. Receive MBSU/FRAM from EV2 5. Soft dock MBSU/FRAM, magnetic soft dock  6. Drive <b>FRAM Primary Bolt</b> PGT, 7/16-6in ext: A4, CW2, <b>10.5</b> ; ~11 turns to HS, push while turning to release anti-rotation device (~10 lb) 7. ✓Status indicator “out” 8. Egress APFR 9. Translate to Lab nadir	<u>MBSU STOW ON ESP2</u> 1. GCA SRMS for MBSU handoff 2. Rotate MBSU for correct alignment 3. Hand off MBSU/FSE to EV1  4. GCA as reqd to assist EV1 with MBSU/FRAM soft dock and install  <u>APFR EGRESS AND PAD/APFR REMOVE</u> 1. ✓Tools and tethers clear of worksite
	Turns	Torque						
FRAM Primary Bolt								
3. Give SRMS GO to mnvr to APFR Egress SRMS: APFR Egress  SRMS: APFR Removal  <input type="checkbox"/> ✓SARJ is locked	10. Assist EV2 with SRMS cleanup 11. Perform P6 SAW deploy assist as reqd (tools in C/L) 12. Retrieve crewlock bag with tools, camera and safety tethers (2) 13. Translate to tether shuttles, perform tether swap	2. Egress APFR  3. GCA as reqd for APFR removal 4. Remove APFR stow on BRT 5. Translate to <b>TBD</b> WIF to stow APFR 6. Remove PAD/WIF adapter from SRMS 7. Stow in C/L bag 8. Perform safety tether swap onto A/L safety tether <input type="checkbox"/> ✓Gate closed <input type="checkbox"/> ✓Hook locked <input type="checkbox"/> ✓Reel unlocked						
4. Once EV2 SRMS safety tether swap complete, notify R1 SRMS is released	14. Translate to SAW viewing position  <table border="1"> <tr> <td style="text-align: center;"><b>WARNING</b></td> </tr> <tr> <td style="text-align: center;">BGA not locked unless EV crew requires access to array</td> </tr> </table> 15. Watch array deploy, taking photos as reqd	<b>WARNING</b>	BGA not locked unless EV crew requires access to array	9. Stow 85' safety tether in C/L bag 10. Retrieve C/L bag, stow on BRT 11. Translate to airlock, temp stow C/L bag				
<b>WARNING</b>								
BGA not locked unless EV crew requires access to array								



## MSBU TRANSFER – TASK DATA

### Tools:

EV1 (FF)	EV2 (SRMS)
PGT	PGT
7/16 – 6 in	7/16 – 6 in

### EVA Fasteners:

Fastener	Head size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
FRAM	7/16	1	6.3	6.3	21	11	30

**EVA Connectors:** None

### Foot Restraints:

Task	WIF	APFR Setting
MBSU Retrieve	SRMS w/ PAD	4,II,F,6
MBSU Stow on ESP-2	ESP-2 - 5	4,PP,G,1

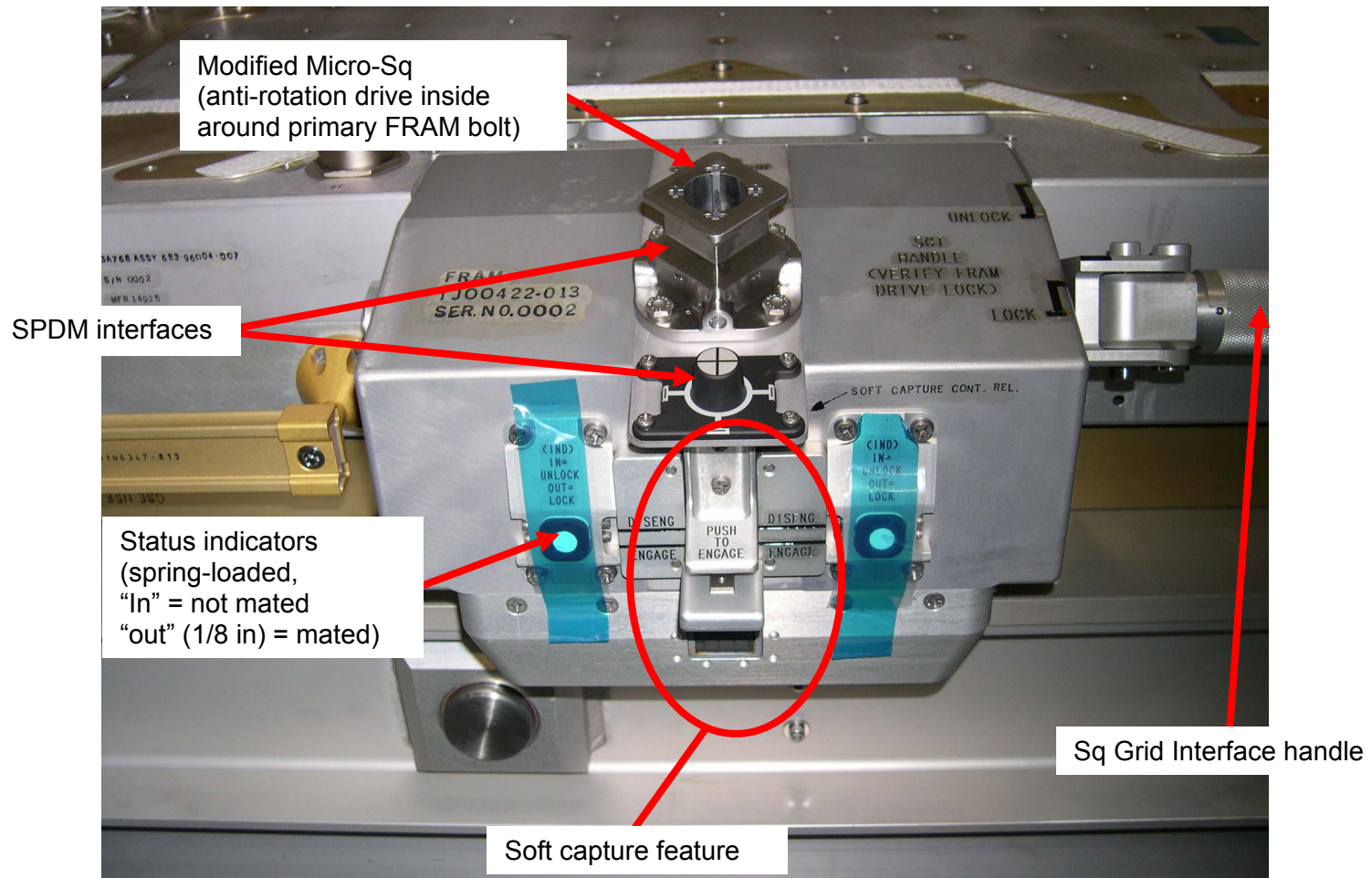
### Warnings:

**Cautions:** None

### Note:

1. FRAM has a 5.5 lb magnetic soft dock at fwd 2 corners and a 3.5 lb soft dock at aft 2 corners
2. PGT MTL set at 10.5 is necessary to ensure the FRAM primary bolt is not damaged

## MBSU TRANSFER – TASK DATA (Cont)



## BSP RETRIEVE (00:45)

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)												
<p>☐ √MCC-H GO to remove BSP</p>	<p><u>BSP REMOVAL</u> 1. Remove dummy box from 6B Box cover, temp stow 2. Open BSP thermal cover ("garage door") 3. Tether to BSP tether point</p>													
<p>2. Give EV GO for BSP remove</p>        <p>Dummy Box Bolt Data</p> <table border="1"><thead><tr><th>Bolt</th><th>Turns</th><th>Torque</th></tr></thead><tbody><tr><td>Center Jack</td><td></td><td></td></tr><tr><td>Outer Fastener (Nadir)</td><td></td><td></td></tr><tr><td>Outer Fastener (Zenith)</td><td></td><td></td></tr></tbody></table>	Bolt	Turns	Torque	Center Jack			Outer Fastener (Nadir)			Outer Fastener (Zenith)			<p>4. On IV GO, release <b>BSP outer fasteners</b> (2) PGT, 7/16-6 in ext: A6, CCW2; 16 turns</p> <p>5. Release <b>BSP center jack bolt</b> PGT, 7/16-6 in ext: A6, CCW2; 33 turns</p> <p>6. Release BSP by sliding it along guide pins 7. Inspect BSP cotherm for damage 8. Inspect Z1 cold plate for cotherm debris 9. Stow BSP on 6B Box Cover</p> <p><u>DUMMY BOX INSTALL</u> 10. Retrieve dummy box, install on Z1</p> <p>11. Drive <b>BSP center jack bolt</b> PGT, 7/16-6 in ext: A6, CW2; 33 turns to HS</p> <p>12. Drive <b>BSP outer fasteners</b> (2) PGT, 7/16-6 in ext: A6, CW2; 16 turns to HS</p> <p>13. Close BSP thermal cover 14. Retrieve 6B Box Cover/BSP</p> <p>15. Translate to airlock 16. Temp stow 6B Box Cover/BSP at airlock</p> <p>17. Translate to ESP-2 for MBSU handoff</p>	
Bolt	Turns	Torque												
Center Jack														
Outer Fastener (Nadir)														
Outer Fastener (Zenith)														

## BSP RETRIEVE – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
PGT	
7/16 – 6 in	
6B Box Cover	
Dummy Box	

### EVA Fasteners:

Fastener	Head size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Outer Fastener	7/16	2	TBD	TBD	TBD	16	30
Center Jacking	7/16	1	TBD	TBD	TBD	33	30

**EVA Connectors:** None

**Foot Restraints:** None

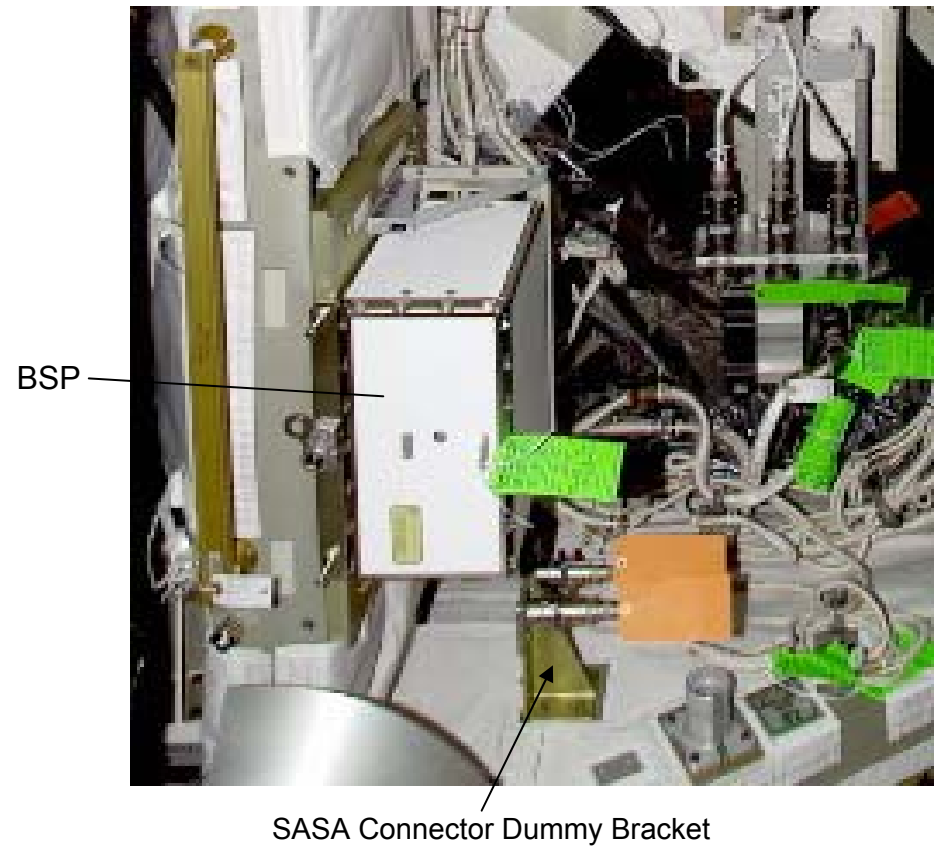
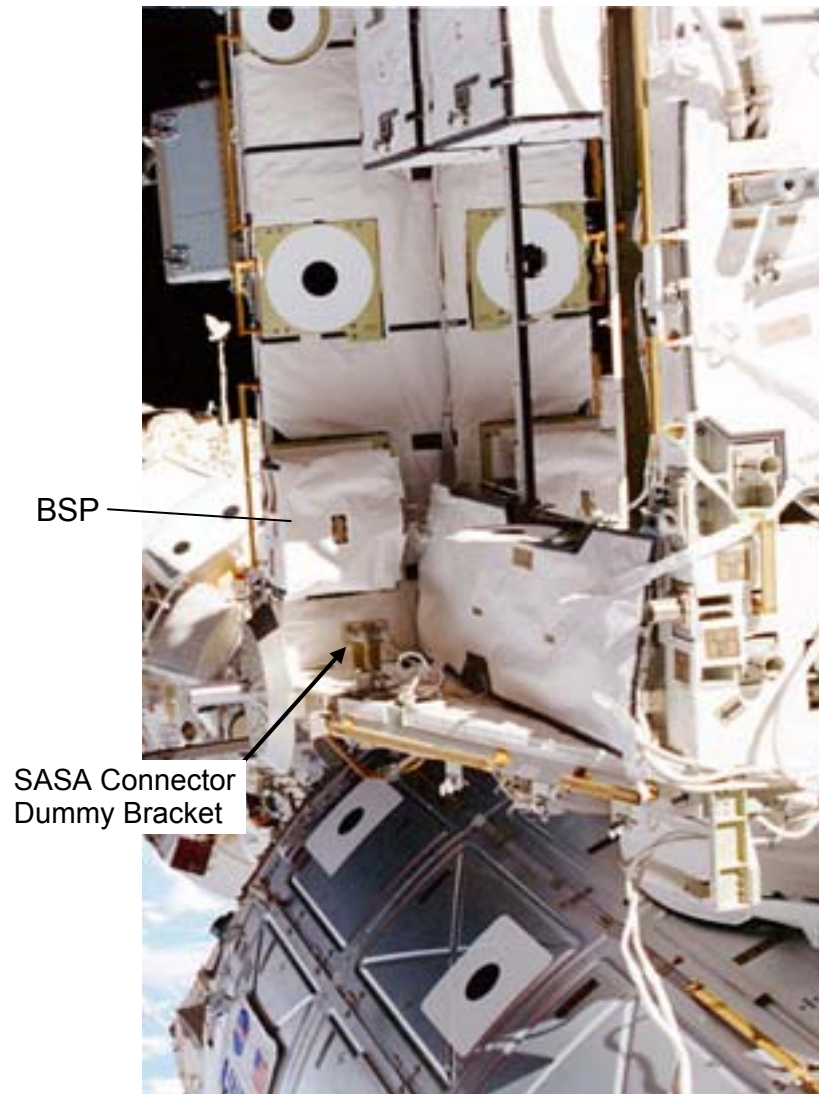
### Cautions:

1. TBD

### Warnings:

1. TBD

**BSP RETRIEVE – TASK DATA (Cont)**



**BASE BAND SIGNAL PROCESSOR (BSP)**

**EVA 3 CLEANUP AND A/L INGRESS (00:20)**

IV	EV1 – Pz (FF)	EV2 – Wheels (FF)
<p>1. Perform prior to ingress: WVS PWRDN (PHOTO/TV, <u>WVS CUE CARD</u>)</p>	<p>1. Translate to airlock 2. Perform tool inventory 3. <u>Ingress airlock</u> 4. Receive C/L bag #1/Med ORU from EV2, stow 5. Receive C/L bag #2 from EV2, stow 6. Receive 6B Box Cover/BSP from EV2, stow 7. Connect right waist tether to A/L D-ring extender     <input type="checkbox"/> √Hook locked 8. <u>Pass A/L safety tether to EV2</u>  DCM 9. Retrieve SCU, remove DCM cover 10. Connect SCU to DCM, √Locked 11. Water – OFF</p>	<p>1. Translate to airlock 2. Perform tool inventory 3. <u>Transfer C/L bag #1/Med ORU bag to EV1</u> 4. <u>Transfer C/L bag #2 to EV1</u> 5. <u>Transfer 6B Box Cover/BSP to EV1</u>  6. Receive EV1 A/L safety tether, stow on handrail     <input type="checkbox"/> √Hook unlocked     <input type="checkbox"/> √Reel unlocked 7. Attach right waist tether to EV1's left waist tether     <input type="checkbox"/> √Hook locked 8. Disconnect EV2 A/L safety tether, stow on handrail     <input type="checkbox"/> √Hook unlocked     <input type="checkbox"/> √Reel unlocked 9. Ingress airlock  DCM 10. Retrieve SCU, remove DCM cover 11. Connect SCU to DCM, √Locked 12. Water – OFF 13. Hatch thermal cover – close 14. Secure thermal cover Velcro strap</p>
<p><b>CAUTION</b> Do not close hatch until EMU water – OFF for 2 min</p>		
	<p>12. Go to PRE REPRESS portion of {CREWLOCK DEPRESS/REPRESS CUE CARD} (SODF: ISS EVA SYS: EVA PREP/POST)</p>	<p>15. √EV Hatch clear of FOD and obstructions 16. EV Hatch – close and lock 17. Go to PRE REPRESS portion of {CREWLOCK DEPRESS/REPRESS CUE CARD} (SODF: ISS EVA SYS: EVA PREP/POST)</p>

**POST EVA 3 TOOL CONFIG**

**EV1**

- EMU D-Rings
  - 1 – Tether Extender on Left
  - 2 – Waist Tethers
- MWS
  - Small trash bag [right inside]
    - 1 – RET (sm-sm)
  - 1 – Adj tether [right]
  - 1 – RET (with PIP pin) [left]
  - 1 – RET (sm-sm) [right]
  - 2 – Wire ties
  - Socket caddy [left inside]
    - RAD S/N \_\_\_\_\_
  - Swing Arm [right side]
    - PGT w/7/16-6 in ext S/N \_\_\_\_\_
    - 1 - RET (sm-sm)
  - BRT [left side]
    - 3 Wire Ties
    - 1 - RET (sm-sm)
- SAFER

RETs sm-sm – 11														
RETs w/PIP pin – 2														
RETs Lg-sm – 2														
Adj tethers – 9														

**EV2**

- EMU D-Rings
  - 1 – Tether Extender on Left
  - 2 – Waist Tethers
  - 1 – 85' Safety Tether (TS)
- MWS
  - Small trash bag [right inside]
    - 1 – RET (sm-sm)
  - 1 – Adj tether [left]
  - 1 – RET (with PIP pin) [left]
  - 1 – RET (sm-sm) [right]
  - 2 – Wire ties
  - Socket caddy [left inside]
    - 5/8-7.8 in ext
    - 5/8-7.8 in ext
  - Swing Arm [right side]
    - PGT w/7/16-6 in ext S/N \_\_\_\_\_
    - 1 – RET (sm-sm)
  - BRT [left side]
    - 3 Wire Ties
    - 1 – RET (sm-sm)
- SAFER

**CREWLOCK**

- C/L Bag#3 (Solar Array Tools)
  - BRS Pin Contingency Tool (w/Tape)
  - Loop Pin Puller (w/Tape)
  - TPS Scraper (w/Tape)
  - Compound Cutter/Needle Nose Pliers Caddy (w/Tape)
- Cheater Bar (w/Kapton Tape)
  - 1.5" Bail Drive Lever (taped to Cheater Bar)

**JOINT A/L EXTERNAL**

- 2 – Crewlock Safety Tethers (55 ft)

**CREWLOCK**

- Staging Bag
  - PGT with battery PGT S/N \_\_\_\_\_
  - Connector Cleaner Tool Caddy
  - DCM Plug
  - Wire Tie Caddy
  - Socket Caddy
    - 7/16-12 in ext
- IV Bag
  - EVA Ratchet (bilateral)
  - 2 – Adj Thermal Mittens
  - Hydrazine Detector Kit
  - 1 – wire tie caddy
  - 4 – waist tethers
- Fish stringer (internal)
  - Med ORU bag (SSU shrouds)
    - Adj tether (4)
    - SSU MLI Shrouds (2)
    - EVA Camera/Bracket
  - C/L bag #1 – adj tether on outside
    - Torque Wrench (set to 57 ft-lb) (outside of bag) w/2 wire ties
      - 1 – RET (sm-sm)
  - EV1 85' safety tether (P5)
  - EV2 85' safety tether (P5)
  - Connector tool (2)
  - Ratchet
- C/L bag #2 – adj tether on outside
  - PAD
    - WIF Adapter
  - EVA Camera/Bracket
  - 6B Box Cover (BSP)
    - Adj tether
    - BSP
  - EV1 85' Safety Tether (TS)

**ADDITIONAL ITEMS RETURNED TO AIRLOCK**

- BSP
- SSU MLI Shrouds (2)

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## PGT SETTINGS TABLE

### TORQUE SETTINGS:

SETTING	TORQUE SETPOINT (FT-LB)	TORQUE WINDOW	TORQUE THRESHOLD	TURN LIMIT
A1	2.5	±1.0	±1.0	Infinite
A2	3.8	±1.0	±1.0	Infinite
A3	4.8	±1.0	±1.0	Infinite
A4	6.3	±1.0	±1.0	Infinite
A5	7.0	±1.0	±1.0	Infinite
A6	8.3	±1.0	±1.0	Infinite
A7	9.2	±1.0	±1.0	Infinite
B1	12.0	±1.0	±1.0	Infinite
B2	16.0	±1.2	±1.0	Infinite
B3	18.4	±1.7	±1.0	Infinite
B4	19.4	±1.9	±1.0	Infinite
B5	22.0	±2.0	±1.0	Infinite
B6	24.0	±2.0	±1.0	Infinite
B7	25.5	±2.0	±1.0	Infinite

### SPEED SETTINGS:

SETTING	RPM
CW1	10
CW2	30
CW3	60
CCW1	10
CCW2	30
CCW3	60

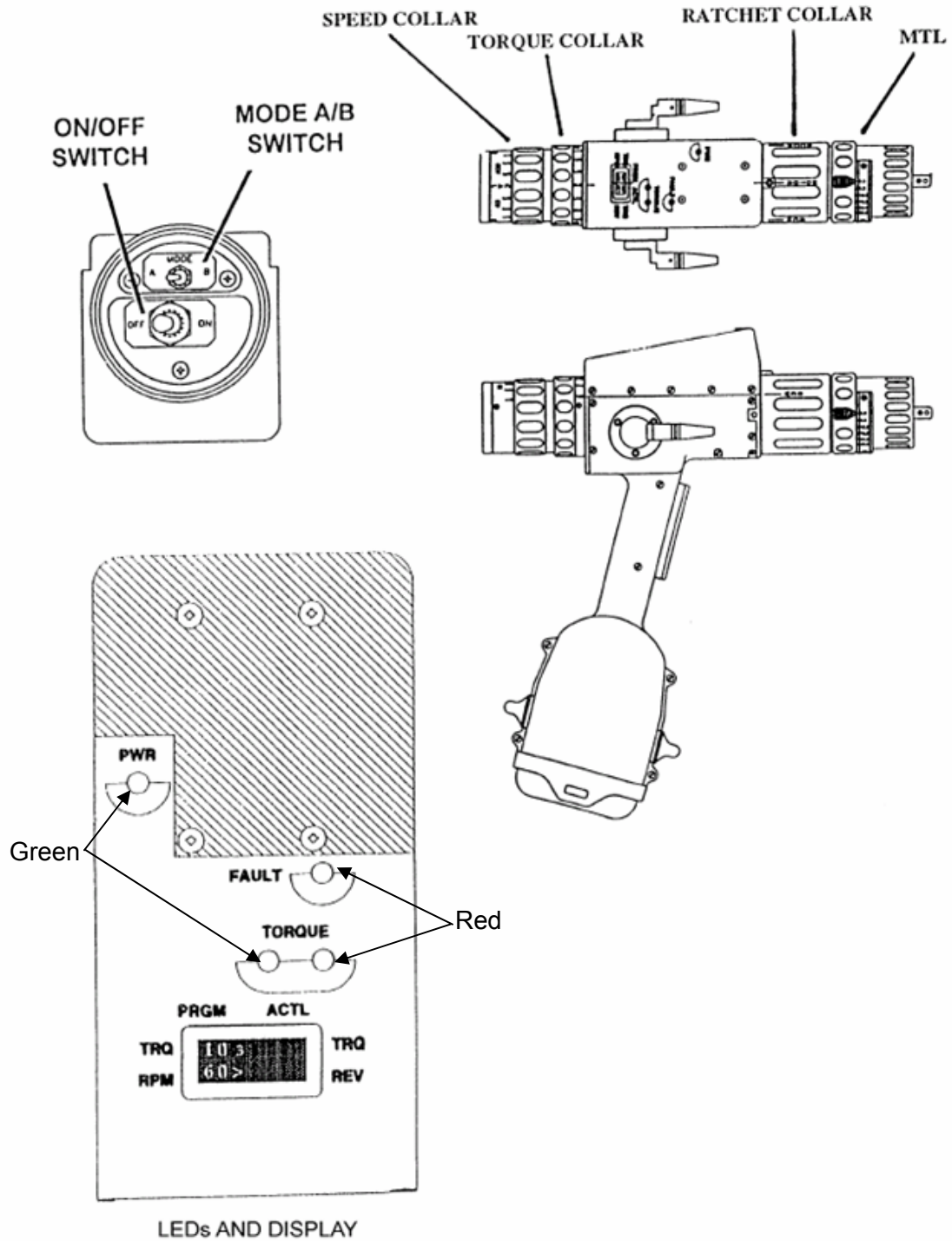
### POWER MANAGEMENT:

FUNCTION	MIN
Auto Sleep	15
Auto Off	30

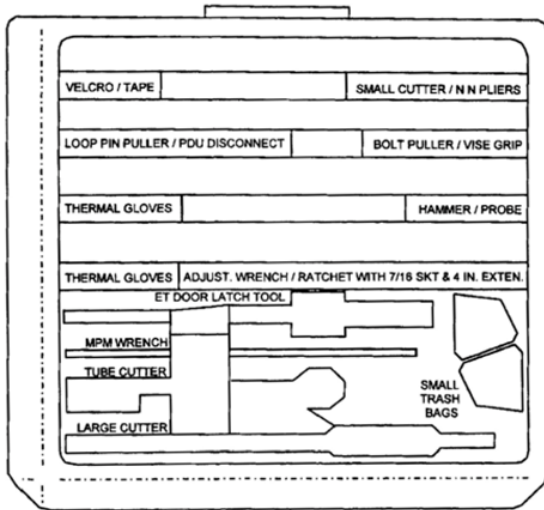
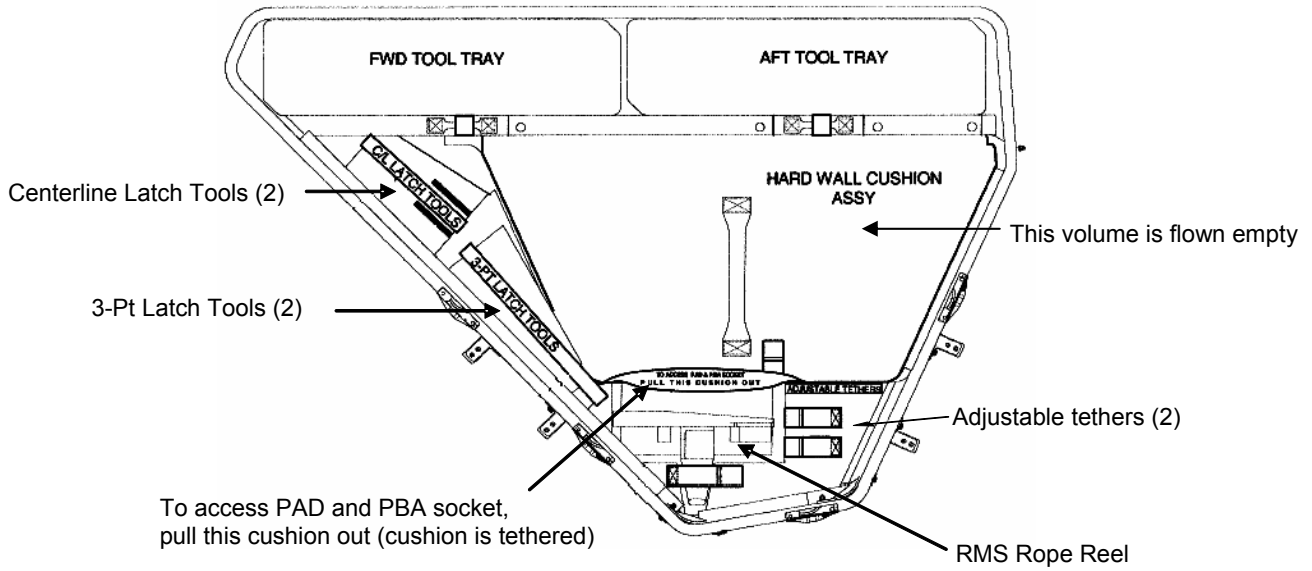
### MULTI-SETTING TORQUE LIMITER (MTL) SETTINGS:

(ft-lb)
2.5
5.5
10.5
15.5
23.5
30.5

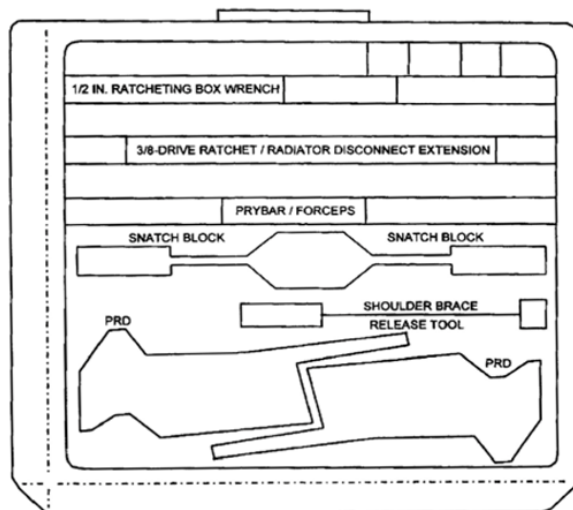
# PISTOL GRIP TOOL



# PORT LIGHTWEIGHT TOOL STORAGE ASSEMBLY



Forward Tray layout and Labels



Aft Tray Layout and Labels



## TOOLBOX STOWAGE

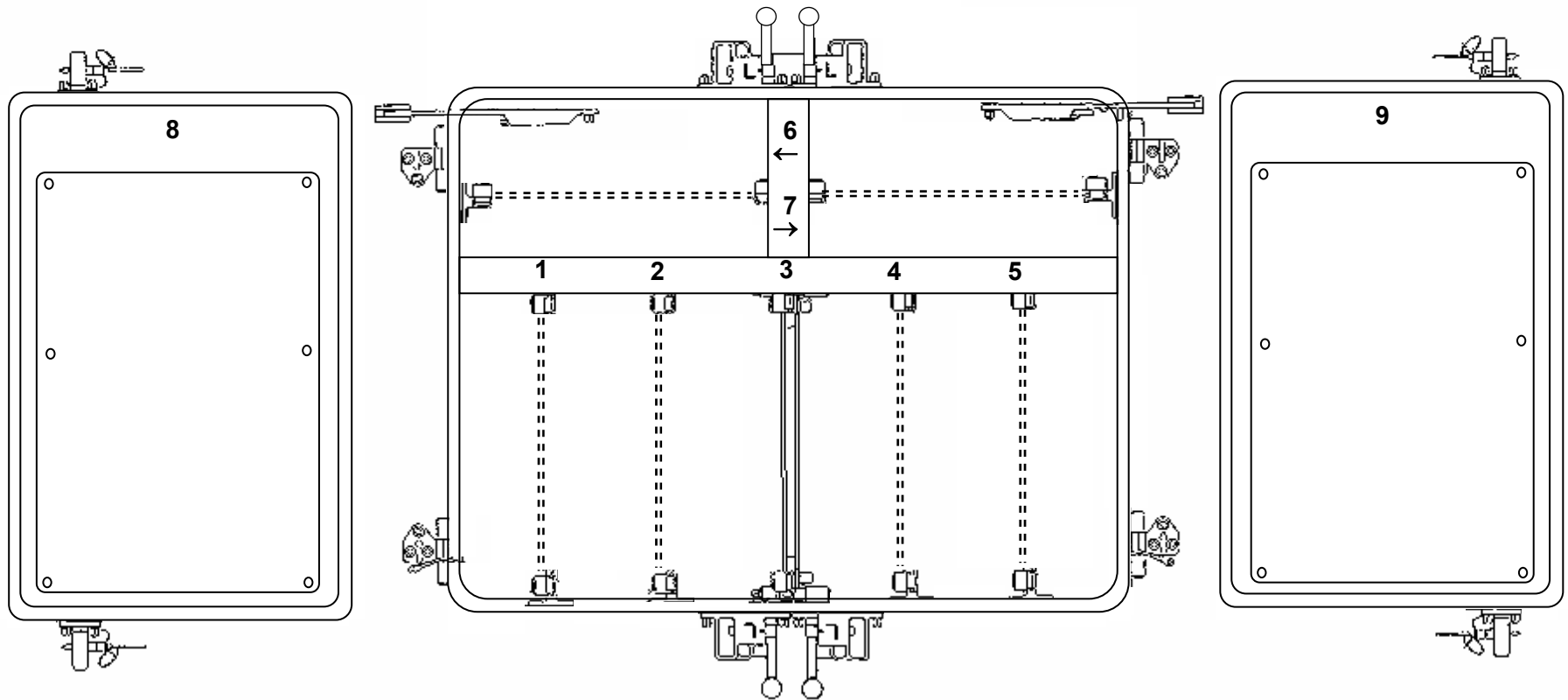
I

	Z1 PORT TOOLBOX	Z1 STBD TOOLBOX	A/L TOOLBOX 1 (STBD)	A/L TOOLBOX 2 (PORT)
<b>SLOT # 1</b>	SQUARE TM BOARD SQ TORQUE MULTIPLIER 7/16" FLUSH SQ SOCKET 7/16" PROUD SQ SOCKET 7/16" RECESSED SQ SOCKET	SQUARE TM BOARD SQ TORQUE MULTIPLIER 7/16" FLUSH SQ SOCKET 7/16" PROUD SQ SOCKET 7/16" RECESSED SQ SOCKET	HAMMER BOARD HAMMER	CABLE CUTTER BOARD COMPOUND CUTTERS (SM) SCISSORS
<b>SLOT # 2</b>		QD BAIL TOOL BOARD BMRRM LATCH TOOL QD BAIL DRIVE TOOL (1")	PLIERS BOARD NEEDLE NOSE PLIERS	
<b>SLOT # 3</b>	RATCHET BOARD 3/8" DRIVE RATCHET 7/16" X 12" WOBBLE SOCKET 7/16" X 2" RIGID SOCKET	RATCHET BOARD 3/8" DRIVE RATCHET 7/16" X 6" WOBBLE SOCKET		
<b>SLOT # 4</b>				
<b>SLOT # 5</b>	ROUND TM BOARD RND TORQUE MULTIPLIER 5/8" PROUD RND SOCKET 7/16" FLUSH RND SOCKET 7/16" PROUD RND SOCKET	ROUND TM BOARD 7/16" FLUSH RND SOCKET 7/16" PROUD RND SOCKET	ADJ WRENCH BOARD FORCEPS WRENCH, ADJ	T-HANDLE TOOL BOARD 1-3" T-TOOLS 2-8" T-TOOLS
<b>SLOT # 6</b>	TRASH BAG BOARD LARGE TRASH BAG SMALL TRASH BAG	TRASH BAG BOARD	HYDRAZINE BRUSH BOARD HYDRAZINE BRUSH	
<b>SLOT # 7</b>	SOCKET BOARD 5/32" BALL END ALLEN DR 1/2" X 8" WOBBLE SOCKET 5/16" X 7" RIGID SOCKET	SOCKET BOARD 5/32" BALL END ALLEN DR 1/2" X 8" WOBBLE SOCKET 5/16" X 7" RIGID SOCKET	PRD (Toolboard) PRD	PRD (Toolboard) PRD
<b>PANEL # 8</b>	CHEATER BAR PANEL ADJ EQUIP TETHER	CHEATER BAR PANEL CHEATER BAR ADJ EQUIP TETHER	TOOL CADDY PANEL CADDY, ISS (BUNGEE)	
<b>PANEL # 9</b>	18" SOCKET PANEL 7/16" X 18" WOBBLE SOCKET	18" SOCKET PANEL	BOLT PULLER PANEL BOLT PULLER MECHANICAL FINGER	LARGE CUTTER PANEL
<b>EXTERNAL</b>	1 SQUARE SCOOP 1 ROUND SCOOP w/D-HANDLE D-HANDLE on port side of toolbox	1 SQUARE SCOOP <u>NOTE</u> D-Handle will not stow on the side of this toolbox due to an interference with the CMG MLI		

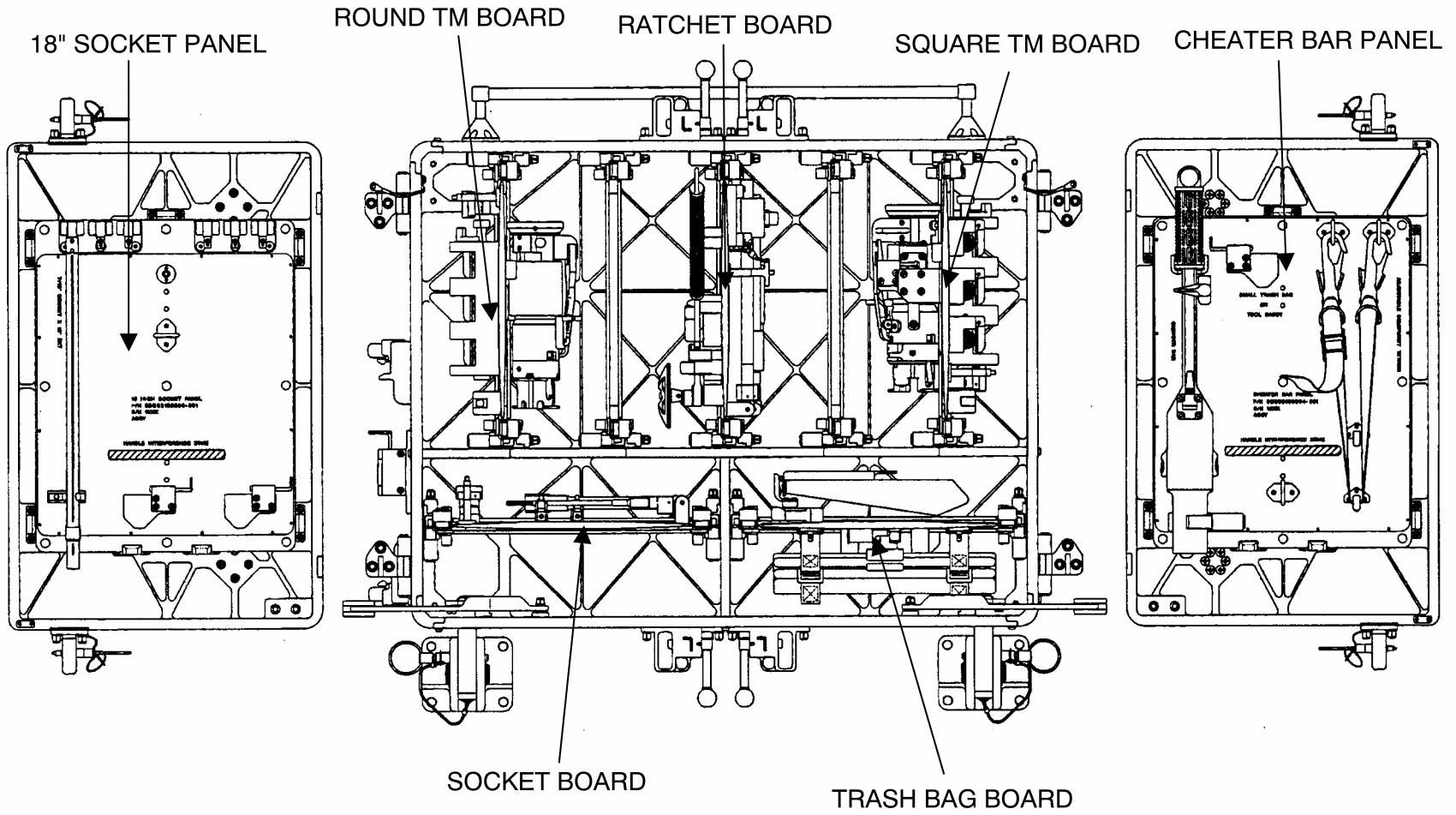
## TOOLBOX PANEL AND SLOT LABELS

### NOTE

- A/L Toolbox: Slider feature located in center slot only (#3)
- CETA Toolbox: Slider feature located in all slots

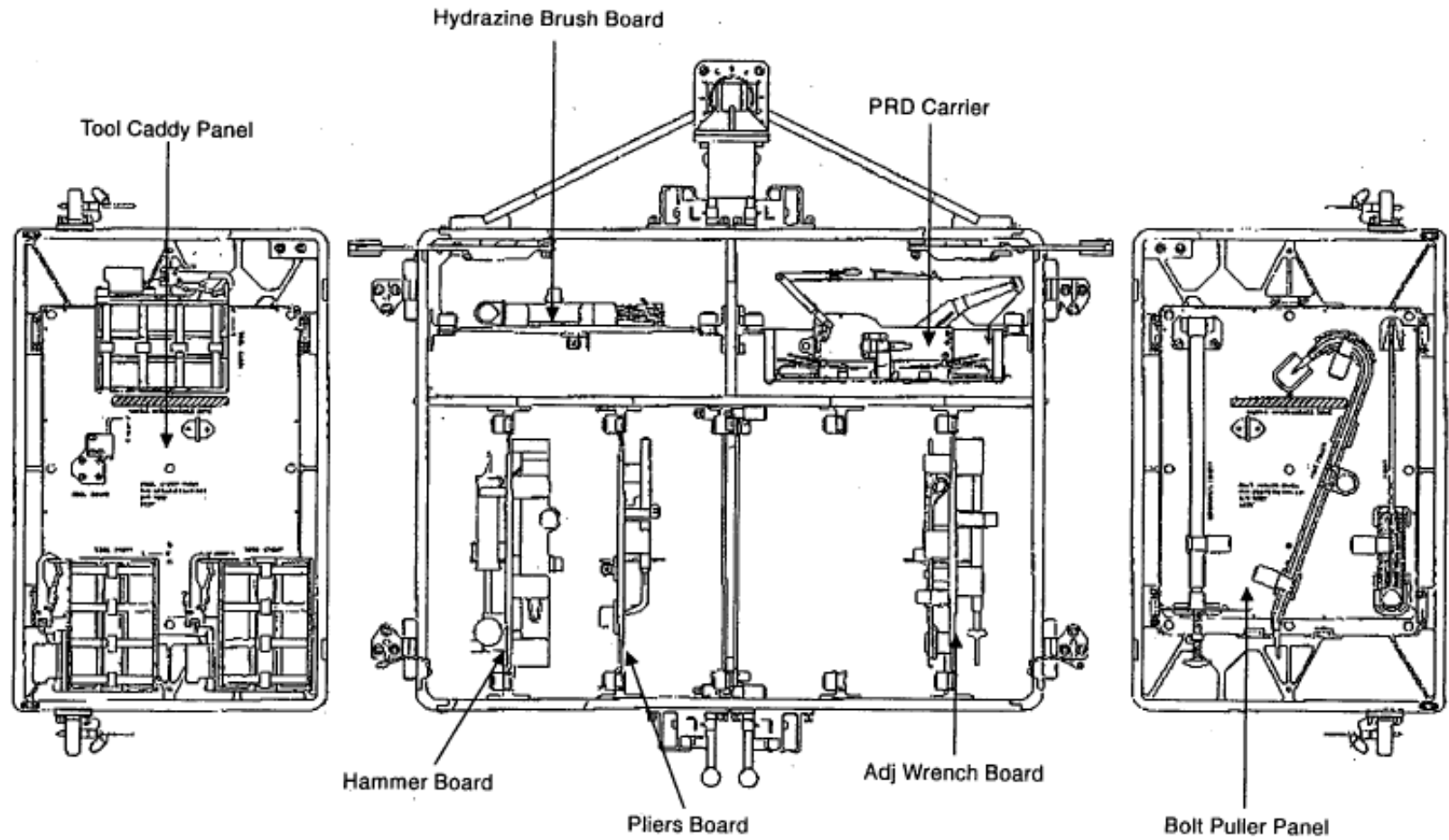


# Z1 TOOLBOX INTERNAL LAYOUT





# AIRLOCK TOOLBOX INTERNAL LAYOUT



**STBD QD BAG (EXTERNAL ON ISS AIRLOCK)**

STBD QD BAG (SEG33114667-301)			
#	TOOL	PART#	LOCATION IN BAG
1.	1/4" cap tool	GD2043725	☐ 1/4" cap tool (pocket)
2.	1/2" cap tool	GD2043730	☐ 1/2" cap tool (pocket)
3.	1" cap tool	GD2043325	☐ 1" cap tool (pocket)
4.	3/4" & 1" QD Bail Drive lever	SDG33113838-703	☐ 3/4" & 1" QD Bail Drive Lever pouch on lid
5.	1.5" QD Bail Drive Lever	SDG33113837-701	☐ 1.5" QD bail Drive Lever pouch on lid
6.	1.5" QRT & FID Gauge	SEG33114617-701	☐ 1.5" QRT & FID Gauge (pocket)
7.	3/4" & 1" QRT & FID Gauge	SEG33114616-701	☐ 3/4" & 1" QRT & FID Gauge (pocket)
8.	1" H2O/N2 Vent Tool – F	1F98593-1	☐ 1" H2O/N2 Vent Tool – F (pocket)
9.	1" NH3/N2 Vent Tool – F	1F98589-1	☐ 1" NH3/N2 Vent Tool – F (pocket)
10.	1" NH3/N2 Vent Tool – M	1F98596-1	☐ 1" NH3/N2 Vent Tool – M (pocket)
11.	1.5" NH3/N2 Vent Tool – F	1F9859-1	☐ 1.5" NH3/N2 Vent Tool – F (pocket)
12.	3/4" NH3/N2 Vent Tool – F	1F98597-1	☐ 3/4" NH3/N2 Vent Tool – F (pocket)
13.	1/4" NH3/N2 Vent Tool – F	1F98592-1	☐ 1/4" NH3/N2 Vent Tool – F (pocket)



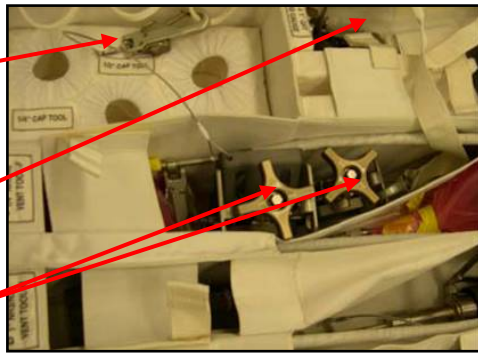
**PORT QD BAG (EXTERNAL ON ISS AIRLOCK)**

PORT QD BAG (SEG33114667-301/1001)			
#	TOOL	PART #	LOCATION IN BAG
1.	1/4" cap tool	GD2043725	<input type="checkbox"/> 1/4" cap tool (pocket)
2.	1/2" cap tool	GD2043730	<input type="checkbox"/> 1/2" cap tool (pocket)
3.	1.5" NH3/N2 Vent Tool – F	1F9859-1	<input type="checkbox"/> 1.5" NH3/N2 Vent Tool – F (pocket)
4.	1" H2O/N2 Vent Tool – F	1F98593-1	<input type="checkbox"/> 1" H2O/N2 Vent Tool – F (pocket)
5.	3/4" NH3/N2 Vent Tool – F	1F98597-1	<input type="checkbox"/> 3/4" NH3/N2 Vent Tool – F (pocket)
6.	1" NH3/N2 Vent Tool – M	1F98596-1	<input type="checkbox"/> 1" NH3/N2 Vent Tool – M (pocket)
7.	1/4" NH3/N2 Vent Tool – F	1F98592-1	<input type="checkbox"/> 1/4" NH3/N2 Vent Tool – F (pocket)
8.	Vent Tool Adapters (2)	SEG33119079-301	<input type="checkbox"/> One VTA goes in the 3/4" & 1" QRT & FID Gauge pouch; the other goes in the 1.5" QRT & FID Gauge pouch <input type="checkbox"/> Each VTA must be tethered inside the bag using 1 adj tether for each <input type="checkbox"/> See picture B
9.	1/4" BDT	SEG33114984-301	<input type="checkbox"/> Stowed on top of 1/4" Vent Tool <input type="checkbox"/> Must be tethered to inside of bag using 1 adj <input type="checkbox"/> See picture A
10.	3/4" BDT	SEG33114986-301	<input type="checkbox"/> Stowed on top of 1/4" Vent Tool, tethers to bag internal loops using BDT integral tether <input type="checkbox"/> See picture A
11.	3/4" AKT	SEG33114983-301	<input type="checkbox"/> Stowed with vent tool adapters in QRT & FID pouches <input type="checkbox"/> Must be tethered to inside of bag using 1 adj <input type="checkbox"/> See picture A

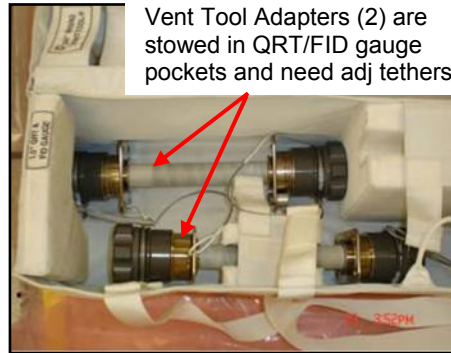
3/4" BDT is tethered to internal bag loop using integral tool tether

3/4" AKT stowed with VTAs in QRT & FID pouch

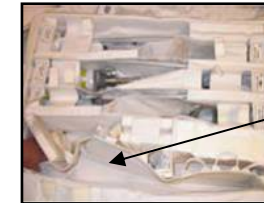
1/4" and 3/4" BDTs are stowed on top of 1/4" vent tool



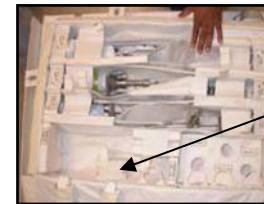
PICTURE A: BDT AND AKT STOWAGE



PICTURE B: VENT TOOL ADAPTER STOWAGE



Port QD Bag launch config with insert peeled back



Port QD Bag with insert re-attached to bag wall

## APFR MANAGEMENT – STS-120 (10A)

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APFR DESIGNATOR	APFR 1 (8A Pitch knob problem)	APFR 2	APFR 3 S/N 1005 no pitch knob prob 9A- inc12	APFR 4 (TS, old ORU tether, heat shield, & safety tether)	APFR 5 (TS, old ORU tether, heat shield)	APFR 6 (heat shield removed on 12A.1 stage)	APFR 7 S/N 1008  Ingress aid	IAPFR 1	IAPFR 2	CRANE (old ORU tether)	TS	ORU stanchion/ TERA (headless)
<b>EVA 1</b>	CETA 1 WIF 4 [8,PP,E,12] Y/P [12,FF]	Z1 WIF 11 [TBD]	ESP2 WIF 08 [3, SS, F, 12]	Node WIF 5 [6,PP,B, 12] Needs to be moved for 10A	PMA1 WIF 2 [12,KK,F,6]	CETA 2 WIF 2 [10,PP,E,12] Y/P [12, FF]	A/L WIF 10 [x,PP,F,6]	Z1 WIF 1 [12,PP,F,12]	Z1 WIF 3 [6,PP,F,12]	PMA1 WIF 5	APFR 4	APFR 5
SASA Retrieve		Z1 WIF 11 [12,SS,A,12] roll to [12,SS,G,12]					SSRMS [12,PP,F,6]					
SASA stow							Node2 WIF 17 [4,TT,F,12]					
Z1 to P6 FQD disconnect		Z1 WIF 17 [4,KK,A,1] Move to Z1 WIF 20 [6,PP,F,12]										
<b>EVA 2</b>	CETA 1 WIF 4 [8,PP,E,12] Y/P [12,FF]	Z1 WIF 20 [6,PP,F,12]	ESP2 WIF 08 [3, SS, F, 12]	TBD	PMA1 WIF 2 [12,KK,F,6]	CETA 2 WIF 2 [10,PP,E,12] Y/P [12, FF]	Node2 WIF 17 [4,TT,F,12]	Z1 WIF 1 [12,PP,F,12]	Z1 WIF 3 [6,PP,F,12]	PMA1 WIF 5	S0 port wedge face	S0 port wedge face
PDGF Install							Node2 WIF 08 [2,QQ,D,12]					
<b>EVA 3</b>	CETA 1 WIF 4 [8,PP,E,12] Y/P [12,FF]	Z1 WIF 20 [6,PP,F,12]	ESP2 WIF 08 [3, SS, F, 12]	TBD	PMA1 WIF 2 [12,KK,F,6]	CETA 2 WIF 2 [10,PP,E,12] Y/P [12, FF]	Node2 WIF 08 [2,QQ,D,12]	Z1 WIF 1 [12,PP,F,12]	Z1 WIF 3 [6,PP,F,12]	PMA1 WIF 5	S0 port wedge face	S0 port wedge face
Attach P6 to P5 Power Umbilicals	P5 WIF 05 [10,QQ,C,11]											
Cleanup	CETA 1 WIF X [TBD]											
MBSU Removal in PLB							SRMS [4,II,F,6]					
MBSU install at ESP-2			ESP-2 WIF 5 [4,PP,H,1]									
Cleanup							Lab WIF 04 [TBD]					
<b>Post EVA 3</b>	CETA 1 WIF X [TBD]	Z1 WIF 20 [6,PP,F,12]	ESP-2 WIF 5 [4,PP,H,1]	TBD	PMA1 WIF 2 [12,KK,F,6]	CETA 2 WIF 2 [10,PP,E,12] Y/P [12, FF]	Lab WIF 04 [TBD]	Z1 WIF 1 [12,PP,F,12]	Z1 WIF 3 [6,PP,F,12]	PMA1 WIF 5	S0 port wedge face	S0 port wedge face

# SAFETY TETHER CONFIGURATION – STS-120 (10A)

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	55 ft Safety Tethers							85 ft Safety Tethers			
	#59 SN 1007 Sm-sm	#66 SN 1016 Sm-sm	#60 SN 1008 Lg-sm	#70 or 1020 Lg-sm	#71 SN 1021 Lg-sm	#72 SN 1022 Lg-sm	#73 SN 1023 Lg-sm	#26 SN 1006 85-ft Lg-sm	#28 SN 1008 85-ft Lg-sm	#XX SN 10XX 85-ft Lg-sm	#XX SN 10XX 85-ft Lg-sm
<b>Pre EVA1</b>	INSIDE Tether Staging Area	INSIDE Tether Staging Area	S0 HH 3539 or 3530  Tether on 3539 had some retracting issues	S0 HH 3530 or 3539  Tether on 3539 had some retracting issues	OUTSIDE A/L (aft side)	INSIDE Tether Staging Area	INSIDE Tether Staging Area  (AR written against this one)	INSIDE Tether Staging Area	INSIDE Tether Staging Area	INSIDE Shuttle Middeck	INSIDE Shuttle Middeck
<b>EVA 1</b>								X	X	X	
<b>EVA 2</b>								X	X		
<b>EVA 3</b>					X			X	X	X	X
<b>Post EVA 3</b>	INSIDE Tether Staging Area	INSIDE Tether Staging Area	S0 HH 3539 or 3530	S0 HH 3530 or 3539	OUTSIDE A/L (aft side)	INSIDE Tether Staging Area	INSIDE Tether Staging Area	INSIDE Tether Staging Area	INSIDE Tether Staging Area	INSIDE Shuttle Middeck	INSIDE Shuttle Middeck

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## TPS REPAIR

The TPS Repair procedures listed below are not published in the hardcopy EVA Flight Supplement. These procedures will be uplinked realtime if they are required.

