US EVA 22 SUMMARY TIMELINE

PET HR : MIN	IV/SSRMS	EV1 (Chris Cassidy)	EV2 (Luca Parmitano)	
00:00	• Verify Inhibits Prior to Egress • Verify SGTRC Inhibits in place • Verify MISSE 8 Inhibits in place	EGRESS/SETUP (00:25) • Post Depress (00:05) • Egress (00:10) • Setup (00:10)	EGRESS/SETUP (00:25) • Post Depress (00:05) • Egress (00:10) • Setup (00:10)	00:00
	• SSRMS setup	SGTRC R&R (01:10) • Setup SGTRC (00:20) • Remove Failed SGTRC (00:10) • Install Spare SGTRC (00:10) • Cleanup SGTRC (00:30)	MISSE 8 RETRIEVAL (01:10) • MISSE 8 & AMS Photos (00:25) • Retrieve MISSE 8 ORMatE (00:10) • Retrieve MISSE 8 PEC (00:15) • Stow MISSE 8 (00:20)	
01:00				01:00
		STBD RADIATOR GRAPPLE BAR INSTALL (01:25) • MBS Mast CLPA Setup (00:25) • Radiator Grapple Bar Setup (00:20)	STBD RADIATOR GRAPPLE BAR INSTALL (01:25) • SSRMS Setup (00:45)	
02:00				02:00
	• Begin coordinated powerdowns for Z1 Y-Bypass Jumpers	• Release Stbd Grapple Bar from POA (00:15) • Remove Grapple Bar FSE B (00:05) • Remove Grapple Bar FSE A (00:10) • Install Stbd Grapple Bar on S1 Radiator (00:10)	• Release Stbd Grapple Bar from POA (00:15) • Install Stbd Grapple Bar on S1 Radiator (00:25)	
03:00		MLM POWER CABLE INSTALL (00:30)	MBS MAST CLPA REMOVAL (00:30) • SSRMS Maneuver to MBS (00:15) • Remove MBS Mast CLPA (00:15)	03:00
		PORT RADIATOR GRAPPLE BAR INSTALL (00:40) • Release Port Grapple Bar from POA (00:05) • Stow CLPA (00:10) • Stow PMA 2 Cover Bag (00:15) • Install Port Grapple Bar on P1 Radiator (00:10)	PORT RADIATOR GRAPPLE BAR INSTALL (00:40) • Release Port Grapple Bar from POA (00:05) • Install Port Grapple Bar on P1 Radiator (00:35)	
04:00	• Verify Z1 Y-Bypass Jumper Inhibits in place			04:00
		Z1 Y-BYPASS JUMPER INSTALL (01:00) • Retrieve Z1 Y-Jumpers (00:25) • Install Z1 Y-Jumper Part 1 (Nadir) (00:20) • Setup Z1 Y-Jumper Part 2 (Zenith) (00:15)	SSRMS CLEANUP (00:55) • SSRMS Maneuver to Egress (00:15) • SSRMS Cleanup (00:40)	
05:00				05:00
	GETAHEADS: • Tempstow PMA 2 Cover Bag (MLM Ethernet/ 1553 Cables) (00:20) • MLM Ethernet Cable Install (00:40) • PDGF FOD Removal (00:20) • PDGF 1553 Cable Install (00:30) • Relocate APFR/TS (00:30)	PMA 2 COVER INSTALL (00:35) • Cover Install (00:25) • Bag Cleanup (00:10)	PMA 2 COVER INSTALL (00:40) • Bag Setup (00:10) • Cover Install (00:20) • Bag Cleanup (00:10)	
		CLEANUP/INGRESS (00:30) • Cleanup (00:10) • Ingress (00:15) • Pre Repress (00:05)	CLEANUP/INGRESS (00:30) • Cleanup (00:10) • Ingress (00:15) • Pre Repress (00:05)	
06:00				06:00
06:30				06:30

US EVA 22 TOOL CONFIG

EV 1

- ☐☐ MWS
  - ☐☐ BRT (L)
    - ☐☐ RET (eq-eq)
    - ☐☐ Adj Equip Tether
    - ☐☐ Wire Tie (2, long)
  - ☐☐ T-Bar
    - ☐☐ RET (eq-eq) (L)
    - ■☐ RET (eq-eq) (L)
      - ■☐ 28mm EVA Camera w/ L-bracket and integral RET
    - ☐☐ RET w/ PIP Pin (R) (through top of dog-house)
      - ☐■ 5/8 (rigid) Socket-2 ext
  - ☐☐ Swing Arm (R)
    - ☐☐ RET (eq-eq)
      - ☐■ PGT [**B1** Xft-lb, **CAL**, MTL **30.5**] s/n 1002
        - ☐■ PGT Battery
        - ☐■ Adj Equip Tether (on PGT)
- ☐☐ D-ring Extender (2) (R & L D-ring)
  - ☐☐ Waist Tether (1) (R D-ring Ext)
  - ☐☐ 85-ft Safety Tether Pack (L D-ring Ext)

EV 2

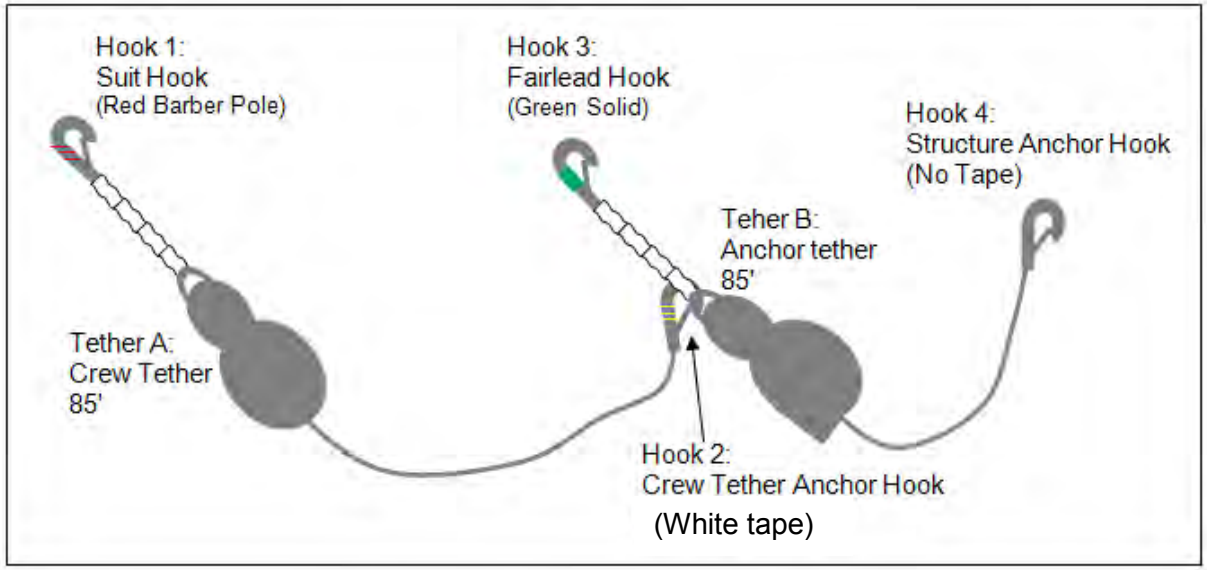
- ☐☐ MWS
  - ☐☐ BRT (L)
    - ☐☐ RET (eq-eq)
    - ☐☐ Wire Tie (2)
  - ☐☐ T-Bar
    - ☐☐ Wire Tie (2)
    - ☐☐ RET (eq-eq) (L)
      - ☐☐ 28mm EVA Camera w/ L-bracket; integral RET (integral to MWS)
    - ☐☐ RET w/ PIP Pin (R)
    - ☐☐ Adj Equip Tether
    - ☐☐ RET (eq-eq) (R)
      - ■☐ Socket Caddy
        - ■☐ 5/8 (rigid) Socket-7.8 ext
        - ■☐ 7/16 (wobble) Socket-6 ext
  - ☐☐ Swing Arm (R)
    - ☐☐ RET (eq-eq)
      - ■☐ PGT s/n 1008
        - ■☐ PGT Battery
        - ■☐ Adj Equip Tether (on PGT)
- ☐☐ D-ring Extender (2) (R & L D-ring)
  - ☐☐ Waist Tether (2) (R & L D-ring Ext)
  - ☐☐ 85-ft Safety Tether Pack (L D-ring Ext)

Tether Counts:

RETs (eq-eq) = 15	RETs (PIP Pin) = 5
RETs (Lg-eq) = 6	Adj Equip Tethers = 12
Fish Stringers = 4	Adj Equip Tether (Lg-eq) = 2

NOTE: Prior to use, inspect the following hardware:

- ❑ RET cords and AET for fraying
- ❑ Inspect Load Alleviating Straps and D-ring Extenders; ref 2.230.100 CREW TETHER INSPECTIONS (SODF: ISS EVA TASKS):
  1. MMOD/general damage
  2. Discoloration
  3. Tack Stitching
  4. Red Band
- ❑ ISS Trash Bag:
  - √ No Bristle Deformation/ Damage
  - √Empty
  - √Zipper Closed
- ❑ BRT Stiffness
- ❑ Swing Arm Stiffness
- ❑ Remove dust caps as directed



US EVA 22 TOOL CONFIG

AIRLOCK CONFIG

- ☐☐ RET (Lg-eq)
  - ☐☐ **SGTRC Lrg ORU Bag** (lid will close over MUT EE-ballstack-MUT EE; configured per video)
    - ☐☐ Adj Equip Tether (outside bag; L-back)
    - ☐☐ Adj Equip Tether (Lg-eq) (outside bag; R-front)
    - ☐☐ Wire Tie (long; on top front loops outside of bag; harness MUT-ballstack-MUT)
      - ☐☐ MUT EE-Ballstack-MUT EE (ECOMs black-on-black)
        - ☐☐ Round Scoop (L) (in L MUT EE jaw)
          - ☐☐ RET (eq-eq) (L, tethered inside bag)
    - ☐☐ RET w/ PIP Pin (one hook to one of two internal lid tether points)
      - ☐☐ 7/16 (rigid) Socket-9 ext (RET hook and entire socket inside Trash Bag)
        - ☐☐ ISS Small Trash Bag (hooked with Lrg ORU bag inside strap integral hook to oppsite internal lid tether point of RET)
    - ☐■ RET (eq-eq) (L)
      - ☐■ 28mm EVA Camera w/ L-bracket and integral RET
    - ☐☐ RET (eq-eq) (R)
      - ☐☐ Round Scoop (R) (handle away from box)
        - ☐■ SGTRC spare (ensure dust caps removed; 4 pink poly)
        - ■☐ SGTRC failed (on scoop)

- ☐☐ RET (Lg-eq)
  - ■☐ Square Scoop
    - ■☐ **MBS Mast CLPA**

AIRLOCK CONFIG (CONT)

- ☐☐ RET (Lg-eq)
  - ☐☐ **PMA 2 Cover Bag** (labeled NOD 3 Avionics)
    - ☐☐ RET (eq-eq) (bottom of bag)
      - ☐☐ Adj Equip Tether (D-rings to RET hook)
        - ☐☐ Small ISS Trash Bag
        - ☐☐ Wire Tie Caddy (w/ 5 short and 4 long)
    - ☐☐ Fish Stringer Tether (Lg hooks to bottom of bag)
      - ☐☐ 1553 Cable (hook 1; secure with non-hinge-side Velcro strap; RS connectors secured w/ wire tie)
        - ☐☐ 1553 Dust Caps (2) (leave on 1553 cable and install tether points on fish stringer hooks 2 & 3)
      - ☐☐ MLM Ethernet Cable (hook 4, secure with hinge-side Velcro strap; remove P2 NZGL cap, keep other 4 dust caps installed on pigtail; RS connectors secured w/ wire tie)
    - ☐☐ RET (Lg-eq)
      - ☐■ PMA 2 Cover (0413 to hinge-fabric handle outside bag; 0414 to non-hinge dog-bone handle outside bag; folded and configure per pictures below and per videos (2))
    - ☐☐ Adj Equip Tether (eq-eq) (hooked from bottom non-hinge tether point to top bag hinge-side tether point)

- ☐☐ RET (Lg-eq) (outside both bags, opposite integral)
  - ☐☐ **Z1 Jumper Crewlock Bag** (configured per video)
    - ☐☐ Adj Equip Tether (on integral RET)
      - ☐■ Y-Bypass Jumper W10 Dust Cap (25)
      - ■☐ Nadir Patch Panel Caps (2)
    - ☐☐ Adj Equip Tether (on integral RET)
      - ☐■ Y-Bypass Jumper W05 Dust Cap (25)
      - ■☐ Zenith Patch Panel Caps (2)
    - ☐☐ Adj Equip Tether (on integral RET)
      - ☐☐ Spare size 25 Dust Cap
      - ☐☐ Small ISS Trash Bag (on integral)
    - ☐■ GTEC (configured per picture below)
      - ☐■ Wire Tie (long,)

AIRLOCK CONFIG (CONT)

- ☐☐ **Fish Stringer Tether** (attached to UIA tether points)
  - ☐■ PGT [**A5** Xft-lb, **CAL**, MTL **30.5**] s/n 1008
    - ☐■ PGT Battery
    - ☐■ Adj Equip Tether (on PGT)
  - ☐■ WIF Adapter (ensure configured and marked up to see short side; per pictures below)
  - ☐■ Socket Caddy
    - ☐■ 5/8 (rigid) Socket-7.8 ext
    - ☐■ 7/16 (wobble) Socket-6 ext
  - ☐☐ ORMatE Cover (attached to lower tether point via fish stringer eq hook)
    - ☐☐ RET (eq-eq) (attached to top tether point)
    - ■☐ **MISSE 8 ORMatE**
  - ■☐ Ratchet Wrench (w/o palm wheel)
    - ■☐ 5/8 (rigid) Socket-2 ext
  - ■☐ PGT s/n 1002
    - ■☐ PGT Battery
    - ■☐ 5/8 (rigid) Socket-2 ext
    - ■☐ Adj Equip Tether (on PGT)

- ☐☐ RET (Lg-eq)
  - ☐■ **FSE Lrg ORU Bag** (inside straps left inside attached to lid)
    - ☐■ Adj Equip Tether (2) (outside bag; 2 on back)
    - ☐■ Adj Equip Tether (Lg-eq) (outside bag; R-front)
    - ☐☐ RET w/ PIP pin (to inside lid)
      - ☐■ Ratchet Wrench (w/o palm wheel)
        - ☐■ 5/8 (rigid) Socket-2 ext
    - ☐■ RET (eq-eq) (R) (later for FSE B)
      - ☐■ Square Scoop (MBS Mast CLPA)
    - ☐■ RET (eq-eq) (L) (FSE A)
      - ☐■ Round Scoop
    - ☐■ RET (eq-eq) (L)
      - ☐■ Socket Caddy
        - ☐■ 5/8 (wobble) Socket-12 ext
    - ☐■ RET w/ PIP pin (L)
      - ☐■ Small STS Trash Bag
  - ■☐ **MISSE 8 PEC**
    - ■☐ Dust cap (red)
    - ■☐ Dust cap (green)

US EVA 22 TOOL CONFIG

AIRLOCK CONFIG (CONT)

- ☐ ☐ Staging Bag
  - ☐ ☐ Fish Stringer Tether
    - ☐ ☐ Long Duration Tie-Down Tethers (4)
    - ☐ ☐ GTEC (configured per picture below)
    - ☐ ☐ Wire Tie Caddy (w/ 5 short and 4 long)
    - ☐ ☐ Velcro/Tape Caddy
    - ☐ ☐ Probe
    - ☐ ☐ Pin Straightener Assy
    - ☐ ☐ EVA Wipe (dry)
    - ☐ ☐ MWS Key Strap Assy
  - ☐ ☐ Fish Stringer Tether
    - ☐ ☐ Spare 85-ft Safety Tether Pack
    - ☐ ☐ PGT, s/n 1007
      - ☐ ☐ PGT Battery
    - ☐ ☐ Ratchet Wrench (w/o palm wheel)
      - ☐ ☐ 7/16 (rigid) Socket-2 ext
    - ☐ ☐ Spare WIF Adapter (ensure configured and marked up to see short side; per pictures below)
    - ☐ ☐ Pry Bar
    - ☐ ☐ Vise Grips
    - ☐ ☐ Connector Cleaner Tool Kit (2 cartridges)
    - ☐ ☐ P2 Cap (US MLM Ethernet Cable Cap)

- ☐ ☐ IV Bag
  - ☐ ☐ Towels (2)
  - ☐ ☐ Contamination Detection Kit
  - ☐ ☐ GP Caddy (2)
    - ☐ ☐ Adjustable Thermal Mittens (2)
  - ☐ ☐ Socket Caddy (hatch cont) w/RET (eq-eq) (Black)
    - ☐ ☐ ½ (rigid) Socket-8 ext
    - ☐ ☐ 7/16 (wobble) Socket-6 ext (spare)
  - ☐ ☐ DCM Plug (SAFER Hardmount) (2)
  - ☐ ☐ RET (eq-eq, Black) (2)

ISS CONFIG (EXTERNAL)

External Airlock Airlock HR 0564 and 0567

- ☐ ☐ **FSE Lrg ORU Bag**
  (inside straps left inside attached to lid)
  - ☐ ☐ Adj Equip Tether (2) (outside bag; 2 on back)
  - ☐ ☐ Adj Equip Tether (Lg-eq) (outside bag; R-front)
  - ☐ ☐ RET w/ PIP pin (R)
  - ☐ ☐ RET (eq-eq) (R)
    - ☐ ☐ Grapple Bar FSE B
  - ☐ ☐ RET (eq-eq) (L)
    - ☐ ☐ Round Scoop
      - ☐ ☐ Grapple Bar FSE A
  - ☐ ☐ RET (eq-eq) (L)
    - ☐ ☐ Socket Caddy
      - ☐ ☐ 5/8 (wobble) Socket-12 ext
  - ☐ ☐ RET (eq-eq) (L)
    - ☐ ☐ Small STS Trash Bag

US EVA 22 TOOL CONFIG PICTURES

WIF Adapter PIP Pin Config

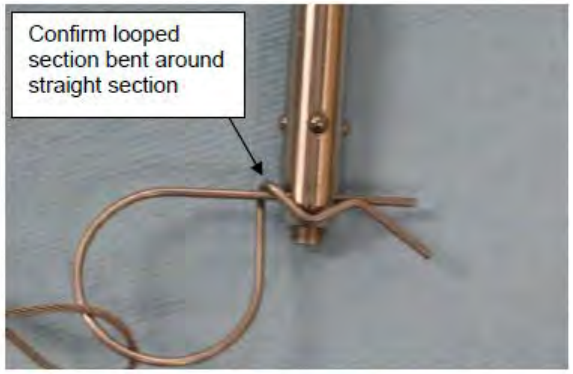


Figure 1

The hole for the hitch pin is offset on the pip pin. The bent part of the hitch pin should be installed around the thinner section of the pip pin offset (Figure 2).

Correct: The bent part of the hitch pin goes over the thinner section of the pip pin.

Incorrect: The hitch pin will not instal correctly over the thicker section of the pip pin.

Figure 2

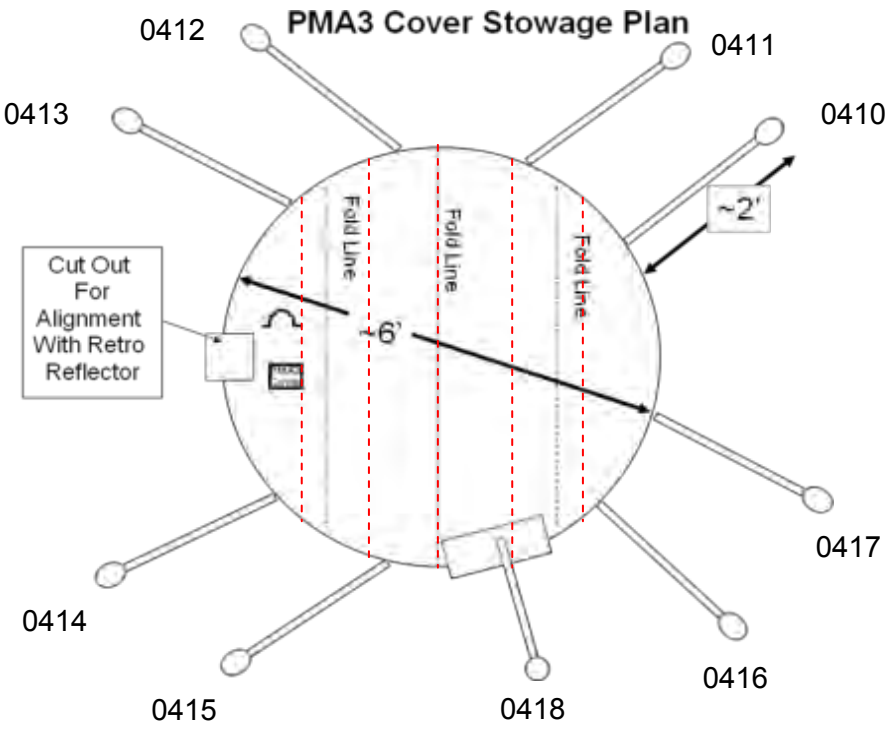
Ensure you mark up the short side.

GTEC Bag

Folded in half and then rolled; secured by Long Wire Tie attached to one of the tether points near the opening of the GTEC. Wire Tie may also be used at worksite in addition to cinch straps if required.

US EVA 22 TOOL CONFIG PICTURES

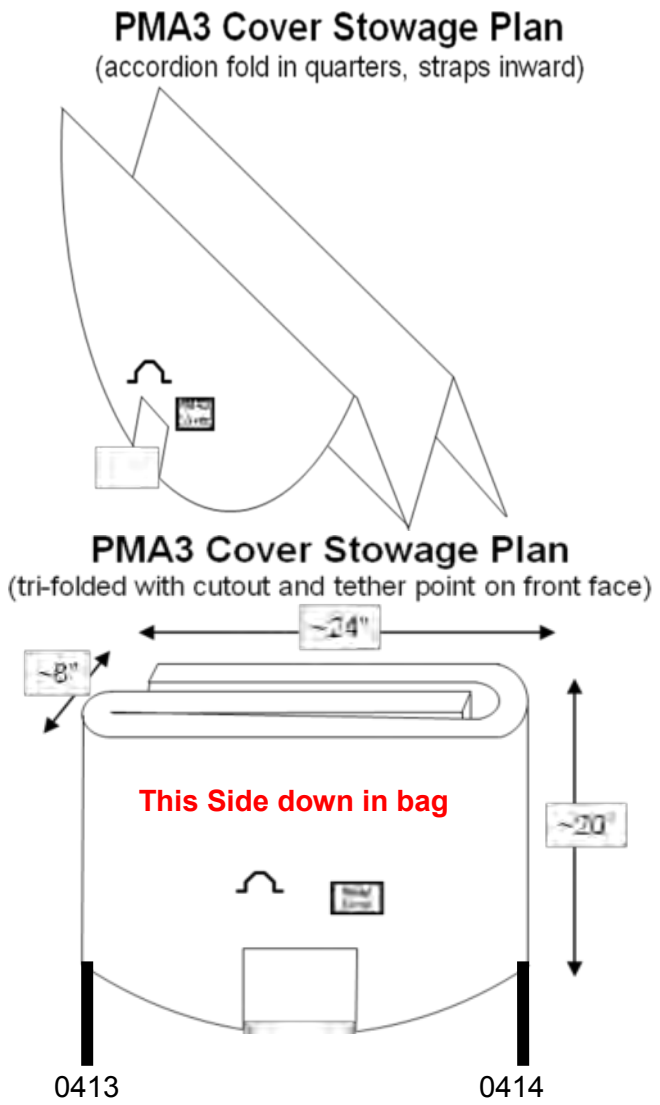
PMA2 Cover Config



With the slightly larger PMA2 Cover than the PMA3 Cover, and using the larger NOD Avionics Bag, the PMA2 Cover might have to be folded in more times in the accordian fashion shown. There are no constraints on the number of folds. What is important is that the Cut Out and Label end up as shown. The cutout and label go in facing the bottom of the bag, so that they can flip over when removing the cover.

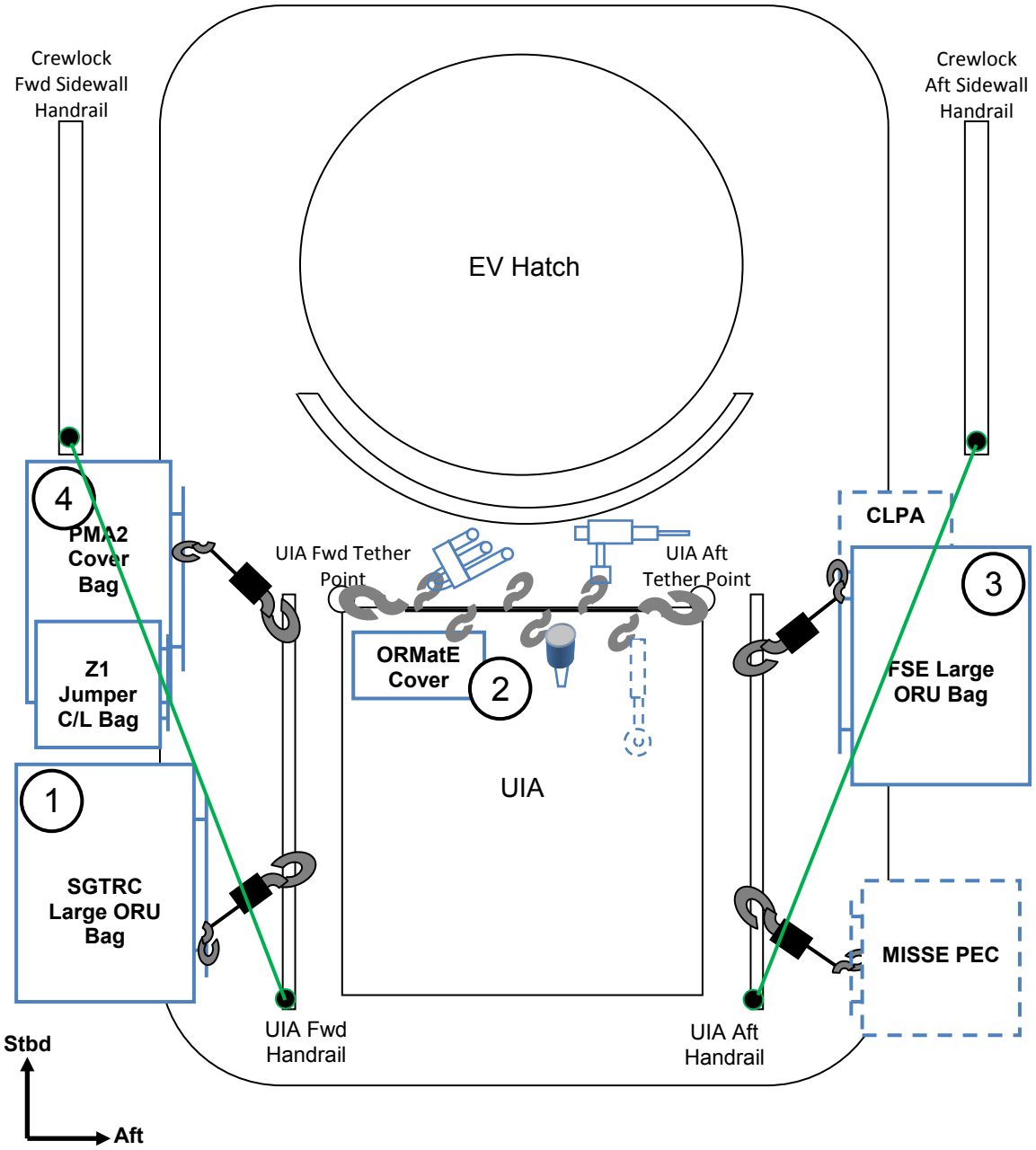
Reccomendation to fold the cover 5 times rather than 3 to fit into the skinier/longer NOD3 Avionics Bag.

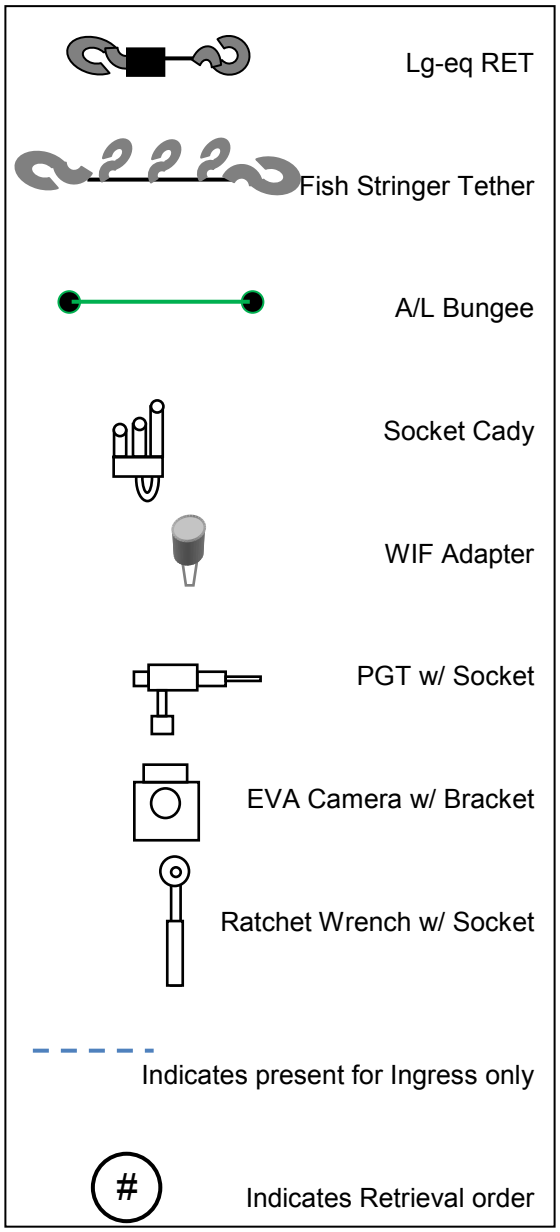
NOD3 Avionics Bag Config



These straps (0413 and 0414) Velcroed to outside of bag

US EVA 22 CREWLOCK CONFIG





Tool Legend

US EVA 22 BRIEFING CARD - CONDUCTED EVENING PRIOR TO EVA

4. People:
   IV – Karen
   EV1 – Chris
   EV2 – Luca
   M1 – Karen
   Capcom / Ground IV – Shane
   Flight Dir – David Korth
   EVA Team – Ernie Bell, Alex Kanelakos, Grant Slusser, John Mularski

2. EVA Prep
   - ❑ Get-up, Plan – clothing and EMU equipment bag – **EV1**
   - ❑ Prebreathe protocol review (Notes and cue card) – **IV**
   - ❑ Equipment lock activities/responsibilities – **IV**
     - Extra people and —helper" management
   - ❑ Suit donning plan – special requests – **EV's, IV's**
   - ❑ SAFER, MWS, tools, C-Lk positions, bag stowage – **EV2**
   - ❑ Airlock depress review (Depress/Repress Cue Card) – **IV**

3. EV Crew Procedure Review – **EV1**
   - ❑ SAFETY, CONFIG, TASK
   - ❑ Egress Plan, tethers, SAFER, MWS tabs
     - Memorize / visualize first 4-5 minutes
   - ❑ Order of tasks (summary timeline)
   - ❑ Translation plan, fairleads and tether swaps
   - ❑ Hazards
   - ❑ Ingress Plan

4. Robotics – **M1**
   - ❑ SSRMS initial position, maneuvers, clearances
   - ❑ Coordinate Frames
   - ❑ SSRMS comm protocol review – expected calls, use first names
   - ❑ GCA – when, where, handover language
   - ❑ Cameras
   - ❑ Contingencies
     - Suit anomalies while ingressed

5. Communication – **EV1**
   - ❑ Overall setup: big picture, S/G2, Hardline, remind EV crew when voice going to ground
   - ❑ EV/IV comm protocol review – Use EV1(2) for DCM sw throws (all time in A/L), use first names otherwise
   - ❑ Handover to/from ground IV during Post-Depress/Pre-Repress

6. General Procedure Review – **EV1**
   - ❑ Get ahead tasks
   - ❑ Constraints – ground and flight
   - ❑ Notes, Cautions, Warnings review

7. Emergencies Review – **EV1**
   - ❑ Cuff checklist with no DCM warning: Loss of Cooling, Air Flow Contamination, BITE light (wagon-wheel), DCS, Comm Failure
   - ❑ No comm signs: —O," —PRI to Alt," "switch freq," —Terminate," —Abort," "to AL"
   - ❑ Lost tools, what if on SSRMS
   - ❑ Incapacitated crew rescue
   - ❑ Terminate: safe worksite, one or both get to airlock, go on SCUs
   - ❑ Abort: Abandon worksites, both enter AL, no SCUs. Put sick guy in, ingress, toss tethers or put on rail, close hatch
   - ❑ IV rapid doffing steps: Equalize (EMER) and open IV hatch, O2 actuator OFF, purge valve up, pop glove. Remove helmet/LTA (going to be hot)
   - ❑ SAFER deploy, use auto-attitude hold button

8. Post EVA – **IV**
   - ❑ Suit doffing responsibilities
   - ❑ Post EVA plan (clean your own body fluids)

9. Morning of EVA – **EV1 and EV2**
   - ❑ —Chair Fly" the whole timeline (5-10 mins)

US EVA 22 Notes/Cautions/Warning

NOTE

1. Bolt install: report torque and turns.
2. Bolt release: report torque and turns if different from published range.
3. CETA Cart brake handle wire ties must be replaced after crew loading, prior to next worksite 08 MT translation.
4. EVA connectors: after disconnection and prior to connection, verify pin and EMI band integrity; verify connector free of FOD.
5. Inspect QDs for damage prior to mating.
6. For HTV N/C/W, refer 3.14.102 HTV NOTES, CAUTIONS, & WARNINGS (SODF: EVA TASK: PROCEDURES: HTV).
7. 85-ft Safety Tether retraction force may affect body positioning.
8. Tool Box doors must be closed with one latch per door when EV crew not in immediate vicinity.

CAUTION

ISS Generic Constraints

A. Electrical cables
   1. Avoid bend radii < 10 times cable diameter.

B. Fiber optic cables
   1. Avoid bend radii < 10 times cable diameter.
   2. Avoid pulling on cable during mate/demate.

C. Fluid line flex hoses and QDs
   1. Avoid bend radii < 14" for hoses with a diameter ≥ 1".
   2. Avoid bend radii less than 5" for hoses with diameter less than 1" on LAB, S0, S1, P1, and 10" for hoses with diameter less than 1" on all other elements.
   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 required.

D. Avoid inadvertent contact
   1. Grapple fixture shafts (drylube)
   2. MBS/SSRMS/SPDM taped radiative surfaces: VDU, ACU, JEU, LEU, MCU, CRPCMs, and Cameras
   3. OTSD
   4. PIP Pins
   5. Passive UMAs
   6. SPDM SJEU, EP, OTCM, LEU, and LEE VDU radiator surfaces

CAUTION

ISS Generic Constraints (cont)

E. For structural reasons
   1. The 2” socket may not disengage the anti-rotation device in a micro square fixture.
   2. Avoid performing shaking motions (sinusoidal functions) for more than four cycles.
   3. Avoid vigorous body motions, quick grabs, and kickoffs against tether restraints.

F. Other
   1. ITT Cannon Connector: on demated connectors, do not rotate collar or manipulate cable or connector using collar or connector tool.
   2. MLI handholds are not rated for crewmember translation loads.

US EVA 22 Notes/Cautions/Warning

CAUTION

ISS Truss Constraints

A. Avoid inadvertent contact
1. CETA lights (Z-93 paint) (LAB, S1, S3, P3, Node 1)
2. CMG cover/shells (Z1)
3. Deployed MISSEs
4. ETCS radiator flexhoses and panels (S1, P1)
5. FPMU (P1)
6. GPS Antennas (S13 paint) (S0, JLP)
7. Ku-Band Antenna (SGANT) dishes (Z1)
8. OBSS composite sections, striker bars, grapple fixture shafts, and cable harnesses
9. OTP on HAB Tray (S0)
10. PCU cathode and HCA ports (Z1)
11. EETCS/PV radiator flexhoses, bellows, and panels (P6, P4, S4, S6)
12. RRM back radiator (Z-93 paint) (ELC-4)
13. S0 Aft face radiator
14. SASA high and low gain Antennas and radiator surfaces (S1, P1, Z1)
15. Deployed TUS cable (Zenith and Nadir CETA rails)
16. UHF Antennas (LAB, P1)
17. Heat pipe radiators (Z1)

B. For structural reasons
1. Avoid kicking S1/P1 radiator beam. If this occurs, wait 2 to 5 minutes to allow structural response to dissipate

CAUTION

ISS Truss Constraints (cont)

C. Other
1. Lubricant from Ku-Band SGANT gimbals (Z1), CMGs (Z1), and RTAS ground strap fasteners (P6, P4, S4, S6) can contaminate EMU.
2. Prevent inadvertent contact of the Tether Shuttle with ETRS when the S3/P3 Tether Shuttle Stop is raised away from the rail.
3. EWIS Antennas: do not use as handholds (Node 1, LAB, P6, Z1)

CAUTION

ISS U.S. Pressurized Elements Constraints

A. Avoid inadvertent contact
1. APAS hardware (PMA 2, PMA 3)
2. Open CBM petal covers, LAB and Cupola window shutters
3. CETA Lights (Z-93 paint) (LAB, S1, S3, P3, Node 1)
4. EVA Crane (PMA 1)
5. S0/Node 2 fluid tray hardlines at Node 2 end, which are limited to 25 lbs
6. MDM Radiator (PMA 1)
7. TCS reflectors (PMA 2, PMA 3)
8. UHF Antennas (LAB, P1)

B. RF radiation exposure
1. Stay 1.3 ft from Dragon UHF transmitters when powered.

C. Other
1. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged.
2. EWIS Antennas: do not use as handholds (Node 1, LAB, P6, Z1)

US EVA 22 Notes/Cautions/Warning

CAUTION

ISS I.P. Elements Constraints

A. Avoid inadvertent contact
1. COL ARISS and AIS Antennas (COL Nadir)
2. GPS Antennas (S13 paint) (S0, JLP)
3. ICS-EF Ka-Band Antenna dish
4. JEF ORUs and EFUs (paint and lubricant)
5. JEM A/L target and pins
6. Trunnions and UCMs (paint and lubricant) (JEF Payloads)
7. JEMRMS taped radiative surfaces (JEU, EE, Cameras)
8. Open JPM window shutter
9. JTVE, WVE/EVE, JEF VE Cameras
10. MAXI front and top panel (paint)
11. MCE outboard and Nadir faces
12. RAIDS covers on end of HREP
13. SEDA-AP sensors (HIT, SDOM, and AOM)
14. Small Fine Arm (SFA) (paint, coating, and lubricant)

B. For structural reasons
1. Avoid tool impact on ICS-EF sensor.
2. Avoid kicking MMOD shields between JLP and JPM.

WARNING

ISS Generic Constraints

A. Fluid line flex hoses and QDs
1. Bail may kick back suddenly when detent button is depressed if pressure has built up in spring cavity.
2. If QD is in FID when valve is opened (bail Fwd), QD will leak and fluid line may whip.
3. Do not rotate if in mated, valve open configuration.

B. Avoid inadvertent contact
1. Grapple fixture targets and target pins

C. Pinch
1. ITT Cannon Connector rotating housing
2. NZGL connector linkage. Use caution when mating/locking.
3. PDGF connector doors

D. Sharp edges
1. APFR active WIF probes
2. Mating surfaces of EVA connectors: avoid side loads during connector mating.
3. Keep hands away from SSRMS LEE, POA, SPDM LEE opening, snares, and PDGF curvic coupling (teeth).
4. Back side of MMOD shield fasteners
5. MMOD strikes on ISS exterior
6. Inner edges of WIF sockets
7. SPDM OTCM gripper jaws

WARNING

ISS Generic Constraints (cont)

8. Spring-loaded captive EVA fasteners (i.e., 6B boxes, BMRRM, RTAS, SARJ Covers); the end of the spring may protrude.

E. Thermal
1. EVA connectors with booties may become hot if left uncovered. Handling may need to be limited.
2. Do not touch EMU protective visor if temperature has been < -134 deg F for > 15 minutes.
3. No EMU boot contact with foot restraint when temperature < -120 deg F or > 200 deg F.
4. Turn off glove heaters when comfortable temperature reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on.
5. PDGF surfaces may not meet touch temperature requirements for unlimited contact when $\beta \leq -70$ or $\beta \geq 70$.
6. SSRMS/MBS/SPDM operating Cameras and lights may radiate large amounts of heat.
7. Uncovered trunnion pins may be hot.

US EVA 22 NOTES/CAUTIONS/WARNING

WARNING

ISS Truss Constraints

A. Electrical shock
1. Stay ≥ 2 ft from ungrounded floating connectors if powered: S0 EVA power cables (inside S0 Bay 00 Face 4, Bay 01 Face 3); ESP-2 jumper (inside S0 Bay 03 Face 4)
2. Avoid all contact with the door which covers the blind mate connectors on passive FRAMs

B. Avoid inadvertent contact
1. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless the beta gimbal is locked and the motor is turned off
2. Deployed MISSEs and ORMatE-III R/W (ELC-2)
3. Moving Radiator: stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate.
4. HDEV windows
5. Moving SGANT Antenna: stay 3.3 ft from Ku-Band Antenna when powered.
6. Moving MT: stay 5 ft from moving MT on Face 1.
7. Moving SARJ: stay inboard of SARJ when active.
8. SCAN Testbed payload hardware above the FRAM interface
9. STP-H3 Experiments: stay 1 ft from top of STP-H3 (ELC-3).

C. Pinch
1. Avoid contact with RRM above FRAM

WARNING

ISS Truss Constraints (cont)

C. Pinch (cont.)
2. Avoid pinch hazards on SCAN Testbed payload hardware above the FRAM interface.

D. RF radiation exposure
1. Stay 3.8 ft from S-Band (SASA) high gain Antenna when powered (S1, P1).
2. Stay 1.3 ft from S-Band (SASA) low gain Antenna when powered (S1, P1).
3. Stay out of KOZ for SCAN Testbed Ku- and S-Band Antennas when powered (ELC-3, P3, P1).
4. Stay 1.3 ft from UHF Antenna when powered (LAB, P1).

E. Sharp edges
1. AMS Star Trackers Baffles (two)
2. Nickel coated braided copper ground straps may contain frayed wires (P6, P4, S4, S6)
3. LDRI Baffles (also an entrapment hazard) (OBSS)
4. Outboard MT rail attachment lug near P6 handrail 5333 and gap spanner
5. P2 connector on EWIS box TAA-06 (Zenith/Forward corner 1 of P5 - SARJ at 0 deg)
6. Avoid contact with RRM above FRAM.
7. SCAN payload (above FRAM)
8. Solar array blanket box (P6, S6)
9. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing

WARNING

ISS Truss Constraints (cont)

F. Thermal
1. ELC may exceed touch temperatures when β > 75 deg.
2. No EMU TMG contact with HRS radiator flex hoses at negative beta angles of 40 or higher magnitude. Temp can exceed 320 deg F, which may result in EMU suit bladder boiling. Avoid ESP-3 inboard face, S3 Nadir between ESP-3 and ELC-4, and ELC-4 outboard face.
3. No EMU TMG contact with RRM Coolant Valve Panel (top of RRM and ISS port when on ELC-4) and attached hardware. Temp can exceed 350 deg F, which may result in EMU layers melting and potential thermal shorts.

US EVA 22 NOTES/CAUTIONS/WARNING

WARNING

ISS U.S. Pressurized Elements Constraints

A. Electrical shock
1. Stay ≥ 2 ft from ungrounded floating connectors if powered: SSPTS connectors include Node 1 Stbd/Fwd HR 0130, LAB Stbd/Fwd HR 0273, PMA 2 Stbd.

B. Fluid line flex hoses and QDs
1. Do not translate on gap spanners restraining Node 3 - LAB NH3 jumpers.

C. Handrails
1. Handrails previously used for MISSE attachment may not be used as a Safety Tether point (A/L endcone 564 and 566, A/L Tank 2 Nadir/Fwd and Port/Fwd, P6 5389).

D. Avoid inadvertent contact
1. APAS hardware (PMA 2, PMA 3)
2. Dragon RCS Thrusters

E. Pinch
1. EV side of IV Hatch during hatch operation (also snag hazard) (A/L)
2. LAB and Cupola window shutters and CBM petal cover linkages during operation

WARNING

ISS U.S. Pressurized Elements Constraints (cont)

F. RF radiation exposure
1. Stay 0.5 m from Cygnus PLS and TT&C Antennas when powered.
2. Stay 0.5 m from Cygnus LIDAR even when unpowered.
3. Stay 2 ft from Dragon S-Band transmitters when powered.
4. Stay 1.3 ft from UHF Antenna when powered (LAB, P1)

G. Sharp edges
1. Port/Aft portion of A/L circular HR (HR 0506)
2. A/L HR 0537 (Eq Lock Zenith)
3. ESP-2 HR 8012
4. Adjustable Fuse Tether (Fish Stringer) buckles stowed in Node Bag
5. PMA umbilical launch restraints - exposed bolt threads
6. PMM ROEU and ROFU panels (Zenith endcone)

H. Thermal
1. PMA and Node 1 Handrails may be hot. Handling may need to be limited.
2. Stay ≥ 1 ft away from PMAs and MMOD shields > 270 deg F if EMU sun visor up; limit time to 15 minutes or less if > 300 deg F.
3. Stay at least 0.5 ft away from PMA and MMOD shields > 325 deg F.
4. No EMU TMG contact with PMAs and MMOD shields > 320 deg F.

WARNING

ISS I.P. Elements Constraints

A. Avoid inadvertent contact
1. ICS-EF sensors
2. JSSOD deployment ports
3. MCE outboard and Nadir faces
4. SOLAR (COL EPF)

B. Pinch
1. HREP hinge sides and RAIDS pinch areas
2. ICS-EF Antenna boom
3. JEF SSE latch
4. JEM Cameras (JTVEs, EVE, WVE, and JEF VEs)
5. JEM EFU latching arms
6. JEMRMS EE
7. JEMRMS Small Fine Arm (SFA) joints and booms
8. JPM window shutter linkages during operation
9. MCE outboard face
10. SEDA-AP mast
11. SMILES Antenna rotating area

C. RF radiation exposure
1. Stay 0.3 ft from Fwd/Aft JPM PROX Antennas.

D. Sharp edges
1. HREP Baffles (four) (Star Tracker aperture Zenith and three instrument baffles Aft)
2. ICS-EF AHM gears
3. JEM A/L Hatch corners
4. JEMRMS EE opening and snares
5. Interior of JEMRMS HRMs
6. MAXI visual star Camera

WARNING

ISS I.P. Elements Constraints (cont)

7. MCE outboard face
8. SFA's Electro-Mechanical GF (EMGF)
9. SMILES Baffles (two), baffle base bare bolts, and Cold Sky Terminator (CST)

E. Thermal

1. Columbus end cones may violate touch temperature constraints when $-75 \leq \beta \leq -60$ or $60 \leq \beta \leq 75$.
2. JPM Port end cones and JLP Port Nadir may violate touch temperature constraints when $\beta > 60$ deg.
3. JEMRMS/JTVE/JEFVE operating Cameras and lights may radiate large amounts of heat.

US EVA 22 INHIBIT PAD

ALL EVAs (PRIOR TO EGRESS)
ISS Hardware

1. COL ANTENNAS

☐ **IV Crew**
1. HAM Radio – Deactivate

2. CUCU

☐ **IV Crew**: LAB1O4
2. √cb POWER A, B (two) – OPEN
3. √cb LINK 1,2 (two) – OPEN

3. Ground Radar

☐ **MCC-H**: TOPO
1. √Ground radar restrictions in place for EVA

4. ICS-EF Antenna

☐ **SSIPC**
1. ICS MOD – OFF
2. ICS UPC – OFF
3. ICS HPA – OFF
4. HPA ON and UPC ON commands are cleared (not present) in the ICS stored command queue

5. MISSE 8

☐ **POIC**: POD
1. ELC-2 ExPA-2 Discrete Channel 6 – Disabled

6. RUSSIAN PAYLOADS

☐ **MCC-M**: RIO
1. Control (КОНТРОЛ)– Deactivate
2. Indicator ISS
   a. Unit of Input Converters (БВП)-Inhibit
   b. Control Unit (БУ)- Inhibit

7. PCU

☐ **MCC-H**: SPARTAN/SPOC

NOTE
PCUs may require up to a 1-hour warmup period before they are operational.