A PDF and a WORD version of the procedures can be found at:  
<http://mod.jsc.nasa.gov/do3/FDF/FDFBooks/Status%20Sheets/index.html>.

Select the "As Flown" Status sheet for STS-117 and the link to the procedures can be found with the link to the EVA FS. The procedures can also be found on the FDF Books CD provided to the FAO console

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## CLEAR/RESTRAIN CBM CAPTURE LATCH (00:30)

Objective: To clear CBM failed Capture Latch from mating interface and restrain via EVA to allow mating operations to continue

Latch Locations: Node 1 Nadir: Latch 1 = Aft Stbd, Latch 2 = Fwd Stbd, Latch 3 = Fwd Port, Latch 4 = Aft Port

Latch Locations: Node 1 Port: Latch 1 = Fwd Zen, Latch 2 = Aft Zen, Latch 3 = Aft Nad, Latch 4 = Fwd Nad

Assumptions: Corresponding CBM Petal Cover for failed latch has been fully deployed via commanding or EVA

IV/SSRMS	EV1	EV2
	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> During any CBM operation, avoid contact with sealing surface</p> </div> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> <li>2. Clear capture latch from CBM mating interface. Restrain capture latch with wire ties, sm-sm RET, or adj equip tethers out of contact zone of CBM ring (latch can be secured to turnbuckle (2 pl), fabric loops, or cable of center disk cover)</li> <li>3. If capture latch cannot be cleared/restrained from mating interface, it must be removed entirely. See REMOVE/REPLACE CBM CAPTURE LATCH procedure</li> <li>4. Clean up worksite</li> <li>5. Visually inspect CBM mating interface, ensure it is clear of latch, wire ties, MLI, and any other equipment or FOD</li> </ol>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><b>CAUTION</b> During any CBM operation, avoid contact with sealing surface</p> </div> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> <li>2. Assist EV1 as reqd</li> <li>3. Clean up worksite</li> <li>4. Visually inspect CBM mating interface, ensure it is clear of latch, wire ties, MLI, and any other equipment or FOD</li> </ol>

# EVA 1 CONTINGENCIES

## CLEAR/RESTRAIN CBM CAPTURE LATCH – TASK DATA

### Tools:

EV1	EV2
Wire Tie Caddy	
Sm-sm RET (2)	
Adj Equip tethers (2)	

### Foot Restraints:

Task	WIF	CETA Position	Swing Arm Settings	APFR Setting
Port CBM – Fwd half	NOD 05	N/A	N/A	11, RR, G, 12
Port CBM – Aft half	NOD 03	N/A	N/A	11, QQ, G, 1
Nadir CBM	SSRMS	N/A	N/A	TBD

\* Not verified in NBL

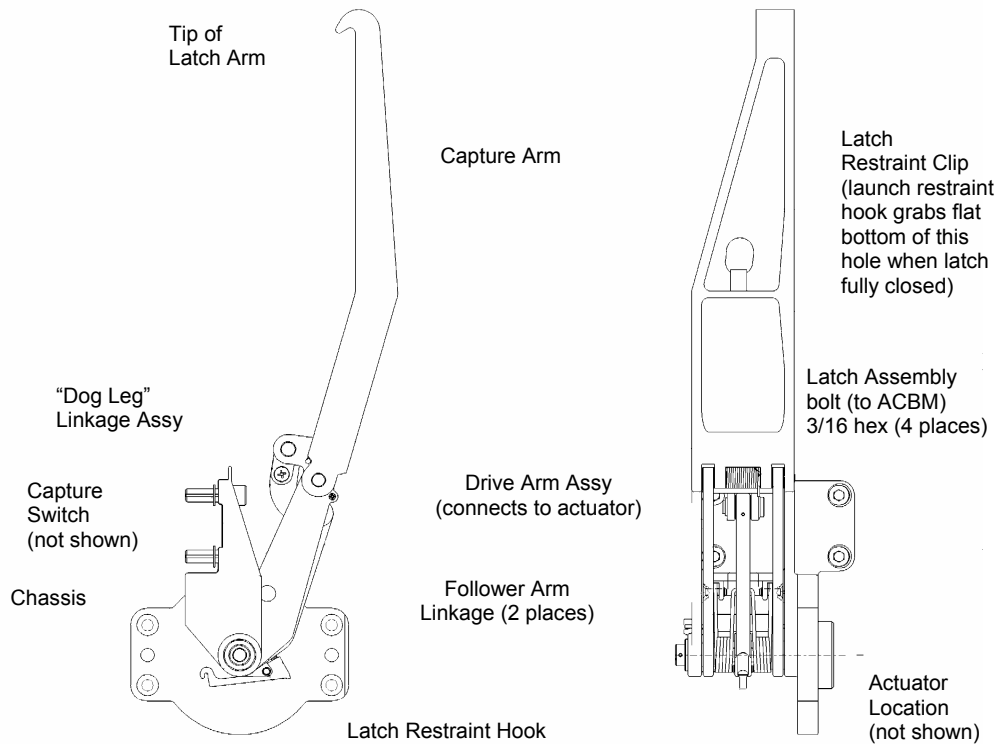
### Cautions:

1. During operation, avoid contact with CBM sealing surface
2. Do not use petals as hand hold unless launch restraints have been engaged

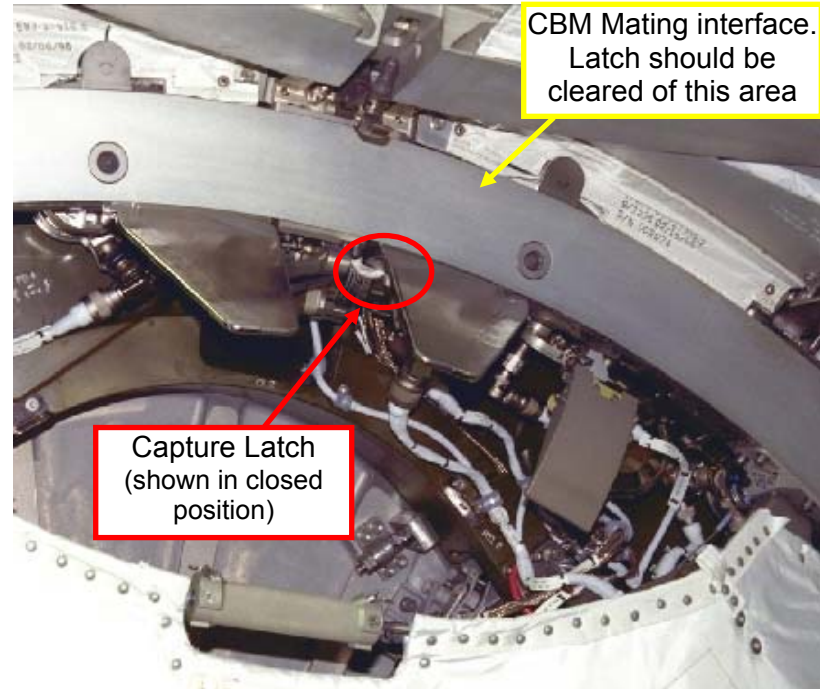
### Notes:

1. CBM CPAs do not have to be powered down for this activity

**CLEAR/RESTRAIN CBM CAPTURE LATCH – TASK DATA (Cont)**



**CBM CAPTURE LATCH NOMENCLATURE**



**CBM CAPTURE LATCH LOCATION AND CBM MATING INTERFACE**

## MANUALLY OPEN/CLOSE CBM PETAL (00:30)

Objective: To manually open/close Node 1 radial Common Berthing Mechanism (CBM) petal via EVA due to CBM contingency

Petal Locations: Node 1 Nadir: Petal 1 = Aft Stbd, Petal 2 = Fwd Stbd, Petal 3 = Fwd Port, Petal 4 = Aft Port

Petal Locations: Node 1 Port: Petal 1 = Fwd Zen, Petal 2 = Aft Zen, Petal 3 = Aft Nad, Petal 4 = Fwd Nad

IV/SSRMS	EV1	EV2
	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><u>CAUTION</u> During any CBM operation, avoid contact with sealing surface</p> </div> <p><u>OPEN PETAL</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> </ol> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><u>CAUTION</u> Do not use petal(s) as hand hold until launch restraints have been engaged</p> </div> <ol style="list-style-type: none"> <li>2. Engage first petal launch restraint for failed petal, push button in</li> <li>3. <b>PGT [A6, CCW2, 30.5]-6 Ext 7/16:</b> Release roller link release bolt (inner-most, one going thru petal) until capture latch disengaged, up to 12-13 turns</li> </ol> <p style="text-align: center;"><u>NOTE</u> Visually verify capture latch tip is no longer engaged on petal roller link</p> <ol style="list-style-type: none"> <li>4. <b>PGT [A6, CW2, 10.5]-6 Ext 7/16:</b> Retighten roller link release bolt up to 12-13 turns</li> <li>5. While restraining petal, release first launch restraint (tether hook)</li> <li>6. Slowly, allow petal to open</li> <li>7. Clean up worksite</li> </ol> <p><u>CLOSE PETAL</u></p> <ol style="list-style-type: none"> <li>1. Close petal (1-2 lb force reqd); hold</li> <li>2. Reengage first launch restraint (push in button)</li> </ol>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><u>CAUTION</u> During any CBM operation, avoid contact with sealing surface</p> </div> <p><u>OPEN PETAL</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> </ol> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><u>CAUTION</u> Do not use petal(s) as hand hold until launch restraints have been engaged</p> </div> <ol style="list-style-type: none"> <li>2. Engage second petal launch restraint for failed petal, push button in</li> <li>3. Assist EV1 as reqd</li> </ol> <ol style="list-style-type: none"> <li>4. While restraining petal, release second launch restraint (tether hook)</li> <li>5. Slowly, allow petal to open</li> <li>6. Clean up worksite</li> </ol> <p><u>CLOSE PETAL</u></p> <ol style="list-style-type: none"> <li>1. Close petal (1-2 lb force reqd); hold</li> <li>2. Reengage second launch restraint (push in button)</li> </ol>

## MANUALLY OPEN/CLOSE CBM PETAL – TASK DATA

### Tools:

EV1	EV2
PGT	BRT
7/16-6in ext	Adjustable Tether
Adjustable Tether	

### Cautions:

1. During operation, avoid contact with CBM sealing surface
2. Do not use petals as hand hold unless launch restraints have been engaged

### Notes:

1. CBM CPAs do not have to be powered down for this activity

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Roller Link Release Bolt	N/A	7/16"	1	8.3	8.3	12.1	12-13	30

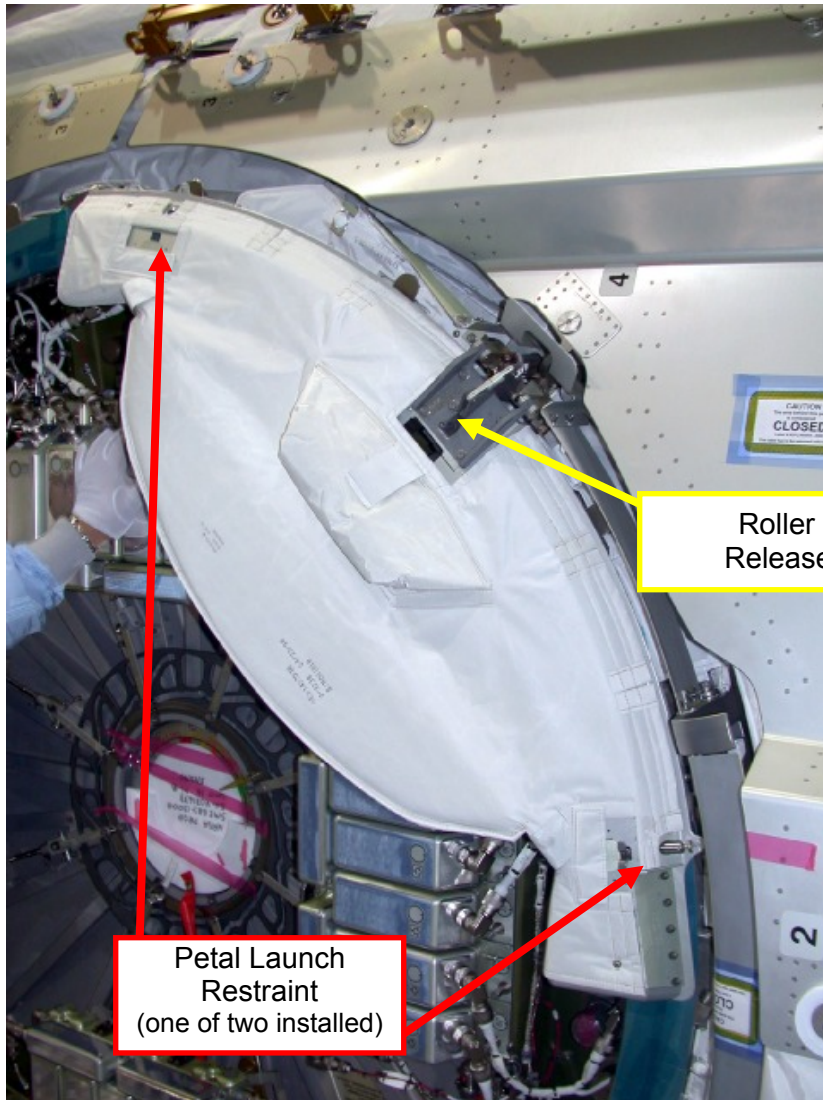
\* Standard PGT settings assumed

### Foot Restraints:

Task	WIF	CETA Position	Swing Arm Settings	APFR Setting
Port CBM – Fwd half	NOD 05	N/A	N/A	11, RR, G, 12
Port CBM – Aft half	NOD 03	N/A	N/A	11, QQ, G, 1
Nadir CBM	SSRMS	N/A	N/A	TBD

\* Not verified in NBL

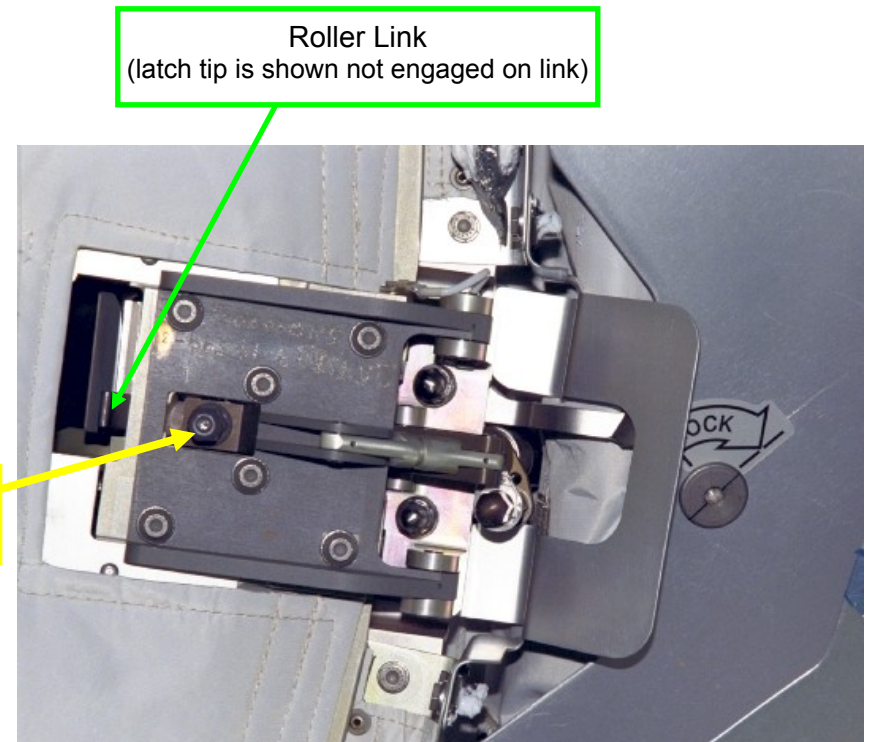
# MANUALLY OPEN/CLOSE CBM PETAL – TASK DATA (Cont)



Petal Launch Restraint  
(one of two installed)

Roller Link Release Bolt

CBM PETAL

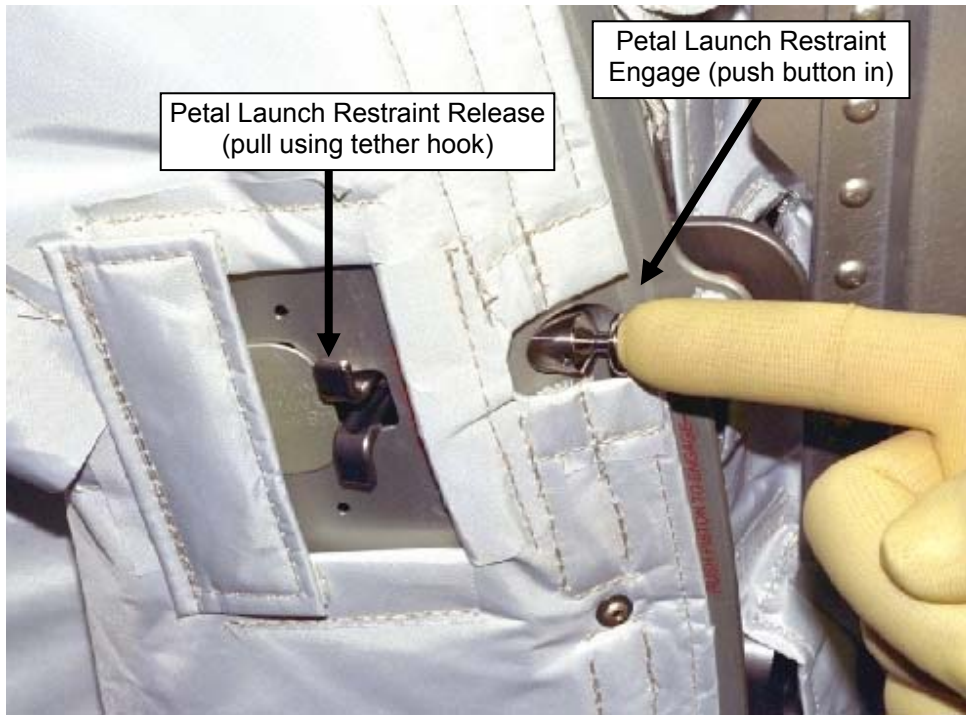


Roller Link  
(latch tip is shown not engaged on link)

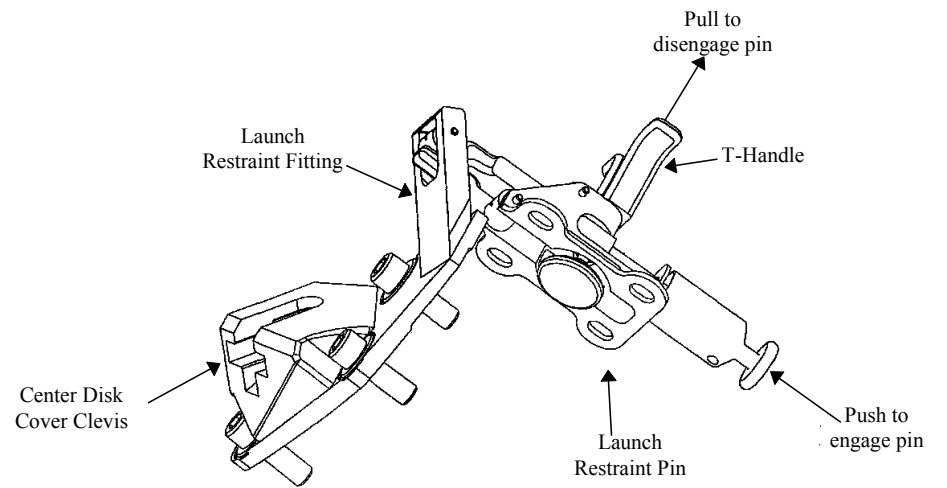
CBM PETAL DEPLOY MECHANISM



## MANUALLY OPEN/CLOSE CBM PETAL – TASK DATA (Cont)



CBM PETAL LAUNCH RESTRAINT OPERATION



CBM PETAL LAUNCH RESTRAINT MECHANISM

**MANUALLY OPEN/CLOSE CBM PETAL – TASK DATA (Cont)**



PETAL LAUNCH RESTRAINT RELEASE USING ADJUSTABLE TETHER STRAP

## REMOVE/REPLACE CENTER DISK COVER (00:30)

IV Tools reqd for this procedure: See Task Data Sheet for more info

IV/SSRMS	EV1	EV2
	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p><b>CAUTION</b> During any CBM operation, avoid contact with sealing surface</p> </div> <p><u>COVER REMOVAL (1 quadrant)</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> <li>2. Access turnbuckle at desired Center Disk Cover quadrant</li> <li>3. Engage 1/4-in Socket IVA Tool assembly on turnbuckle PIP pin hex head (1 of 2). Turn ccw 1/2 turn</li> <li>4. Repeat step 3 for second turnbuckle PIP pin</li> <li>5. Attach tether equipment hook to PIP pin ring (pin non-captive). Grasp equipment hook and unscrew pin ccw 4 turns until free from turnbuckle. Ring will remain on tether</li> <li>6. Repeat step 5 for second turnbuckle PIP pin</li> <li>7. Open Center Disk Cover flap below turnbuckle to view Instructions</li> <li>8. Rotate turnbuckle in "LOOSEN" direction to release cable tension (~20-30 turns)</li> <li>9. Configure retractable tethers to cinch back cover</li> <li>10. Pull PIP pins from pulleys (two) to be removed, one per pulley</li> <li>11. Stow pulley PIP pins (two) Standoff Bar ends</li> <li>12. Remove each pulley from clevis. Use a tether to keep pulley away from CBM mating interface</li> <li>13. Cinch adjustable tether as required</li> <li>14. Remove PIP pins (two) from Standoff Bar. Remove Standoff Bar by rotating inward 45 deg. Use a tether to clear worksite</li> </ol> <p><u>COVER REINSTALL</u></p> <ol style="list-style-type: none"> <li>1. Release/stow tethers used to restrain cover</li> <li>2. Reattach Standoff Bar, rotate outward 45 deg to reinstall cover quadrant</li> <li>3. Insert pulleys (two) back into clevises (two)</li> <li>4. Reinstall pulley PIP pins (1 per pulley)</li> <li>5. Reinstall Standoff Bar PIP pins if time permits (2 per standoff)</li> <li>6. Repeat steps 2-5 as reqd for other CBM quadrants</li> <li>7. Secure cover using tethers or wire ties as reqd</li> <li>8. Clean up worksite</li> </ol>	

## REMOVE/REPLACE CENTER DISK COVER – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
Retractable Tethers (2) w/small equipment hook	
Adjustable Tether	
Wire Ties	
IV: 1/4" Socket, 3/8" Drive	
EVA Ratchet	
Drop Proof Tether Adapter	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Turnbuckle PIP Pin Fastener	N/A	1/4"	4	TBD	TBD	TBD	0.5	--

\* Standard PGT settings assumed

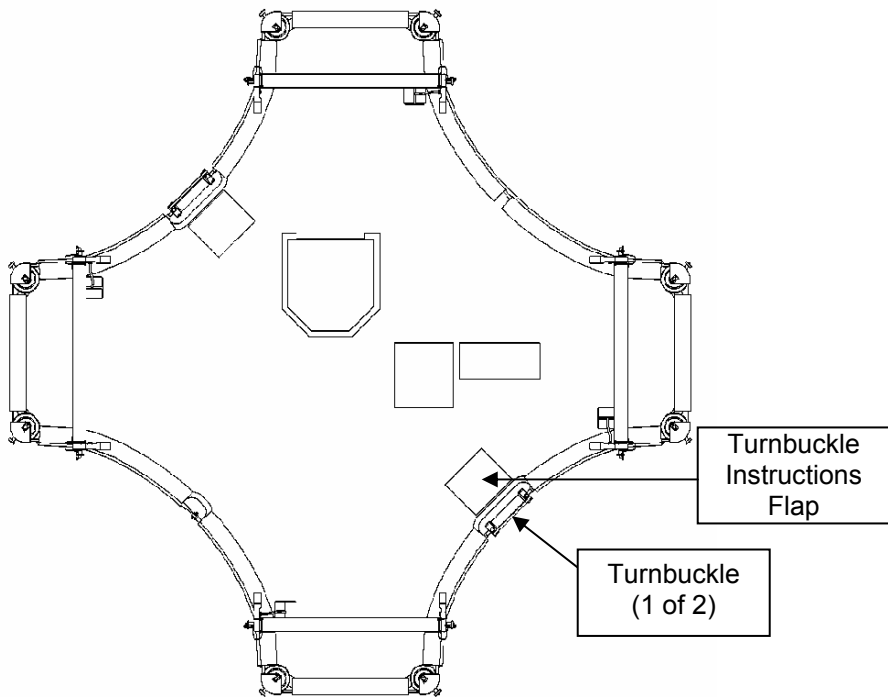
### Notes:

1. If removing Center Disk Cover for CPA R&R, only one quadrant reqd to be removed
2. Turnbuckle PIP pin functions somewhat like a set screw and is nominally disengaged by pulling ring and rotating 1/4 turn. However, since it can easily pop back to the engaged position while rotating the turnbuckle, the entire pin is unscrewed for EVA operations

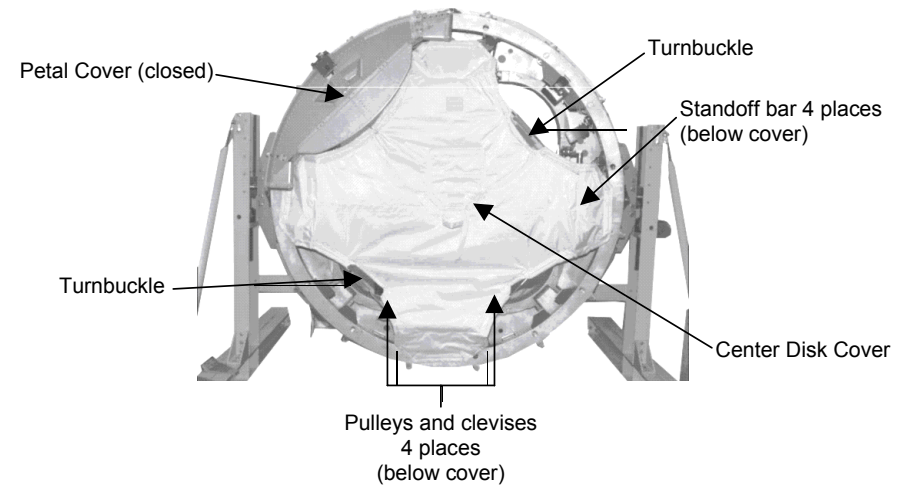
### IV Tool Setup:

1. Attach 1/4" Socket, 3/8" Drive to Drop Proof Tether Adapter
2. Attach assembly to EVA ratchet

## REMOVE/REPLACE CENTER DISK COVER – TASK DATA (Cont)



CENTER DISK COVER DRAWING

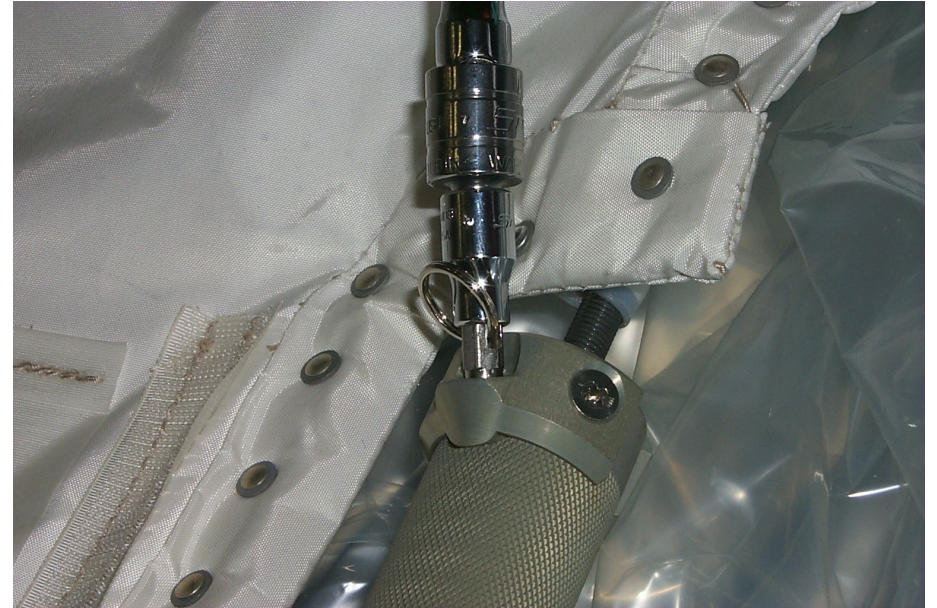


CENTER DISK COVER PHOTO

REMOVE/REPLACE CENTER DISK COVER – TASK DATA



TURNBUCKLE PIP PINS (1 OF 2 SHOWN)



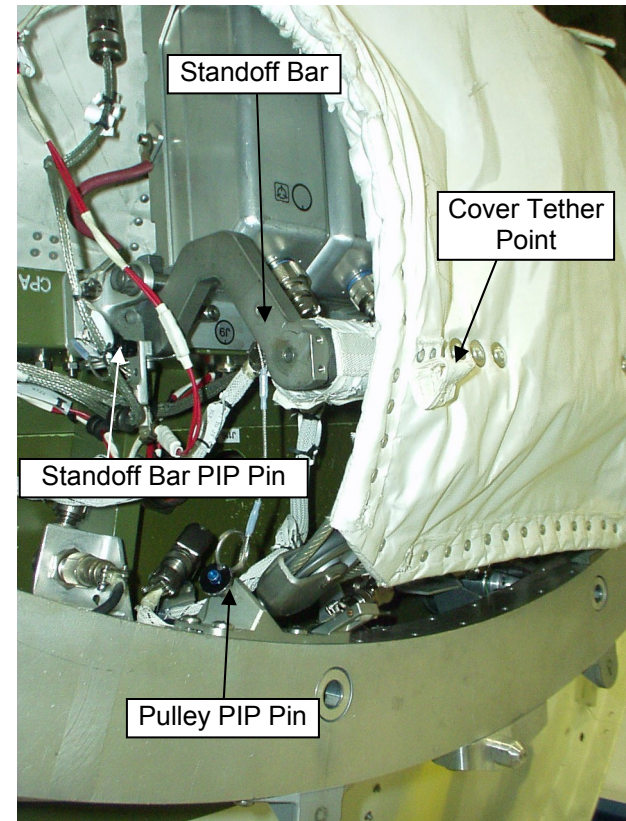
TOOL INTERFACE WITH TURNBUCKLE PIP PIN



## REMOVE/REPLACE CENTER DISK COVER – TASK DATA



TETHER INTERFACE WITH TURNBUCKLE PIP PIN RING



CLEVIS AND PULLEY PIP PIN LOCATIONS

## REMOVE/REPLACE CBM CONTROLLER PANEL ASSEMBLY (CPA) (02:00)

Objective: To remove and replace failed CBM Controller Panel Assembly (CPA) from Node 1

CPA Locations: Node 1 Nadir: CPA 1 = Stbd, CPA 2 = Fwd, CPA 3 = Port, CPA 4 = Aft

CPA Locations: Node 1 Port: CPA 1 = Zen, CPA 2 = Aft, CPA 3 = Nad, CPA 4 = Fwd

Assumptions: Corresponding CBM Petal Covers (two) for failed CPA have been fully deployed via commanding or EVA

IV Tools reqd for this procedure and must be retrieved prior to EVA. See Task Data Sheet for more info

IV/SSRMS	EV1	EV2
<p>1. √Inhibits in place for affected CPA (see Task Data Sheet)</p> <p>Record S/N of spare CPA _____</p> <p>Record S/N of failed CPA _____</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p><u>WARNING</u></p> <p>Power must be removed from CPA prior to EVA maintenance</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p><u>CAUTION</u></p> <p>During any CBM operation, avoid contact with sealing surface</p> </div> <p><u>CPA REMOVAL</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR tools as reqd; transfer to worksite</li> <li>2. Remove Center Disk Cover corresponding quadrant: Perform REMOVE/REPLACE CENTER DISK COVER, COVER REMOVAL, removal steps only</li> <li>3. Attach CBM Tether Point to seat track on failed CPA</li> <li>4. Demate cable connectors J1-J9 on CPA (use connector tool as reqd)</li> <li>5. Disconnect grounding straps (two) from CPA with EVA ratchet, 5/32-in Ball End Allen Driver</li> <li>6. Tether to CBM Tether Point on CPA</li> </ol> <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">Do not use EVA 7/16" socket on CPA fasteners – will disassemble fastener</p> <ol style="list-style-type: none"> <li>7. <b>PGT [A6, CCW2, 30.5] IV 7/16" w/DPTA:</b> Release fasteners (five) on CPA 13-14 turns</li> <li>8. Detach from bulkhead</li> <li>9. Stow CPA</li> </ol>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p><u>WARNING</u></p> <p>Power must be removed from CPA prior to EVA maintenance</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p><u>CAUTION</u></p> <p>During any CBM operation, avoid contact with sealing surface</p> </div> <p><u>CPA REMOVAL</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR tools as reqd; transfer to worksite</li> <li>2. Assist EV1 as reqd</li> </ol>



# REMOVE/REPLACE CBM CONTROLLER PANEL ASSEMBLY (CPA) (02:00) (Cont)

IV/SSRMS	EV1	EV2
	<div style="border: 1px solid black; padding: 5px;"><p style="text-align: center;"><u>WARNING</u></p><p>Power must be removed from CPA prior to EVA maintenance</p></div> <div style="border: 1px solid black; padding: 5px;"><p style="text-align: center;"><u>CAUTION</u></p><p>During any CBM operation, avoid contact with sealing surface</p></div> <p><u>CPA REPLACE</u></p> <ol style="list-style-type: none"><li>1. Install new CPA, align CPA: bolt plate edge flush with edge of bulkhead. (May hand start fasteners to "soft-dock" CPA)</li></ol> <p style="text-align: center;"><u>NOTE</u></p> <p>Do not use EVA 7/16" socket on CPA fasteners</p> <ol style="list-style-type: none"><li>2. <b>PGT [A2, CW2, 30.5]- IV 7/16" w/DPTA:</b> Start fasteners (five) on CPA ~3-4 turns</li><li>3. <b>PGT [A2, CW2, 30.5]- IV 7/16" w/DPTA:</b> Tighten fasteners (five) on CPA ~10 turns</li><li>4. Remove CBM Tether Point</li><li>5. Connect grounding straps (two) to CPA with EVA ratchet, 5/32-in Ball End Allen Driver</li><li>6. Mate cable connectors J1-J9 to CPA (use connector tool as reqd)</li><li>7. Reinstall Center Disk Cover as reqd: Perform REMOVE/REPLACE CENTER DISK COVER, COVER REINSTALL, install steps only</li><li>8. Visually inspect CBM mating interface, ensure it is clear of latch, wire ties, MLI and any other equipment or FOD</li></ol>	<div style="border: 1px solid black; padding: 5px;"><p style="text-align: center;"><u>WARNING</u></p><p>Power must be removed from CPA prior to EVA maintenance</p></div> <div style="border: 1px solid black; padding: 5px;"><p style="text-align: center;"><u>CAUTION</u></p><p>During any CBM operation, avoid contact with sealing surface</p></div> <p><u>CPA REPLACE</u></p> <ol style="list-style-type: none"><li>1. Assist EV1 as reqd</li><li>2. Visually inspect CBM mating interface, ensure it is clear of latch, wire ties, MLI and any other equipment or FOD</li></ol>

## REMOVE/REPLACE CBM CONTROLLER PANEL ASSEMBLY (CPA) – TASK DATA

### Tools:

EV1	EV2
PGT	BRT
Spare CPA	
CBM Tether Point (1 of 2)	
5/32-in Ball End Allen Driver	
CBM Tether Point (for failed unit)	
Connector Tool, Sm locking electrical	
EVA ratchet	
IV: 7/16" Socket, 3/8" Drive	
Drop Proof Tether Adapter	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
CPA Removal Fastener		7/16"	5	3.8	8.3	Rel/12.0 Inst/6.0	13-14	30
CPA Ground Strap Fastener		5/32"	2	hand tight	~ 3	~ 5	6.5	30

\* Standard PGT settings assumed

### EVA Connectors:

Harness	From	To	Function
W7(2)0	P(2)	J1	Power cable
W7(2)1	P(2)	J2	Data cable
W7(2)2	P(2)	J3	Power cable
W7(2)3	P(2)	J4	Data cable
P1 to J5 LCH CONT	P1	J5	Bolt/latch cable
P1 to J6 LCH CONT	P1	J6	Bolt/latch cable
P1 to J7 LCH CONT	P1	J7	Bolt/latch cable
P1 to J8 LCH CONT	P1	J8	Bolt/latch cable
P1 to J9 LCH CONT	P1	J9	Bolt/latch cable

### Foot Restraints:

Task	WIF	CETA Position	Swing Arm Settings	APFR Setting
Port CBM – Fwd half	NOD 05	N/A	N/A	11, RR, G, 12
Port CBM – Aft half	NOD 03	N/A	N/A	11, QQ, G, 1
Nadir CBM	SSRMS	N/A	N/A	TBD

\* Not verified in NBL

### Warnings:

- Power must be removed from CPA prior to EVA maintenance

### Cautions:

- During operation, avoid contact with CBM sealing surface

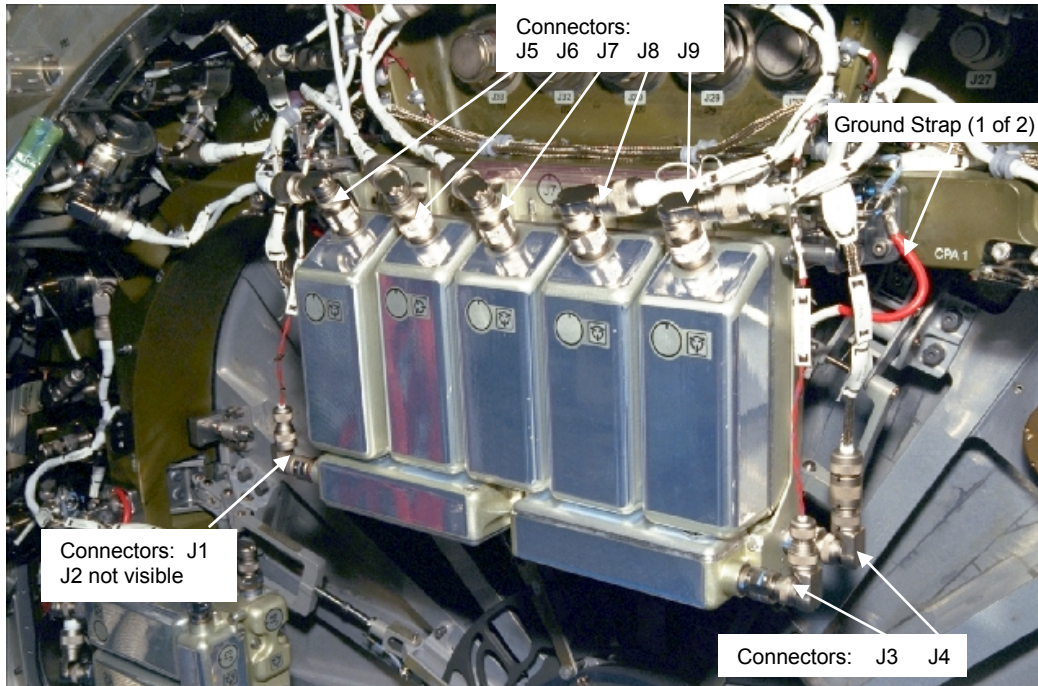
### CPA Power Inhibits:

CPA	Primary RPCM	Secondary RPCM
<b>NODE 1 NADIR</b>		
CPA 1	RPCM N13B B RPC 03	RPCM N14B B RPC 11
CPA 2	RPCM N13B B RPC 04	RPCM N14B B RPC 12
CPA 3	RPCM N13B B RPC 05	RPCM N14B B RPC 13
CPA 4	RPCM N13B B RPC 06	RPCM N14B B RPC 14
<b>NODE 1 PORT</b>		
CPA 1	RPCM N1RS2 C RPC 07	RPCM N1RS1 B RPC 05
CPA 2	RPCM N1RS2 C RPC 08	RPCM N1RS1 B RPC 06
CPA 3	RPCM N1RS2 C RPC 10	RPCM N1RS1 B RPC 13
CPA 4	RPCM N1RS2 C RPC 11	RPCM N1RS1 B RPC 14

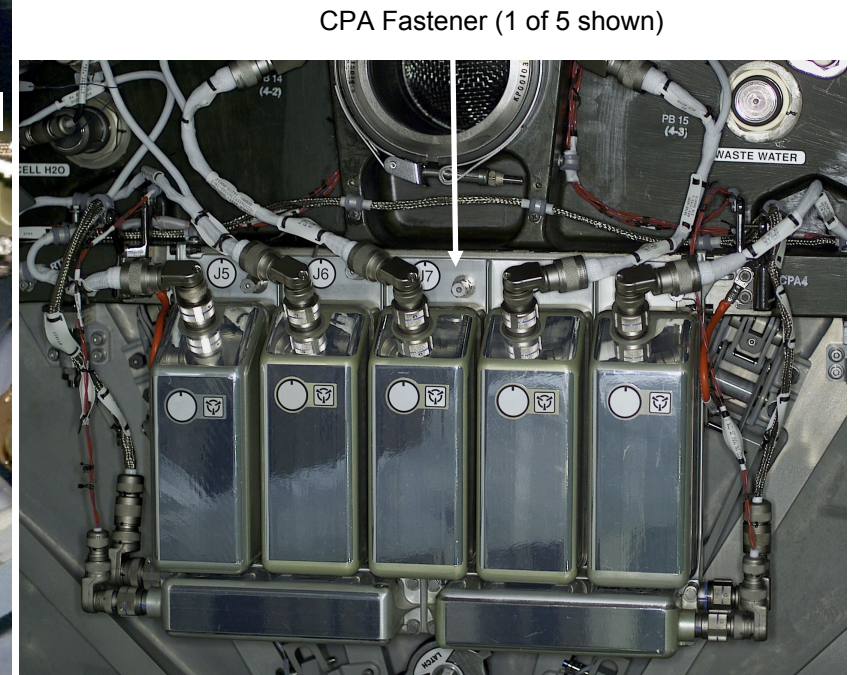
### Notes:

- Do not use an EVA 7/16" socket on CPA Removal Fasteners. Although it is possible to remove these fasteners using this socket, the EVA socket is too long and it is possible to simultaneously engage and remove the entire bolt assembly, making it non-captive. To prevent this, the IV 7/16" socket will be used with the DPT
- There is no real aligning feature for the CPA other than the Removal Fastener bolt holes, therefore reinstalling can be difficult. It may be easiest to start a few bolts by hand (2 bolts furthest out radially have proven easiest with EVA Glove). Note CPA is properly aligned when bolt plate is flush with end of Node bulkhead
- During installation, to prevent binding of CPA Removal Fasteners, can turn each fastener a few turns, then repeat until torque is met
- CPA Connectors are fully mated when Red Indicator Ring is no longer visible

## REMOVE/REPLACE CBM CONTROLLER PANEL ASSEMBLY (CPA) – TASK DATA (Cont)

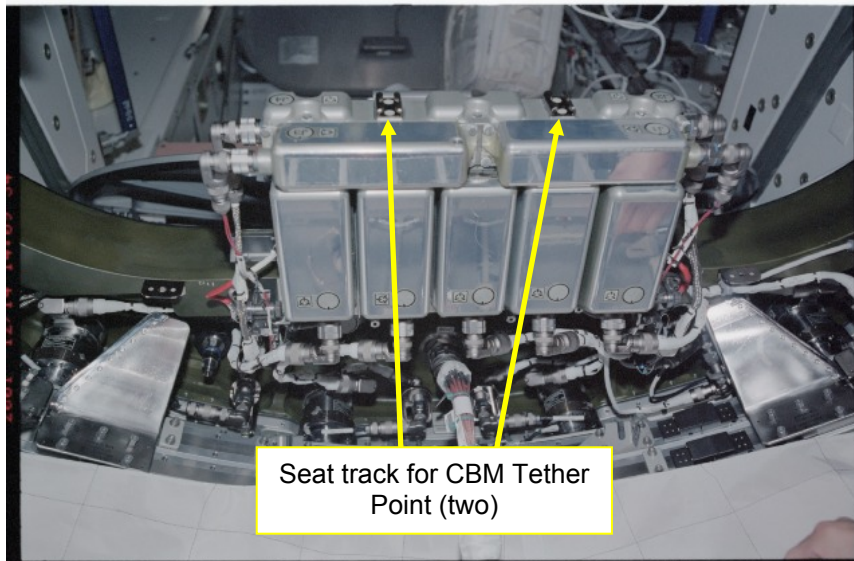


CBM CPA CONNECTORS AND GROUND STRAP  
(CENTER DISK COVER REMOVED)

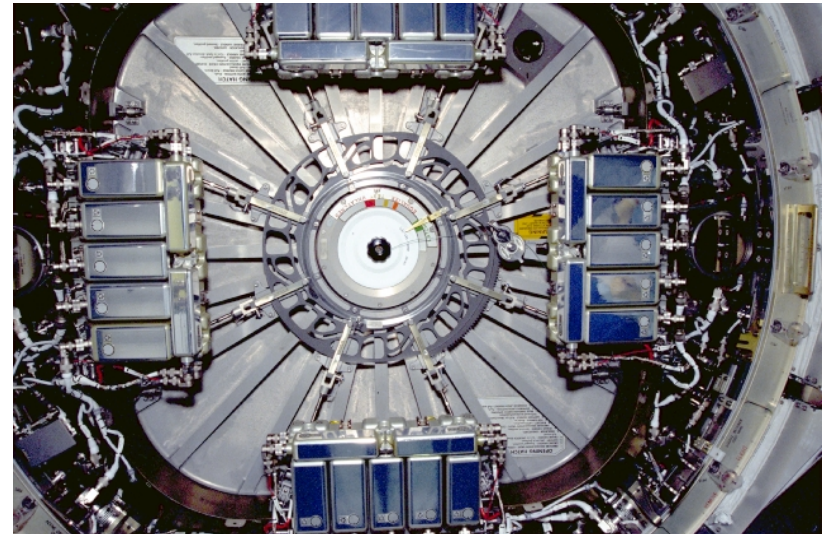


CBM CPA FASTENER LOCATIONS

## REMOVE/REPLACE CBM CONTROLLER PANEL ASSEMBLY (CPA) – TASK DATA (Cont)



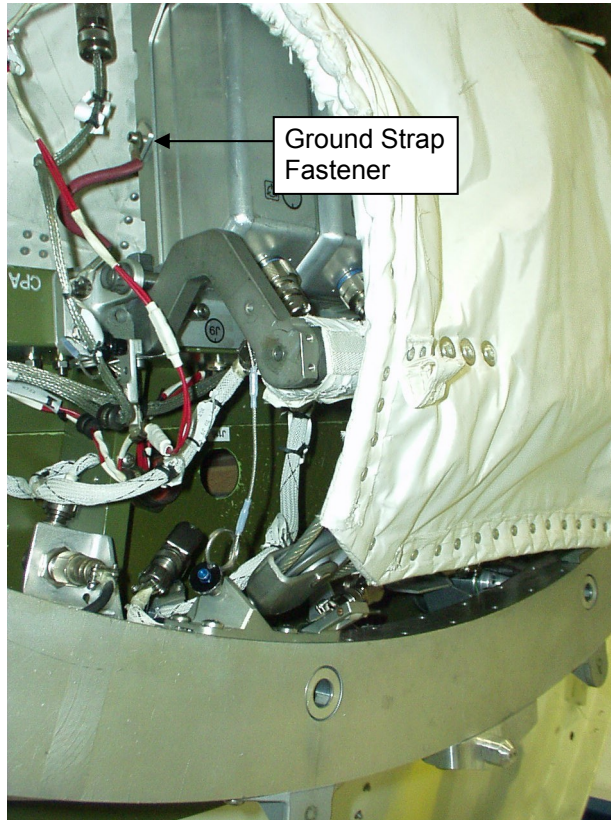
SEAT TRACK FOR CBM TETHER POINT INSTALLATION