1. √PCUs (two) operational in discharge mode and one of the following:
   a. CCS PCU EVA hazard control FDIR enabled, if required or
   b. Only allowed arrays unshunted and oriented <105º from velocity vector
2. If one or both PCUs failed
   a. Only allowed arrays unshunted and oriented <105º from velocity vector

8. SM Antennas

☐ **IV Crew**
1. ARISS (Ham Radio) – Deactivate

☐ **MCC-M**: RIO
1. GTS – Deactivate
2. Napor (РСПИ) – Deactivate
3. Laser Comm System (БТЛС-Н) – Deactivate

9. EKTS Communication System

☐ **MCC-M**: RIO
1. EKTS Commincation System – Deactivate

US EVA 22 INHIBIT PAD

LOCATION-DEPENDENT (PRIOR TO EGRESS)
RSOS

10. **FGB ANTENNAS** *(1553 Cable, FBG PDGF FOD Removal, MLM Ethernet Cable)*
    - ☐ **MCC-M**: RIO
      EVA on RSOS
      1. √TORU (TOPY) – Deactivated
      2. √TV System (TBC) – Deactivated
      3. Radiotelemetry (БР-9ЦУ-8) – Deactivated
      4. √TV System (КЛ-108А) – Deactivated
      5. √CNPMS (СИТНП) – Deactivated
      6. √KOMPARUS (КИС) – Deactivated

11. **RSOS and RSOS Visiting Vehicle Antennas** (*MLM Power Cable, 1553 Cable, FGB PDGF FOD Removal, MLM Ethernet Cable*)
    - ☐ **MCC-M**: RIO
      EVA on PMA 1 or RSOS
      1. √KURS P (КУРС Р) – Deactivated
      2. √KURS A (КУРС А) – Deactivated

12. **SM ANTENNAS** *(1553 Cable, FBG PDGF FOD Removal, MLM Ethernet Cable)*
    - ☐ **MCC-M**: RIO
      EVA on RSOS
      1. √LIRA (ОНА) – Deactivated

13. **FGB PDGF Power** *(FBG PDGF FOD Removal)*
    - ☐ **MCC-M**: RIO
      1. √RACU-5 – OFF
      2. √RACU-6 – OFF

      SYSTEM POWER Panel (ППС) FGB 313
      3. √БКС Cable 77КМ-7228-110-01 – Demated
      4. √БКС Cable 77КМ-7228-110 – Demated

LOCATION-DEPENDENT (PRIOR TO EGRESS)
Visiting Vehicles

14. **ATV Antennas** *(1553 Cable, FGB PDGF FOD Removal, MLM Ethernet Cable)*
    - ☐ **ATV-CC**: RIO
      EVA on RSOS
      1. √PROXimity Link – Deactivated
      2. √KURS P: KMTA 1&2 – Deactivated

15. **ATV Other Equipment (Lasers)** *(1553 Cable, FGB PDGF FOD Removal, MLM Ethernet Cable)*
    - ☐ **ATV-CC**: RIO
      EVA on RSOS
      1. √Telegoniometer – Deactivated
      2. √Videometer – Deactivated

16. **ATV Thrusters** *(MLM Power Cable, 1553 Cable, FGB PDGF FOD Removal, MLM Ethernet Cable)*
    - ☐ **ATV-CC**: RIO
      EVA on RSOS
      1. √ATV Attitude Control Thruster Valves (56) – Closed

17. **SOYUZ THRUSTERS** *(1553 Cable, FBG PDGF FOD Removal, MLM Ethernet Cable)*
    - ☐ **MCC-M**: RIO
      EVA on PMA 1 or RSOS
      1. √35S Thruster on MRM 1 – Inhibited

US EVA 22 INHIBIT PAD

LOCATION-DEPENDENT (PRIOR TO EGRESS)
USOS

18. **Mobile Transporter** *(RGB Install, CLPA Removal)*
    - ☐ **MCC-H**: ROBO/MSS SYSTEMS
      EV crew < 1.5 meters from MT
      1. √MT latched

19. **MBS Mast CLPA** *(Mast CLPA Removal)*
    - ☐ **MCC-H**: ROBO/MSS SYSTEMS
      1. CRPCM 3P RPC 5 (VDU-2 Primary Power) open
      2. CRPCM 3R RPC 5 (VDU-2 Redundant Power) open

20. **FPMU** *(Port RGB Install)*
    - ☐ **MCC-H**: SPARTAN/SPOC
      EV crew on Port truss (P1-P6) or working within 5 feet of Floating Potential Measurement Unit
      1. RPCM P11A_B RPC 13 Open/Close Cmd Inhibit

21. **MLM Power Cable** *(MLM Power Cable Routing)*
    - ☐ **MCC-H**: SPARTAN/SPOC
      1. MBSU 1 RBI 5 Open/Close Cmd Inhibit
      2. MBSU 3 RBI 5 Open/Close Cmd Inhibit

22. **SSPTS** *(MLM Cable Routing and PMA 2 Cover)*
    - ☐ **MCC-H**: SPARTAN/SPOC
      EV crew working within 2 feet of SSPTS cable connections
      1. RPCM LA2A3B D RPC 1 – Open, Close Cmd Inhibit
      2. RPCM Z14B A RPC 2 – Open, Close Cmd Inhibit
      3. RPCM Z13B A RPC 2 – Open, Close Cmd Inhibit

23. **Port TRRJ** *(RGB Install, APFR/TS Relocate)*
    - ☐ **MCC-H**: SPARTAN/SPOC
      EV crew working within 2 feet of P1 TRRJ rotation envelope
      1. √DLA 1(2) – LOCKED at 0 deg
      2. √DLA 2(1) – ENGAGED
      3. All motor setpoints set to zero
      4. All motors deselected

24. **Stbd TRRJ** *(RGB Install)*
    - ☐ **MCC-H**: SPARTAN/SPOC
      EV crew working within 2 feet of S1 TRRJ rotation envelope
      1. √DLA 1(2) – LOCKED at 0 deg
      2. √DLA 2(1) – ENGAGED
      3. All motor setpoints set to zero
      4. All motors deselected

25. **Port SARJ** *(MISSE 8, SSRMS Setup/Cleanup)*
    - ☐ **MCC-H**: SPARTAN/SPOC
      EV crew working within 2 feet, outboard of SARJ, or required per loads FR (includes outboard faces of outboard ELCs/ESPs)
      1. √DLA 1(2) – LOCKED at 75 deg
      2. √DLA 2(1) – ENGAGED
      3. All motor setpoints set to zero
      4. All motors deselected

26. **Stbd SARJ** *(MISSE 8, SSRMS Setup/Cleanup)*
    - ☐ **MCC-H**: SPARTAN/SPOC
      EV crew working within 2 feet, outboard of SARJ, or required per loads FR (includes outboard faces of outboard ELCs/ESPs); NOT OK range: 55-95 deg and 235-275 deg
      1. √DLA 1(2) – LOCKED at 294 deg
      2. √DLA 2(1) – ENGAGED
      3. All motor setpoints set to zero
      4. All motors deselected

US EVA 22 INHIBIT PAD

LOCATION-DEPENDENT (PRIOR TO EGRESS)
USOS

27. **SGTRC #2** *(SGTRC R&R)*
☐ **MCC-H**: CATO/STARCOM
1. √RPCM Z14B_B RPC 3 (Ops Power) Open/Close Cmd Inhibit

28. **SCAN Testbed** *(RGB Install)*
☐ **POIC**: POD (SCAN Testbed)
1. SSRMS or EV crew working within 5 meters of SCAN Ka-band antenna or if EV crew in KOZ (B19-31)
   a. ELC-3 ECM ExPA-1 120V MAIN
      - SWITCH – OFF
   b. HARRIS SDR – OFF
   c. TWTA – OFF
2. SSRMS/SPDM/MBS within 1.3 meters of SCAN S-band antennas or if EV crew working within 0.7 meters of SCAN S-band antennas (refer to Flight Rule B19-31)
   a. ELC-3 ECM ExPA-1 120V MAIN SWITCH – OFF
   b. GC SDR – OFF (S-BAND POWER – OFF)
   c. JPL SDR – OFF (S-BAND POWER – OFF)

29. **MISSE 8** *(MISSE 8, RGB Install)*
☐ **POIC**: POD
EV crew Zenith of the plane of MISSE 8 (includes ELC-2, ELC-3, and SSRMS) (B19-30)
1. MISSE-8 PASCAL solar cells – Zero voltage bias
2. ELC-2 ExPA-2 Discrete Channel 1 – Disabled
3. ELC-2 ExPA-2 28V Operational Power – Disabled

Open FRAM Site 7
4. ELC-2: FRAM site 7 – ELC2, Power Module 1 & 2, Channel 11 - Open

CHIT 11457
5. √ ELC-2, Power Module 1 & 2, Channel 12 - Open

LOCATION-DEPENDENT (TIME DEPENDENT)
USOS

30. **SGTRC #2** *(SGTRC R&R)* **– Egress**
☐ **MCC-H**: CATO/STARCOM
1. RPCM Z13B_B RPC 3 (Heater Power) - Open, Close, Cmd Inhibit

31. **MISSE 8** *(MISSE 8)* **– Egress**
☐ **POIC**: POD
EV crew performing MISSE 8 retrieval (B19-30)
1. ELC-2 ECM EXPA-2 120V OPEN
2. ELC-2 ECM EXPA-2 28V OPEN
3. ELC-2 EXPA-2 OP PWR OPEN
4. ELC-2 Power Module 1, Channel 8 OPEN

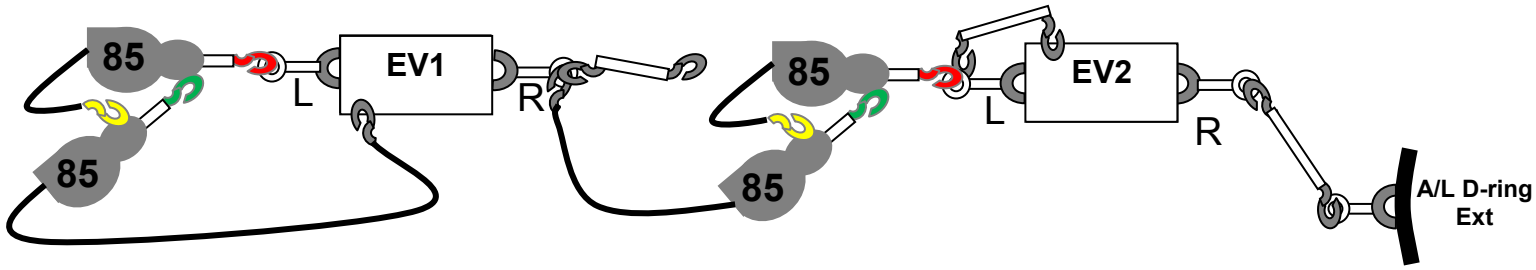
32. **ESP2 Open FRAM Locations** *(SSRMS Setup, SSRMS Cleanup)* **– End of MISSE 8 Retrieval**
☐ **MCC-H**: SPARTAN/SPOC
Site 1
1. RPC N1RS2-B, RPC 6 - Open, Close, Cmd Inhibit
2. S04B-F RPC 10 - Open, Close, Cmd Inhibit

Site 4
3. RPC N1RS2-B, RPC 10 - Open, Close, Cmd Inhibit
4. S04B-F RPC 12 - Open, Close, Cmd Inhibit

33. **Z1 Y-Bypass Jumper** *(Z1 Jumper Install)* **–End of Install of Port RGB**
☐ **MCC-H**: SPARTAN/SPOC
1. √IVA isolation jumpers installed
2. DDCU S04B converter off

34. **NODE 3 J1 FGB & J2 FGB 1553** *(Required for 1553 Cable)* **– Prior to Node 3 Connections**
☐ **MCC-H**: ROBO
1. If any RWS active, cmd ‗Active Assert Backup'

US EVA 22 EGRESS/SETUP (00:25)

<table>
<tr><th>IV/SSRMS</th><th>EV1</th><th>EV2</th></tr>
<tr><td colspan="3"> 
</td></tr>
<tr><td rowspan="4">1. PET Start Time __ : __
(Pwr to Batt)</td><td>POST-DEPRESS (00:05)
1. √All gates closed & hooks locked
❑ Red hook on L D-ring Ext
❑ White hook on Anchor Reel
❑ Green hook on crew tether Reel
❑ Blank hook on MWS
❑ EV2 Safety Tether to R D-Ring Ext</td><td>POST-DEPRESS (00:05)
1. √All gates closed & hooks locked
❑ Red hook on L D-ring Ext
❑ White hook on Anchor Reel
❑ Green hook on crew tether Reel
❑ Blank hook to EV1 R D-ring Ext
❑ R Waist Tether to A/L D-ring Ext
❑ L Waist Tether to MWS</td></tr>
<tr><td colspan="2">WARNING
Sharp edge hazard: port/aft portion of A/L circular HR (0506) and Face 1 CETA rail</td></tr>
<tr><td>EGRESS (00:10)
2. Open A/L thermal cover</td><td rowspan="3">EGRESS (00:10)</td></tr>
<tr><td rowspan="3">2. Spare SGTRC bag Thermal Clock: __:__
3. MCC-H: Perform WETA Scan
4. Failed SGTRC Thermal Clock: __:__
5. MISSE 8 PEC Thermal Clock: __:__
(2 hr)</td><td>3. Egress A/L, with SGTRC Bag, stow on BRT
4. Attach EV1 Safety Tether (blank hook) to aft A/L tether point
❑ √Gate closed, hook locked, reels unlocked
5. Relocate EV2 Safety Tether (blank hook) from R Waist Tether to fwd A/L tether point</td></tr>
<tr><td>❑ √Gate closed, hook locked</td><td>❑ √reels unlocked</td></tr>
<tr><td>6. Give EV2 GO to release Waist Tether
7. Give EV2 GO to Egress</td><td>2. Release R Waist Tether from internal A/L D-ring Ext
3. On EV1 GO:
❑ Reposition UIA Fish Stringer hooks
❑ Egress A/L w/ ORMatE Cover and RET
❑ Stow on swing arm using RET on ORMatE Cover</td></tr>
</table>

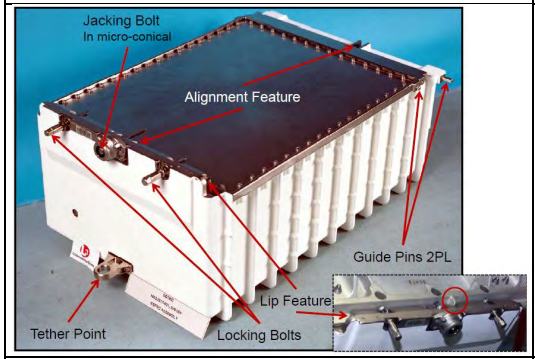
US EVA 22 EGRESS/SETUP (00:25)

IV/SSRMS	EV1	EV2
	8. Perform buddy checks ❑ SAFER handles down ❑ Tethers and Tools ❑ WVS Green LED	4. Perform buddy checks ❑ SAFER handles down ❑ Tethers and Tools ❑ WVS Green LED 5. Close A/L thermal cover
6. Verify SGTRC Inhibits in place 7. Verify MISSE 8 Inhibits in place	SETUP (00:10) 9. Translate to Z1 zenith worksite via: ❑ aft on A/L ❑ zenith on NOD1 endcone, tool box, and Z1 **WARNING** Sharp edge hazard: stbd and port Z1 tool boxes **CAUTION** Avoid contact with heat pipe radiators, SASA high and low gain antennas and radiative surfaces, and SGTRC-2 Z93 paint Do not use SGTRC connector bracket for restraint or stability loads	SETUP (00:10) 6. Perform translation adaptation 7. Translate to S1 HR 3200 (face 1) via: ❑ CETA Spur ❑ do not fairlead at base of CETA spur (let tether tend stbd from A/L) 8. Attach Safety Tether green hook to S1 HR 3200 (mm 5850) **WARNING** Do not touch hinged side while closing MISSE PEC **CAUTION** Avoid contact with deployed MISSE, and silver avionics boxes on ExPA. Keep tether fairlead free of MISSE. NOTE Avoid sideloads when installing cover on ORMatE Cover Labeled RAM side fwd MISSE PIP pins do not come all the way out of sockets

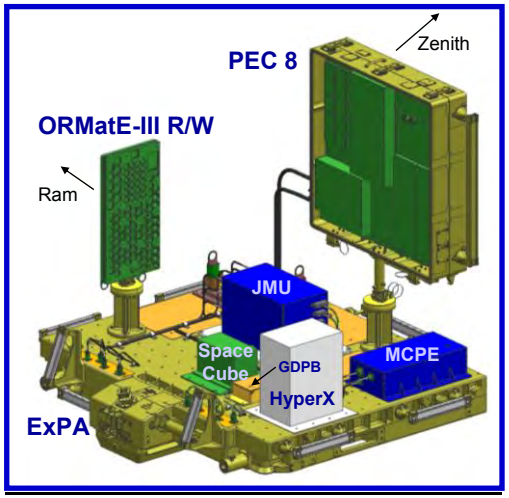
=

US EVA 22 SGTRC R&R / MISSE 8 RETRIEVAL (01:10)

IV/SSRMS



1. Spare SGTRC Thermal Clock: __:__



2. Record SGTRC bolt data:

Bolt	Turns	Torque (ft-lb)
Center		(2.5)
Fwd		(2.5)
Aft		(2.5)

EV1

SETUP SGTRC (00:20)

1. Stow SGTRC Bag hinge aft on Z1 HR 6057 (Lg-eq AET) and HR 6058 (eq-eq AET)
2. Retrieve Round Scoop from MUT, install on failed SGTRC (handle orthogonal to box-pointing nadir)
3. Install MUT-Ballstack-MUT on Z1 HR 6059 (bias stbd, close to SGANT boom),
4. Lock MUT EE jaws
5. Install 7/16 (rigid) Socket-9 ext on PGT
   - ❑ Pull test
6. Retrieve spare SGTRC from SGTRC Bag, install in MUT EE
   - ❑ paddles out

REMOVE FAILED SGTRC (00:10)

7. BRT to SGANT-Boom #2 HR 0001
8. Configure PGT:
   [B1 (12.0), CCW2, 30.5] 9-Ext 7/16
9. Release 2 outer fasteners **~ 10-13 turns**
   - ❑ Fwd
   - ❑ Aft
10. Release center fastener **~28-31 turns** (no soft dock present - **[B1 (12.0), CCW2, 30.5]** 9-Ext 7/16)
11. Remove failed SGTRC, tend to SGTRC Bag

INSTALL SPARE SGTRC (00:10)

12. Inspect blind mate connectors on boom receptacle and spare SGTRC
13. As required, reposition spare SGTRC within reach
14. Configure PGT:
    [A1 (2.5), CW2, 30.5] 9-Ext 7/16
15. Retrieve spare SGTRC from MUT-Ballstack-MUT
16. Install SGTRC (no soft dock present)
17. Drive center fastener **~28-31 turns to trq**
18. Drive 2 outer fasteners **~ 10-13 turns to trq**
    - ❑ Fwd
    - ❑ Aft

EV2

MISSE 8 PHOTOS (00:25)

1. Translate to ELC2 MISSE ExPA via fwd/zenith route
   - ❑ Fairlead inboard SARJ HRs
   - ❑ Fairlead outboard on ELC2
2. 📷 Photograph deployed MISSE 8, attempt to be orthogonal and BRT as reqd; multiple photos are acceptable to get entire coverage
   - ❑ Fairlead underneath zenith FRAM HR
   - ❑ Aft ORMatE (DCSU FRAM aft-zenith HR)
   - ❑ Nadir PEC (DCSU FRAM aft-zenith HR)
   - ❑ Zenith PEC (zenith MISSE FRAM HR)
   - ❑ Fwd ORMatE (ELC2 HR 8603)
   - ❑ Best effort pics of AMS, focusing on aft radiator and zenith surface

RETRIEVE MISSE 8 ORMatE (00:10)

3. Install ORMatE Cover on ORMatE payload
   - ❑ align bottom tether points
   - ❑ prevent sideloadings ORMatE
4. Engage Velcro strap
5. Move RET to ORMatE and Cover tether points near probe
6. Release ORMatE (release 2 PIP pins), stow on swing arm
   - ❑ Reinstall socket PIP pins (2)

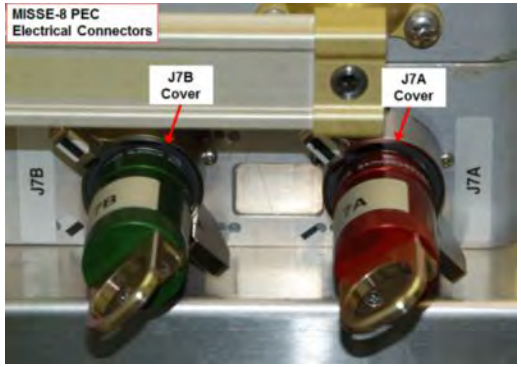
RETRIEVE MISSE 8 PEC (00:15)

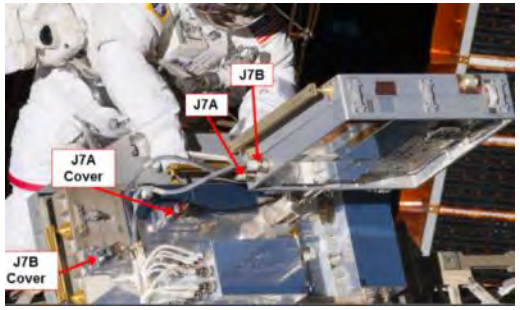
7. Translate to PEC
8. Close MISSE 8 PEC
   - ❑ disengage all 4 PIP pins
   - ❑ rotate PEC lid 360-deg
   - ❑ re-engage all 4 PIP pins
9. Demate MISSE 8 connector 7A:
   - ❑ 7A cap (red) ←|→ dummy connector J7A
   - ❑ J7A connector ←|→ PEC (lower connector)
   - ❑ √no FOD, pins
   - ❑ J7A connector →|← dummy panel J7A

US EVA 22 SGTRC R&R / MISSE 8 RETRIEVAL (01:10)

IV/SSRMS

3. Give CATO GO to restore power to SGTRC





4. Give POIC GO to restore heater power to ELC2
5. Verify ESP2 Inhibits in place

EV1

CLEANUP SGTRC (00:30)

19. Retrieve Round Scoop from SGTRC, install on MUT EE, lock jaws
20. Stow 7/16 (rigid) Socket-9 ext on PIP pin RET, and install 5/8 (rigid) Socket-2ext on PGT
21. Stow failed SGTRC in Bag
22. Retrieve MUT-Ballstack-MUT
23. Stow MUT-Ballstack-MUT on outside SGTRC Bag with Wire Tie
24. Retrieve EVA Camera and RET
25. Perform SGTRC Bag Inventory
    - ☐ **SGTRC Lrg ORU Bag**
    - ☐ Adj Equip Tether (outside bag; L-back)
    - ☐ Adj Equip Tether (Lg-eq) (outside bag; R-front)
    - ☐ Wire Tie (long; on top front loops outside of bag)
      - ☐ MUT EE-Ballstack-MUT EE (ECOMs black-on-black)
        - ☐ Round Scoop (in MUT EE jaw)
          - ☐ RET (eq-eq) (tethered inside bag)
    - ☐ RET w/ PIP Pin (internal lid tether points)
      - ☐ 7/16 (rigid) Socket-9 ext
        - ☐ ISS Small Trash Bag (internal lid tether point)
    - ☐ RET (eq-eq)
      - ☐ Round Scoop
        - ☐ SGTRC failed (on scoop)
26. Close SGTRC Bag, stow on BRT
27. Translate to Airlock
28. Open Thermal Cover
29. Stow SGTRC Bag in A/L, fwd side
30. Retrieve FSE Bag
31. Close Thermal Cover
32. Perform SAFER handle check
33. Perform glove inspection

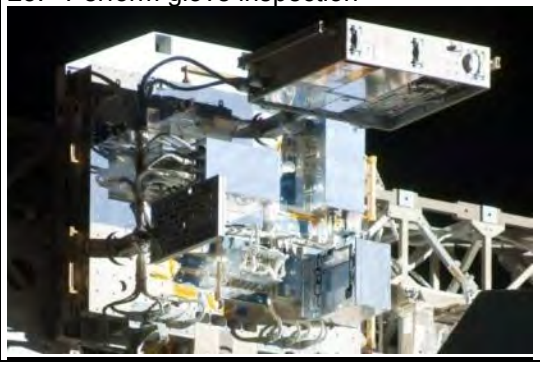
EV2

- ❑ 7A cap →|← PEC

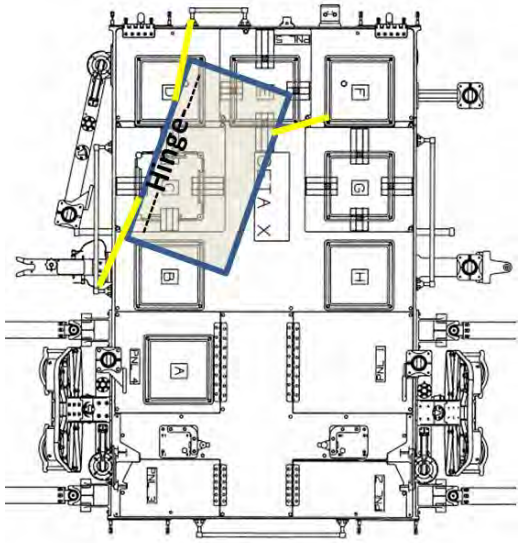
10. Demate MISSE 8 connector 7B:
    - ❑ 7B cap (green) ←|→ dummy connector J7B
    - ❑ J7B connector ←|→ PEC (upper connector)
    - ❑ √no FOD, pins
    - ❑ J7B connector →|← dummy panel J7B
    - ❑ 7B cap →|← PEC
11. Close TA Clamps
    - ❑ J7A connector ❑ J7B connector
12. RET to MISSE 8 PEC
13. Release MISSE 8 PEC (release 2 PIP pins), stow on BRT
    - ❑ Reinstall socket PIP pins (2)

STOW MISSE 8 (00:20)

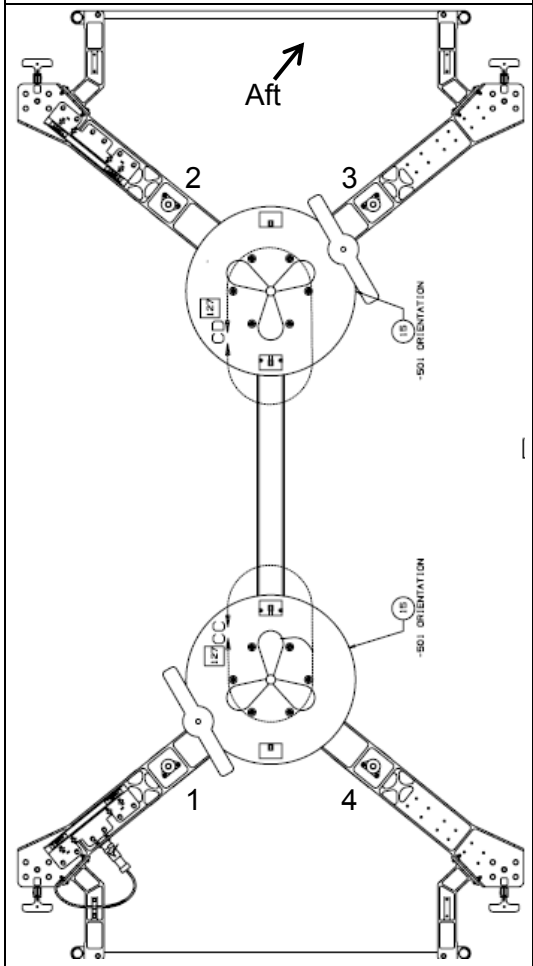
14. Translate to S1 HR 3200
15. Attach Safety Tether green hook to crew tether reel
    - ❑ √Gate closed, hook locked, reels unlocked
16. Translate to the Airlock, release fairlead
17. Open Thermal Cover
18. Stow MISSE 8 PEC on RET (Lg-eq)
19. Stow ORMatE w/RET on Fish Stringer
20. Retrieve PGT, WIF Adapter, and Socket Caddy from Fish Stringer, stow on MWS
21. Close Thermal Cover
22. Perform SAFER handle check
23. Perform glove inspection



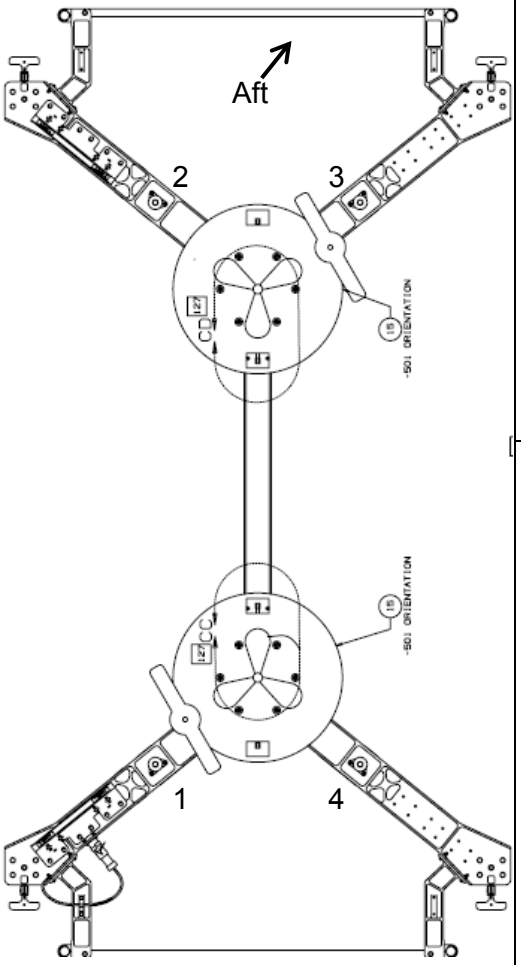
US EVA 22 STBD RADIATOR GRAPPLE BAR INSTALL (01:25)

IV/SSRMS	EV1	EV2
	WARNING • Due to entrapment hazard, do not insert glove into the exposed latch mechanisms • Limit touch time of LGF and APFR Ingress Aid due to potential extreme hot or cold temperatures **CAUTION** • Breaking torque should be between 1-1.25 turns to prevent binding and damage to the RGBs • EVA translation on the stbd RGB is only allowed with all 4 bolt fully torqued or released ≤1.25 turns • Avoid quick-grabs, cyclical loading, and gross body movement while on the RGB bundle • Pause 15 seconds between cycles of Ratchet Wrench to allow any RGB bundle motion to dampen • Avoid contact with LEE radiative surfaces and grapple fixture target pins	
 PORT CETA CART	MBS MAST CLPA SETUP (00:25) 1. Translate to S0 HR 3413 (CETA spur), fairlead at base of CETA spur 2. Attach Safety Tether green hook to S0 HR 3413 (nadir stanchion) 3. Translate to port CETA Cart 4. If required, reconfigure WIF 2 APFR to low profile, report settings **[5,__,__,__]**; previously [6,GG], [5,XX,G,6] 5. Stow FSE Bag on port CETA Cart ❑ flap hinge stbd ❑ AET to stbd HR (nadir stanchion) ❑ AET to zenith HR (stbd stanchion) ❑ AET (Lg-eq) to grid F 6. Retrieve Square Scoop w/ RET (eq-eq) from FSE Bag, stow RET loose hook outside FSE Bag 7. Translate to the MBS Mast CLPA ❑ via nadir of the MT ❑ local tether around MBS mast 8. Install Square Scoop on MBS Mast CLPA, handle oriented away from CLPA (aft) 9. Translate to port CETA Cart	SSRMS SETUP (00:50) 1. Translate to ESP2 WIF 5 via zenith of ESP2, fairlead around E/L endcone 2. Reconfigure APFR **[PP,F,6]**; previously [UU,F,6] 3. Collapse Ingress Aid on APFR boot plate 4. Retrieve APFR, stow on BRT 5. Translate to S0 Bay 04 ❑ via LAB gap-spanner ❑ zenith on port most LAB strut ❑ inboard of SSRMS 6. Install WIF Adapter and PIP pin ❑ Tether point toward LEE tip ❑ Pull Test 7. Install hitch pin, on marked side of PIP pin 8. Install APFR in WIF Adapter **[12,PP,F,6]** ❑ Black on Black ❑ Pull and Twist Test 9. Verify SSRMS/ APFR position good for ingress; GCA as required 10. Perform Safety Tether Swap ❑ White hook to LEE HR ❑ Gate closed, hook locked

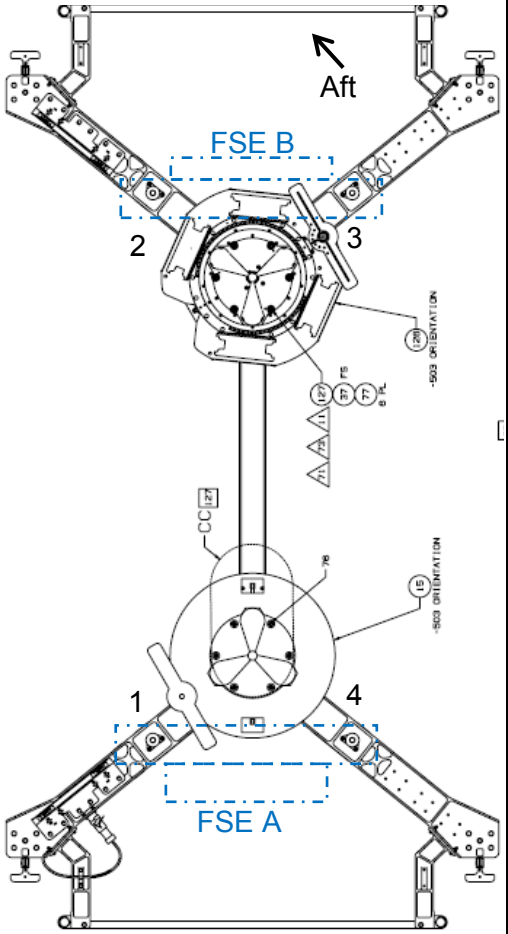
US EVA 22 STBD RADIATOR GRAPPLE BAR INSTALL (01:25)

IV/SSRMS	EV1	EV2
	RADIATOR GRAPPLE BAR SETUP (00:20) 10. Retrieve Ratchet Wrench and Round Scoop from FSE Bag, stow Scoop RET loose hook outside FSE Bag; stow tools on MWS 11. Configure Ratchet Wrench: **[CCW]** 2-ext 5/8 12. Break torque **1.25 turns** on aft bolts #2 and #3 on Stbd Grapple Bar (expect release trq ~25.0 ft-lb) ❑ Bolt #2 (zenith) ❑ Bolt #3 (nadir) 13. Translate to FSE A (fwd FSE) 14. Attach Round Scoop on port side of FSE A 15. Break torque **1.25 turns** on fwd bolts #1 and #4 on Stbd Grapple Bar ❑ Bolt #1 (zenith) ❑ Bolt #4 (nadir) 16. Stow Ratchet Wrench on MWS 17. Configure PGT: **[B7 (25.5), CCW2, 30.5]** 2-ext 5/8 18. Release fwd bolts #1 and #4, **16-18 turns** ❑ Bolt #1 (zenith) ❑ Bolt #4 (nadir) 19. Move Round Scoop to stbd side of FSE A 20. Ensure Safety Tether routed for translation back to CETA Cart via the Port Grapple Bar	❑ Green hook to LAB HR 0251 (fwd stanchion), ensure EV1 tether not captured ❑ Both reels unlocked 11. Deploy Ingress Aid 12. Attach Waist Tether to Ingress Aid 13. Ingress APFR

US EVA 22 STBD RADIATOR GRAPPLE BAR INSTALL (01:25)

IV/SSRMS	EV1	EV2
	RELEASE STBD GRAPPLE BAR FROM POA (00:15) 1. Translate on Port Grapple Bar to POA, perform fitcheck of PGT w/ 2-ext 5/8 on FSE B Bolt #3 (on the Port Grapple Bar) 2. Stow Ratchet Wrench in FSE Bag 3. Attach Waist Tether to Port Grapple Bar 4. Perform glove inspection 5. Verify PGT: **[B7 (25.5), CCW2, 30.5]** 2-ext 5/8	RELEASE STBD GRAPPLE BAR FROM POA (00:15) 1. Give SSRMS GO to mnvr to APFR Backoff posn (12 min) ❑ GCA SSRMS as reqd 2. Perform glove inspection 3. Install 5/8 (rigid) Socket-7.8 ext ❑ Pull test 4. Configure PGT: **[A3 (4.8), CW1, 30.5]** 7.8-ext 5/8 5. Stow PGT 6. Deconflict Ingress Aid as required 7. RET to Stbd Grapple Bar 8. Hold stbd Grapple Bar corner (near electrical connector)
	6. On EV2 GO, release aft bolts #2 and #3, **16-18 turns** ❑ Bolt #2 (zenith) ❑ Bolt #3 (nadir)	9. Give EV1 GO to release Stbd Grapple Bar bolts #2 and #3

US EVA 22 STBD RADIATOR GRAPPLE BAR INSTALL (01:25)

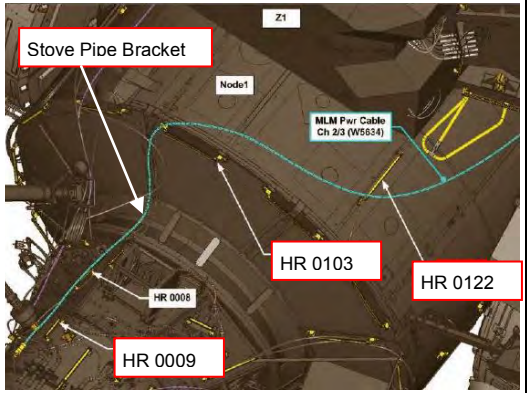
IV/SSRMS	EV1	EV2
	REMOVE GRAPPLE BAR FSE B (00:05) 7. Provide clearance calls for EV2 (while zenith on Port Grapple Bar) 8. Stow PGT 9. Attach RET to FSE B nadir tether point using RET from FSE Bag NOTE Stabilize FSE so that it does not rotate during PGT ops 10. As required, perform socket swap to 5/8 (wobble) Socket-12 ext ❑ Pull test 11. Configure PGT: **[B7 (25.5), CCW2, 30.5]** 12-ext 5/8 12. Release bolts #2 and #3, **16-18 turns** ❑ Bolt #2 ❑ Bolt #3 (may require 12”-ext) 13. Stow PGT 14. Stow/ tend FSE B in FSE Bag 15. As required, perform socket swap to 5/8 (rigid) Socket-2 ext ❑ Pull test 16. Inspect V-guide brackets on Port RGB, ensuring alignment markings are visible REMOVE GRAPPLE BAR FSE A (00:10) 17. Translate to FSE A 18. Attach RET to Round Scoop from stbd side 19. Configure PGT: **[B7 (25.5), CCW2, 30.5]** 2-ext 5/8 20. Release bolts #1 and #4, **16-18 turns** ❑ Bolt #1 ❑ Bolt #4 21. Configure PGT: **[A3 (4.8), CW1, 30.5]** 2-ext 5/8 ❑ Stow on swing arm 22. Stow/ tend FSE A w/ Round Scoop in FSE Bag	INSTALL STBD RGB ON S1 RADIATOR (00:25) 10. Give SSRMS GO to mnvr to Stbd Grapple Bar Backoff posn (15 min)
SSRMS: Give EV2 GO; Verify EV2 ready to mnvr to S1  		11. On SSRMS GO, reposition Stbd RGB for Mnvr to S1

US EVA 22 STBD RADIATOR GRAPPLE BAR INSTALL (01:25)

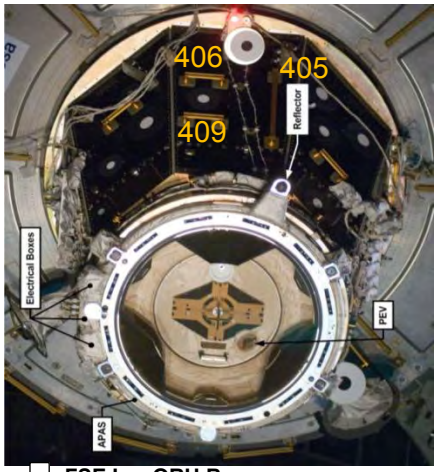
<table>
<tr><th>IV/SSRMS</th><th>EV1</th><th>EV2</th></tr>
<tr><td></td><td>INSTALL STBD RGB ON S1 RADIATOR (00:10)
23. Translate to S1 HR 3235 via face 1 to S3 and then zenith
❑ Translate zenith at S1-S3 interface (mm 5760)
❑ Fairlead on S1 HR 3210 (keep outboard of OSE)</td><td></td></tr>
<tr><td rowspan="6">1. Coordinate beginning of Z1 Y-Bypass Jumper power downs

2. Record Stbd Grapple Bar bolt data:
<table><tr><th>Bolt</th><th>Turns</th><th>Torque (ft-lb)</th></tr><tr><td>Inboard (#1)</td><td></td><td>(4.8)</td></tr><tr><td></td><td></td><td>(18.4)</td></tr><tr><td>Outboard (#2)</td><td></td><td>(4.8)</td></tr><tr><td></td><td></td><td>(18.4)</td></tr></table></td><td colspan="2">NOTE
• Prevent side loads on RGB bolts when installing to prevent zip nut release loss of preload
• Push bolt into zip nut as far as possible to minimize PGT driving</td></tr>
<tr><td>24. GCA EV2 and Grapple Bar as reqd
❑ Lean back as reqd
❑ Put hand on Grapple Bar and assist with alignment
25. Verify PGT:
[A3 (4.8), CW1, 30.5] 2-ext 5/8</td><td>12. Rotate Grapple Bar clear of EV1</td></tr>
<tr><td>26. Receive control of Grapple Bar from EV2</td><td>13. Transfer control of Grapple Bar to EV1
14. Verify PGT:
[A3 (4.8), CW1, 30.5] 7.8-ext 5/8
15. Zip inboard bolt #1</td></tr>
<tr><td>27. Zip outboard bolt #2</td><td></td></tr>
<tr><td></td><td>16. Drive inboard bolt #1, to trq 16-18 turns w/o zip</td></tr>
<tr><td>28. Drive outboard bolt #2, to trq 16-18 turns w/o zip</td><td>17. Configure PGT:
[B3 (18.4), CW1, 30.5] 2-ext 5/8</td></tr>
<tr><td>29. Configure PGT:
[B3 (18.4), CW1, 30.5] 2-ext 5/8</td><td>18. Drive inboard bolt #1, ~0.25 turns to trq</td></tr>
<tr><td>30. Drive outboard bolt #2, ~0.25 turns to trq</td><td></td></tr>
<tr><td>31. Stow PGT</td><td>19. Perform jiggle test
20. Stow PGT
21. Release RET from Grapple Bar</td></tr>
</table>

US EVA 22 MLM POWER CABLE INSTALL / MBS MAST CLPA RETRIEVAL (00:30)

IV/SSRMS	EV1	EV2
	ROUTE MLM POWER CABLE W5634 (00:30) 1. Translate to S0 HR 3413 (CETA spur) 2. Attach Safety Tether green hook to crew tether reel 3. Translate to fwd/zenith A/L HPGT **WARNING** Sharp edge hazard: zenith A/L HR (0537) **CAUTION** Avoid inadvertant contact with zenith PMA1 MDM radiator, above 22" of OTD (US crane), and SASA high and low gain Antennas and radiator surfaces NOTE Ensure Safety Tether not under cable 4. Retrieve W5634 from aft side of fwd/zenith A/L HPGT 5. Secure cable to HRs with 3 half-twists using integrated wire ties ❑ NOD 1 HR 0122 aft stanchion ❑ NOD 1 HR 0103 port stanchion ❑ NOD 1 stovepipe bracket ❑ Ensure cable can reach PMA1-FGB interface ❑ PMA 1 HR 0009 (secure slack coil) ❑ Leave spare wire tie low profile on harness 6. Perform glove inspection 7. Translate to port CETA Cart 8. Retrieve Ratchet Wrench from FSE Bag, stow on MWS 9. Perform Getahead as time permits: ❑ Stow FSE Bag 10. Translate on RGB to EV2	SSRMS MANEUVER TO MBS (00:15) 1. Give SSRMS GO to mnvr to S1 Backoff posn (13 min) ❑ GCA SSRMS as reqd 2. Perform glove inspection 3. Perform socket swap to 7/16 (wobble) Socket-6 ext ❑ Pull test 4. Deconflict Ingress Aid as required **WARNING** Avoid handling grounding points, connectors, and bolt threads when ORU is released **CAUTION** Avoid inadvertent contact with MBS MCAS target and CLPA Do not drive to a hard stop on the CLPA bolt REMOVE MBS MAST CLPA (00:15) 5. RET to Square Scoop, prep to BRT to Scoop 6. Configure PGT: **[B7 (25.5), CCW2, 30.5]** 6-ext 7/16 7. Release bolt, **19 turns**, stow on BRT 8. Give SSRMS GO to mnvr to MBS Mast CLPA Backoff posn (7 min) ❑ GCA SSRMS as reqd 9. Perform socket swap to 5/8 (rigid) Socket-7.8 ext ❑ Pull test 10. Configure PGT: **[A3 (4.8), CW1, 30.5]** 7.8-ext 5/8 11. Stow PGT
	11. Retrieve CLPA from EV2, stow on BRT 12. Translate to port CETA Cart	12. Transfer CLPA to EV1 (hold tether point) 13. RET to Port Grapple Bar 14. Hold port Grapple Bar square HR (near electrical connector)

US EVA 22 PORT RADIATOR GRAPPLE BAR INSTALL (00:40)

IV/SSRMS	EV1	EV2
POA: Derigidize and Release Snares	RELEASE PORT GRAPPLE BAR FROM POA (00:05) 13. Assist clearance and provide clearance calls for EV2 STOW CLPA (00:10) 14. Translate to Airlock 15. Open Thermal Cover 16. Stow CLPA in Airlock on RET (Lg-eq) 17. Stow Ratchet Wrench on Fish Stringer STOW PMA 2 BAG (00:15) 18. Retrieve and stow Z1 Jumper Crewlock Bag on A/L circular HR 19. Retrieve PMA2 Cover Bag, stow on BRT 20. Close Thermal Cover 21. Perform SAFER handle check 22. Translate to port LAB Strut HR 23. Attach Safety Tether green hook to LAB strut HR, deconflicting EV2's Safety Tether 24. Translate to PMA2 zenith via zenith/port route 25. Stow PMA2 Cover Bag on PMA2 ❑ flap hinge port ❑ integral hooks to PMA2 HR 0405 and 0409 26. Attach first two PMA2 Cover straps ❑ HR 0414 ❑ HR 0413 27. Translate to port CETA Cart 28. Perform FSE Bag inventory 29. Close FSE Bag	RELEASE PORT GRAPPLE BAR FROM POA (00:05) 15. Give SSRMS GO for Port Grapple Bar Release INSTALL PORT GRAPPLE BAR ON P1 (00:35) 16. Give SSRMS GO to mnvr to Port Grapple Bar Backoff posn (27 min)
SSRMS: Give EV2 GO; Verify EV2 ready to mnvr to P1  ☐ **FSE Lrg ORU Bag** ☐ Adj Equip Tether (2) (outside bag) ☐ Adj Equip Tether (Lg-eq) (outside bag) ☐ RET w/ PIP pin (R) ☐ RET (eq-eq) (R) ☐ Grapple Bar FSE B ☐ RET (eq-eq) (L) ☐ Round Scoop ☐ Grapple Bar FSE A ☐ RET (eq-eq) (L) ☐ Socket Caddy ☐ 5/8 (wobble) Socket-12 ext ☐ RET (eq-eq) (L) ☐ Small STS Trash Bag		17. On SSRMS GO, reposition Port RGB for Mnvr to P1

US EVA 22 PORT RADIATOR GRAPPLE BAR INSTALL (00:40)

<table>
<tr><th>IV/SSRMS</th><th>EV1</th><th>EV2</th></tr>
<tr><td>MCC-H: Consumables Update</td><td colspan="2">INSTALL PORT GRAPPLE BAR ON P1 (00:10)
30. Translate to P1 HR 3367 via face 1
❑ Translate nadir at FHRC (mm 9150)
❑ Fairlead on P1 HR 3651 (face 6 HR)</td></tr>
<tr><td>1. Record Stbd Grapple Bar bolt data:<table><tr><th>Bolt</th><th>Turns</th><th>Torque (ft-lb)</th></tr><tr><td>Inboard (#1)</td><td></td><td>(4.8)</td></tr><tr><td></td><td></td><td>(18.4)</td></tr><tr><td>Outboard (#2)</td><td></td><td>(4.8)</td></tr><tr><td></td><td></td><td>(18.4)</td></tr></table></td><td colspan="2">NOTE
• Prevent side loads on RGB bolts when installing to prevent zip nut release loss of preload
• Push bolt into zip nut as far as possible to minimize PGT driving</td></tr>
<tr><td rowspan="8"></td><td>31. GCA EV2 and Grapple Bar as reqd
❑ Lean back as reqd
❑ Put hand on Grapple Bar and assist with alignment
32. Configure PGT:
[A3 (4.8), CW1, 30.5] 2-ext 5/8</td><td>18. Rotate Grapple Bar clear of EV1</td></tr>
<tr><td>33. Receive control of Grapple Bar from EV2</td><td>19. Transfer control of Grapple Bar to EV1
20. Configure PGT:
[A3 (4.8), CW1, 30.5] 7.8-ext 5/8
21. Zip inboard bolt #1</td></tr>
<tr><td>34. Zip outboard bolt #2</td><td></td></tr>
<tr><td></td><td>22. Drive inboard bolt #1, to trq 16-18 turns w/o zip</td></tr>
<tr><td>35. Drive outboard bolt #2, to trq 16-18 turns w/o zip</td><td>23. Configure PGT:
[B3 (18.4), CW1, 30.5] 2-ext 5/8</td></tr>
<tr><td>36. Configure PGT:
[B3 (18.4), CW1, 30.5] 2-ext 5/8</td><td>24. Drive inboard bolt #1, ~0.25 turns to trq</td></tr>
<tr><td>37. Drive outboard bolt #2, ~0.25 turns to trq</td><td></td></tr>
<tr><td>38. Stow PGT
39. Perform glove inspection</td><td>25. Perform jiggle test
26. Stow PGT
27. Release RET from Grapple Bar</td></tr>
</table>

US EVA 22 Z1 Y-BYPASS JUMPER INSTALL (01:00) / SSRMS CLEANUP (00:55)

IV/SSRMS

SSRMS: Verify EV2 ready to mnvr into S0

1. Verify Y-Bypass Jumper Inhibits complete

EV1

RETRIEVE Z1 Y-BYPASS JUMPERS (00:25)

1. Translate to port LAB strut HR
2. Attach Safety Tether green hook to crew tether reel
3. Transfer to A/L circular HR
4. Retrieve Z1 Jumper Crewlock Bag with RET (Lg-eq)
5. Translate aft to Aux Bag#1 on NOD1 aft endcone
6. Open Aux Bag #1 ¼-turn fasteners (2); Velcro
7. RET to Z1-Jumpers (2) using 2 tether points, release Velcro strap, stow between MWS T-bar and DCM
   - ❑ Jumper Z1-005/ 4B– (nadir)
   - ❑ Jumper Z1-006/ 3B – (zenith)
8. Close Aux Bag, secure ¼-turn fasteners (2) and Velcro
9. Translate to port Z1 via zenith NOD1 endcone

WARNING

Do not demate Cable W05 Connectors P1 or P2 as these connections are not inhibitied

CAUTION

Avoid contact with PCU cathode and HCA ports, heat pipe radiators, WETA, and NOD1 CETA light

NOTE
Missing label on zenith X2 J3 Patch Panel jack

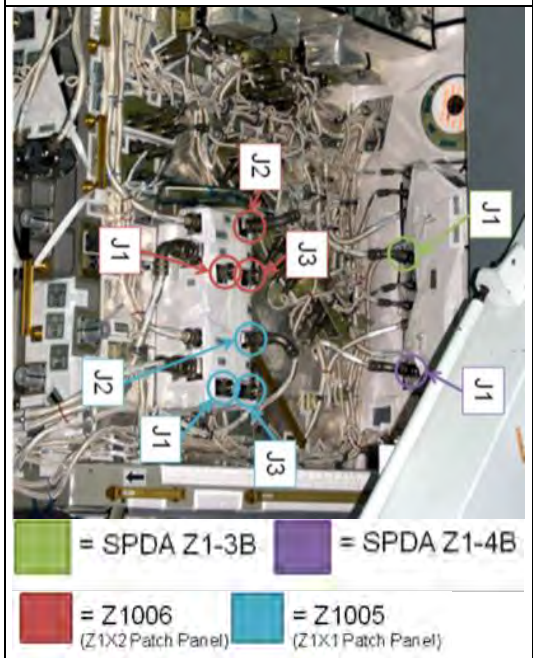
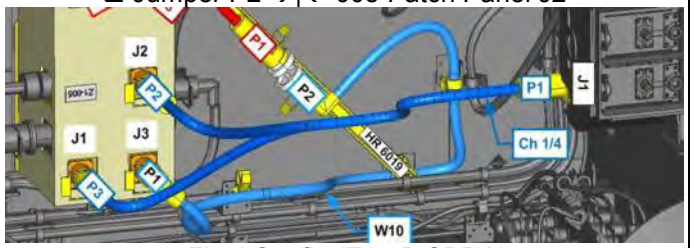
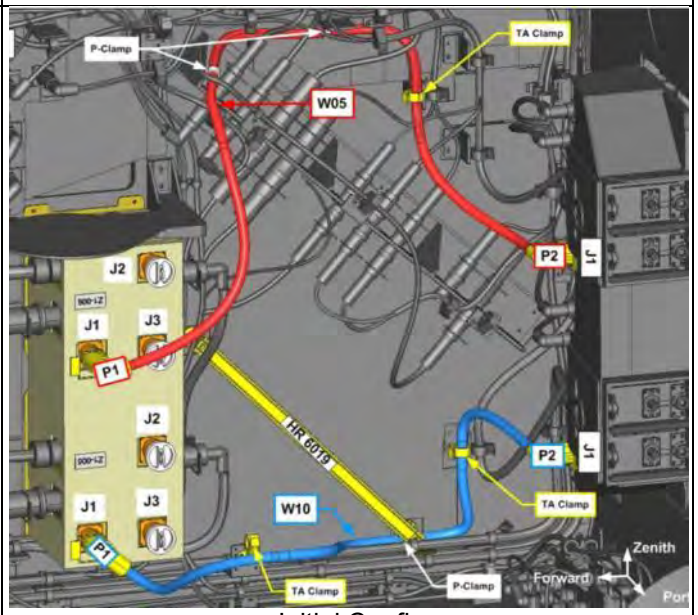
10. Pitch IAPFR out of worksite, report settings **[6,__,__,__]**; previously [6,PP,F,12]
11. Stow Z1 Jumper Crewlock Bag between IAPFR and Z1 HR 6020
12. Perform worksite familiarization
    - ❑ 005 Patch Panel (Nadir, fwd connectors)
    - ❑ W10 Cable Harness (attached to J1)
    - ❑ 4B RPCM Panel (Nadir, aft connectors)
    - ❑ 006 Patch Panel (Zenith, fwd connectors)
    - ❑ W05 Cable Harness (DO NOT DEMATE)

EV2

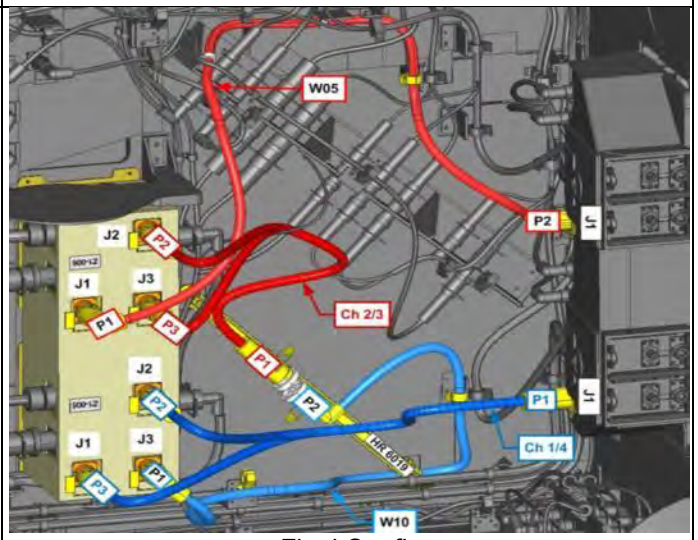
SSRMS CLEANUP (00:55)

1. Give SSRMS GO to mnvr to P1 Backoff posn (13 min)
2. Perform socket swap to 7/16 (wobble) Socket-6 ext
   - ❑ Pull test
3. GCA SSRMS as reqd
   - ❑ Brakes on SSRMS
4. Egress APFR
5. Perform Safety Tether Swap
   - ❑ Green hook from LAB HR 0251 to crew tether reel
   - ❑ Gate closed, hook locked
   - ❑ White hook from LEE HR to anchor reel
   - ❑ Gate closed, hook locked
   - ❑ Both reels unlocked
6. Remove APFR from WIF Adapter, stow on BRT
7. Verify all tethers and hardware free from SSRMS
8. Give SSRMS GO to mnvr to SSRMS Park posn
9. Translate to ESP2 WIF 5
10. Install APFR in port ESP2 WIF 5 **[6,UU,F,6]**
    - ❑ Black on Black
    - ❑ Pull and Twist Test
    - ❑ Telescope in and collapse Ingress Aid against boot plate
11. Perform glove inspection

US EVA 22 Z1 Y-BYPASS JUMPER INSTALL (01:00) / SSRMS CLEANUP (00:55)

IV/SSRMS	EV1	EV2
 2. Give SPARTAN GO to repower DDCU converter	INSTALL Z1 Y-JUMPER PART 1 (NADIR) (00:20) 13. Retrieve GTEC, attach to Z1 HR 6019 via integral eq hook (in center of diagonal HR) 14. Perform the following mate/demates on Nadir Y-Bypass Jumper Z1-005/4B and Harness W10: Aft connectors (Z1-4B SPDA Nadir RPCM Panel): ❑ W10 P2 ←|→ 4B RPCM Panel J1 ❑ W10 P2 →|← Dust Cap (Crewlock Bag) ❑ Insert W10 P2 in GTEC on Z1 HR 6019 ❑ (4B) Jumper P1 →|← 4B RPCM Panel J1 Fwd connectors (Z1-005 Nadir X1 Patch Panel): ❑ Tether 005 Patch Panel J2 and J3 Dust Caps (2), using Adj Equip Tether from Crewlock Bag ❑ Dust cap ←|→ 005 Patch Panel J2 ❑ Dust cap ←|→ 005 Patch Panel J3 ❑ W10 P1 ←|→ 005 Patch Panel J1 ❑ W10 P1 →|← 005 Patch Panel J3 ❑ Jumper P3 →|← 005 Patch Panel J1 ❑ Jumper P2 →|← 005 Patch Panel J2  Final Config (Z1-4B SPDA)	 Initial Config

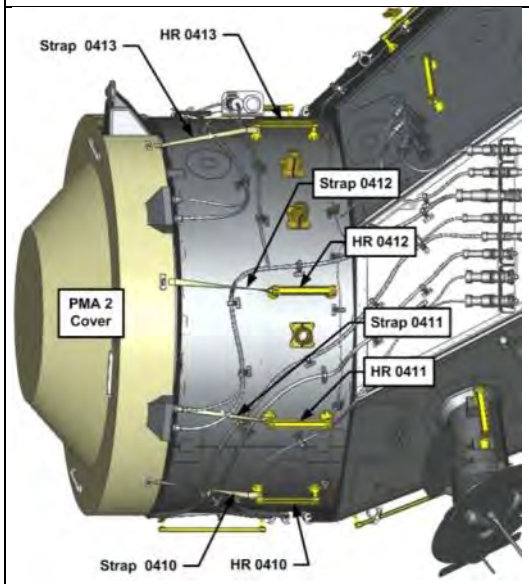
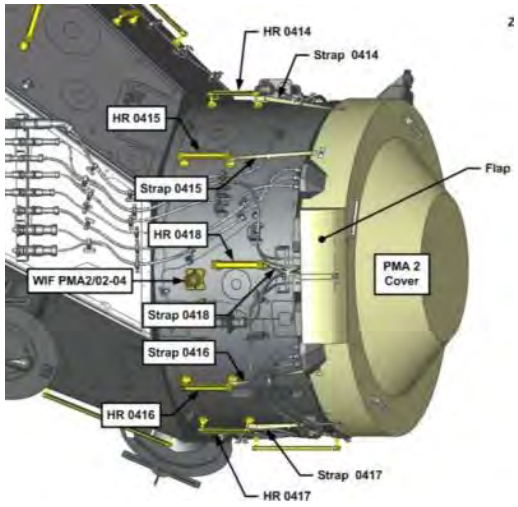
US EVA 22 Z1 Y-BYPASS JUMPER INSTALL (01:00) / SSRMS CLEANUP (00:55)