EXTERNAL VIEW OF CBM CPAs INSTALLED  
(CENTER DISK COVER REMOVED)



**REMOVE/REPLACE CBM CONTROLLER PANEL ASSEMBLY (CPA) – TASK DATA (Cont)**



**CPA GROUND STRAP FASTENER  
(CENTER DISK COVER INSTALLED)**

## REMOVE/REPLACE CBM PETAL (00:30)

Objective: To manually open/close Node 1 radial Common Berthing Mechanism (CBM) petal via EVA due to CBM contingency

Petal Locations: Node 1 Nadir: Petal 1 = Aft Stbd, Petal 2 = Fwd Stbd, Petal 3 = Fwd Port, Petal 4 = Aft Port

Petal Locations: Node 1 Port: Petal 1 = Fwd Zen, Petal 2 = Aft Zen, Petal 3 = Aft Nad, Petal 4 = Fwd Nad

IV/SSRMS	EV1	EV2
<p style="text-align: center;"><u>NOTE</u></p> <p>It is preferable to remove/replace petal from closed position</p>	<div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 10px;"> <p><u>CAUTION</u></p> <p>During any CBM operation, avoid contact with sealing surface</p> </div> <p><u>PETAL REMOVAL</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> </ol> <div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 10px;"> <p><u>CAUTION</u></p> <p>Do not use petal(s) as handhold until launch restraints have been engaged</p> </div> <ol style="list-style-type: none"> <li>2. If petal in fully closed position: Engage first petal launch restraint for failed petal, push button in</li> <li>3. <b>PGT [A4, CW2, 30.5]-6 Ext 7/16:</b> Turn Actuator Lock-out Bolt (outer-most bolt) to disable spring actuator ~18 turns</li> <li>4. <b>PGT [A6, CCW2, 30.5]-6 Ext 7/16:</b> Turn Roller Link Release Bolt up to 12-13 turns to disengage Capture Latch</li> <li>5. Visually verify Capture Latch is not engaged on Petal Roller Link</li> <li>6. <b>PGT [A6, CW2, 10.5]-6 Ext 7/16:</b> Retighten Roller Link Release Bolt up to 12-13 turns</li> <li>7. Attach tether to petal hinge linkage</li> <li>8. <b>PGT [ B4, CCW2, 30.5]-6 Ext 7/16:</b> Remove Petal Attachment Bolts (two) ~12 turns</li> <li>9. If launch restraints engaged, release first launch restraint</li> <li>10. Remove petal</li> </ol>	<div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 10px;"> <p><u>CAUTION</u></p> <p>During any CBM operation, avoid contact with sealing surface</p> </div> <p><u>PETAL REMOVAL</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> </ol> <div style="border: 1px solid black; padding: 5px; text-align: center; margin-bottom: 10px;"> <p><u>CAUTION</u></p> <p>Do not use petal(s) as handhold until launch restraints have been engaged</p> </div> <ol style="list-style-type: none"> <li>2. If petal in fully closed position: Engage second petal launch restraint for failed petal, push button in</li> <li>3. Assist EV1 as reqd</li> <li>4. If launch restraints engaged, release second launch restraint</li> <li>5. Remove petal</li> </ol>

**REMOVE/REPLACE CBM PETAL (00:30) (Cont)**

IV/SSRMS	EV1	EV2
	<p><u>PETAL REPLACE</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> <li>2. Position replacement petal</li> <li>3. If petal in closed position: Engage first launch restraint (push button in)</li> <li>4. <b>PGT [A7, CW2, 30.5]-6 Ext 7/16:</b> Engage Petal Attachment Bolts (two) 12 turns, apply pressure on bolt while turning to ensure engagement</li> <li>5. Remove tether from petal</li> <li>6. <b>PGT [A7, CCW2, 10.5]-6 Ext 7/16:</b> Reengage Actuator Lock-out Bolt (outer-most bolt) ~12 turns</li> <li>7. While holding petal, release first launch restraint</li> <li>8. Clean up worksite</li> <li>9. Visually inspect CBM mating interface, ensure it is clear of latch, wire ties, MLI and any other equipment or FOD</li> </ol>	<p><u>PETAL REPLACE</u></p> <ol style="list-style-type: none"> <li>1. Configure/set up APFR and tools as reqd; transfer to worksite</li> <li>2. Assist EV1 as reqd</li> <li>3. If petal in closed position: Engage second launch restraint (push button in)</li> <li>4. While holding petal, release second launch restraint</li> <li>5. Clean up worksite</li> <li>6. Visually inspect CBM mating interface, ensure it is clear of latch, wire ties, MLI and any other equipment or FOD</li> </ol>

## REMOVE/REPLACE CBM PETAL – TASK DATA

### Tools:

EV1	EV2
PGT	BRT
7/16-6in ext	Adjustable Tether
Adjustable Tether	
BRT	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Roller Link Release Bolt	N/A	7/16"	1	8.3	8.3	12.0	up to 12-13	30
Petal Attachment Bolt	N/A	7/16"	2	9.2	19.4	26.1/Rel 13.1/Inst	12	30
Actuator Lock-out Bolt	N/A	7/16"	1	9.2	9.2	~15	TBD	30

\* Standard PGT settings assumed

### Foot Restraints:

Task	WIF	CETA Position	Swing Arm Settings	APFR Setting
Port CBM – Fwd half	NOD 05	N/A	N/A	11, RR, G, 12
Port CBM – Aft half	NOD 03	N/A	N/A	11, QQ, G, 1
Nadir CBM	SSRMS	N/A	N/A	TBD

\* Not verified in NBL

### Warnings:

1. Do not use petals as hand hold unless launch restraints have been engaged

### Cautions:

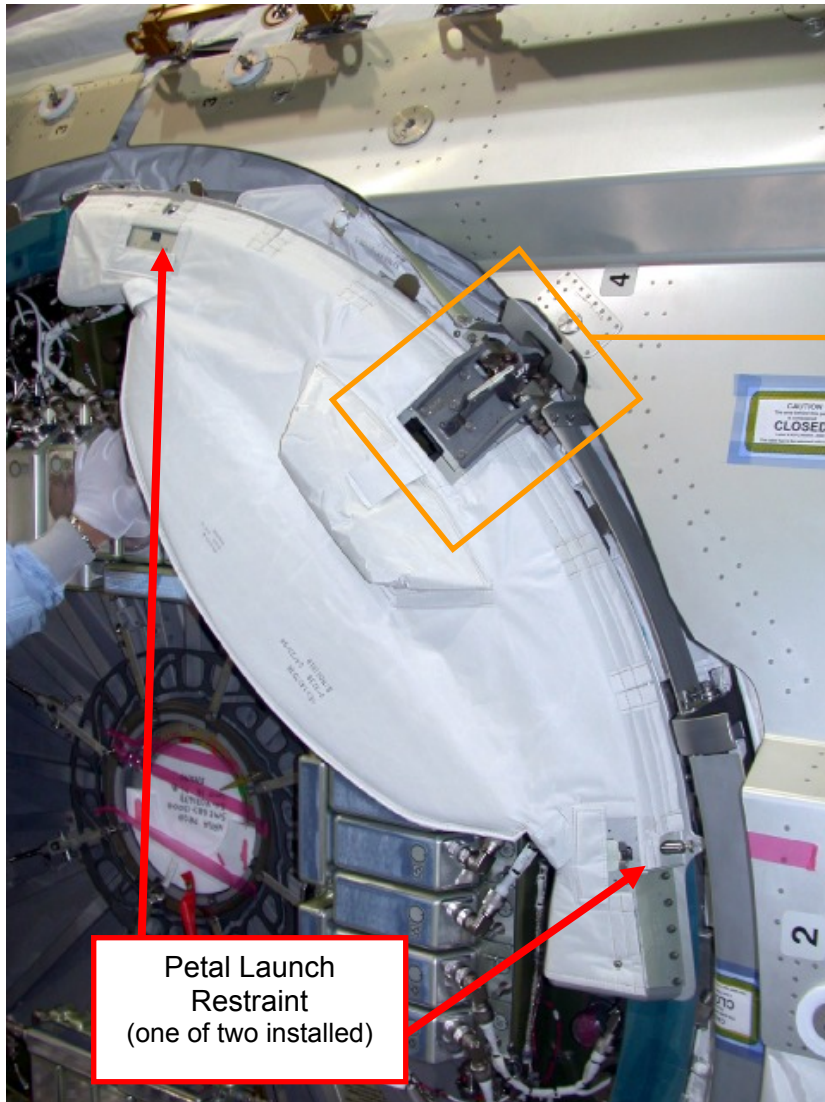
1. During operation, avoid contact with CBM sealing surface

### Notes:

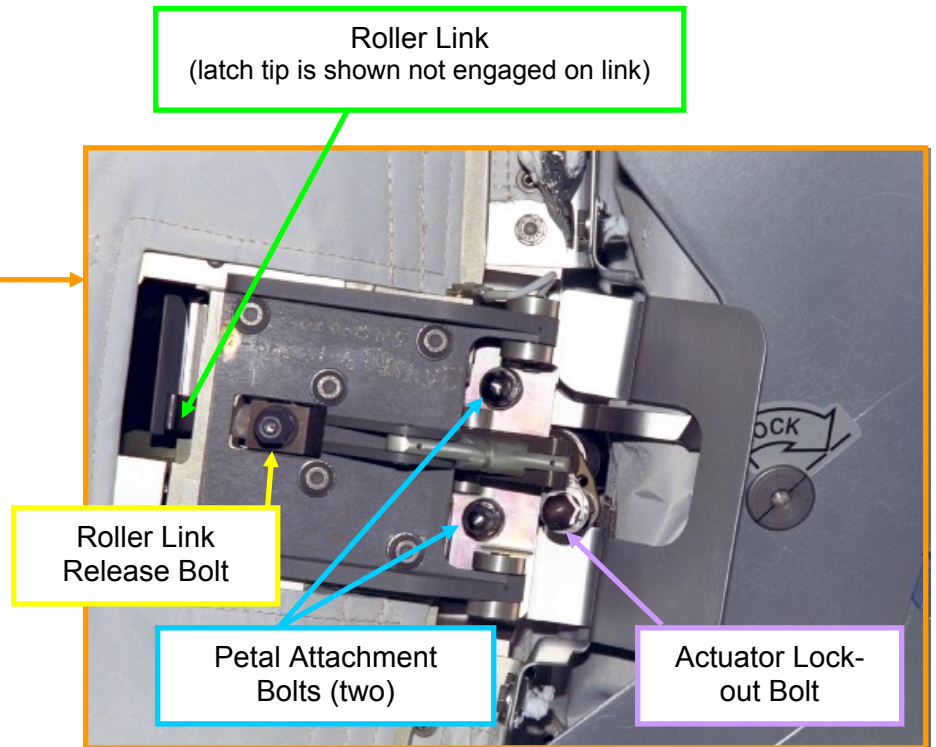
1. CBM CPAs do not have to be powered down for this activity
2. It is preferable to remove/replace petal from closed position, thus allowing crew to disable actuator spring



# REMOVE/REPLACE CBM PETAL – TASK DATA (Cont)

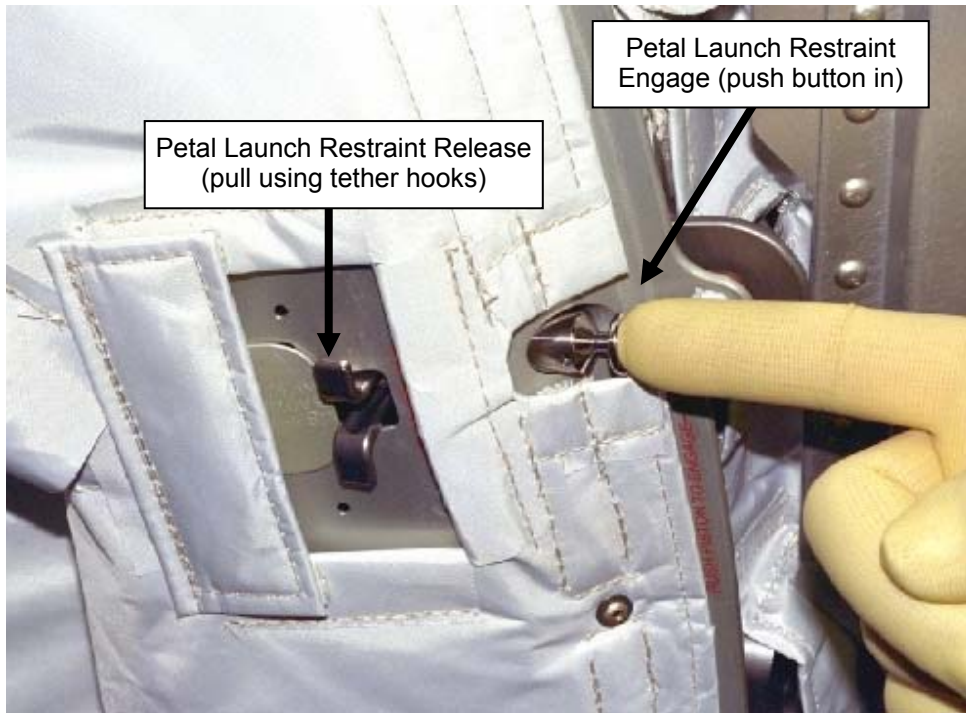


CBM PETAL

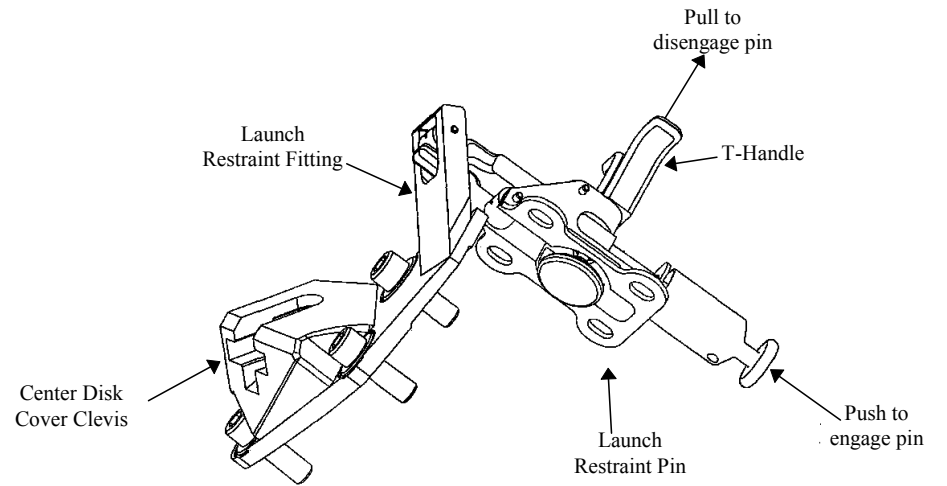


CBM PETAL DEPLOY MECHANISM

## REMOVE/REPLACE CBM PETAL – TASK DATA (Cont)



CBM PETAL LAUNCH RESTRAINT OPERATION



CBM PETAL LAUNCH RESTRAINT MECHANISM

**REMOVE/REPLACE CBM PETAL – TASK DATA (Cont)**



PETAL LAUNCH RESTRAINT RELEASE USING ADJUSTABLE TETHER STRAP

## REMOVE CBM READY-TO-LATCH (RTL) (00:45)

Objective: To remove a CBM failed Ready-To-Latch via EVA to allow mating operations to continue

Latch Locations: Node 1 Nadir: Latch 1 = Aft Stbd, Latch 2 = Fwd Stbd, Latch 3 = Fwd Port, Latch 4 = Aft Port

Node 1 Port: Latch 1 = Fwd Zen, Latch 2 = Aft Zen, Latch 3 = Aft Nad, Latch 4 = Fwd Nad

Assumptions: Corresponding CBM Petal Cover for failed RTL has been fully deployed via commanding or EVA

IV/SSRMS	EV1	EV2
<p>1. √Inhibits in place for affected RTL (see Task Data Sheet)</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px; text-align: center;"> <p><u>WARNING</u></p> <p>Power must be removed from CPA prior to EVA maintenance</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p><u>CAUTION</u></p> <p>During any CBM operation, avoid contact with sealing surface</p> </div> <p><u>RTL REMOVAL</u></p> <ol style="list-style-type: none"> <li>1. Configure/setup APFR &amp; tools as reqd; Transfer to worksite</li> <li>2. Remove center disk cover as reqd: REMOVE/REPLACE CENTER DISK COVER, COVER REMOVAL, steps 1-11</li> <li>3. Verify power removed before continuing</li> <li>4. <b>PGT [A4, CCW2, 30.5]-RAD/DPTA/ 3/8"</b>: Remove RTL fasteners (2), 13.5 turns</li> <li>5. Tether to RTL assembly</li> <li>6. Disconnect data connector from RTL (use connector tool as required)</li> <li>7. Remove RTL and stow (use trash bag as reqd for loose Pieces)</li> <li>8. Reinstall MMOD center cover as required: REMOVE/REPLACE CENTER DISK COVER, COVER REINSTALL, steps 1-5</li> <li>9. Clean up worksite</li> <li>10. Visually inspect CBM mating interface, ensure it is clear of latch, wire ties, MLI, and any other equipment or FOD</li> </ol>	<p><u>RTL REMOVAL</u></p> <ol style="list-style-type: none"> <li>1. Configure/setup APFR &amp; tools as reqd; transfer to worksite</li> <li>2. Assist EV1 as required</li> </ol>

## REMOVE CBM READY-TO-LATCH (RTL) – TASK DATA

### Tools:

EV1 (FF)	EV2 (FF)
PGT	BRT
3/8" Socket	
Drop Proof Tether Adapter (DPTA)	
Connector Tool, Sm locking elec	
Small trash bag	
EVA ratchet	
BRT	
Right Angle Drive (RAD)	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Capture Latch Captive Fastener Release	N/A	3/8"	1	N/A	6.3	10.6	13.5	30

\* Standard PGT settings assumed

### Foot Restraints:

Task	WIF	CETA Position	Swing Arm Settings	APFR Setting
Port CBM – FWD half	NOD 05	N/A	N/A	11, RR, G, 12
Port CBM – Aft half	NOD 03	N/A	N/A	11, QQ, G, 1
Nadir CBM	SSRMS	N/A	N/A	

\* Not verified in NBL

### Warnings:

1. Power must be removed from CPA prior to this task

### Cautions:

1. During operation, avoid contact with CBM sealing surface

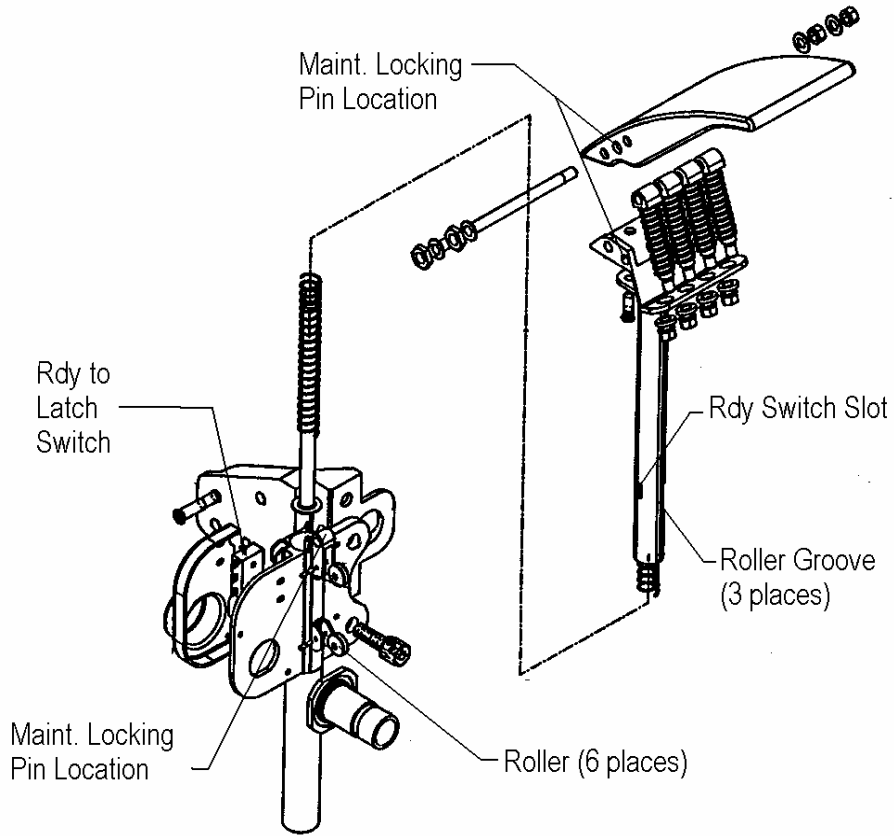
### Notes:

1. Connectors are fully mated when red indicator ring is no longer visible
2. Fitcheck of RAD / DPTA / 3/8-in socket has not been verified – note DPTA is not shown in photo
3. CPA number in Power Inhibits chart below corresponds to RTL number, e.g. CPA 2 is for RTL 2

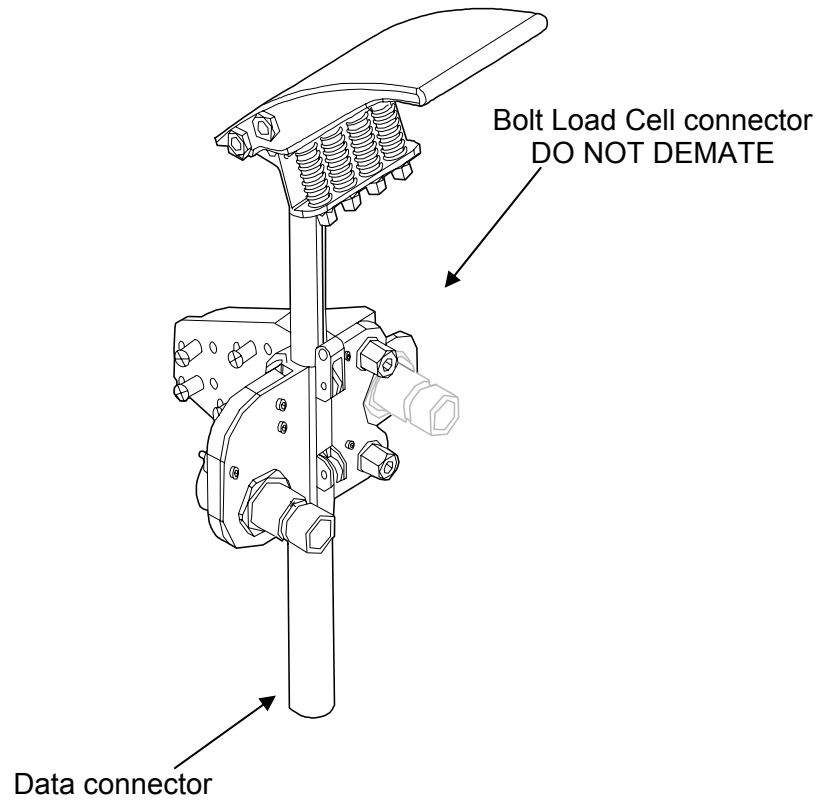
### CPA Power Inhibits:

CPA	Primary RPCM	Secondary RPCM
<b>NODE 1 NADIR</b>		
CPA 1	RPCM N13B B RPC 03	RPCM N14B B RPC 11
CPA 2	RPCM N13B B RPC 04	RPCM N14B B RPC 12
CPA 3	RPCM N13B B RPC 05	RPCM N14B B RPC 13
CPA 4	RPCM N13B B RPC 06	RPCM N14B B RPC 14
<b>NODE 1 PORT</b>		
CPA 1	RPCM N1RS2 C RPC 07	RPCM N1RS1 B RPC 05
CPA 2	RPCM N1RS2 C RPC 08	RPCM N1RS1 B RPC 06
CPA 3	RPCM N1RS2 C RPC 10	RPCM N1RS1 B RPC 13
CPA 4	RPCM N1RS2 C RPC 11	RPCM N1RS1 B RPC 14

# REMOVE CBM READY-TO-LATCH (RTL) – TASK DATA (Cont)



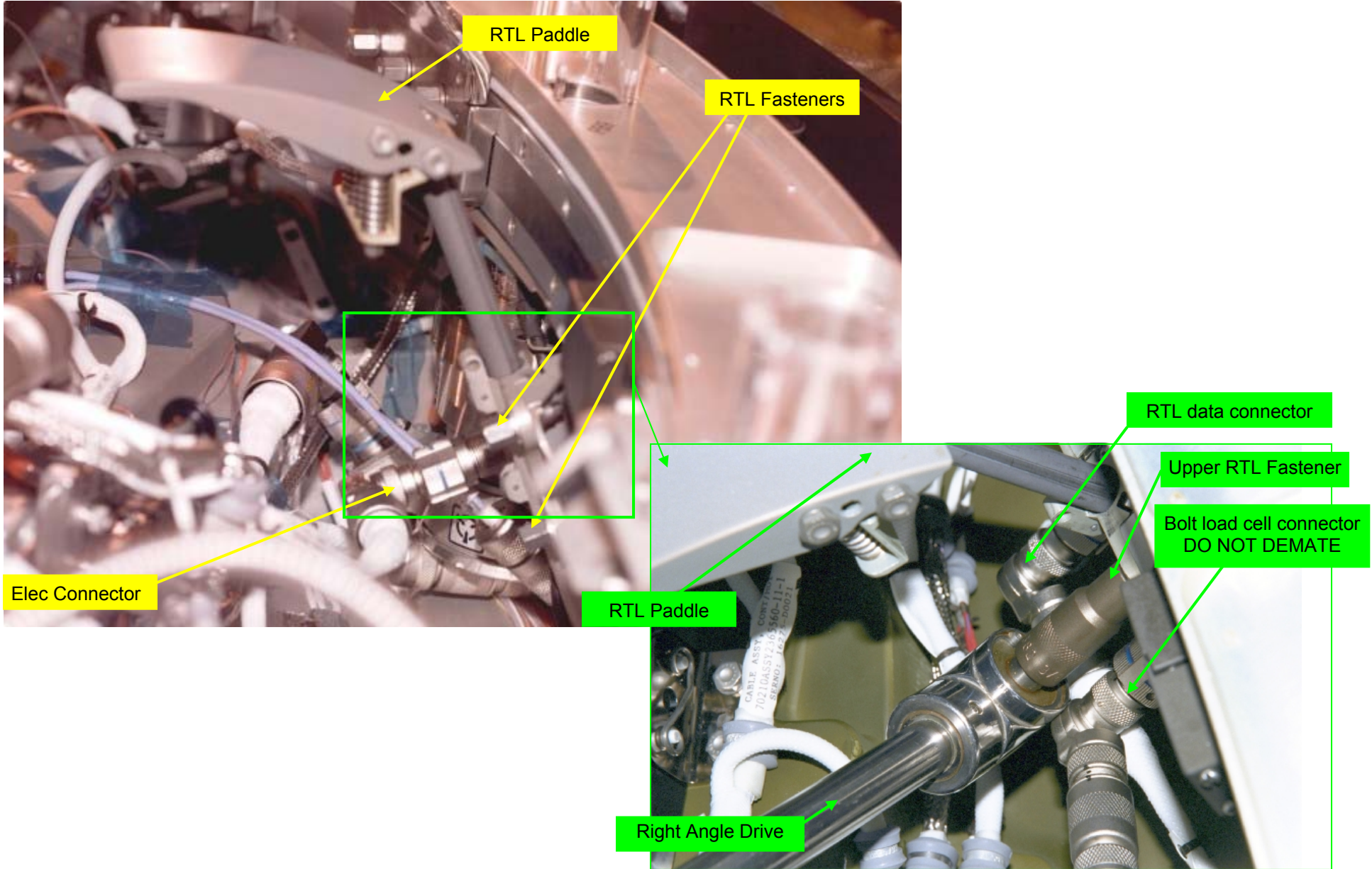
CBM RTL Nomenclature



CBM RTL



# REMOVE CBM READY-TO-LATCH (RTL) – TASK DATA (Cont)



FS 16-31

EVA/120/FIN

## EVA 2 CONTINGENCIES

### P6 RTAS SLEEVE REMOVAL

IV	EV1 – Pz (FF)	EV2 – Wheels
<p>SSRMS: Grappled, brakes on</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <b>CAUTION</b>            All RTAS other than failed RTAS and the Z1 CLA should be fully released before removing the failed RTAS sleeve         </div> <ol style="list-style-type: none"> <li>1. Install APFR (see task data)</li> <li>2. Remove <b>spherical bearing locking plate bolt on P6</b> PGT, 7/16–6 in ext; A4,CCW1,10.5; 14 turns</li> <li>3. Remove sleeve retention PIP pin on failed RTAS (P6 side)</li> <li>4. Secure PIP pin to keep clear of Z1/P6 mating interface</li> <li>5. Reinstall <b>spherical bearing locking plate bolt on P6</b> PGT, 7/16–6 in ext; A4,CW1,10.5; 14 turns</li> <li>6. Verify P6/Z1 mating interface is clear and ready for demate</li> <li>7. Verify CLA motion</li> </ol>	<ol style="list-style-type: none"> <li>1. Verify P6/Z1 mating interface is clear and ready for demate</li> <li>2. Partially open <b>Z1 CLA</b> PGT, 7/16-6 in ext; B1 CCW2; TBD turns to allow enough travel for P6</li> </ol>
<p>1. Notify M1/M2 “Capture claw partially open, GO for SSRMS mode to limp”</p> <p><b>Once M1/M2 confirmed SSRMS limped,</b></p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <b>WARNING</b>            EV crewmembers should remain clear of P6/Z1 mating interface. P6 will move away from Z1 when RTAS sleeve is driven out         </div>	<ol style="list-style-type: none"> <li>3. Monitor P6 Motion</li> </ol>
<p>2. Give EV GO for primary bolt release</p>	<ol style="list-style-type: none"> <li>8. On IV GO, release <b>RTAS Primary Bolt</b> Bolt 2 &amp; 4: PGT, 5/8-7.8 in ext; B7,CCW1; ~TBD turns Bolt 1 &amp; 3: PGT, RAD, 5/8-7.8 in ext; B1,CCW1; ~TBD turns</li> <li>9. Verify RTAS sleeve has been removed from RTAS housing</li> </ol>	<ol style="list-style-type: none"> <li>4. On IV GO, fully open <b>Z1 CLA</b> PGT, 7/16-6 in ext; B1 CCW2; TBD turns to HS</li> </ol>
<p>3. Notify M1/M2 “RTAS sleeve removed, GO for SSRMS brakes on”</p> <p><b>Once M1/M2 confirmed SSRMS brakes on</b></p>		
<p>4. Give EV GO to fully open capture claw</p>		
<p>5. Give SSRMS GO for P6 demate</p>	<p style="text-align: center;"><b>NOTE</b> RTAS contingency bolt will be required for P6 mating at corner where sleeve was removed</p>	



## P6 RTAS SLEEVE REMOVAL – TASK DATA

### EVA Tools:

EV1 (FF)	EV2 (FF)
PGT	N/A
7/16 - 6 in ext	
5/8 - 7.8 in ext	
APFR	

### EVA Fasteners:

Fastener	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Z1 CLA	7/16	1	2.0	10.0	TBD	127	30
RTAS Primary bolt	5/8	1/RTAS	52	TBD	TBD	TBD	10
Spherical bearing locking plate bolt	7/16	1/RTAS	3.0	3.25	9.5	14	10

**EVA Connectors:** None

### Foot Restraints:

Task	WIF	APFR Setting
Z1 capture latch	Z1-18	6,OO,F,12
Aft/Stbd RTAS bolt (bolt #1)	Z1-21	4,PP,H,12
Fwd/Stbd RTAS bolt (bolt #2)	Z1-11	2,OO,D,1
Aft/Port RTAS bolt (bolt #3)	Z1-22	10,PP,H,12
Fwd/Port RTAS bolt (bolt #4)	Z1-12	9,PP,F,12

### Warnings:

- EV crewmembers should remain clear of P6/Z1 mating interface. P6 will move away from Z1 when RTAS sleeve is driven out

### Cautions:

- All RTAS other than failed RTAS and the Z1 capture claw should be fully released before removing the failed RTAS sleeve

### Notes:

## Z1 CAPTURE LATCH FAILED CLOSED (00:30)

IV	EV1 – Pz (FF)	EV2 – Wheels
	<p><u>ROTATE CAPTURE BAR</u></p> <ol style="list-style-type: none"> <li>1. Retrieve 7/16-18 in ext socket from Z1 port toolbox</li> <li>2. Install APFR Z1 WIF 19 (<b>10,V V,F,11</b>); ingress</li> <li>3. Open thermal shroud flap to access capture bar</li> <li>4. Loosen <b>capture bar disk clamp bolt</b> PGT, 7/16-18 in ext; AX [5.0 ft-lb], CCW2, 5.5; ~4 turns to HS</li> <li>5. Manually turn <b>capture bar disk center bolt</b> PGT, 7/16-18 in ext; RCW; ~turn until clamp bolt is at the end of disc slot, rotating capture bar to disengage position</li> </ol> <p style="text-align: center;"><u>NOTE</u> Crewmember may need to remove MWS to ingress long spacer</p> <ol style="list-style-type: none"> <li>6. Tighten <b>capture bar disk clamp bolt</b> PGT, 7/16-18 in ext; AX [5.0 ft-lb], CW1, 5.5; ~4 turns to HS</li> <li>7. Egress APFR</li> </ol> <p><u>FOR Z1</u></p>	<p><u>FOR Z1</u></p> <ol style="list-style-type: none"> <li>1. Release PIP pin on EVA handle CLA PIP PIN RELEASE (Z1 stbd)</li> <li>2. Rotate EVA handle to disengage position</li> <li>3. Give EV1 GO to rotate port handle</li> </ol>
	<ol style="list-style-type: none"> <li>8. On EV2 GO, release PIP pin on EVA handle CLA PIVOT PIN RELEASE (Z1 port)</li> <li>9. Rotate EVA handle to disengage position</li> <li>10. ✓Capture latch claws released</li> <li>11. Rotate EVA handle back to engage position; reinstall PIP pin</li> <li>12. Close P6 thermal shroud</li> </ol>	<ol style="list-style-type: none"> <li>4. ✓Capture latch claws released</li> <li>5. Rotate EVA handle back to engage position; reinstall PIP pin</li> </ol>

## Z1 CAPTURE LATCH FAILED CLOSED – TASK DATA

### EVA Tools:

EV1 (FF)	EV2 (FF)
PGT	N/A
7/16 - 18 in ext	
APFR	

### EVA Fasteners:

Fastener	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Capture bar disk clamp bolt	7/16	1	TBD	TBD	TBD	4	30
Capture bar disk center bolt	7/16	1	TBD	TBD	TBD	TBD	N/A

**EVA Connectors:** None

### Foot Restraints:

Task	WIF	APFR Setting
Z1 capture bar	Z1-19	10,V V,F,11

### Warnings:

### Cautions:

### Notes:

1. Crewmember may need to remove MWS to ingress long spacer
2. Starboard handle must be rotated before port handle for Z1 CLA release

### 16.1a P6 TO P5 MATING FAILURE (CAPTURE LATCH)

During ATTACH P6 TO P5, CLA Fails to Close on P6 Long Spacer Capture Bar (less than 72 turns engagement) and Initial Gap > 0.6-in

①

1
<ul style="list-style-type: none"><li>• Visually check for physical interference (PGT (A3,CCW2, 5.5), 7/16-in-6 in)</li><li>• Reverse CLA drive, 5 turns</li></ul>
(PGT (A3,CW2, 5.5), 7/16-in-6 in)
<ul style="list-style-type: none"><li>• Attempt to CLA again</li></ul>
If no joy:
<ul style="list-style-type: none"><li>• Obtain PRDs (two) from TSA</li><li>• GCA P6 into P5 as far as possible</li></ul>
<ul style="list-style-type: none"><li>• Install PRDs at P5 corners #1,#4</li><li>• SSRMS: Mode to Limp</li></ul>
<ul style="list-style-type: none"><li>• Ratchet to close gap between P5 and P6</li></ul>

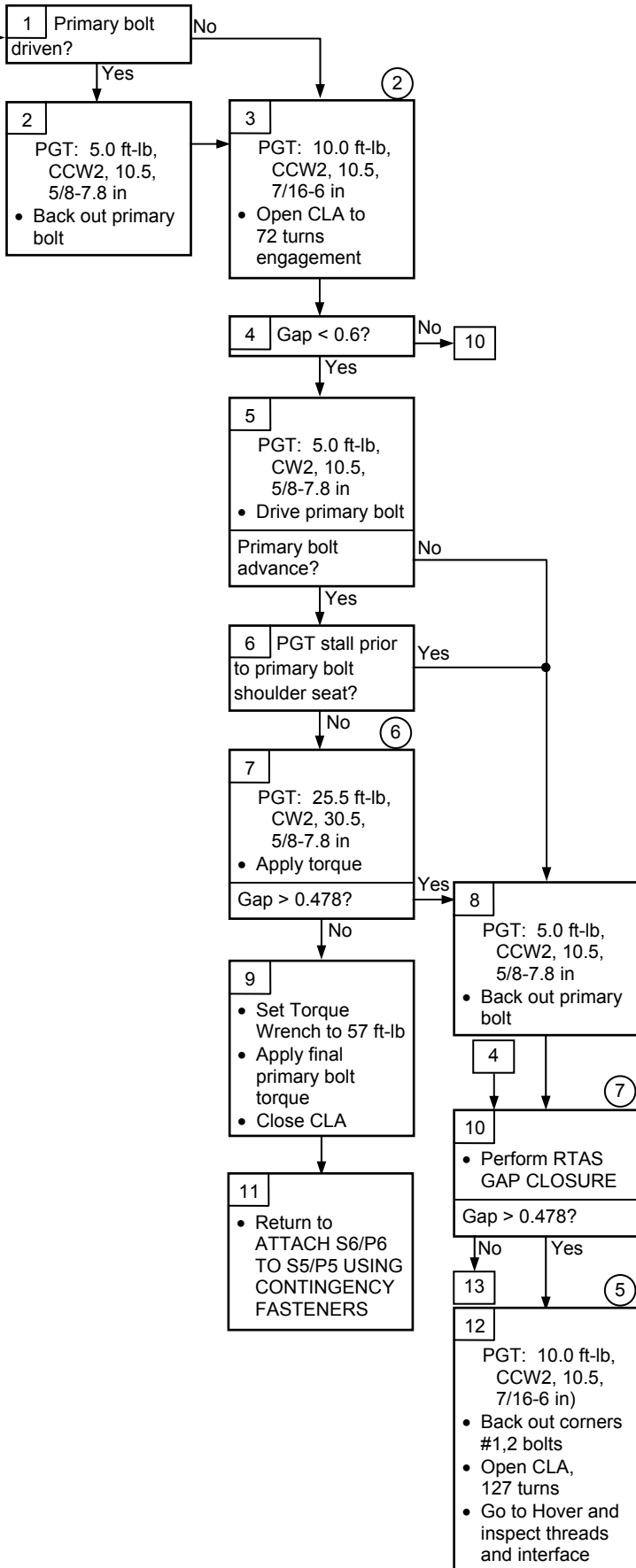
↓

2
<ul style="list-style-type: none"><li>• Continue nominal ops</li></ul>

①  
If CLA cannot be closed, PRDs will be used to mate P6 to P5. PRD routing between P5 and P6 shown on P5/P6 PRD Routing, EVA REFERENCE

# 16.1b P6 TO P5 MATING FAILURE (RTAS CORNERS #1 OR #2)

- ① During ATTACH P6 to P5 Gap > 0.6 after CLA closure
- ③ Primary bolt does not advance
- ④ PGT stalls prior to primary bolt shoulder seat
- ⑤ Gap > 0.478 after primary bolt shoulder seating



① Gap = distance between passive and active RTAS housings. Gap must not be greater than 0.6 in prior to driving primary bolt. Gap must not be greater than 0.478 in after primary bolt is driven to allow for shear loading. Measuring tools: Small crew hook = 0.430 in; drop proof tether end of 7/16 in-6 in ext = 0.66 in; S5/P5 contingency spacer locking tool thickness range = 0.3 to 0.6 in

② Structure warped or misalignment of fastener. Releasing CLA allows recentering of passive RTAS bearings while keeping fine alignment cone engaged with bearing

③ Misalignment of Primary bolt. Teflon nut may shear if torque increased. Do not increase torque

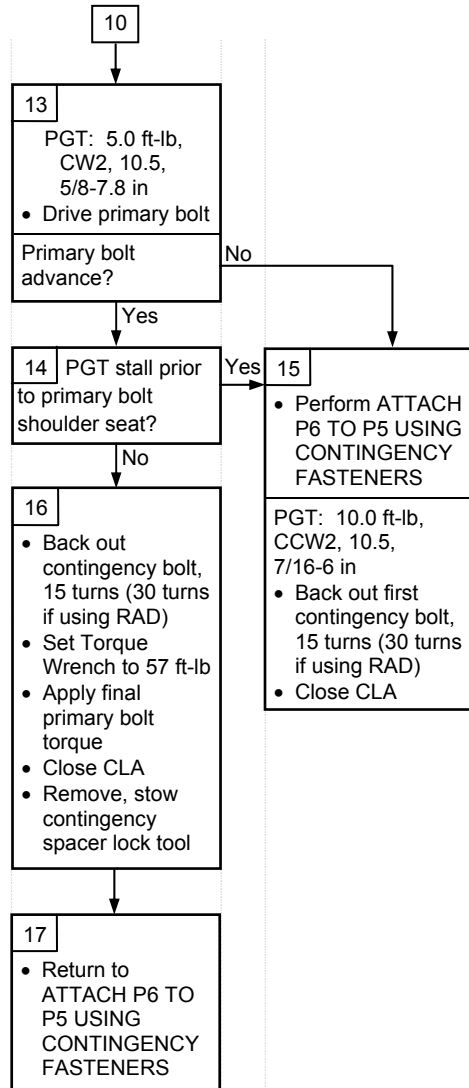
④ Probable jam of primary bolt

⑤ Primary bolt thread problem or obstruction

⑥ Higher torque can be used with no CLA preload

⑦ Contingency bolt used to seat shear cylinder

## 16.1b (Cont)



## ATTACH P6 TO P5 USING CONTINGENCY FASTENERS

IV	EV1 – Pz (FF)	EV2 – Wheels
<p>1. Initial RTAS gap: _____</p> <p>2. Record which contingency sleeve used: _____</p> <p>3. Final RTAS gap: _____</p>	<p style="text-align: center;"><u>NOTE</u></p> <p>EVA worksite per nominal bolt engagement Contingency Spacer Lock Tools are at P5 inboard and outboard RTAS corner (TBD)</p> <ol style="list-style-type: none"> <li>1. Remove ground straps if required</li> <li>2. Unbolt <b>Gap Check Tool Bolt (2)</b> (also called Contingency Spacer Lock Tool) PGT, 7/16-6 in ext; A3,CCW2,10.5; 5-7 turns</li> <li>3. Measure RTAS gap, record gap</li> </ol> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><u>CAUTION</u></p> <p>Do not loosen P5 contingency spacer locking bolt more than 1½ turn. Excessive turns of spacer locking bolt may cause guide washer to come out of slot and snap ring washer to bend</p> </div> <ol style="list-style-type: none"> <li>4. Loosen <b>contingency spacer locking bolt</b> PGT, 7/16-6 in ext; A4,CCW2,10.5; 1-1.5 turns only</li> <li>5. Tighten spacer sleeve until snug against P6 spherical bearing (~10 turns CW)</li> <li>6. Notify IV which contingency sleeve used</li> <li>7. Verify spacer sleeve aligned within nut by jiggling back end of P6 contingency ball/nut</li> </ol> <p style="text-align: center;"><u>NOTE</u></p> <p>Contingency spacer sleeve may need to be rotated to allow tool installation, prefer ccw rotation</p> <ol style="list-style-type: none"> <li>8. Install Contingency Spacer Lock Tool over contingency spacer sleeve (friction fit)</li> <li>9. Fasten <b>contingency spacer locking bolt</b> PGT, 7/16-6 in ext; A4,CW1,10.5; 1-1.5 turns only</li> <li>10. Tighten <b>RTAS contingency bolt</b> PGT, 7/16-6 in ext; A4,CW2,10.5; 7 turns. Bolt will come out of launch position and move ~2 in fwd</li> <li>11. Push bolt ~0.5 in to contact nut</li> <li>12. Continue to tighten <b>RTAS contingency bolt</b> PGT, 7/16-6 in ext; A4,CW2,10.5; 15 turns to HS</li> <li>13. Torque <b>RTAS contingency bolt</b> Torque Wrench, 7/16-6 in ext; 52 ft-lb</li> <li>14. Remove Contingency Spacer Lock Tool from sleeve</li> <li>15. Measure gap; report to MCC-H</li> <li>16. Stow Contingency Spacer Lock Tool in trash bag</li> <li>17. Remove <b>spherical bearing locking plate bolt on P6</b> PGT, 7/16-6 in ext; A4,CCW1,10.5; 14 turns</li> <li>18. Stow plate with wire tie to adjacent handrail</li> <li>19. Install ground strap per nominal ATTACH P6 TO P5 procedure</li> </ol>	

## ATTACH P6 TO P5 USING CONTINGENCY FASTENERS – TASK DATA

### EVA Tools:

EV1 (FF)	EV2 (FF)
PGT	N/A
7/16 - 6 in ext	
Torque Wrench	

### EVA Fasteners:

Fastener	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Gap Check Tool bolt (Contingency spacer lock tool bolt)	7/16	2/Tool	4.58	4.83	8.75	14	30
Contingency spacer locking bolt	7/16	1/RTAS	8.25	8.75	63.3	1.5	N/A
RTAS contingency bolt	7/16	2/RTAS	52	N/A	283.3	22	30
Spherical bearing locking plate bolt	7/16	1/RTAS	3.0	3.25	9.5	14	10

**EVA Connectors:** None

**Foot Restraints:** See nominal procedure

### Warnings:

### Cautions:

1. Do not loosen S5/P5 contingency spacer locking bolt more than 1.5 turns. Excessive turns of spacer locking bolt may cause guide washer to come out of slot and cause snap ring washer to bend

### Notes:

1. EVA worksite per nominal bolt engagement. Contingency spacer lock tool is at RTAS corner #1 on S5/P5
2. If contingency spacer sleeve needs to be rotated to allow tool installation, rotate ccw
3. Contingency bolt will come out of launch position and move ~2 in fwd after 7 turns



## RTAS GAP CLOSURE

IV	EV1 – Pz (FF)	EV2 – Wheels
<p>1. Initial RTAS gap: _____</p>          <p>2. Record with contingency sleeve used: _____</p>          <p>3. Final RTAS gap: _____</p>	<p style="text-align: center;"><u>NOTE</u></p> <p>EVA worksite per nominal bolt engagement. RAD will be reqd for Bolts 1 and 2 RTAS contingency bolts Contingency Spacer Lock Tools are at P5 inboard and outboard RTAS corner #1</p> <p>1. Unbolt <b>Gap Check Tool Bolt (2)</b> (also called Contingency Spacer Lock Tool) PGT, 7/16-6 in ext; A3,CCW2,10.5; 5-7 turns</p> <p>2. Measure RTAS gap, record gap</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p style="text-align: center;"><u>CAUTION</u></p> <p>Do not loosen P5 contingency spacer locking bolt more than 1½ turn. Excessive turns of spacer locking bolt may cause guide washer to come out of slot and snap ring washer to bend</p> </div> <p>3. Loosen <b>contingency spacer locking bolt</b> PGT, 7/16-6 in ext; A4,CCW2,10.5; 1-1.5 turns only</p> <p style="text-align: center;"><u>NOTE</u></p> <p>Contingency spacer sleeve may need to be rotated to allow tool installation, prefer ccw rotation</p> <p>4. Install Contingency Spacer Lock Tool over contingency spacer sleeve (friction fit)</p> <p>5. Fasten <b>contingency spacer locking bolt</b> PGT, 7/16-6 in ext; A4,CW1,10.5; 1-1.5 turns only</p> <p>6. Tighten <b>RTAS contingency bolt</b> – Notify IV which contingency sleeve used PGT, 7/16-6 in ext; A4,CW2,10.5; 7 turns – Bolt will come out of launch position and move ~2 in fwd</p> <p>7. Push bolt ~0.5 in to contact nut</p> <p>8. Continue to tighten <b>RTAS contingency bolt</b> PGT, 7/16-6 in ext; A4,CW2,10.5; 15 turns to HS</p> <p>9. Remove Contingency Spacer Lock Tool from sleeve; stow in trash bag</p> <p>10. Measure gap; report to MCC-H</p> <p>11. If gap is nominal, proceed with nominal bolting procedure</p>	

## RTAS GAP CLOSURE – TASK DATA

### EVA Tools:

EV1 (FF)	EV2 (FF)
PGT	N/A
7/16 - 6 in ext	

### EVA Fasteners:

Fastener	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Gap Check Tool bolt (Contingency spacer lock tool bolt)	7/16	2/Tool	4.58	4.83	8.75	14	30
Contingency spacer locking bolt	7/16	1/RTAS	8.25	8.75	63.3	1.5	N/A
RTAS contingency bolt	7/16	2/RTAS	52	N/A	283.3	22	30

**EVA Connectors:** None

**Foot Restraints:** See nominal procedure

### Warnings:

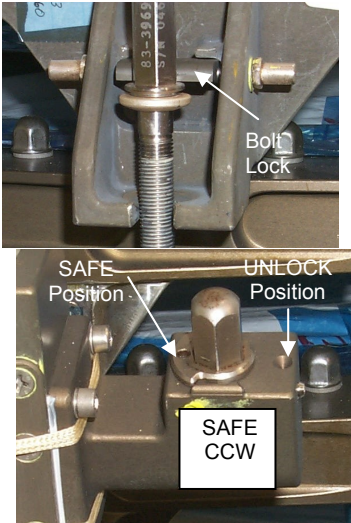
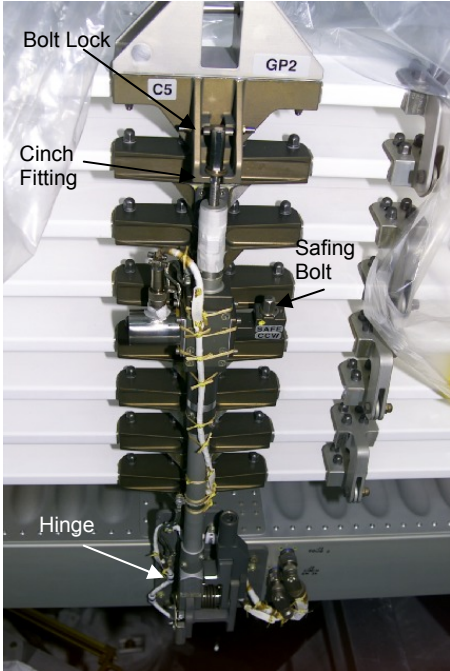
### Cautions:

1. Do not loosen S5/P5 contingency spacer locking bolt more than 1.5 turns. Excessive turns of spacer locking bolt may cause guide washer to come out of slot and cause snap ring washer to bend


### Notes:

1. EVA worksite per nominal bolt engagement. Contingency spacer lock tool is at RTAS corner #1 on S5/P5
2. If contingency spacer sleeve needs to be rotated to allow tool installation, rotate ccw
3. Contingency bolt will come out of launch position and move ~2 in fwd after 7 turns