IV/SSRMS	EV1	EV2
	SETUP Z1 Y-JUMPER PART 2 (ZENITH) (00:20) 15. Perform the following mate/demates on Zenith Y-Bypass Jumper Z1-006/3B: Aft connectors (GTEC): ❑ (3B) Jumper P1 →|← Dust Cap (Crewlock Bag) ❑ Insert Jumper P1 in GTEC on Z1 HR 6019 ❑ Cinch straps on either side of GTEC opening to capture both connectors ❑ Use Wire Tie as required to secure connectors Fwd connectors (Z1-006 Zenith X2 Patch Panel): ❑ Tether 006 Patch Panel J2 and J3 Dust Caps (2), using Adj Equip Tether from Crewlock Bag ❑ Dust cap ←|→ 006 Patch Panel J2 ❑ Dust cap ←|→006 Patch Panel J3 (missing label) ❑ Jumper P3 →|← 006 Patch Panel J3 ❑ Jumper P2 →|← 006 Patch Panel J2 16. Perform WVS close-out imagery of Z1 Jumper worksite 17. Perform Z1 Jumper Crewlock Bag inventory ☐ RET (Lg-eq) (outside both bags, opposite integral) ☐ **Z1 Jumper Crewlock Bag** (configured per video) ☐ Adj Equip Tether (on integral RET) ☐ Nadir Patch Panel Caps (2) ☐ Adj Equip Tether (on integral RET) ☐ Zenith Patch Panel Caps (2) ☐ Adj Equip Tether (on integral RET) ☐ Spare size 25 Dust Cap ☐ Small ISS Trash Bag (on integral) 18. If desired, stow EVA Camera and RET in Z1 Jumper Crewlock Bag 19. Retrieve Z1 Jumper Crewlock Bag, stow on BRT 20. Perform survey of NOD1 HR 0141 and MLM	 Final Config

US EVA 22 Z1 Y-BYPASS JUMPER INSTALL (01:00) / SSRMS CLEANUP (00:55)

IV/SSRMS	EV1	EV2
	Ethernet jack 21. Translate to A/L 22. Open Thermal Cover 23. Stow Z1 Jumper Crewlock Bag in the A/L aft side 24. Stow PGT on Fish Stringer 25. Close Thermal Cover 26. Perform SAFER handle check 27. Perform glove inspection	

US EVA 22 PMA 2 COVER INSTALL (00:35/00:40)

IV/SSRMS	EV1	EV2
	INSTALL PMA2 COVER (00:35) 1. Translate to LAB HR 0263 via CETA spur and the LAB zenith/port route 2. Release and attach green hook on LAB HR 0263 3. Translate to PMA 2 zenith	INSTALL PMA2 COVER (00:40) 1. Translate to LAB HR 0264 via zenith/stbd route 2. Release and attach green hook on LAB HR 0264 3. Translate to PMA2 zenith
	WARNING Avoid contact with potential sharp edges on NOD2 fwd HR 0327, PMA2 nadir HR 0417, zenith PMA2 surface, APAS mating surface, reflector, and umbilical launch restraints NOTE Allow for extra slack in first few Cover straps to ensure full coverage of PMA2 mating surface	
	4. Assist EV2 as required	4. Open PMA 2 Cover Bag and release Adj Equip Tether and RET (Lg-eq)
	5. Align Cover cut-out with APAS reflector 6. Continue to unfold PMA2 cover, while attaching Velcro straps on fwd circumferential HRs ❑ 0412 ❑ 0411 ❑ 0410	5. Align Cover cut-out with APAS reflector 6. Continue to unfold PMA2 cover, while attaching Velcro straps on aft circumferential HRs ❑ 0415 ❑ 0418 ❑ 0416 ❑ 0417
	7. Work back zenith toward bag, ensuring at least a ½ inch overlap, retightening straps as required and perform WVS close-out imagery of PMA2 cover ❑ 0410 ❑ 0411 ❑ 0412 ❑ 0413 8. Perform glove inspection 9. Translate to LAB HR 0263 10. Attach Safety Tether green hook to crew tether reel 11. Translate to port CETA Cart 12. Stow FSE Bag on BRT 13. Translate to Airlock endcone HR 0564 14. Stow FSE Bag on Airlock HR 0564 and 0567, using Adj Equip Tethers (3)	7. Work back zenith toward bag, ensuring at least a ½ inch overlap, retightening straps as required and perform WVS close-out imagery of PMA2 cover ❑ 0417 ❑ 0416 ❑ 0418 ❑ 0415 ❑ 0414 8. Perform glove inspection 9. Perform PMA2 Cover Bag inventory ☐ **PMA 2 Cover Bag** ☐ RET (eq-eq) (bottom of bag) ☐ Adj Equip Tether (D-rings to RET hook) ☐ Small ISS Trash Bag ☐ Wire Tie Caddy (w/ 9 short) ☐ Fish Stringer Tether (Lg hooks to bottom of bag) ☐ 1553 Cable (secure with non-hinge-side Velcro strap) ☐ 1553 Dust Caps (hooks 1 & 2) ☐ MLM Ethernet Cable (secure with hinge-side Velcro strap)

US EVA 22 PMA 2 COVER INSTALL (00:35/00:40)

IV/SSRMS	EV1	EV2
		☐ RET (Lg-eq) ☐ Adj Equip Tether (eq-eq) (2) 10. Retrieve PMA2 Cover Bag, stow on BRT 11. Translate to LAB HR 0263 12. Attach Safety Tether green hook to crew tether reel

US EVA 22 CLEANUP/INGRESS (00:30)

IV/SSRMS	EV1	EV2
	CLEANUP (00:10) 1. Perform tool inventory 2. Translate to A/L	CLEANUP (00:10) 1. Perform tool inventory 2. Translate to A/L
	INGRESS (00:15) 3. Open A/L thermal cover	INGRESS (00:15) 3. Open A/L thermal cover 4. Stow PMA 2 Cover Bag inside A/L 5. Ingress A/L 6. Attach R Waist Tether to A/L internal D-ring Ext ❑ √Gate closed, hook locked, reel unlocked
	4. On GO, release EV2 Safety Tether, attach to R D-Ring Ext ❑ √Gates closed, hooks locked, reel unlocked 5. Release EV1 Safety Tether, attach to MWS	7. Give EV1 GO to release Safety Tether
	6. On EV2 GO, ingress A/L 7. Close A/L thermal cover, attach Velcro strap	8. Give EV1 GO to ingress
	8. Remove SCU from stowage pouch 9. Remove DCM cover; Velcro to DCM 10. Connect SCU to DCM √SCU locked	9. Remove SCU from stowage pouch 10. Remove DCM cover; Velcro to DCM 11. Connect SCU to DCM √SCU locked
	NOTE A TCV setting 8 – Max C minimizes time for SCU cooling	
	11. WATER – OFF (fwd), expect H2O IS OFF msg	12. WATER – OFF (fwd), expect H2O IS OFF msg
	CAUTION Do not close hatch until EMU Water OFF for 2 min. Verify outer hatch clear of hardware	
	12. Verify outer hatch clear of hardware 13. Verify handle position per hatch decal 14. Close and lock hatch PRE REPRESS (00:05) Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card)	PRE REPRESS (00:05) Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card)

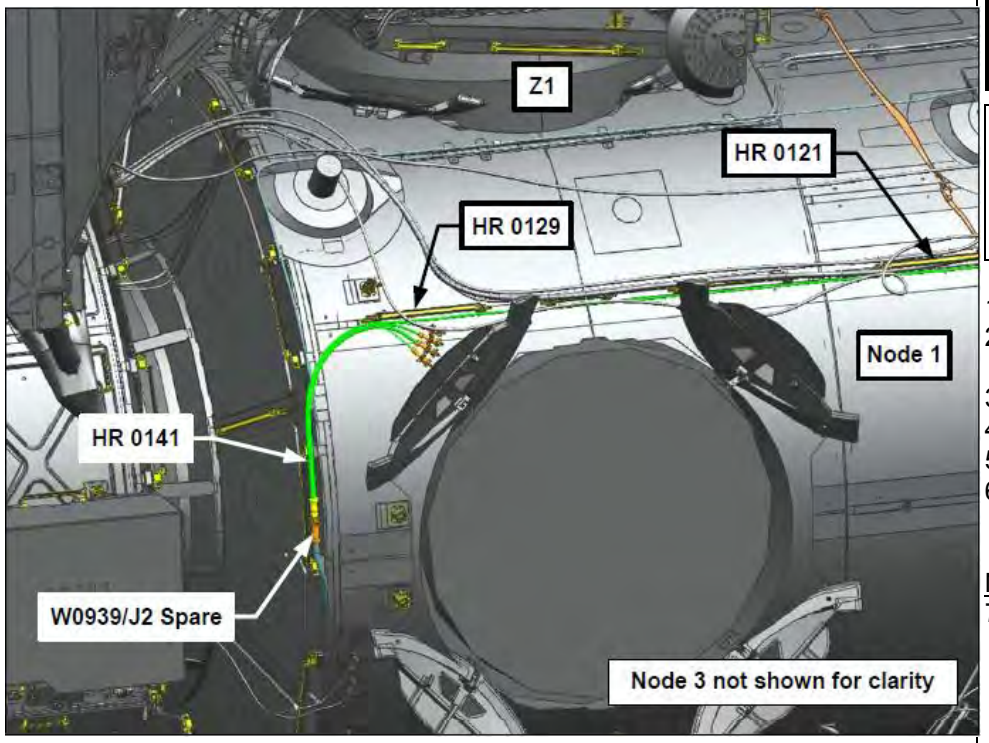
US EVA 22 GETAHEADS

EVA Get-ahead Tasks (Priority Order)	Duration 1EV / 2EV	Inhibits
1. PMA 2 Cover Bag (MLM/ 1553 Cables) Tempstow	00:20 / NA	N/A
2. MLM Ethernet Cable Install	00:35 / NA	RSOS
3. PDGF FOD Removal	00:20 / NA	RSOS
4. PDGF 1553 Cable Install	00:30 / NA	RSOS
5. APFR/TS Relocate	NA / 00:20	Port TRRJ lock

US EVA 22 GETAHEAD – PMA 2 COVER BAG (MLM/ 1553 CABLES) TEMPSTOW (00:20)

IV/SSRMS	EV1
	TEMPSTOW PMA 2 COVER BAG (MLM/ 1553 CABLES) (00:20) 1. Translate to Node 1 HR 0103 via stbd route; if desired, drop green hook on Node 1 HR (fairlead). 2. Stow PMA2 Cover Bag ❑ Hinge stbd ❑ Node 1 HR 0102 (port Stanchion) ❑ Node 1 HR 0104 (stbd Stanchion) 3. Perform glove inspection

US EVA 22 GETAHEAD – MLM ETHERNET CABLE INSTALL (00:40)

IV/SSRMS	EV1
	NODE 1 CONNECTION (00:15) **WARNING** Avoid contact with grapple fixture target, target pin, connector doors, and PDGF curvic coupling (teeth) Avoid contact with FGB sun sensors (possible sharp edges) **CAUTION** Avoid contact with zenith PMA1 MDM and above 22" of EVA crane (OTD) **NOTE** Do not release MLM Ethernet Cable Wire Tie labeled "PIGTAIL". This Wire Tie secures 4 pigtails to main cable and is not used to secure cable to structure Verify Safety Tether is clear before securing each Wire Tie 1. Retrieve MLM Ethernet Cable from PMA2 Cover Bag 2. Translate to Node 1 Fwd endcone HR 0141 (existing Ethernet pigtail), staying zenith of CETA Light 3. Release Wire Ties labeled **HR 0141/START** & **HR 0140/ FIRST TY** 4. RET to J2 cap on existing Ethernet pigtail (release Wire Tie if req'd 5. Pigtail (W0939) J2 →|← P2/W5946 (MLM Ethernet) 6. Briefly describe worksite access near MMOD shield C1-01 (future NOD3 IFHX worksite under NOD3 MMOD shield C1-01) NODE 1 ROUTING TO FGB (0:20) 7. Secure cable to HRs with 1 pre-integrated Short Wire Tie each, 3 twists. Verify Safety Tether is clear before securing each Wire Tie ❒ Node 1 **HR 0141** (optional) (If not installed, make low profile) ❒ Node1 **HR 0140/ FIRST TY** nadir stanchion (Circumferential HR) ❒ Node 1 **HR 0129** fwd stanchion (Horiz HR) ❒ Node 1 **HR 0121** aft stanchion (Horiz HR) ❒ Node 1 **HR 0105** zenith stanchion (Circumferential HR) ❒ PMA1 **STOVEPIPE** (Wire Tie label "HR STOVEPIPE") ❒ PMA1 **TA C-7** (Wire Tie label "TA-C7") ❒ PMA1 **HR 0010** (nadir of Crane) ❒ FGB **HR 1050** (Circumferential HR) – coil & restrain extra cable in this Wire Tie zenith on HR away from FGB PDGF

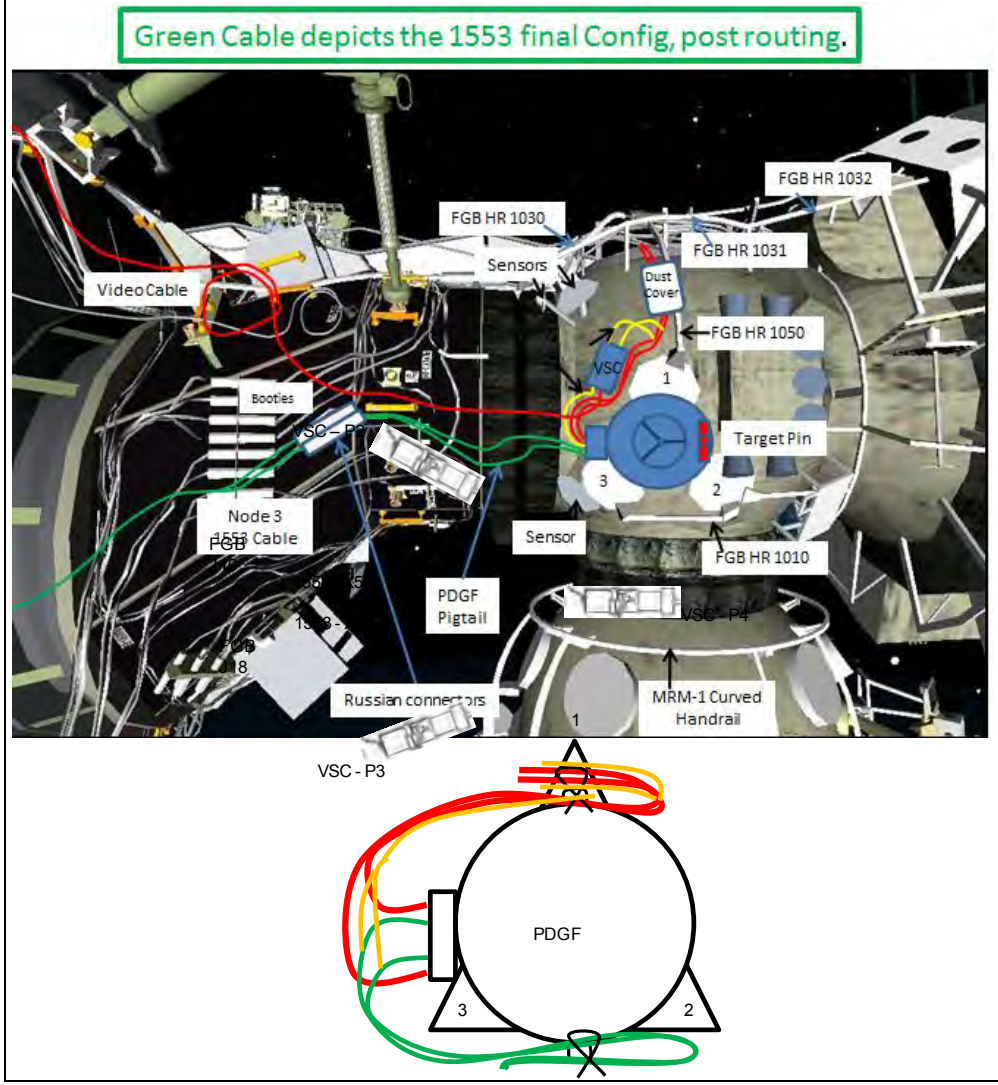
US EVA 22 GETAHEAD – MLM ETHERNET CABLE INSTALL (00:40)

IV/SSRMS	EV1
	❒ Check booties on Russian connectors secure (2) 8. WVS close-out imagery of stowed cable end 9. Translate to PMA2 Cover Bag 10. Open PMA2 Cover Bag ❑ Stow Dust Cap from Ethernet Jack on Fish Stringer 11. Perform PMA2 Cover Bag inventory ☐ **PMA 2 Cover Bag** ☐ RET (eq-eq) (bottom of bag) ☐ Adj Equip Tether (D-rings to RET hook) ☐ Small ISS Trash Bag ☐ Wire Tie Caddy (w/ 9 short) ☐ Fish Stringer Tether (Lg hooks to bottom of bag) ☐ 1553 Cable (hook 1, secure with non-hinge-side Velcro strap) ☐ 1553 Dust Caps (hooks 2 & 3) ☐ MLM Ethernet Jack Dust Cap (hook 5) ☐ RET (Lg-eq) ☐ Adj Equip Tether (eq-eq) 12. Perform glove inspection

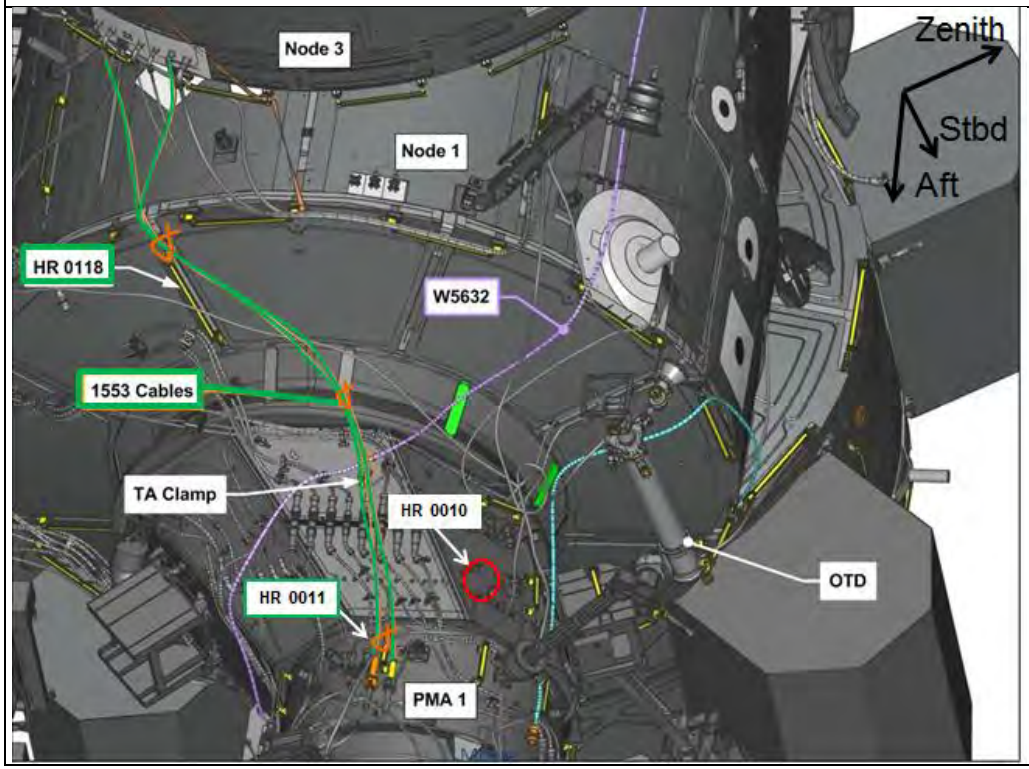
US EVA 22 GETAHEAD – FGB PDGF FOD REMOVAL (00:20)

IV/SSRMS	EV1
1. √FGB PDGF inhibits in place  Crew hook on waist tether used to open PDGF Electrical Connector	FGB PDGF FOD REMOVAL (0:20) 1. ←**MCC Coord Only** Verify Inhibits **WARNING** • Avoid contact with grapple fixture target, target pin, and PDGF curvic coupling (teeth) • Avoid contact with FGB sun sensors (possible sharp edges) **CAUTION** • Avoid contact with zenith PMA1 MDM and above 22" of EVA crane stanchion NOTE • VSC cover should not be used as a translation aid or handhold (attached only by detents and Russian Tether) 2. Translate zenith of PDGF 3. If needed, BRT to PAMA HR, (else MWS EE to PDGF tether point) 4. Insert large crew hook in zenith/fwd electrical connector doors (orient hook perpendicular to doors so hook does not damage pins 5. FOD Removal ❑ Inspect grounding wire & attachment point (for damage or potential snag concerns for wire slack removal) ❑ Open zenith/forward PDGF MLI ❑ Pull grounding wire slack out of PDGF housing ❑ Secure grounding wire slack between PDGF housing and MLI ❑ Using crew hook on Waist Tether, verify zenith/fwd electrical connector clear of grounding wire 6. ☜ WVS close-out imagery and crew inspection inside PDGF connector door 7. Perform glove inspection

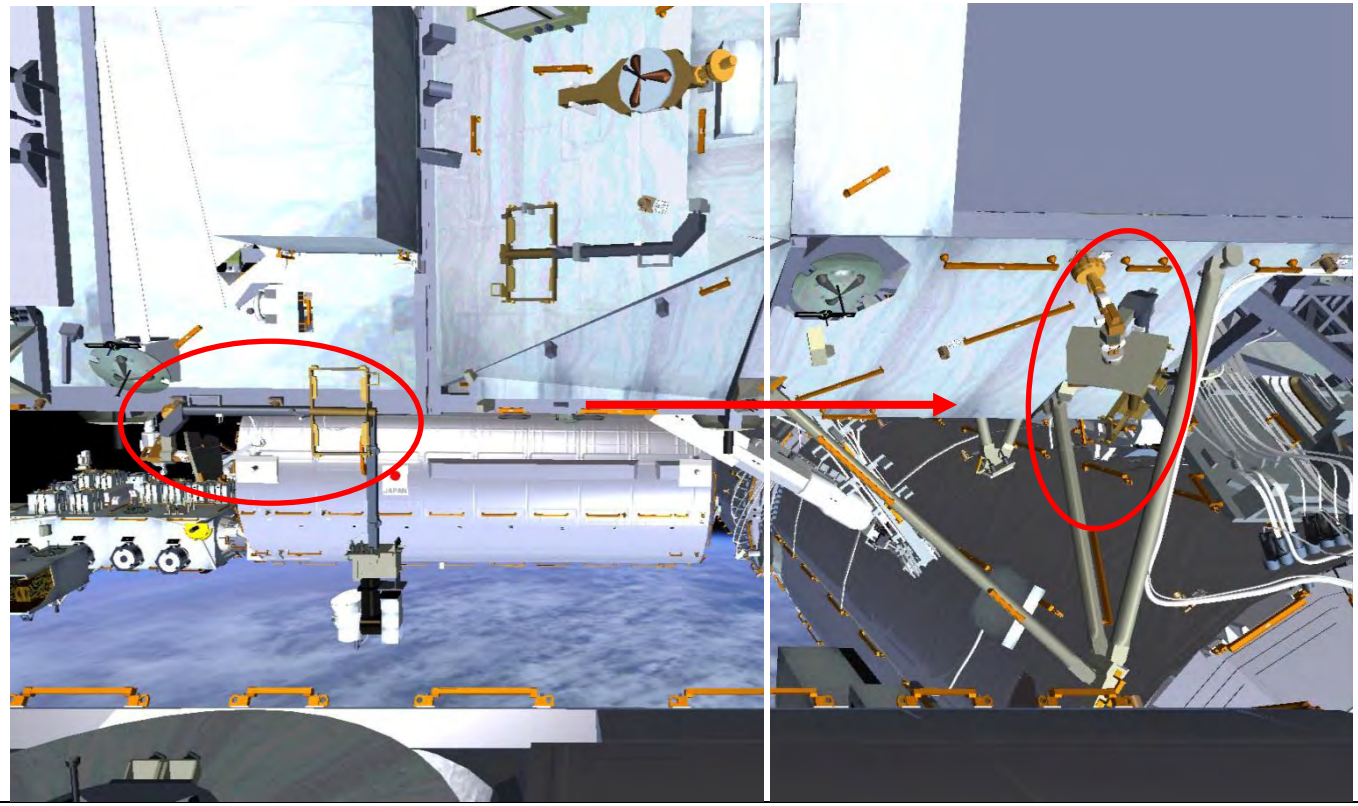
US EVA 22 GETAHEAD – PDGF 1553 CABLE INSTALL (00:30)

IV/SSRMS	EV1
1. √1553 Cable (RSOS) inhibits in place  	RSOS 1553 CONNECTIONS (00:30) 1. ←**MCC Coord Only** Verify Inhibits **WARNING** Avoid contact with grapple fixture target, target pin, connector doors, and PDGF curvic coupling (teeth) Avoid contact with FGB sun sensors (possible sharp edges) **CAUTION** Avoid contact with zenith PMA1 MDM and above 22" of EVA crane 2. Translate to PAMA/PDGF nadir tether point 3. Release Wire Tie from PDGF for the 1553 cables (Nadir tether point, captive to cable) 4. Route PDGF harness cables toward PMA1 HR 0011 ❑ Verify Safety Tether routed over the cables 5. Temp stow PDGF harness cables on PMA1 HR 0011 with Wire Tie 6. Translate to Node1 HR 0103 7. Open PMA2 Cover Bag 8. Retrieve 1553 cable only from PMA2 Cover Bag ❑ RET to connector cable or bail (NOD3 end) 9. Translate to PMA1 HR 0011 10. Open Bootie and release caps (4) (captive via wire ties) 11. Mate 1553 Cable Russian Connectors to PDGF harness and lock connector: ❑ √Good pins; no FOD ❑ PDGF harness 1800-X54 →|← J54 (Bus A) ❑ Verify lock is in Open position ❑ Align arrows on connector shells ❑ Push connectors together ❑ Rotate connectors ~1/4 turn ❑ Verify arrow on plug points to white mark on socket ❑ Slide lock closed ❑ PDGF harness 1800-X53 →|← J53 (Bus B) ❑ Verify lock is in Open position ❑ Align arrows on connector shells ❑ Push connectors together

US EVA 22 GETAHEAD – PDGF 1553 CABLE INSTALL (00:30)

IV/SSRMS	EV1
	❑ Rotate connectors ~1/4 turn ❑ Verify arrow on plug points to white mark on socket ❑ Slide lock closed 12. Secure FPP booties around 1553/PDGF harness connections 13. Wire tie to PMA1 HR 0011 14. Route cable nadir/port to Node 3 connector panel ❑ Stove Pipe (BRT Wire Tie) ❑ NOD1 HR 0118 (pre-integrated Wire Tie) ❑ leave cable bundle on NOD1 HR 0118 15. Translate to PMA2 Cover Bag 16. Perform PMA2 Cover Bag inventory ☐ **PMA 2 Cover Bag** ☐ RET (eq-eq) (bottom of bag) ☐ Adj Equip Tether (D-rings to RET hook) ☐ Small ISS Trash Bag ☐ Wire Tie Caddy (w/ 9 short) ☐ Fish Stringer Tether (Lg hooks to bottom of bag) ☐ 1553 Dust Caps (hooks 2 & 3) ☐ MLM Ethernet Jack Dust Cap (hook 5) ☐ RET (Lg-eq) ☐ Adj Equip Tether (eq-eq) 17. Perform glove inspection

US EVA 22 GETAHEAD – APFR/ TS RELOCATE (00:30)

IV/SSRMS	EV1/EV2
1. Verify Port TRRJ locked	RELOCATE APFR/ TS (00:30) 1. Translate to P1 WIF 3 via port route 2. RET to APFR/ TS 3. Release APFR/ TS, stow on BRT 4. Translate to S0 WIF 33 5. If desired, soft-dock APFR in clocking of 12, then rotate to 11 6. Install APFR in S0 WIF 33 **[11,PP,F,11]** ❑ Black on Black ❑ Pull and Twist Test 7. Re-orient TS head as required _____ was [1.5] 8. Perform glove inspection 

US EVA 22 TIME CONSIDERATIONS

Bingo Times – NLT Start PET for tasks – to not extend

- Stbd RGB (assuming drop PMA2 Cover and leave a little pad)
  - 2:00 – based on 6:15 EVA
  - 2:15 – based on 6:30 EVA
- Mast CLPA (assuming drop PMA2 Cover and no APFR cleanup on SSRMS))
  - 4:00 – based on 6:15 EVA
  - 4:15 – based on 6:30 EVA
- Port RGB Install (assuming drop PMA 2 Cover and no APFR cleanup on SSRMS)
  - 4:30 – based on 6:15 EVA
  - 4:45 – based on 6:30 EVA
- Z1 Jumper (assuming drop PMA2 Cover)
  - 4:55 – based on 6:15 EVA
  - 5:10 – based on 6:30 EVA

*rationale for using 45 min to replace the PMA 2 Cover Task is from the large pad used on both PMA2 Cover and Cleanup/Ingress Tasks
**deleting APFR cleanup from the SSRMS results in a 15 min time savings

Thermal Clock

- SGTRC failed and spare
- MISSE 8
- No other Thermal Clocks Applicable

Other Time Considerations:

- If EV1 is 15 min ahead or more of EV2 after the SGTRC R&R consider MLM Power Cable Routing Task or photo ops
- If EV1 is 15 min ahead or more of EV2 after MLM Power Cable consider retrieving Z1-Jumpers

US EVA 22 TASK DATA – SGTRC

Estimated Task Duration:

	With RMS	Without RMS
One EV	N/A	01:00

Tools:

EV1
MUT-Ballstack-MUT
Round Scoop (2)
PGT w/ 7/16" socket-9" ext

Restraints:

HR	WIF	APFR Setting
SGANT spare Boom HR	N/A	N/A

ORUs:

Item	P/N	Failed s/n	Spare s/n	Mass (lb)	Dimensions (in)
SGANT	10033317-501	003	001	74.8	25x16.2x10.1

EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Trq (ft-lb)	Release Trq (ft-lb)	Failure Trq (ft-lb)	Turns	RPM
Center Jacking	N/A	7/16"	1	7.58-8.8 ground; 2.5	12.0	14.73 release, 4.2 install	28-31	30
Outer Locking	N/A	7/16"	2	7.58-8.8 ground; 2.5	12.0	14.73 release, 4.2 install	10-13	30

SGTRC ground installation torques from ADP

Bolt	Running Torque (ft-lbs)	Final Torque (ft-lbs)
Left	4.17	8.83
Center	1.25	5.92
Right	2.92	7.58

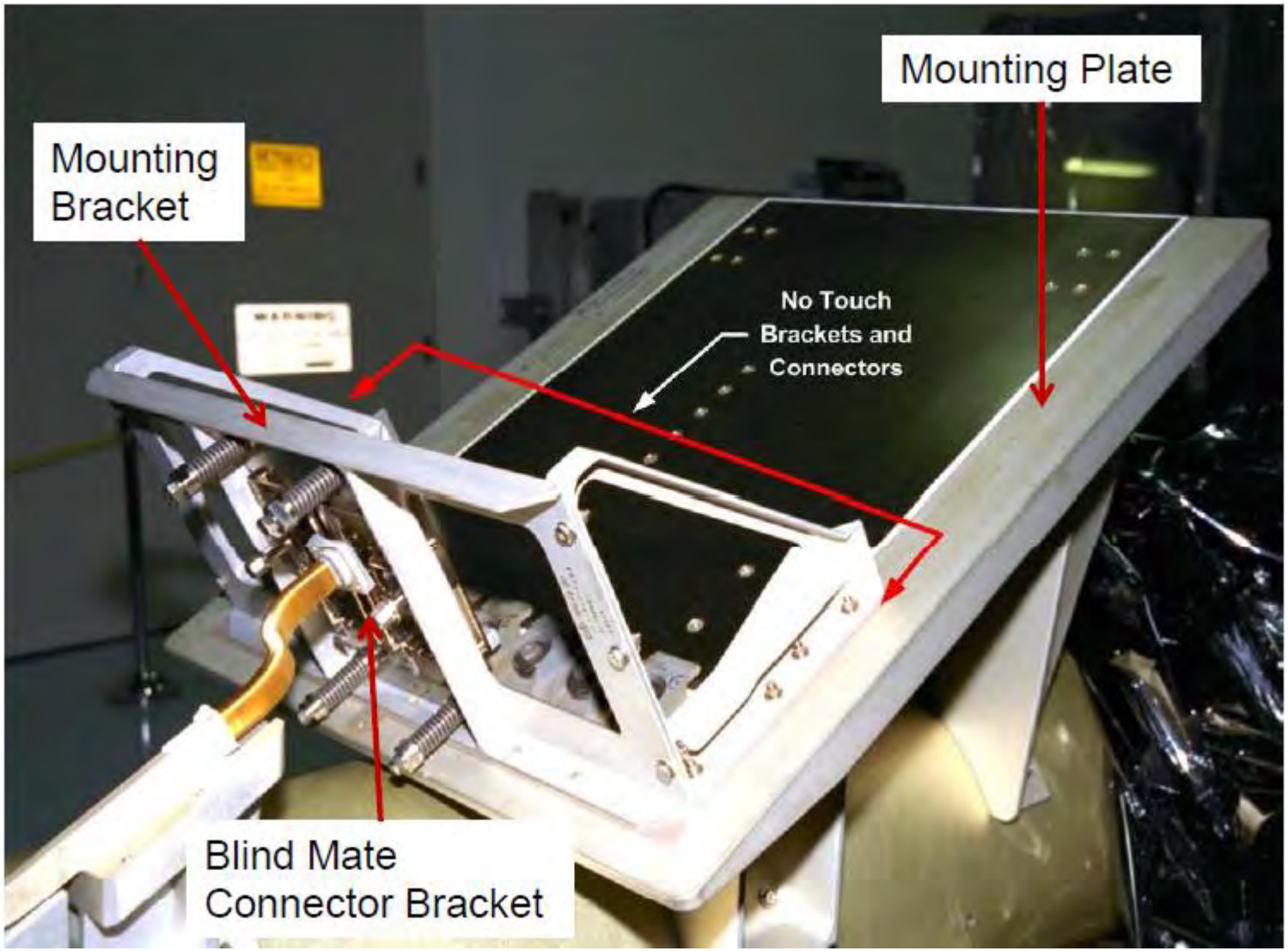
US EVA 22 TASK DATA – SGTRC

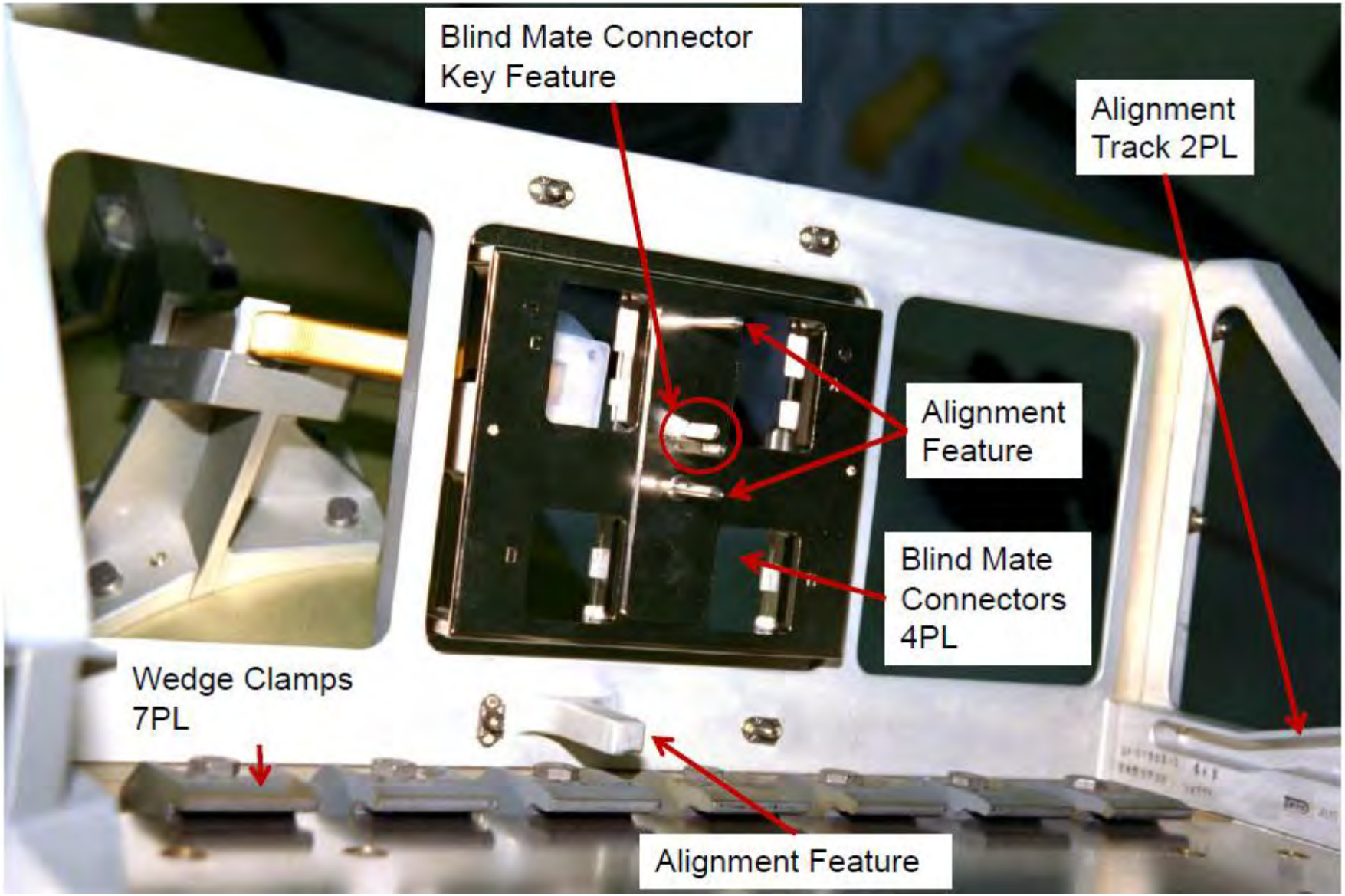
Warning:
1.

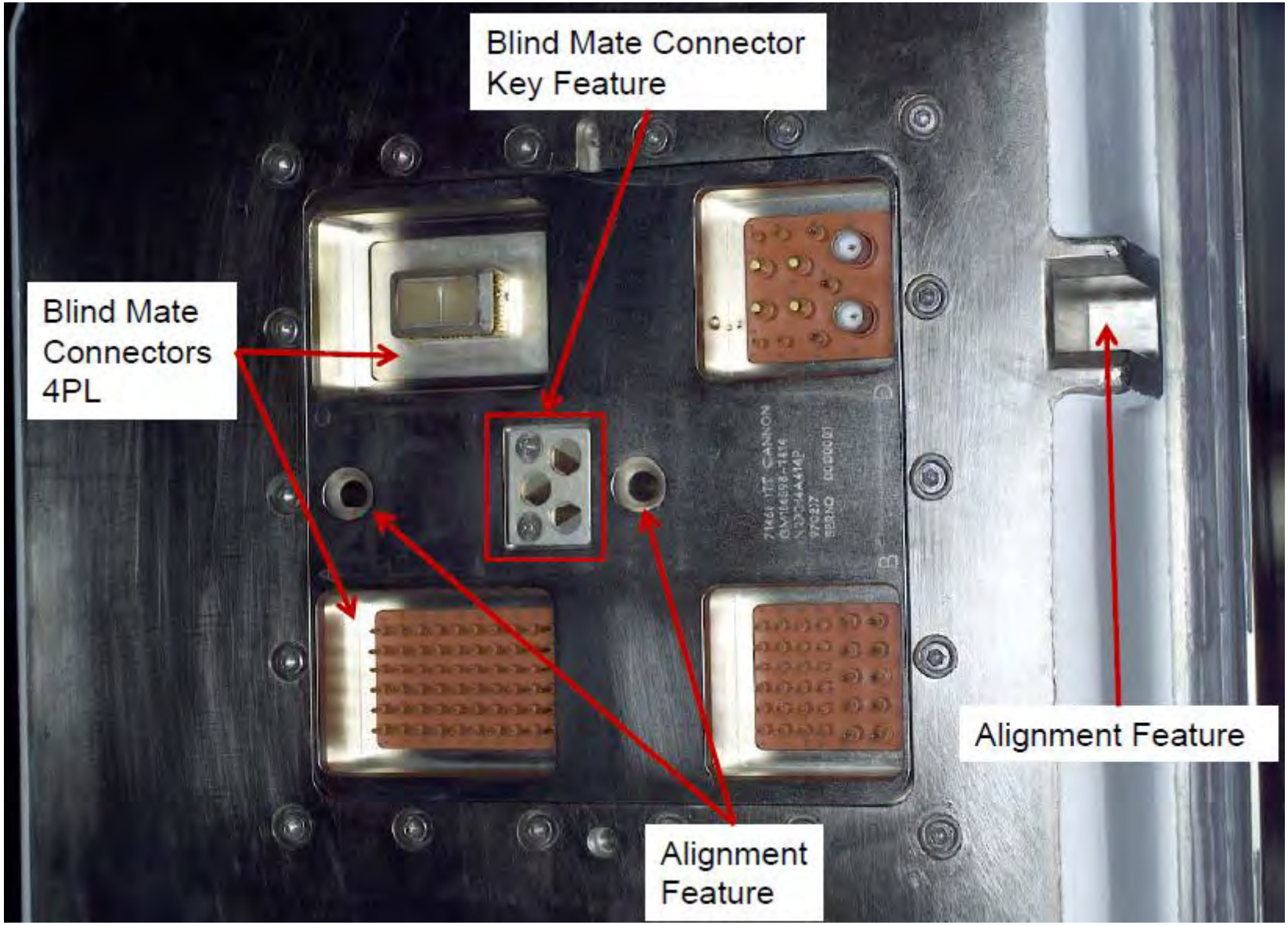
Caution:
1. Avoid contact with heat pipe radiators, and SASA high and low gain antennas and radiator surfaces, and SGTRC-2 Z93 paint – EV&CS
2. Do not use the connector bracket for stability during nom ops – S&M
3. The AGIT bolts on the SGTRC ORU launching on ULF-4 were identified to be undersized and the maximum torque of 39 ft-lbf must not be exceeded in order to prevent rounding of the bolt head – S&M

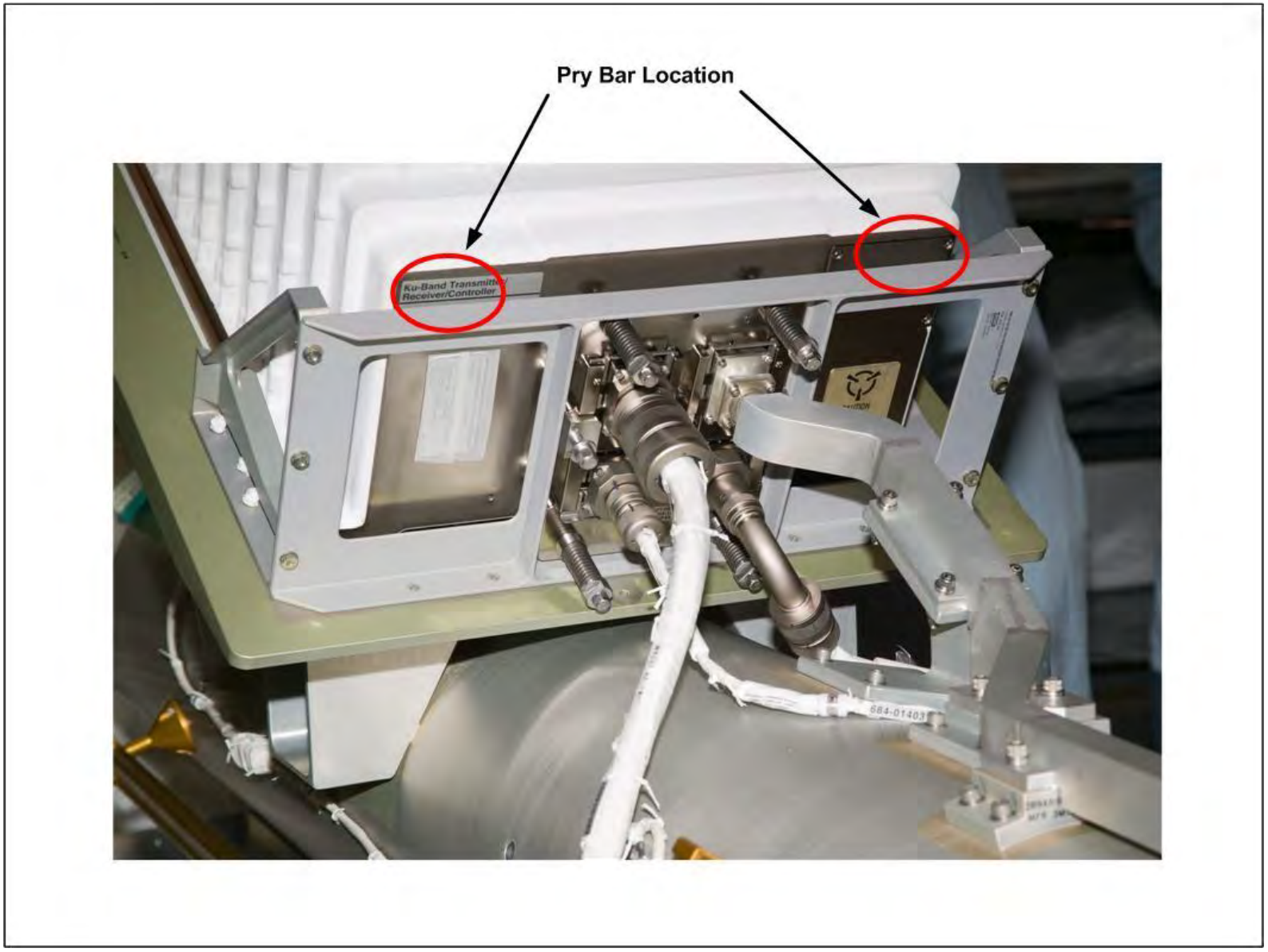
Note:
1. Failure Mode for Release = Torsional Shear Shank Failure; Failure Mode for Install = Combined Loading – S&M
2. No anti-rotation device nor soft dock – EV&CS
3. Bolts were installed with lock patch applied to threads on failed unit only. There was no lock patch installed on the spare SGTRC – S&M
4. Installation is highly dependent on running torque, due to the presence of lock patch. In order to overcome higher running torque due to residual lock patch the torque can be incrementally increased. The torque must be increased one PGT setting at a time to a maximum of 22.0 ft-lbf – S&
5. B7 (25.5 ft-lbs) can be used for 1 turn to break torque on the fastener – S&M
6. The WR-62 waveguide interface is the same as the SGANT installed on ULF-4. The SGANT was installed on the Boom and the crew could see there was a small gap and ability to wiggle the SGANT. This interface has a very tight tolerance to allow data to pass at that Ku-Band frequencies (15 Ghz). S&M and C&T determed that higher torque values were needed, and went back and tightened the bolts. This resolved the issue. The original torque values were conservative because they were worried about stripping the bolts. The SGTRC has similar guide pins and a tight tolerance, that are all driven by the torque values on the 3 6B bolts – NASA C&T
7. Bottom of TRC and the receptacle plate is okay to touch – EV&CS
8. IVA Cover returned on ULF-4 - EV&CS
9. No SGANT Masking concerns with this task (SGTRC R&R) – C&T
10. No PRs nor IFIs exist – EV&CS
11. Approval to leave 9” socet in ISS Small Trash Bag (one time approval) – MER Tools

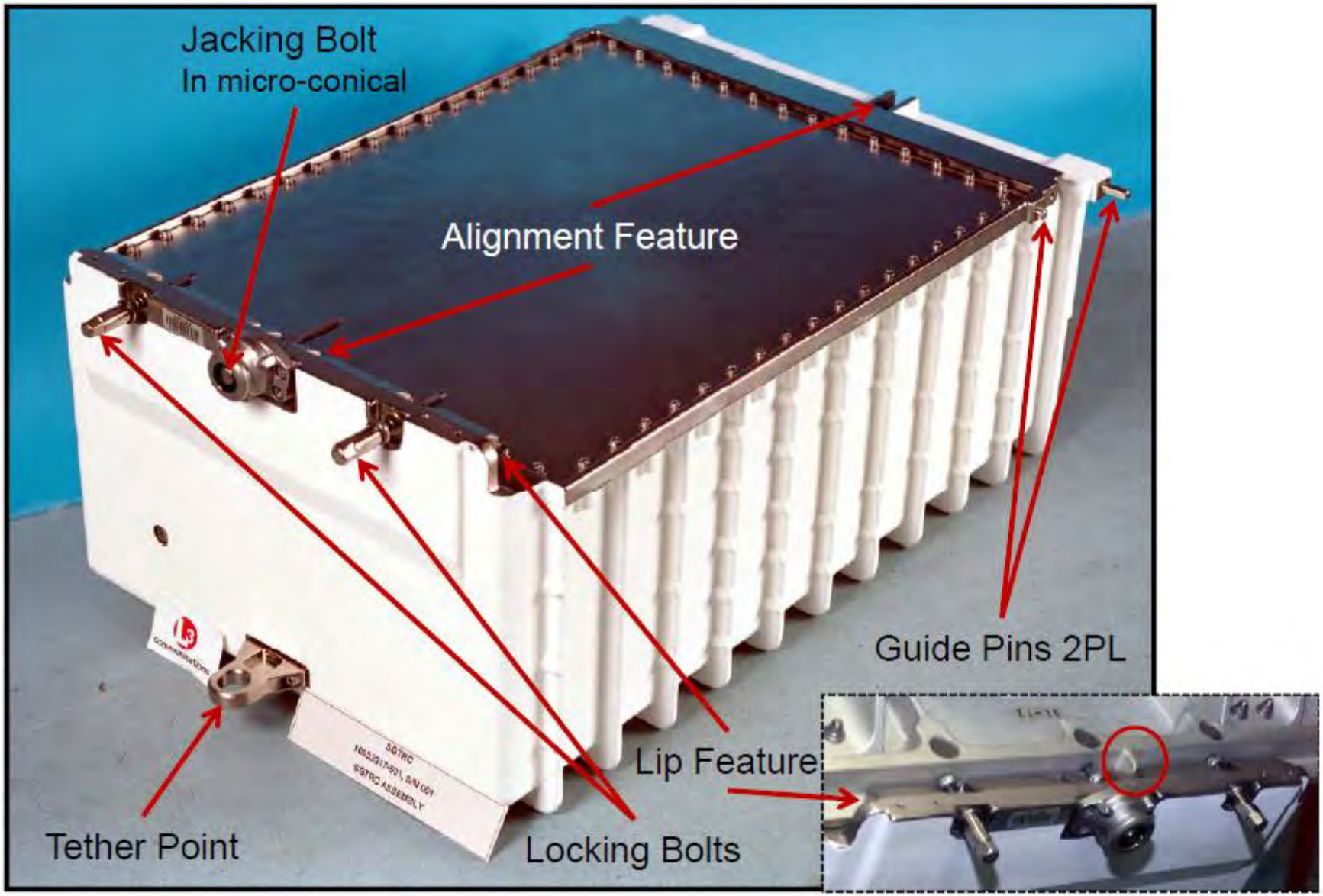
Timeline Considerations:
1. Plan is to not checkout SGTRC#2 prior to Z1 Y-Bypass Jumper Install – MOD

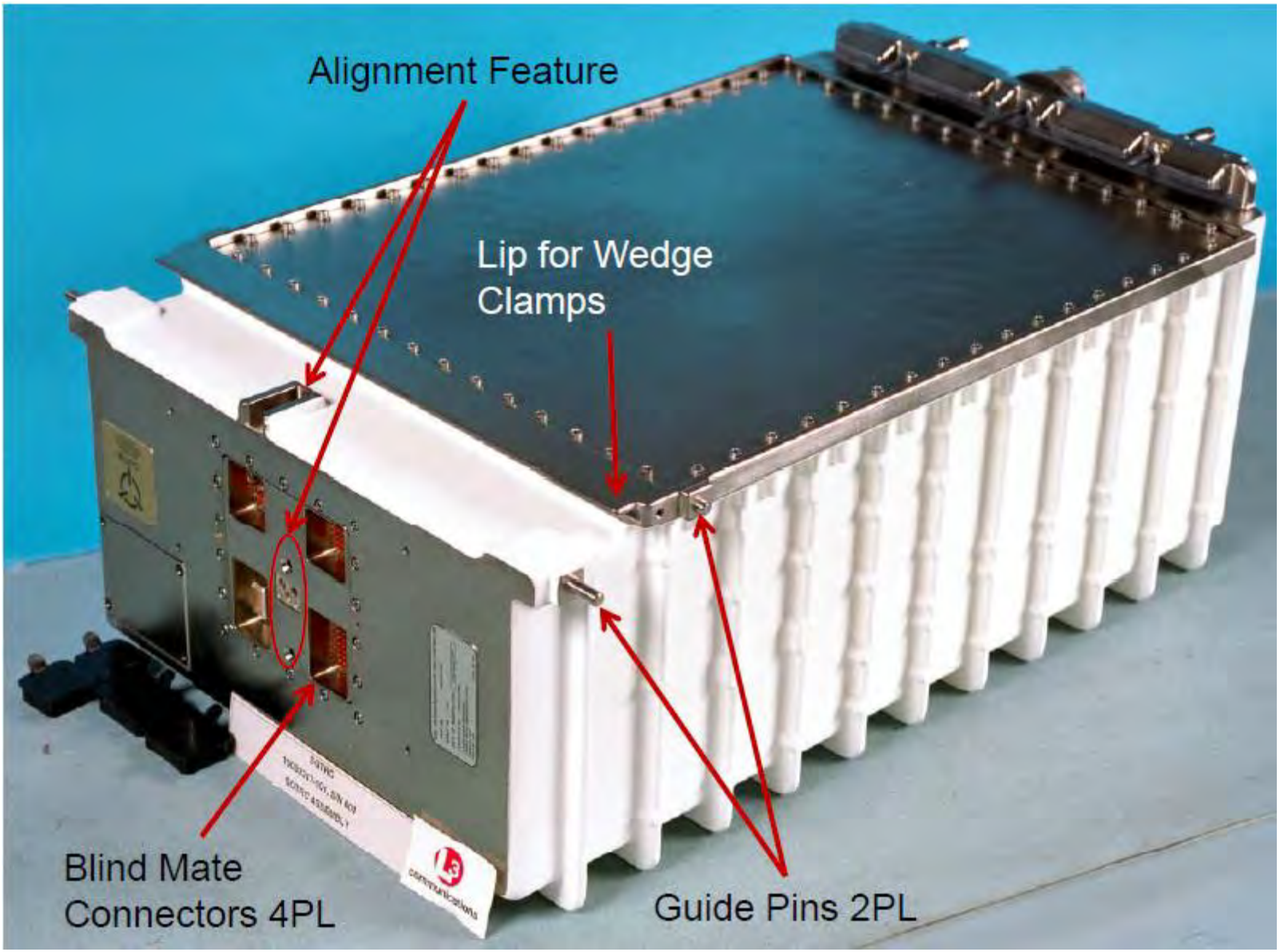

Mounting Plate
Mounting Bracket
No Touch Brackets and Connectors
Blind Mate Connector Bracket

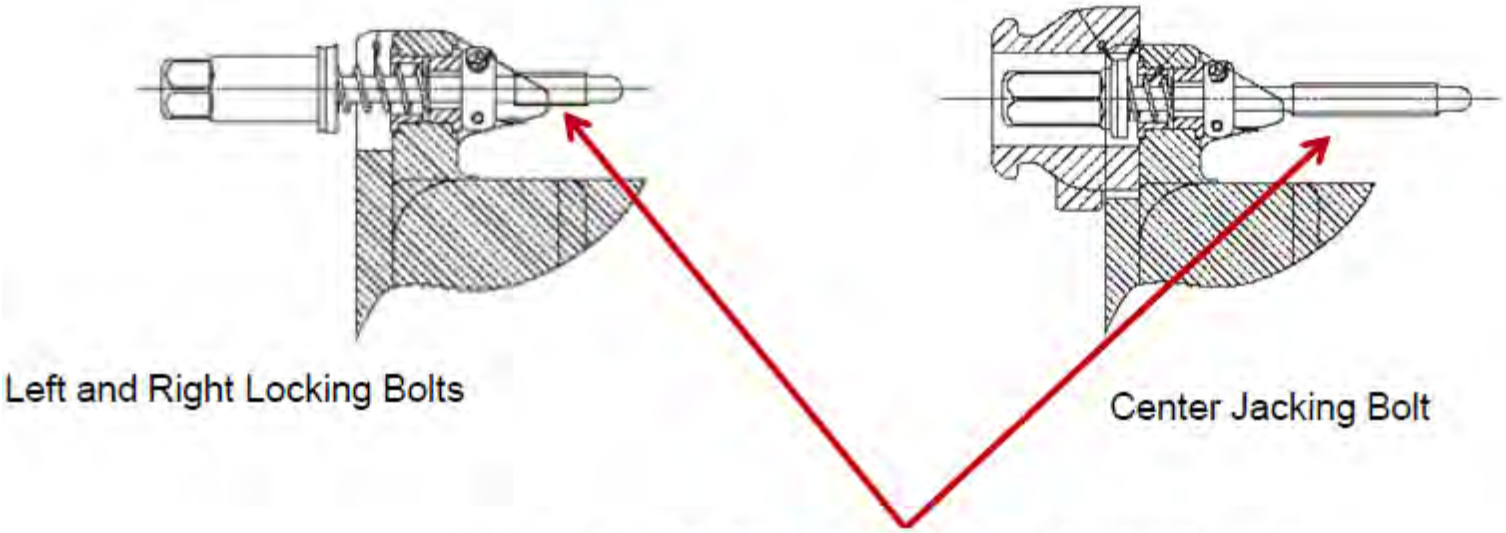

Blind Mate Connector
Key Feature
Alignment
Track 2PL
Alignment
Feature
Blind Mate
Connectors
4PL
Wedge Clamps
7PL
Alignment Feature


Blind Mate Connector Key Feature
Blind Mate Connectors 4PL
Alignment Feature
Alignment Feature

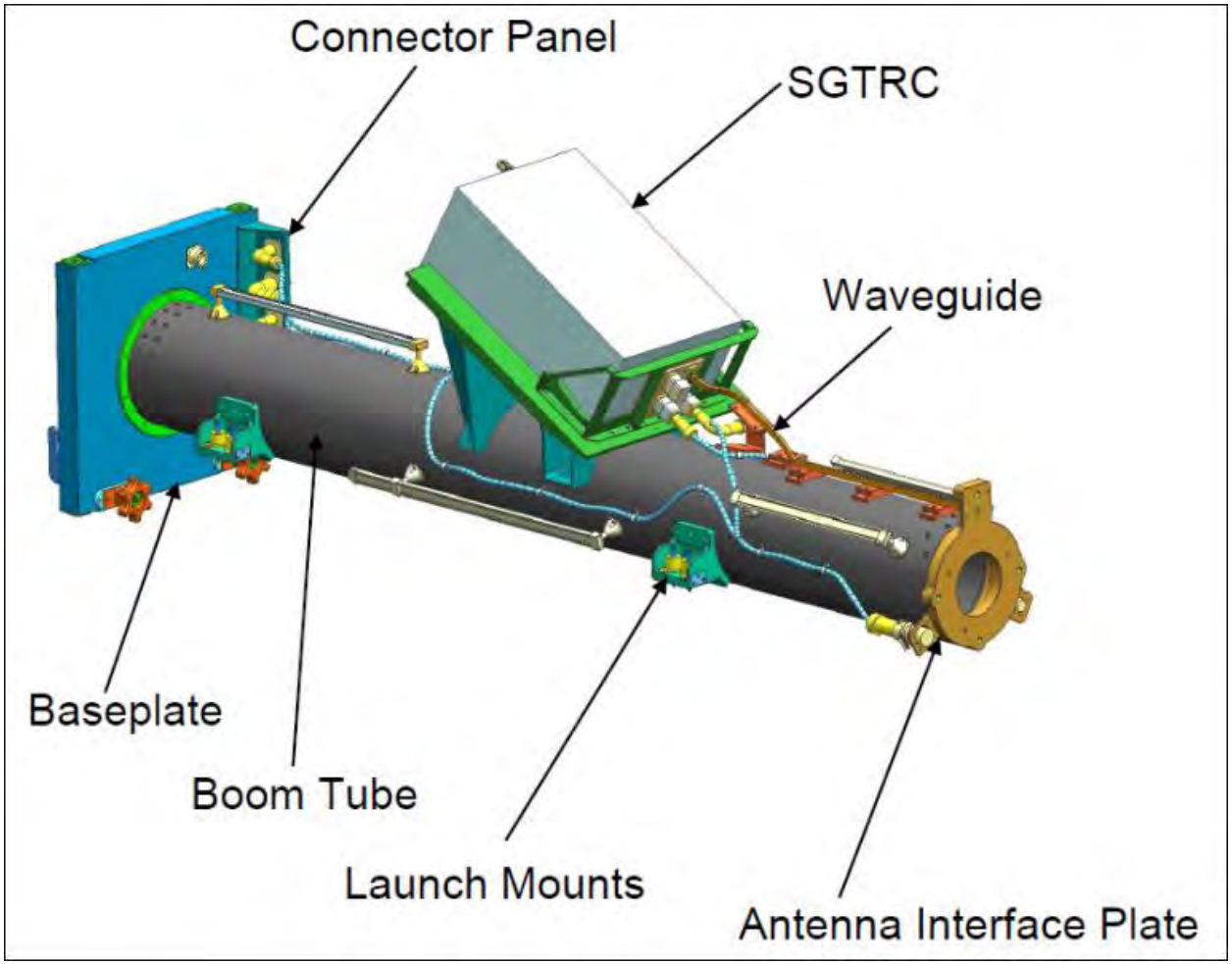

Pry Bar Location
Ku-Band Transmitter/
Receiver/Controller

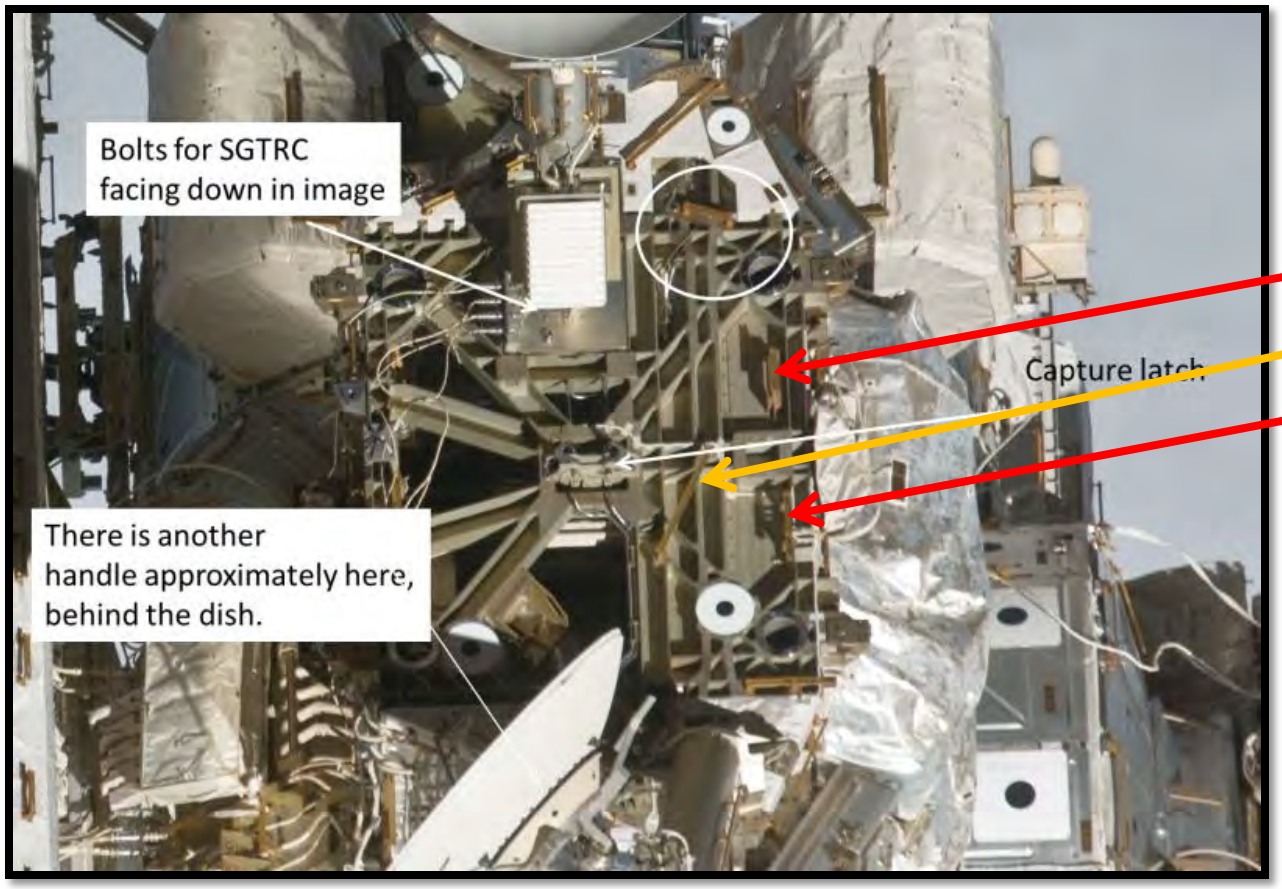

Jacking Bolt
In micro-conical
Alignment Feature
Guide Pins 2PL
Lip Feature
Tether Point
Locking Bolts


Alignment Feature
Lip for Wedge Clamps
Blind Mate Connectors 4PL
Guide Pins 2PL



Locking Patch installed on threads on all 3 bolts (failed SGTRC unit ONLY)


Connector Panel
SGTRC
Waveguide
Baseplate
Boom Tube
Launch Mounts
Antenna Interface Plate


Bolts for SGTRC facing down in image
There is another handle approximately here, behind the dish.
Capture latch
Z1 HR 6058
Z1 HR 6059
Z1 HR 6057

US EVA 22 TASK DATA – MISSE 8

Estimated Task Duration:

	With RMS	Without RMS
One EV	N/A	01:10

Tools:

EV2
28mm EVA Camera w/ Bracket

Restraints:

HR	WIF	APFR Setting
MISSE FRAM and ELC 2 HRs as required	N/A	n/A

ORUs:

Item	P/N	Failed s/n	Spare s/n	Mass (lb)	Dimensions (in)
PEC	FT-TA-8010-01	N/A	N/A	80.2	33.6x30.9x6.8
ORMatE Tray	FT-TA-8210-01	N/A	N/A	12.9	19.55x9x3.03
ORMatE Cover	FT-TA-8220-01	N/A	N/A	6	19.27x10.83x2.59

EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
P1	JMU/CIB	PEC 7A	1	21	PWR/DATA
P2	JMU/CIB	PEC 7B	1	21	PWR/DATA

EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Trq (ft-lb)	Release Trq (ft-lb)	Failure Trq (ft-lb)	Turns	RPM
PEC Contingency Bolts	PEC 8	7/16”	2	10.58 ground	6.5	21.66	11.5	30
ORMatE-III R/W Contingency Bolts	ORMatE -III R/W	7/16	2	10.6-12.3	9.58	21.66	6.5	30

US EVA 22 TASK DATA – MISSE 8

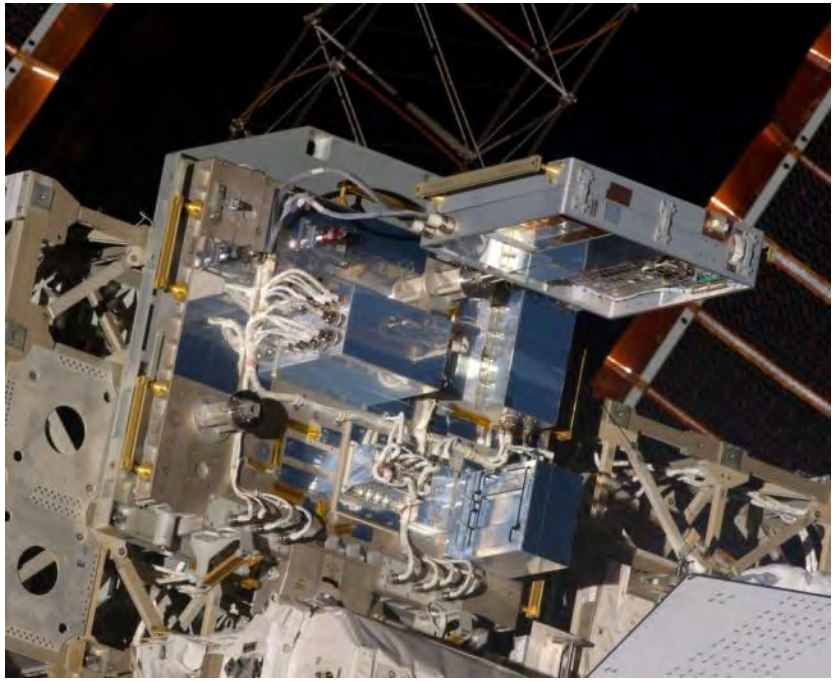
Warning:
1. Do not touch hinged side while closing MISSE PEC – EVA Safety

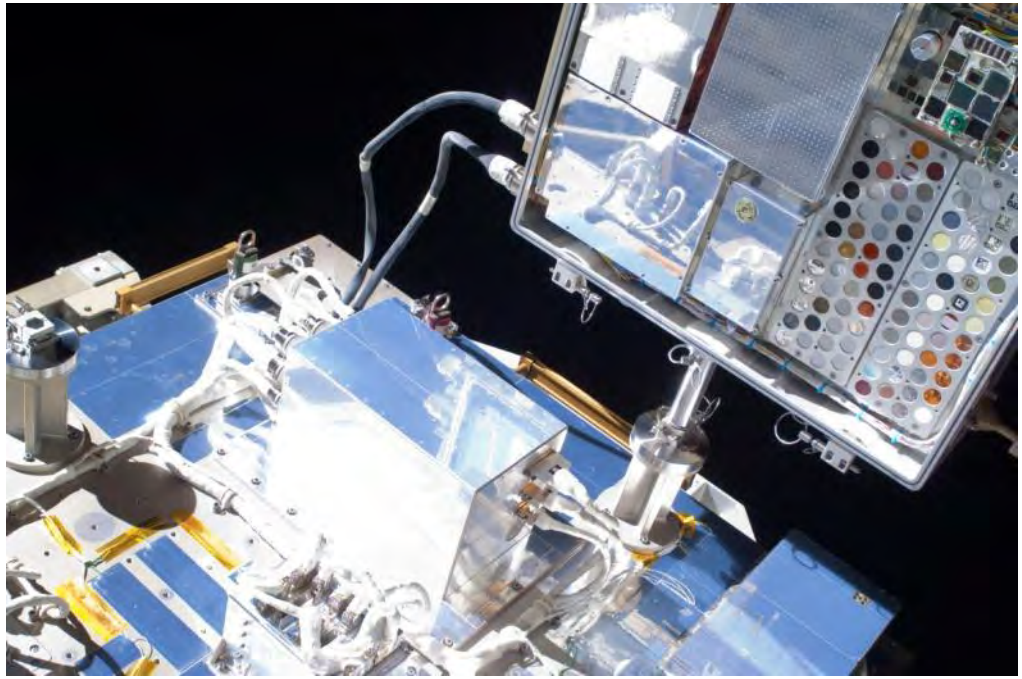
Caution:
1. Avoid contact with deployed MISSE and silver avionics boxes on ExPA – DOD

Note:
1. Requires 28mm EVA Camera - DOD
2. Contingency bolts designed after issues releasing MISSE 6 – DOD
3. All ELC2 HRs are good for BRT – EVA AIT
4. Avoid sideloads when installing cover over ORMatE
5. Cover is labled with RAM side Fwd
6. MISSE 8 PIP pins do not come all the way out of sockets
7. Exceptions taken: allignment features, connectors on PEC within 1.4" of HR, HR envelope clearances obstructed by probe and soctes, EMI
8. GP Cutters required if have to cut electrical cable (1.22-1.4")

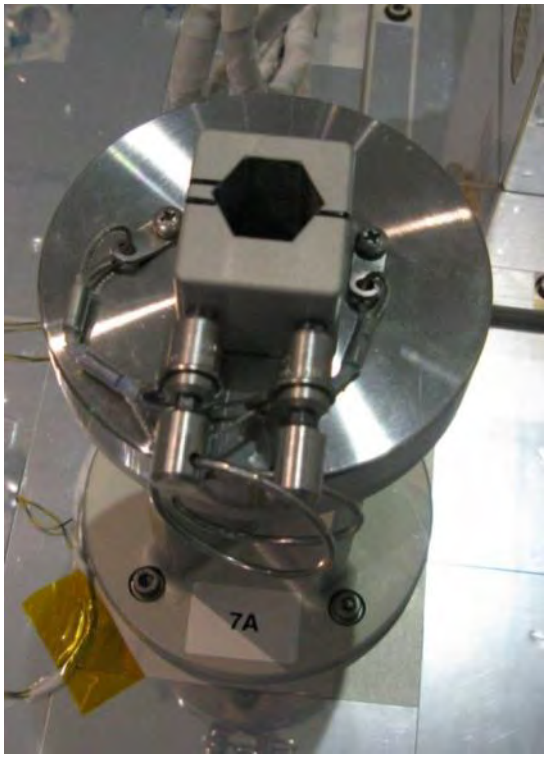
Timeline Considerations:
1. No thermal clock after PEC is closed– DOD; PTCS
2. MISSE 8 PEC and ORMatE do not have to be brought IVA at the same time, however, due to IVA packing constraints, it is more efficient IVA-wise to bring them in at the same time – DOD
3. MISSE 8 PEC is higher priority than MISSE 8 ORMatE – DOD
4. MISSE 8 PEC and ORMatE can withstand induced loads from being tethered outside ISS between EVAs – DOD
5. The MISSE 8 connectors, PEC receptacles and dummies are all keyed – DOD
6. There are no washers on the non-captive contingency bolts; just the tether loop and bolt - DOD
7. MISSE 8 PEC door must be opened to release the contingency bolt - DOD

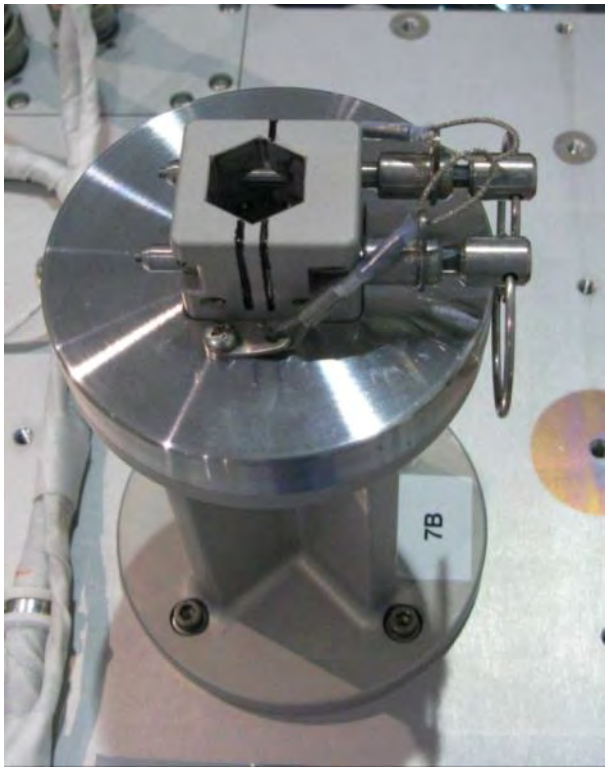

AMS
AMS



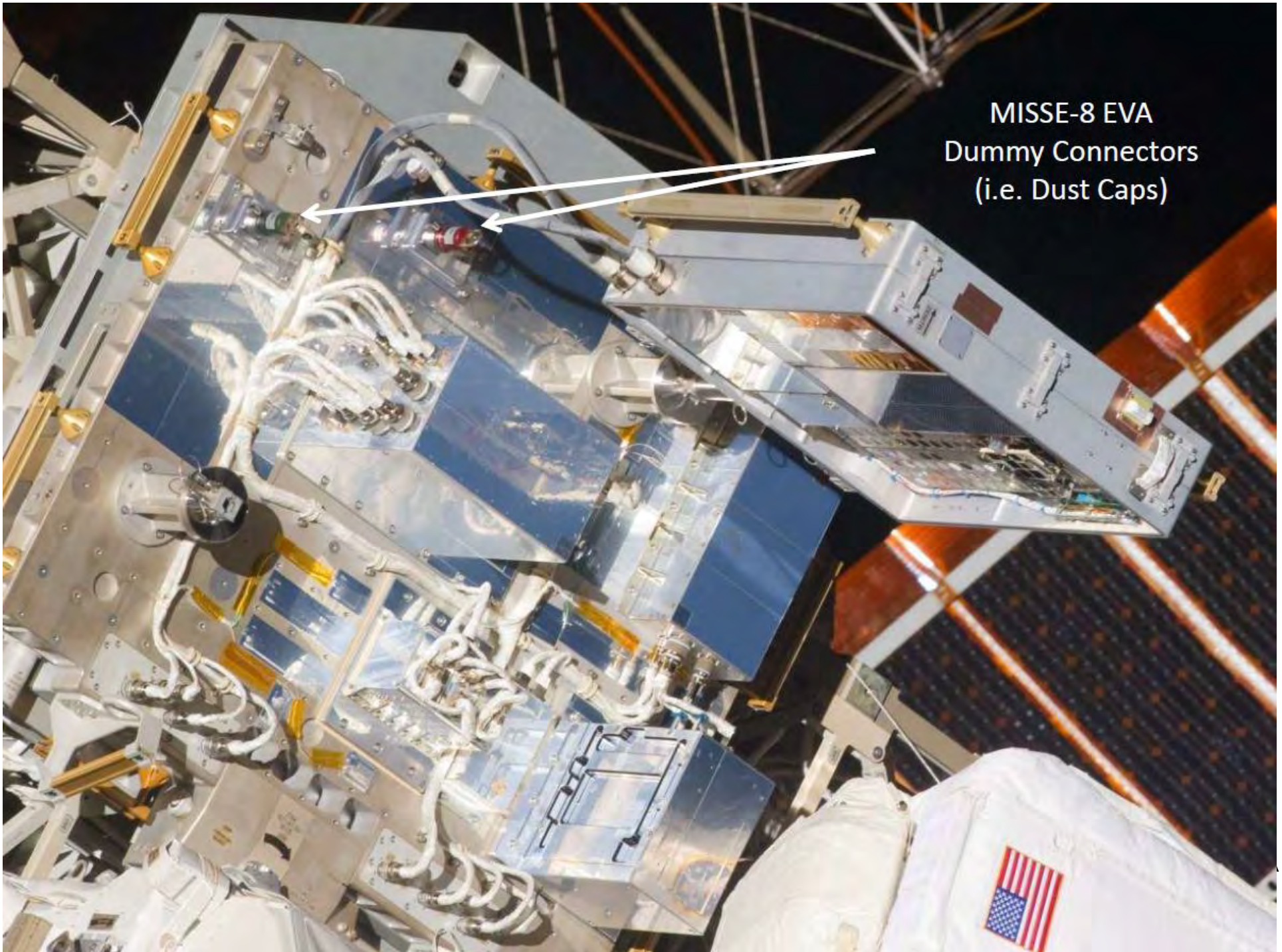


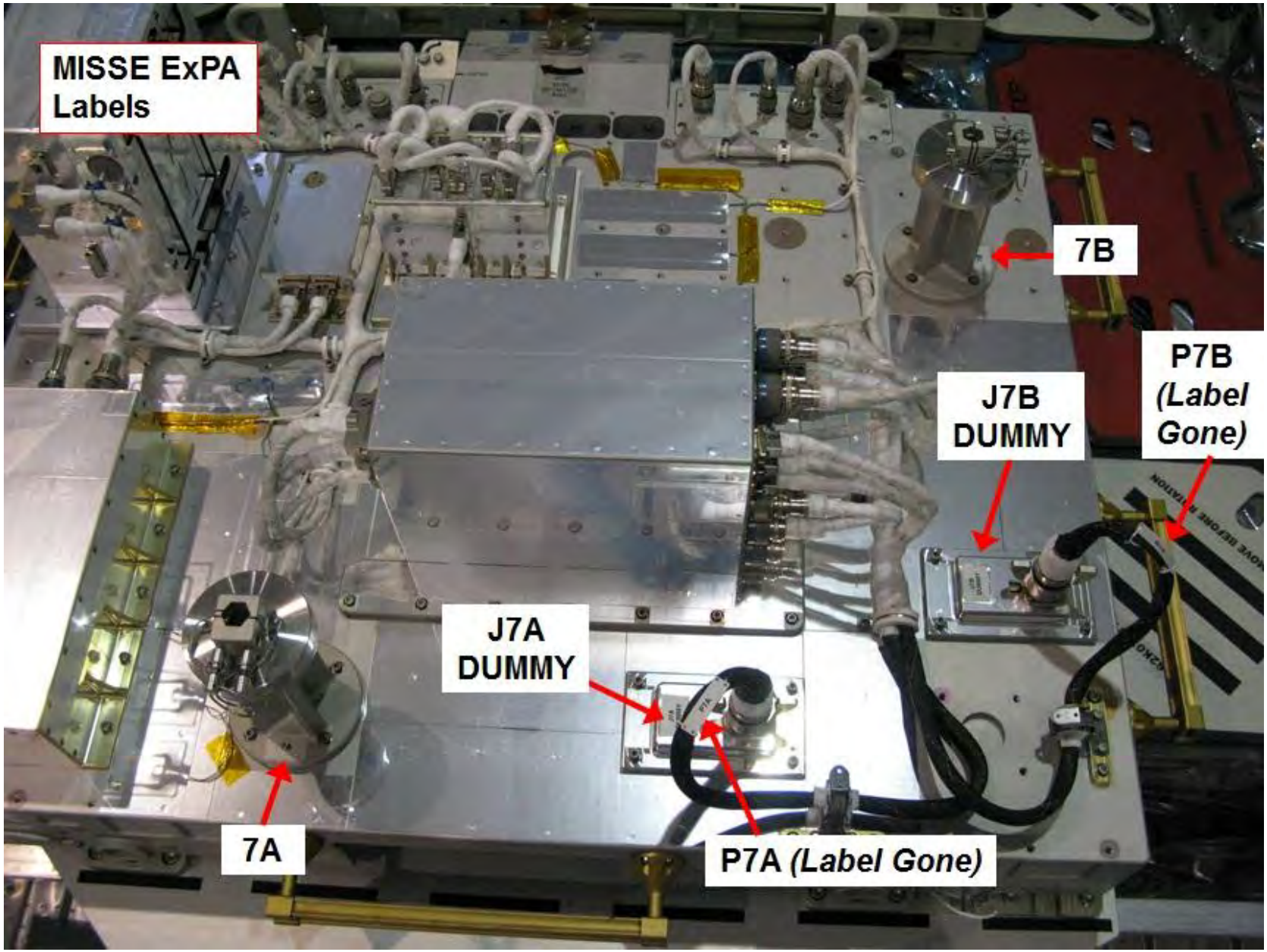
US EVA 22 TASK DATA – MISSE 8

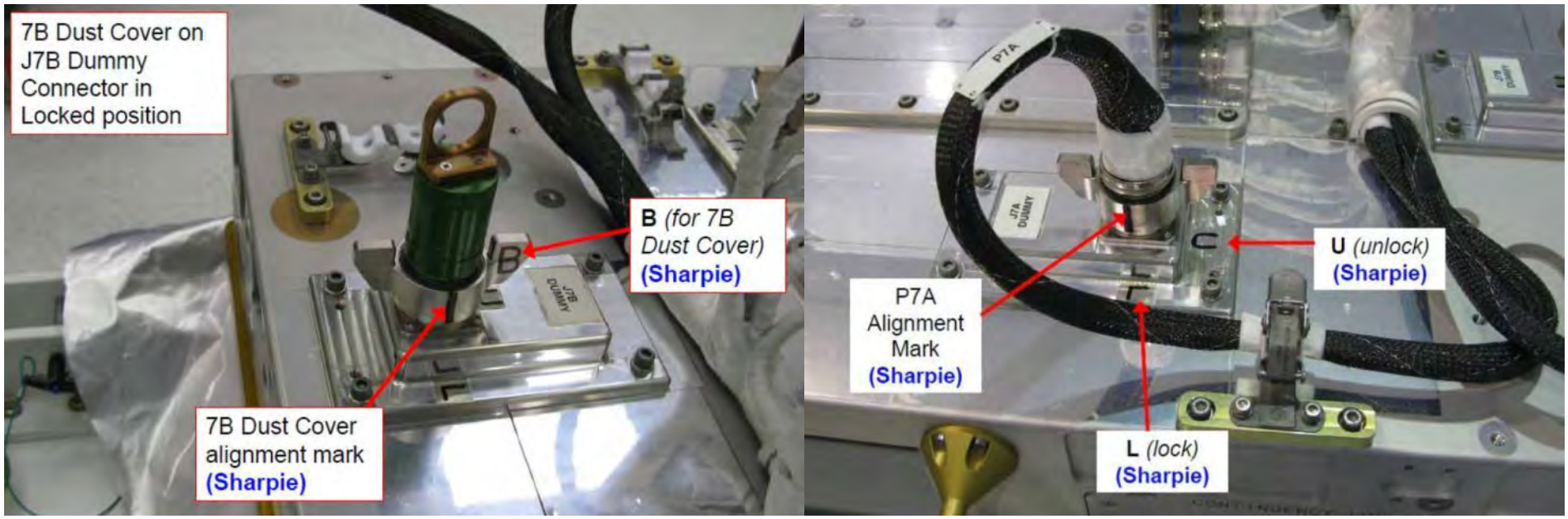


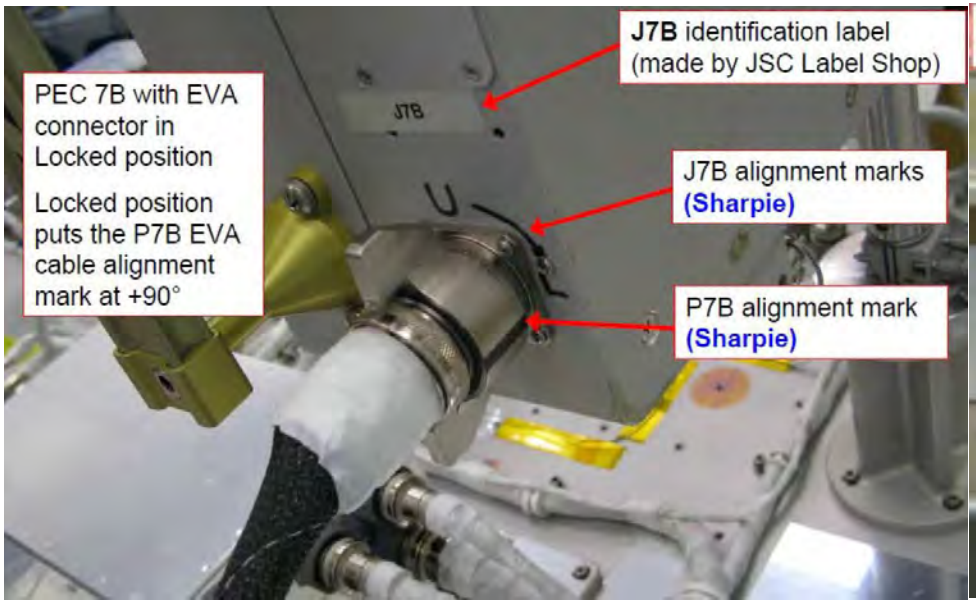


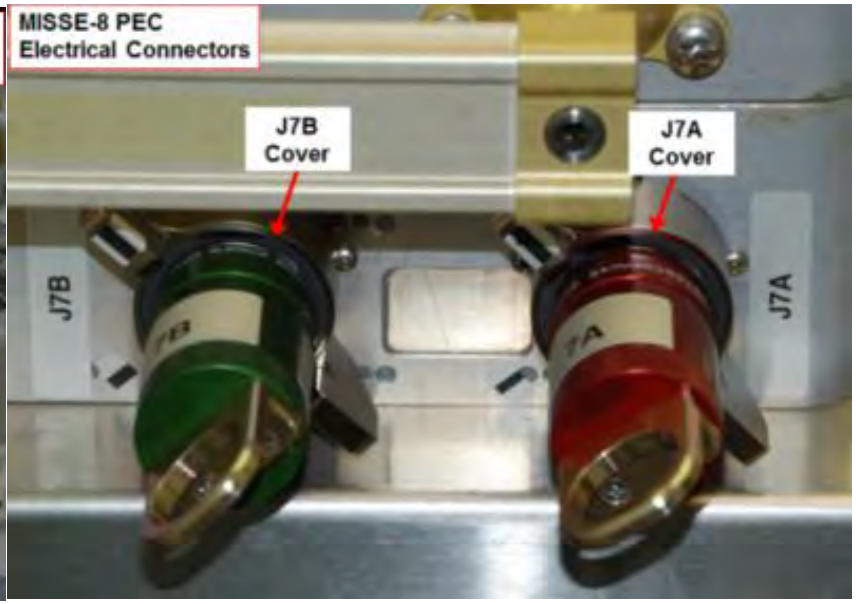
US EVA 22 TASK DATA – MISSE 8

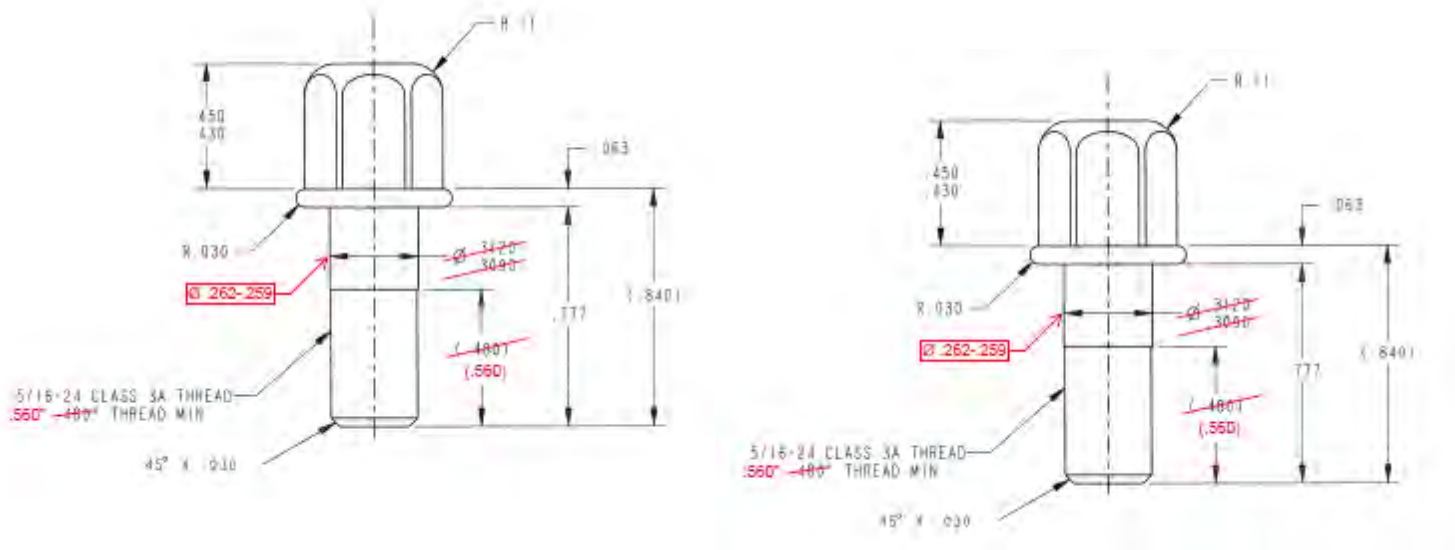



MISSE ExPA Labels
7B
P7B (Label Gone)
J7B DUMMY
J7A DUMMY
7A
P7A (Label Gone)


7B Dust Cover on J7B Dummy Connector in Locked position
B (for 7B Dust Cover) (Sharpie)
7B Dust Cover alignment mark (Sharpie)
P7A
J7A DUMMY
P7A Alignment Mark (Sharpie)
U (unlock) (Sharpie)
L (lock) (Sharpie)


J7B identification label
(made by JSC Label Shop)
PEC 7B with EVA connector in Locked position
Locked position puts the P7B EVA cable alignment mark at +90°
J7B alignment marks
(Sharpie)
P7B alignment mark
(Sharpie)
J7B


MISSE-8 PEC
Electrical Connectors
J7B
Cover
J7A
Cover
J7B
J7A



Contingency Bolts

US EVA 22 TASK DATA – RGB

Estimated Task Duration:

	With RMS	Without RMS
One EV	N/A	N/A
Two EV	03:00	N/A

Tools:

EV1	EV2
EVA Ratchet Wrench w/ 5/8" socket-2" ext	WIF Adapter
Round Scoop	28mm Camera w/ Bracket
PGT w/ 5/8" socket-2" ext	PGT w/ 5/8" socket-7.8" ext

Restraints:

HR	WIF	APFR Setting
	SSRMS	12,PP,F,6

ORUs:

Item	P/N	Failed s/n	Spare s/n	Mass (lb)	Dimensions (in)
RGB1	1F81220-501	N/A	001	230	126x66x20
RGB2	1F81220-503	N/A	002	263.4	126x66x20
FSE A	00034757-501	N/A	N/A	62	38x15.25x8.75
FSE B	00034757-503	N/A	N/A	52	38x10x8

EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
W0250 P1	N/A	N/A	1	15	grounding

EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Trq (ft-lb)	Release Trq (ft-lb)	Failure Trq (ft-lb)	Turns	RPM
RGB Assy Bolt – FSE Removal	Bolt 1, 2, 3, 4	5/8"	4 each	17.9 - 21.3 ft-lbs on ground	28.42; break w/ Ratchet Wrench; 25.5 rest of release	68.4	13.5-16	30
RGB Assy Bolt – FSE Install	Bolt 1, 2, 3, 4	5/8"	4 each	Hand start, 6.3		55.25	13.5-16	30
RGB Assy Bolt – Stow Beam Install	Bolt 1, 2 or Bolt 3, 4	5/8"	2 each	18.4 final		41.92	16-18	10
RGB Assy Bolt – Stow Beam Removal	Bolt 1, 2 or Bolt 3, 4	5/8"	2 each		22	77.0	16-18	30

US EVA 22 TASK DATA – RGB

Ground Install Bolt Info (ft-lbs):

Bolt	Initial turns	Running trq	Final turns	Final trq
1-4	10.75	7.92	15.625	19.17
1-3	15	6.67	15.385	17.92
1-2	15	8.33	15.5	19.58
1-1	15	8.33	15.5	19.58
2-4	15.25	6.67	15.5	17.92
2-3	15	10.00	15.375	21.25
2-2	15	9.17	16.25	20.42
2-1	15	10.00	15.5	21.25

Contingency EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Trq (ft-lb)	Release Trq (ft-lb)	Failure Trq (ft-lb)	Turns	RPM
FRGF Grapple Shaft EVA Release Rod, 10 O'Clock Position	unmarked	1/2"	1	9.2 +/- 1 (PGT A7)		20	9	CCW
FRGF Grapple Shaft EVA Release Rod, 4 O'Clock Position	Black segment on Abutment Plate edge next to the drive	1/2"	1	9.2 +/- 1 (PGT A7)	To hard stop	20	8	CW
LGF Grapple Shaft EVA Release Rod, 6 O'Clock Position	unmarked	1/2"	1	9.2 +/- 1 (PGT A7)		20	9	CCW
LGF Grapple Shaft EVA Release Rod, 12 O'Clock Position	unmarked, behind grapple target	1/2"	1	9.2 +/- 1 (PGT A7)	To hard stop	20	8	CW
POA Latches Manual EVA Drive	This activity will not be required as latches will be disengaged prior to the EVA day and the RGB bundle will be secured via the POA snares – ROBO MOD							

Warning:

1. Due to entrapment hazard, do not insert glove into the exposed latch mechanisms – EVA Safety
2. Curvic coupling does not meet sharp edge requirements – EVA Safety

Caution:

1. Keep loads into Radiator Beam close to centerline → ref FR B18-351, B1 – S&M
2. All loads (translation, BRT) must be constrained to RGB2 (port RGB) and FSEs once all 4 bolts on RGB1 have broken trq >1.25 turns – S&M
3. Previous issue on zip nuts when installing Stow Beams. Zip nuts are very sensitive to side-loading. Reference IFI 7532 – EV&CS
4. Breaking torque more or less than 1-1.25 turns can cause biding and damage to the RGBs – S&M

US EVA 22 TASK DATA – RGB

Note:

1. Bolt #3 on FSE B may need to be released with a 5/8 (wobble) socket-12" ext due to interferance with CLA on POA– EV&CS
2. Grounding connector on grapple bars are for radiator R&R only – EV&CS
3. This assembly uses a zip nut. The bolt should be pressed completely into the nut before applying final torque. – S&M
4. Two stage installation recommendation: Install both bolts to 4.8 ft-lbf prior to applying final torque on either of the two bolts, to ensure bolts properly engage zip nuts upon final torque application. – EV&CS
5. Release the first three (3) bolts 1 to 1.25 turns before releasing the final bolt per PRs 15421 and 15422. Releasing the FSE from the grapple bar connected directly to the POA (HRSGB2) has no similar constraints on turns or order. – EV&CS
6. Releasing the HRSGB1 EVA bolts needs to be between 1 and 1.25 to ensure trq is broken and prevent the floating nut plates from being side loaded, possibly yielding in a way that can prevent release – S&M
7. For on-orbit re-installation of HRSGB to FSE, engage all released bolts (qty. 1 to 4 bolts) 8-10 turns before applying final torques to ensure all bolts engage before fully seating cup/cone interfaces. – EV&CS
8. Per program direction, the HRS Grapple Bar "T-handle" assembly was removed from the Grapple Bar Assemblies (8 total, 2 Grapple Bars) due to vibration concerns for the SpaceX 2 launch. – EV&CS
9. Special Safety Tether Pack swap was approved - EVA Tools Panel 2/14/12
10. The white lines disappear when the bolt has about an inch to go in. One additional inch could be about 10 turns. The white line only indicates if the bolt is released. – S&M
11. .500-20 thread – S&M
12. The nut for bolt #2 on the stow beams has slop and should be installed after bolt #1 to allow for tolerance stackup – S&M
13. Zip nuts are sensitive to side loads and high RPMs; recommendation is to use wobble and a PGT setting of 10 RPMs – S&M
14. SpaceX FSE nuts are not zip nuts – S&M
15. Cannot put cyclical loading of >30lbs in bolt direction while grapple bars are on POA – EVA AIT
16. Only 1 EV allowed FF on the RGBs; no quick loads allowed on RGBs – S&M
17. Ref FR B2-561
18. Grounding wire not required for RGB stow on radiator beams – EV&CS
19. The LGF grapple pin release bolts do not meet EVA clearance requirements, but were fitchecked at KSC prior to launch with a ½" (wobble) Socket – 8" ext and a Ratchet Wrench – EV&CS
20. Known tolerance issues with RGB dimensions for install on stow beams; worst case models still show margin for install – S&M
21. The TA-clamp on both RGBs is rotated 180-deg out from the drawings – EV&CS
22. Scoop will not fit on micro-conical on FSEB closest to the LGF; no plans to use this micro – EV&CS
23. Max delta T between grapple bars on the POA is 48-deg F; bolts must be released with Ratchet Wrench to break trq loading due to thermal loading – S&M
24. The grapple bars were assessed for the worst case thermal conditions for alignment of the attachment features in PRs 15421 & 15422. The worst delta T between the HRSGB temperature before removal at the POA and the temperature of the radiator beam where it gets installed was analyzed with no issues. – S&M; PTCS
25. No SGANT masking concerns with RGB Install task – C&T
26. FSE bag has been approved to stow outside with 3 Adj Equip Tethers – MET Tools
27. When looking at black alignment guides RGB arm will overlap (hang-over) the stow beam
28. Initial confige: Starboard HRSGB = HRSGB 1; Port HRSGB - HRSGB 2, has LGF, attached to POA
29. ½" (wobble) Socket -8" ext in Z1 jumper boxes – MOD
30. Max force required to zip bolt is 11-lbs – S&M
31. Failure Mode for Release = Nut Plate Shear Failure; Install Mode Failure = Bolt Shank Shear Failure – S&M
32. For RGB installation on truss into zip nuts, the first torque can be 3.8 or 4.8 ft-lbs. – S&M

Timeline Considerations:

1. WIF adapter approved to leave on LEE – CSA & MER Tools
2. Long pole in procedure is EV on SSRMS - MOD
3. No thermal clock – PTCS

exception. The two EVA Grapple Shaft Release Rods do not have the minimum tool head clearance of 1.0 inch radius from the outer edge of the fastener head as specified in SSP 50005 Rev E, Figure 14.6.2.3-1. CAD Modeling of a 1/2 inch x 8 inch Wobble Socket Extension (P/N SEG33108423-301, SSP 30256:001 Rev H, Figure B.19.2.1-5) on the Grapple Shaft Release Rods is illustrated in Figure R3.2.1.2-1.

R3.2.1.3 LGF STRUCTURAL INTERFACE

The LGF to User structural interface shall be as defined in Table R3.2.1.3-1.

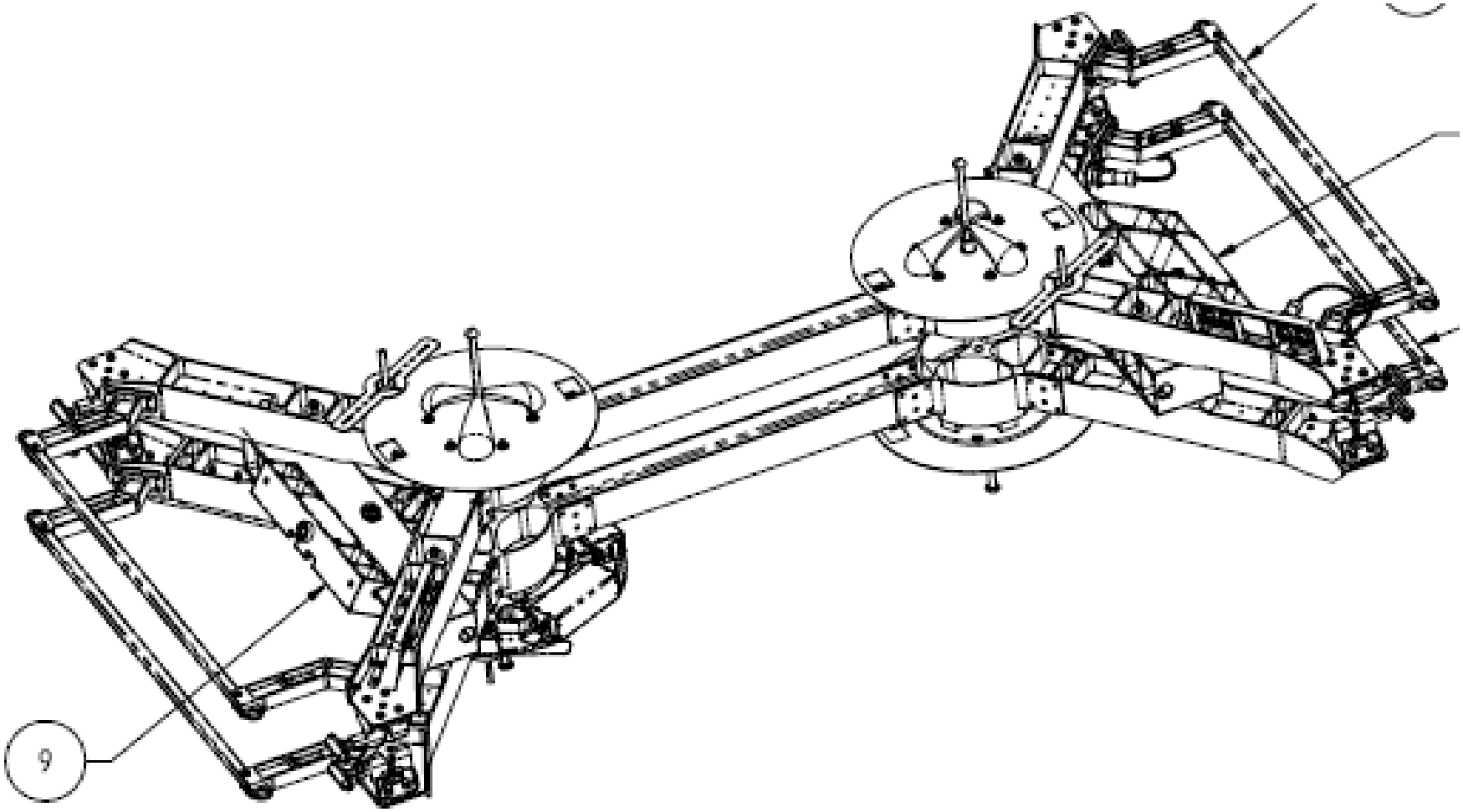
TABLE R3.2.1.3-1 LGF TO CARGO ELEMENT OPERATING LOAD LIMITS

End Effector	Case	Torsion Moment	Bending Moment	Shear Force	Axial Force
		ft-lb (Nm)	ft-lb (Nm)	lbf (N)	Lbf (N)
LEE (Latched or Unlatched)	1	700 (949)	900 (1220)	150 (667)	150 (667)
	2	450 (610)	1200 (1627)	150 (667)	0 (0)

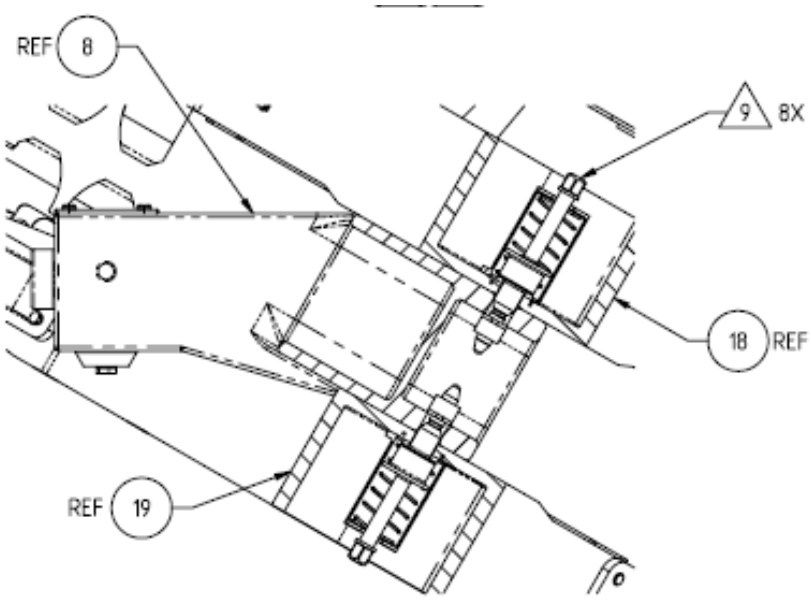
Axial force, both negative and positive, is defined along the longitudinal axis of the End Effector while the shear force is perpendicular to this axis.

The torsional moment, bending moment, shear force, and axial force for either case shall be applied simultaneously. The load cases should not be combined.

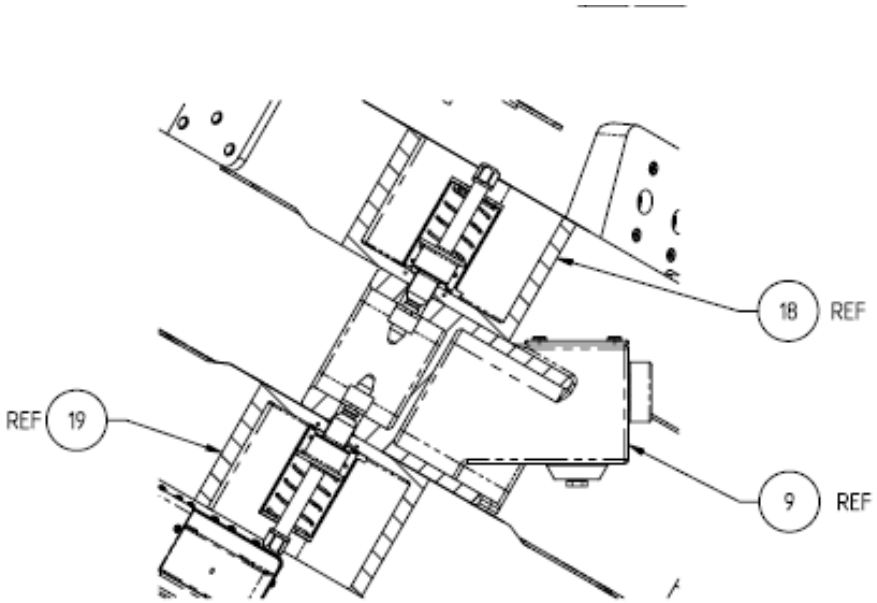
(Reference: NSTS 21000-IDD-ISS, Section 14.4.5.1.4.1).