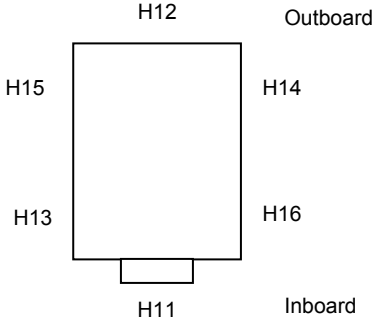
# S1 RADIATOR MANUAL CINCH RELEASE

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)
<p><b>IV/MCC-H:</b> 1. Verify power is OFF to SFU 2. Verify which cinch(es) to be released</p> <p><b>NOTE</b> Verify the socket extension rotates the cinch bolt locking tab downward prior to releasing bolt.</p> <p>Cinch will rotate away from radiator when bolt is clear of cinch fitting</p> 	<p><u>CINCH RELEASE</u></p> <ol style="list-style-type: none"> <li>1. Rotate <b>Pin Puller Safing bolt</b> PGT, 7/16-6in ext, RCCW, 30.5 (manual ratchet), 0.5 turns to the SAFE position</li> <li>2. Release <b>cinch bolt</b> PGT, 7/16-6 in ext, B7, CCW1, 30.5 (25.5 ft-lbs, 10 RPM), until clear of cinch fitting</li> <li>3. If higher torque required to break torque, use PGT in manual PGT, 7/16-6in ext, RCCW, 30.5 (manual ratchet)</li> <li>4. Allow cinch to rotate away from radiator</li> <li>5. Verify cinch is locked in deployed detent</li> </ol>	<p>APFR Setups: C1: S1-19 (bay 11, face 4 nadir); 9, NN, G, 12 C2: S1-19 (bay 11, face 4 nadir); 9, NN, D, 12 C3: SSRMS only C4: SSRMS only C5: S1-18 (bay 11, face 4 zenith); 3, PP, E, 12 C6: S1-18 (bay 11, face 4 zenith); 3, PP, H, 12</p> 

## S1 RADIATOR MANUAL OVERRIDE TO DEPLOY/RETRACT

IV/SSRMS	EV1 – Pz (FF)	EV2 – Wheels (FF)
<p>IV/MCC-H: Verify telemetry is enabled through radiator IMCA</p> 	<p><u>MANUAL DEPLOY</u></p> <ol style="list-style-type: none"> <li>1. APFR setup in S1-23 (Bay 13) (5, PP, F, 12)</li> <li>2. PGT, 7/16-6 inch extension B1, CW1, 30.5 (12.0 ft-lb, 5 RPM)</li> <li>3. √PGT turn count at 0.0</li> <li>4. Drive manual override through its maximum torque region. Stop at 20 turns</li> <li>5. PGT, 7/16-6 inch ext A6, CW2, 30.5 (9.0 ft-lb, 20 RPM)</li> <li>6. √PGT turn count at 0.0</li> <li>7. Drive manual override till close to the deploy stop. Stop at 95 turns</li> <li>8. PGT, 7/16-6 inch ext A1, CW1, 30.5 (2.5 ft-lb, 5 RPM)</li> <li>9. Drive manual override to lightly preload on the deploy stop. Stop on torque</li> <li>10. √PGT turn count at 0.0</li> <li>11. PGT, 7/16-6 inch ext A7, CW1, 30.5 (10.0 ft-lb, 5 RPM)</li> <li>12. Drive manual override to preload on the deploy stop. Stop at 2.5 turns</li> </ol> <p><u>MANUAL RETRACT</u></p> <ol style="list-style-type: none"> <li>1. APFR setup in S1 WIF 23 (Bay 13) 5, PP, F, 12</li> <li>2. PGT, 7/16-6 inch extension A5, CCW2, 30.5 (8.0 ft-lb, 20 RPM)</li> <li>3. √PGT turn count at 0.0</li> <li>4. Drive manual override through its maximum torque region. Stop at 115 turns</li> <li>5. PGT, 7/16-6 inch ext A4, CCW1, 30.5 (7.0 ft-lb, 5 RPM)</li> <li>6. Drive manual override to preload on the retract stop. Stop on torque</li> </ol>	<p style="text-align: center;"><u>NOTE</u></p> <p>Verify the socket extension disengages the override bolt locking mechanism</p> <p style="text-align: center;"> <u>NOTE</u></p> <p>Verify the socket extension disengages the override bolt locking mechanism</p>

## P6 RADIATOR MANUAL OVERRIDE TO DEPLOY/RETRACT

IV	EV1	EV2
<p>MCC-H 1. Verify PVR motor OFF</p> <p style="text-align: center;"><u>NOTE</u> Free Drift or CMG Control with Thrusters Disabled is required while radiator is being deployed/retracted. Applies only while mechanisms are in motion</p> <p>MCC-H 2. Configure ISS/Orbiter attitude control to CMG Control with thrusters disabled or Orbiter and ISS in free drift</p> <p>IV 3. Give EV crew GO for extend/retract radiator</p> <p>IV 4. On EV GO, CMD nominal attitude control</p> <div style="text-align: center;">  </div>	<p><u>MANUAL OVERRIDE TO EXTEND (RETRACT) RADIATOR</u></p> <ol style="list-style-type: none"> <li>1. If required, APFR, set up and ingress (see Task Data for WIF position and APFR settings)</li> <li>2. On IV GO, release <b>PVR MDA fastener H32</b> PGT, 7/16 - 6in ext; B1 (12 ft-lb), CCW2 (CW2) 30RPM, MTL 30.5; push to engage (5 lb) ~45 turns to HS</li> <li>3. If required to re-engage <b>H32 locking collar</b> PGT, 7/16 - 6in ext; RCCW (RCW), MTL 30.5; ~1/6 turn until collar pops up completely and re-engages</li> <li>4. Report to IV, radiator deployment (retraction) complete</li> </ol> <p>If retracting, re-install PVR cinches using the procedure below. Manual compression of the radiator panels may be required to install cinches (two crewmember operation):</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cinch H11</li> <li><input type="checkbox"/> Cinch H13</li> <li><input type="checkbox"/> Cinch H15</li> </ul>	<p>If retracting, re-install PVR cinches using the procedure below. Manual compression of the radiator panels may be required to install cinches (two crewmember operation):</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cinch H12</li> <li><input type="checkbox"/> Cinch H14</li> <li><input type="checkbox"/> Cinch H16</li> </ul>

**P6 RADIATOR MANUAL OVERRIDE TO DEPLOY/RETRACT (Cont)**

IV	EV1	EV2																																						
	<b>REINSTALL PVR CINCHES</b>	<b>REINSTALL PVR CINCHES</b>																																						
	<ol style="list-style-type: none"> <li>1. Position for cinch H11 installation</li> <li>2. Verify cinch H11 bolt is engaged in last thread (to maximize clearance); verify fixed end pulled all the way out and seated properly in bracket</li> <li>3. Compress radiator panels and assess cinch H11 installation</li> <li>4. If EV1 and EV2 both GO for cinch install</li> <li>5. <b>Give EV2 GO for cinch install</b>, install cinch H11</li> <li>6. Remove winch bar PIP pin (H33); align winch bar clevis to lug on radiator; re-install PIP pin</li> <li>7. If NO GO for cinch install, assess winch bar installation</li> <li>8. If GO for winch installation:</li> <li>9. Remove winch bar PIP pin (H33)</li> <li>10. <b>Give EV2 GO for winch install</b>, compress radiator panels, align winch bar clevis to lug on radiator, re-install PIP pin</li> <li>11. <b>REMOVE FQDC SHROUD</b> per steps below</li> <li>12. <b>RETRACT WINCH</b> per steps below</li> <li>13. <b>REPLACE FQDC SHROUD</b> per steps below</li> <li>14. If NO GO for winch install:</li> <li>15. <b>REMOVE FQDC SHROUD</b> per steps below</li> <li>16. <b>EXTEND WINCH</b> per steps below</li> <li>17. Remove winch bar PIP pin (H33)</li> <li>18. <b>Give EV2 GO for winch install</b>; align winch bar clevis to lug on radiator; re-install PIP pin</li> <li>19. <b>RETRACT WINCH</b> per steps below</li> <li>20. <b>REPLACE FQDC SHROUD</b> per steps below</li> <li>21. Install cinch H11</li> <li>22. Tension <b>cinch H11</b> PGT, 7/16-6in ext; A3 (4.8 ft-lb), CW2 (30RPM), MTL 30.5; push 5 lb, ~6-14 turns to HS</li> <li>23. Install and tension <b>cinches H13 and H15</b> PGT, 7/16-6in ext; A3 (4.8 ft-lb), CW2 (30RPM), MTL 30.5; push 5 lb, ~6-14 turns to HS, each</li> <li>24. Tighten <b>cinch H11</b> PGT, 7/16-6in ext; A3 (4.8 ft-lb), CW2 (30RPM), MTL 30.5; push 5 lb, turn to HS</li> </ol>	<ol style="list-style-type: none"> <li>1. Position for cinch H12 installation</li> <li>2. Verify cinch H12 bolt is engaged in last thread (to maximize clearance); verify fixed end pulled all the way out and seated properly in bracket</li> <li>3. Compress radiator panels and assess cinch H12 installation</li> <li>4. If EV1 and EV2 GO for cinch install</li> <li>5. <b>On GO from EV1</b>, install cinch H12</li> <li>6. Remove winch bar PIP pin (H34); align winch bar clevis to lug on radiator; re-install PIP pin</li> <li>7. If NO GO for cinch install, assess winch bar installation</li> <li>8. If GO for winch installation:</li> <li>9. Remove winch bar PIP pin (H34)</li> <li>10. <b>On GO from EV1</b>, compress radiator panels, align winch bar clevis to lug on radiator, re-install PIP pin</li> <li>11. If NO GO for winch install:</li> <li>12. Remove winch bar PIP pin (H34)</li> <li>13. <b>On GO from EV1</b>, compress radiator panels, align winch bar clevis to lug on radiator, re-install PIP pin</li> <li>14. Install cinch H12</li> <li>15. Tension <b>cinch H12</b> PGT, 7/16-6in ext; A3 (4.8 ft-lb), CW2 (30RPM), MTL 30.5; push 5 lb, ~6-14 turns to HS</li> <li>16. Install and tension <b>cinches H14 and H16</b> PGT, 7/16-6in ext; A3 (4.8 ft-lb), CW2 (30RPM), MTL 30.5; push 5 lb, ~6-14 turns to HS, each</li> <li>17. Tighten <b>cinch H12</b> PGT, 7/16-6in ext; A3 (4.8 ft-lb), CW2 (30RPM), MTL 30.5; push 5 lb, turn to HS</li> </ol>																																						
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Cinch (initial Torque)</th> <th style="text-align: left; border-bottom: 1px solid black;">Torque/Turns</th> </tr> </thead> <tbody> <tr><td>H11</td><td>____/____</td></tr> <tr><td>H12</td><td>____/____</td></tr> <tr><td>H13</td><td>____/____</td></tr> <tr><td>H14</td><td>____/____</td></tr> <tr><td>H15</td><td>____/____</td></tr> <tr><td>H16</td><td>____/____</td></tr> </tbody> </table> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Cinch (Final Torque)</th> <th style="text-align: left; border-bottom: 1px solid black;">Torque/Turns</th> </tr> </thead> <tbody> <tr><td>H11</td><td>____/____</td></tr> <tr><td>H12</td><td>____/____</td></tr> <tr><td>H13</td><td>____/____</td></tr> <tr><td>H14</td><td>____/____</td></tr> <tr><td>H15</td><td>____/____</td></tr> <tr><td>H16</td><td>____/____</td></tr> </tbody> </table> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Cinch (Manual Torque)</th> <th style="text-align: left; border-bottom: 1px solid black;">Turns</th> </tr> </thead> <tbody> <tr><td>H11</td><td>_____</td></tr> <tr><td>H12</td><td>_____</td></tr> <tr><td>H13</td><td>_____</td></tr> <tr><td>H14</td><td>_____</td></tr> </tbody> </table>	Cinch (initial Torque)	Torque/Turns	H11	____/____	H12	____/____	H13	____/____	H14	____/____	H15	____/____	H16	____/____	Cinch (Final Torque)	Torque/Turns	H11	____/____	H12	____/____	H13	____/____	H14	____/____	H15	____/____	H16	____/____	Cinch (Manual Torque)	Turns	H11	_____	H12	_____	H13	_____	H14	_____		
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## P6 RADIATOR MANUAL OVERRIDE TO DEPLOY/RETRACT (Cont)

IV	EV1	EV2
<p>H15 _____</p> <p>H16 _____</p>	<p>25. Tighten <b>cinch H11</b> PGT, 7/16-6in ext ; RCW, MTL 30.5; 3/4 turn</p> <p>26. Verify anti-rotation device is up; if not, rotate bolt cw until up, max 60 deg</p> <p>27. Tighten <b>cinches H13 and H15</b> PGT, 7/16-6in ext; A3 (4.8 ft-lb), CW2 (30RPM), MTL 30.5; push 5 lb, turn to HS</p> <p>28. Tighten <b>cinches H13 and H15</b> PGT, 7/16-6in ext ; RCW, MTL 30.5; 3/4 turn</p> <p>29. Verify anti-rotation device is up; if not, rotate bolt cw until up, max 60 deg (x2)</p> <p><u>REMOVE FQDC SHROUD</u></p> <ol style="list-style-type: none"> <li>1. Stage RET for FQDC shroud restraint</li> <li>2. Release <b>FQDC Shroud bolts</b> (4) PGT, 7/16-6in ext; A7 (9.2 ft-lb), CCW2 (30 RPM), MTL 30.5, 7 turns</li> <li>3. Restrain FQDC shroud w/RET</li> </ol> <p><u>EXTEND WINCH</u></p> <ol style="list-style-type: none"> <li>1. Actuate <b>H10 bolt</b> PGT, 7/16-6in ext; A1 (2.5 ft-lb), CW1 (10 RPM), MTL 30.5; push 5 lb, extend winch bars until winch bar clevis aligns with radiator lug (=20 turns max)</li> </ol> <p><u>RETRACT WINCH</u></p> <ol style="list-style-type: none"> <li>1. <b>PGT[A1 2.5 ft-lb, CCW1 10 RPM, MTL 30.5]-6ext 7/16:</b> Actuate H10 bolt, push 5 lb, fully retract winch bars (~25 turns max)</li> </ol> <p><u>REPLACE FQDC SHROUD</u></p> <ol style="list-style-type: none"> <li>1. Retrieve FQDC Shroud</li> <li>2. Engage <b>FQDC shroud bolts</b> (4) PGT, 7/16-6in ext; A7 (9.2 ft-lb), CW2 (30 RPM), MTL 30.5, 7 turns to HS</li> <li>3. Retrieve RET</li> </ol>	<p>18. Tighten <b>cinch H12</b> PGT, 7/16-6in ext ; RCW, MTL 30.5; 3/4 turn</p> <p>19. Verify anti-rotation device is up; if not, rotate bolt cw until up, max 60 deg</p> <p>20. Tighten <b>cinches H14 and H16</b> PGT, 7/16-6in ext; A3 (4.8 ft-lb), CW2 (30RPM), MTL 30.5; push 5 lb, turn to HS</p> <p>21. Tighten <b>cinches H14 and H16</b> PGT, 7/16-6in ext ; RCW, MTL 30.5; 3/4 turn</p> <p>22. Verify anti-rotation device is up; if not, rotate bolt cw until up, max 60 deg (x2)</p>

## P6 RADIATOR MANUAL OVERRIDE TO DEPLOY/RETRACT – TASK DATA

### Estimated Task Duration:

	With RMS	Without RMS
One EV Crew	NA	0:30 (E)
Two EV Crew	NA	1:30 (R)

### Tools:

EV1	EV2
PGT	PGT
6 Ext 7/16	6 Ext 7/16
APFR	
RET	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Max Break Away Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
PVR MDA	H32	7/16	1	12.0	19.1*	25.2	45-50	30
Cinch bolts	H11-H12	7/16	2	4.8	15.8	35.7	8-14	30
Cinch bolts	H13-H16	7/16	4	4.8	24.6	39.7	8-14	30
FQDC Shroud bolts	H5, H6, H8, H9	7/16	4	9.2	6.7	21.2 (R) 18.1 (I)	7	30
Winch bolt	H10	7/16	1	2.5	4.4*	6.4	25 (R) 20 (I)	30

\*Indicates Max On-Orbit Installation Torque

### EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
NA					

### Foot Restraints:

Task	WIF	APFR Setting
PVR MDA worksite	P6 - 16	(5,PP, E, 1)

Mass: NA

### Notes:

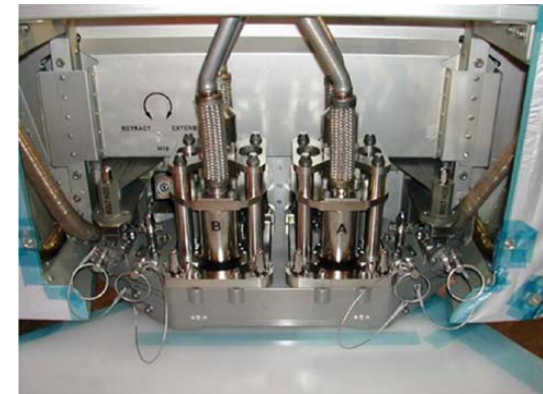
- Free drift or CMG Control with Thrusters Disabled is required while radiator is being deployed/retracted. Applies only while mechanisms are in motion

### Cautions:

- Equipment damage. Avoid contact with radiator bellows

### Warnings:

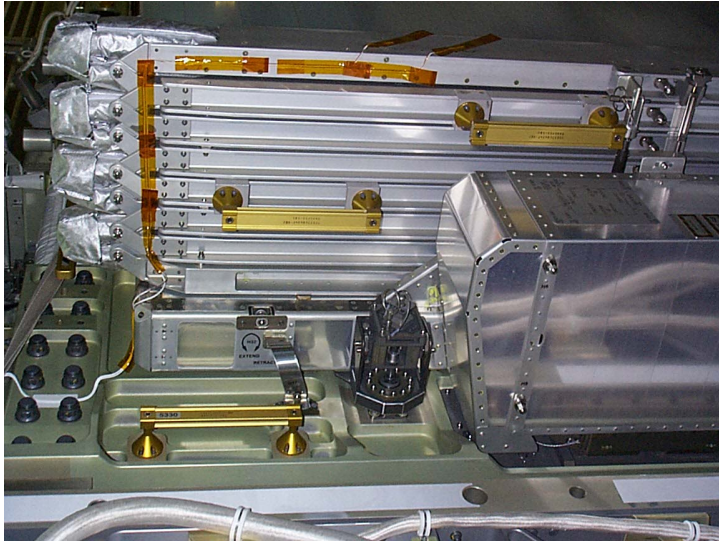
- Moving equipment. Avoid contact with panels and mechanisms during extension of radiator



PVR FQDC



# P6 RADIATOR MANUAL OVERRIDE TO DEPLOY/RETRACT – TASK DATA (Cont)

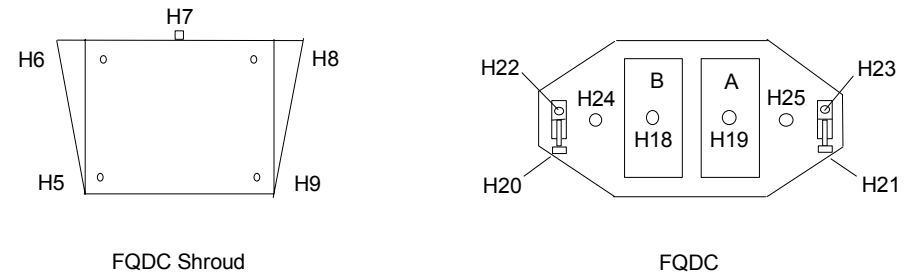
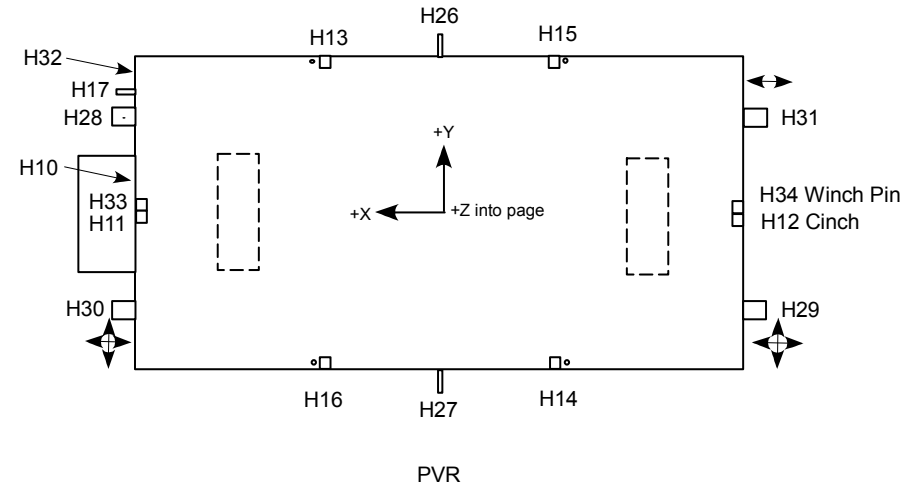


PV Radiator – MDA H32 Fastener Located Near Ground Strap



PV Radiator MDA Fastener

## PVR EVA Interfaces



- H5,6,9,8 = FQDC Shroud Fasteners
- H7 = FQDC Shroud Alignment Pin
- H10 = Winch Drive
- H11- H16 = Cinches
- H17 = Grounding Strap
- H18 - H19 = FQDC Drive bolts
- H20 - H21 = Carrier Slider bolts
- H22 - H23 = Carrier to PVR Attach
- H24 - H25 = Carrier to IEA Attach
- H26 - H27 = Center Bolts
- H28 - H31 = Corner Bolts
- H32 = Manual Deploy/Retract
- H33-H34 = Winch PIP pins

## MANUAL OVERRIDE TO DISENGAGE BETA GIMBAL ANTI-ROTATION LATCH (01:00)

TIME (HR:MN)	IV/RMS	EV1	EV2
01:00	<p>MCC-H 1. BGA 4B(2B) ANTI-ROTATION LATCH FAIL TO UNLATCH REMOTELY (ISS EPS GENERIC, <u>MALFUNCTION PROCEDURES</u>)</p> <p>IV PCS 2. Determine Anti-rotation latch posn, P6: EPS: BGA 4B(2B) <u>BGA 4B(2B)</u></p> <p>'ECU 4B(2B)' Verify Integ Cnt – Incrementing</p> <p>'BGA 4B(2B)' Record Actual Angle = _____deg Motor State - _____ Latch 1 Pin Status - _____ Latch 2 Pin Status - _____</p> <p>Refer to BMRRM Anti-Rotation Latch Table to determine beta gimbal anti-rotation latch access hole: Anti-rotation latch posn = (Hole#)</p> <p>IV PCS 3. ✓Anti-rotation latch released P6: EPS: BGA 4B(2B) <u>BGA 4B(2B)</u></p> <p>'ECU 4B(2B)' Verify Integ Cnt – Incrementing</p> <p>'BGA 4B(2B)' Verify: Latch 1 Pin Status – Unlatched Latch 2 Pin Status – Unlatched</p>	<p>Stbd Tool Box/QD BDT Board: Obtain BMRRM anti-rotation latch tool</p> <p>1. Port SAW BGA APFR: P6-39 (9,QQ,H,12) Stbd SAW BGA APFR: P6-40 (9,NN,G,3)</p> <p>2. Insert tool into designated beta gimbal hole to depress and release anti-rotation latch. Use indicator mark on tool for correct insertion depth</p>	

## BMRRM ANTI-ROTATION LATCH TABLE

Hole	Latch 1 Angle	Latch 2 Angle	Cable Restricts Access		
1	0	267.1875			
2	5.625	272.8125			
3	11.25	278.4375			
4	16.875	284.0625			
5	22.5	289.6875			
6	28.125	295.3125	J1 – Primary Power		
7	33.75	300.9375	J1 – Primary Power		
8	39.375	306.5625	J1 – Primary Power		
9	45	312.1875	J1 –Primary Power		
10	50.625	317.8125			
11	56.25	323.4375			
12	61.875	329.0625			
13	67.5	334.6875			
14	73.125	340.3125			
15	78.75	345.9375			
16	84.375	351.5625			
17	90	357.1875			
18	95.625	2.8125			
19	101.25	8.4375			
20	106.875	14.0625			
21	112.5	19.6875			
22	118.125	25.3125			
23	123.75	30.9375	J4 – 1553 Bus B		
24	129.375	36.5625	J4 – 1553 Bus B		
25	135	42.1875	J4 – 1553 Bus B		
26	140.625	47.8125			
27	146.25	53.4375			
28	151.875	59.0625			
29	157.5	64.6875			
30	163.125	70.3125			
31	168.75	75.9375			
32	174.375	81.5625			
33	180	87.1875			
34	185.625	92.8125			
35	191.25	98.4375			
36	196.875	104.0625			
37	202.5	109.6875			
38	208.125	115.3125			
39	213.75	120.9375			
40	219.375	126.5625			
41	225	132.1875			
42	230.625	137.8125	J2 – Secondary Pwr (RPCM XX A RPC 2)		
43	236.25	143.4375	J2 – Secondary Pwr (RPCM XX A RPC 2)		
44	241.875	149.0625	J2 – Secondary Pwr (RPCM XX A RPC 2)		
45	247.5	154.6875			
46	253.125	160.3125			
47	258.75	165.9375			
48	264.375	171.5625			
49	270	177.1875			
50	275.625	182.8125			
51	281.25	188.4375	J3 – 1553 Bus A and Sec Pwr (RPCM XX A RPC 1)		
52	286.875	194.0625	J3 – 1553 Bus A and Sec Pwr (RPCM XX A RPC 1)		
53	292.5	199.6875	J3 – 1553 Bus A and Sec Pwr (RPCM XX A RPC 1)		
54	298.125	205.3125			
55	303.75	210.9375			
56	309.375	216.5625			
57	315	222.1875			
58	320.625	227.8125			
59	326.25	233.4375			
60	331.875	239.0625			
61	337.5	244.6875			
62	343.125	250.3125			
63	348.75	255.9375			
64	354.375	261.5625			

# MANUAL OVERRIDE TO UNLATCH/LATCH (TENSION) SABB

IV/RMS	EV
<p>Identify Affected Power Channel XX = _____</p> <p><u>IF UNLATCHING SABB</u></p> <p>MCC-H 1. Perform {3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY} (SODF: EPS: MALFUNCTION: PRIMARY POWER)</p> <p>IV 2. GO for EV crew ingress at worksite</p> <p><u>IF TENSIONING SABB</u></p> <p>MCC-H 1. Perform {3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY} (SODF: EPS: MALFUNCTION: PRIMARY POWER)</p> <p>THEN:</p> <p>IV 2. If required (see Task Data notes), Verify affected SABB positioned over the IEA and BGA latched</p> <p>PCS PVM: EPS: BGA XX  <span style="border: 1px solid black; padding: 2px;">BGA XX</span>            'ECU XX'            Verify:            Integ Cnt – Incrementing</p> <p>'BGA XX'            Verify:            Actual Angle, deg = 270.000 (± 0.5) (Left SABB)            OR            Actual Angle, deg = 90.000 (± 0.5) (Right SABB)</p> <p>Motor State – OFF            Latch 1 Pin Status – Latched</p> <p>IV 3. GO for EV crew ingress at worksite</p> <p style="text-align: center;"><u>NOTE</u></p> <p>Free Drift or CMG Control with Thrusters Disabled is required while SABB is being unlatched/latched. Applies only while mechanisms are in motion</p> <p>MCC-H 4. Configure ISS/Orbiter attitude control to CMG Control with thrusters disabled</p> <p>IV 5. When task complete, give MCC-H GO to resume nominal attitude control</p>	<div style="border: 3px double black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><u>WARNING</u></p> <p>Sharp edge/pinch point/entrapment hazard – Avoid contact with outboard underside of SABB due to exposed reels, guide-wire and tension mechanisms</p> <p style="text-align: center;">Avoid contact with blanket box latches during manual override operation</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;"><u>CAUTION</u></p> <p>Maintain a constant push force (3-10 lb) on the MDA fastener anti-rotation collar during fastener rotation</p> </div> <p><u>MANUAL OVERRIDE TO UNLATCH SABB</u></p> <ol style="list-style-type: none"> <li>1. On IV GO (see IV column, Unlatching SABB, step 2) – Enter worksite area</li> <li>2. If required, APFR, setup and ingress (see Task Data for WIF position, APFR settings, and BGA angle)</li> <li>3. Release PIP pin from back-up position lever</li> <li>4. Move override lever to MANUAL position</li> <li>5. Insert PIP pin into lock lever position</li> <li>6. Drive <b>MDA drive fastener</b>              PGT, 7/16-2in ext; A6 (8.3 ft-lb), CCW2 (30 RPM), MTL 30.5; Push to engage (3-10 lb), 48 ± 1 turns until visual indication of latch position or HS</li> <li>7. Release PIP pin from override positioning lever</li> <li>8. Move override lever to AUTOMATIC position</li> <li>9. Insert PIP pin into lock lever position</li> <li>10. Drive <b>MDA drive fastener</b> (opposite direction)              PGT 7/16-2in ext; RCW, MTL 30.5; Push to engage (3-10 lb), ¼ turn to engage clutch pins</li> </ol> <p><u>MANUAL OVERRIDE TO TENSIONING SABB</u></p> <ol style="list-style-type: none"> <li>1. On IV GO (see IV column, Tensioning SABB, step 3), Enter worksite area</li> <li>2. If required, APFR, setup and ingress (see Task Data for WIF position, APFR settings, and BGA angle)</li> <li>3. Release PIP pin from back-up position lever</li> <li>4. Move override lever to MANUAL position</li> <li>5. Insert PIP pin into lock lever position</li> <li>6. Drive <b>MDA drive fastener</b>              PGT, 7/16-2in ext; A6 (8.3 ft-lb), CW2 (30 RPM), MTL 30.5; Push to engage (3-10 lb), 48 ± 1 turns until visual indication of latch position or HS. The latches along the blanket box are visible and will move to the engaged position</li> <li>7. Release PIP pin from override positioning lever</li> <li>8. Move override lever to AUTOMATIC position</li> <li>9. Insert PIP pin into lock lever position</li> <li>10. Drive <b>MDA drive fastener</b> (opposite direction)              PGT 7/16-2in ext; RCCW, MTL 30.5; Push to engage (3-10 lb), ¼ turn to engage clutch pins</li> </ol>

## MANUAL OVERRIDE TO UNLATCH/LATCH (TENSION) SABB (Cont)

### Estimated Task Duration:

	With RMS	Without RMS
One EV Crew	NA	0:30
Two EV Crew	NA	NA

### Tools:

EV1	EV2
PGT	NA
2 Ext 7/16	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Max Break Away Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
SABB MDA Fastener	Yes	7/16	1 per	NA	7.5	12	48	30

### EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
NA					

### Foot Restraints:

Task	WIF	APFR Setting	BGA Angle
IEA Non-keel side – Right SABB	P4/S4-26; P6/S6-38	(12,FF,F,3)	90
IEA Non-keel side – Left SABB	P4/S4-26; P6/S6-38	(12,FF,E,9)	270
IEA Keel side – Right SABB	P4/S4-25; P6/S6-37	(12,FF,F,3)	90
IEA Keel side – Left SABB	P4/S4-25; P6/S6-37	(12,FF,E,9)	270

Mass: NA

### Notes:

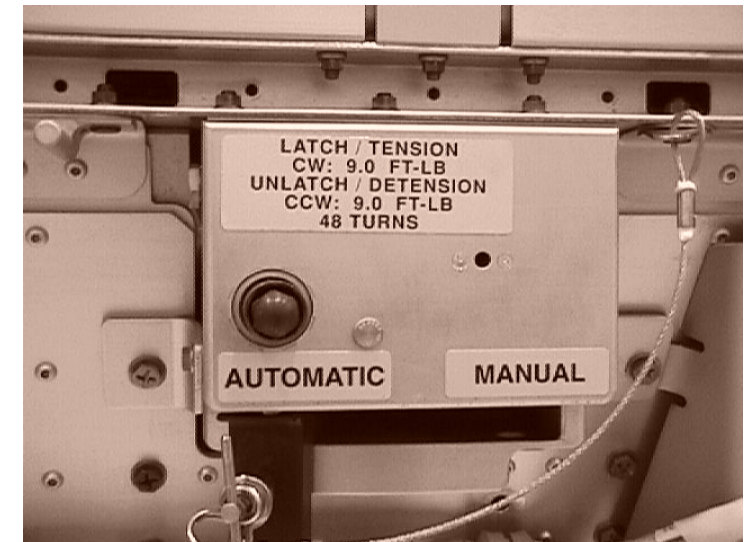
1. It has been demonstrated in the NBL that the EVA crewmember can access the SABB Manual Override Fastener from a free floating position on the mast canister. If the EVA crew thinks they can actuate the SABB Manual Override Fastener from a free floating position on the mast canister, there is no need to position the BGA per IV step 2
2. Free Drift or CMG Control with Thrusters Disabled is required while SABB is being unlatched/latched. Applies only while mechanisms are in motion

### Cautions:

1. Equipment damage – Maintain a constant push force (3-10 lb) on the MDA fastener anti-rotation collar during fastener rotation. Damage to the locking collar and/or the fastener could result if the collar is allowed to extend during fastener rotation
2. Equipment damage – Avoid contact with blanket box latches and mechanisms on underside of blanket box

### Warnings:

1. Sharp edge/pinch point/entrapment hazard – Avoid contact with outboard underside of SABB due to exposed reels, guide-wire and tension mechanisms
2. Moving equipment. Avoid contact with blanket box latches during manual override operation



SABB MDA

# MANUAL OVERRIDE TO EXTEND/RETRACT MAST

IV	EV
<p>Identify Affected Power Channel XX = _____</p> <p>MCC-H 1. Perform {3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY} (SODF: EPS: MALFUNCTION: PRIMARY POWER)</p> <p>OR</p> <p>Perform {3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY} (SODF: EPS: MALFUNCTION: PRIMARY POWER)</p> <p>IV PCS 2. Verify affected SABB positioned over the IEA and BGA latched PVM: EPS: BGA XX <b>BGA XX</b> 'ECU XX' Verify: Integ Cnt – Incrementing</p> <p>'BGA XX' Verify: Actual Angle, deg = 180.000 (+/- 0.5) Motor State – OFF Latch 1 Pin Status– Latched</p> <p>IV 3. GO FOR EV CREW INGRESS AT WORKSITE</p> <p style="text-align: center;"><u>NOTE</u></p> <p>Free Drift or CMG Control with Thrusters Disabled is required while solar array is being deployed/retracted. Applies only while mechanisms are in motion</p> <p>MCC-H 4. Configure ISS/Orbiter attitude control to CMG Control with thrusters disabled</p>	<div style="border: 2px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><u>WARNING</u></p> <p>Sharp edge/pinch point/entrapment hazard – Avoid contact with outboard underside of SABB due to exposed reels, guide-wire and tension mechanisms</p> <p>Avoid contact with blanket box latches during manual override operation</p> </div> <p style="text-align: center;"><u>MANUAL OVERRIDE TO EXTEND MAST</u></p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><u>CAUTION</u></p> <p>If excessive blanket panel "stiction" occurs during mast deployment, perform contingency incremental deployment</p> </div> <ol style="list-style-type: none"> <li>1. On IV GO (see IV column, step 3), Enter worksite area</li> <li>2. Set up and ingress APFR (see Task Data page)</li> <li>3. If reqd, Deploy MCHD PGT swing arm, install MCHD onto mast canister, zip nuts (4)</li> <li>4. If reqd, secure <b>MCHD fasteners</b> (4) PGT, 7/16-2in ext; A5 (7.0 ft-lb), CW2 (30RPM), MTL 30.5; to HS</li> <li>5. Rotate <b>Manual Override Actuator Shaft</b> on left side of MDA Ratchet, 7/16-2in ext; cw; 180 deg to disengage MDA, √indicator – MANUAL</li> <li>6. If reqd, place PGT in MCHD PGT swing arm</li> </ol> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><u>CAUTION</u></p> <p>Crew must monitor the tension bar. Stop SAW deployment if the tension bar rises more than 1.5 inches from the sill. Drive MDA EVA override fastener until tension bar returns to 1.5 inches from the sill: PGT, 7/16-2in ext; A7 (9.2 ft-lb), CW3 (60 RPM), MTL 30.5. When panels release and tension bar returns to the sill, deployment can continue</p> </div> <p style="text-align: center;"><u>NOTE</u></p> <p>Insolation is not required for this task, unless needed for visual abort cues. As expected, the tension bar will rise 18 to 20 inches from the sill as the last half mast bay is deployed.</p> <p>Extension complete when: Visual observation of the last mast bay visual indicators (black/white, cross hatched). Hard stop, sharp rise in tool torque.</p> <p>If reqd, off-load drive shaft with IVA pipe wrench</p> <ol style="list-style-type: none"> <li>7. Drive <b>MDA EVA override fastener</b> PGT, 7/16-2in ext; A7 (9.2 ft-lb), CCW3 (60 RPM), MTL 30.5; ~ 78 turns until 1 mast bay is deployed</li> <li>8. Give MCC-H GO to place solar array blanket boxes in high tension</li> </ol>

## MANUAL OVERRIDE TO EXTEND/RETRACT MAST (Cont)

IV	EV
<p>MCC-H 5. On EV GO (see EV column, Extend Mast, step 8), place solar array blanket boxes in high tension, when complete, give EV GO to continue SAW deployment</p> <p>MCC-H 6. On EV GO – resume nominal attitude control</p>	<ol style="list-style-type: none"> <li>9. On MCC-H GO (see IV column, step 5), drive <b>MDA EVA override fastener</b> PGT, 7/16-2in ext; A7 (9.2 ft-lb), CCW3 (60 RPM), MTL 30.5; 2382 turns (x1 PGT battery will actuate approx 1300 turns), PGT battery changeout expected</li> <li>10. While holding the <b>PGT with 7/16-2in ext</b> on the backup drive fastener, <b>Ratchet with 7/16-2in ext</b> – rotate Manual Override Actuator Shaft 180 to disengage MDA, indicator – AUTOMATIC</li> <li>11. Give MCC-H GO to resume nominal attitude control</li> <li>12. Egress worksite, if utilized, leave MCHD on mast canister</li> </ol> <p><u>MANUAL OVERRIDE TO RETRACT MAST</u></p> <ol style="list-style-type: none"> <li>1. On IV GO (see IV column, step 3), Enter worksite area</li> <li>2. Set up and ingress APFR (see Task Data page)</li> <li>3. If reqd, deploy MCHD PGT swing arm, install MCHD onto mast canister, zip nuts (4)</li> <li>4. If reqd, secure <b>MCHD fasteners</b> (4) PGT, 7/16-2in ext; A5 (7.0 ft-lb), CW2 (30RPM), MTL 30.5; to HS</li> <li>5. Rotate <b>Manual Override Actuator Shaft</b> on left side of MDA Ratchet, 7/16-2in ext; cw; 180 deg to disengage MDA, indicator – MANUAL</li> <li>6. If reqd, place PGT in MCHD PGT swing arm</li> <li>7. Drive MDA EVA override fastener PGT, 7/16-2in ext; A7 (9.2 ft-lb), CW3 (60 RPM), MTL 30.5; 2460 turns (x1 PGT battery will actuate approx 1300 turns), PGT battery changeout expected</li> <li>8. While holding the <b>PGT with 7/16-2in ext</b> on the backup drive fastener, <b>Ratchet with 7/16-2in ext</b> – rotate Manual Override Actuator Shaft 180 deg to disengage MDA, indicator – AUTOMATIC</li> <li>9. Give MCC-H GO to resume nominal attitude control</li> <li>10. Egress worksite, if utilized, leave MCHD on mast canister</li> </ol>



# MANUAL OVERRIDE TO EXTEND/RETRACT MAST – TASK DATA

## Estimated Task Duration:

	With RMS	Without RMS
One EV Crew	NA	2:00
Two EV Crew	NA	NA

## Tools:

EV1	EV2
PGT with 7/16-2in ext	NA
Ratchet wrench with 7/16-2in ext	
If reqd, MCHD	
APFR	

## EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Max Break Away Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
MCHD Fasteners	NA	7/16	4	7.0	8.1	11.0 (L) 12.2 (R)	Zip	10
Mast Canister Manual Override Actuator Shaft	Yes	7/16	2 per	NA	2.5	10	0.5	10
Mast Canister MDA Fastener	Yes	7/16	1 per	NA	9.0	19.3	2461	60

## EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
NA					

## Foot Restraints:

Task	WIF	APFR Setting
IEA Keel Side	P6/S6-37, P4/S4-25	(12,FF,F,12)
IEA Non-keel side	P6/S6-38, P4/S4-26	(12,FF,F,12)

Mass: NA

## Notes:

- Insulation is not required for this task, unless needed for visual abort cues. As expected, the tension bar will rise 18 to 20 inches from the sill as the last half mast bay is deployed
- Extension complete when: Visual observation of the last mast bay visual indicators (black/white, cross hatched). Hard stop, sharp rise in tool torque
- The mast canister needs to be positioned such that the MDA faces the direction of the IEA. This will allow an EV crewmember to set up an APFR to access the MDA
- In order to release MCHD fasteners from zipnuts, inward force on each bolt must be minimized

## Cautions:

- Crew must monitor the tension bar. Stop SAW deployment if the tension bar rises more than 1.5 inches from the sill. Drive MDA EVA override fastener until tension bar returns to 1.5 inches from the sill. When panels release and tension bar returns to the sill, deployment can continue
- Equipment damage – Avoid contact with blanket box latches and mechanisms on underside of blanket box
- If monitoring IVA notes excessive blanket panel "stiction", during mast deployment, abort deployment. Coordinate with IVA to perform contingency incremental deploy. Not applicable for retraction

## Warnings:

- Sharp edge/pinch point/entrapment hazard – Avoid contact with outboard underside of SABB due to exposed reels, guide-wire and tension mechanisms
- Moving equipment. Avoid contact with blanket box latches during manual override operation



Mast Canister MDA



## ASSISTED SOLAR ARRAY DEPLOY/RETRACT

### WARNING

1. Sharp edges:
  - a. SABB (skirt, swing bolts)
  - b. Solar cells
  - c. Springs along tension bar
  - d. Panel hinges
  - e. Guide cable burrs or frays
  - f. Mast Canister roller guides
  - g. Braided cables
  - h. Fastener exposed threads
  - i. Exposed bolts in rib cavities on mast canister
2. Shock hazard:
  - a. Avoid EMU contact with FCC and Kapton part of solar array panels
  - a. EV crew will only contact energized surfaces with approved tools that have been insulated with Kapton tape to prevent molten metal and shock
  - b. Solar array to be manipulated will be shunted prior to EV crew entering worksite
3. Pinch:
  - a. Lower SABB exposed reels and pulleys (guide wire and tensioning mechanisms)
  - b. Solar array mast during deploy/retraction
4. Avoid inadvertent contact with:
  - a. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless the beta gimbal is locked and the motor is turned off

## ASSISTED SOLAR ARRAY DEPLOY/RETRACT (Cont)

IV/SSRMS	EV1	EV2
Deploy Solar Array	<p style="text-align: center;"><u>ASSISTED DEPLOY</u></p> <ol style="list-style-type: none"> <li>1. Verify glove gauntlets cover wrist disconnects</li> <li>2. Determine SAW problem (perform full <u>SAW SURVEY FOR DEPLOY</u> below as required)</li> <li>3. Perform <u>SAW WORKAROUND</u> for problem seen</li> <li>4. Translate ~ 3 feet away if on SSRMS or layback below Mast Canister separation plane, and give GO for deploy</li> <li>5. Monitor array, call ABORT if problem seen</li> <li>6. Repeat steps 1 thru 5 as required, translating in or away as required</li> </ol> <p style="text-align: center;"><u>SAW SURVEY FOR DEPLOY (IF REQD)</u></p> <ol style="list-style-type: none"> <li>1. Prior to deploy, perform SABB/SAW survey to verify the following: <ul style="list-style-type: none"> <li><input type="checkbox"/> Tension reels are spooled (2 per SABB)</li> <li><input type="checkbox"/> No slack in tension cables (2 per SABB)</li> <li><input type="checkbox"/> Center, outboard guide wires run through pulleys and reels (3 per SABB, but cannot check inboard guide wire due to cover)</li> <li><input type="checkbox"/> Center, outboard guide wire not rubbing against power cable (3 per SABB, but cannot check inboard guide wire due to cover)</li> <li><input type="checkbox"/> No slack in guide wires (3 per SABB)</li> </ul> </li> </ol>	
Retract Solar Array  Retract Solar Array	<p style="text-align: center;"><u>ASSISTED RETRACT</u></p> <ol style="list-style-type: none"> <li>1. Verify glove gauntlets cover wrist disconnects</li> <li>2. Determine SAW problem (perform full <u>INITIAL SAW SURVEY PRIOR TO RETRACT</u> below as reqd)</li> <li>3. Perform <u>SAW WORKAROUND</u> for problem seen</li> <li>4. Translate ~ 3feet away if on SSRMS or layback below Mast Canister separation plane, and give GO for retract</li> <li>5. Monitor array, call ABORT if problem seen</li> <li>6. Repeat steps 1 thru 5 as reqd, until 1 bay out</li> <li>7. Perform <u>1 BAY OUT SAW SURVEY DURING FINAL RETRACT</u></li> <li>8. Give IV GO for final bay retraction</li> <li>9. Verify guide wires remain tight and grommets are not caught between panels</li> <li>10. If latching to be performed, verify latches aligned and within reach of latch pins on upper blanket box</li> </ol> <p style="text-align: center;"><u>INITIAL SAW SURVEY PRIOR TO RETRACT (IF REQD)</u></p> <ol style="list-style-type: none"> <li>1. Prior to retract, perform SABB/SAW survey to verify the following: <ul style="list-style-type: none"> <li><input type="checkbox"/> Y-guides (4 per SABB) should not be visible</li> <li><input type="checkbox"/> Center, outboard guide wire not rubbing against power cable</li> <li><input type="checkbox"/> Foam pads in SABB base (7 per SABB) not overlapping and appear seated in original location (look through leaders)</li> </ul> </li> </ol> <p style="text-align: center;"><u>1 BAY OUT SAW SURVEY DURING FINAL RETRACT</u></p> <ol style="list-style-type: none"> <li>1. Perform SABB/SAW survey to verify the following: <ul style="list-style-type: none"> <li><input type="checkbox"/> Blanket fully contained within blanket box</li> <li><input type="checkbox"/> Outboard STE loops neatly stacked within goal posts</li> <li><input type="checkbox"/> Upper blanket box cover guide pins/alignment tabs aligned with goal posts</li> <li><input type="checkbox"/> Guide wires (3 per SABB) retracted with no slack</li> </ul> </li> </ol>	

## ASSISTED SOLAR ARRAY DEPLOY/RETRACT (Cont)

IV/SSRMS	EV1	EV2
	<p style="text-align: center;"><u>SAW WORKAROUND</u></p> <p><b>Over-center Hinge Reset:</b>            A. Use cheater bar to press metal panel hinge into normal configuration; avoid contact with guide wire</p> <p><b>Uneven Panel Distribution (causes stuck grommets during retract):</b>            B. Get as close as possible to lower blanket box near center guide wire on affected solar array            C. Use TPS scraper or cheater bar to evenly distribute panel folds along array (fluff); avoid contact with guide wire</p> <p><b>Stuck Grommet:</b></p> <p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">Provided a fray is not causing the grommet fault, panel fluffing near center guide wire will likely clear problems at all three guide wires</p> <p>If guide wire fray NOT suspected:            D. Get as close as possible to affected panel near center guide wire            E. Use TPS scraper or cheater bar to evenly distribute panel folds (fluff); avoid contact with guide wire            F. If no joy; perform steps as if guide wire fray suspected</p> <p>If guide wire fray is suspected:            G. Use TPS scraper or cheater bar to free grommet; repeat as necessary for lower panel grommets as guide wire fray retracts</p> <p><b>Guide Wire Slack Due to Reel/Pulley Jam:</b></p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;"><u>CAUTION</u></p> <p style="text-align: center;">Guide wire can jump out of pulley track, attempt cable manipulation from inside blanket box first. If guide wire must be handled from outside of blanket box, avoid pulling guide wire to side of pulley plane</p> </div> <p>H. Verify all grommets on affected guide wire are loose            I. Use needle nose pliers to pull cable out of reel; allow cable to retract</p> <p><b>Out of Plane Panels or Guide Wire Slack After Retract:</b>            J. Perform steps for stuck grommet            K. If no joy; GCA SSRMS (if available) to goal posts of affected blanket            L. Use gloved hand to realign STE loops between goal posts; avoid contact with FCC</p> <p><b>Y-Guide Reset</b>            M. Verify SABB is unlatched (low tension)            N. Use BRS Pin Tool on short skirt stiffener to lift tension bar; TPS scraper can be used assist with tension bar manipulation            O. Lower tension bar on to Y-guide</p> <p><b>Leader Disconnected from Tension Bar</b>            P. If spring not connected to leader, inspect tension bar for spring condition and determine if it will interfere with latching            Q. If spring still connected to leader, use needle nose pliers to retain loose piece and cut leader with EVA scissors; stow in trash            R. If spring needs to be cut from tension bar, use needle nose pliers to retain loose piece and cut spring with compound cutters; stow in trash</p>	

## ASSISTED SOLAR ARRAY DEPLOY / RETRACT – TASK DATA

### Estimated Task Duration:

	With RMS	Without RMS
One EV Crew	NA	NA
Two EV Crew	As long as it takes	As long as it takes

### Tools:

EV1	EV2
APFR	Crewlock Bag
Cheater Bar with 1.5" bail drive lever	Digital Camera
Needle Nose Pliers	BRT
Compound Cutters	
Loop Pin Puller	
TPS Scraper	
BRS Pin Tool	
EVA Scissors	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
NA								

### EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
NA					

### Foot Restraints:

Task	WIF	APFR Setting

### Notes:

1. Provided a fray is not causing the grommet fault, panel fluffing near center guide wire will likely clear problems at all three guide wires

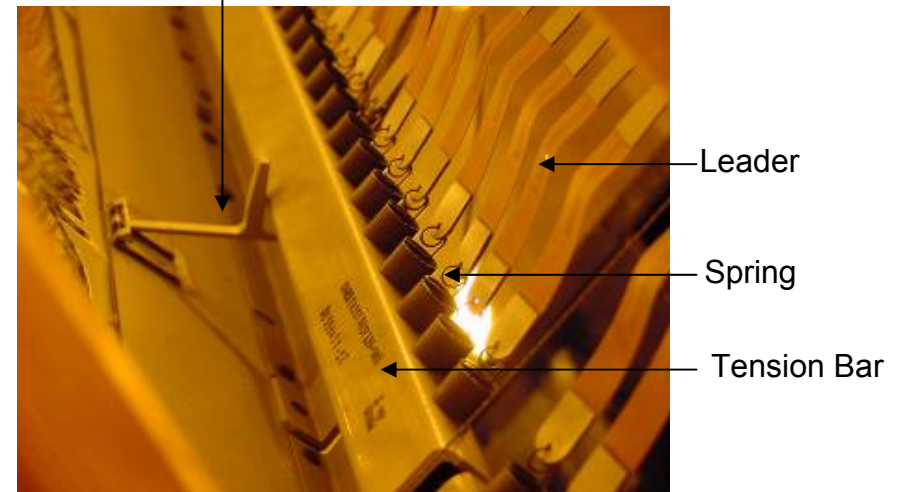
### Cautions:

1. Guide wire can jump out of pulley track, attempt cable manipulation from inside blanket box first. If guide wire must be handled from outside of blanket box, avoid pulling guide wire to side of pulley plane