9

Cross Section of RGB bundle Bolts

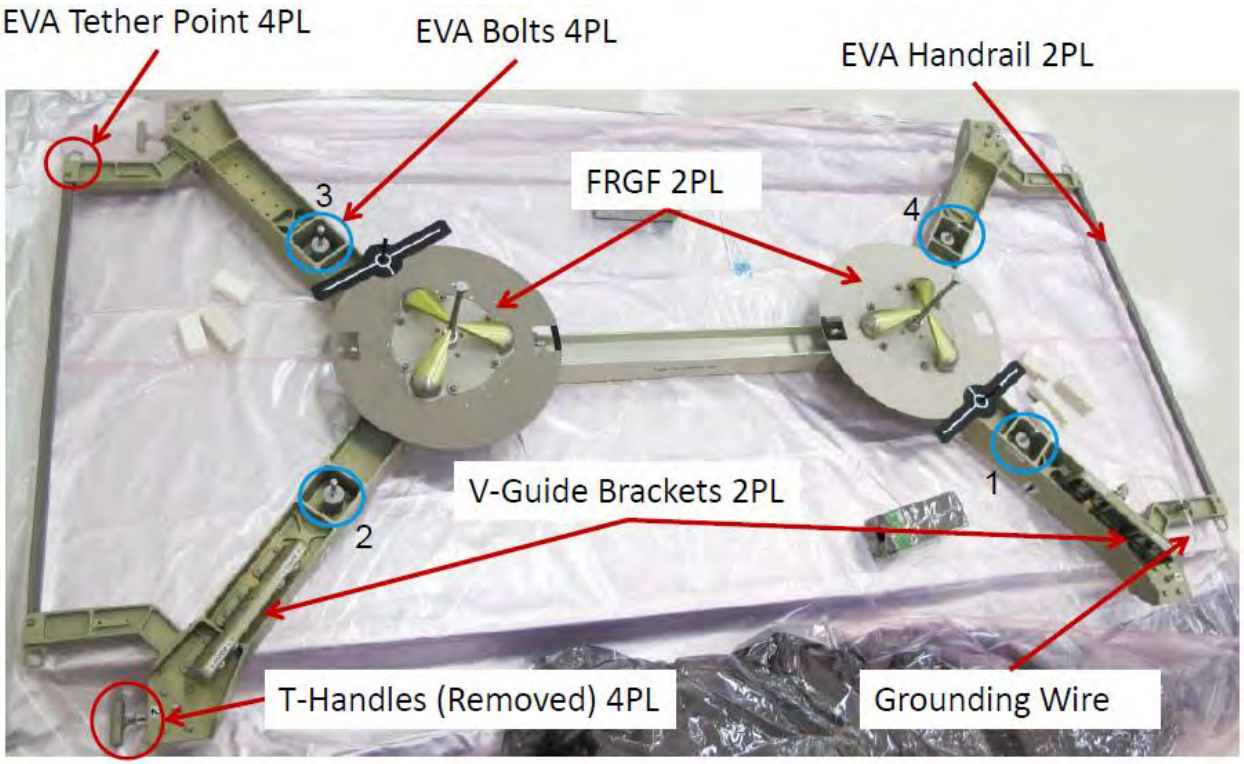


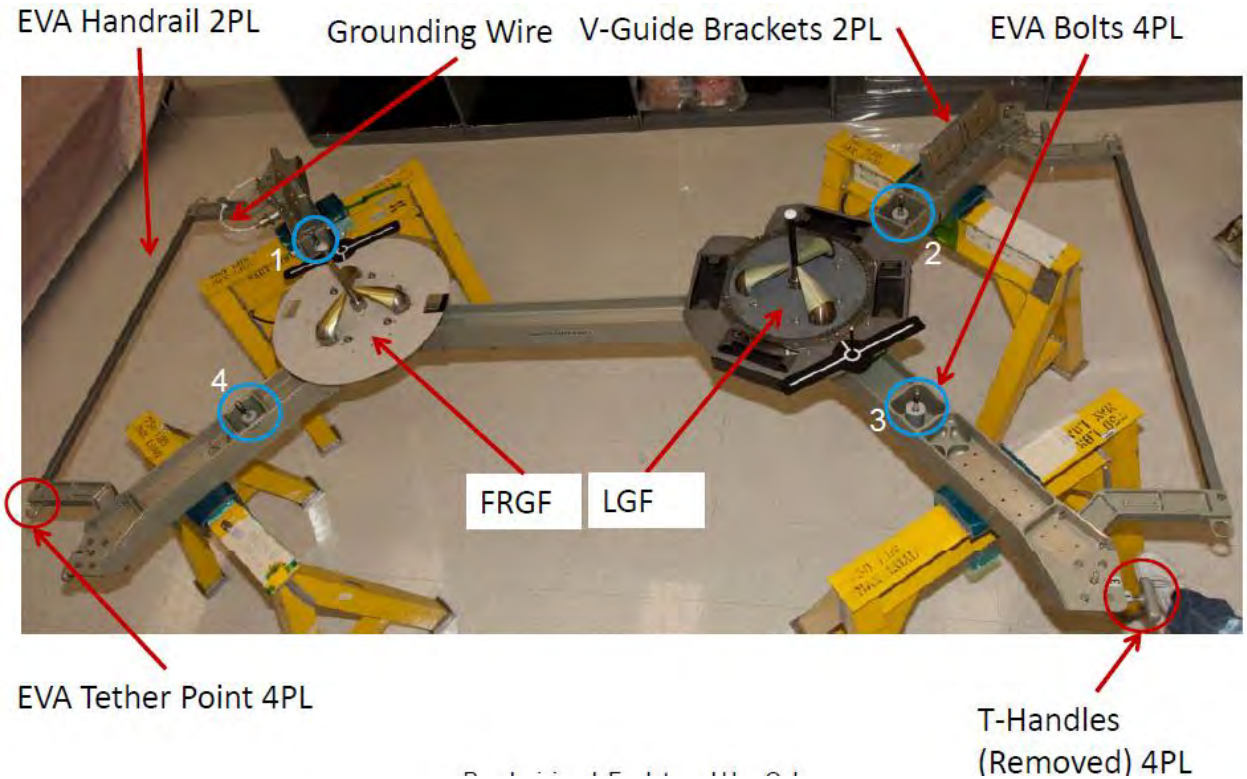
FSE A (upper)

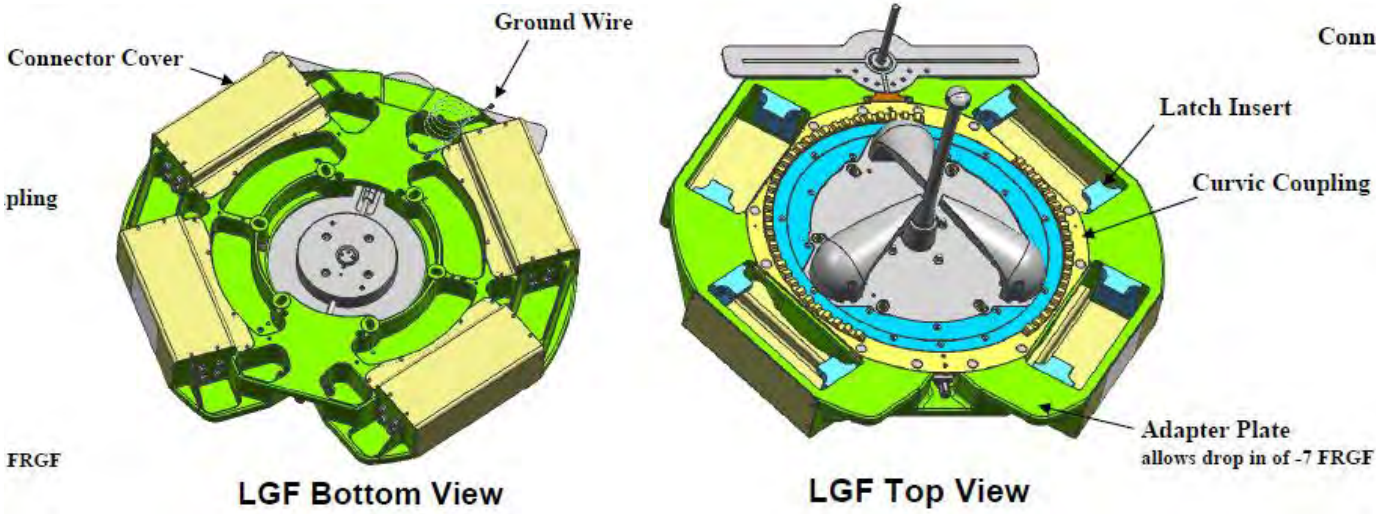


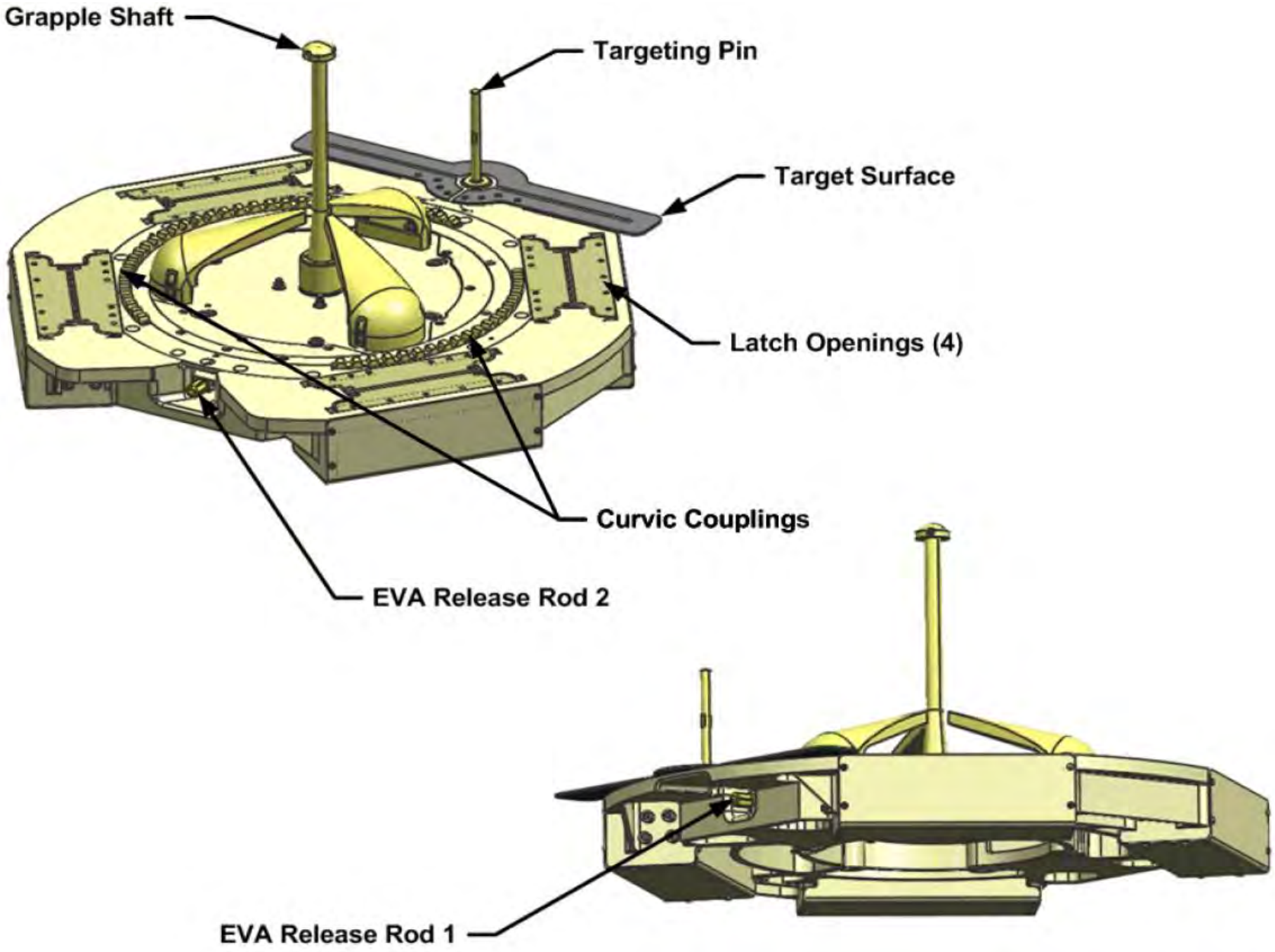
FSE B (lower)

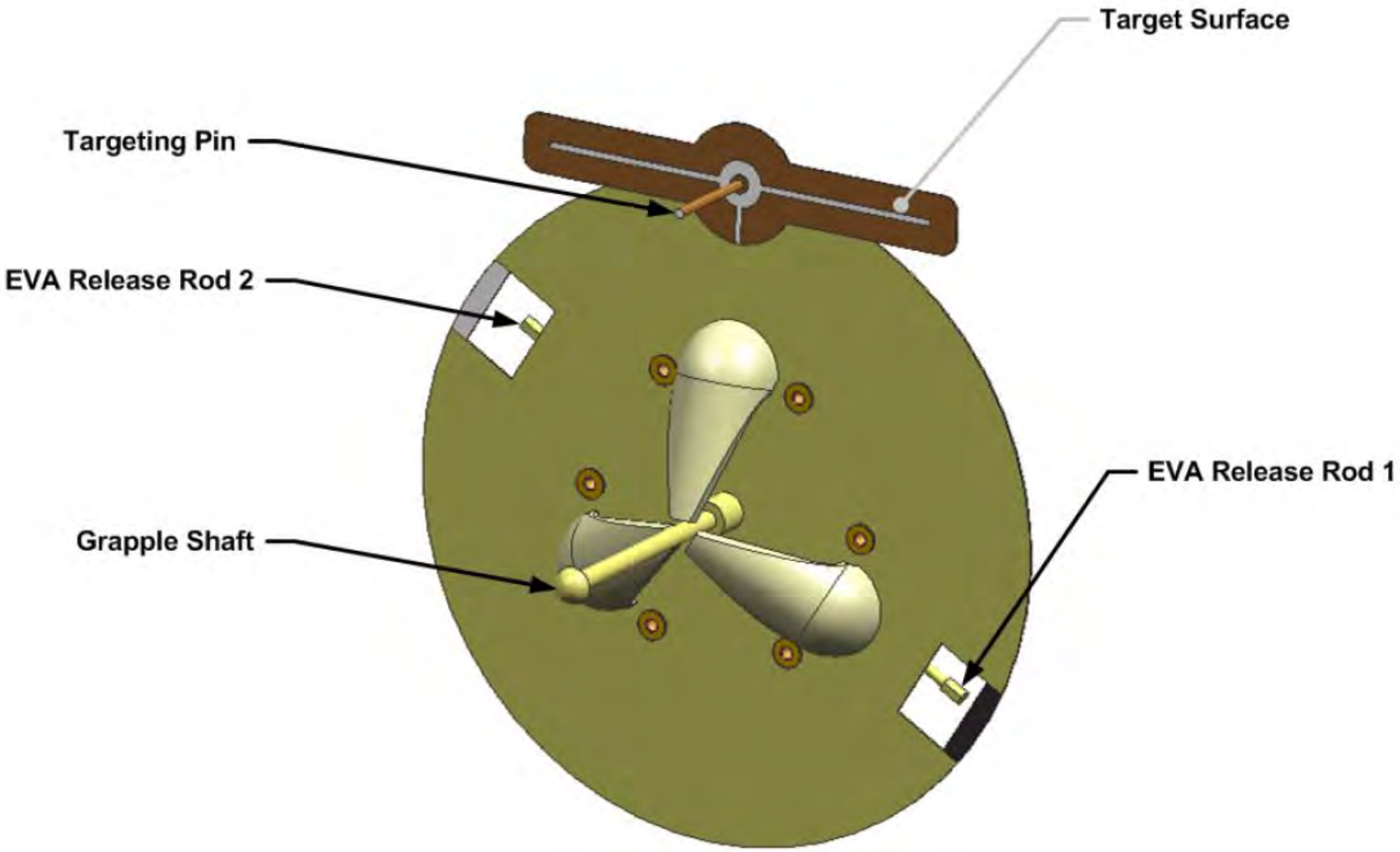
US EVA 22 TASK DATA – RGB

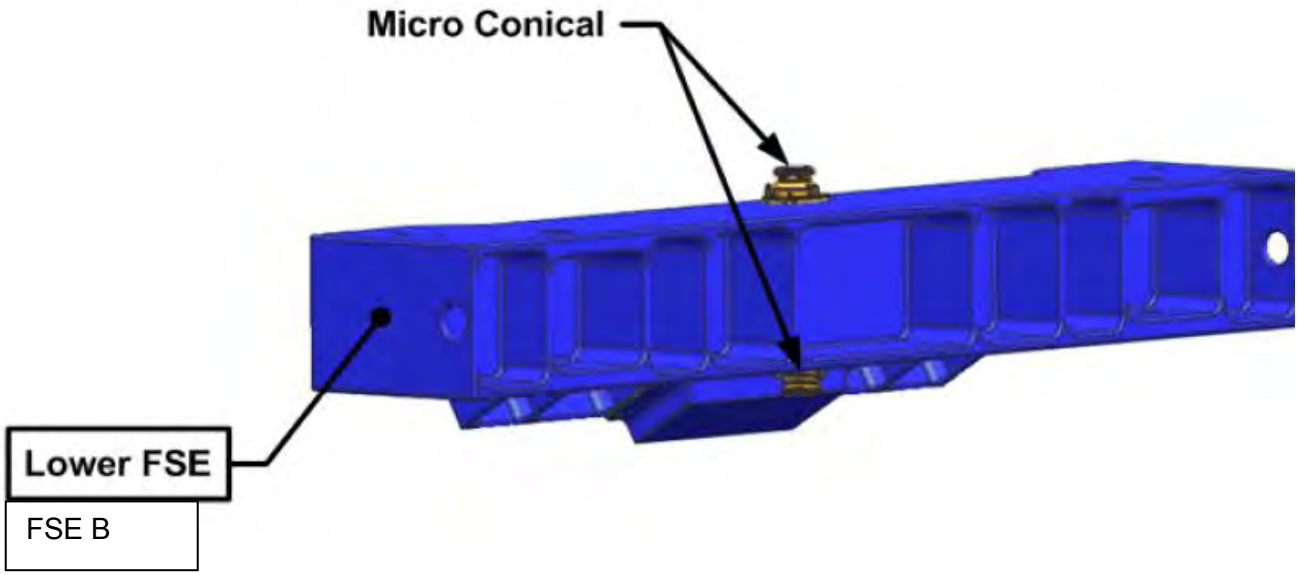


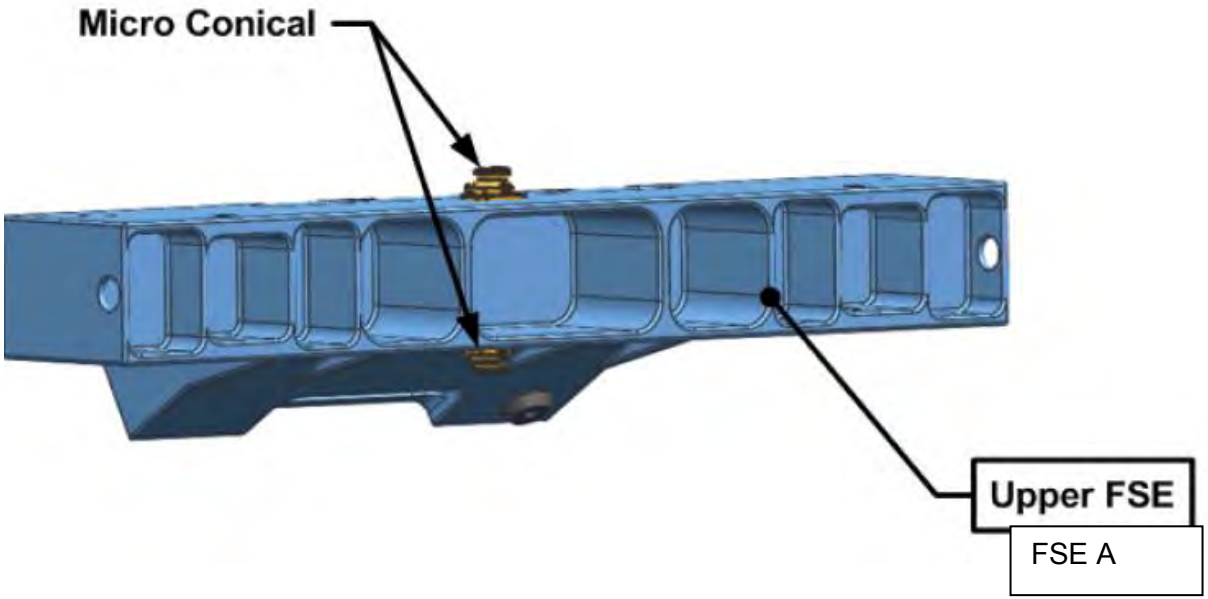

EVA Handrail 2PL
Grounding Wire
V-Guide Brackets 2PL
EVA Bolts 4PL
1
2
3
4
FRGF
LGF
EVA Tether Point 4PL
T-Handles
(Removed) 4PL

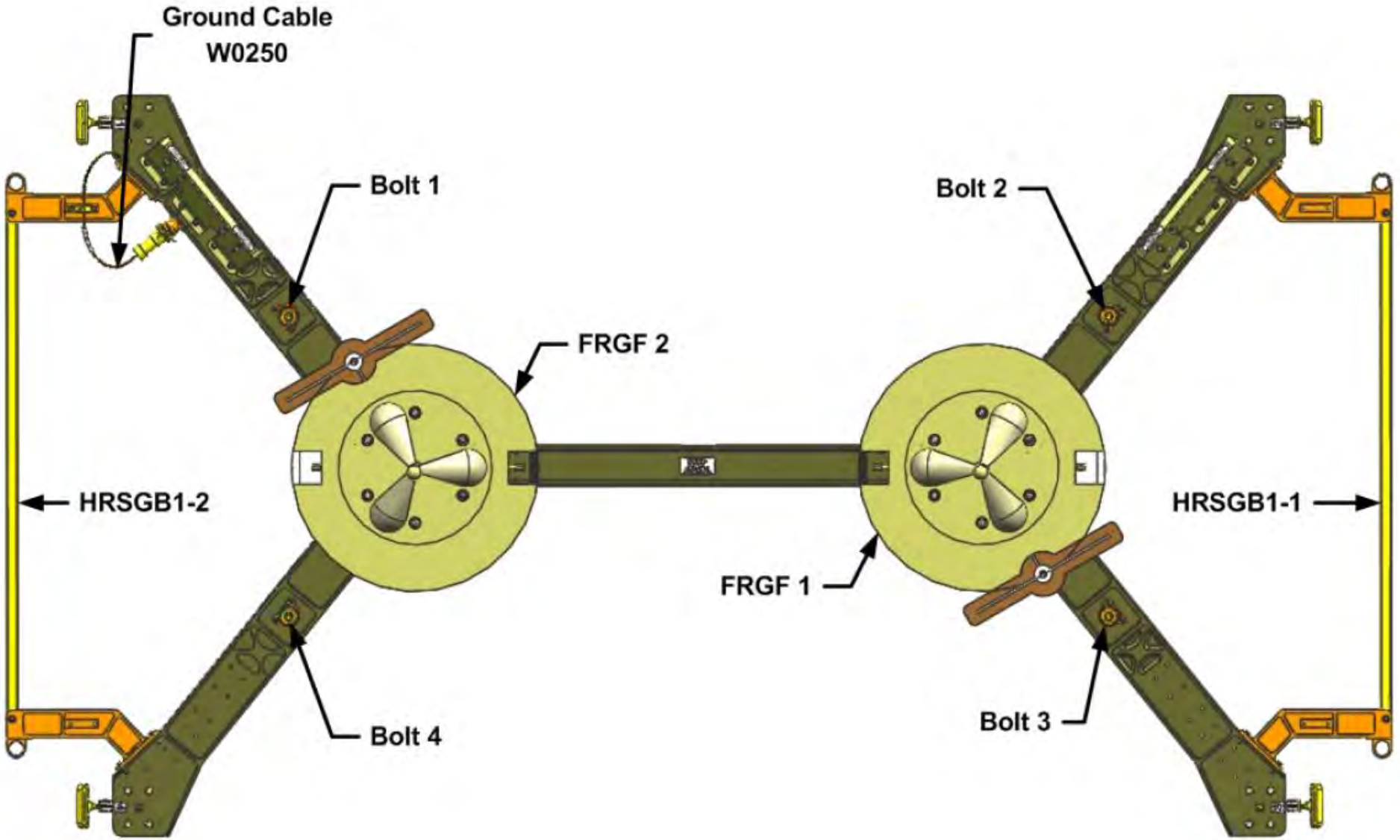

Ground Wire
Connector Cover
pling
FRGF
LGF Bottom View
Conn
Latch Insert
Curvic Coupling
Adapter Plate
allows drop in of -7 FRGF
LGF Top View

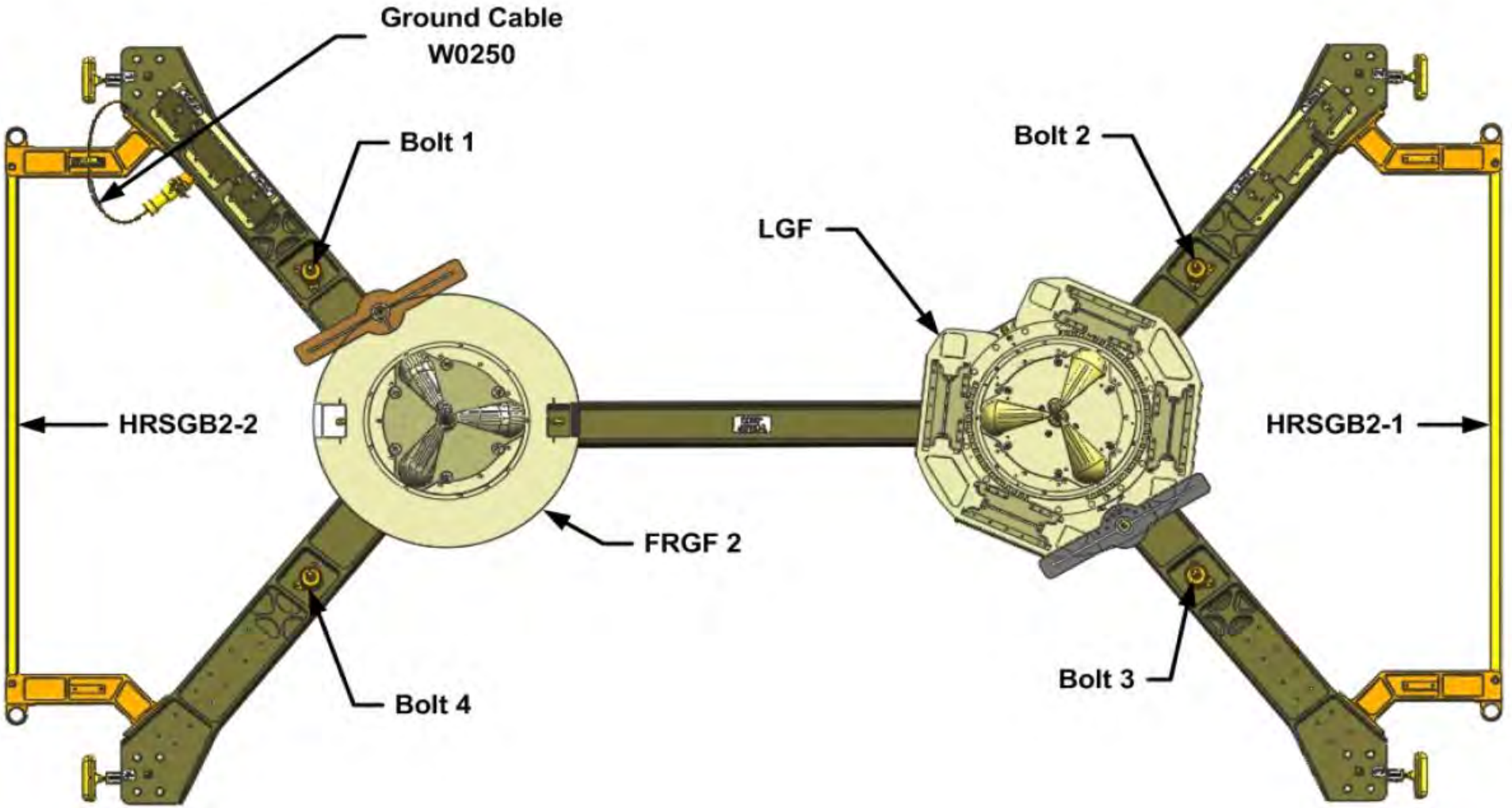

Grapple Shaft
Targeting Pin
Target Surface
Latch Openings (4)
Curvic Couplings
EVA Release Rod 2
EVA Release Rod 1

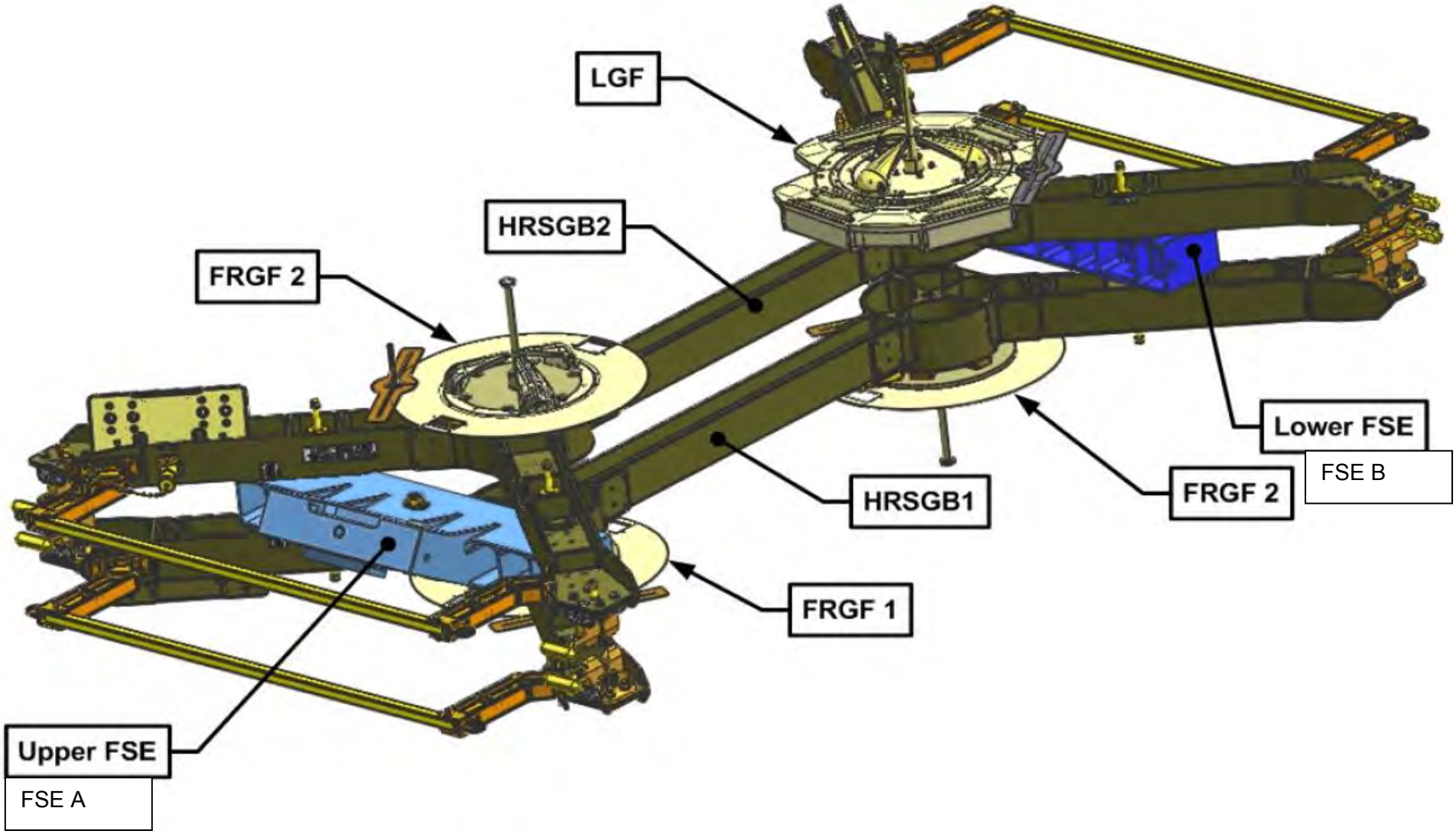

Target Surface
Targeting Pin
EVA Release Rod 2
EVA Release Rod 1
Grapple Shaft


Micro Conical
Lower FSE
FSE B

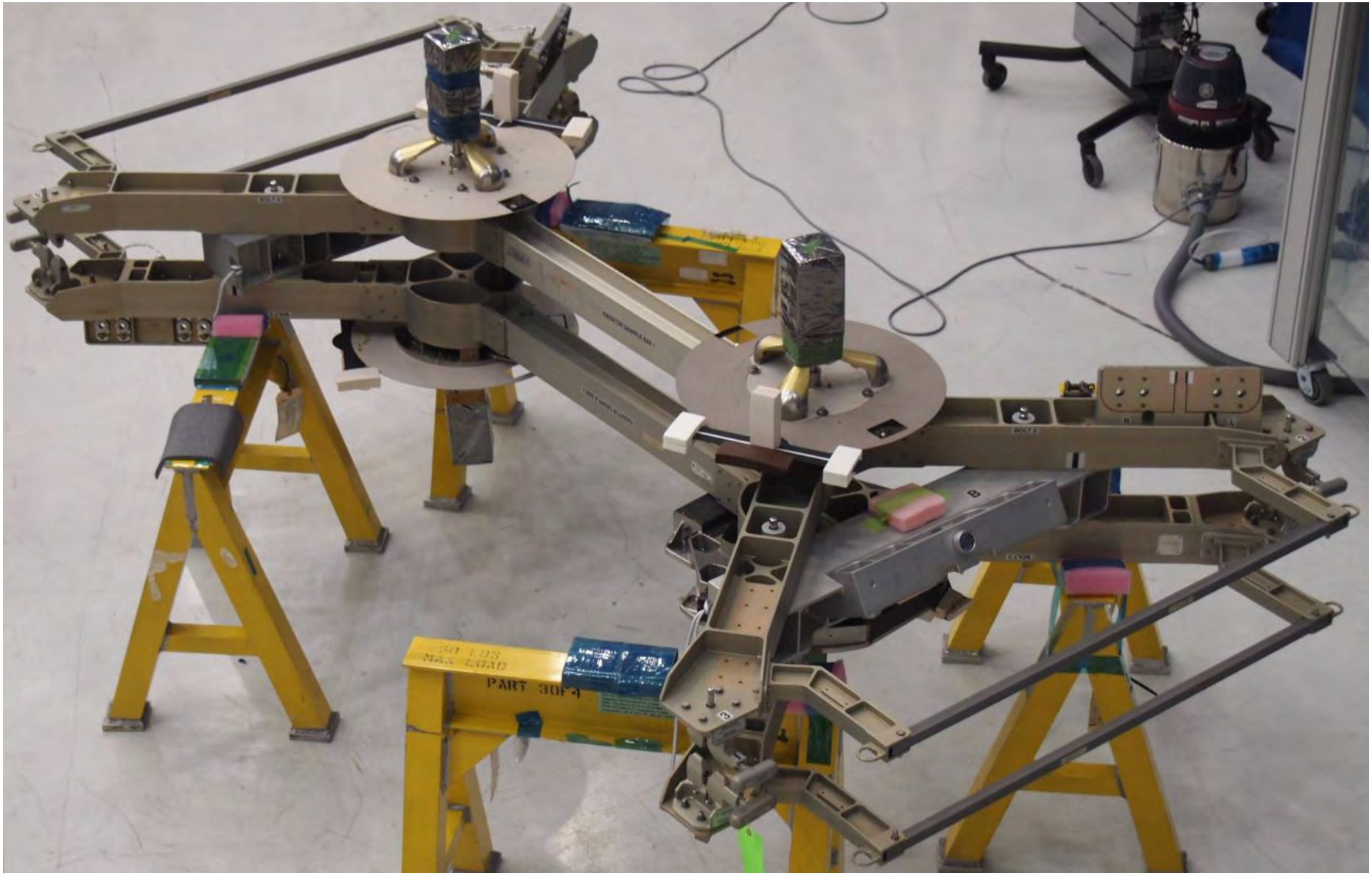

Micro Conical
Upper FSE
FSE A

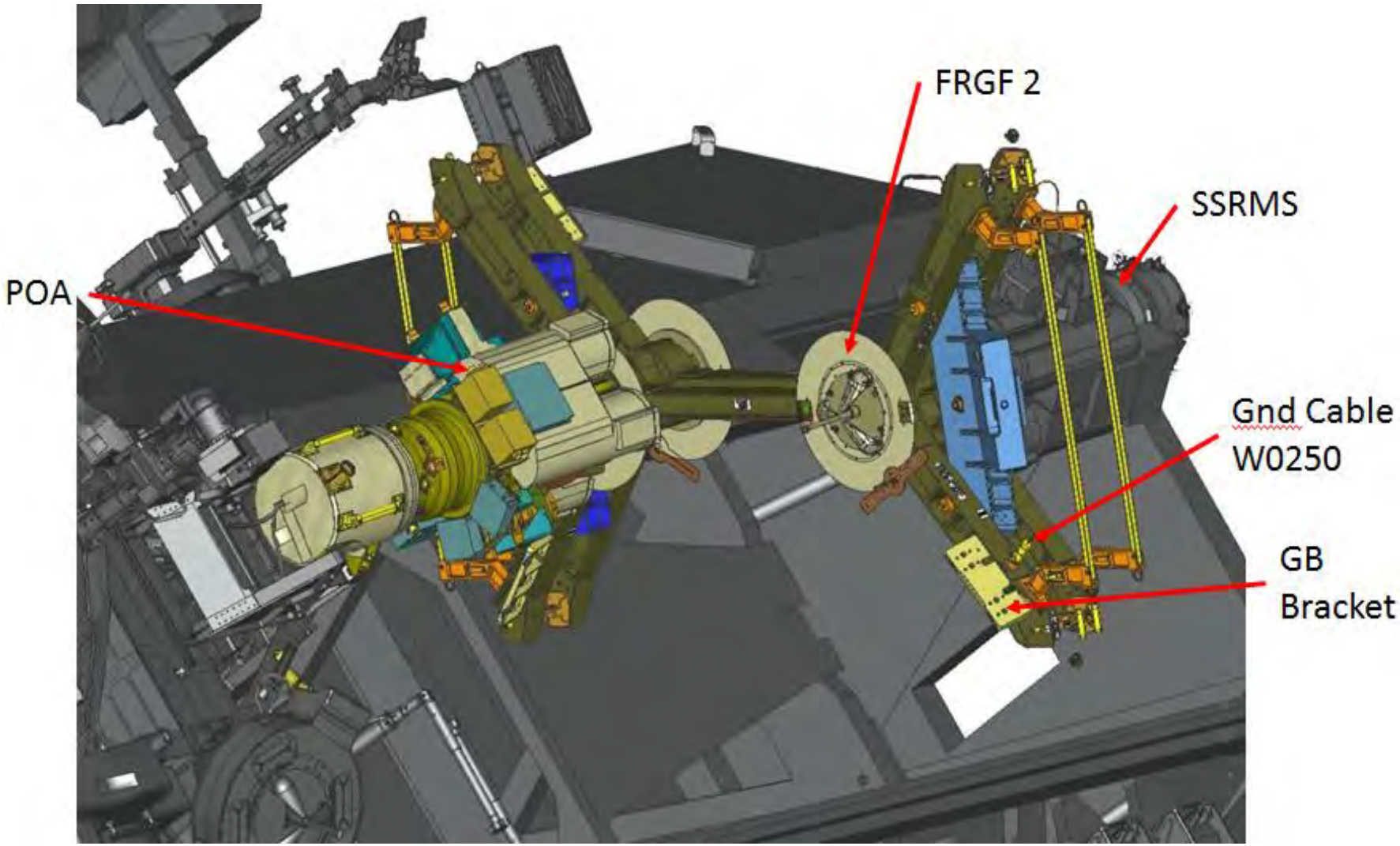

Ground Cable
W0250
Bolt 1
Bolt 2
FRGF 2
HRSGB1-2
HRSGB1-1
FRGF 1
Bolt 4
Bolt 3


Ground Cable
W0250
Bolt 1
Bolt 2
LGF
HRSGB2-2
HRSGB2-1
FRGF 2
Bolt 3
Bolt 4

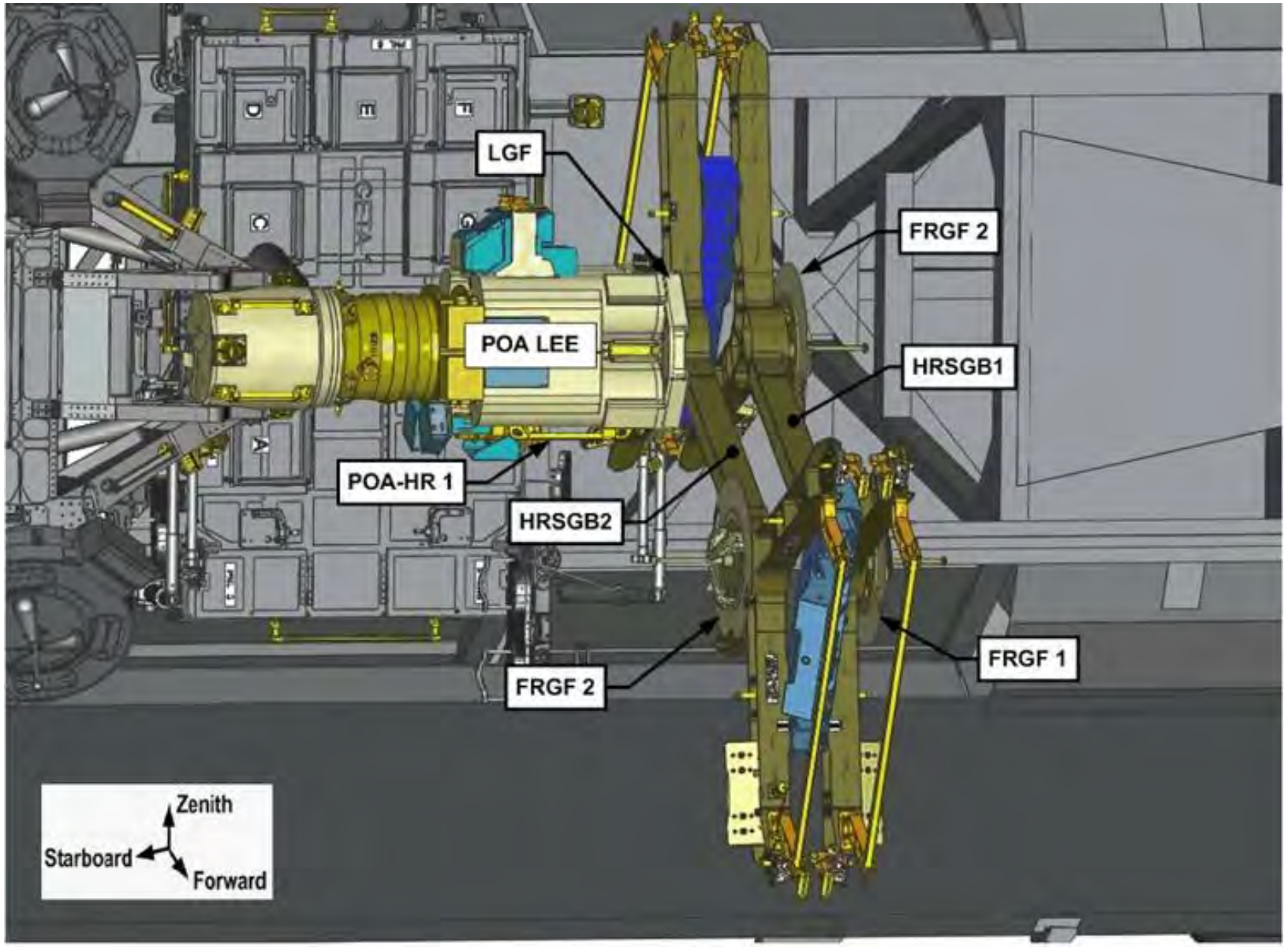

LGF
HRSGB2
FRGF 2
Lower FSE
FSE B
HRSGB1
FRGF 2
FRGF 1
Upper FSE
FSE A

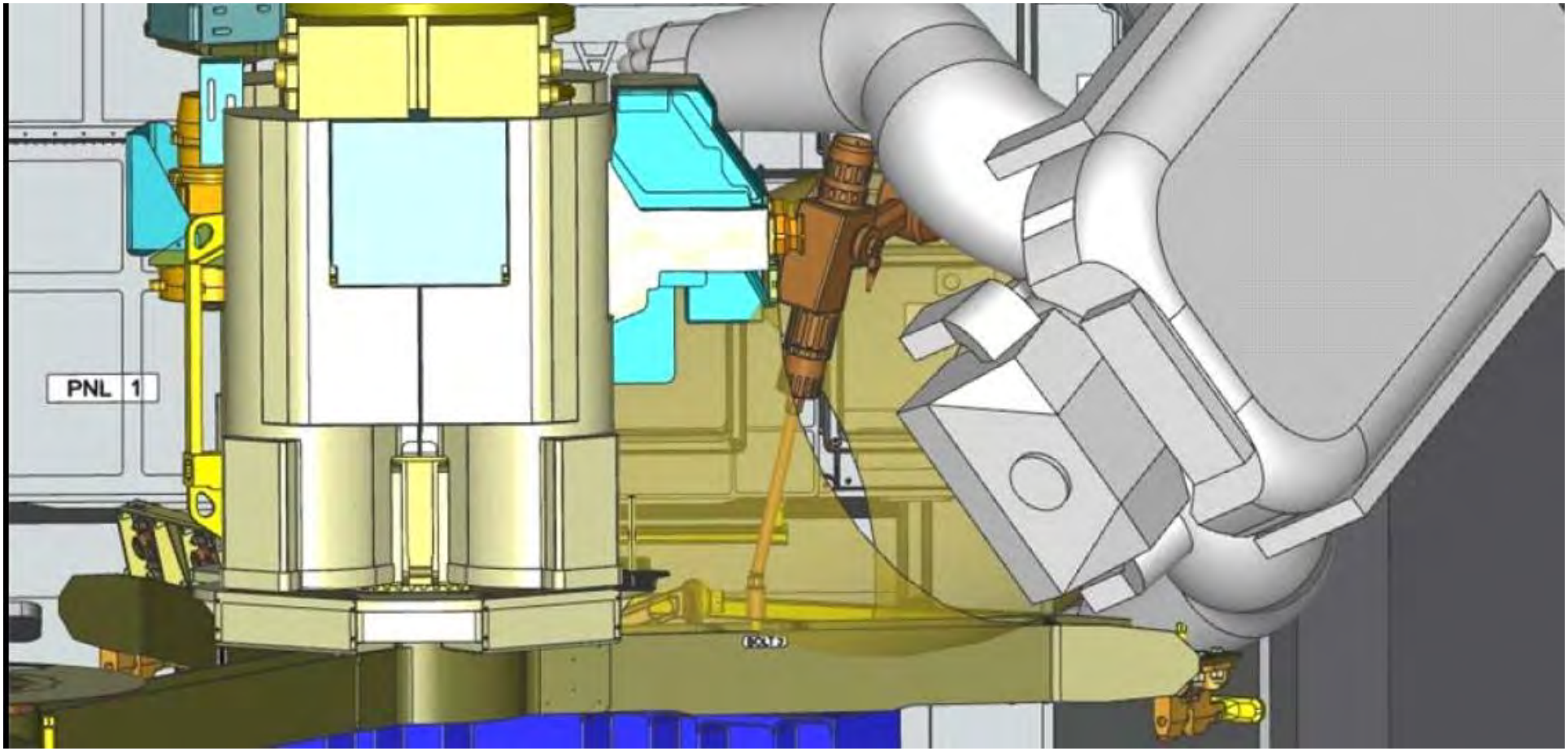
US EVA 22 TASK DATA – RGB



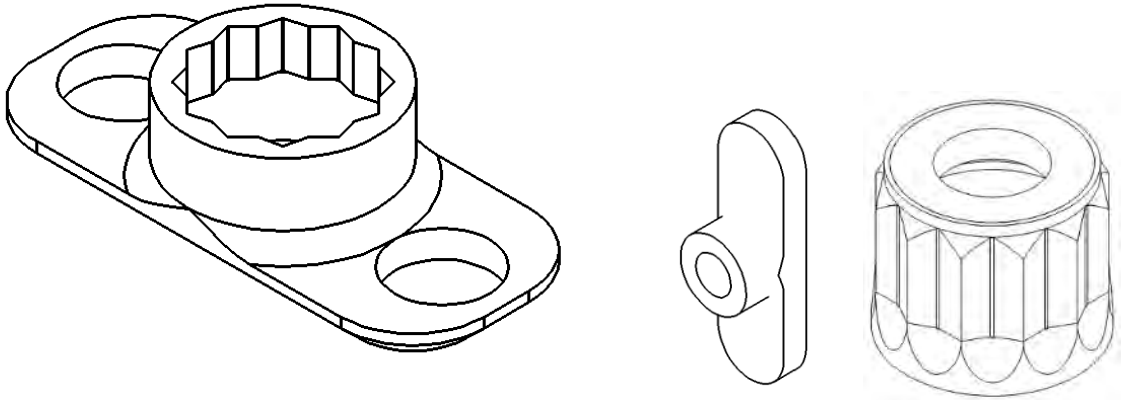

FRGF 2
SSRMS
POA
Gnd Cable
W0250
GB
Bracket

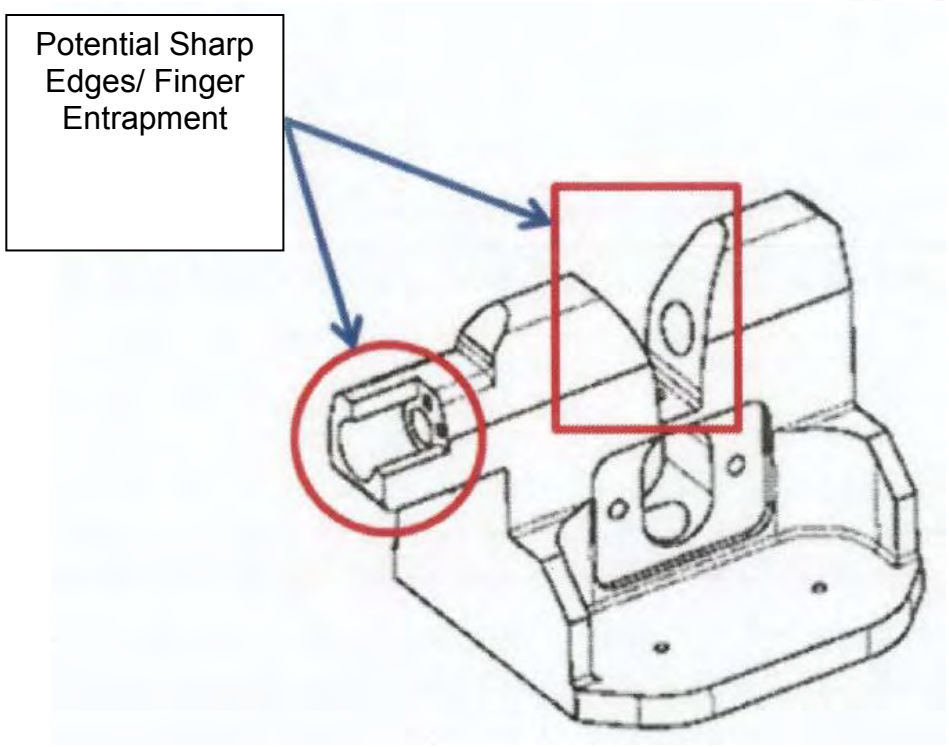
US EVA 22 TASK DATA – RGB

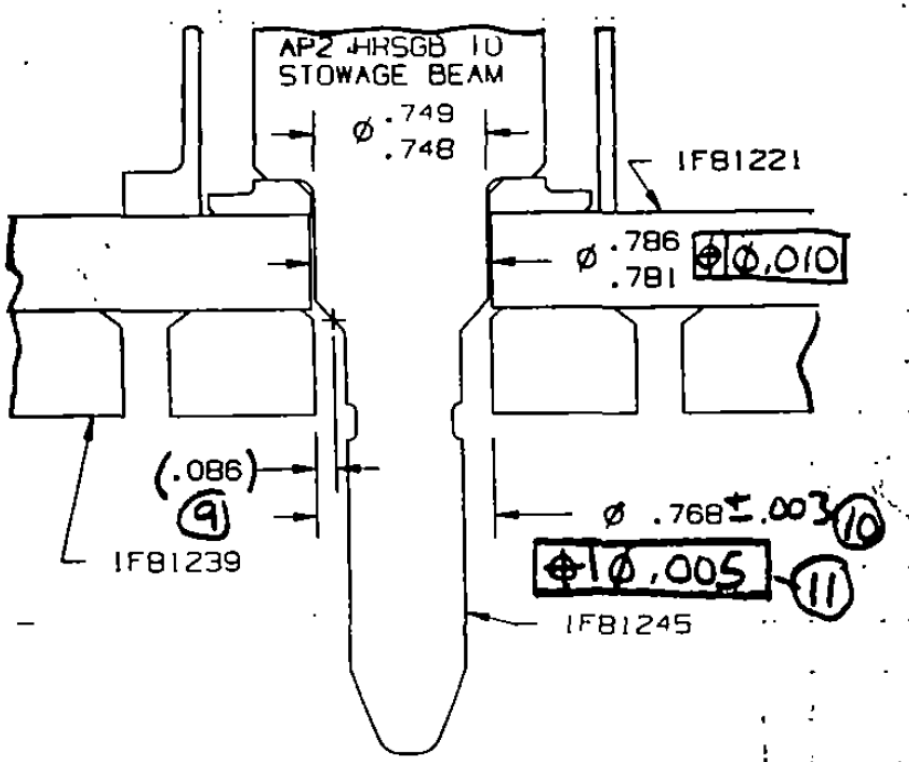


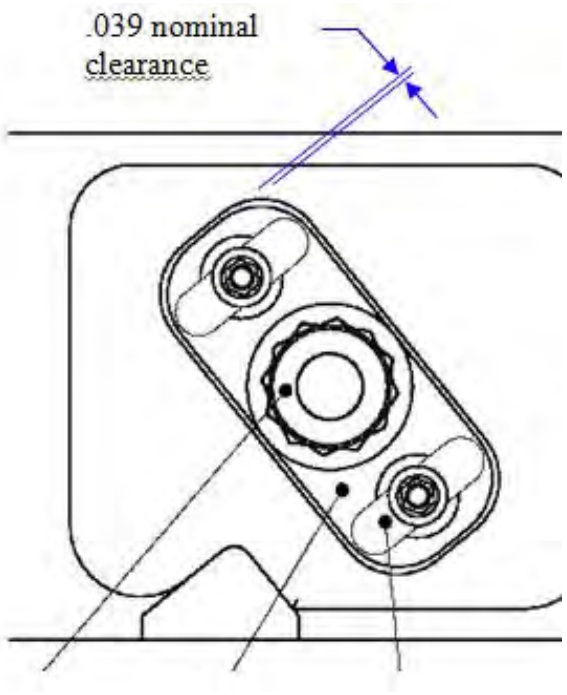


Port RGB Bolt #3 access with 12” wobble socket

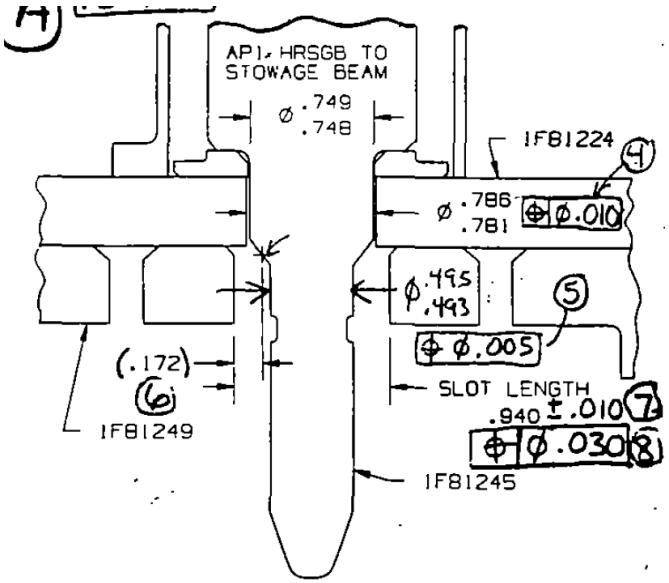


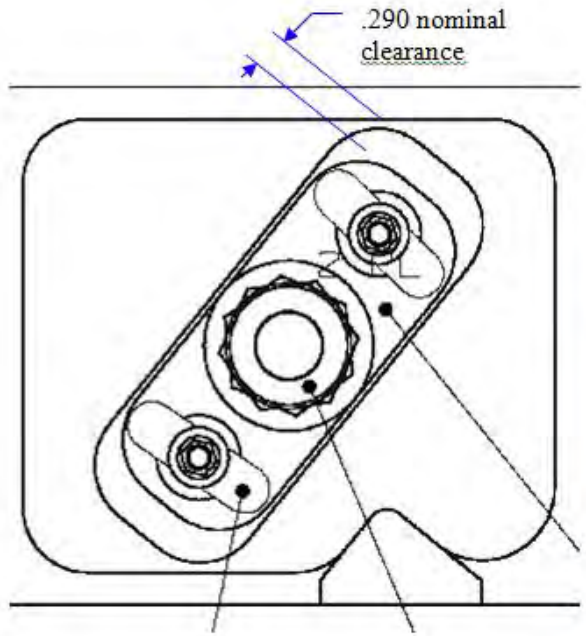

Potential Sharp Edges/ Finger Entrapment

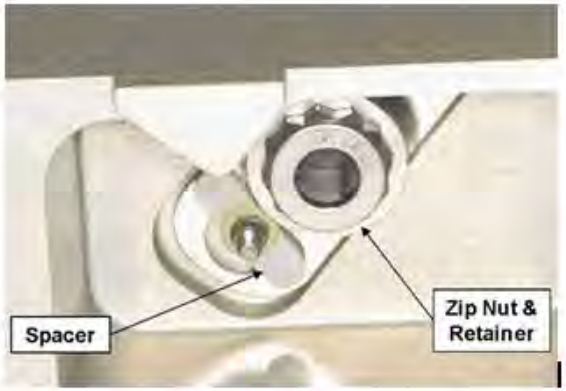




Inboard Bolt and Stow Beam receptacle (zip nut)