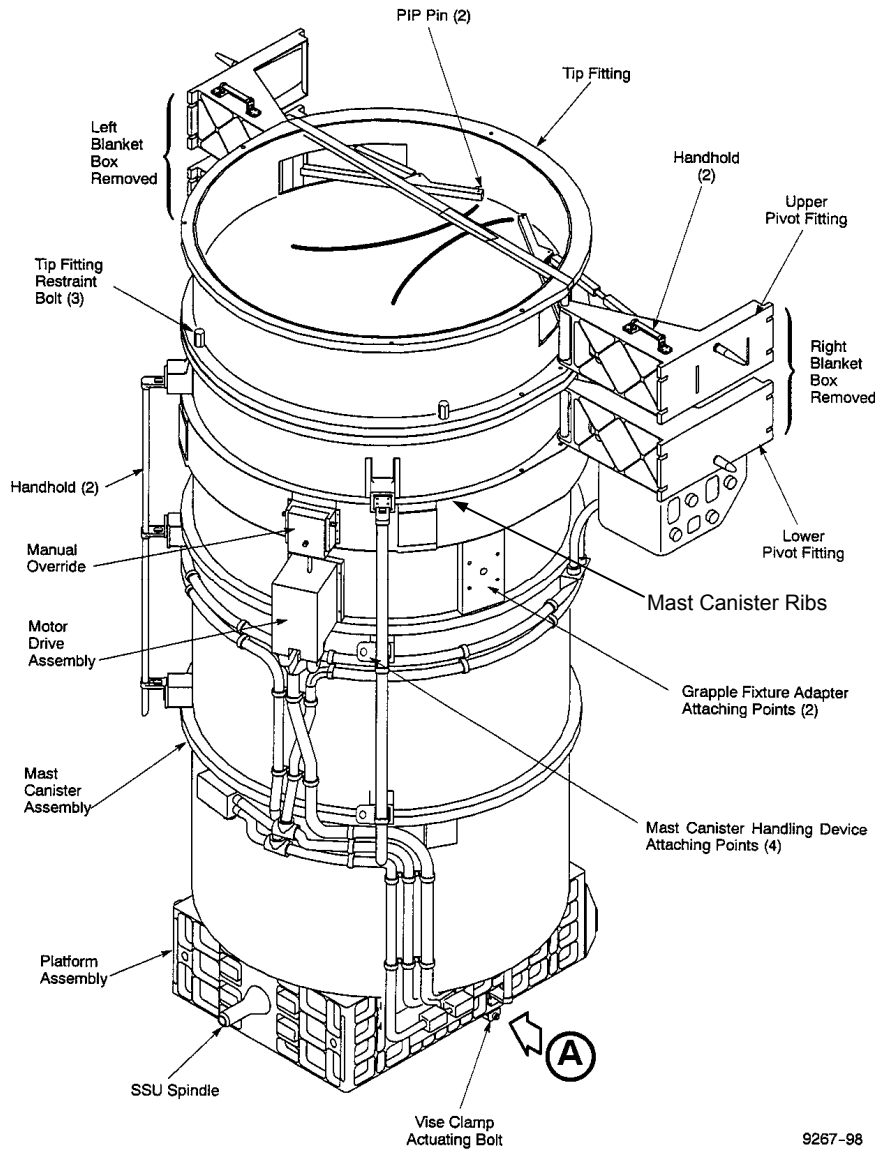
### Warnings:

1. Sharp edge/pinch point/shock hazard: Avoid EMU contact with the following:
  - Lower SABB exposed reels and pulleys (guide wire and tensioning mechanisms)
  - SABB skirt
  - Swing bolts
  - Springs on tension bar
  - Panel hinges
  - Guide wire frays
  - Braided cables
  - Fastener exposed threads
  - Exposed bolts in rib cavities on mast canister
  - Mast roller guides
  - FCC and Kapton part of solar array panels

### Y-guide

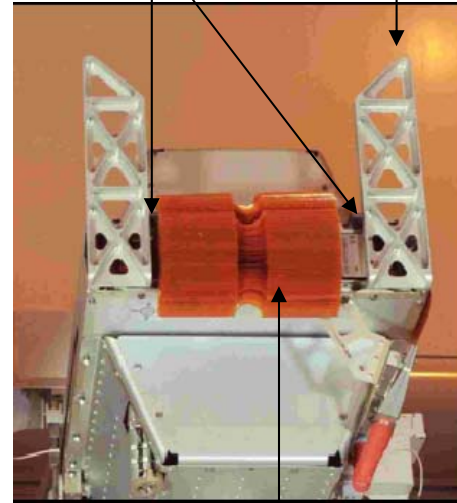


# ASSISTED SOLAR ARRAY DEPLOY/RETRACT – TASK DATA (Cont)



9267-98

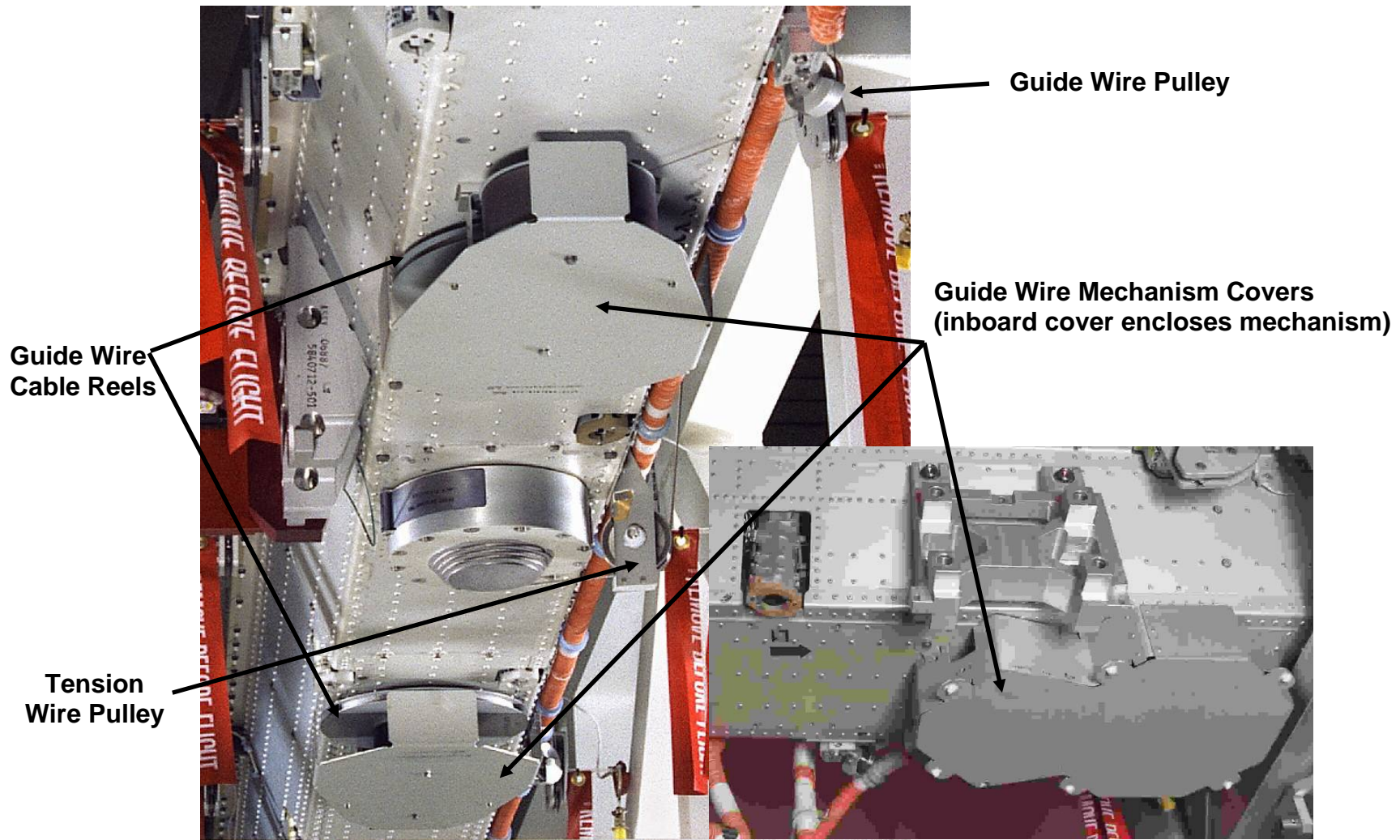
Cover Guide Pins/alignment tab      Goal Posts



STE Loops  
(FCC is inside BB)



**ASSISTED SOLAR ARRAY DEPLOY/RETRACT – TASK DATA (Cont)**



# SABB SPOOL RE-TENSION

IV/RMS	EV1	EV2
<p>Identify Affected Power Channel XX = _____</p> <p>Which SABB needs re-tensioning _____</p> <p>Which Tension Reel needs re-tensioning _____</p> <p>IV 1. Retract Affected SAW approx 1 mast bay only if Mast is fully deployed</p> <p>PCS PVM: EPS: SAW XX  <span style="border: 1px solid black; padding: 2px;">SAW</span>  'Mast'  sel Mast Commands</p> <p><span style="border: 1px solid black; padding: 2px;">SAW XX Mast</span></p> <p><b>cmd Mast – Retract Arm</b>  <b>cmd Mast – Retract</b></p> <p>Wait approx 20 sec (~ 1 bay)  <b>cmd Mast – Abort</b></p> <p>√MDA Voltage, <math>V &lt; 10 (\pm 2.8)</math></p> <p>2. Unlatch affected SABB. If required: Perform {1.3.450 SAW XX SABB INITIAL UNLATCH} (SODF: EPS: ACTIVATION AND CHECKOUT: CHANNEL ACTIVATION), step 2 for LBB or step 3 for RBB (NOTE: BRS Pin visual checks can be ignored)</p> <p>MCC-H 3. Position and safe SAW for Tension Reel Task. Perform {2.101 PVM BGA XX ENGAGE ANTIROTATION LATCH} (SODF: EPS: NOMINAL: PRIMARY POWER), using the following values:</p> <p>If Right SABB (Inboard Reel)  BGA XX Cmded Angle = 80.000 deg  BGA XX Latch Select = 1  If Right SABB (Outboard Reel)  BGA XX Cmded Angle = 93.000 deg  BGA XX Latch Select =  If Left SABB (Inboard Reel)  BGA XX Cmded Angle = 285.000 deg  BGA XX Latch Select = 2  If Left SABB (Outboard Reel)  BGA XX Cmded Angle = 283.000 deg  BGA XX Latch Select = 1</p>	<div style="border: 3px double black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><b>WARNING</b></p> <p>Moving equipment hazard. Stay clear of SABB and capture latch mechanisms</p> <hr/> <p>Moving equipment hazard. Avoid contact with mast canister/beta gimbal during rotation of SAW</p> <hr/> <p>Sharp edges:  Pulley shroud at machined edges  Guide wire mechanism cover at machined edges  Guide wire mechanism  Guide wire pulley  Guide wire  Top flange of blanket box  Protrusions (4) on tension reel housing</p> </div> <p style="text-align: center;"><u>TENSION REEL TASK SETUP</u></p> <p>1. Translate to P6</p> <p>2. Set up APFR (see Task Data page)</p> <p>3. Ingress APFR</p>	<div style="border: 3px double black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><b>WARNING</b></p> <p>Moving equipment hazard. Stay clear of SABB and capture latch mechanisms</p> <hr/> <p>Moving equipment hazard. Avoid contact with mast canister/beta gimbal during rotation of SAW</p> <hr/> <p>Sharp edges:  Pulley shroud at machined edges  Guide wire mechanism cover at machined edges  Guide wire mechanism  Guide wire pulley  Guide wire  Top flange of blanket box  Protrusions (4) on tension reel housing</p> </div> <p style="text-align: center;"><u>TENSION REEL TASK SETUP</u></p> <p>1. Translate to P6</p> <p>2. Set up APFR (see Task Data page)</p> <p>3. Ingress APFR using EV 1 ingress aid or EV 1 for assistance</p>

## SABB SPOOL RE-TENSION (Cont)

IV/RMS	EV1	EV2
<p>IV 4. SSRMS: SSRMS RECONFIGURATION FOR EVA SUPPORT (SODF: ROBO PROCEDURE REFERENCE)</p> <p>5. SRMS: SRMS RECONFIGURATION FOR EVA SUPPORT (FDF: PDRS PROCEDURE REFERENCE)</p> <p style="text-align: center;"><u>NOTE</u></p> <p>Free Drift or CMG Control with Thrusters Disabled is required while the EV crewmembers are handling the cable</p> <p>MCC-H 6. Configure ISS/Orbiter attitude control to CMG control with thrusters disabled</p> <p>IV 7. When task complete, give MCC-H GO to resume nominal attitude control</p>	<p><u>INSTALL CABLE ON OUTBOARD REEL</u></p> <p>1. Assist EV2 with cable as required</p> <p style="text-align: center;"><u>NOTE</u></p> <p>The reel will rotate a fraction of a turn without resistance. Some uneven tension and binding may be initially detected as internal mechanism seats. The 2.5 turn count begins when this minimal rotational resistance (approx 2-6 lb) is encountered. The tension reel housing will self tend back to initial position. Hand guidance is required to control rate</p> <p>2. Rotate tension reel ccw by hand approx 2.5-2.75 turns to hard stop</p> <p style="text-align: center;"><u>NOTE</u></p> <p>EV1 acts as the "clutch" on reel in case EV2 lets go. Tension reel housing will self tend back to initial position. Hand guidance is required to control rate of motion</p> <p>3. Maintain reel and help tend cable during EV2 alignment</p> <p>4. Inspect final cable routing on tension reel grooves, through pulley, and clear of blanket box fasteners</p> <p>5. Take closeout photos</p> <p>6. Egress APFR</p> <p><u>INSTALL CABLE ON INBOARD REEL</u></p> <p>1. Set up APFR (see task data)</p> <p>2. Ingress APFR</p> <p>3. Repeat <u>INSTALL CABLE ON OUTBOARD REEL</u> for the SABB inboard reel</p> <p>4. Give IV GO for solar array deploy</p>	<p><u>INSTALL CABLE ON OUTBOARD REEL</u></p> <p style="text-align: center;"><u>NOTE</u></p> <p>Pull cable on bottom side of blanket box running between pulley and tension reel. There will be approx 2 ft of cable slack. The tension bar will be pulled into position against blanket box</p> <p>1. Using the loop pin puller, pull slack on tension cable by pulling cable through pulley using light force (expect 5-10 lb pull force. If force is high, contact MCC)</p> <p>2. Align cable through pulley</p> <p>3. Maintain cable tension during reel rotation using loop pin puller</p> <p>4. Feed cable onto reel using loop pin puller as reel rotates back cw under it's own spring power</p> <p>5. Remove loop pin puller</p> <p>6. Egress APFR</p> <p><u>INSTALL CABLE ON INBOARD REEL</u></p> <p>1. Set up APFR (see Task Data page)</p> <p>2. Ingress APFR using EV1 ingress aid or EV1 for assistance</p> <p>3. Repeat <u>INSTALL CABLE ON OUTBOARD REEL</u> for the SABB inboard reel</p>



**SABB SPOOL RE-TENSION (Cont)**

IV/RMS	EV1	EV2
<p>MCC-H 8. Return SAW/BGA to Deploy Position. If reqd: Perform {2.101 PVM BGA XX ENGAGE ANTIROTATION LATCH} (SODF: EPS: NOMINAL: PRIMARY POWER)</p> <p>IV 9. Return to Nominal SAW Deploy Camera configuration (Truss Cameras, PLB Cameras, etc)</p> <p>10. SSRMS: SSRMS RECONFIGURATION FOR SAW VIEWING (SODF: ROBO PROCEDURE REFERENCE)</p> <p>11. SRMS: SRMS RECONFIGURATION FOR SAW VIEWING (FDF: PDRS PROCEDURE REFERENCE)</p> <p>MCC-H 12. Re-Latch (Tension) Affected SABB If reqd: Perform {1.3.452 SAW XX DEPLOY} (SODF: EPS: ACTIVATION AND CHECKOUT: CHANNEL ACTIVATION) step 13 for LBB, or step 14 for RBB</p>	<p>IF REQD:</p> <p><u>TENSION REEL JAM CONTINGENCY</u></p> <ol style="list-style-type: none"> <li>1. If no rotational resistance or no hard stop (free spinning), call MCC</li> <li>2. If excessive force (&gt; 6 lb) or mechanism jam is encountered, go to <u>INSTALL CABLE ON INBOARD REEL</u></li> <li>3. EV guide tension reel back into initial position</li> <li>4. IV Cycle SABB Latches. Perform {4.118 SAW XX RETRACT} (SODF: EPS: CORRECTIVE: PRIMARY POWER) steps 12 (13) for Unlatch OR steps 18 (19) for Latch</li> <li>5. EV attempt outboard tension reel rotation</li> <li>6. If smooth reel rotation, go to <u>INSTALL CABLE ON OUTBOARD REEL</u>, EV2, step 1</li> <li>7. If jam or resistance encountered, repeat steps 4 and 5</li> <li>8. If no joy, call MCC</li> </ol>	

## SABB SPOOL RE-TENSION – TASK DATA

### Estimated Task Duration:

	With RMS	Without RMS
One EV Crew	NA	NA
Two EV Crew	NA	1:00

### Tools:

EV1	EV2
APFR	APFR
Ingress aid	Loop pin puller

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
N/A								

### EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
NA					

### Foot Restraints:

Task	WIF	APFR Setting	BGA Angle
IEA Non-keel side – SABB Outboard Reel EV1 access	P4/S4-11, P6/S6-23	(12, HH, F, 6)	283, 93
IEA Non-keel side – SABB Outboard Reel EV2 access	P4/S4-15, P6/S6-27	(10, HH, G, 1)	283, 93
IEA Non-keel side – SABB Inboard Reel EV1 access	P4/S4-26, P6/S6-38	(1, FF, F, 2)	285, 80
IEA Non-keel side – SABB Inboard Reel EV2 access	P4/S4-19, P6/S6-31	(5, GG, F, 7)	285, 80
IEA Keel side – SABB Outboard Reel EV1 access	P4/S4-09, P6/S6-21	(12, HH, F, 6)	283, 93
IEA Keel side – SABB Outboard Reel EV2 access	P4/S4-13, P6/S6-25	(10, HH, G, 1)	283, 93
IEA Keel side – SABB Inboard Reel EV1 access	P4/S4-25, P6/S6-37	(1, FF, F, 2)	285, 80
IEA Keel side – SABB Inboard Reel EV2 access	P4/S4-17, P6/S6-29	(5, GG, F, 7)	285, 80

### Notes:

1. SABB Outboard Reel does not have a pulley shroud
2. Combination wrenches may be used if the tension reel fails to take up the tension cable slack

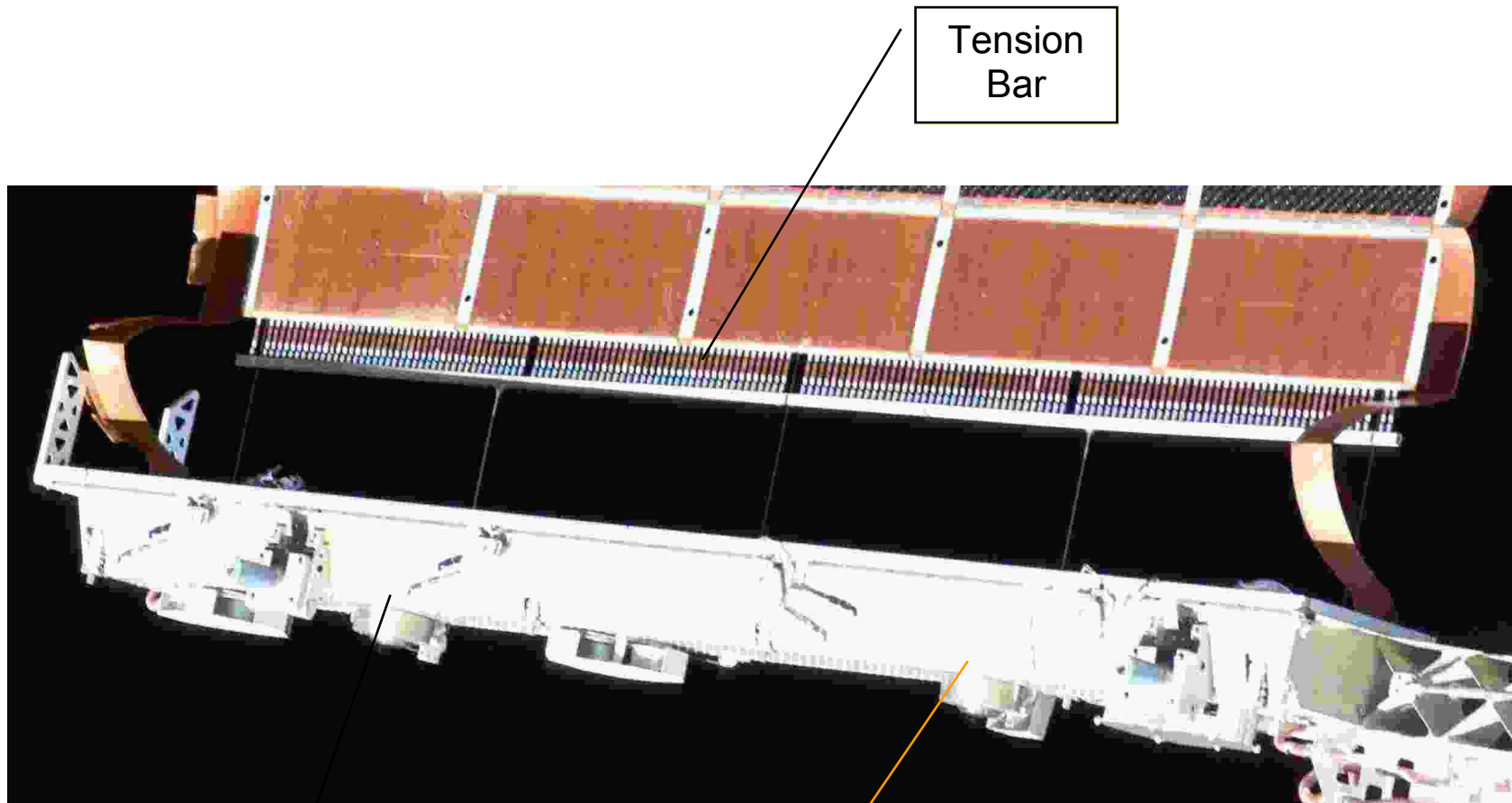
### Cautions:

1. Equipment damage – Beware of close proximity to blanket box during ingress. Visually inspect cables prior to handling for fraying or jamming on structure or nearby cables
2. Do not allow uncontrolled CW rotation of tension reel
3. Do not manually wrap cable on reel housing

### Warnings:

1. Sharp edges:
  - Pulley shroud at machined edges
  - Guide wire mechanism cover at machined edges
  - Guide wire mechanism
  - Guide wire pulley
  - Guide wire
  - Top flange of blanket box
  - Protrusions (4) on tension reel housing
2. Moving equipment hazard. Stay clear of SABB and capture latch mechanisms
3. Moving equipment hazard. Avoid contact with mast canister/beta gimbal during rotation of SAW

SABB SPOOL RE-TENSION – TASK DATA (Cont)



Tension  
Bar

Outboard  
TM

Inboard  
TM

NOTE

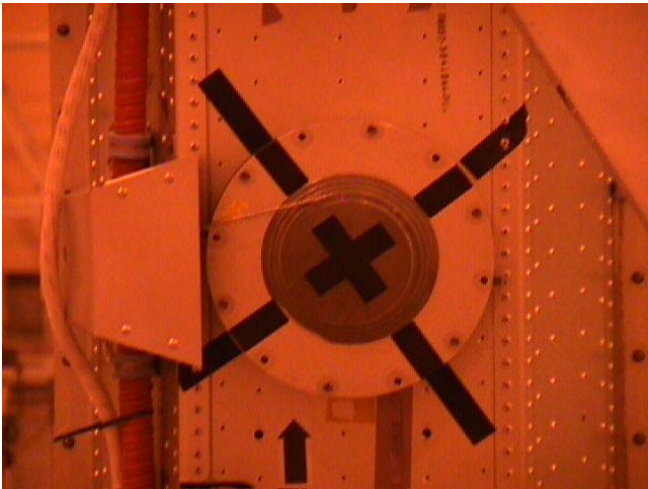
No markings on these TMs, markings are on P6

Tension Bar in fully extended position

## SABB SPOOL RE-TENSION – TASK DATA (Cont)



SABB Tensioning Reel Outboard – markings not on P6



SABB Tensioning Reel Inboard – markings not on P6

# MANUAL SAW JETTISON

## PRIOR TO EVA:

1. Unstow SSU cover and place in crewlock
2. If ECU removal is planned, stow Medium ORU bag in crewlock
3. Remove SSU shunt plug adapter J5A and J6A caps and tether to tether point on SSU shunt plug adapter
4. Remove SSU shunt plug caps and mate SSU shunt plugs to SSU shunt plug adapter J5A and J6A (shunt plugs can go on either adapter receptacle)
5. Remove caps from SSU shunt plug adapter ground service equipment connectors
6. Stow SSU shunt plug adapter/shunt plugs, Cannon connector tool in EVA crewlock bag
7. If available, stow size 37 Cannon connector plug cap in EVA crewlock bag; if not available, will need to retrieve one from Z1

IV/RMS	EV1	EV2
<p>Identify Affected Power Channel XX = _____ and opposite deck Power Channel YY = _____</p> <p>MCC-H 1. Mnv/orient ISS for SAW jettison</p> <p>MCC-H 2. Position and safe SAW for SSU Removal Perform {2.101 PVM BGA XX ENGAGE ANTIROTATION LATCH} (SODF: EPS: NOMINAL: PRIMARY POWER)</p> <p>MCC-H 3. Verify solar array positioned for EV crew access to SSU and BGA latched PCS PVM: EPS: BGA XX <b>BGA XX</b> 'ECU XX' Verify: Integ Cnt – Incrementing  'BGA XX' Verify: Actual Angle, deg = 270 Motor State – OFF Latch 1(2) Pin Status – Latched</p> <p>4. GO for EV ingress at SSU worksite</p> <p>MCC-H 5. Verify power connector inhibits in place before SSU Removal PCS PVM: EPS: DCSU XX <b>DCSU XX</b> 'DCSU XX' sel RBI 1 Verify: Cmdded Position – Op</p>	<div style="border: 2px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><u>WARNING</u></p> <p>Voltage hazard exists at the connectors of the SSU. SSU must be safed before removal</p> <p>Electrical Shock Hazard. SSU Shunt Plug installation/removal and SSU removal/installation must occur during eclipse. <b>STEPS DENOTED BY AN “E” MUST OCCUR DURING ECLIPSE.</b> Crew must wait the specified wait periods for voltage drops to safe levels before proceeding. EV crew will need to move away from exposed electrical receptacles during day pass</p> <p>Protrusion Hazard. SSU alignment post protrudes beyond mast canister. Maintain clearances between structure and crewmember during SSU removal</p> <p>Collision Hazard. The solar array motion should be prevented by locking the BGA. This avoids a collision hazard with the EV crew if the EV crew is within 24 inches of the array rotational envelope</p> </div> <p><u>EVA SETUP</u></p> <ol style="list-style-type: none"> <li>1. If required, retrieve Sq TM with 7/16 Rec socket and square scoop from Z1 toolbox</li> <li>2. If required, translate to Z1 forward face, demate Cannon connector cap from Z1 J259 or J260, stow in EVA crewlock bag</li> <li>3. On MCC GO, translate to SSU worksite</li> <li>4. Transfer tools and APFR with AIA to worksite</li> <li>5. Set up APFR (see Task Data page)</li> </ol>	<div style="border: 2px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><u>WARNING</u></p> <p>Voltage hazard exists at the connectors of the SSU. SSU must be safed before removal</p> <p>Electrical Shock Hazard. SSU Shunt Plug installation/removal and SSU removal/installation must occur during eclipse. <b>STEPS DENOTED BY AN “E” MUST OCCUR DURING ECLIPSE.</b> Crew must wait the specified wait periods for voltage drops to safe levels before proceeding. EV crew will need to move away from exposed electrical receptacles during day pass</p> <p>Protrusion Hazard. SSU alignment post protrudes beyond mast canister. Maintain clearances between structure and crewmember during SSU removal</p> <p>Collision Hazard. The solar array motion should be prevented by locking the BGA. This avoids a collision hazard with the EV crew if the EV crew is within 24 inches of the array rotational envelope</p> </div> <p><u>EVA SETUP</u></p> <ol style="list-style-type: none"> <li>1. Translate to Mast Canister/Aux bag (PMA1 stbd by Node bag)</li> <li>2. Retrieve MCHD</li> <li>3. On MCC GO, translate to worksite</li> <li>4. Temp stow MCHD and SSU cover</li> <li>5. Translate to BMRRM</li> <li>6. Remove BMRRM thermal shroud (peels back)</li> </ol>

# MANUAL SAW JETTISON (Cont)

IV/RMS	EV1	EV2
<p>Close Cmd – Inh Voltage: -4.2 – 4.2 Current: -7.5 – 7.5</p> <p>PCS PVM: EPS: SSU XX <b>SSU XX</b> 'BCDU YY1' (YY= opposite channel on IEA) sel CP RBI</p> <p><b>BCDU XX CP RBIs</b> 'YY1 CP RBI' (YY= opposite channel on IEA) Verify: YY1 CP RBI Posn – Op</p> <p>MCC-H 6. Turn off and off point video camera luminaries, rpcm open and closed inhibited</p> <p>MCC-H 7. Give GO for BMRRM J1 demate and SSU shunt plug installation</p> <p>MCC-H 8. Give GO for SSU removal during 2nd ECLIPSE ONLY</p>	<div> </div> <p><b>SSU shunt plugs and adapter installed on mast canister with shroud open</b></p> <p><b>E6.</b> On MCC GO (2 min wait after transition from insolation to eclipse), remove mast canister ground test port caps (2) and place in EVA trash bag</p> <p><b>E7.</b> Position MLI shroud as shown above or folded against shunt plugs</p> <p><b>E8.</b> Install SSU shunt plug adapter with bails facing outward, not against mast canister</p> <p>9. Reinstall MLI shroud</p> <p>10. Ingress APFR</p> <p><b><u>REMOVE FAILED SSU</u></b></p> <p><b>1.</b> Install Sq TM onto primary fastener, √anti-backlash neutral</p> <p><b>E2.</b> On MCC GO (5 min wait after transition from insolation to eclipse), Release <b>SSU fastener 1 turn</b> PGT, Sq TM-7/16Rec; B1 (12.0 ft-lb), CCW2 (30RPM), MTL 30.5; 1 turn on bolt = 5 turns from PGT</p> <p><b>E3.</b> Remove Sq TM</p> <p><b>E4.</b> Install Sq Scoop on SSU</p> <p><b>E5.</b> Release <b>SSU fastener</b> PGT, 7/16-6 in ext; B1 (12.0 ft-lb), CCW2 (30RPM), MTL 30.5; 10 turns</p>	<p><b>E7.</b> On MCC GO, demate connector from BMRRM J1</p> <p><b>E8.</b> Mate Cannon connector cap on BMRRM J1</p> <p>9. If reqd, reinstall BMRRM thermal shroud</p> <p><b><u>REMOVE FAILED SSU</u></b></p>

# MANUAL SAW JETTISON (Cont)

IV/RMS	EV1	EV2
<p>9. Position and safe SAW for ECU Removal (if required) and SAW jettison. Perform {2.101 PVM BGA XX ENGAGE ANTI-ROTATION LATCH} (SODF: EPS: NOMINAL: PRIMARY POWER) using the following values:</p> <p>BGA XX Cmded Angle = 180 deg BGA XX Latch Select = 1</p> <p>10. GO for EV ingress at ECU worksite</p> <p>MCC-H 11. Remove ECU power PCS PVM: EPS:BGA XX <b>BGA XX</b></p> <p>sel RPCM YY A RPC 02 <b>RPCM YY A RPC 02</b></p> <p>cmd RPC Position – Open (Verify – Op)</p> <p>(Expect Caution Message: BGA XX Loss of Comm)</p> <p>MCC-H 12. GO for ECU removal and BMRRM cable demate</p>	<p><b>E6.</b> √Status indicator – UNLOCK <b>E7.</b> Remove SSU and hand to EV2 8. Clear BGA rotation plane for BGA rotation and inform IV when clear</p> <div style="border: 1px solid black; padding: 5px; text-align: center; margin: 10px 0;"> <p><b>WARNING</b> Moving equipment hazard: Avoid contact with mast canister/beta gimbal during rotation of SAW</p> </div> <p><u>REMOVE ECU [if reqd]</u></p> <ol style="list-style-type: none"> <li>Set up and ingress APFR [see Task Data page]</li> <li>On MCC GO, release <b>ECU fastener 1 turn</b> PGT, Sq TM-7/16Rec ; B1 (12.0 ft-lb), CCW2 (30RPM), MTL 30.5; 1 turn on bolt = 5 turns from PGT</li> <li>Remove Sq TM</li> <li>Install Square Scoop on ECU</li> <li>Release <b>ECU fastener</b> PGT, 7/16-6 in ext; B1 (12.0 ft-lb), CCW2 (30RPM), MTL 30.5; 10 ± 2 turns</li> <li>√Status indicator – UNLOCK</li> <li>Remove ECU and stow in ORU transfer bag</li> </ol>	<ol style="list-style-type: none"> <li>Receive SSU and stow on SSU cover</li> <li>Clear BGA rotation plane for BGA rotation and inform IV when clear</li> </ol> <p><u>RELEASE BMRRM FASTENERS/CONNECTORS</u></p> <ol style="list-style-type: none"> <li>If not done already, remove BMRRM thermal shroud and temp stow</li> <li>Release <b>BMRRM center fastener</b> PGT, 7/16-6 in ext; B6 (24.0 ft-lb), CCW2 (30RPM), MTL 10.5; 17 turns</li> <li>On MCC GO, disconnect the following connectors from the BMRRM: <ul style="list-style-type: none"> <li><input type="checkbox"/> Demate connector from J3</li> <li><input type="checkbox"/> Demate connector from J2</li> </ul> </li> </ol>

## MANUAL SAW JETTISON (Cont)

IV/RMS	EV1	EV2
<p>MCC-H 13. Give GO for MCHD installation</p> <p>MCC-H 14. Give GO for jettison</p>	<p><u>INSTALL MCHD</u></p> <ol style="list-style-type: none"> <li>1. On MCC GO, set up and ingress APFR (see Task Data page)</li> <li>2. Deploy MCHD appendages</li> <li>3. Install MCHD on mast canister</li> <li>4. Fasten <b>MCHD corner attach fasteners</b> (4) PGT, 7/16-6 in ext; A5 (7.0 ft-lb), CW2 (30RPM), MTL 30.5; to HS</li> </ol> <p><u>MANUAL SAW JETTISON</u></p> <ol style="list-style-type: none"> <li>1. Using MCHD, move mast canister from beta gimbal at a velocity less than 1 ft/min. Move mast canister 2 ft from beta gimbal separation plane. Correct wing attitude as reqd to achieve stability</li> <li>2. Release MCHD</li> <li>3. Monitor SAW separation</li> <li>4. When SAW is clear, egress worksite</li> </ol>	<p><u>MANUAL SAW JETTISON</u></p> <ol style="list-style-type: none"> <li>1. On MCC GO, release <b>platform vice clamp fastener</b> PGT, 7/16-6 in ext; B1 (12.0 ft-lb), CCW2 (30RPM), MTL 10.5; 19 turns to HS</li> <li>2. When complete, give EV1 GO for SAW motion</li> <li>3. Call out separation distance until 2 ft separation achieved</li> <li>4. Monitor SAW separation</li> </ol>



## MANUAL SAW JETTISON – TASK DATA

### Estimated Task Duration:

	Without RMS
One EV Crew	NA
Two EV Crew	3:00

### Tools:

EV1	EV2
PGT	PGT
6 ext-7/16	6 ext-7/16
APFR/ingress aid	
Square TM with 7/16-in Recessed socket	
EVA crewlock bag	SSU cover
SSU shunt plug adapter	Mast Canister Handling Device
SSU shunt plugs (2)	
Size 33 Cannon conn plug cap	
Square scoop (2)	
Medium ORU bag (if reqd - for ECU)	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Max Break Away Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
SSU fastener	NA	7/16	1	6.3	35.7	264 (R)	11 ± 2	30
ECU fastener	NA	7/16	1	6.3	30.5	290.3 (R)	11 ± 2	30
BMRRM Center Fastener	NA	7/16	1	NA	16.0	54.0	17	30
MCHD Fasteners	NA	7/16	4	7.0	8.1	11.0 (l)	ZIP	10
Vice Clamp	NA	7/16	1	NA	5.2	20.1	19	30

### EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
W05 P23 J3		BMRRM J3		25	ECU feed; SSU Control pwr; 1553B
W06 P22 J2		BMRRM J2		25	ECU cross feed
		BMRRM J1		37	Primary power

### Foot Restraints:

Task	WIF	APFR Setting	BGA Angle
Access to SSU (IEA non-keel side 4A/3A SAW)	P4/S4-23	4, PP, G, 9	270
Access to SSU (IEA keel side 2A/1A SAW)	P4/S4-24	4, PP, G, 9	270
Access to BMRRM (IEA non-keel side 4A/3ASAW)	P4/S4-28	9, NN, G, 3	Any
Access to BMRRM (IEA keel side 2A/1A SAW)	P4/S4-27	9, NN, G, 3	Any
Install MCHD and 4A/3A SAW jettison position (IEA non-keel side SAW)	P4/S4-26	6, FF, F, 6	180
Install MCHD and 2A/1A SAW jettison position (IEA keel side SAW)	P4/S4-25	6, FF, F, 6	180
Access to 4A/3A ECU	P4/S4-26	8, OO, A, 3	180
Access to 2A/1A ECU	P4/S4-25	8, OO, A, 3	180
Access to SSU (IEA non-keel side)	P6/S6-35	4, PP, G, 9	270
Access to SSU (IEA keel side)	P6/S6-33	4, PP, G, 9	270
Access to BMRRM (IEA non-keel side)	P6/S6-39	9, NN, G, 3	Any
Access to BMRRM (IEA keel side)	P6/S6-40	9, NN, G, 3	Any
Install MCHD and SAW jettison position (IEA non-keel side)	P6/S6-38	12, FF, F, 12	180
Install MCHD and SAW jettison position (IEA keel side)	P6/S6-37	12, FF, F, 12	180
Access to ECU (IEA non-keel side)	P6/S6-38	8, OO, A, 3	180
Access to ECU (IEA keel side)	P6/S6-37	8, OO, A, 3	180

ORU Mass: SSU – 186 lb

ECU – 90 lb SAW – approx 2326 lb

## MANUAL SAW JETTISON – TASK DATA (Cont)

### Notes:

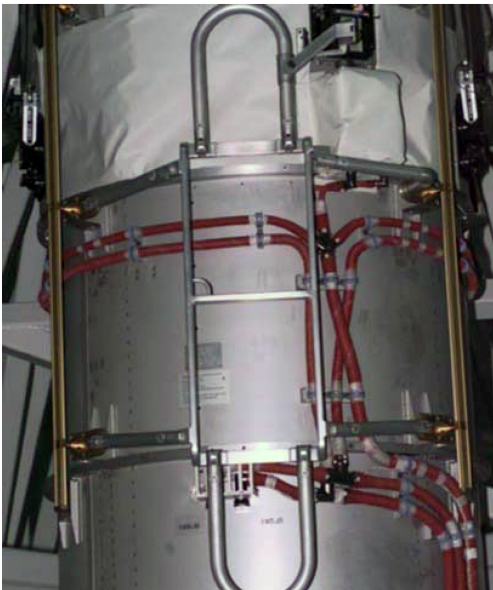
1. The MCHD has four deployable legs. Each leg has an EVA fastener which engages a zip nut on the mast canister hand rails. The MCHD also has a deployable PGT cradle assembly which is used to drive the mast canister MDA. The PGT cradle assembly is not required for the jettison procedure

### Cautions:

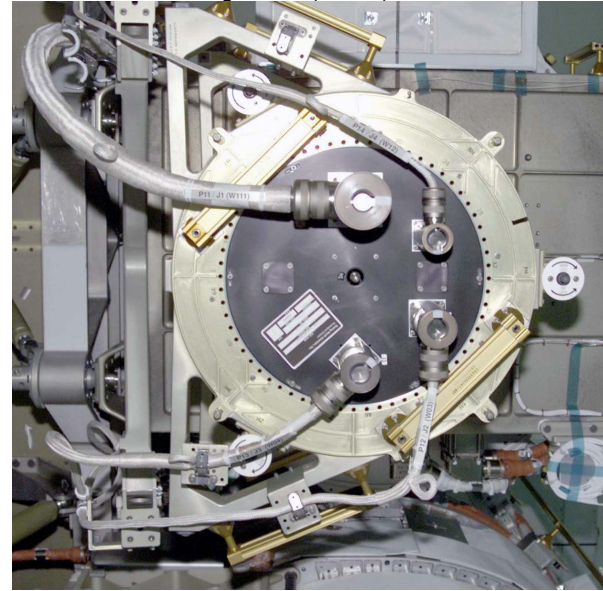
None

### Warnings:

1. Electrical Shock Hazard: Install SSU shunt plug adapter/SSU shunt plugs and remove SSU during orbital eclipse. Procedure specifies wait time before installing SSU shunt plug adapter/SSU shunt plugs and removing SSU to allow voltages to drop to safe levels
2. Protrusion Hazard: SSU alignment post protrudes beyond mast canister. Maintain clearances between structure and crewmember during SSU changeout
3. Voltage hazard may exist at connectors of the ECU and BMRRM. ECU and BMRRM must be safed before removal
4. Collision Hazard: The solar array motion should be inhibited to prevent a collision hazard with the EV crew because the EV crew may be within 24 inches of the array rotational envelope
5. Moving equipment hazard: Avoid contact with mast canister/beta gimbal during rotation of SAW
6. Mass handling – The crewmember will control the SAW mass with bent arms to avoid loading the EMU suit structure
7. Release mast canister with minimal tip-off rates



Mast Canister Handling Device (MCHD)



BMRRM connectors without BMRRM thermal cover

# BMRRM REMOVE/REPLACE

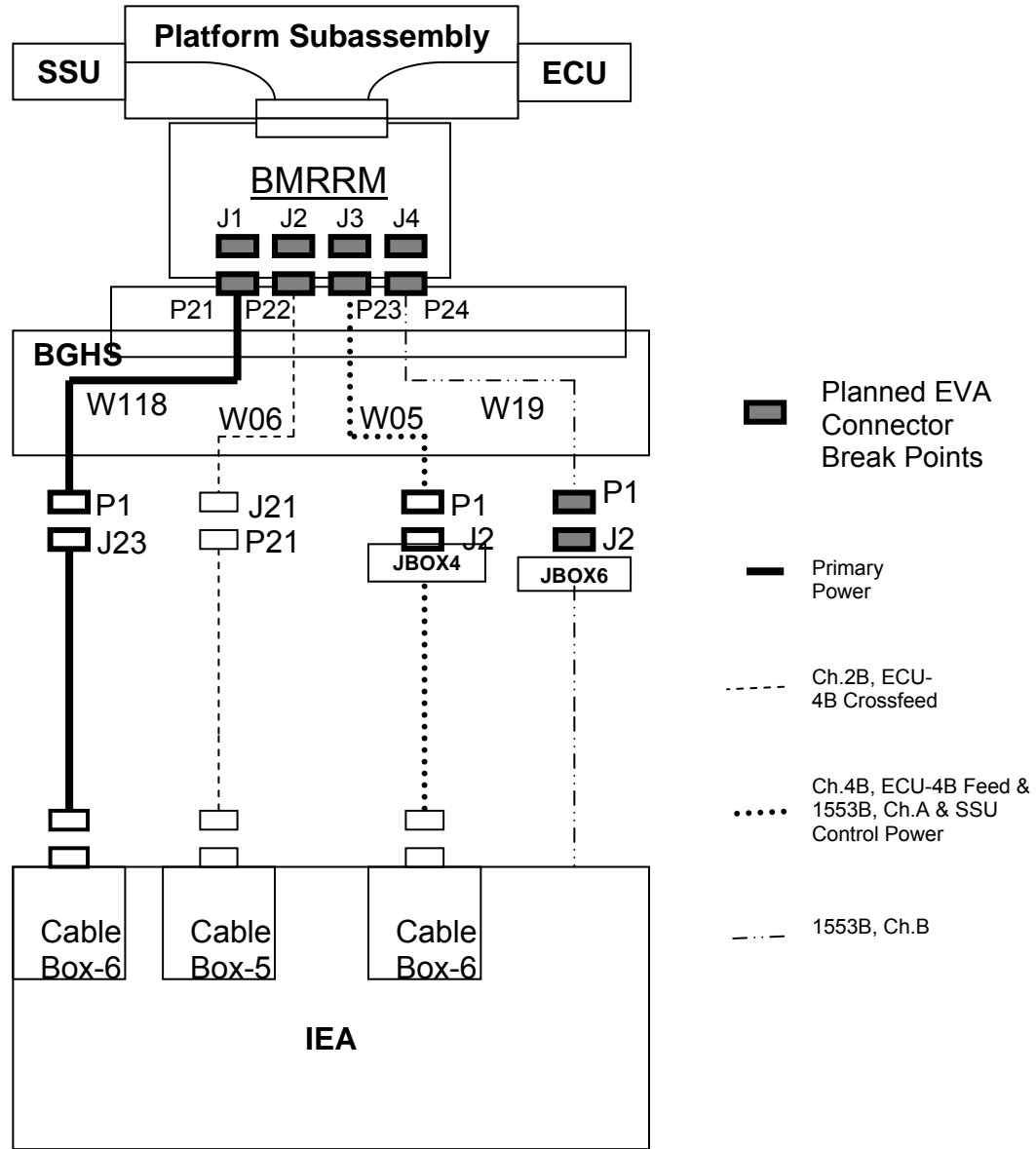
IV/RMS	EV1	EV2
<p>IV: 1. Safe Channel B for EV2 terminator install and EV1 J2 and J4 demate  Verify ISS perform P6 PREPARATION FOR 4B BMRRM R&amp;R steps 11 &amp; 12 complete  GO for EV1 step 5 and EV2 steps 2-3</p> <p>IV: 2. When EV2 steps 2-3 complete  ISS perform P6 PREPARATION FOR 4B BMRRM R&amp;R steps 13 &amp; 14</p> <p>IV: 3. Prior to eclipse, safe Primary Power for EV1 J1 demate  ISS perform P6 PREPARATION FOR 4B BMRRM R&amp;R steps 15 &amp; 16  GO for EV1 step 6</p> <p>IV: 4. If IV step 2 not successful, EV2 steps E5 and E6 required</p> <p>IV: 5. Safe Channel A for EV1 J3 demate  ISS perform P6 PREPARATION FOR 4B BMRRM R&amp;R steps 17 &amp; 18  GO for EV1 step E9</p>	<p><u>REMOVE OLD BMRRM</u></p> <ol style="list-style-type: none"> <li><b>PGT[A5 7.0 ft-lb, CCW2 30RPM, MTL 10.5]-6ext 7/16:</b> Unfasten BMRRM housing bolts (H6, H7, H8, H9) 8 +/- 1 turns, verify bolts spring up</li> <li><b>PGT[A5 7.0 ft-lb, CCW2 30RPM, MTL 10.5]-6ext 7/16:</b> Drive dual latch bolts (H3, H2, H4) 15 turns</li> <li><b>PGT[A1 2.5 ft-lb, CCW2 30RPM, MTL 5.5]-6ext 7/16:</b> Drive dual latch bolts (H4, H2, H3) to hard stop, 8 turns expected (23 ± 2 turns total expected)</li> <li>Release remaining T/A clamps</li> <li>On IV GO, demate connectors from BMRRM J4, J2 receptacles</li> <li>On IV GO, demate J1 receptacle</li> <li>Secure demated connectors clear of BMRRM removal area</li> <li>Notify IV when complete</li> </ol> <div style="border: 2px solid black; padding: 5px; text-align: center;"> <p><b>WARNING</b>  STEPS DENOTED BY AN "E" MUST OCCUR DURING ECLIPSE TO PREVENT POSSIBLE HOT CONNECTOR MATE  OLD BMRRM HAS SHARP EDGE HAZARD</p> </div> <ol style="list-style-type: none"> <li>On IV GO, demate connector from the BMRRM J3 receptacles</li> <li>Secure demated connectors clear of BMRRM removal area</li> <li><b>PGT[B1 12.0 ft-lb, CCW2 30RPM, MTL 10.5]-6ext 7/16:</b> Release BMRRM center bolt H1, 10 turns</li> <li>Remove old BMRRM from Beta Gimbal housing assembly</li> <li>Transfer old BMRRM to EV2</li> </ol>	<p><u>REMOVE OLD BMRRM</u></p> <ol style="list-style-type: none"> <li>Verify dual latches engaged to mast canister platform</li> <li>On IV GO, demate W19 P1 from JBOX 6 J2</li> <li>Mate 1553B terminator cap 10955J to JBOX 6 J2</li> <li>Notify IV when complete</li> </ol> <div style="border: 2px solid black; padding: 5px; text-align: center;"> <p><b>WARNING</b>  STEPS DENOTED BY AN "E" MUST OCCUR DURING ECLIPSE TO PREVENT POSSIBLE HOT CONNECTOR MATE  OLD BMRRM HAS SHARP EDGE HAZARD</p> </div> <ol style="list-style-type: none"> <li>If reqd: On IV GO, demate W05 P1 from JBOX 4 J2</li> <li>If reqd: Mate 1553B terminator cap 10956J to JBOX 4 J2</li> <li>If reqd: Notify IV when E5 and E6 complete</li> <li>Translate to vice clamp worksite</li> <li><b>PGT[A4 6.3 ft-lb, CCW2 30RPM, MTL 10.5]-6ext 7/16:</b> Unfasten vice clamp bolt, 19 ± 2 turns</li> <li>Receive old BMRRM from EV1 and stow on MUT EE/Ballstack/MUT EE</li> </ol>

MISC

BMRRM REMOVE/REPLACE (Cont)

IV/RMS	EV1	EV2
<p>IV: 6. Notify ISS EV1 step E20 complete GO for ISS perform EPS RETURN TO NOMINAL CONFIG POST 4B BMRRM R&amp;R steps 1-4</p> <p>IV: 7. If Eclipse time permits, GO for EV1 step 21 Else, verify ISS perform EPS RETURN TO NOMINAL CONFIG POST 4B BMRRM R&amp;R steps 1-4 complete GO for EV1 step 21</p> <p>IV: 8. Verify ISS perform EPS RETURN TO NOMINAL CONFIG POST 4B BMRRM R&amp;R step 1 complete GO for EV2 steps 16 &amp; 17</p> <p>IV: 9. Notify MCC-H EV1 step 21 and EV2 step 17 complete</p>	<p><b>INSTALL NEW BMRRM</b></p> <p><b>E14. PGT[B1 12.0 ft-lb, CCW2 30RPM, MTL 10.5]-6ext 7/16:</b> Release new BMRRM center bolt H1, 10 turns, verify center bolt springs up</p> <p><b>E15.</b> Remove new BMRRM from housing</p> <p><b>E16.</b> Position new BMRRM for EV2 verification of lever latch position</p> <p><b>E17.</b> Use alignment mark to clock BMRRM; Install new BMRRM in Beta Gimbal housing assembly</p> <p><b>E18.</b> Push center bolt H1 to soft capture BMRRM to platform</p> <p><b>E19. PGT[A6 8.3 ft-lb, CW2 30RPM, MTL 10.5]-6ext 7/16:</b> Fasten center bolt H1 to hard stop, notify EV2 center bolt hard stop, turns will vary due to zip nut feature</p> <p><b>E20.</b> Mate J3 connector to the new BMRRM, notify IV when complete</p> <p>21. On IV GO, mate connectors to the new BMRRM J1, J2 and J4 receptacles, notify IV when complete</p> <p>22. <b>PGT[A4 6.3 ft-lb, CW2 30RPM, MTL 5.5]-6ext 7/16:</b> Start each bolt before driving to hard stop, fasten BMRRM housing bolts (H7, H9, H6, H8) 8 ± 1 turns</p> <p>23. <b>PGT[A6 8.3 ft-lb, CW2 30RPM, MTL 10.5]-6ext 7/16:</b> Drive dual latch bolts (H3, H2, H4) to hard stop, 23 ± 2 turns expected</p> <p>24. Receive old BMRRM from EV2</p> <p>25. Position old BMRRM for EV2 verification of lever latch position</p> <p>26. Using alignment pin to clock BMRRM, stow old BMRRM in housing</p> <p>27. Push in center bolt H1 to set soft capture</p> <p>28. Inspect old BMRRM for contaminants</p> <p>29. <b>PGT[A6 8.3 ft-lb, CW2 30RPM, MTL 10.5]-6ext 7/16:</b> Fasten center bolt H1 to hard stop on old BMRRM, turns will vary due to zip nut feature</p> <p>30. Install connector cover on old BMRRM</p> <p>31. Stow old BMRRM RET on old BMRRM</p>	<p><b>INSTALL NEW BMRRM</b></p> <p><b>E11.</b> Verify lever latch in latched position on new BMRRM</p> <p><b>E12.</b> Assist EV1 with alignment of new BMRRM into Beta Gimbal housing assembly</p> <p><b>E13.</b> If reqd, On IV GO, Demate terminator cap 10956J from JBOX 4 J2</p> <p><b>E14.</b> If reqd, Mate W05 P1 to JBOX 4 J2, notify IV when complete</p> <p>15. <b>PGT[A3 5.0 ft-lb, CW2 30RPM, MTL 5.5]-6ext 7/16:</b> Fasten vice clamp bolt, 19 ± 2 turns, verify locking collar engages, install vice clamp contingency tool with wire tie if reqd</p> <p>16. Verify dual latch blocks are still flush on platform</p> <p>17. On IV GO, Demate terminator cap 10955J from JBOX 6 J2</p> <p>18. Mate W19 P1 to JBOX 6 J2, notify IV when complete</p> <p>19. Stow terminator connector</p> <p>20. Verify dual latches released from mast canister platform</p> <p>21. Retrieve old BMRRM by releasing MUT from BGA HR</p> <p>22. Transfer old BMRRM to EV1</p> <p>23. Verify lever latch in latched position on old BMRRM</p>