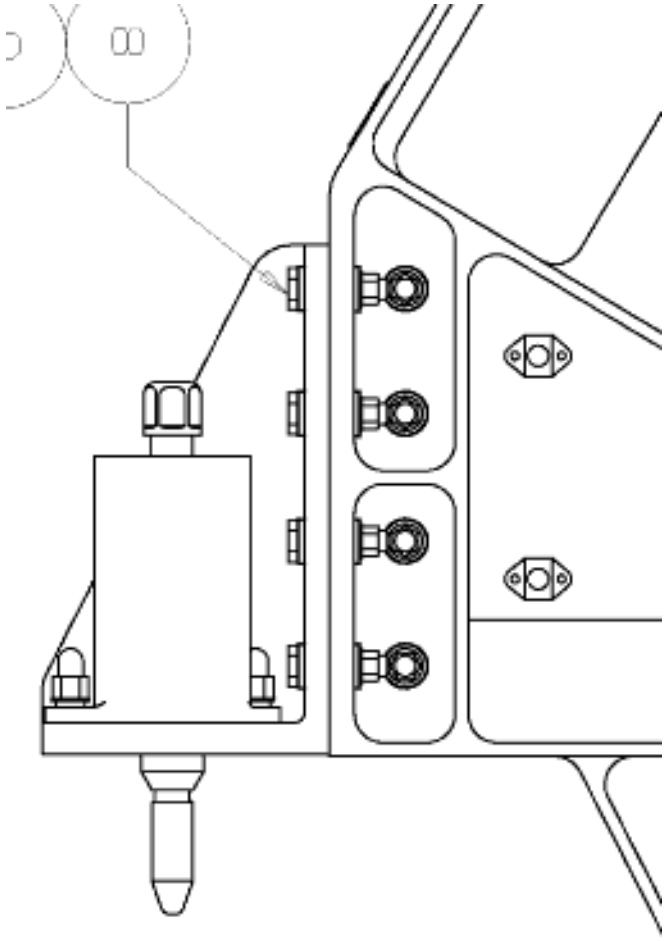


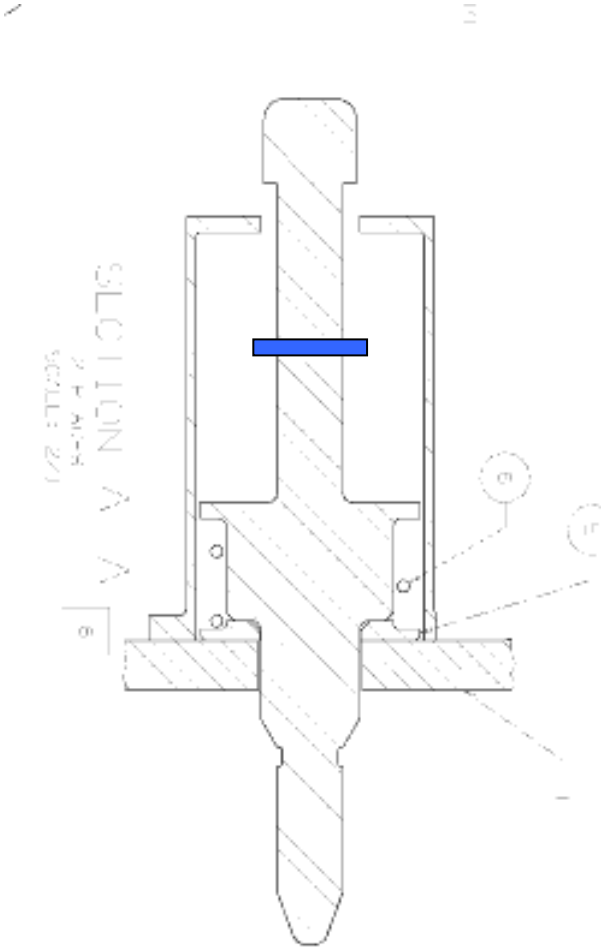


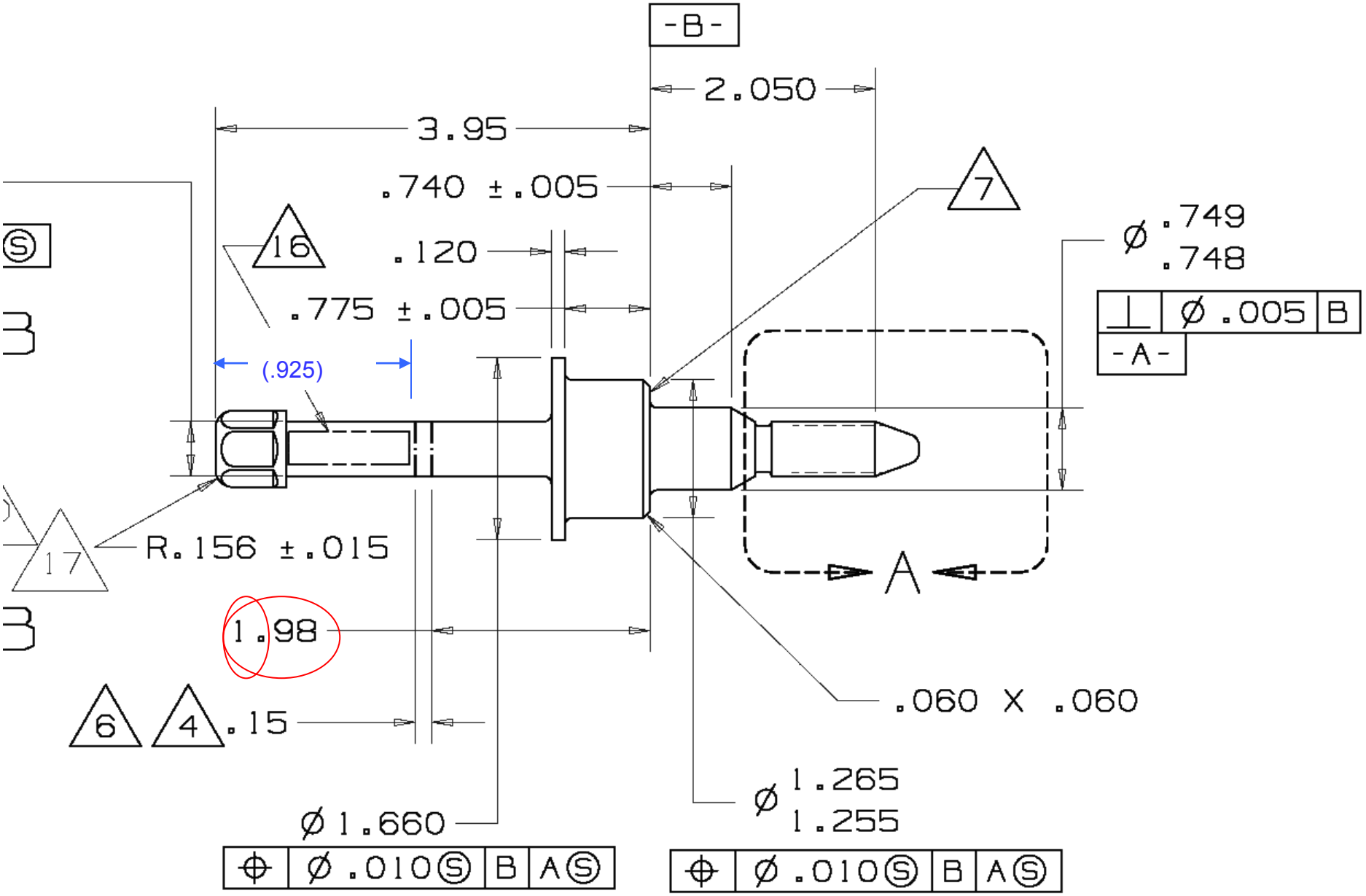


Outboard Bolt and Stow Beam receptacle (zip nut)

V-Guide EVA Bolt – Drawing shows white lines will be in deep when engaged






-B-
2.050
3.95
.740 ±.005
.120
.775 ±.005
16
7
Ø .749
.748
⊥ Ø .005 B
-A-
(.925)
17
R.156 ±.015
A
1.98
6
4
.15
.060 X .060
Ø 1.660
⌖ Ø .010Ⓢ B AⓈ
Ø 1.265
1.255
⌖ Ø .010Ⓢ B AⓈ

US EVA 22 TASK DATA – MLM POWER CABLE

Estimated Task Duration:

	With RMS	Without RMS
One EV	N/A	00:30

Tools:

EV1
N/A

Restraints:

HR	WIF	APFR Setting
	N/A	n/A

EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function	Mass (lbs)
W5634 J2	Fwd/Zenith A/L	PMA1	N/A	25	Power	22.48

Warning:

1.

Caution:

1. Avoid inadvertant contact with zenith PMA1 MDM radiator, above 22" of OTD (US crane), and SASA high and low gain Antennas and radiator surfaces

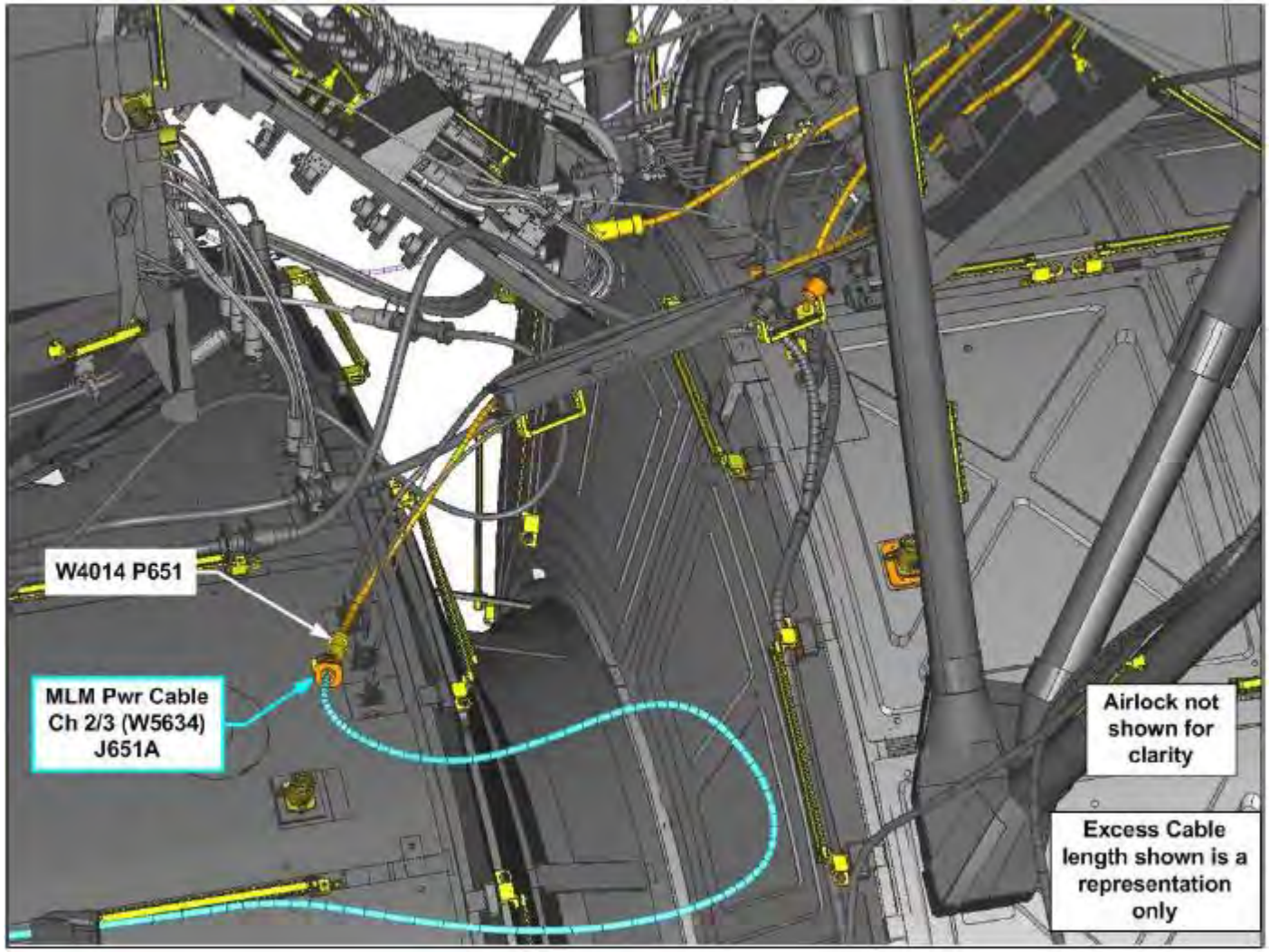
Note:

1. It is important to prevent routing the cable over Safety Tethers and Gaps Spanners
2. No IFIs for this Hardware – EV&CS
3. Per S. Williams and WVS, cable was left on aft side of the fwd/zenith A/L HPGT

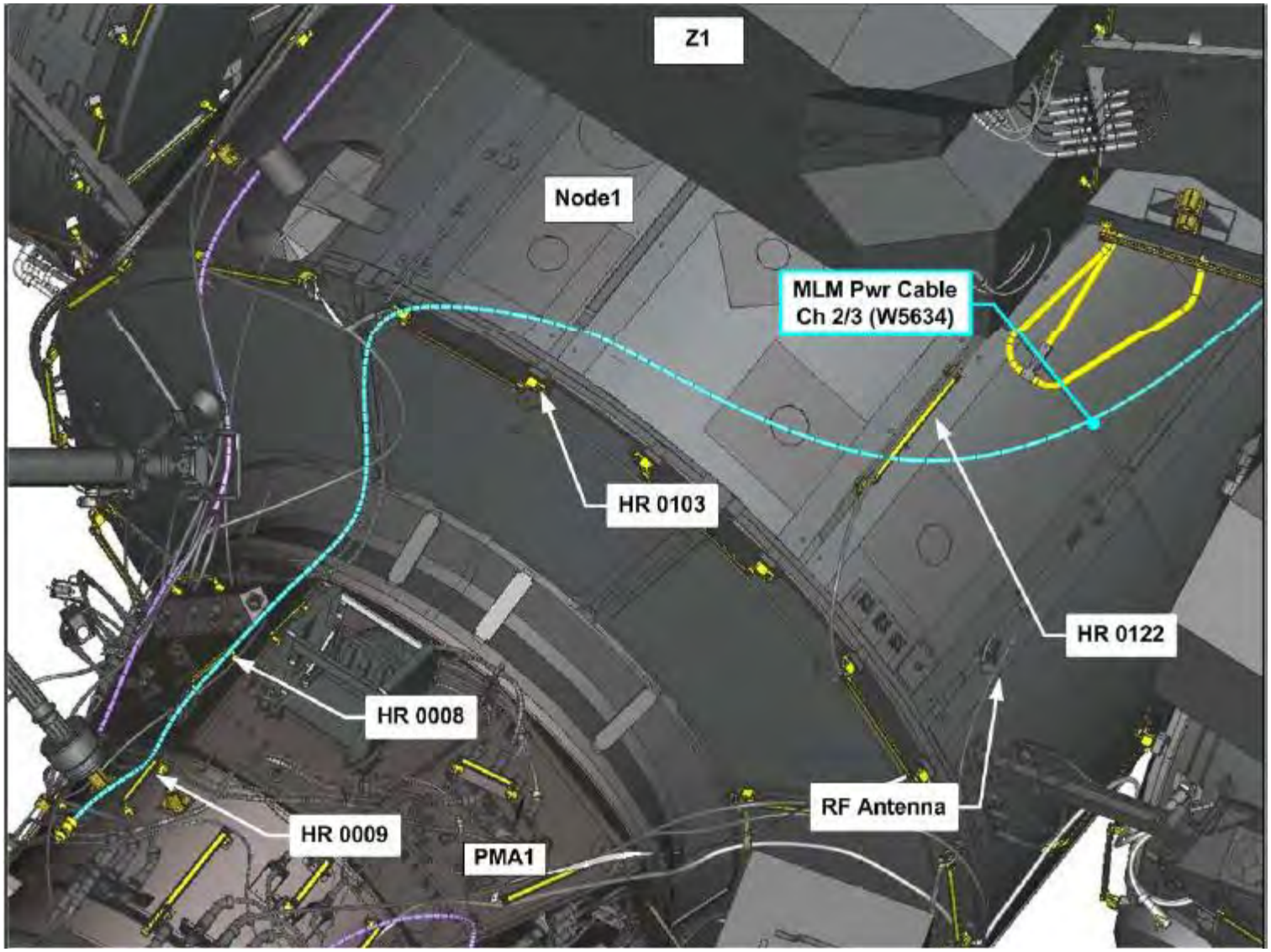
Timeline Considerations:

1. This task can be broken out at any point

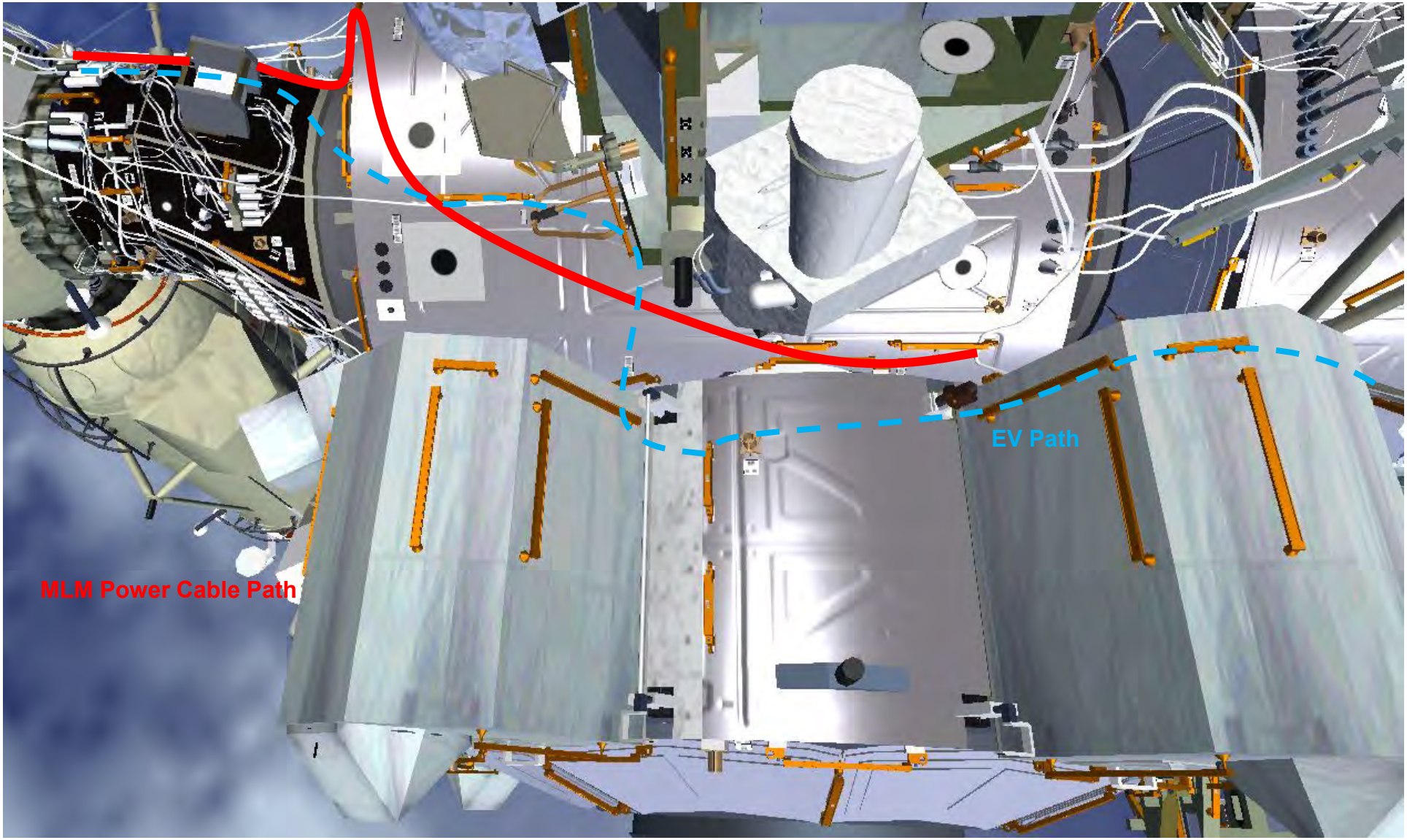
US EVA 22 TASK DATA – MLM POWER CABLE



US EVA 22 TASK DATA – MLM POWER CABLE



US EVA 22 TASK DATA – MLM POWER CABLE



US EVA 22 TASK DATA – CLPA

Estimated Task Duration:

	With RMS	Without RMS
One EV	00:40	01:30
Two EV	00:30	01:30

Tools:

EV1	EV2
Square Scoops	Square Scoops
	PGT w/7/16” socket 6” extension

Restraints:

HR	WIF	APFR Setting
MBS Mast CLPA Retrieval	SSRMS	12, PP, F, 6
	MBS WIF 7	3, NN, K, 9

ORUs:

Item	P/N	Failed s/n	Spare s/n	Mass (lb)	Dimensions (in)
CLPA (Mast)	51612-3004-1	203	N/A	46.11	22.47x17x16.82

EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Trq (ft-lb)	Release Trq (ft-lb)	Failure Trq (ft-lb)	Turns	RPM
CLPA Tie-Down Bolt	None	7/16”	1	10.8-16.7	25.5	43.0	24-26 = hard stop 19 = fully released	30

US EVA 22 TASK DATA – CLPA

Warning:

1. Avoid handling grounding points, connectors, and bolt threads when ORU is released. Failure to comply may result in crew injury or equipment damage. – CSA
2. After the CLPA is removed from the MBS Mast, the receptacle connectors will be left exposed. A 2 ft KOZ from these connectors will apply if the respective VDU are no inhibited. Ref MSS-SNCR-046 – Safety

Caution:

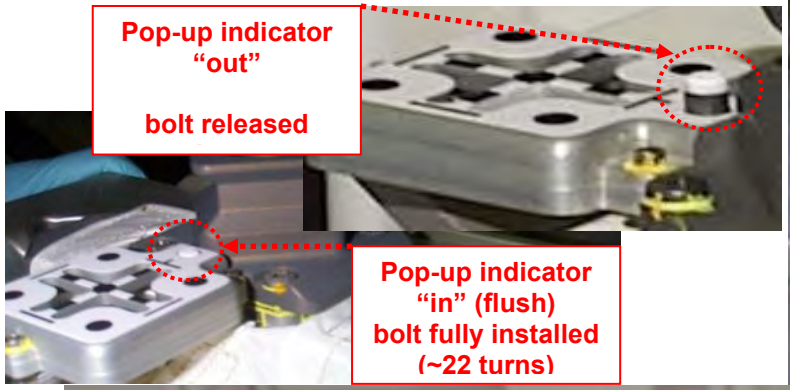
1. Avoid handling the front surfaces of the lens/lighting assembly. Failure to comply may result in equipment damage – CSA
2. Do not use a prybar to aid in removal of the CLPA as the connector box wedge can be damaged

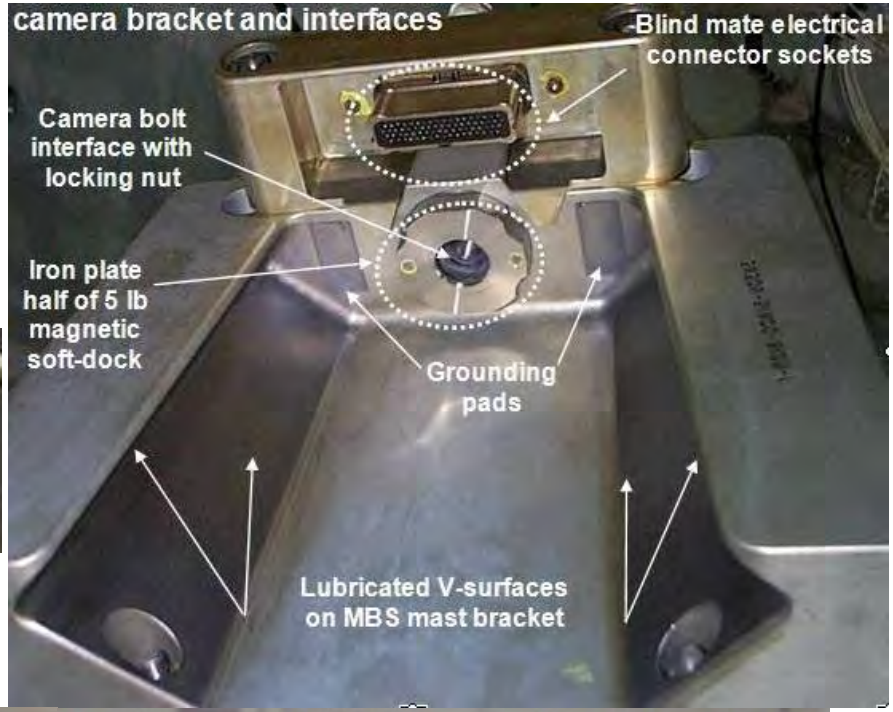
Note:

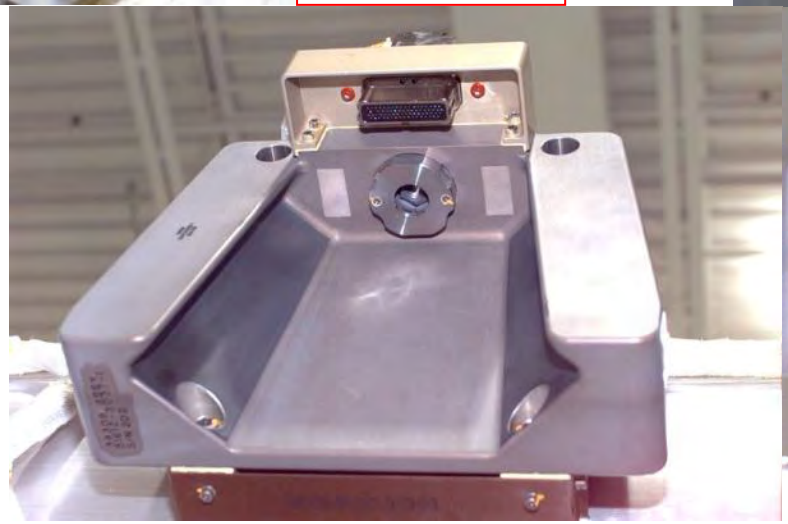
1. Bolt is not free spinning. Drive to turn count, not hard stops - CSA
3. GTEC may be used to cover passive blind-mate connector on MBS mast – CSA; EVA AIT
4. No thrusters while EV on SSRMS and within 2 ft structure – CSA
5. When releasing the CLPA: mechanical safing is lost after 5 turns, bolt is no longer threaded in nut after 14 turns, bolt threads are not exposed after 19 turns – CSA

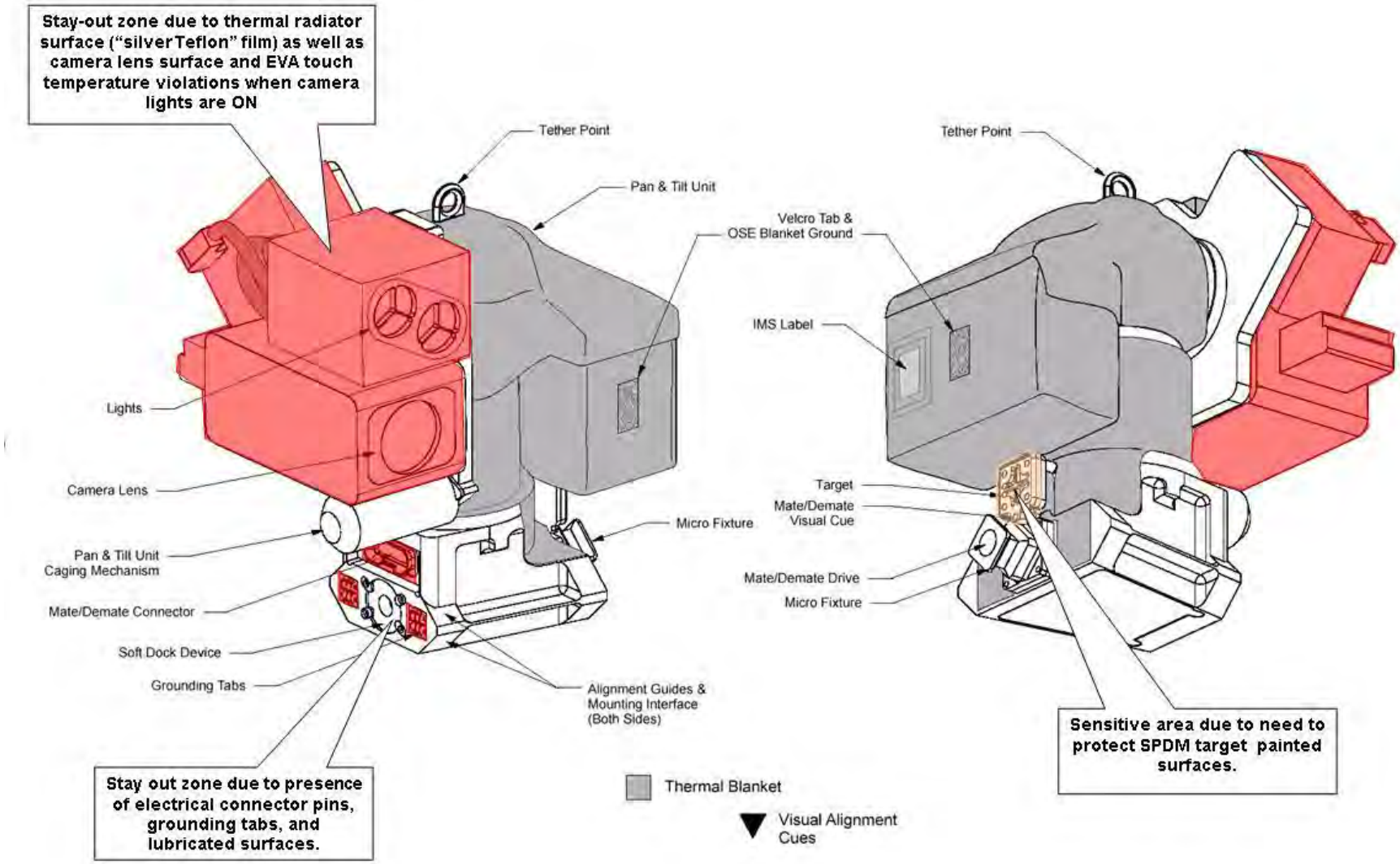
Timeline Considerations:

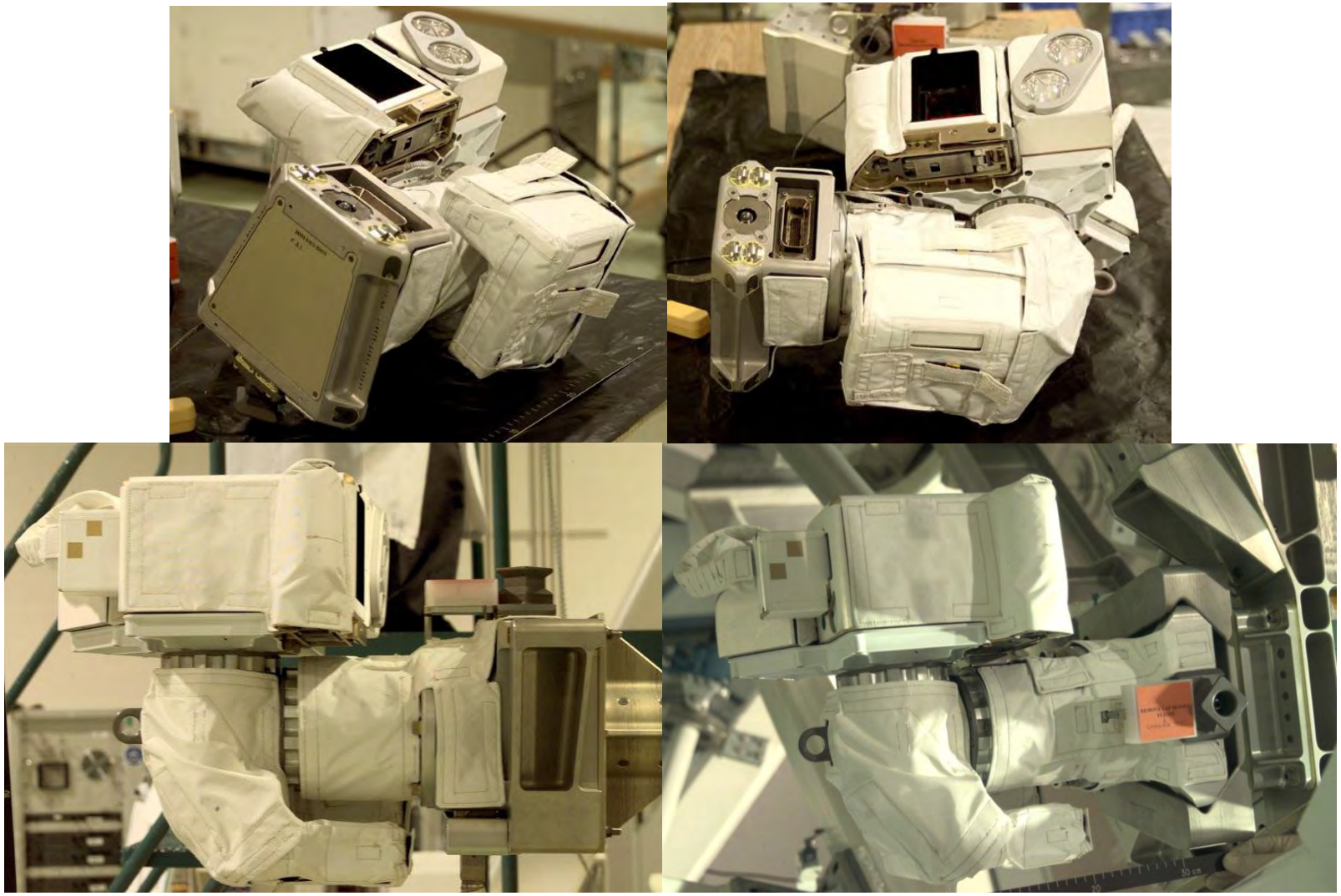
1. There is no thermal clock for this hardware – CSA; PTCS

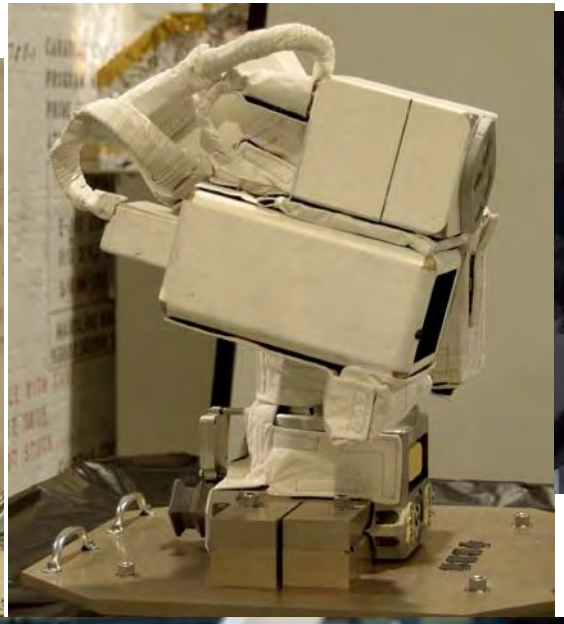

Pop-up indicator
"out"
bolt released
Pop-up indicator
"in" (flush)
bolt fully installed
(~22 turns)

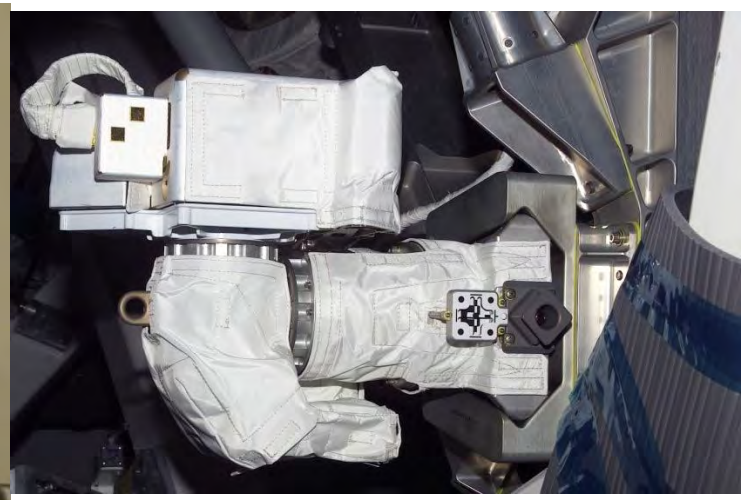

camera bracket and interfaces
Blind mate electrical
connector sockets
Camera bolt
interface with
locking nut
Iron plate
half of 5 lb
magnetic
soft-dock
Grounding
pads
Lubricated V-surfaces
on MBS mast bracket

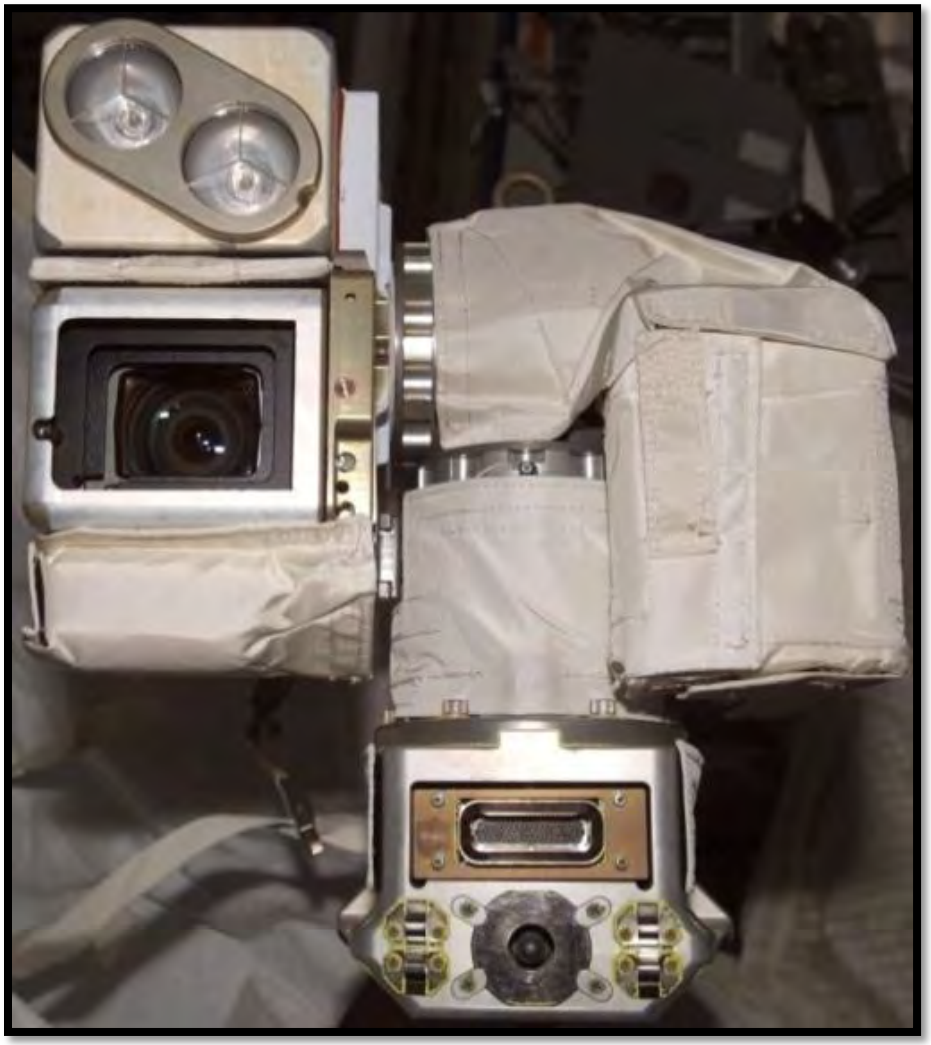



Stay-out zone due to thermal radiator surface ("silver Teflon" film) as well as camera lens surface and EVA touch temperature violations when camera lights are ON
Tether Point
Pan & Tilt Unit
Velcro Tab & OSE Blanket Ground
Lights
Camera Lens
Micro Fixture
Pan & Tilt Unit Caging Mechanism
Mate/Demate Connector
Soft Dock Device
Grounding Tabs
Alignment Guides & Mounting Interface (Both Sides)
Stay out zone due to presence of electrical connector pins, grounding tabs, and lubricated surfaces.
Tether Point
IMS Label
Target
Mate/Demate Visual Cue
Mate/Demate Drive
Micro Fixture
Sensitive area due to need to protect SPDM target painted surfaces.
Thermal Blanket
Visual Alignment Cues

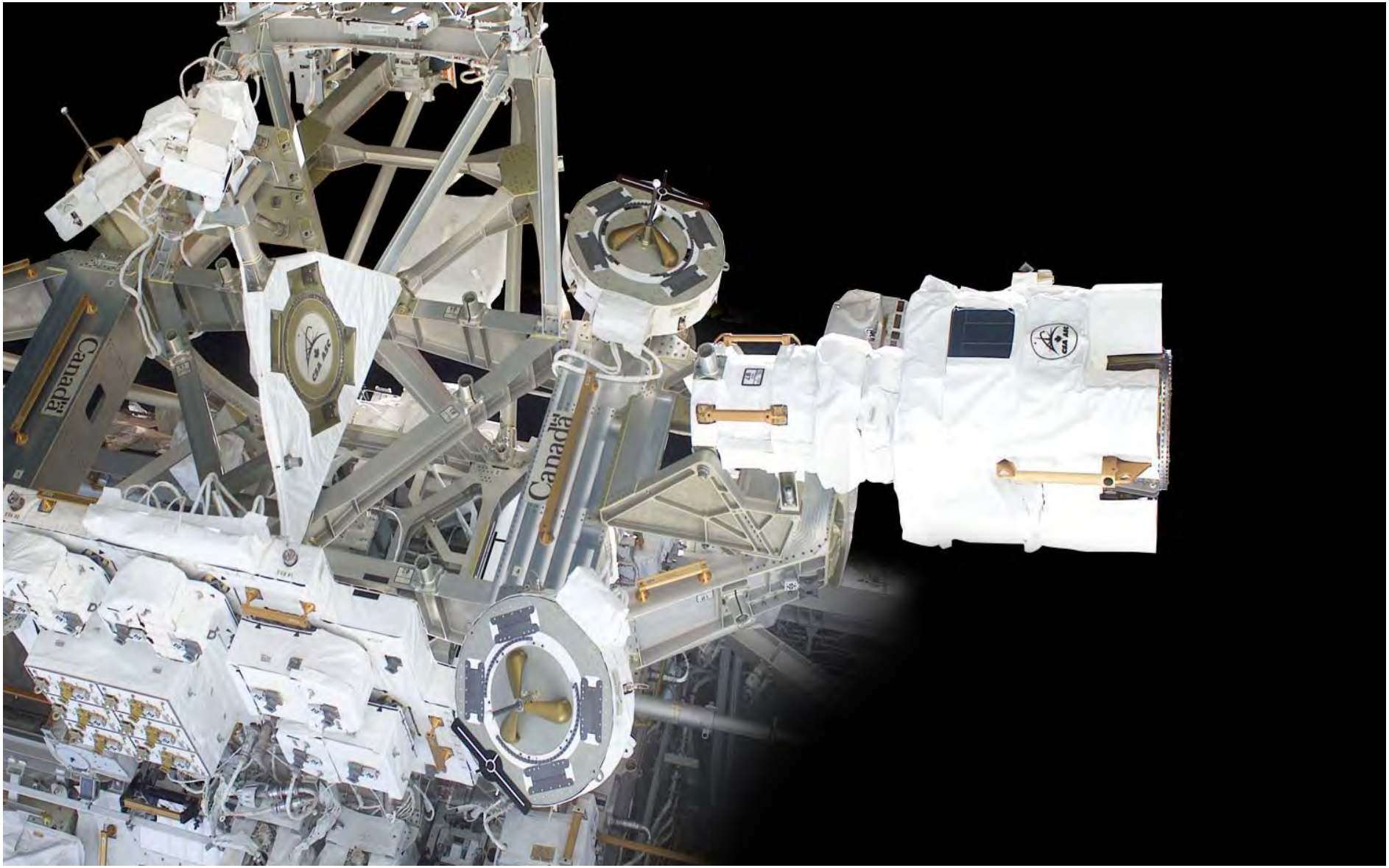




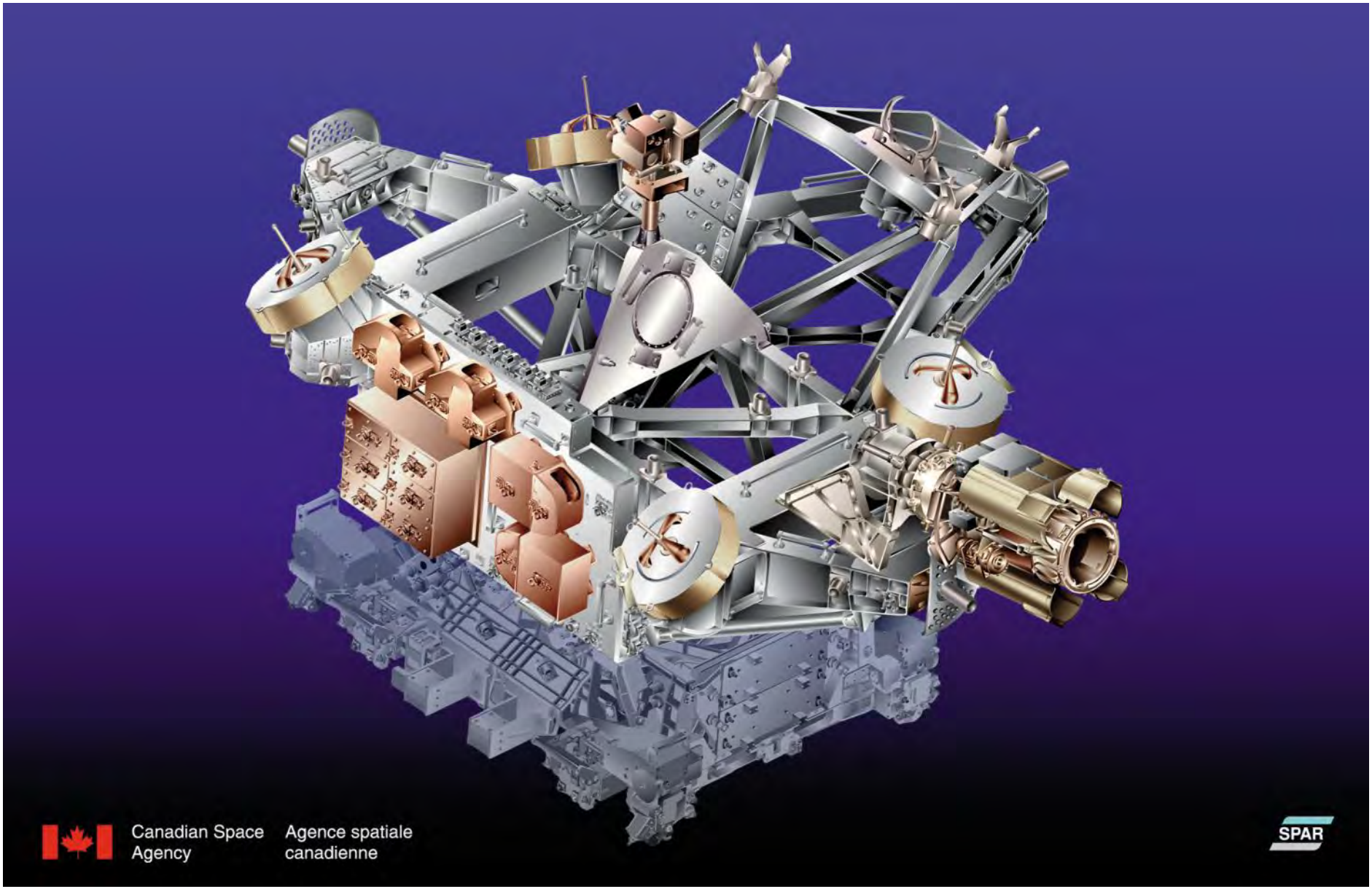


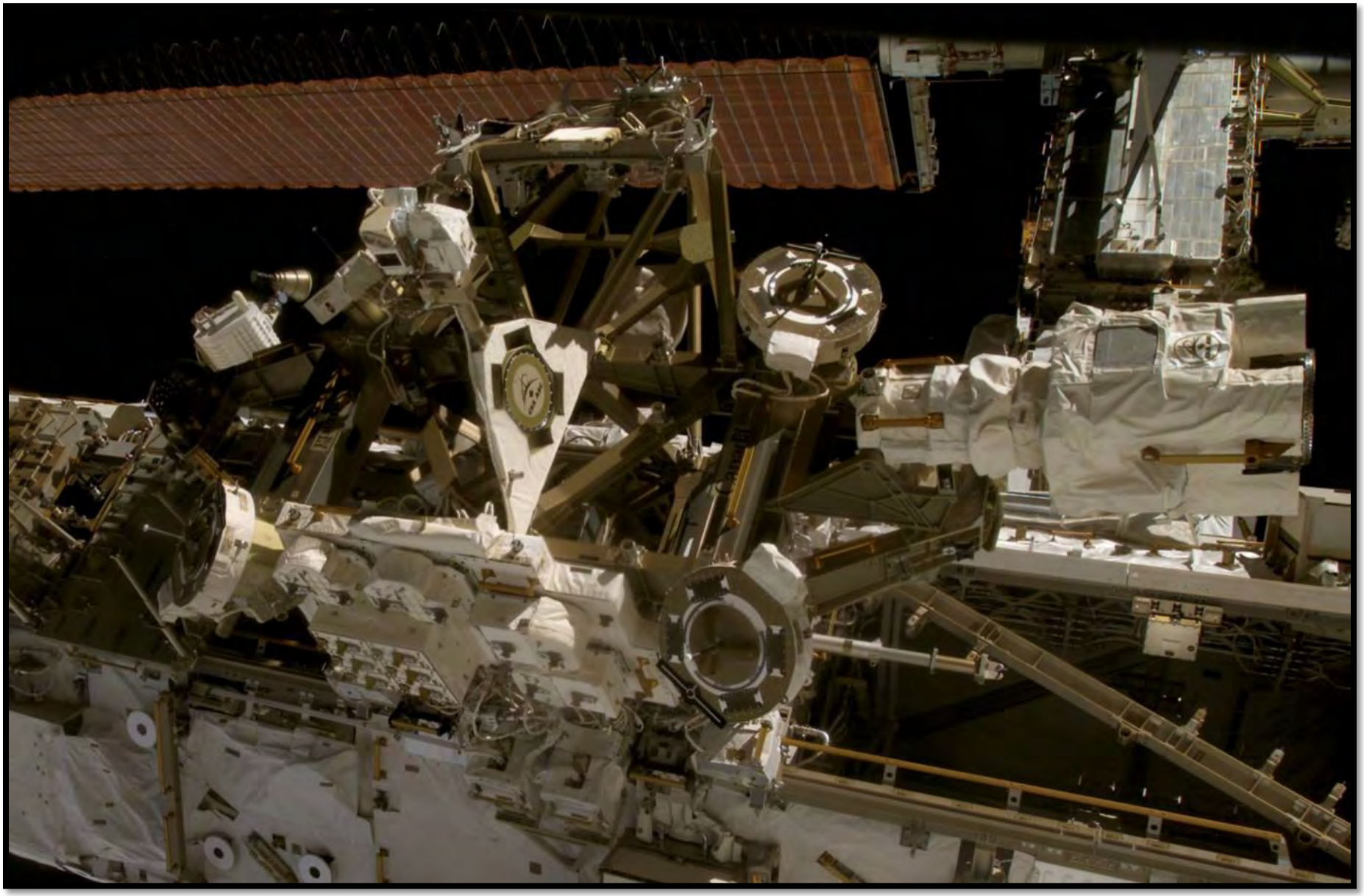


S129E010360


Canada
Canada

US EVA 22 TASK DATA – CLPA





S131E009745

US EVA 22 TASK DATA – Z1 Y-BYPASS JUMPER

Estimated Task Duration:

	With RMS	Without RMS
One EV	N/A	01:00

Tools:

EV1
GTEC
Small trash bag (loose cable ties)

Restraints:

HR	WIF	APFR Setting
IAPFR	N/A	N/A

EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
W05 P1	N/A	N/A	N/A	25	Power
W05 P2	N/A	N/A	N/A	25	Power
W10 P1	Z1005 J1	Z1005 J3	N/A	25	Power
W10 P2	SPDAZ1-4B P2	HR 6019	N/A	25	Power
Jumper005 P1	N/A	SPDAZ1-4B J1	N/A	25	Power
Jumper005 P2	N/A	Z1005 J2	N/A	25	Power
Jumper005 P3	N/A	Z1005 J1	N/A	25	Power
Jumper006 P1	N/A	HR 6019	N/A	25	Power
Jumper006 P2	N/A	Z1006 J2	N/A	25	Power
Jumper006 P3	N/A	Z1006 J3	N/A	25	Power

US EVA 22 TASK DATA – Z1 Y-BYPASS JUMPER

Warning:
1. Do not demate Cable W05 Connectors P1 or P2 as these connections are not inhibitied

Caution:
1. Avoid contact with PCU cathode and HCA ports (Z1)

Note:
1. Prior to Z1 Y-Bypass Jumper (R081661-1) installation, the N1 Isolation Cable (W5210-1) must be installed to prevent power back-flow to Z1 (OCAD)—completed
2. Task inhibits take down several other pieces of ISS hardware: FGB ARCU 53, SGANT 2, PCU 2, CMG 4
3. FPP booties may be required to cover unmated connectors due to touch temperature constraints – per EV&CS
4. Sockets are always on the powered side here. The patch panels have sockets and the P3 and P2 connectors on the Y side of the Jumper have pins, while the P1 side of the Jumper has sockets with the J1 connector on the SPDA having pins. - EPS
5. The Y side connectors of the jumper are interchangeable with each other. It does not matter if J3 or J2 gets connected to P1 or P2. But the jumpers are NOT interchangeable with each other. - EPS
6. All the caps that fit on one plug (P side on the cables) will fit on all the Ps. Same with the jacks (J sides). – EPS
7. Z1 Patch Panel Z1-006 caused label J3 is missing– EV&CS
8. Due to potential for high temperatures on the Z1 unmated connectors, the connectors must be insulated by at least 3 layers of the bootie material, requiring 2 booties
9. Z1 Aux Bag, flap opens zenith
10. J3 on the patch panels are un-powered receptacles – EV&CS
11. Due to an orbiter loads issue red plastice cable ties (similar to those used to secure cables on electronic equipment in cars) were added to several Z1 harnesses. The cable ties are not required for on orbit operations and they can be removed if they are still present (very suseptable to AO). The will likely break if the cable is moved much. – EV&CS
12. W10 has a p-clamp near the diagonal handrail. W05 has a p-clamp after the TA-clamp coming from the P2 end. – EV&CS
13. Missing label on zenith X2 J3 Patch Panel jack
14. Wire Tie and GTEC config has been approved – MER Tools and EV&CS
15. No IFIs on this hardware – EV&CS

Timeline Considerations:
1. System can be re-powered if all three legs of the jumper are properly installed or capped. The jumper cannot be re-energized with an uncapped leg. Capping is also required within 90days to prevent degredation of the materials inside the connector. – EPS

US EVA 22 TASK DATA – Z1 Y-BYPASS JUMPER

Packing Procedures of Z1 Jumpers:

i. Remove all protective coverings from the Y-bypass jumper cable, item d. Verify the part number and the descriptor "3B" on the tag.

j. Coil the cable approx 9-12 inch diameter such that all three connectors point in the same direction and that the faces of the connectors roughly align, i.e., the lengths are about the same. Insert the coiled cable in to bag cavity containing the retaining strap labeled "3B". Ensure that each connector is individually housed inside a pocket at the bottom of the bag.

k. Feed the retaining strap under the coil, through the middle of the coil and back to the fixed end. Secure the cable in place by pressing the Velcro patches together.