# BMRRM REMOVE/REPLACE (Cont)



## BMRRM REMOVE/REPLACE – TASK DATA

### Estimated Task Duration:

	With RMS	Without RMS
One EV Crew	NA	NA
Two EV Crew	NA	3:00

### Tools:

EV1 (RMS)	EV2 (FF)
PGT	Crewlock bag
6ext 7/16	Vice clamp locking tool
Cannon connector tool	Cannon Connector tool
Round scoop	J23 Connector Cap
Ball stack (2)	JBOX 6 J2 terminator cap
MUT end effector (3)	JBOX 4 J2 terminator cap
APFR	

### EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque	Failure Torque	Turns	RPM
Dual Latches	H2, H3, H4	7/16	3	2.5 SAW Latch	8.3 BMRRM Latch	3.4 SAW Latch	47 BMRRM Latch	23 +/- 2	N/A
BMRRM Center Fastener	H1	7/16	1	8.3	10.5		51.6	10 +/- 2	N/A
BMRRM Housing Fasteners	H6, H7, H8, H9	7/16	4	5.5	7.0		15.5	8 +/- 1	N/A
Vice Clamp Fastener	None	7/16	1	2.5	5.0		8	19 +/- 2	N/A

### EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
W111 P11		2B BMRRM J1			Primary power
W03 P12		2B BMRRM J2			
W04 P13		2B BMRRM J3			
W12 P14		2B BMRRM J4			
W118 P21		4B BMRRM J1		37	Primary power
W118 P1		W18 J23		37	Primary power
W06 P22		4B BMRRM J2			ECU-2B cross feed
W05 P23		4B BMRRM J3		25	ECU-4B feed; SSU 4B Control pwr; 1553B, Bus A
W05 P1		J2 (JBOX 4)		25	ECU-4B feed; SSU 4B Control pwr; 1553B, Bus A
W19 P24		4B BMRRM J4		19	1553B, Bus B
W19 P1		J2 (JBOX 6)		19	1553B, Bus B

### Foot Restraints:

Task	WIF	APFR Setting
Access to Stbd SAW BMRRM	P6-39	9, NN, G, 3
Access to Port SAW BMRRM	P6-40	9, NN, G, 3
BMRRM change-out support	P6-34	12, QQ, K, 2
BMRRM change-out support	P6-36	1, HH, L, 12
Access to Stbd SAW SSU	P6-35	4, PP, H, 9
Access to Port SAW SSU	P6-33	4, PP, H, 9

ORU Mass: BMRRM = 142 lb Cover = 69 lb

## **BMRRM REMOVE/REPLACE – TASK DATA (Cont)**

### **Notes:**

1. Translation technique: The BMRRM within the ORU cover can be attached to the EVA crewmember via the BRT and Round Scoop. The EVA crewmember should attach an additional tether between themselves and the ORU cover to prevent uncontrolled motion
2. Fastener turn counts in the procedures are in reference to the bolt head
3. Recommend spare BMRRM temp stowage configuration: MUT end effector; ball stack, round scoop attached to cover microconical. A second tether should be tethered between the cover and structure
4. The three dual latches are used to latch the housing to the platform. Order of operation is not important
5. Three Dual Latches are equipped with locking collars. Collars must be pushed and held while rotating bolt heads
6. BMRRM center bolt is equipped with a spring and will pop out when fully unfastened
7. Vice Clamp Assembly actuating bolt is equipped with a locking collar. Collar must be pushed and held while rotating the bolt head
8. Four captive fasteners securing BMRRM to the housing are equipped with springs and will pop out when fully unfastened
9. Center bolt on the bottom of the platform assembly is a ZIP bolt. The number of turns to tighten to hard stop depends on how far the center bolt is pushed into the ZIP nut
10. BMRRM housing fasteners must be pushed lightly to start thread engagement
11. Vernier thrusters with CMG are allowed for attitude control during the BMRRM ORU changeout

### **Cautions:**

1. FPP solar arrays, probes, and RF box are sensitive to impact loads. FPP (located in WIF P6-39) will interfere with BMRRM remove and replace procedure. FPP can be relocated to an alternate WIF. Grounding pin can be removed from grounding lug if necessary
2. Hardware Damage. The Vice clamp fastener may "back out" if the fastener locking collar does not engage after the spare BMRRM is installed. Vice clamp locking collar must be installed to prevent inadvertent rotation of Vice clamp bolt. Installation of Vice clamp collar locking tool will be required if vice clamp locking collar fails to engage
3. Minimize loads on Mast Platform when only Dual Latch Fasteners are engaged
4. Loss of ISS Hardware. Failure to engage the BMRRM Dual latches prior to failed BMRRM removal will result in SAW release

### **Warnings:**

1. Excessive loads into the EMU: The EVA crewmember should translate at a rate no greater than 1.6 fps when the EVA crewmember is translating with the BMRRM attached to their BRT
2. Crew must remain 24 inches from rotating starboard SAW
3. Sharp Edge Hazard. The flange at the base of the failed BMRRM is sharp. Handle the BMRRM only by the EVA handle holds. Avoid contact with the end of the BMRRM opposite of the BMRRM face plate. The flange at the base of the replacement BMRRM is not sharp but should be avoided to avoid hardware damage
4. Umbilical mate/demate inhibits/constraints must be verified to avoid HOT connector mate/demate

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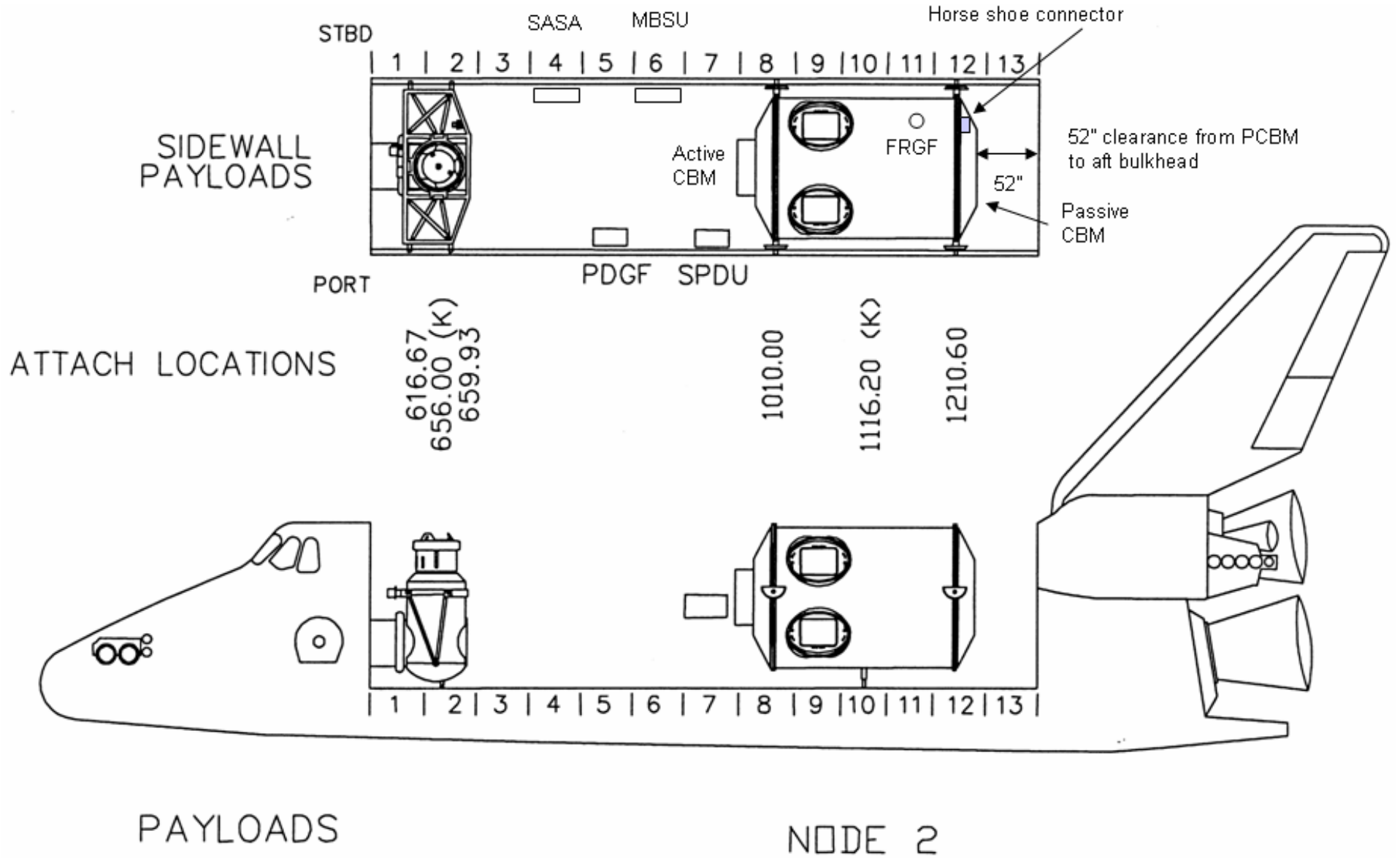
FLIGHT SPECIFIC EVA REFERENCE

PAYLOAD BAY CONFIG.....	FS 18-3
NODE 2	
NODE 2 ZENITH PORT HANDRAILS .....	FS 18-4
NODE 2 END CONE .....	FS 18-5
NODE 2 NADIR STBD HANDRAILS.....	FS 18-6
NODE 2 PORT NADIR HANDRAILS .....	FS 18-7
NODE 2 STBD ZENITH HANDRAILS.....	FS 18-8
EVA 1	
TRUNNION COVER LABELING .....	FS 18-9
ACBM.....	FS 18-10
PCBM WITH CONTAMINATION COVERS .....	FS 18-11
CONTAMINATION COVER .....	FS 18-12
PCBM CONTAMINATION COVER .....	FS 18-13
CBM PETAL RELEASE .....	FS 18-14
Z1 FLUID QDs STOWED ON Z1 .....	FS 18-15
PDGF SIDEWALL CARRIER.....	FS 18-16
PDGF UNDERSIDE .....	FS 18-17
EVA 2	
NODE 2 PDGF MOUNTING RING .....	FS 18-18
HORSESHOE CONNECTOR INTERFACE.....	FS 18-19
PDGF HORSESHOE CONNECTOR RECEPTACLE .....	FS 18-20
NODE 2 HORSESHOE CONNECTORS .....	FS 18-21
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S1 SFU CONFIG FOR DEPLOY.....	FS 18-24
MBSU BYPASS JUMPER – PANELS A260 AND A200 .....	FS 18-25
EVA 3	
P6 TO P5 MEASUREMENTS .....	FS 18-28
CANNON CONNECTOR CAPS INSTALLED ON P5 .....	FS 18-29
P6 OUTBOARD RADIATOR.....	FS 18-30
GAP CHECK TOOL .....	FS 18-31
P5 CAPTURE LATCH ASSEMBLY (CLA) .....	FS 18-32
MBSU STACK-UP.....	FS 18-33
MBSU PASSIVE FRAM ON ESP-2.....	FS 18-34
MBSU ACTIVE FRAM FLIGHT SUPPORT EQUIPMENT .....	FS 18-35
MBSU ACTIVE FRAM CONTINGENCY PINS.....	FS 18-36
CONTINGENCY	
S1 RADIATOR OVERVIEW .....	FS 18-37
S1 RADIATOR CINCH RELEASE .....	FS 18-38
CETA CART – TOP VIEW .....	FS 18-39
CETA CART – SWING ARMS AND WIF MARKINGS .....	FS 18-40
CETA CART – COUPLERS .....	FS 18-41
CETA CART – WHEEL BOGIES .....	FS 18-42
STATUS INDICATORS (MBSU, DDCU, BCDU).....	FS 18-43

FLIGHT SPECIFIC  
EVA REFERENCE

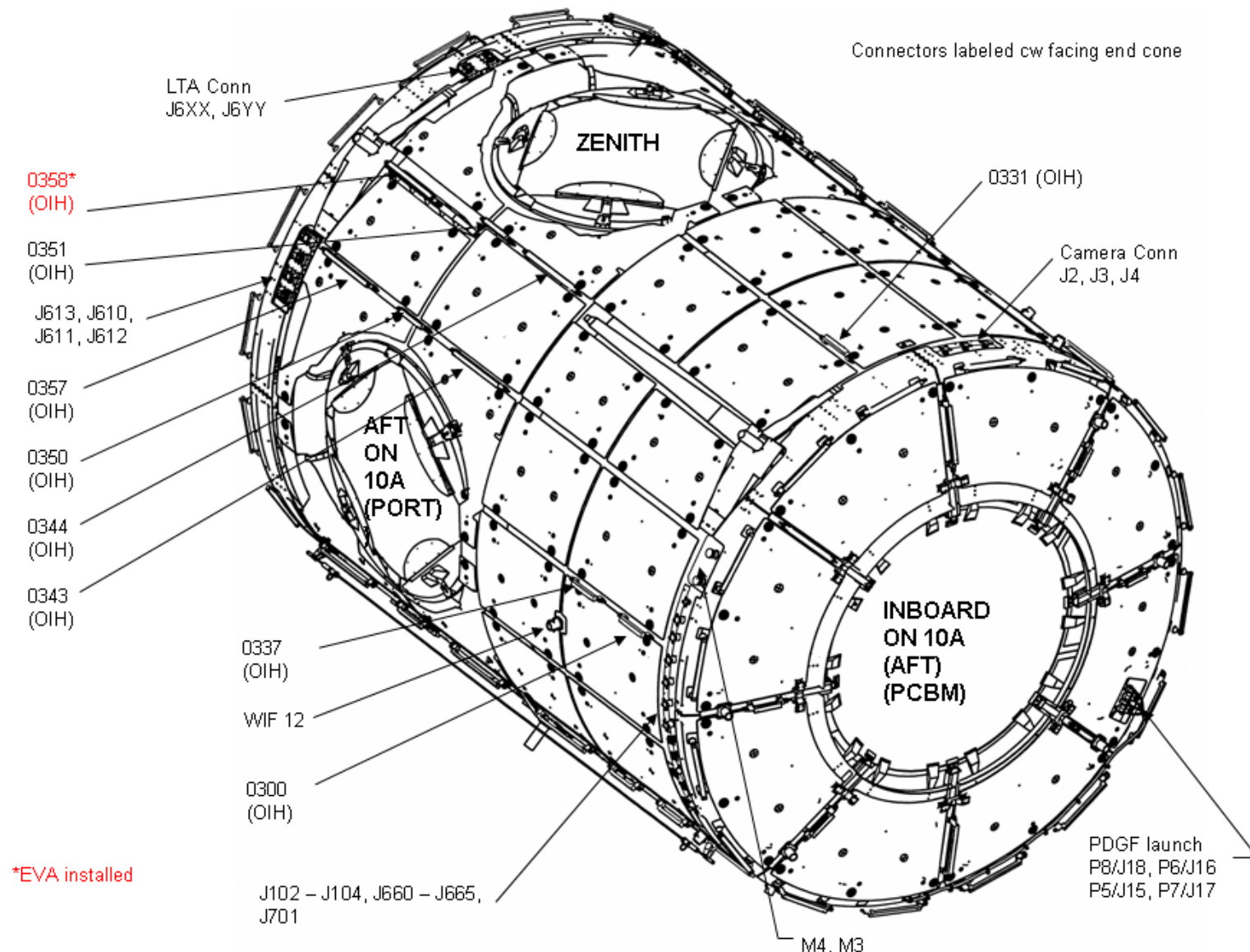
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**PAYLOAD BAY CONFIG**

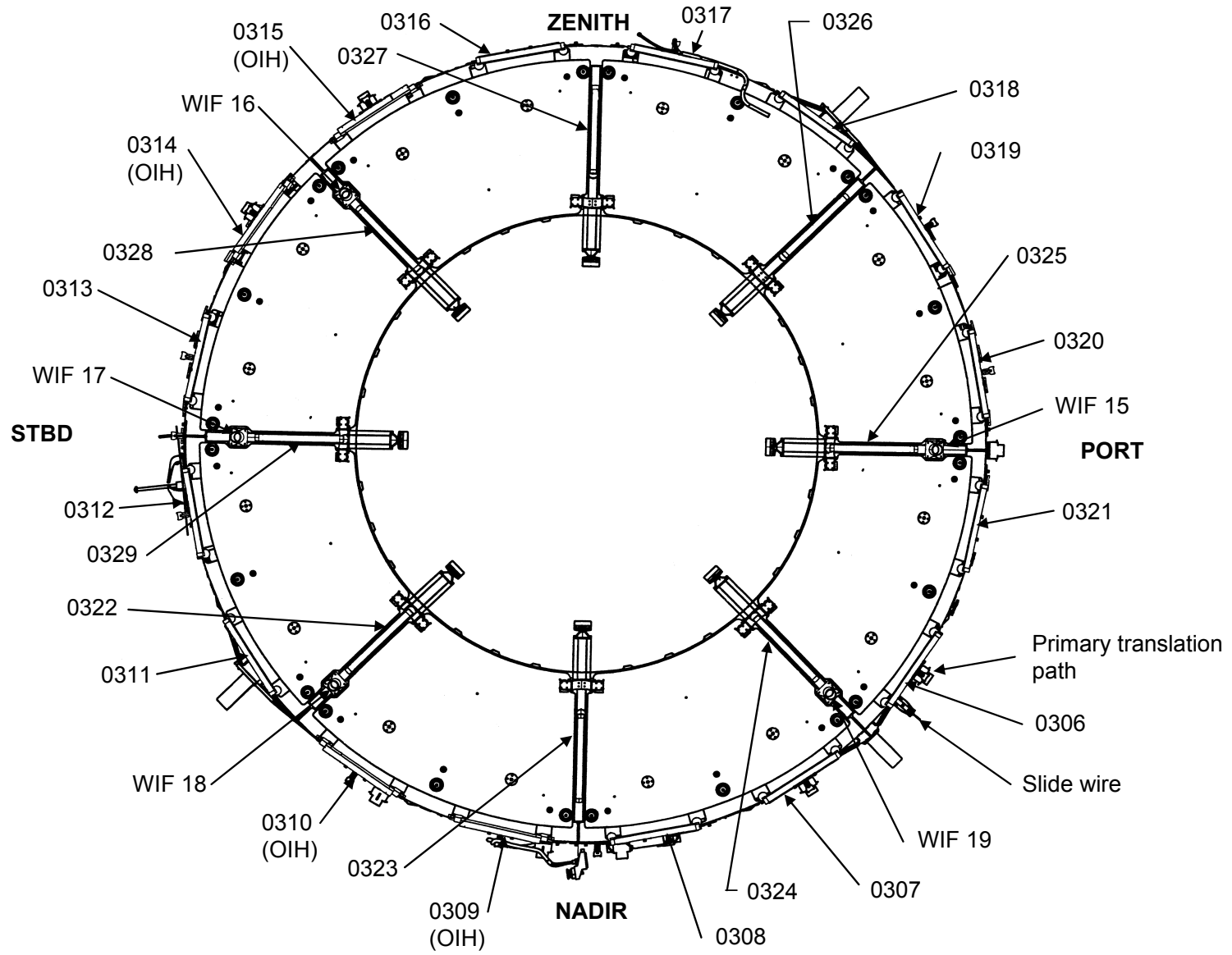


# NODE 2

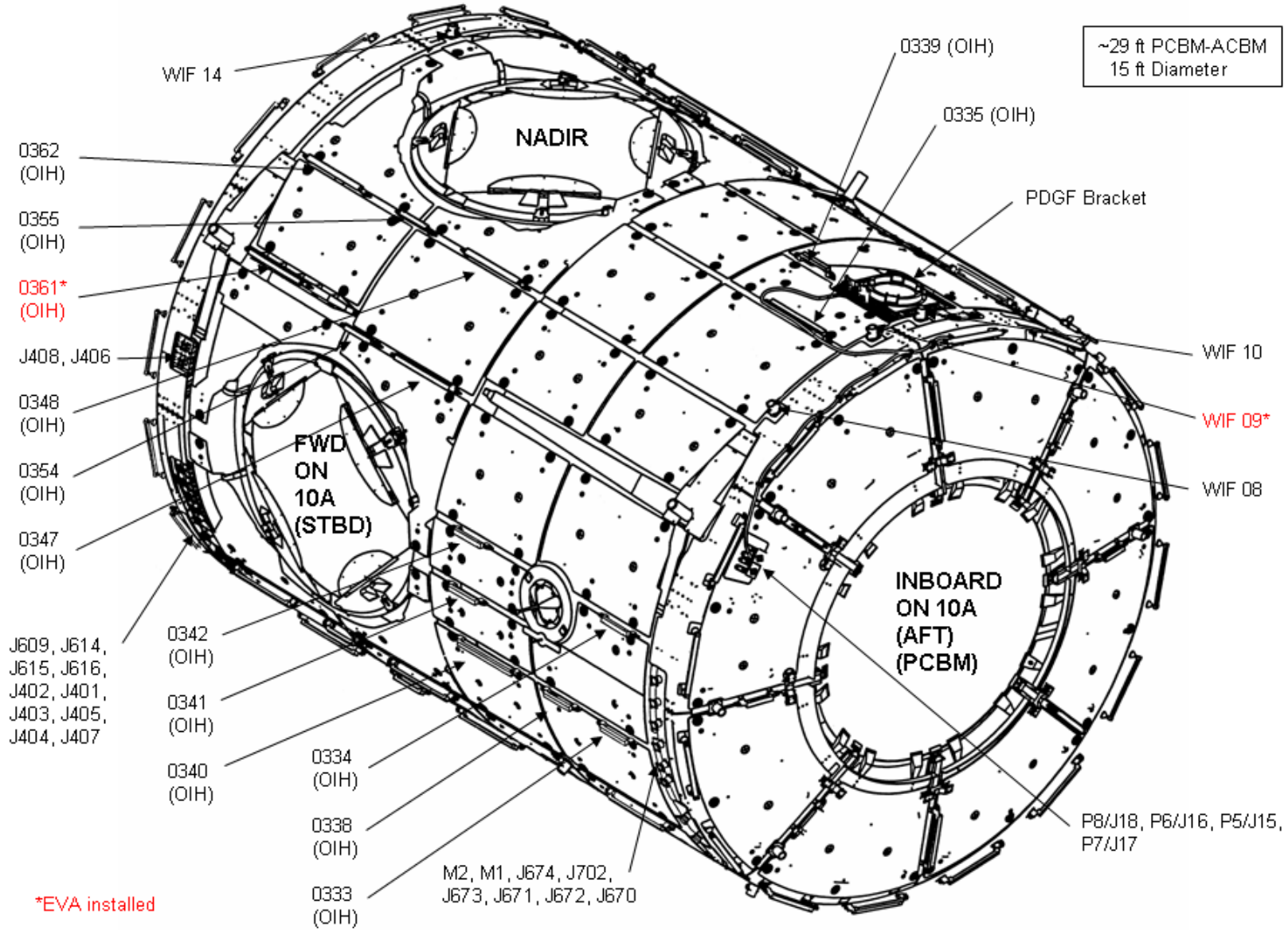
## NODE 2 ZENITH PORT HANDRAILS



# NODE 2 FWD END CONE

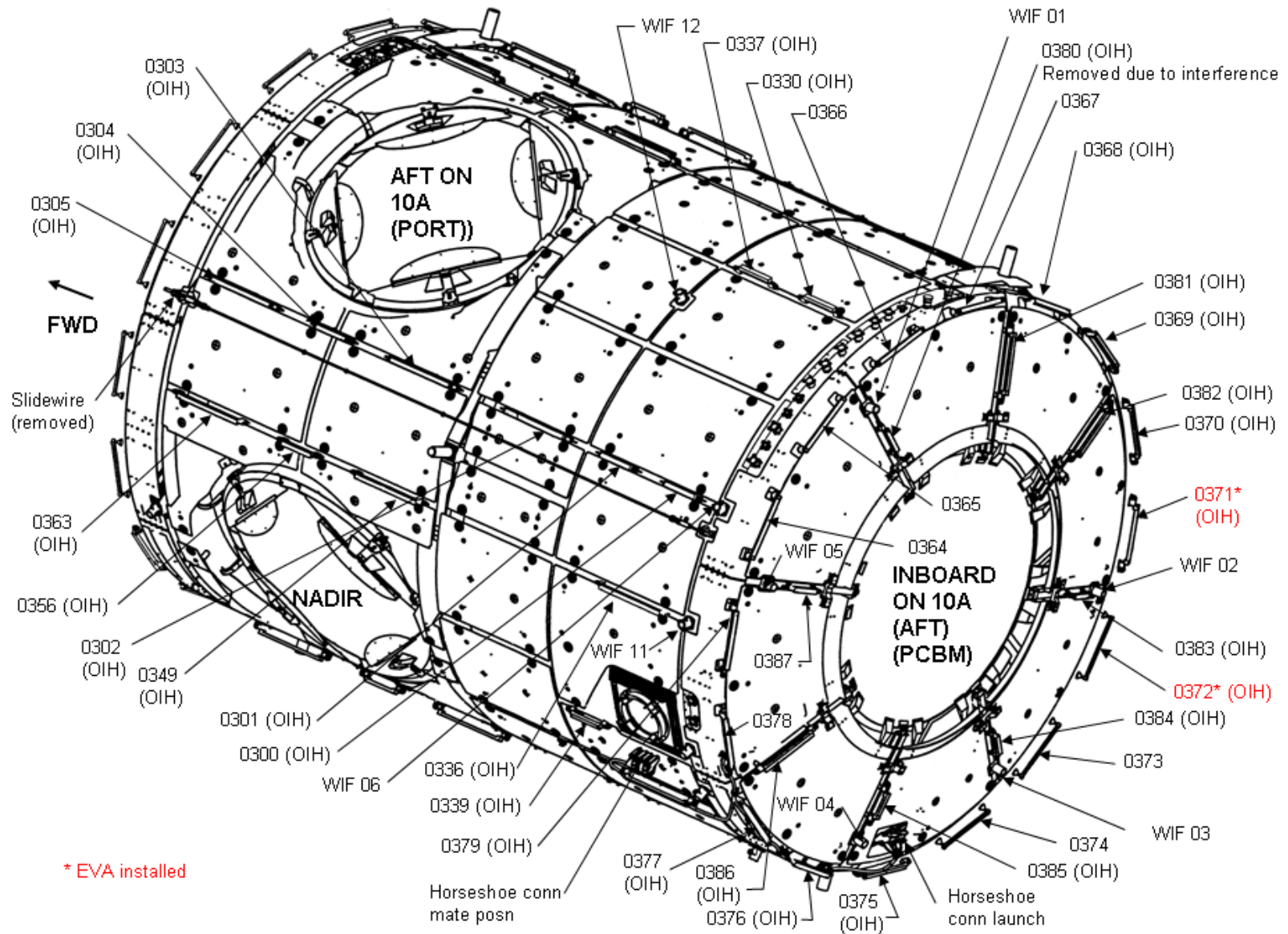


# NODE 2 NADIR STBD HANDRAILS

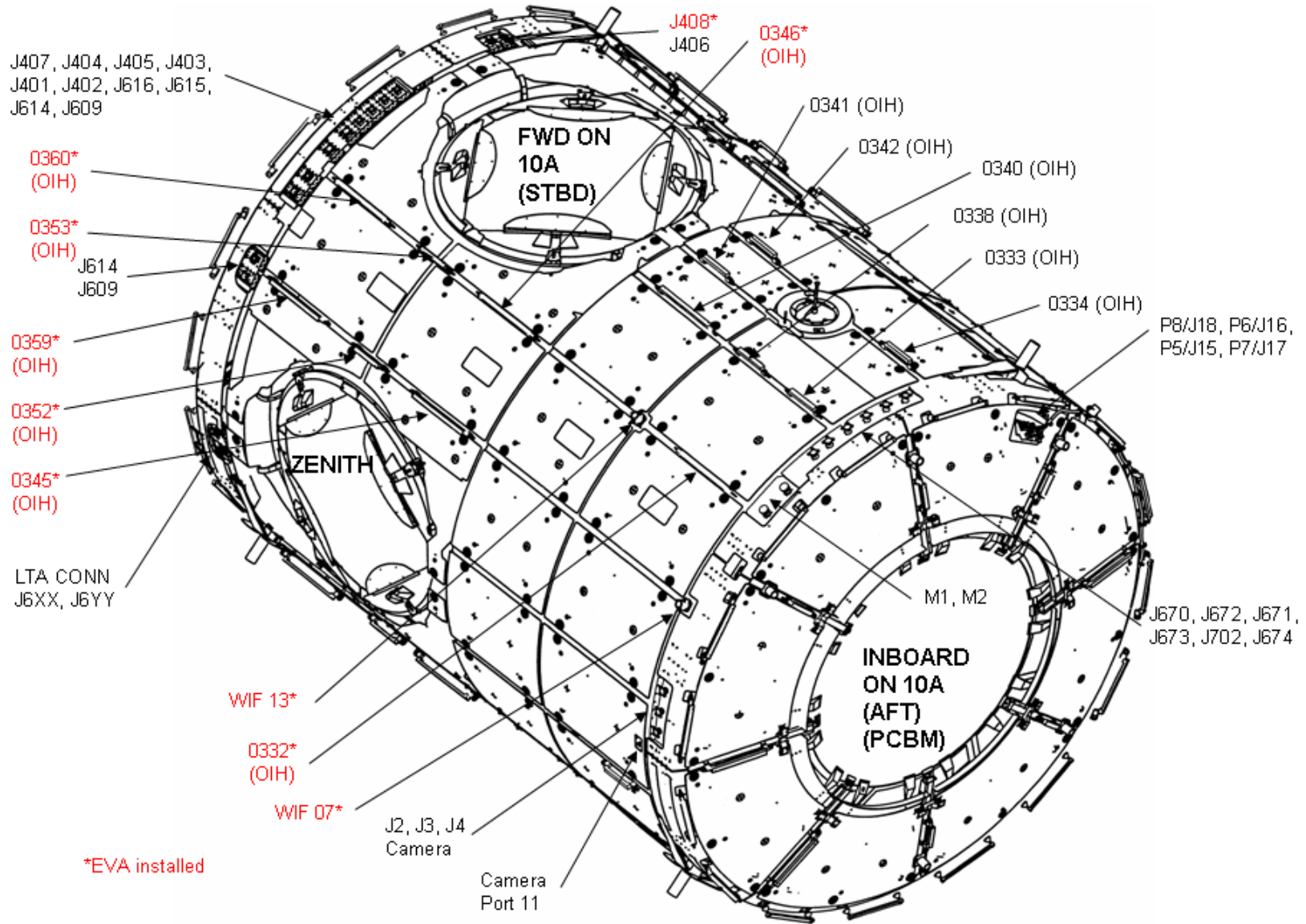




# NODE 2 PORT NADIR HANDRAILS



# NODE 2 STBD ZENITH HANDRAILS





## TRUNNION COVER LABELING

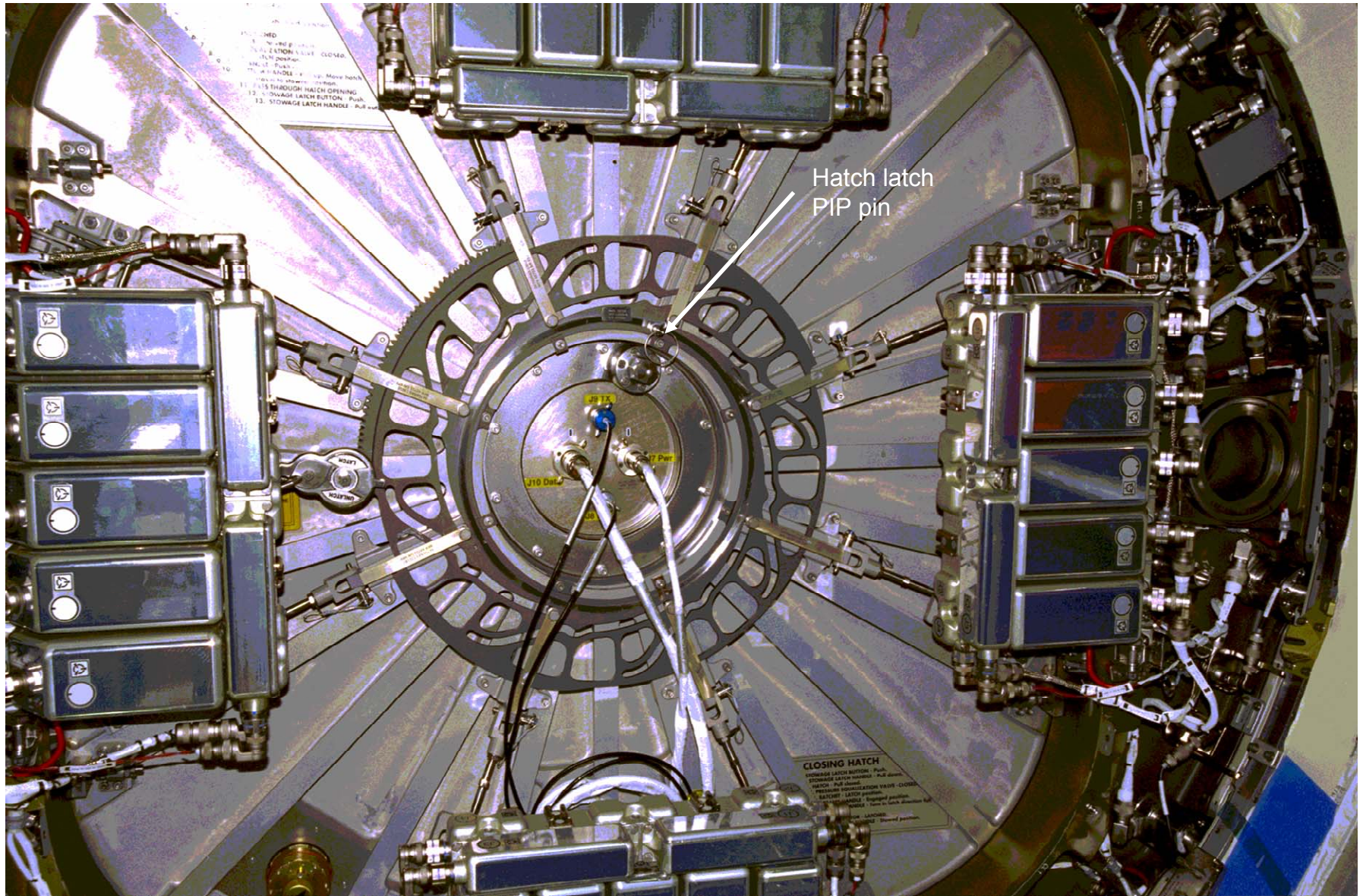


FS 18-9

EVA/120/FIN

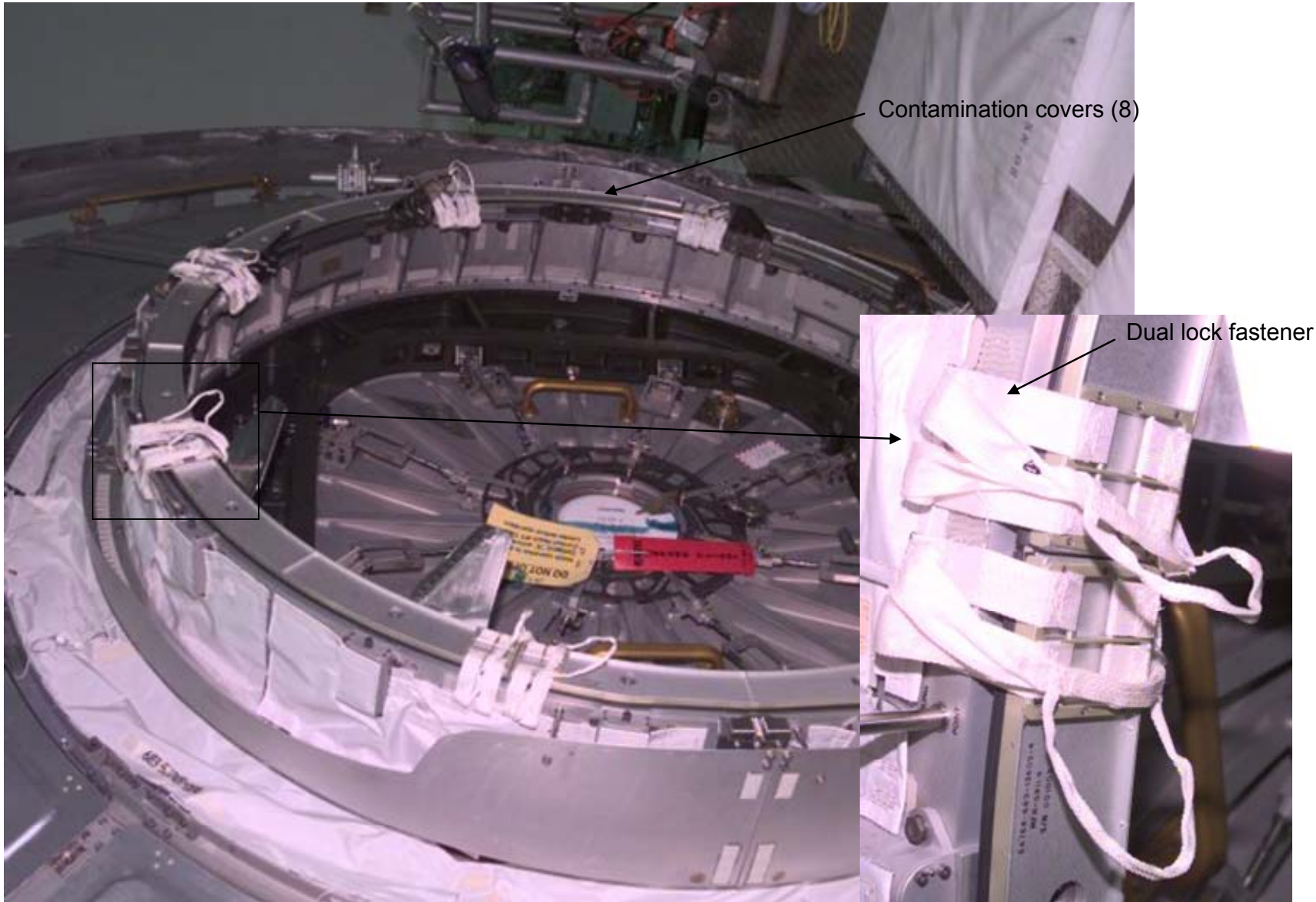


ACBM





# PCBM WITH CONTAMINATION COVERS



**CONTAMINATION COVER**



Tether point

Dual lock



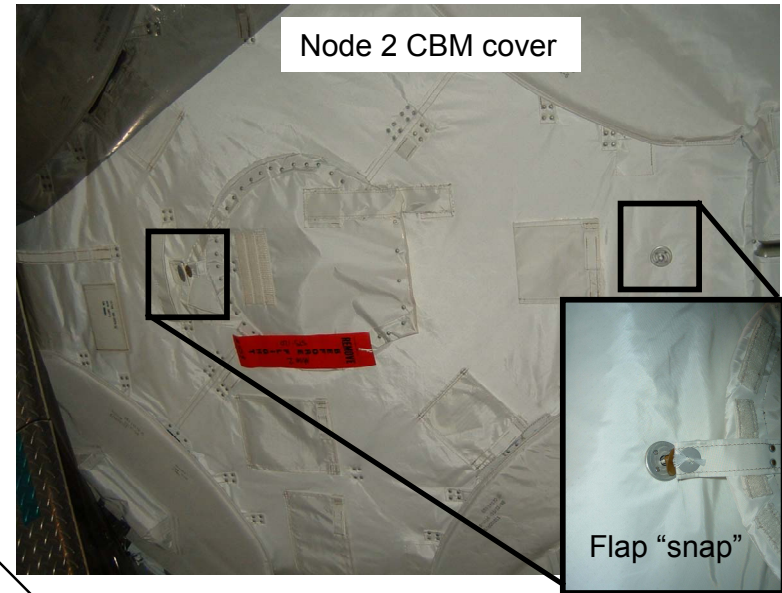
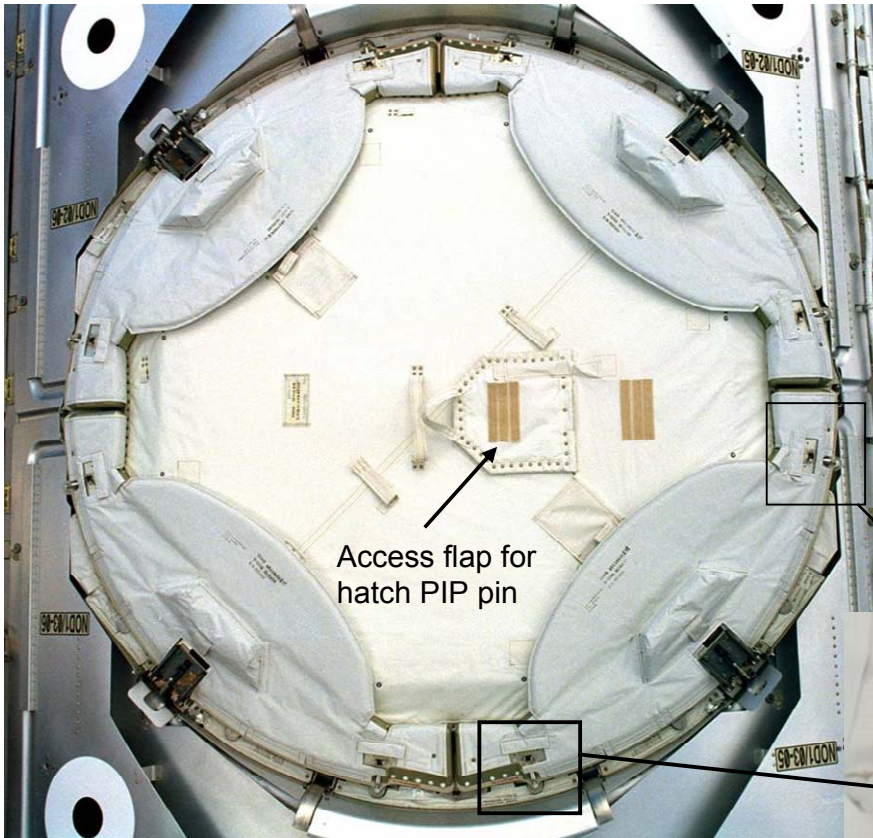
## PCBM CONTAMINATION COVER



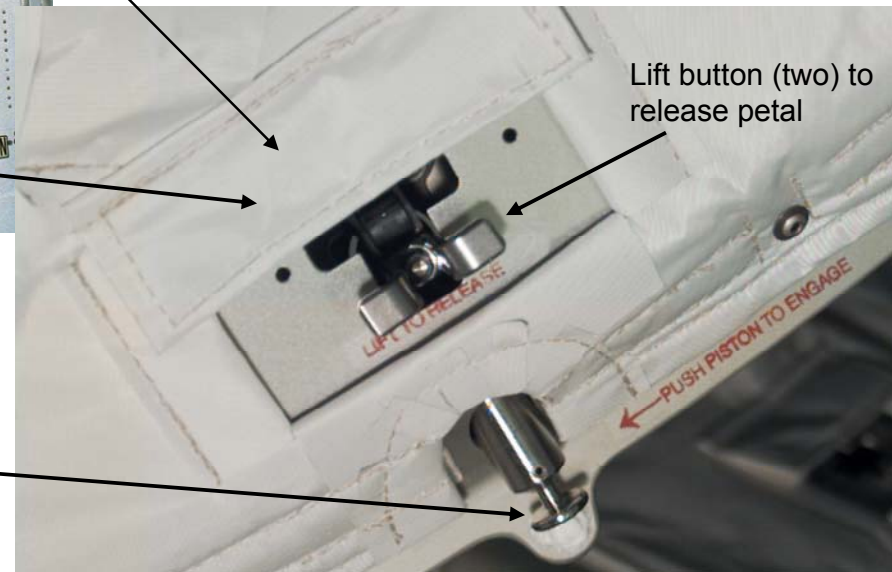
Dual lock  
fastener

Tether point and  
release strap

# CBM PETAL RELEASE



NOTE: Node 1 CMB – Node 2 CBMs look slightly different



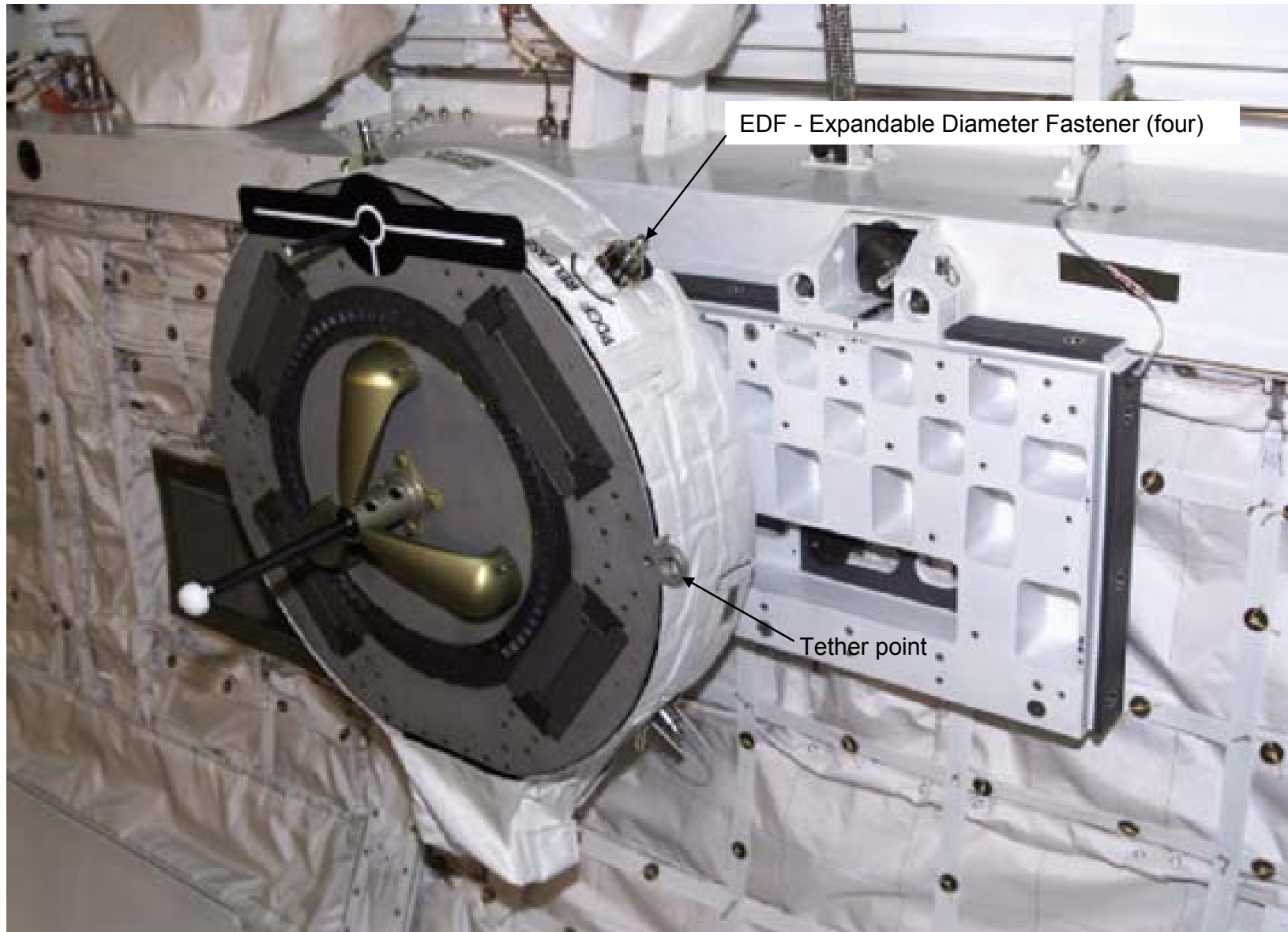


Z1 FLUID QDs STOWED ON Z1



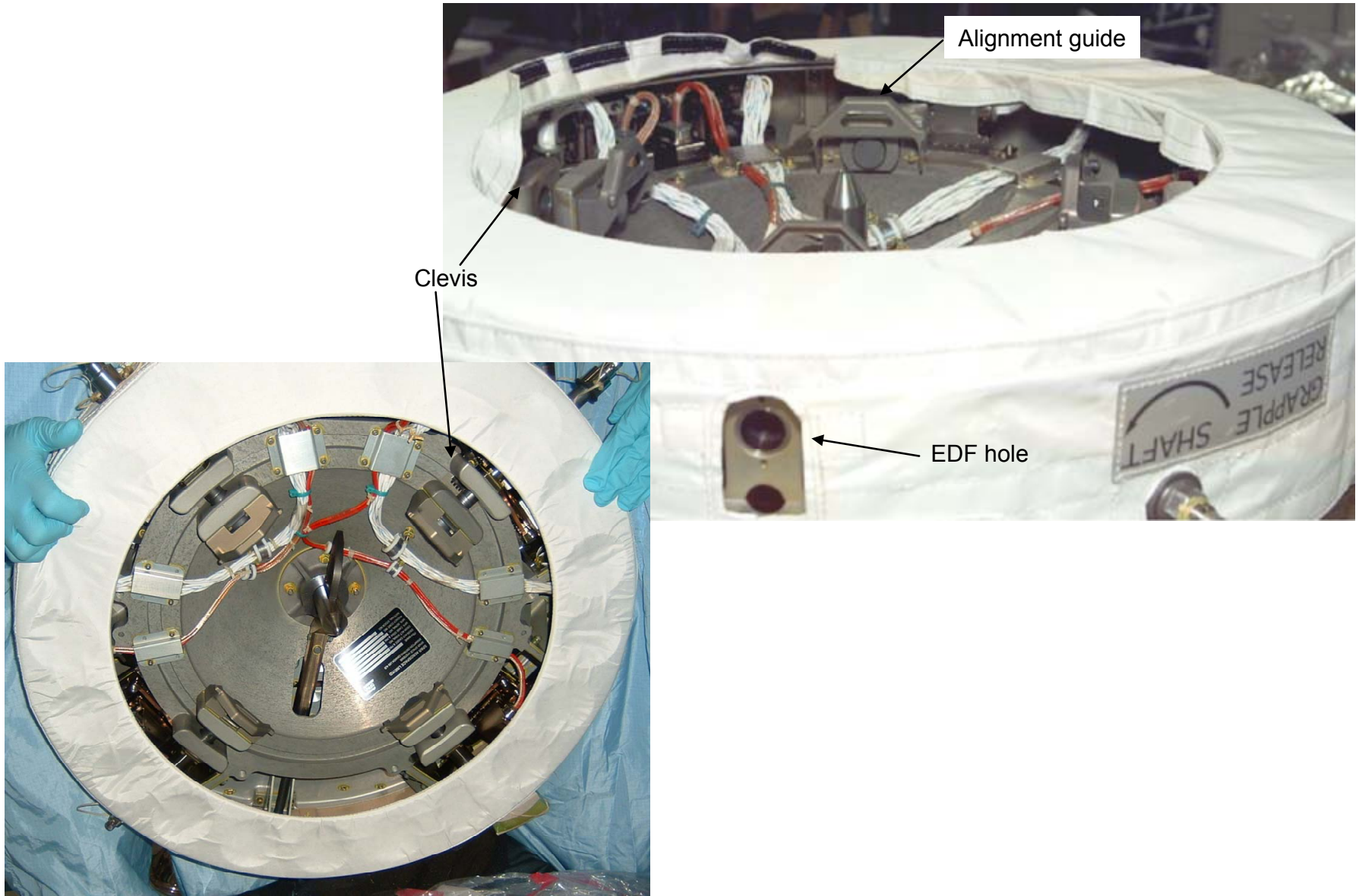
NOTE: MLI shroud not installed

## PDGF SIDEWALL CARRIER

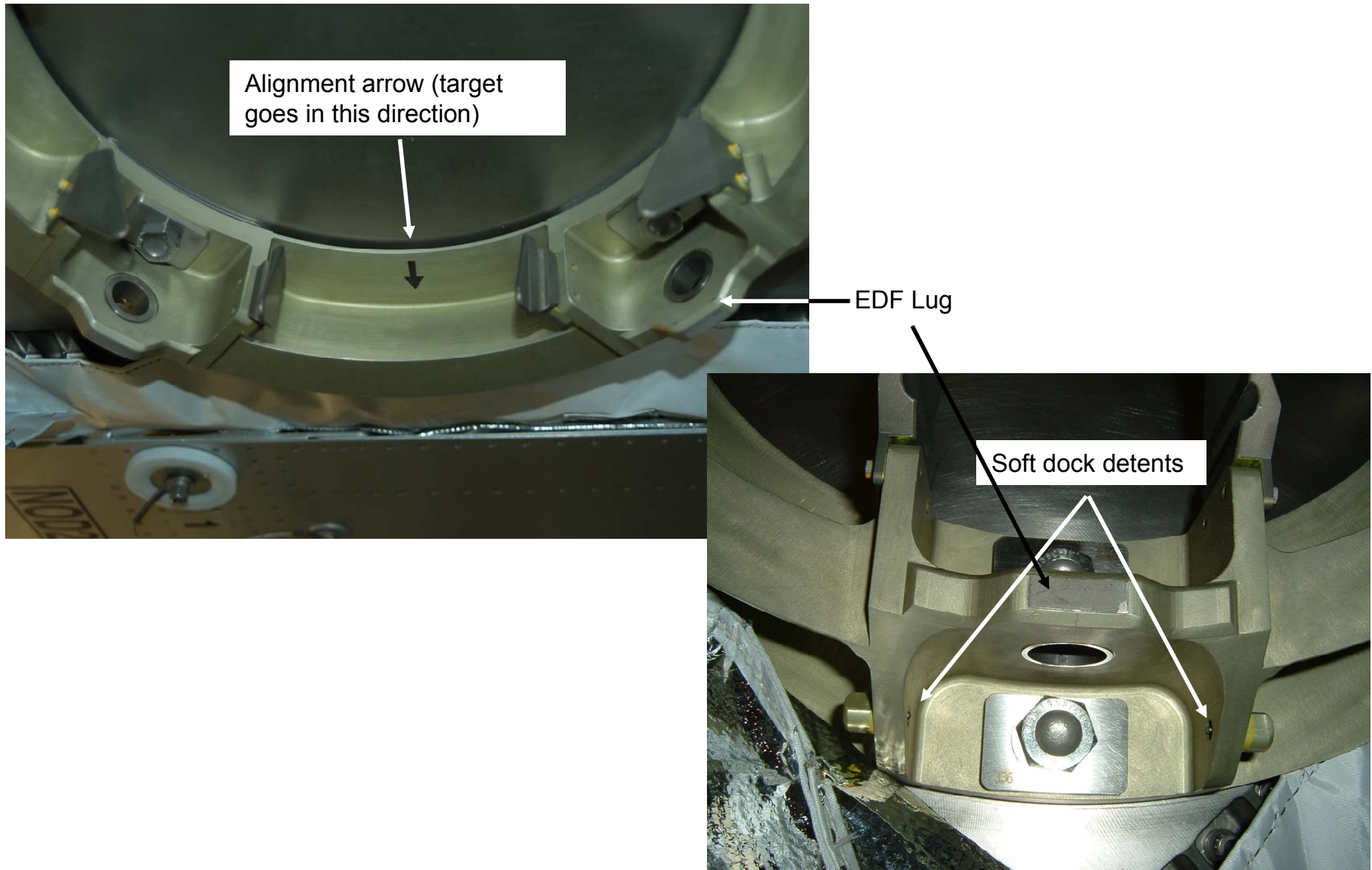




**PDGF UNDERSIDE**

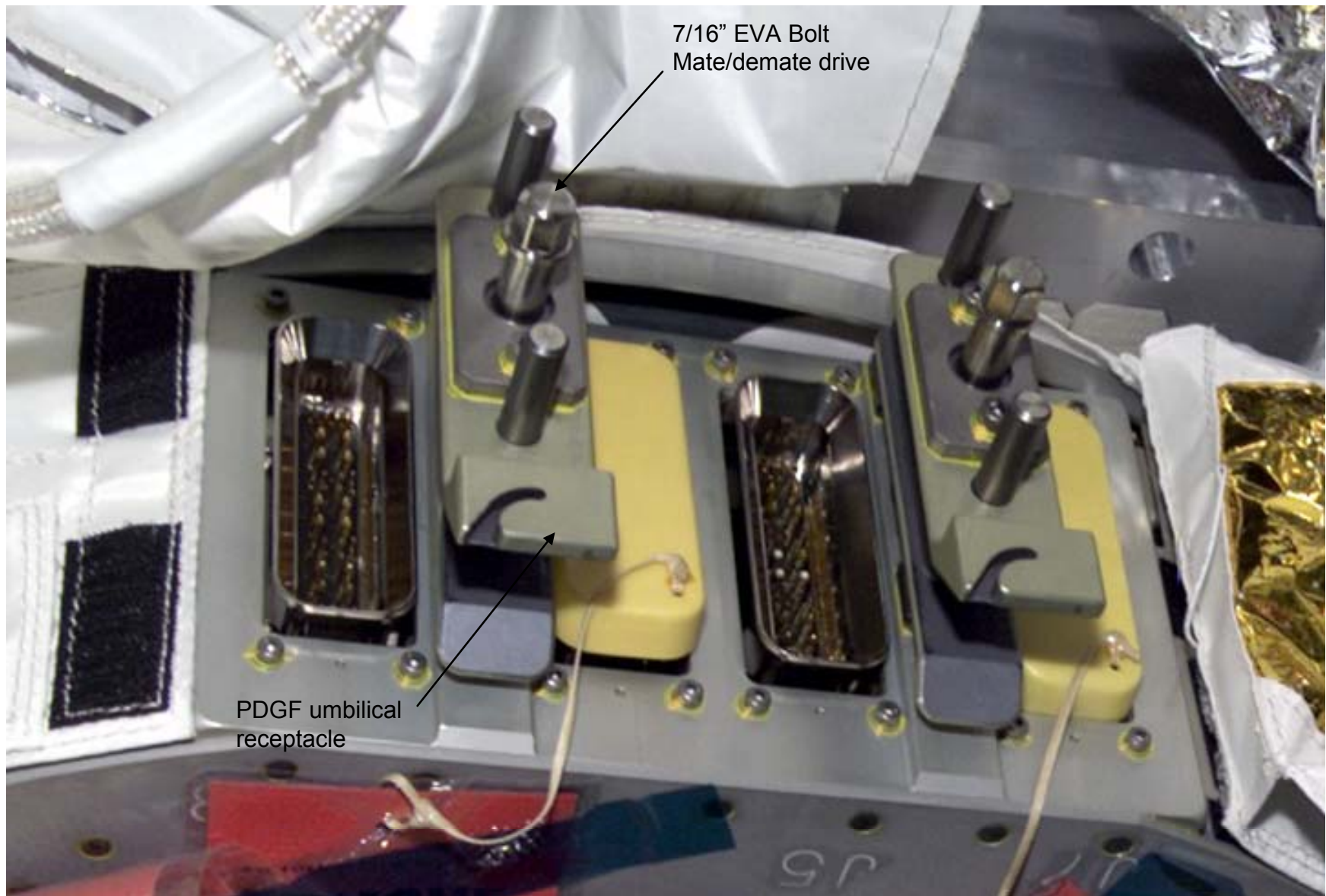


NODE 2 PDGF MOUNTING RING

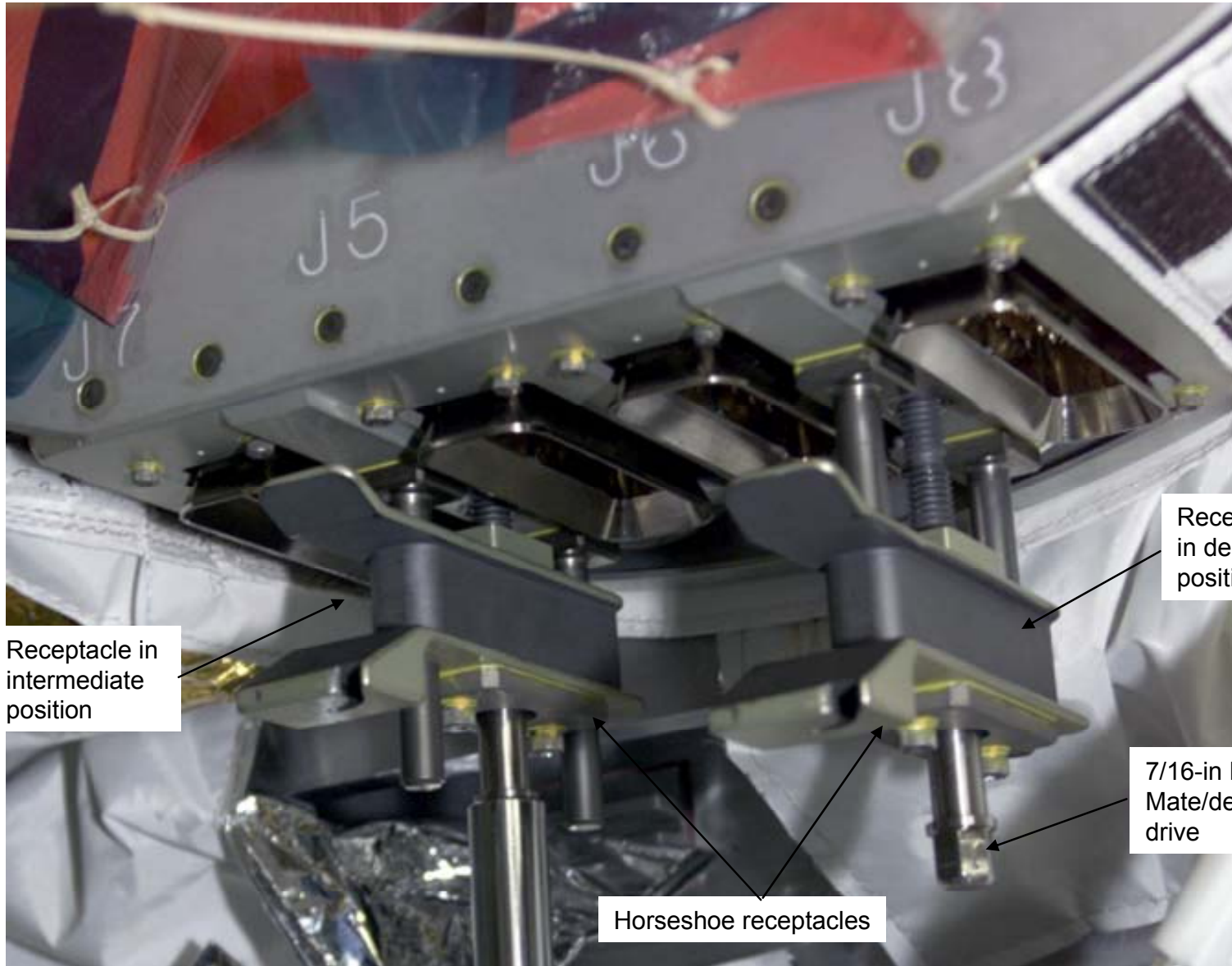




## HORSESHOE CONNECTOR INTERFACE



# PDGF HORSESHOE CONNECTOR RECEPTACLE



Receptacle in intermediate position

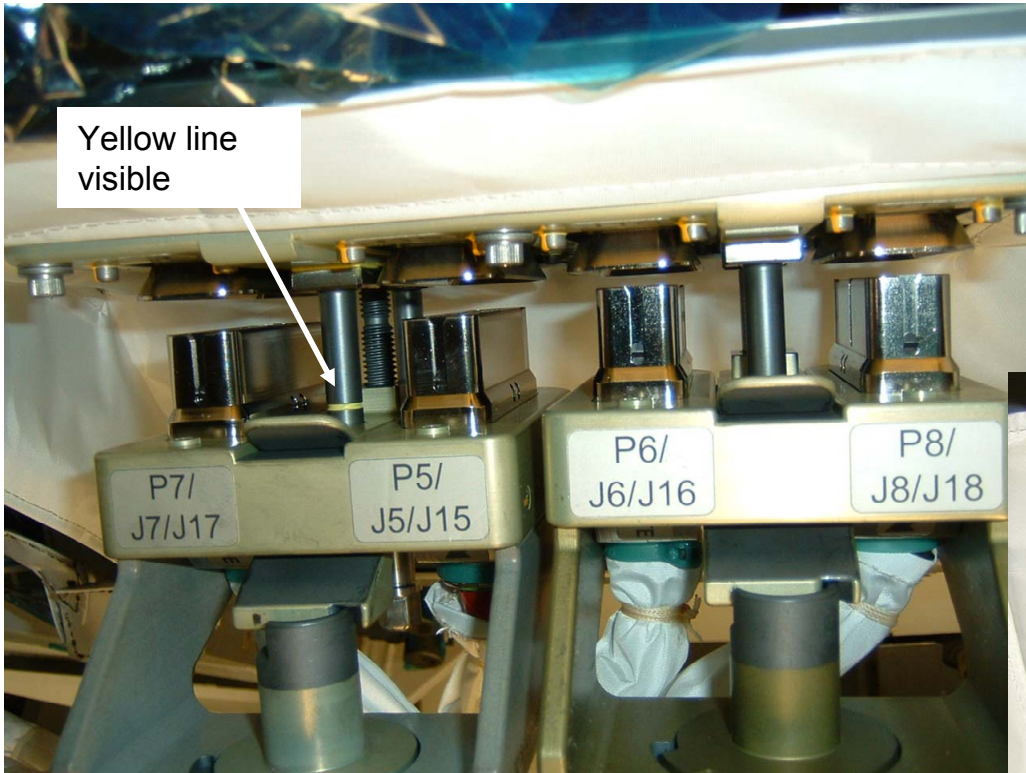
Receptacle in demated position

7/16-in EVA bolt  
Mate/demate drive

Horseshoe receptacles



## NODE 2 HORSESHOE CONNECTORS



Horseshoe connector engagement bolt released, with microfixture still in locked position



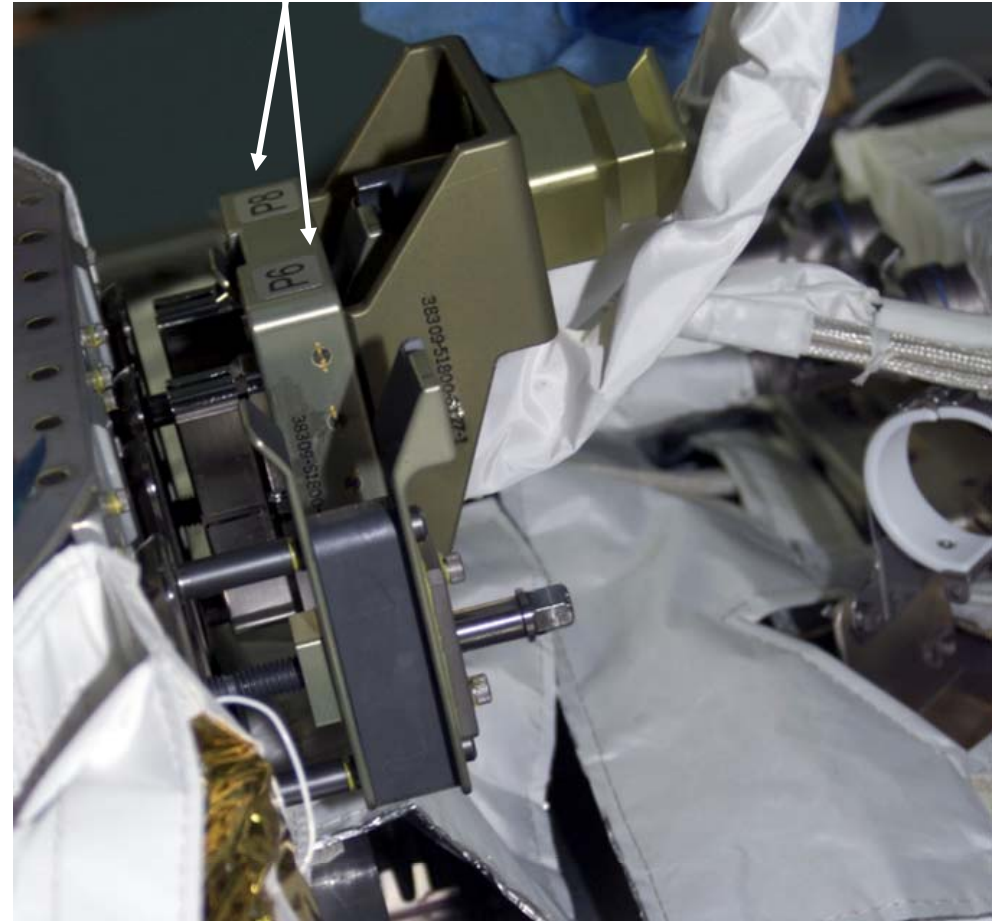
Horseshoe connectors released and removed

## HORSESHOE CONNECTOR SOFTDOCK

NOTE: Labeling on Node 2  
horseshoe is different than in photo



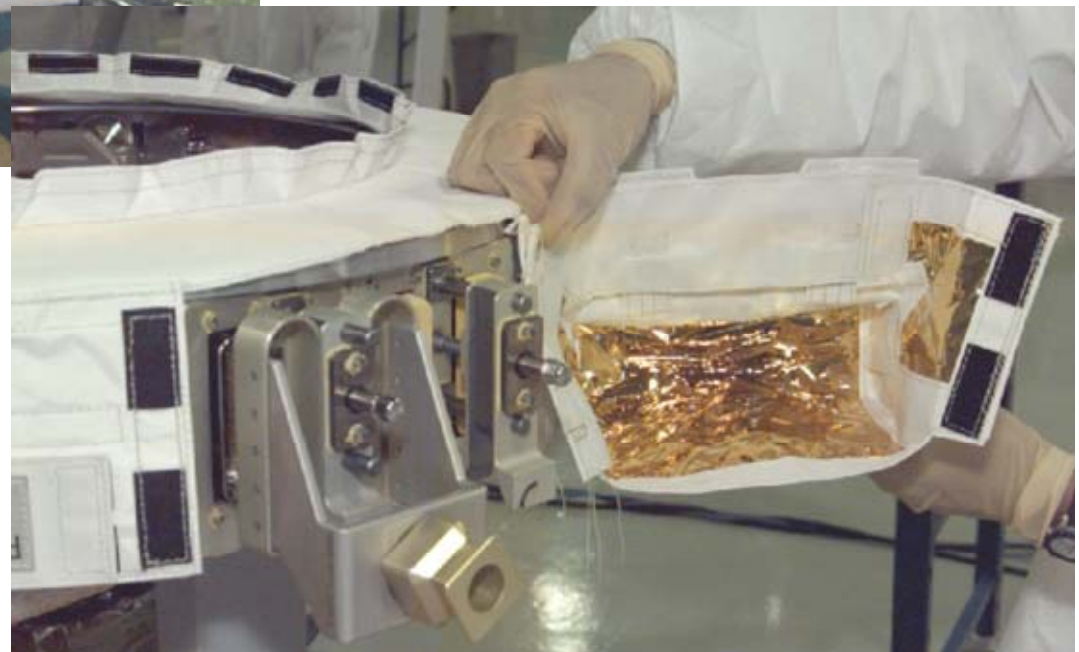
Connector prior to softdock



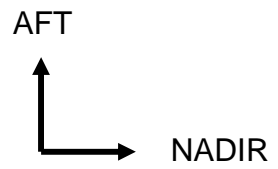
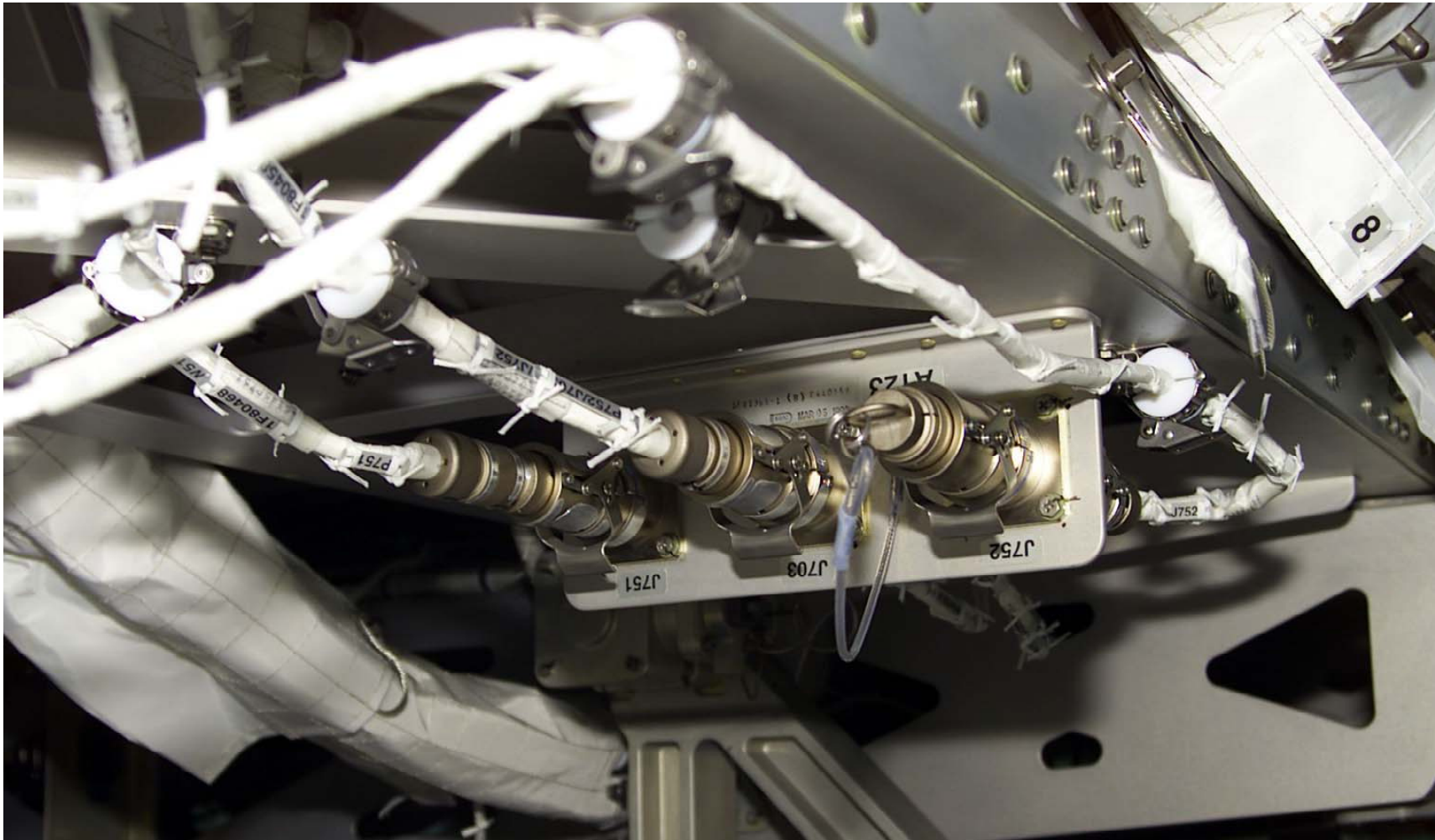
Connector softdocked and in the  
demated position



## PDGF CONNECTOR INTERFACE

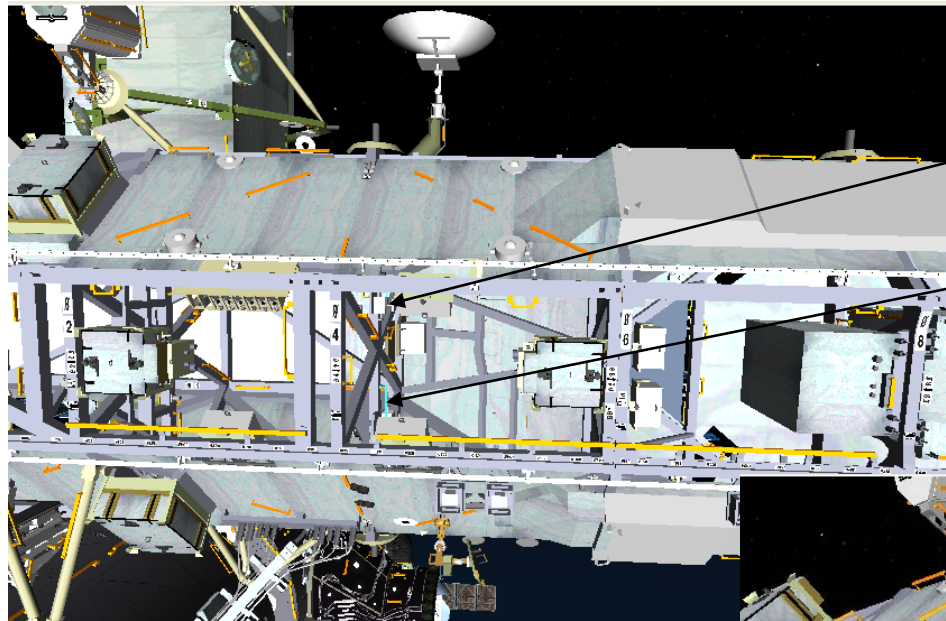


# S1 SFU CONFIG FOR DEPLOY

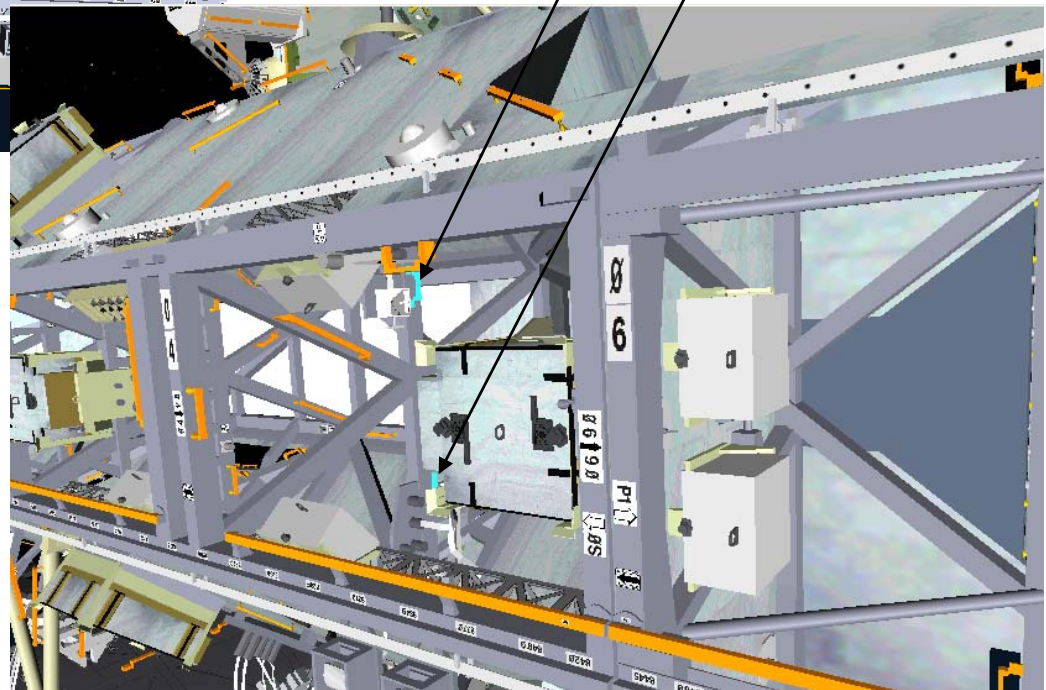




# MBSU BYPASS JUMPER – PANELS A260 AND A200



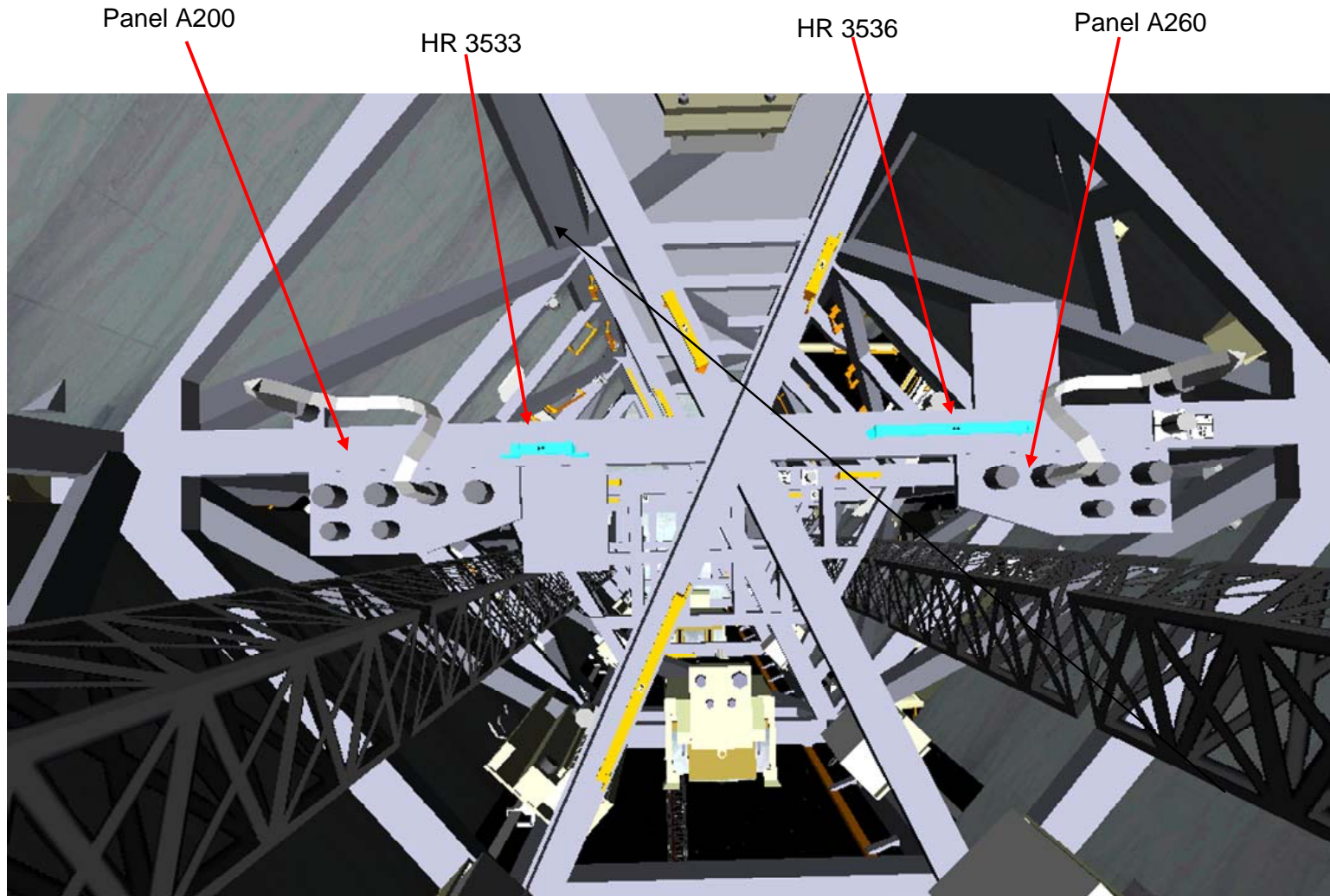
S0, Bay 4



HR 3533  
Panel A200

HR 3536  
Panel A260

# MBSU BYPASS JUMPER – PANELS A260 AND A200 (Cont)



Panel A200

HR 3533

HR 3536

Panel A260

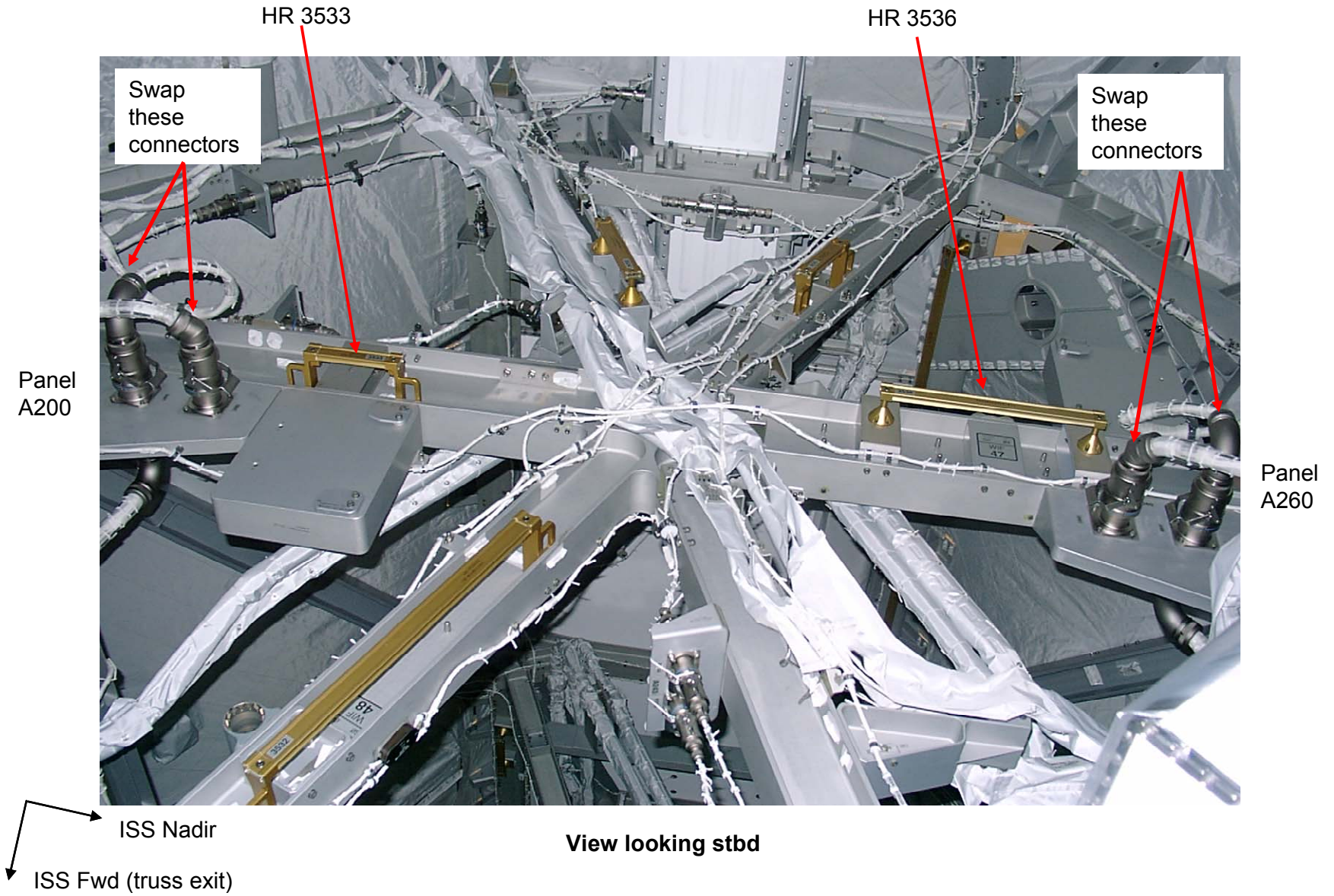
→ ISS Nadir  
↓ ISS Fwd

View looking stbd

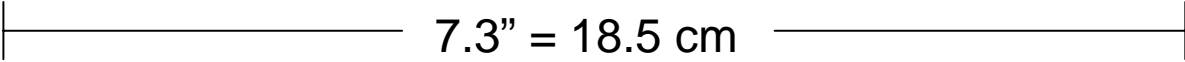
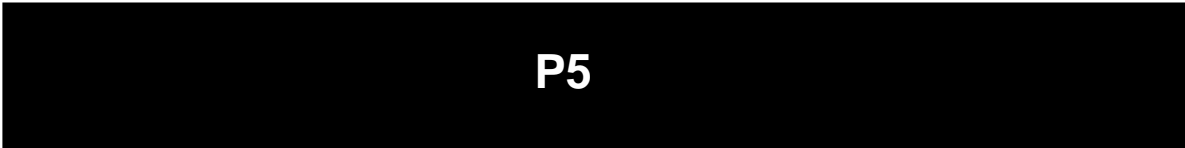
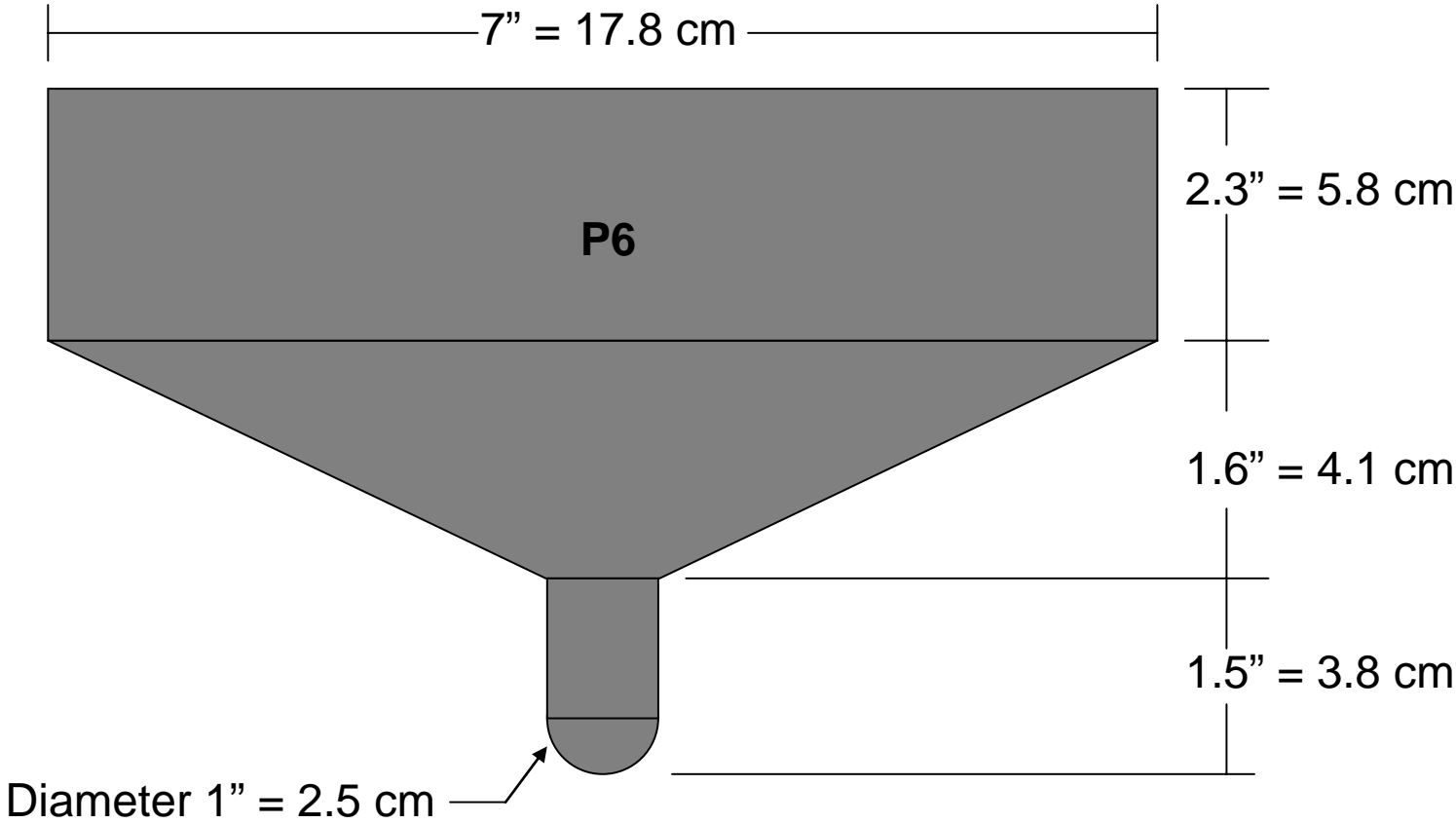
NOTE: Jumper routing  
not flight-like



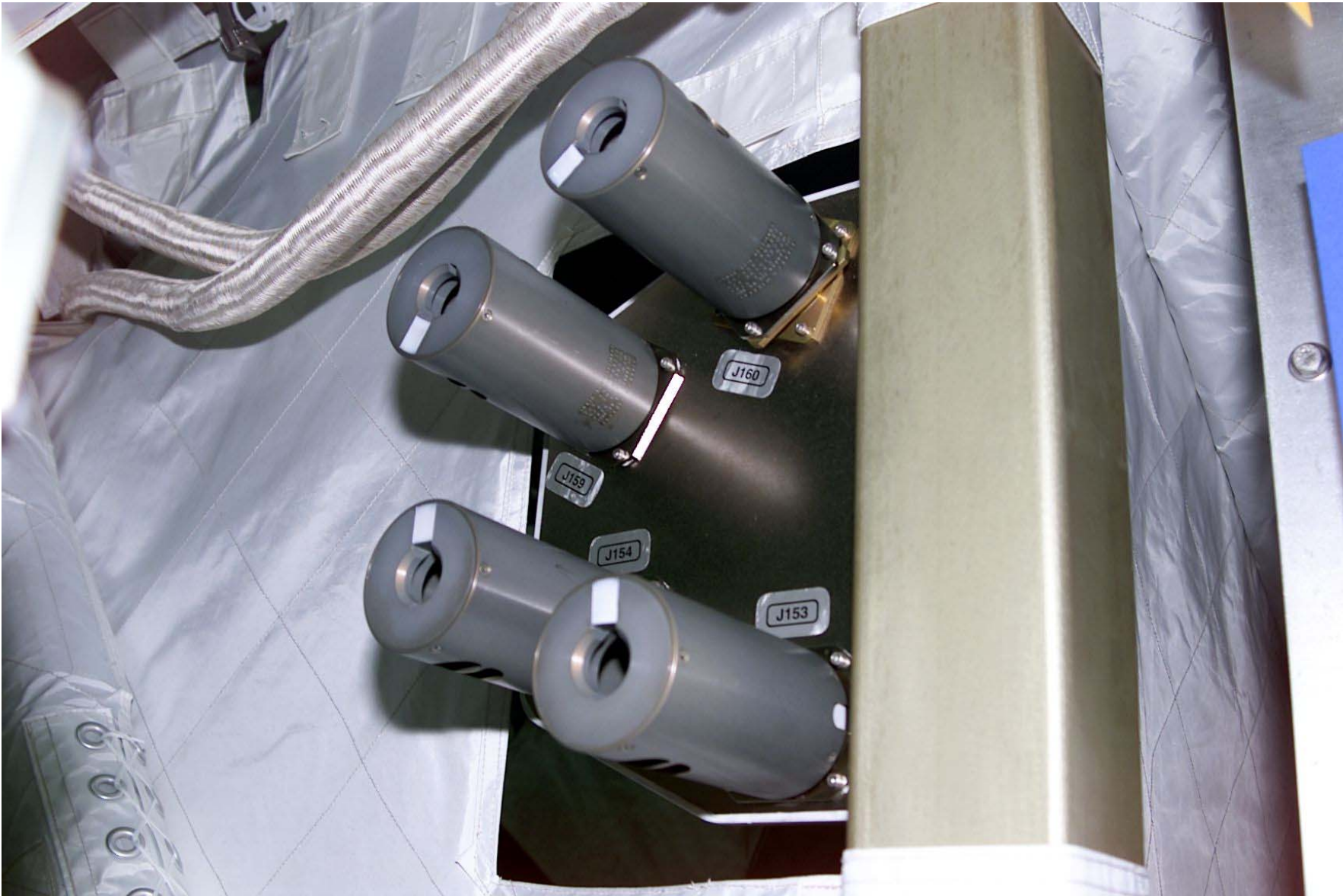
# MBSU BYPASS JUMPER – PANELS A260 AND A200 (Cont)



P6 TO P5 MEASUREMENTS

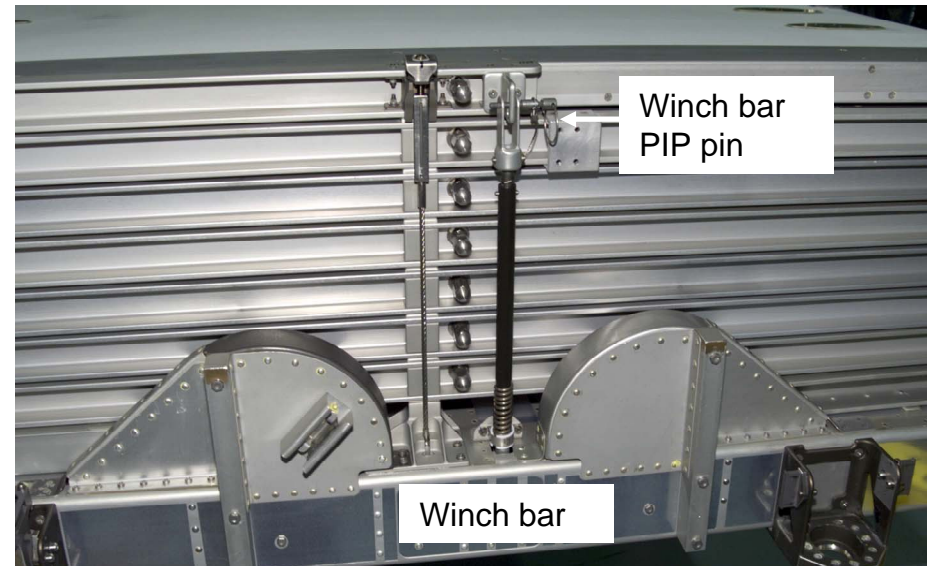
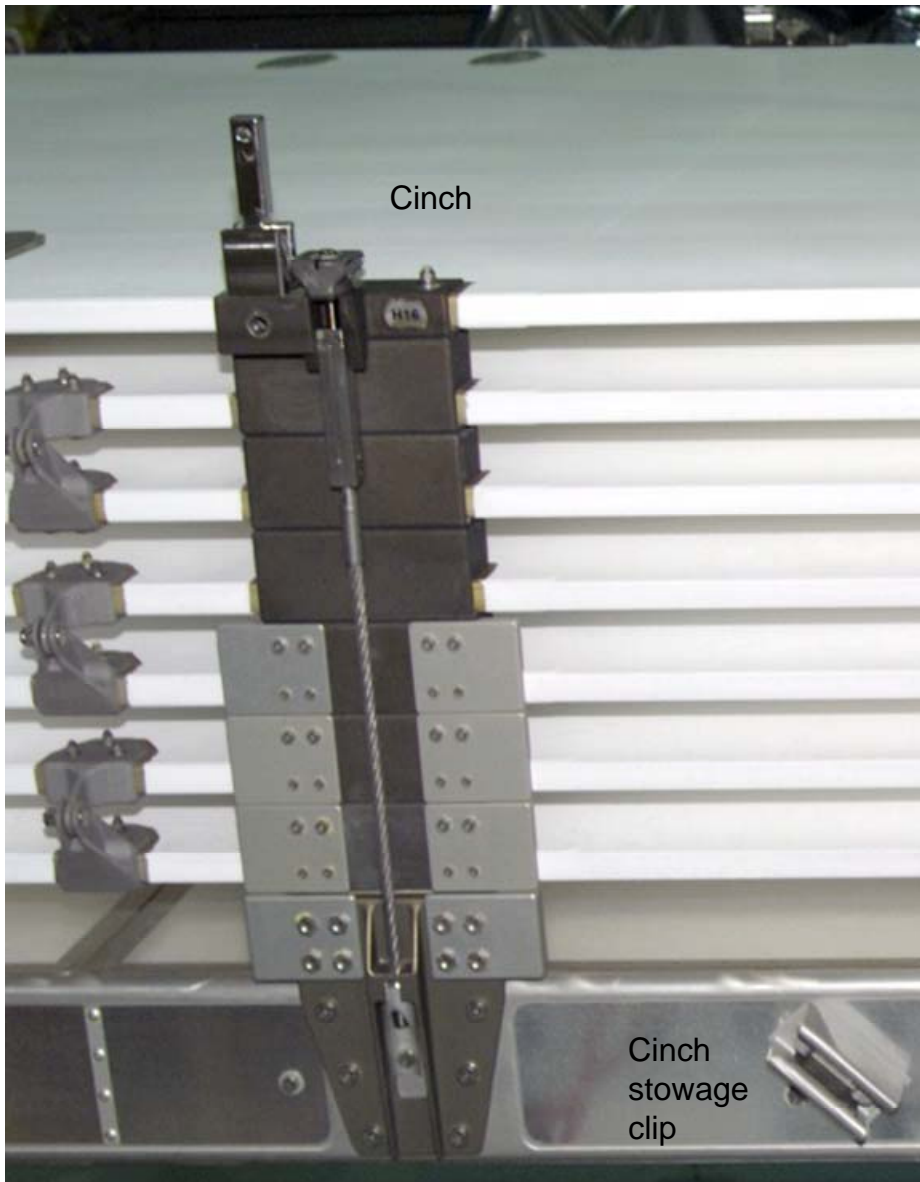