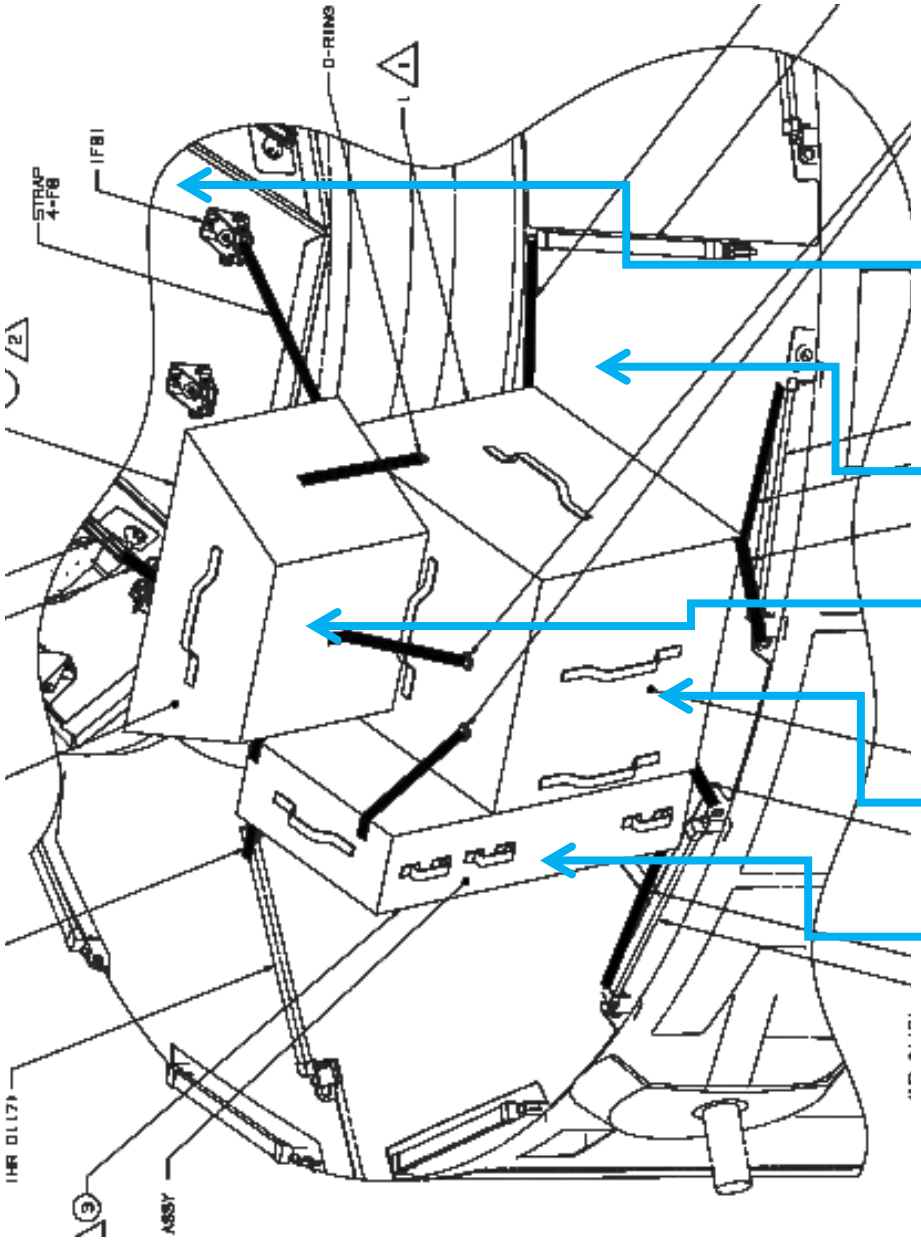
l. Repeat steps h through j for the other cable, item e, and install in the "4B" partition.

m. Verify there is no debris or foreign object within the bag.

n. Perform a final check of all Velcro contact patches, making sure they are flat, straight, and fully engaged.

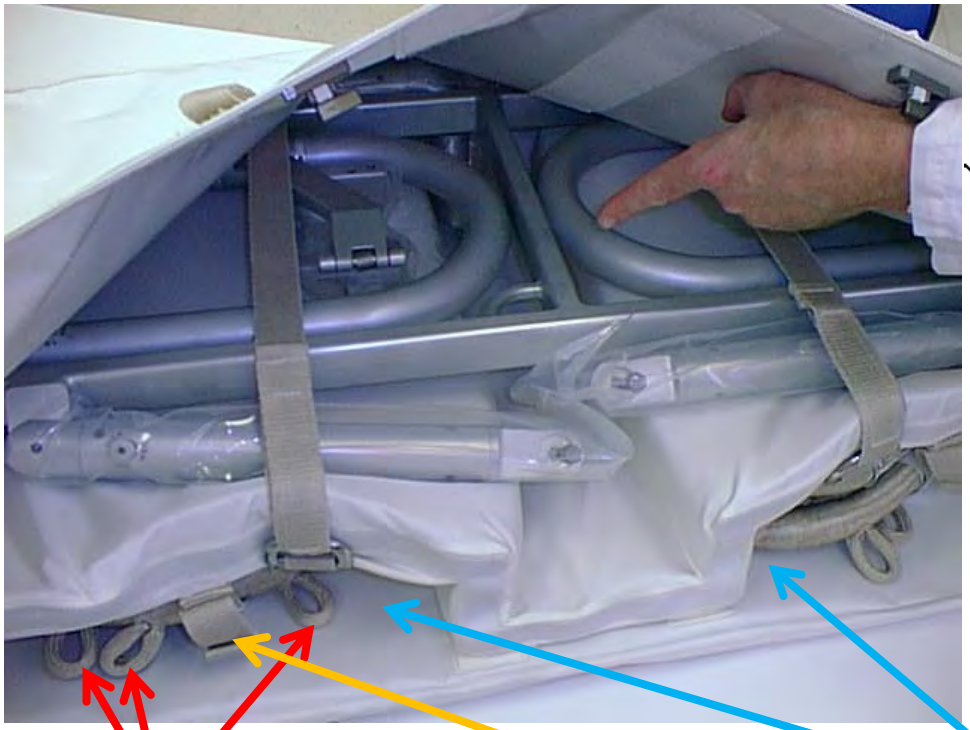
o. Verify label is properly positioned for viewing through hole in door panel and is secure within its pocket.

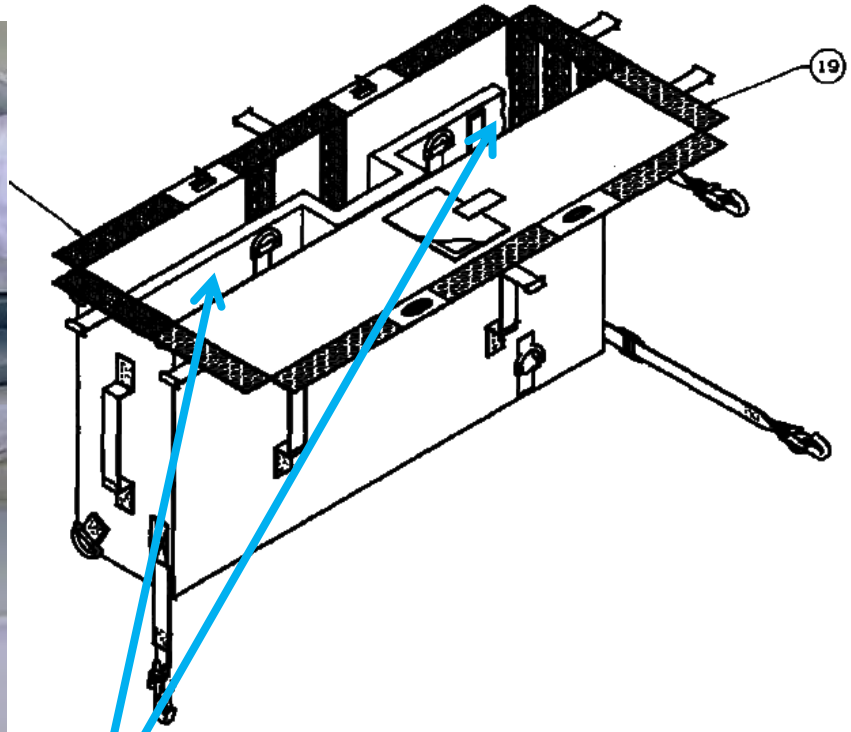
p. Close door of bag. Secure ¼ turn fasteners and all three edge flaps of door opening.


PMA1
NOD1
OHTS Bag
NOD Bag
AUX Bag #1 – ¼ -turns on nadir side, hinge is zenith and, flap opens zenith

US EVA 22 TASK DATA – Z1 Y-BYPASS JUMPER

AUX Bag #1 config



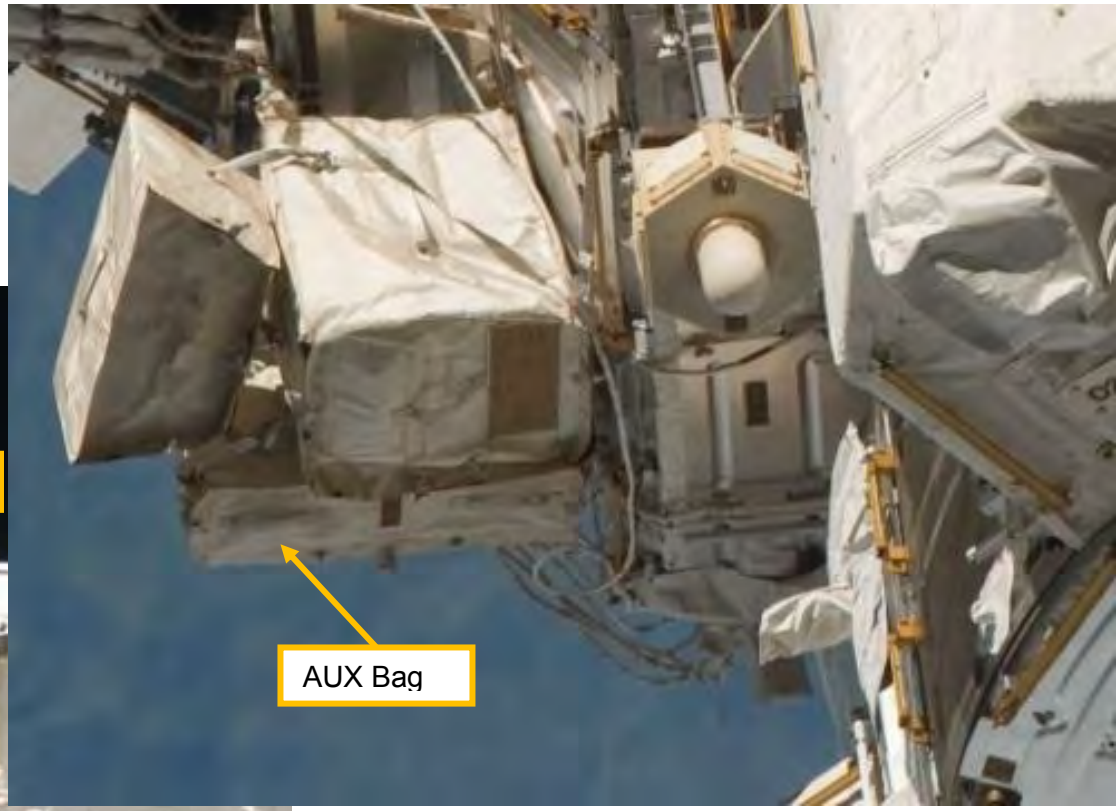


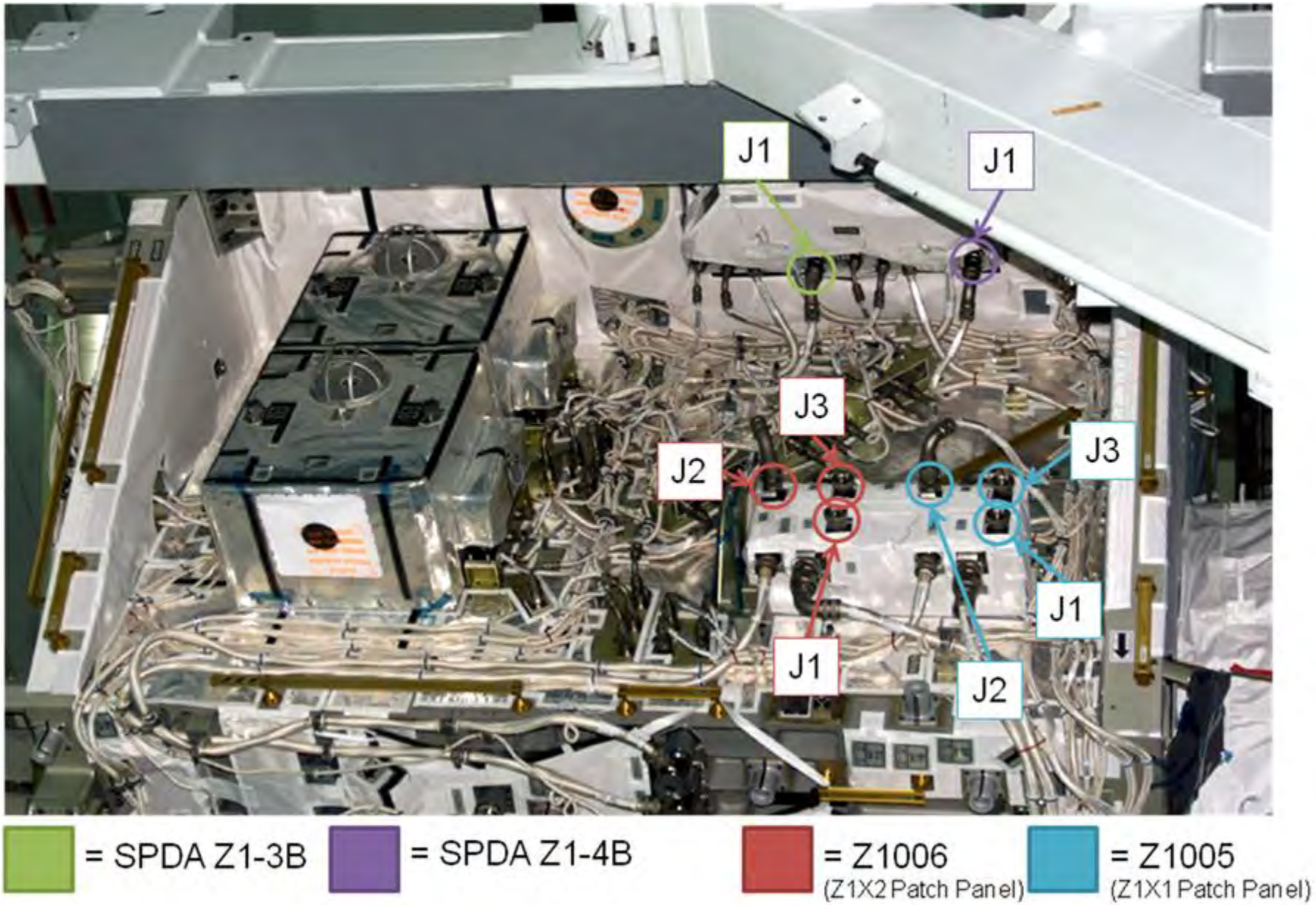
3 tether points per jumper

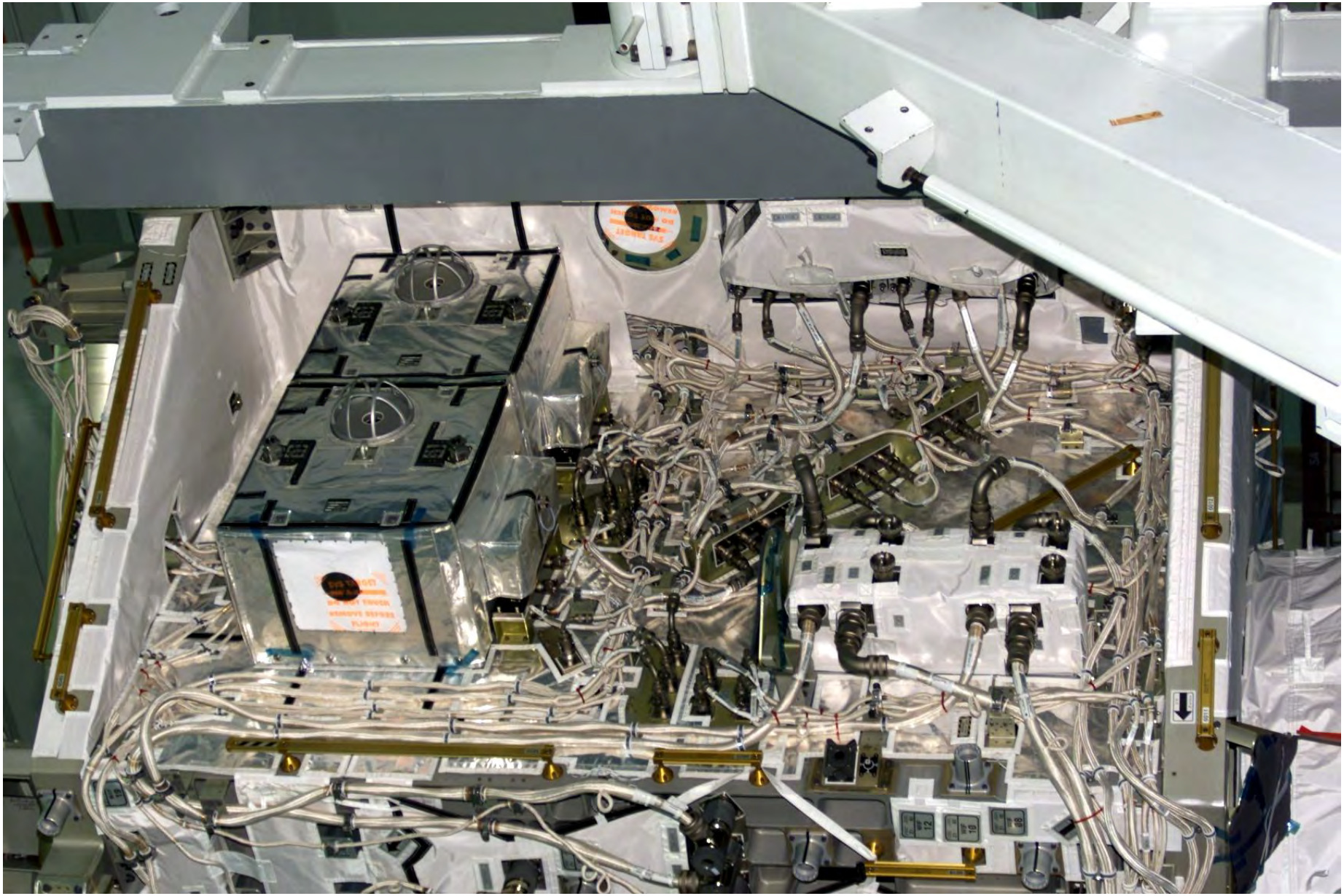
single Velcro strap restraining jumper

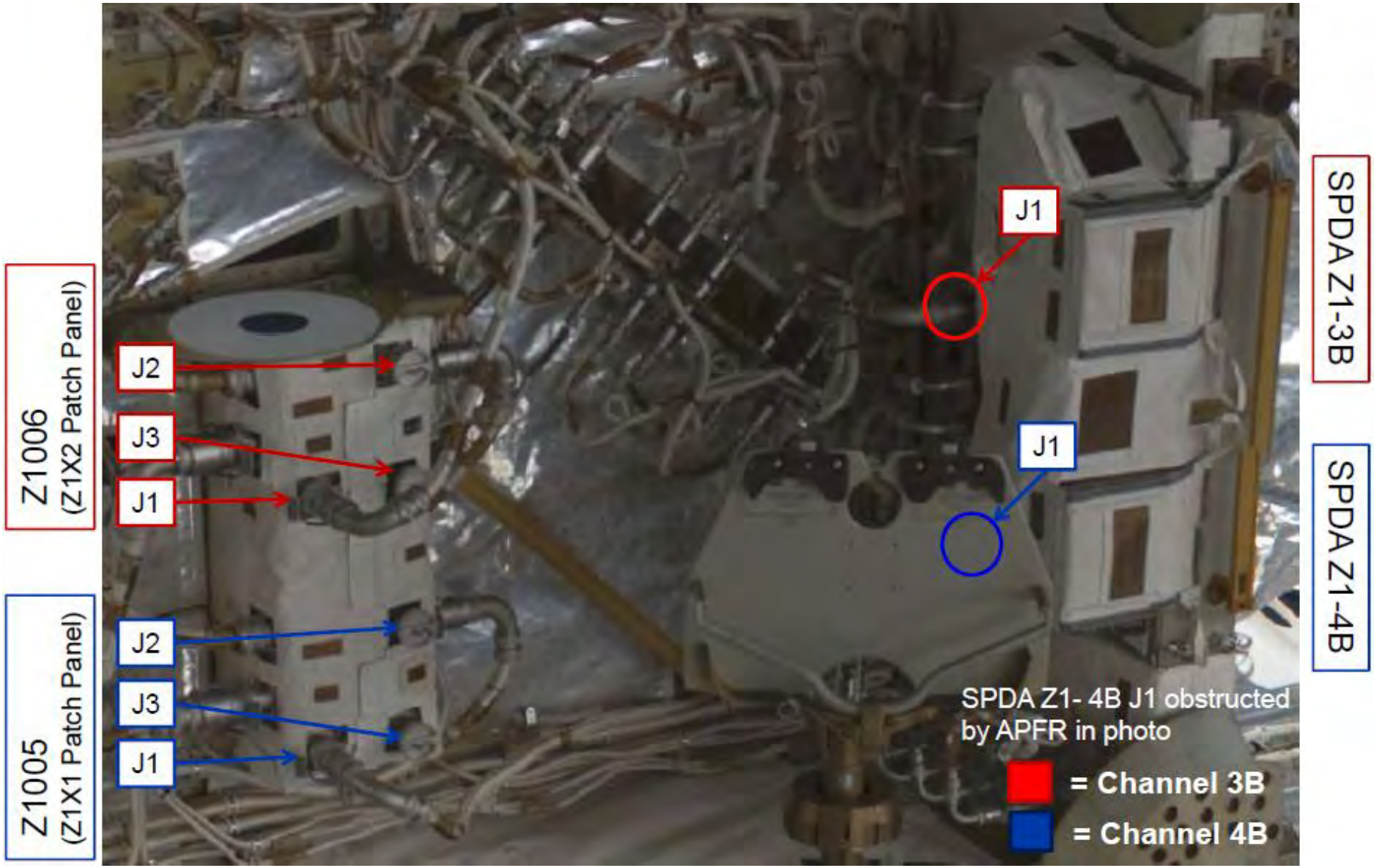
1 pouch for each jumper


AUX Bag

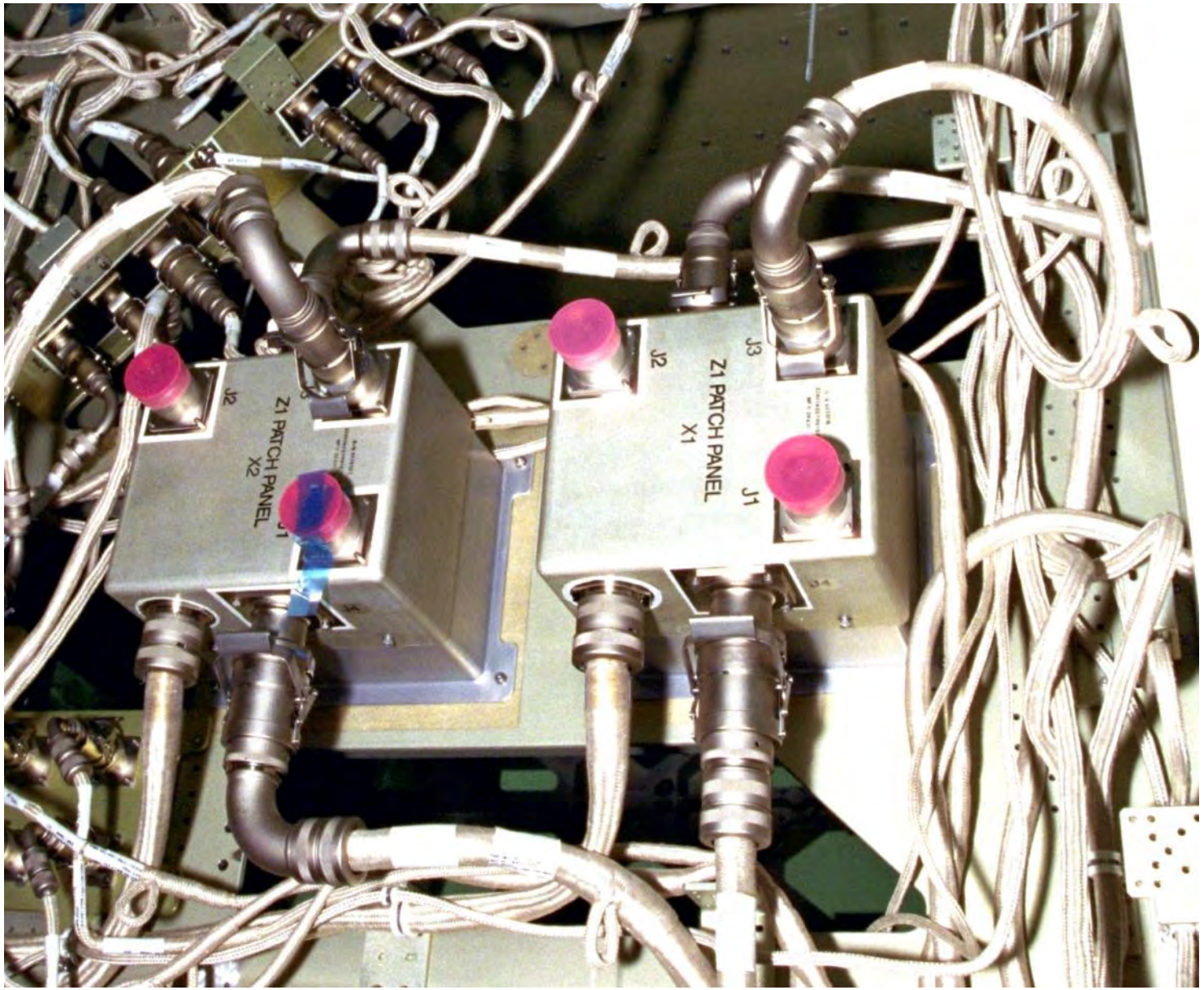

AUX Bag

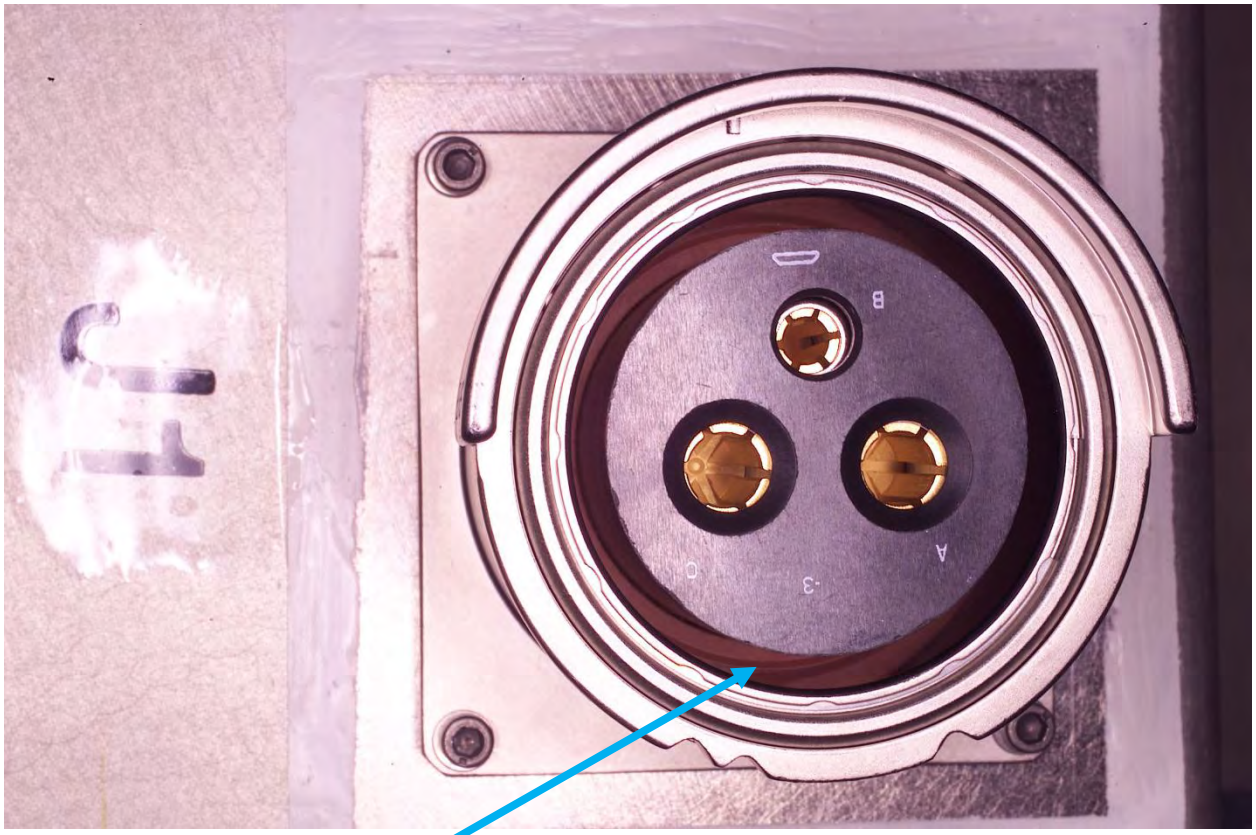

J1
J1
J3
J2
J3
J1
J1
J2
= SPDA Z1-3B
= SPDA Z1-4B
= Z1006
(Z1X2 Patch Panel)
= Z1005
(Z1X1 Patch Panel)



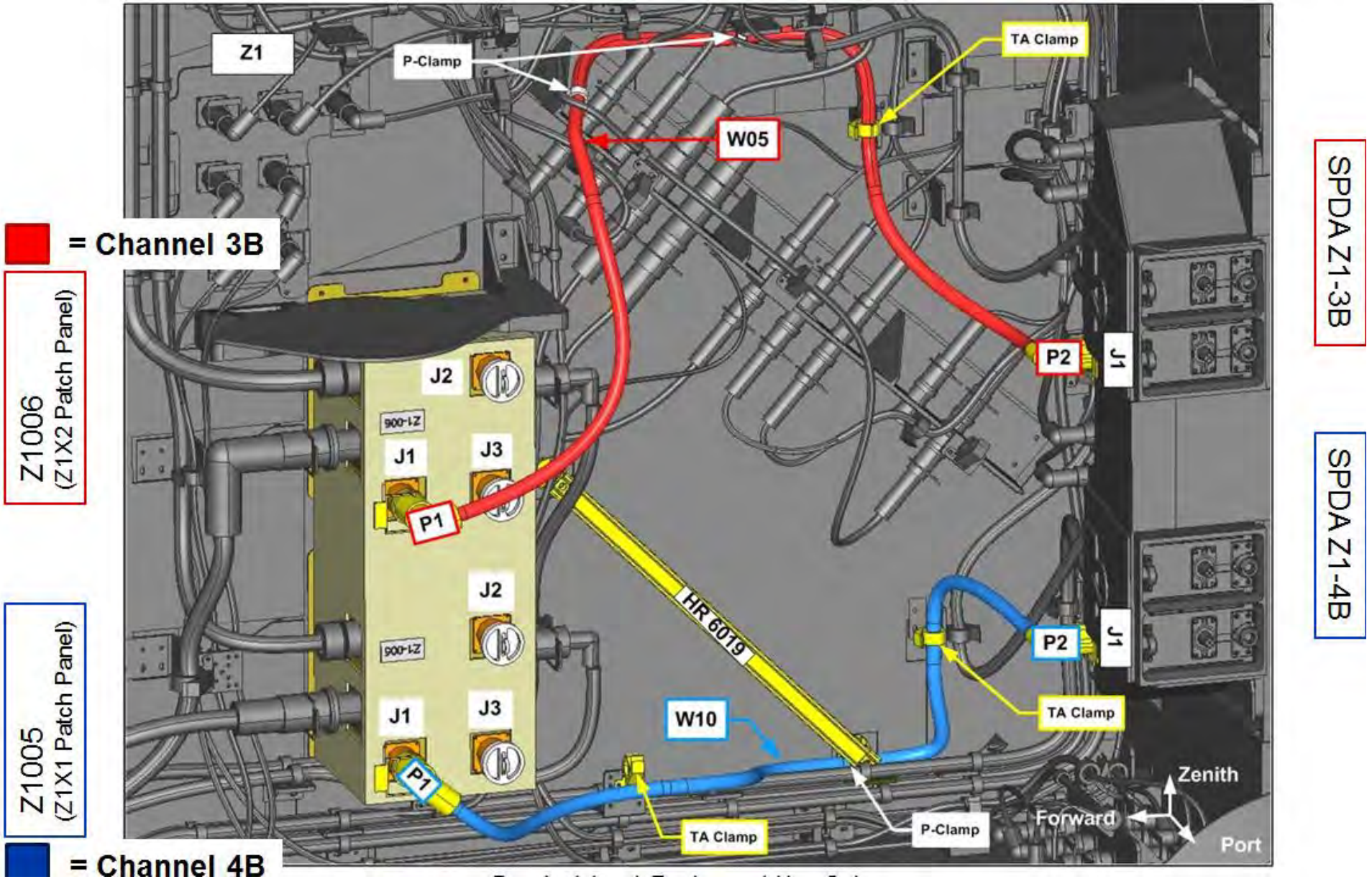

Z1006
(Z1X2 Patch Panel)
J2
J3
J1
Z1005
(Z1X1 Patch Panel)
J2
J3
J1
J1
J1
SPDA Z1-3B
SPDA Z1-4B
SPDA Z1- 4B J1 obstructed by APFR in photo
= Channel 3B
= Channel 4B

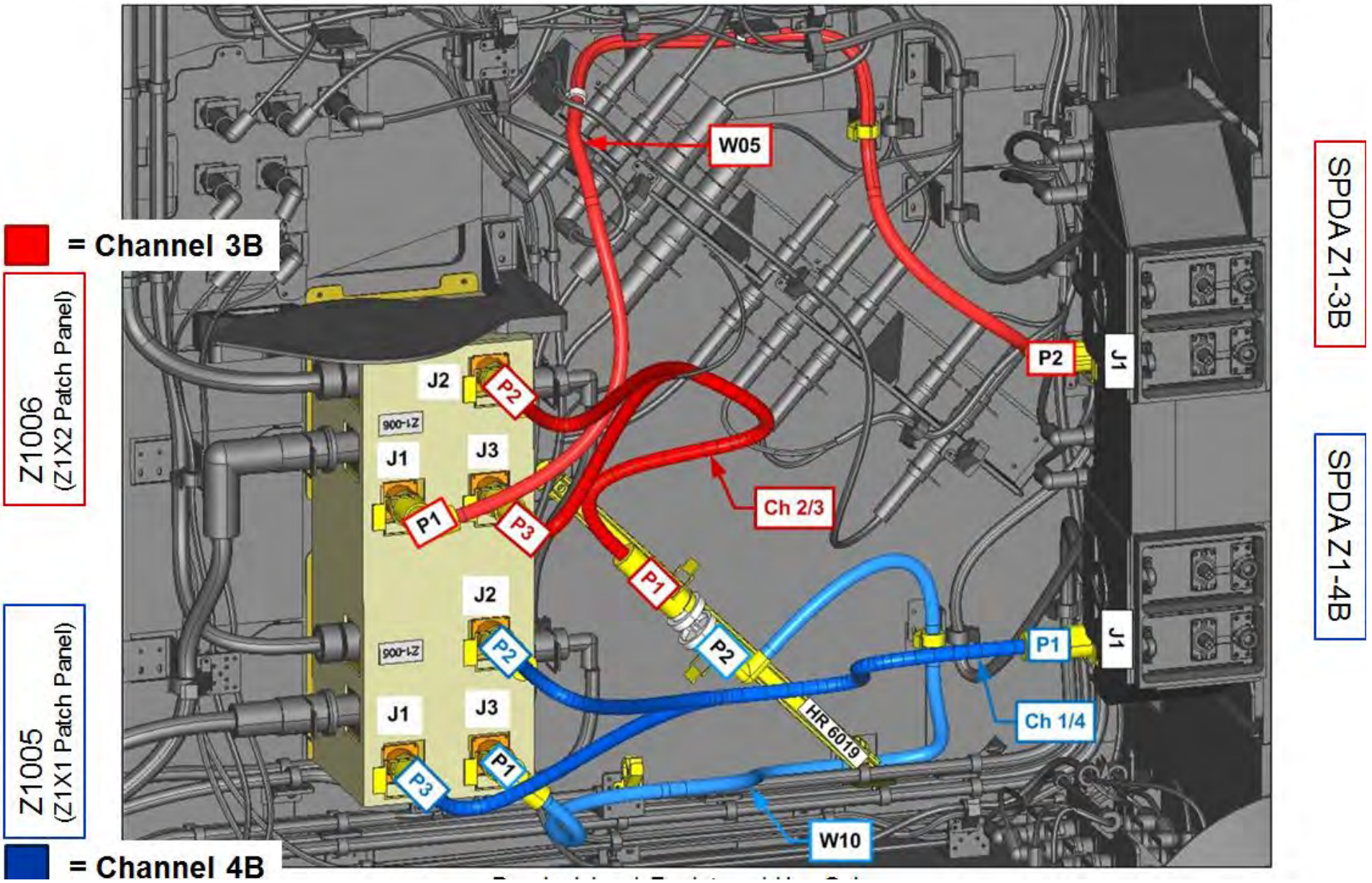
US EVA 22 TASK DATA – Z1 Y-BYPASS JUMPER

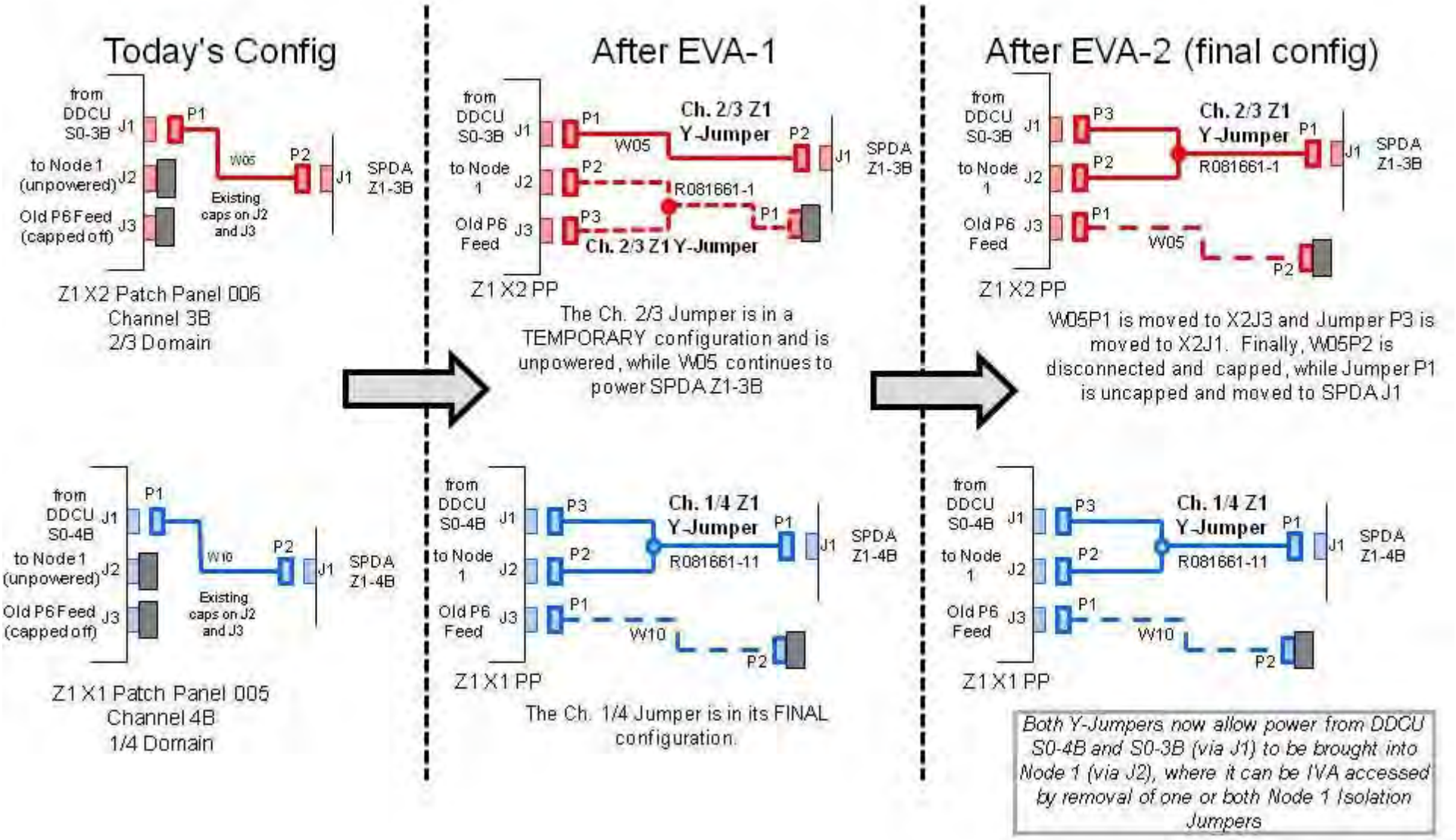


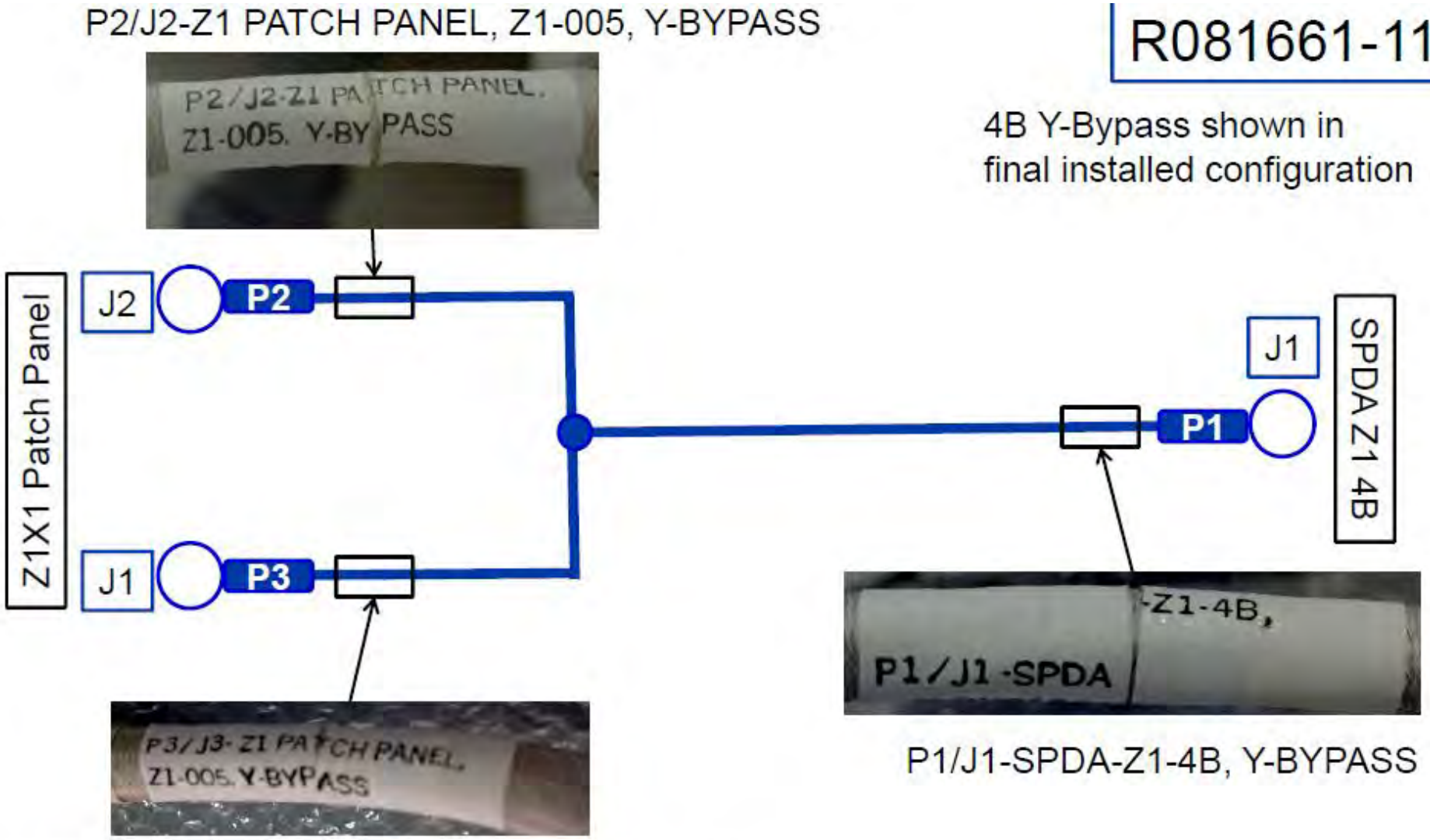


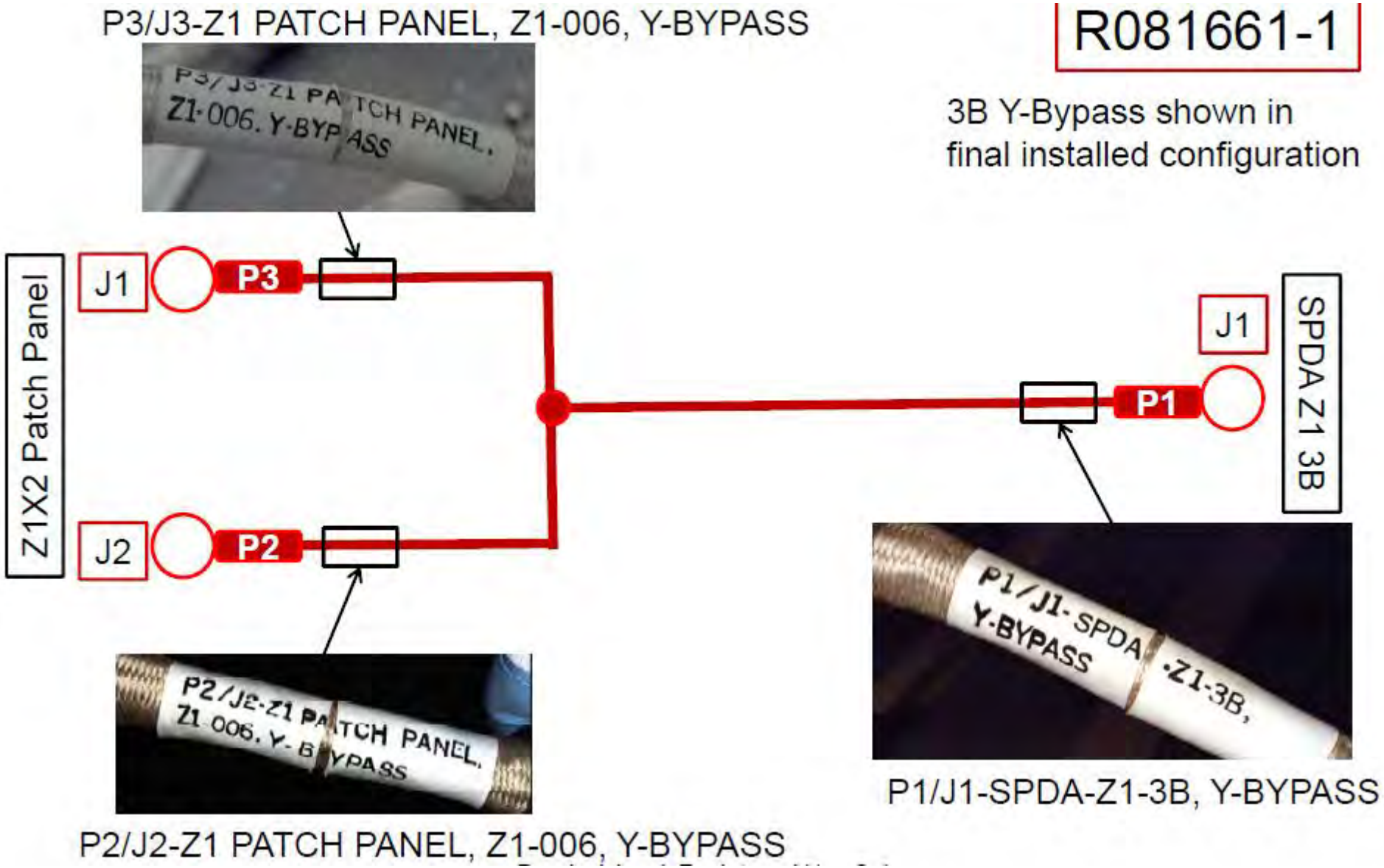
O-Ring shown inside receptacle around sockets.
This is a contamination protection O-ring and similar O-rings have liberated on previous assembly missions.