**CANNON CONNECTOR CAPS INSTALLED ON P5**

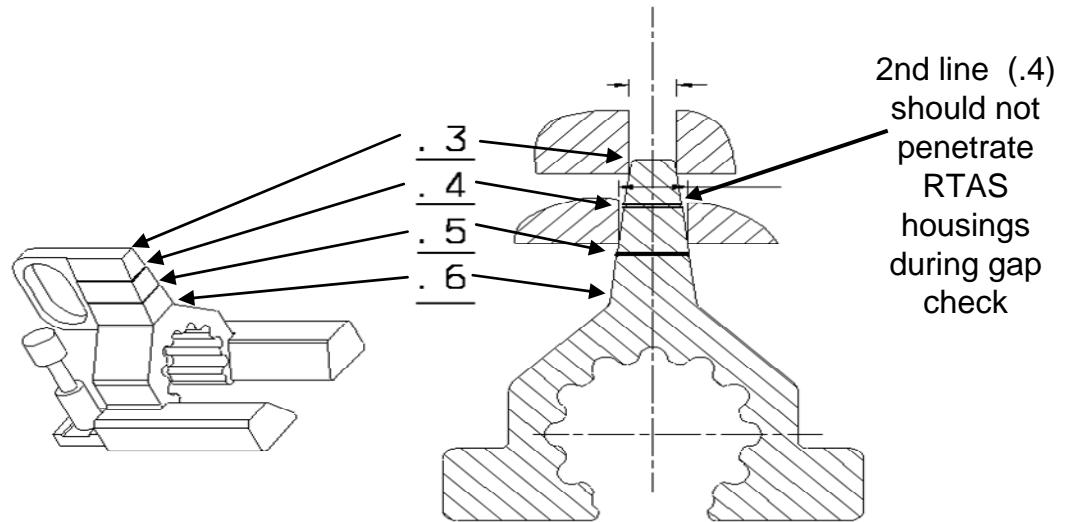
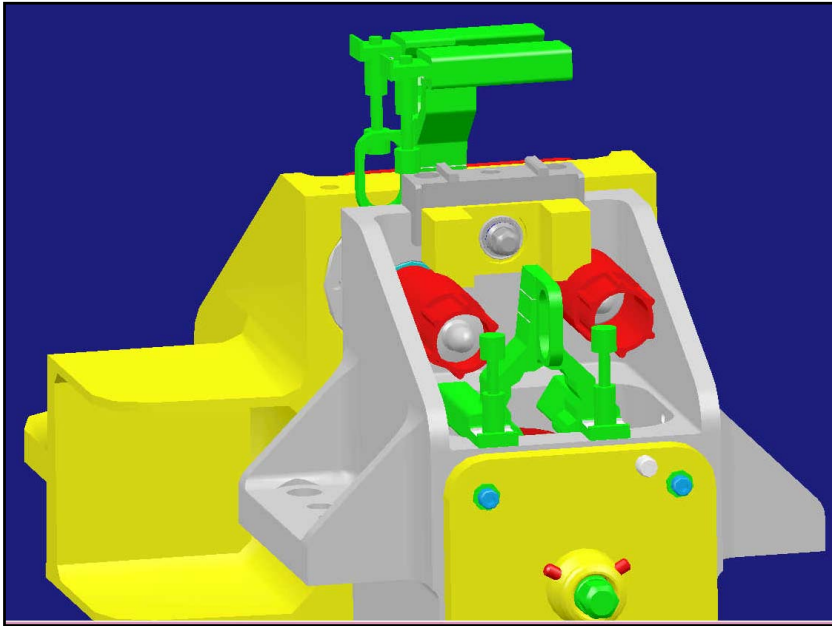




## P6 OUTBOARD RADIATOR



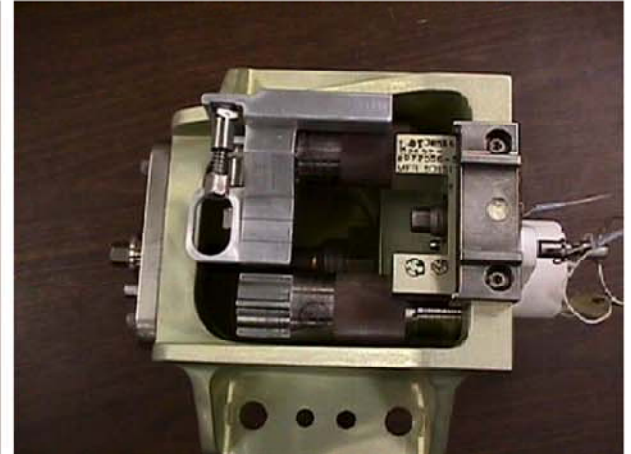
# GAP CHECK TOOL



LAUNCH POSITION  
(RTAS corner #1)



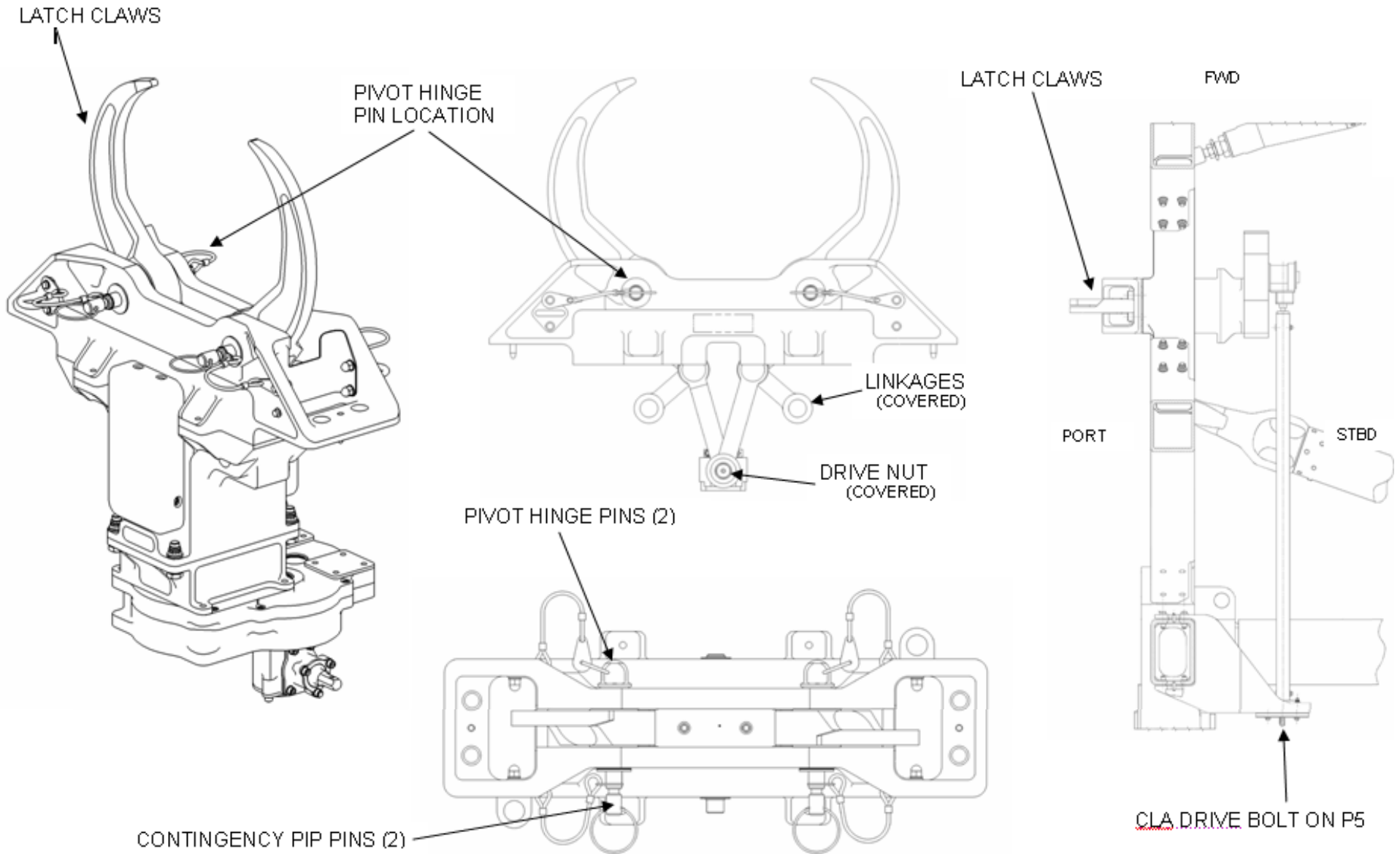
TOOL REMOVED



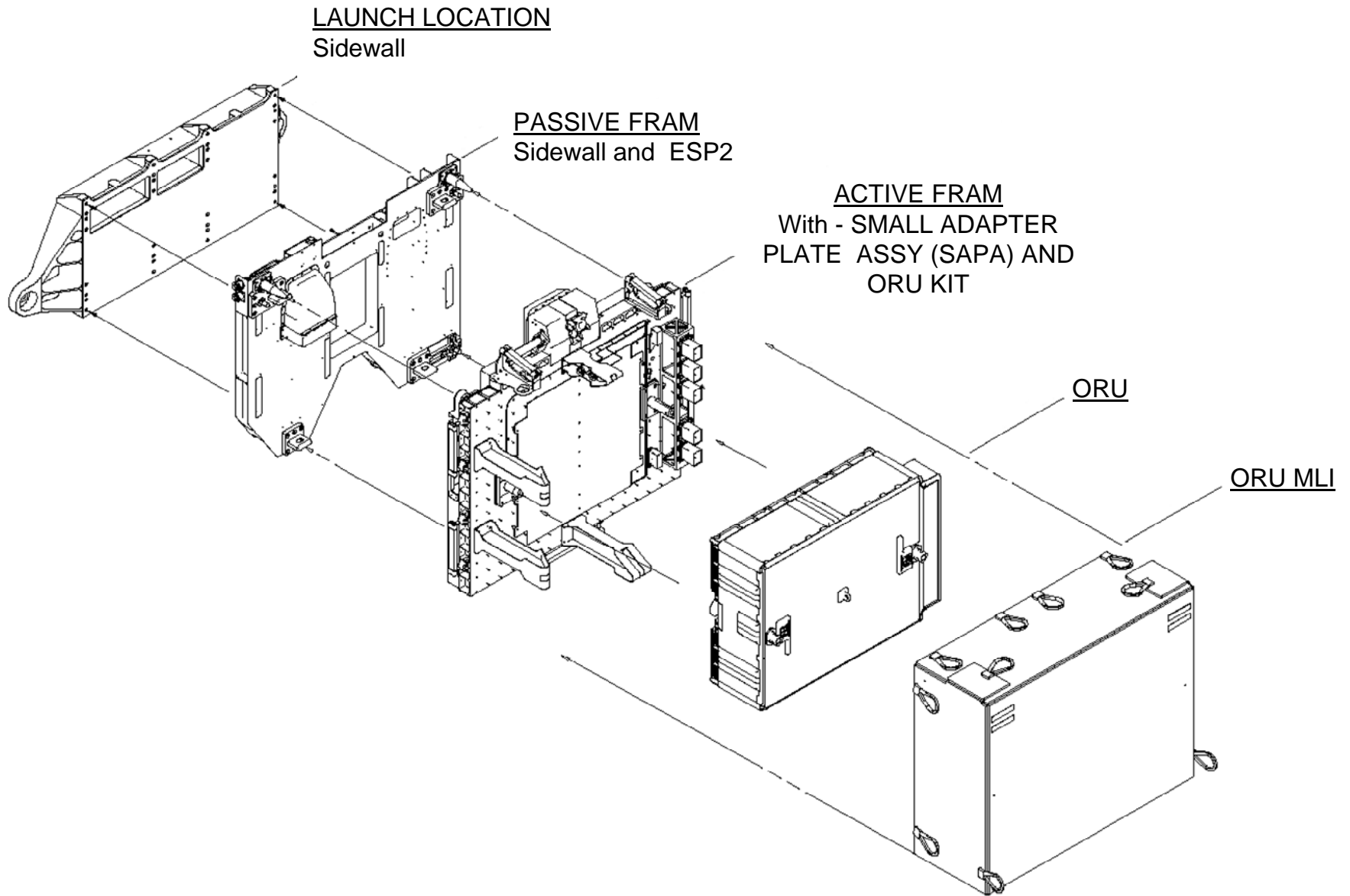
TOOL INSTALLED ON  
RTAS CONTINGENCY SPACER SLEEVE



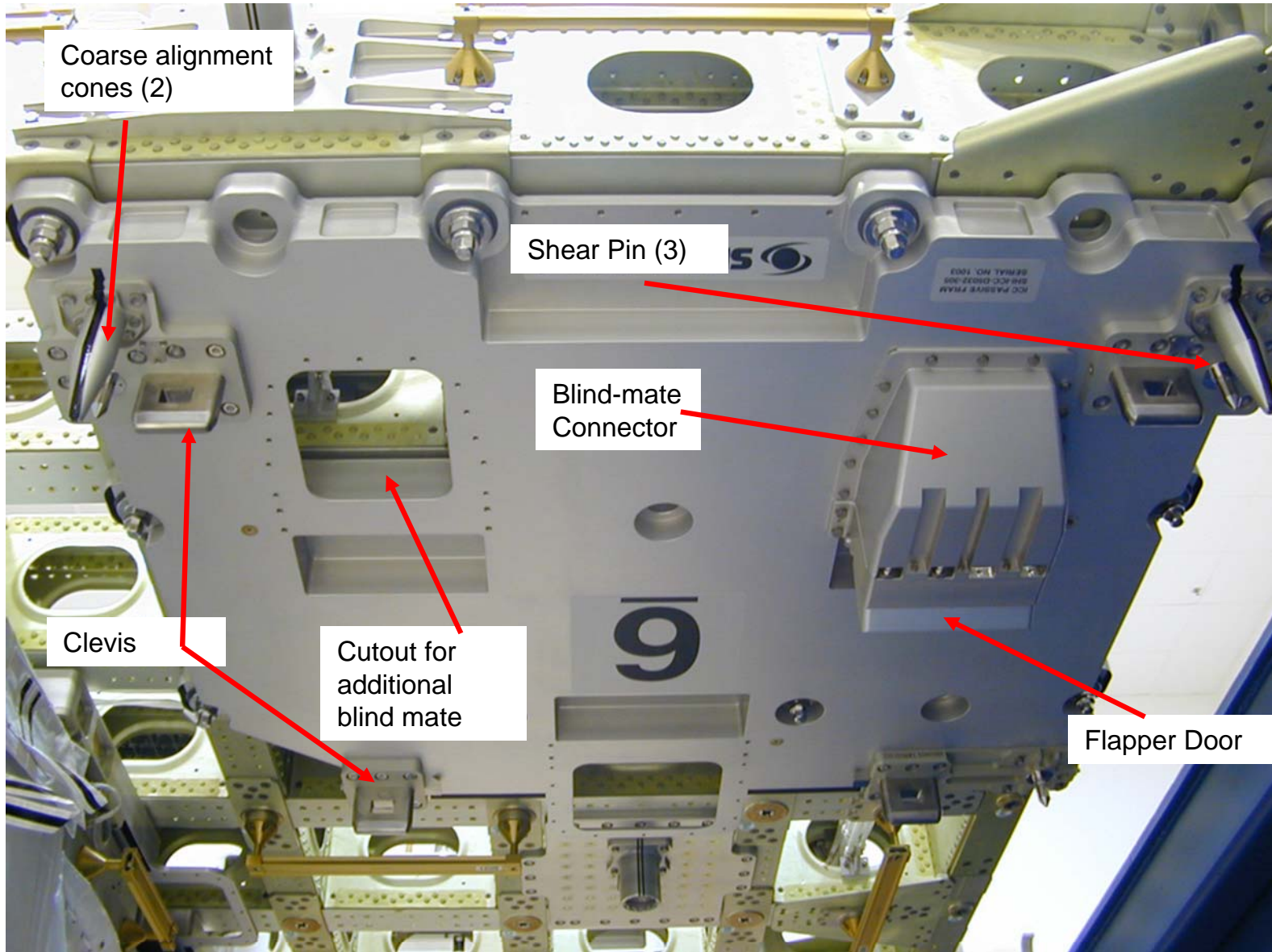
# P5 CAPTURE LATCH ASSEMBLY (CLA)



# MBSU STACK-UP



**MBSU PASSIVE FRAM ON ESP-2**

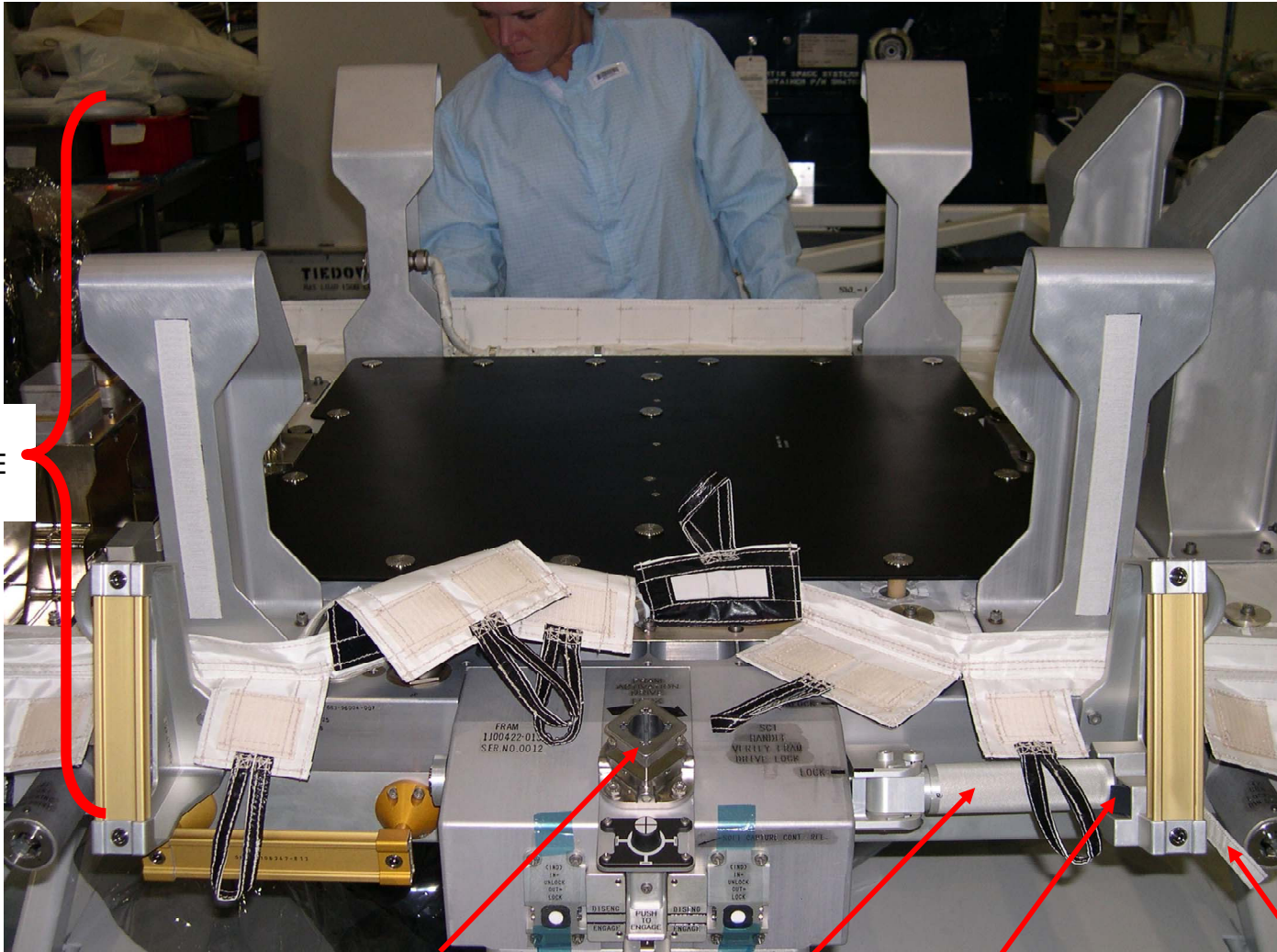


Lab

FHRC

# MBSU ACTIVE FRAM FLIGHT SUPPORT EQUIPMENT

MBSU FSE  
ON ACTIVE  
FRAM



Primary Bolt

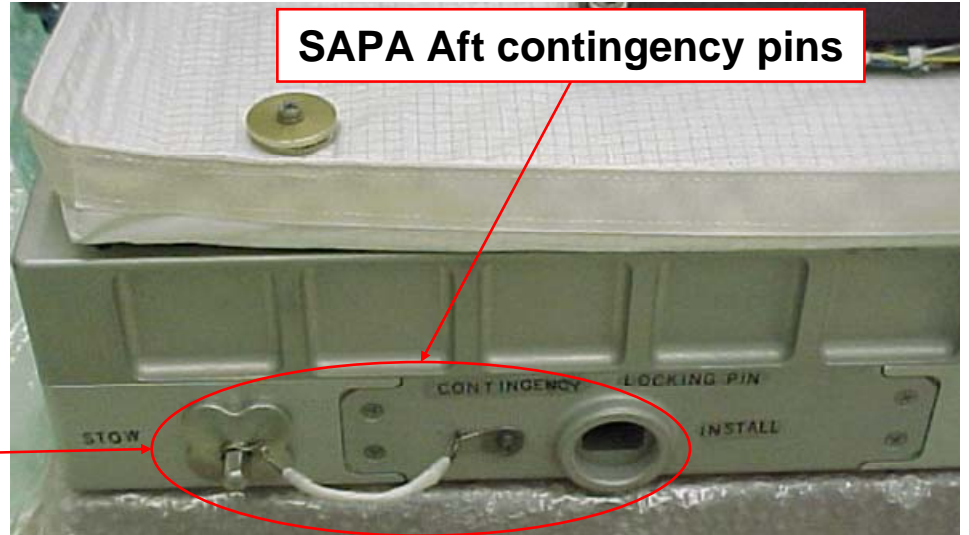
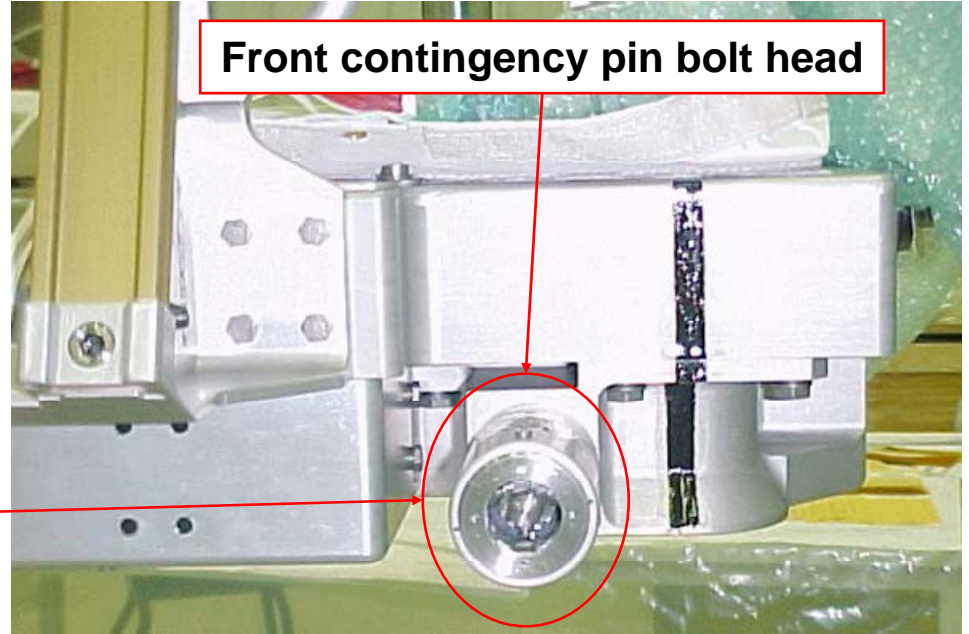
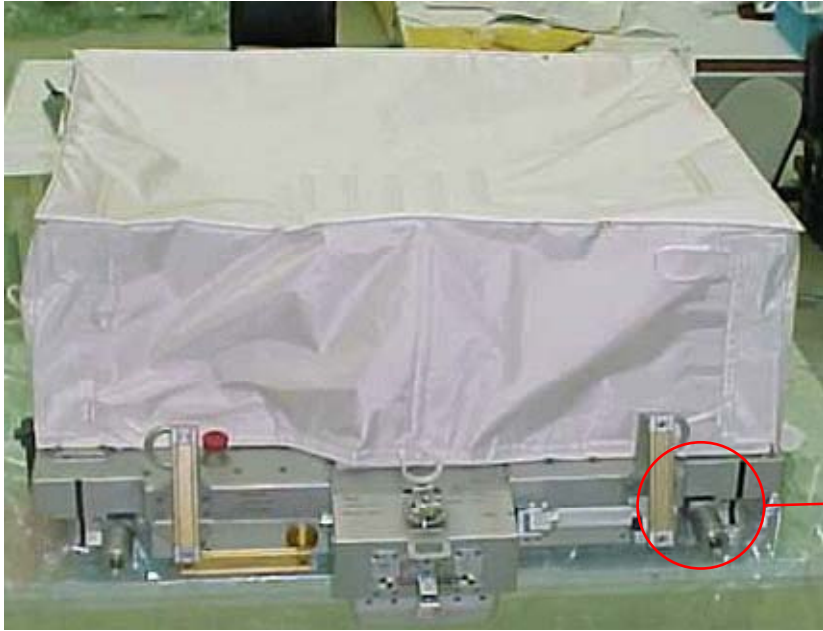
Override Lever

Lever Locking  
Tab

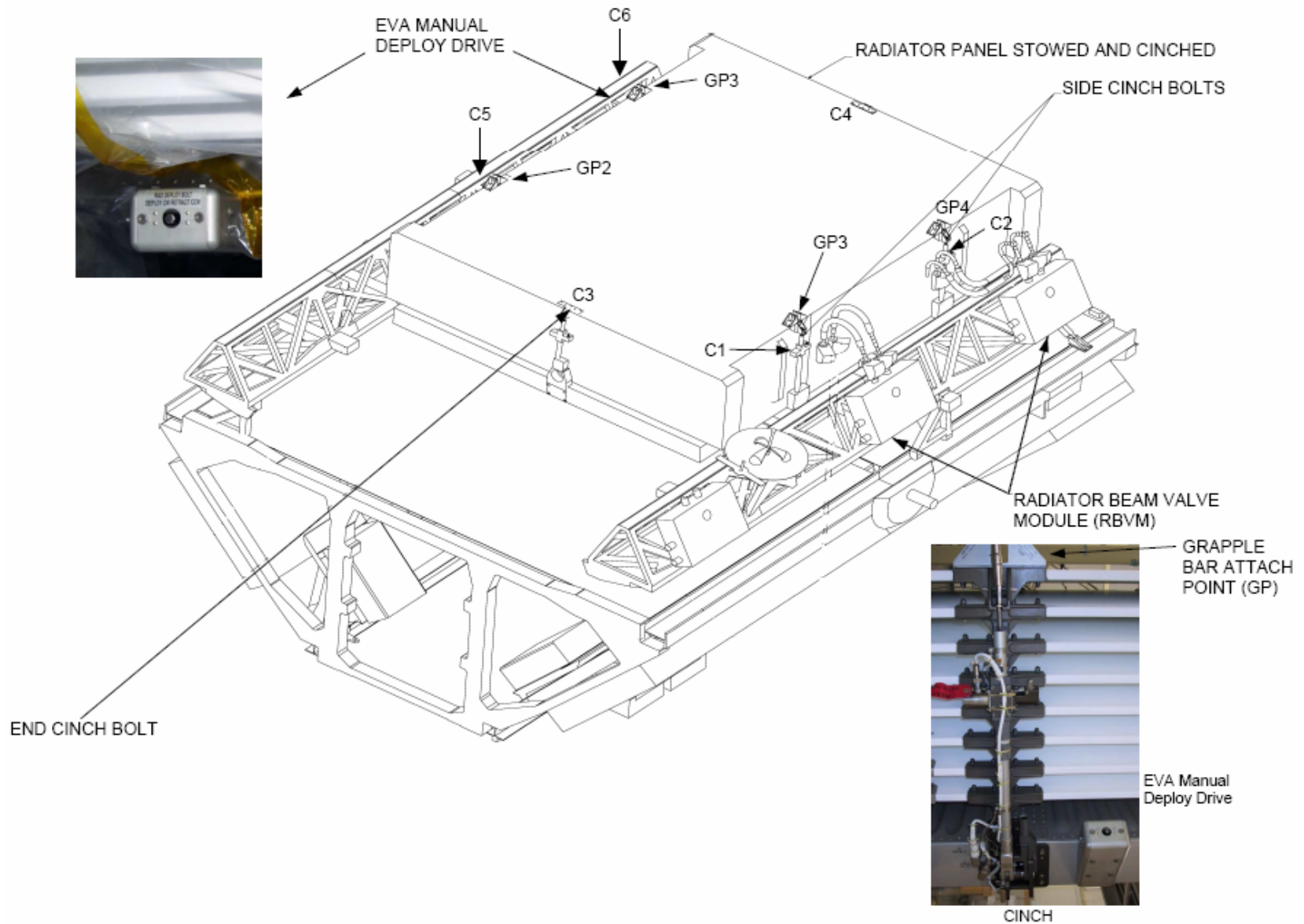
Lanyard to pull  
to retract lever  
locking tab



# MBSU ACTIVE FRAM CONTINGENCY PINS



# S1 RADIATOR OVERVIEW



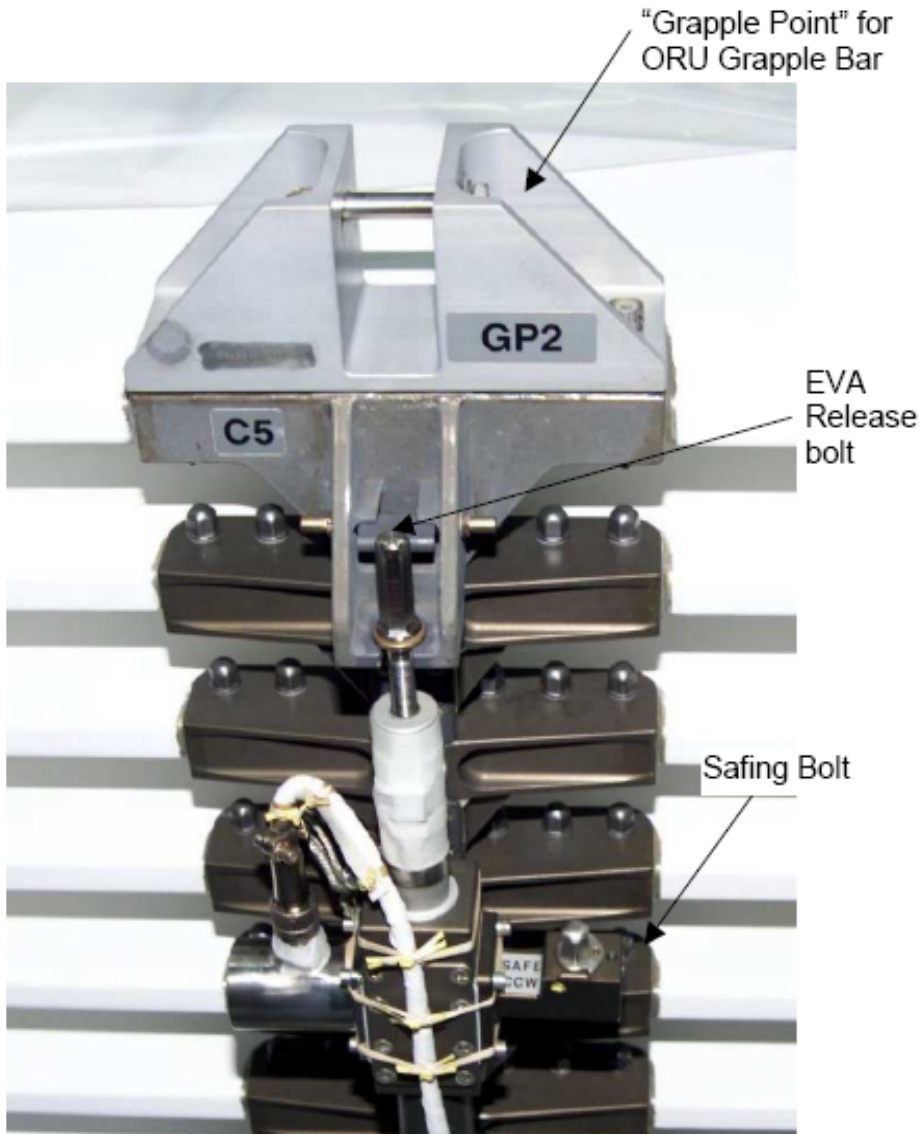
FS 18-37

EVA/120/FIN

**CONTINGENCY**

# CONTINGENCY

## S1 RADIATOR CINCH RELEASE



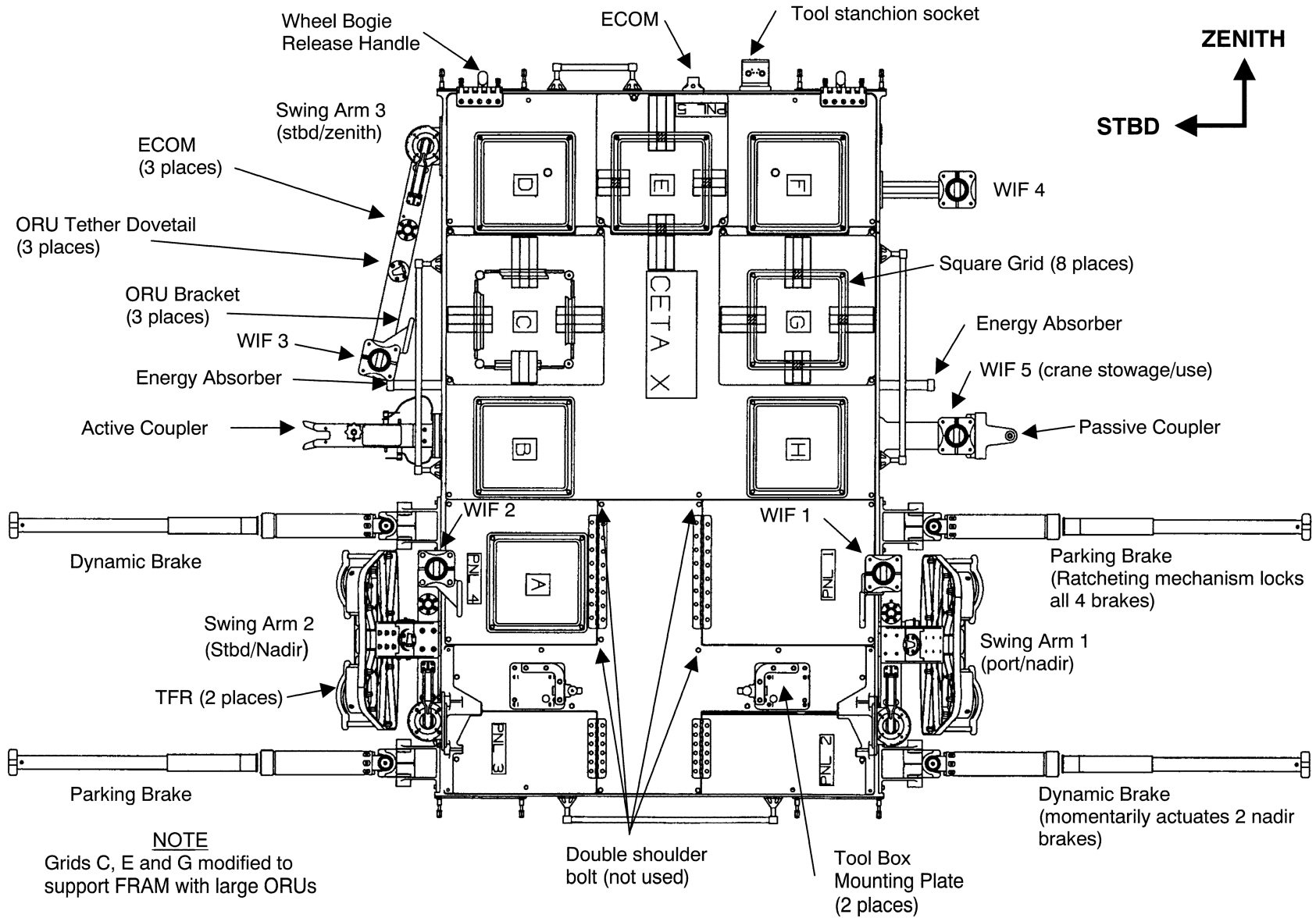
CINCH INSTALLED



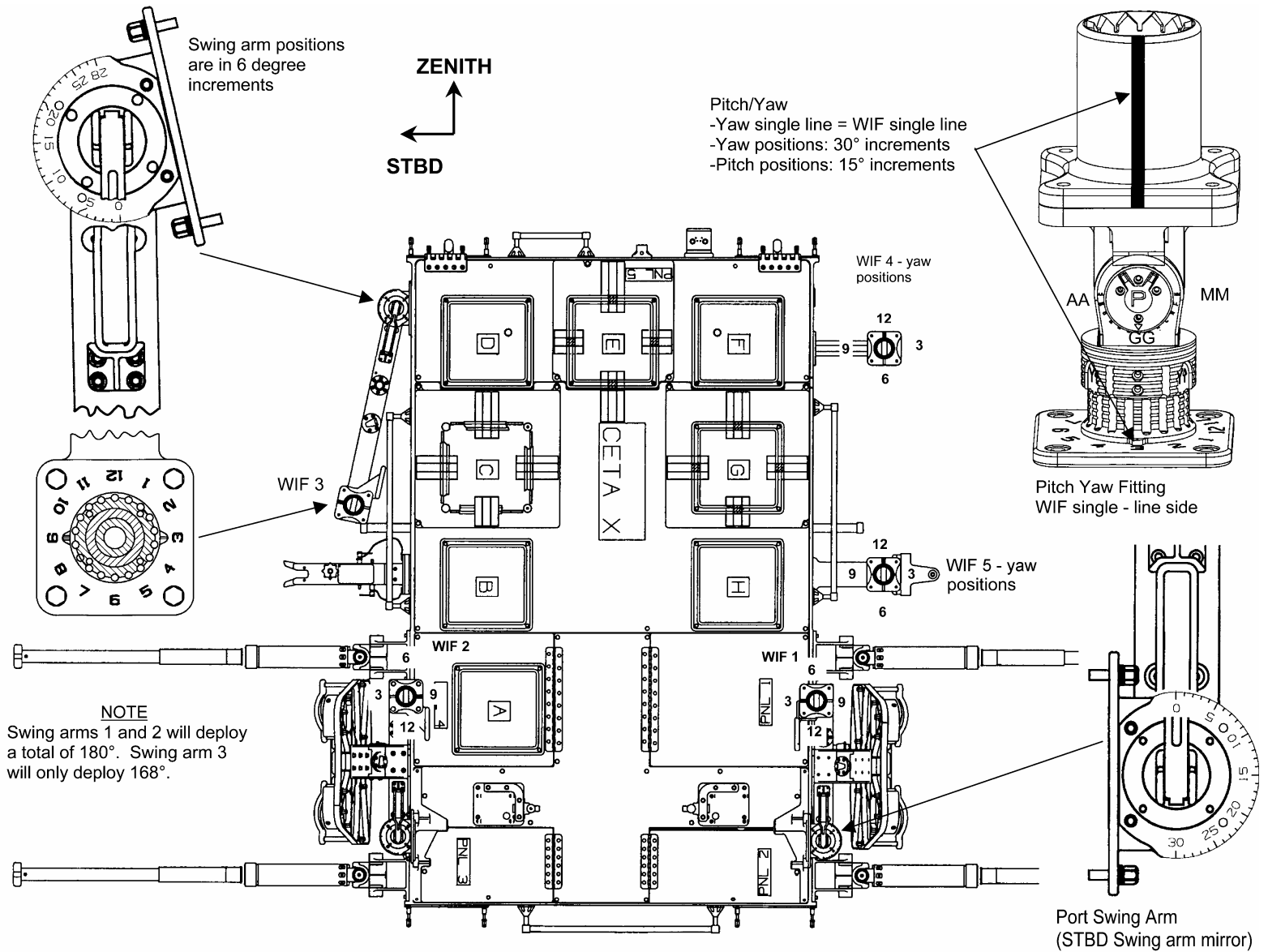
CINCH DEPLOYED



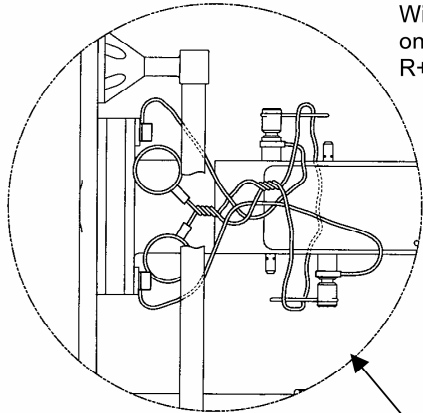
# CETA CART – TOP VIEW



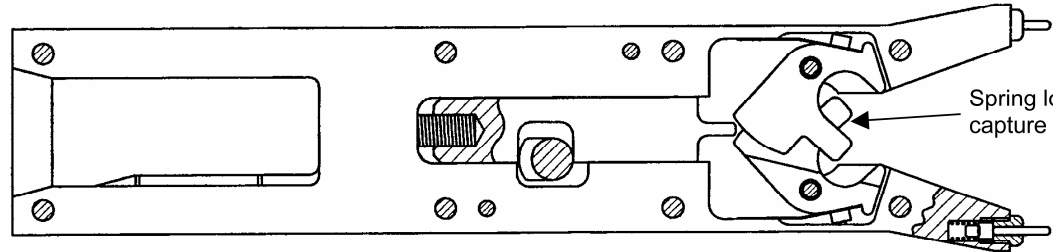
# CETA CART – SWING ARMS AND WIF MARKINGS



# CETA CART – COUPLERS



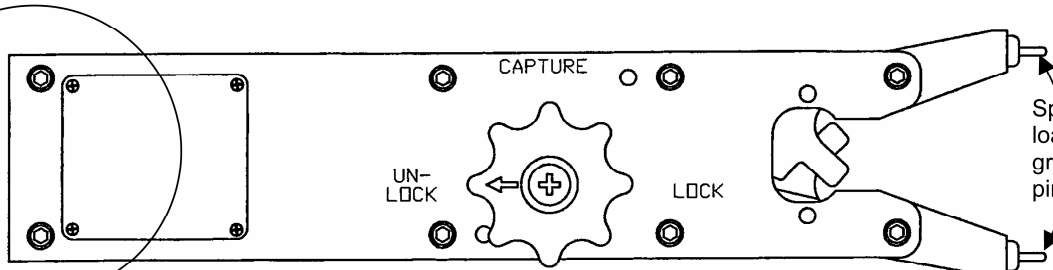
Wire ties required for launch only. Removed for coupler R+R



**BOTTOM VIEW**

Spring loaded capture latch

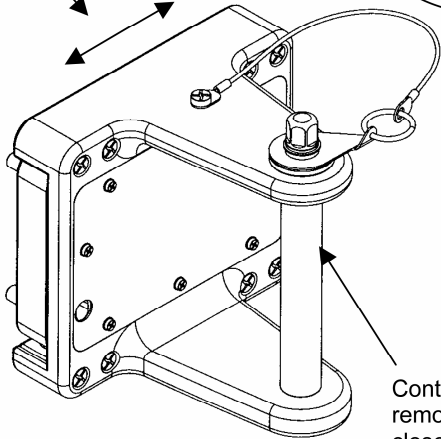
Compliance in indicated direction to allow for misalignment. Centering spring nominally constrains motion



**TOP VIEW**

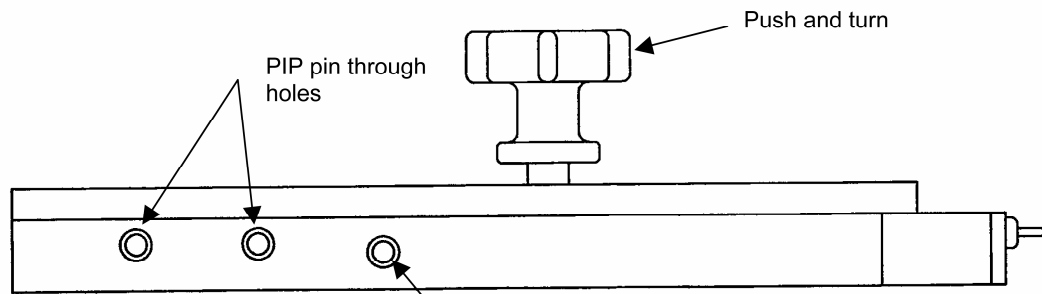
Spring loaded grounding pins

CAPTURE  
UN-LOCK ←  
LOCK



**PASSIVE COUPLER**

Contingency bolt removed if latch failed closed



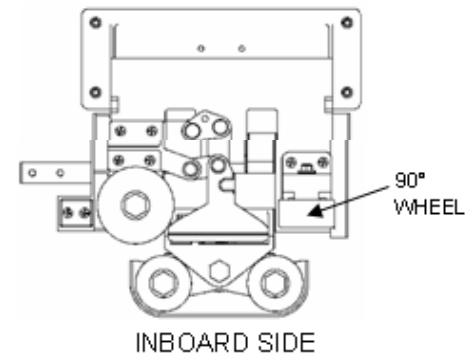
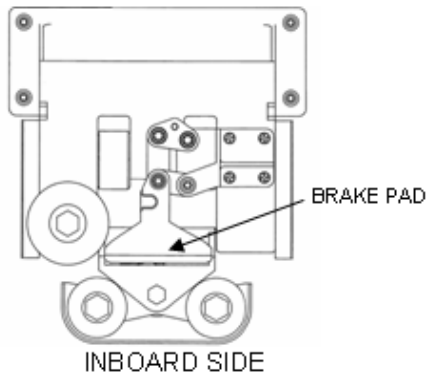
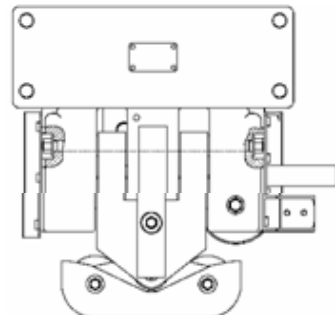
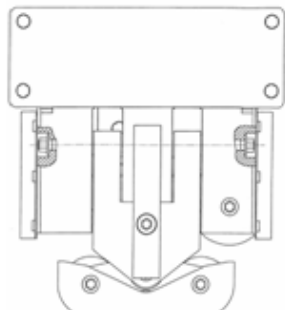
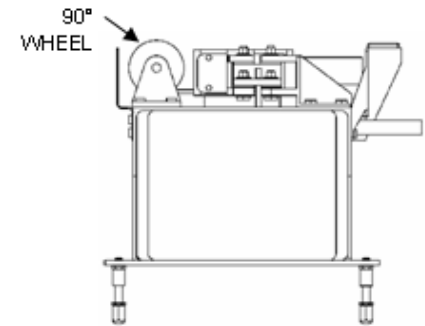
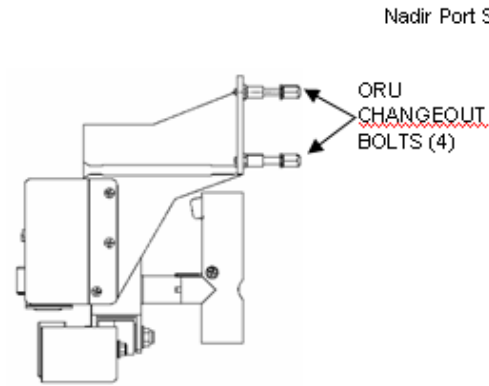
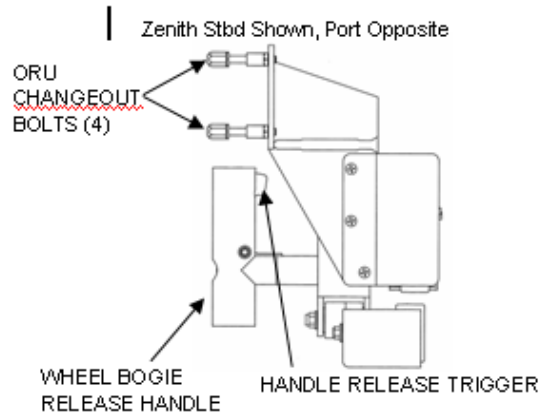
**SIDE VIEW**

PIP pin through holes

Push and turn

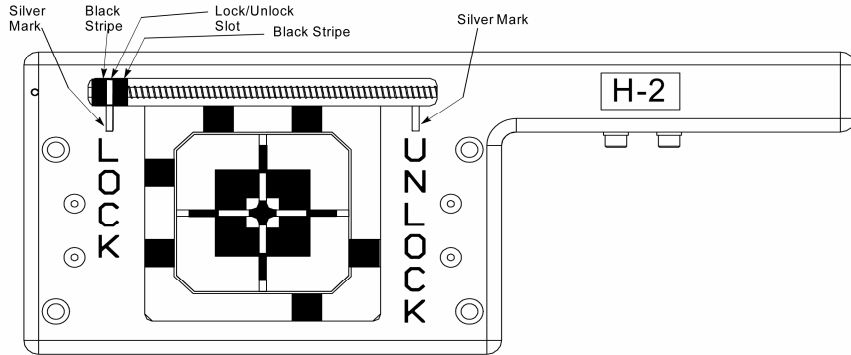
Threaded bolt hole not used

# CETA CART – WHEEL BOGIES

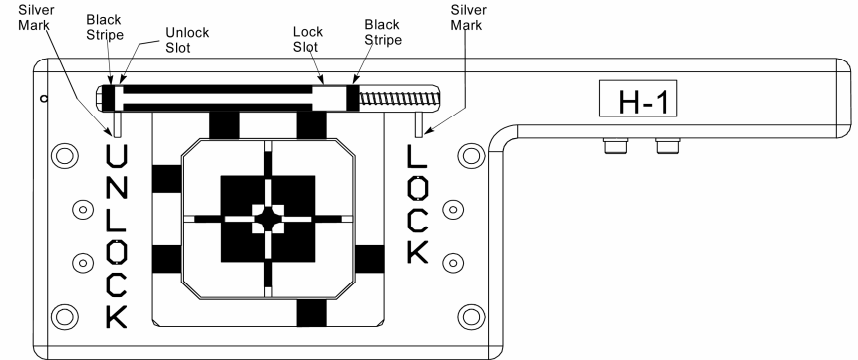


# STATUS INDICATORS (MBSU, DDCU, BCDU)

## H2 Status Indicator



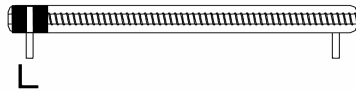
## H1 Status Indicator



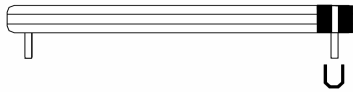
### Positional Criteria

(Adhered to in accordance with torque and turns specified in LSAR procedure.)

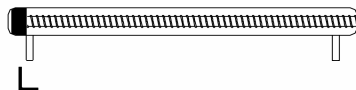
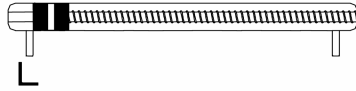
Locked, Nominal: The lock/unlock slot should be centered in relation to the silver mark.



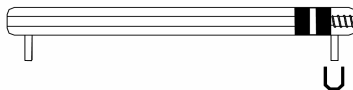
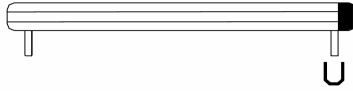
Unlocked, Nominal: The lock/unlock slot should be centered in relation to the silver mark.



Locked, Tolerance: The lock/unlock slot can be left or right of nominal by a distance no greater than the width of the black stripe.



Unlocked, Tolerance: The lock/unlock slot can be left or right of nominal by a distance no greater than the width of the black stripe.



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### Positional Criteria

(Adhered to in accordance with torque and turns specified in LSAR procedure.)

Unlocked, Nominal: The unlock slot should be centered in relation to the silver mark.



Locked, Nominal: The right edge of the lock slot should be flush with the right edge of the silver mark.



Unlocked, Tolerance: The unlock slot can be left or right of nominal by a distance no greater than the width of the black stripe.



Locked, Tolerance: The lock slot can be left of nominal by a distance no greater than the width of the black stripe.



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# EVA CHECKLIST

# STS 120