Z1
P-Clamp
TA Clamp
W05
= Channel 3B
Z1006
(Z1X2 Patch Panel)
J2
J1
J3
P1
P2
J1
SPDA Z1-3B
HR 6019
J2
J1
J3
P1
P2
J1
SPDA Z1-4B
W10
TA Clamp
Z1005
(Z1X1 Patch Panel)
= Channel 4B
TA Clamp
P-Clamp
Zenith
Forward
Port


= Channel 3B
Z1006
(Z1X2 Patch Panel)
Z1005
(Z1X1 Patch Panel)
= Channel 4B
SPDA Z1-3B
SPDA Z1-4B
W05
W10
Ch 2/3
Ch 1/4
HR 6019
J1
J2
J3
P1
P2
P3


Today's Config
from DDCU S0-3B J1
to Node 1 (unpowered) J2
Old P6 Feed (capped off) J3
P1
W05
P2
J1
SPDA Z1-3B
Existing caps on J2 and J3
Z1 X2 Patch Panel 006
Channel 3B
2/3 Domain
from DDCU S0-4B J1
to Node 1 (unpowered) J2
Old P6 Feed (capped off) J3
P1
W10
P2
J1
SPDA Z1-4B
Existing caps on J2 and J3
Z1 X1 Patch Panel 005
Channel 4B
1/4 Domain
After EVA-1
from DDCU S0-3B J1
to Node 1 J2
Old P6 Feed J3
P1
W05
Ch. 2/3 Z1 Y-Jumper
P2
J1
SPDA Z1-3B
P2
R081661-1
P3
P1
Ch. 2/3 Z1 Y-Jumper
Z1 X2 PP
The Ch. 2/3 Jumper is in a TEMPORARY configuration and is unpowered, while W05 continues to power SPDA Z1-3B
from DDCU S0-4B J1
to Node 1 J2
Old P6 Feed J3
P3
Ch. 1/4 Z1 Y-Jumper
P1
J1
SPDA Z1-4B
P2
R081661-11
P1
W10
P2
Z1 X1 PP
The Ch. 1/4 Jumper is in its FINAL configuration.
After EVA-2 (final config)
from DDCU S0-3B J1
to Node 1 J2
Old P6 Feed J3
P3
Ch. 2/3 Z1 Y-Jumper
P1
J1
SPDA Z1-3B
P2
R081661-1
P1
W05
P2
Z1 X2 PP
W05P1 is moved to X2J3 and Jumper P3 is moved to X2J1. Finally, W05P2 is disconnected and capped, while Jumper P1 is uncapped and moved to SPDA J1
from DDCU S0-4B J1
to Node 1 J2
Old P6 Feed J3
P3
Ch. 1/4 Z1 Y-Jumper
P1
J1
SPDA Z1-4B
P2
R081661-11
P1
W10
P2
Z1 X1 PP
Both Y-Jumpers now allow power from DDCU S0-4B and S0-3B (via J1) to be brought into Node 1 (via J2), where it can be IVA accessed by removal of one or both Node 1 Isolation Jumpers


P2/J2-Z1 PATCH PANEL, Z1-005, Y-BYPASS
R081661-11
4B Y-Bypass shown in final installed configuration
P2/J2-Z1 PATCH PANEL, Z1-005, Y-BYPASS
Z1X1 Patch Panel
J2
P2
J1
P3
J1
P1
SPDA Z1 4B
P1/J1-SPDA-Z1-4B, Y-BYPASS
P3/J3-Z1 PATCH PANEL, Z1-005, Y-BYPASS


P3/J3-Z1 PATCH PANEL, Z1-006, Y-BYPASS
R081661-1
3B Y-Bypass shown in final installed configuration
P3/J3-Z1 PATCH PANEL, Z1-006, Y-BYPASS
Z1X2 Patch Panel
J1
P3
J2
P2
J1
P1
SPDA Z1 3B
P1/J1-SPDA-Z1-3B, Y-BYPASS
P2/J2-Z1 PATCH PANEL, Z1-006, Y-BYPASS

US EVA 22 TASK DATA – Z1 Y-BYPASS JUMPER

Connector Polarization in Red

Channel 3B (2/3 Domain) Powers SPDA Z1-3B(Zenith Worksite on Z1)

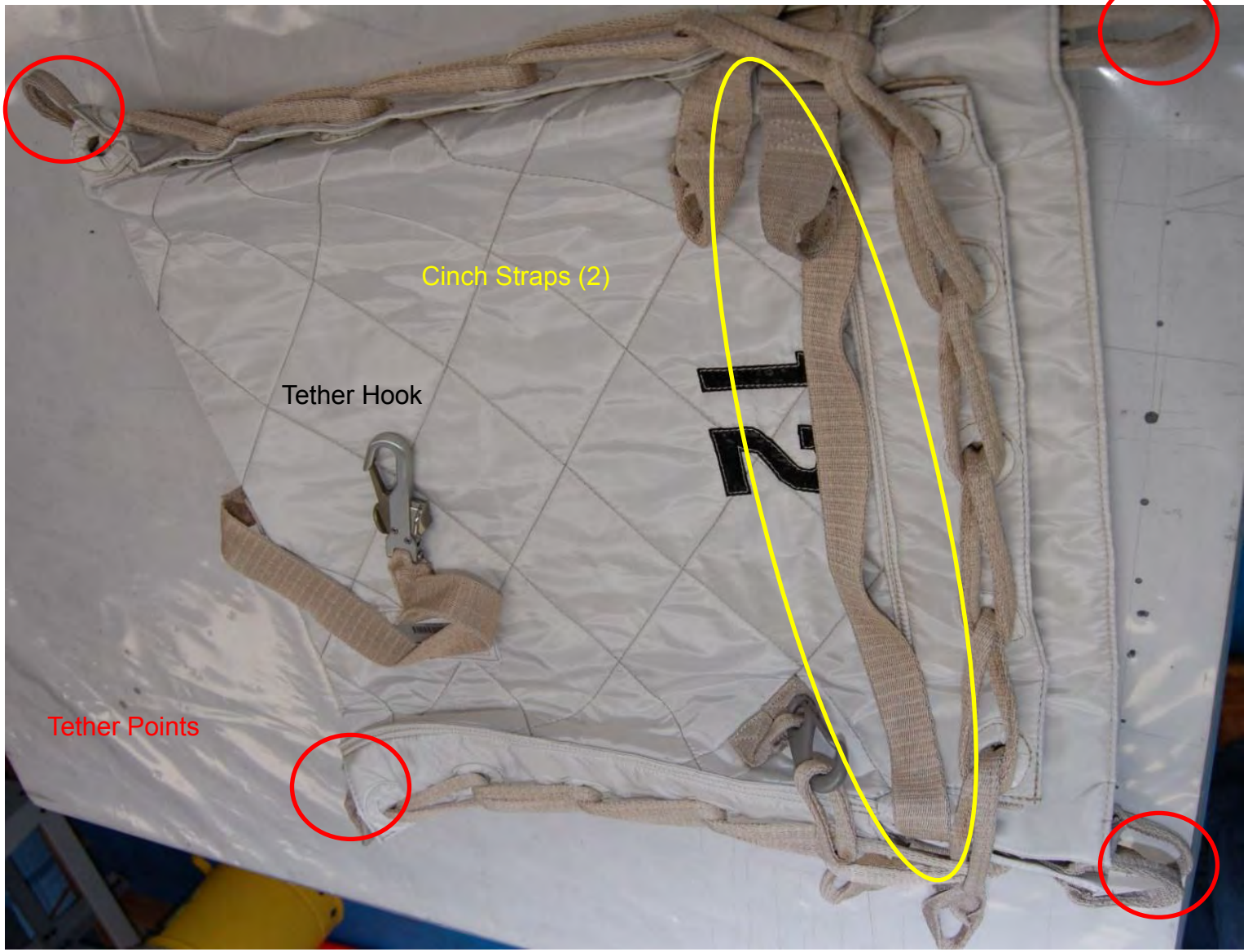
Patch Panel Z1-0006 R076336-11	J1 NZGL00T2525LN3SH	J2 NZGL00T2525LN3SH	J3 NZGL00T2525LN3SH
R076304 (W05)	P1 NZGL06G2525LN3PH	P2 NZGL06G2525LN3SN	
Y-Jumper Channel 2/3 R081661-1	P1 NZGL06G2525LN3SN	P2 NZGL06G2525LN3PH	P3 NZGL06G2525LN3PH
SPDA 1F97006-1	J1 NZGL00T2525LN3PN		

Channel 4B (1/4 Domain) Powers SPDA Z1-4B (Nadir Worksite on Z1)

Patch Panel Z1-0005 R076336-1	J1 NZGL00T2525LN3SG	J2 NZGL00T2525LN3SG	J3 NZGL00T2525LN3SG
R076308 (W10)	P1 NZGL06G2525LN3PG	P2 NZGL06G2525LN3SN	
Y-Jumper Channel 1/4 R081661-11	P1 NZGL06G2525LN3SN	P2 NZGL06G2525LN3PG	P3 NZGL06G2525LN3PG
SPDA 1F97006-1	J1 NZGL00T2525LN3PN		

Note "Z1 Y-Bypass jumpers are NOT interchangeable"

US EVA 22 TASK DATA – Z1 Y-BYPASS JUMPER


Cinch Straps (2)
Tether Hook
Tether Points

US EVA 22 TASK DATA – PMA 2 COVER INSTALL

Estimated Task Duration:

	With RMS	Without RMS
One EV	N/A	00:60
Two EV	N/A	00:35

Tools:

EV1	EV2
N/A	NOD 3 Avionics Bag

Restraints:

HR	WIF	APFR Setting
N/A	N/A	N/A

ORUs:

Item	P/N	Failed s/n	Spare s/n	Mass (lb)	Dimensions (in)
PMA 2 Cover	684-022327-0001	N/A	001	38lbs	20x24x10 inches folded

Warning:

1. Stay clear of PMA fwd mating surface due to potential sharp edge with latching mechanisms – EVA Safety
2. Sharp edge potential with PMA umbilical launch restraints - exposed bolt threads – EVA Safety

Caution:

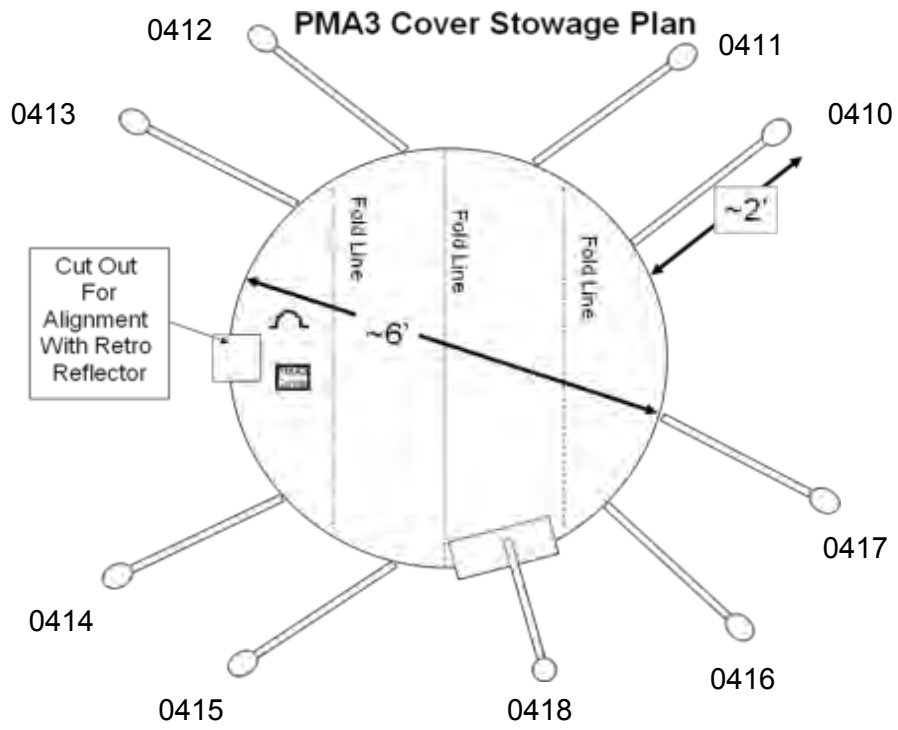
1. Avoid inadvertent contact with TCS reflector (PMA 2) – EVA Safety
2. There must be at least a ½" overlap between the PMA 2 Cover and the fwd face mating surface - PTCS

Note:

1. Diameter of cover was increased 2" and straps were increased 2" each, 4 soft good EVA handles were added in addition to the 4 EVA tether points, due to lessons learned from PMA 3 cover. – EV&CS
2. A larger size bag was chosen to transport the Cover due to its increased size and its stiffness (delta from PMA 3 cover) – MOD
3. The cover can be folded and unfolded an unlimited number of times without damaging the thermal properties of the cover – A&OSP
4. PMA 2 Cover does not have folding restrictions due to the material used for the MLI; it can be folded multiple times, over-and-over – EV&CS

Timeline Considerations:

1. Task can be completed by 1 or 2 EV, but 2 are preferred based on Lessons Learned from PMA 3 cover - MOD
2. Real-time analysis to be completed for any intermittent state. – PTCS

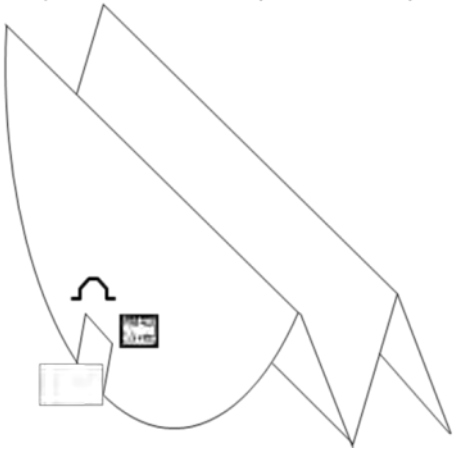


NOTE

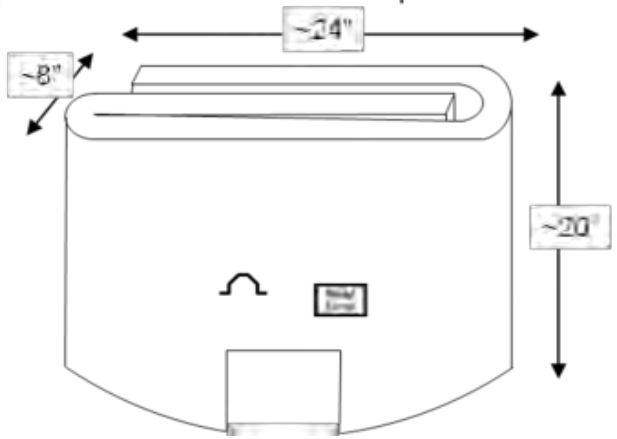
With the slightly larger PMA2 Cover than the PMA3 Cover, and using the larger NOD Avionics Bag, the PMA2 Cover might have to be folded in more times in the accordian fashion shown. There are no constraints on the number of folds. What is important is that the Cut Out and Label end up as shown. The cutout and label go in facing the bottom of the bag, so that they can flip over when removing the cover.

Recommendation to fold the cover 5 times rather than 3 to fit into the skinnier/ longer NOD3 Avionics Bag.

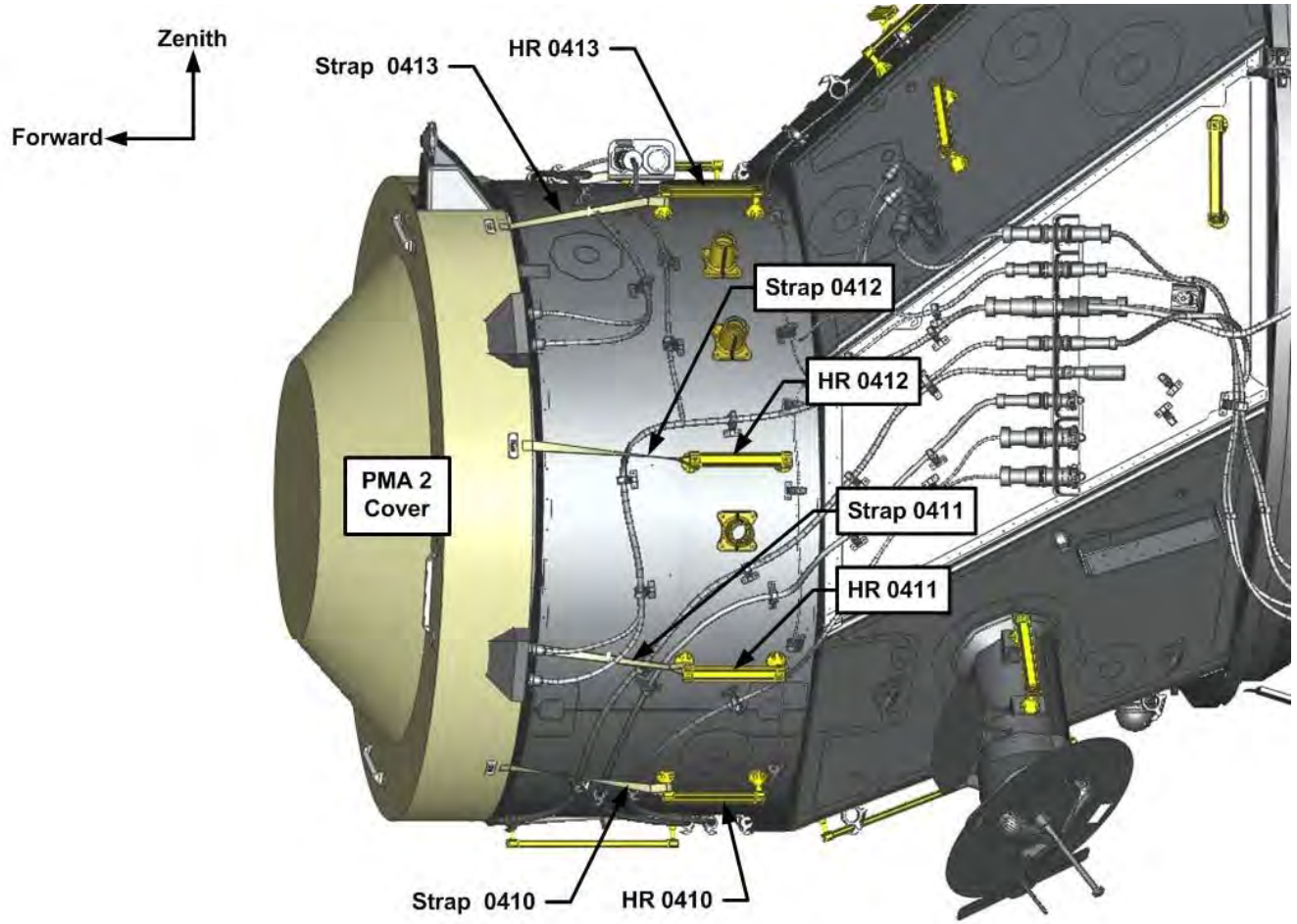
PMA3 Cover Stowage Plan
(accordion fold in quarters, straps inward)



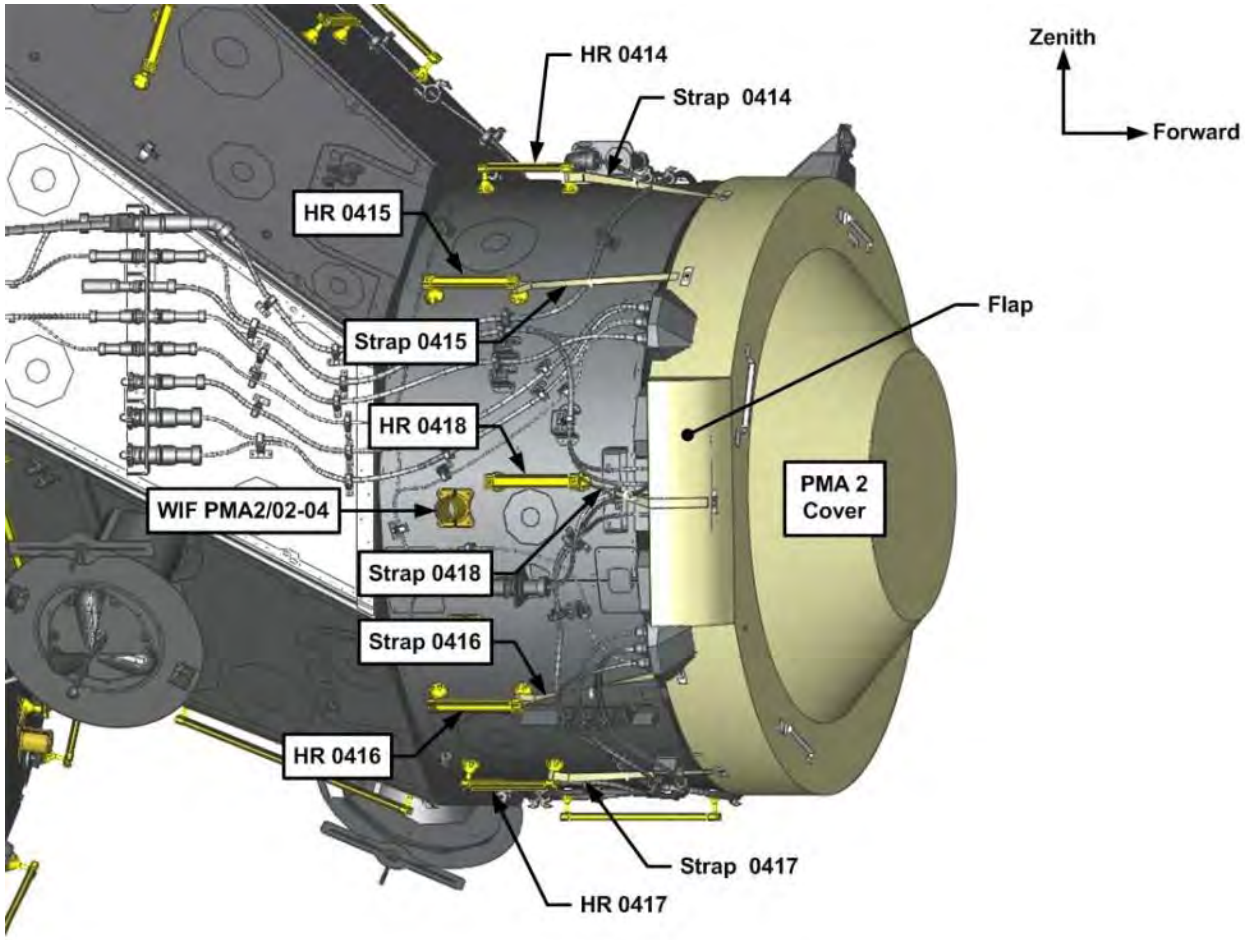
PMA3 Cover Stowage Plan
(tri-folded with cutout and tether point on front face)

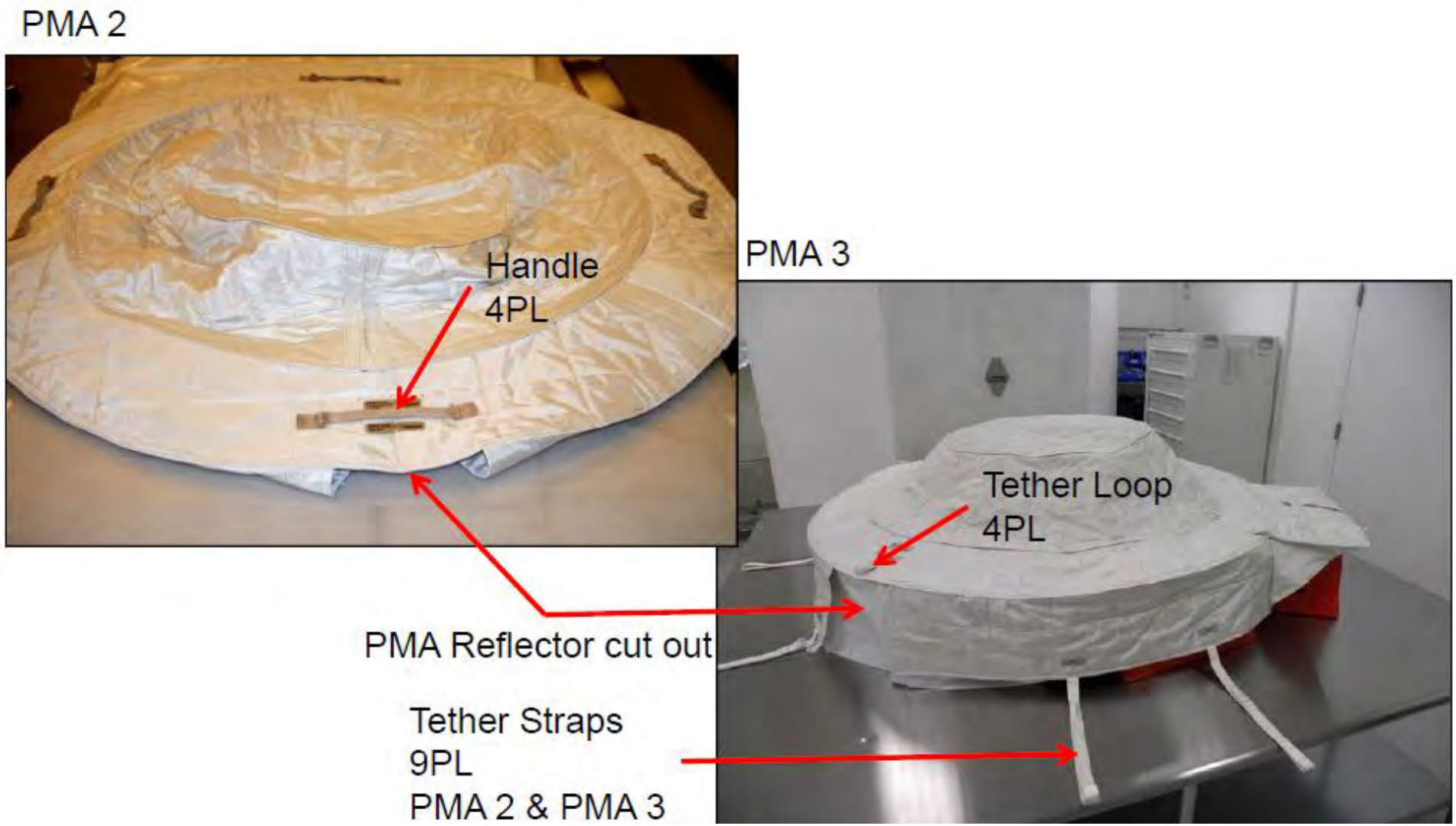


US EVA 22 TASK DATA – PMA 2 COVER INSTALL

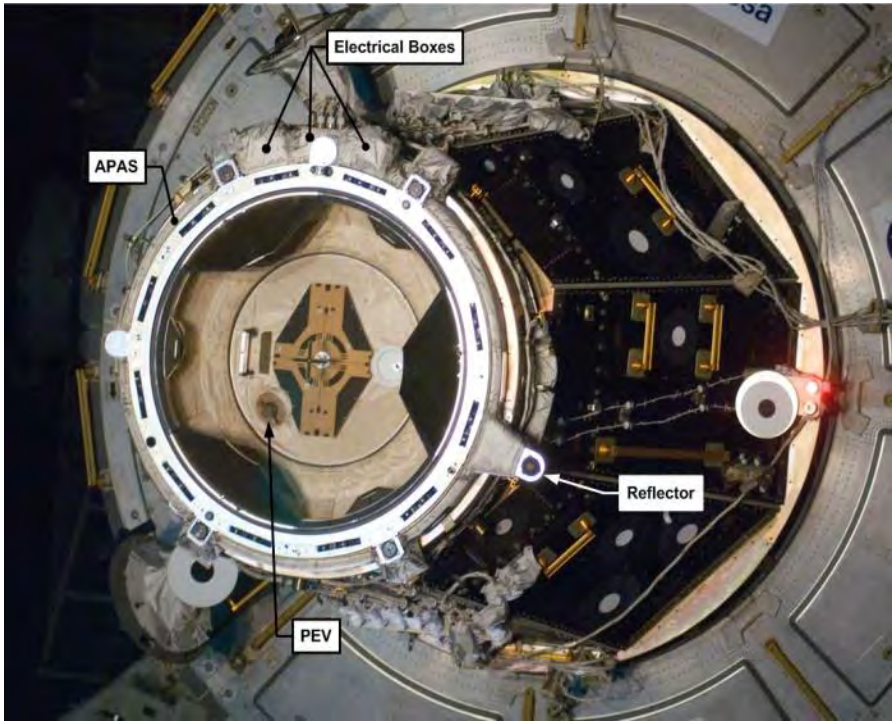


US EVA 22 TASK DATA – PMA 2 COVER INSTALL




PMA 2
Handle
4PL
PMA 3
Tether Loop
4PL
PMA Reflector cut out
Tether Straps
9PL
PMA 2 & PMA 3

US EVA 22 TASK DATA – PMA 2 COVER INSTALL



Deltas Between PMA 2 & PMA 3 Cover

	PMA 2 HTV3/PMA 3 ULF7	PMA 2	PMA 3
Top level Assembly	684-022327/684-016240	-	-
Tether Straps	684-022303/684-016241	30.0	28.0
Velcro Hook		5.0	5.0
Velcro Pile		17.5	13.5
Blanket Assy Diameter	684-022327/684-016240	66.0	64.0
Handle Assy on Blanket (QTY)	684-015295	4.0	-
Tether Loops on Blanket (QTY)	684-016240	-	4.0

Estimated Task Duration:

	With RMS	Without RMS
One EV Crew	n/a	0:45
Two EV Crew	n/a	n/a

Tools:

EV1	EV2
Ethernet cable	
Wire ties	
Fishstringer	
Tethers	

EVA Connectors:

Connector	To	Size	Function
P2	J2	21	Ethernet
J578	TBD	RSOS TBD	Ethernet

Ground photo of cable post RS connector integration.

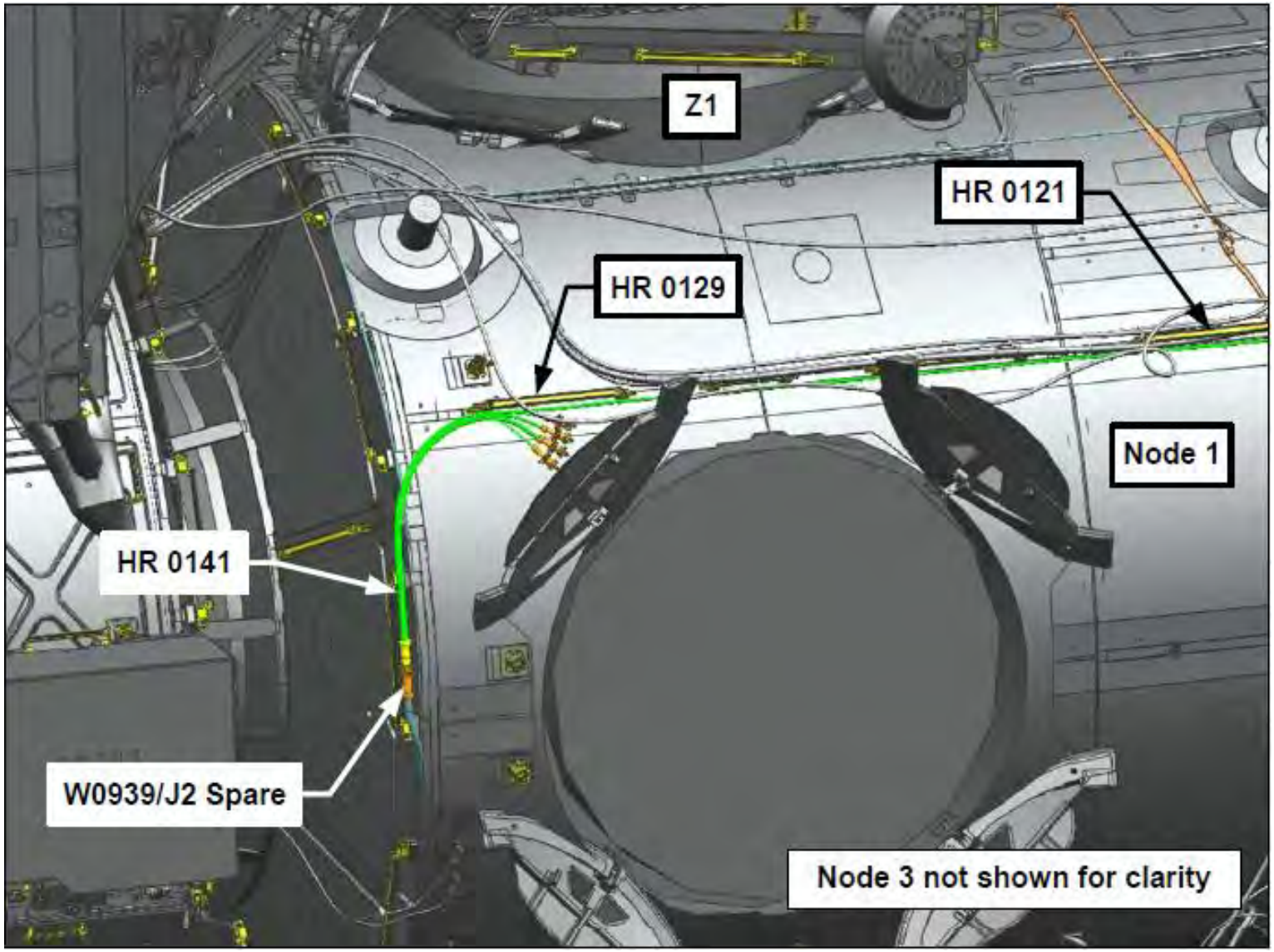
Notes:

1. The cable length is not per drawing due to the preintegration of the wire ties. Once the final length is Known post RS connector integration it will be updated In the task data.
2. US caps were added prior to shipment to Russia. VITT cannot confirm that the caps were sharp edge Inspected at this time (Nov 2012).
3. Do not release wire tie Labeled _PgTail'
4. NZGL Cap on P2 can be removed IVA

Timeline Considerations:

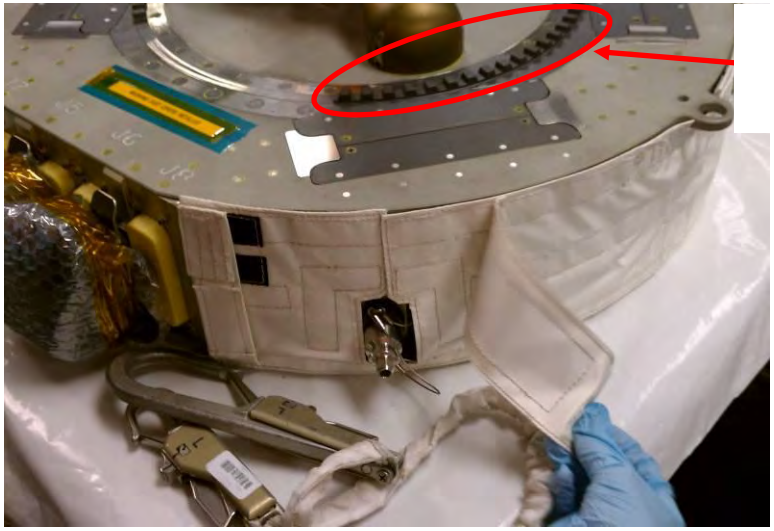
1. EVA Inspection of Node 1 HR 141 is required to verify J2 connector location (nadir or zenith stanchion)


W0939 J2
Node

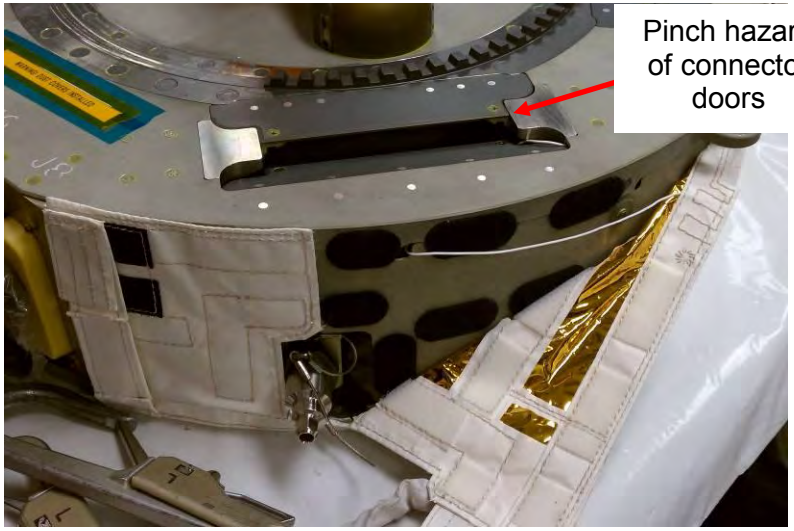

Z1
HR 0121
HR 0129
Node 1
HR 0141
W0939/J2 Spare
Node 3 not shown for clarity


PIGTAIL

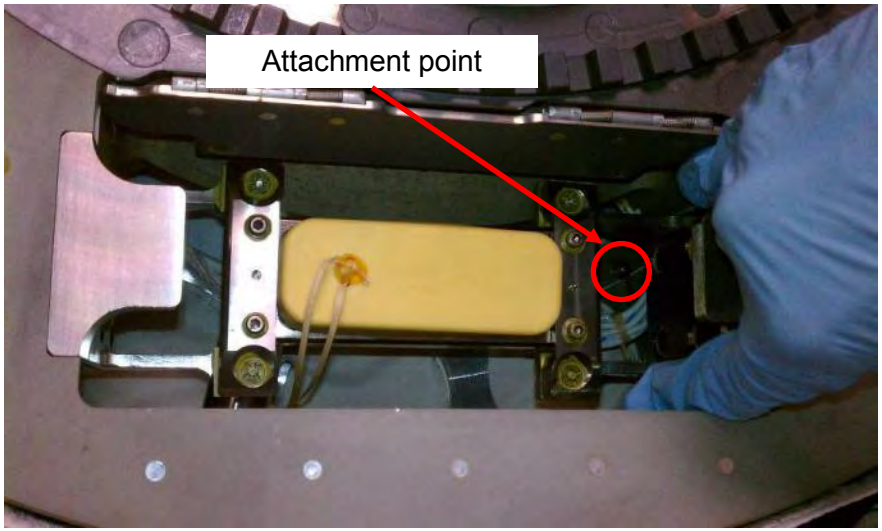

Demated
Mated



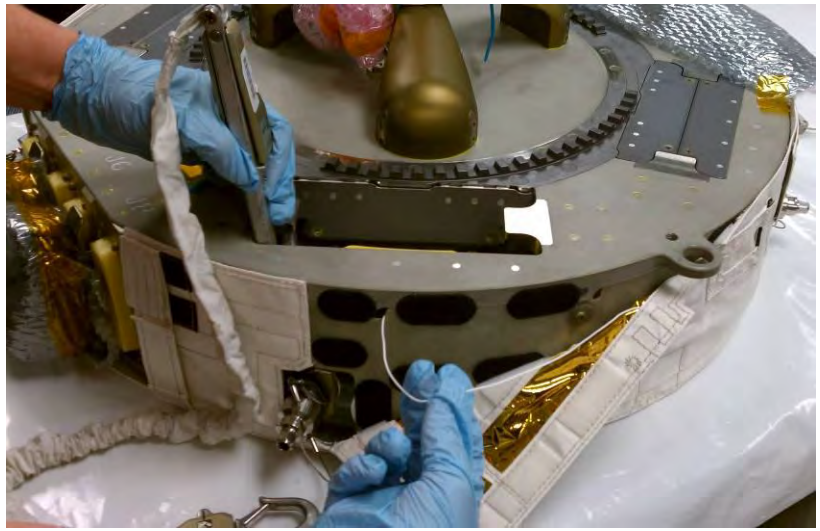
Peeling back MLI tab



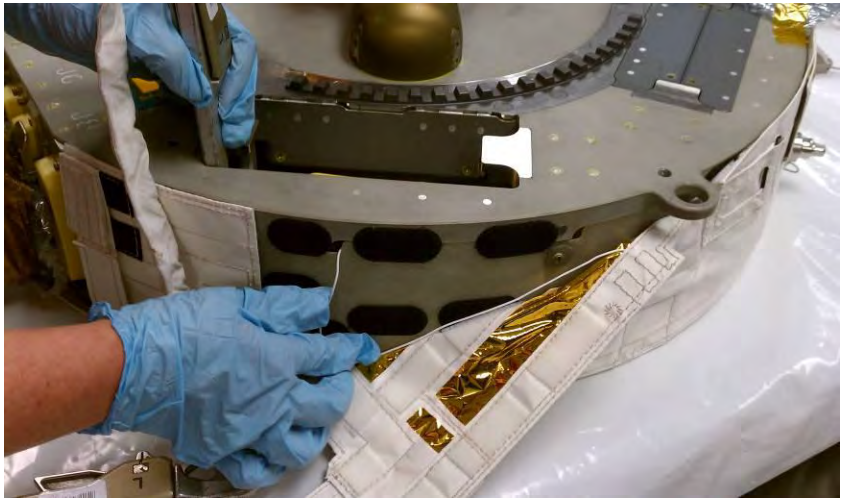
Peeling back MLI to expose grounding wire



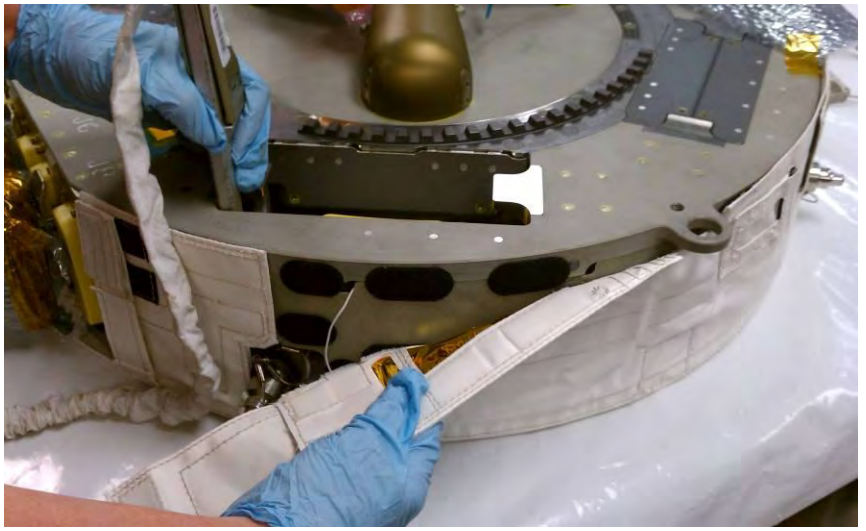
Inspecting grounding tab attachment point



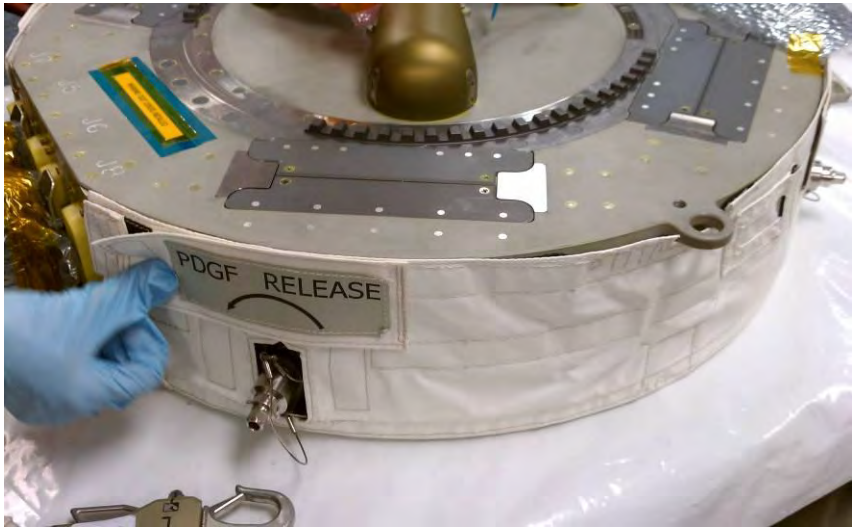
Large crew hook inserted into electrical connector housing to hold open doors. Grounding wire slack being pulled out of PDGF housing



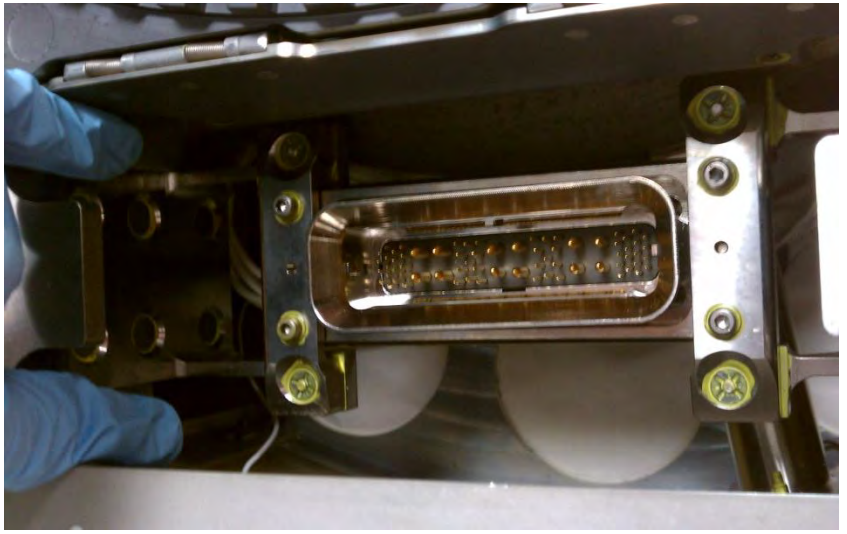
Grounding wire slack being stowed so that Velcro will hold it in place when MLI closed



Closing MLI



Closing MLI tab



Pins in electrical connector

Estimated Task Duration:

	With RMS	Without RMS
One EV Crew	N/A	0:45
Two EV Crew	N/A	N/A

Tools:

EV1	EV2
RET	
Wire Ties	

EVA Connectors:

Connector	To	Size	Function
1553 Cables			
P1	J1 FGB	15	Bus A
P2	J2 FGB	15	Bus B
J53	1800-X53	male	Bus B
J54	1800-X54	female	Bus A
PDGF Harness			
1800-X53	1553 J53	female	FGB Alt Data
1800-X54	1553 J54	male	FGB Prime Data

Inhibits:

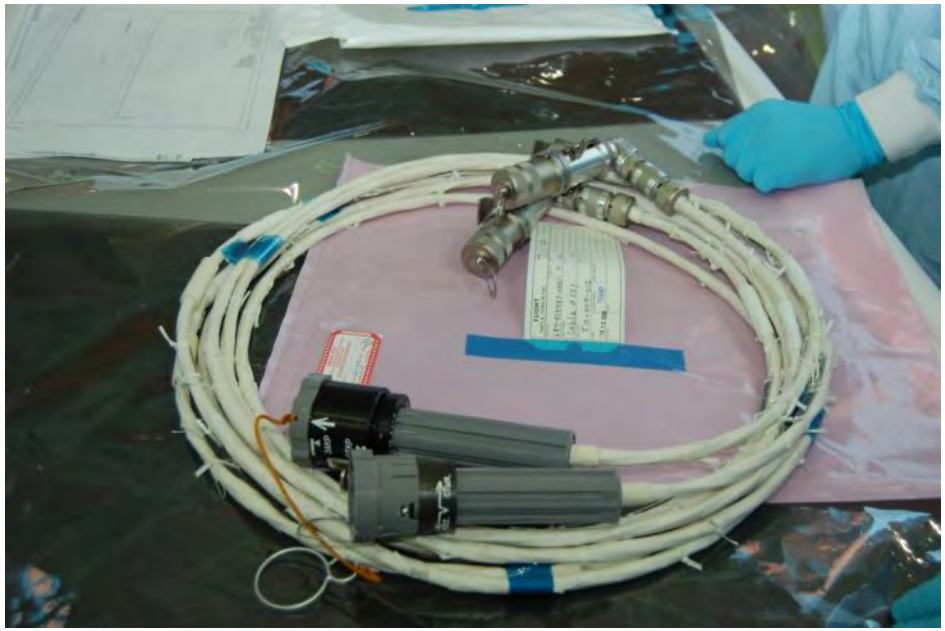
ORU/Task	Location	Inhibit
1553 Cable	FGB to NOD 3 Avionics Panel	• **PDGF 1553 Cable** • NOD3 J1 FGB • NOD3 J2 FGB • PDGF harness 1800-X54 • PDGF harness 1800-X53 • RACU-6 –OFF • RACU-5-OFF • RWS- NOT ACTIVE • Loc. RSOS Inhibits

Notes:

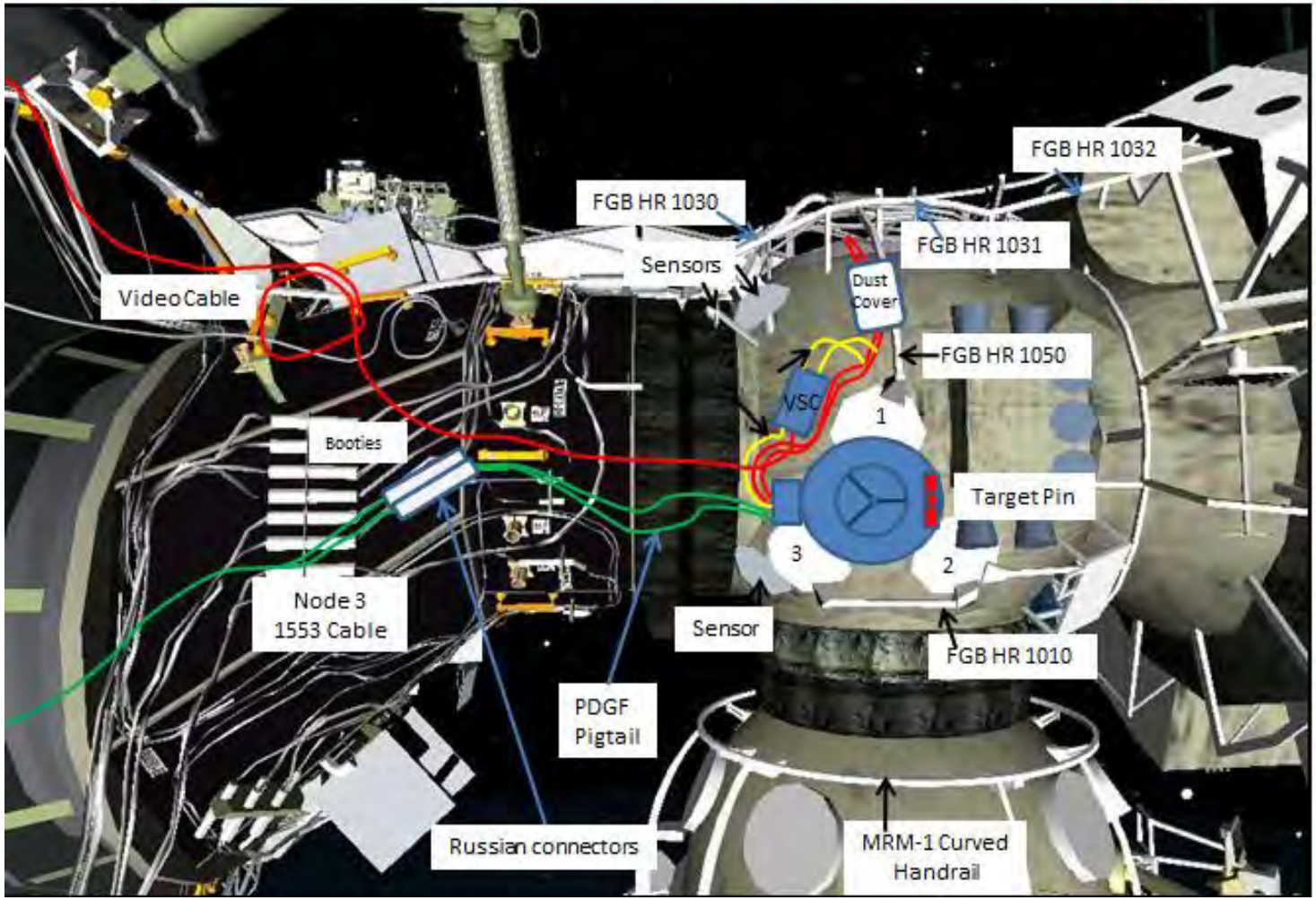
1. 1553 cables were taped together into a single bundle along middle of cable length First tape location on Russian connector side is located approximately 2 ft from connector; first tape location on NZGL connector side is located approximately 5 ft from connector

Timeline Considerations:

1. Routing of the Russian 1553 Pigtail will be carried as a get ahead on EVA 1
2.
3.
4.
5.



Green Cable depicts the 1553 final Config, post routing.



FGB
J19

1553 - X54

1553 - X53

FGB
J18

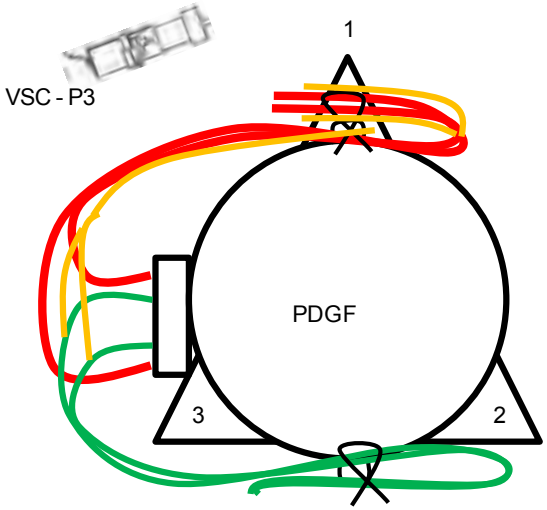
P7

P5

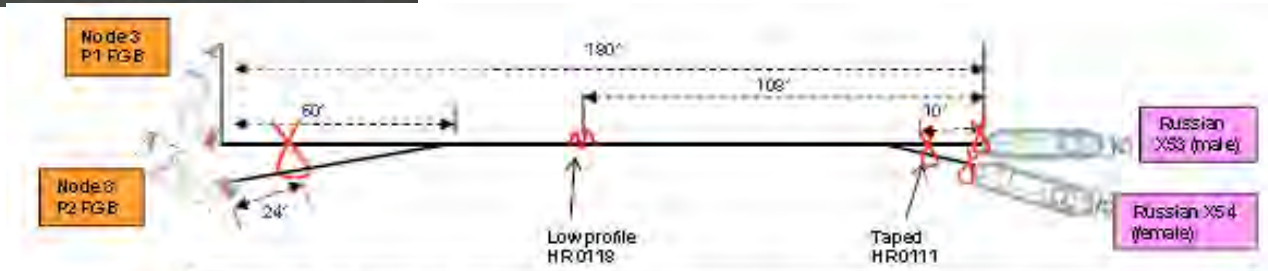
VSC - P4

P6

P8

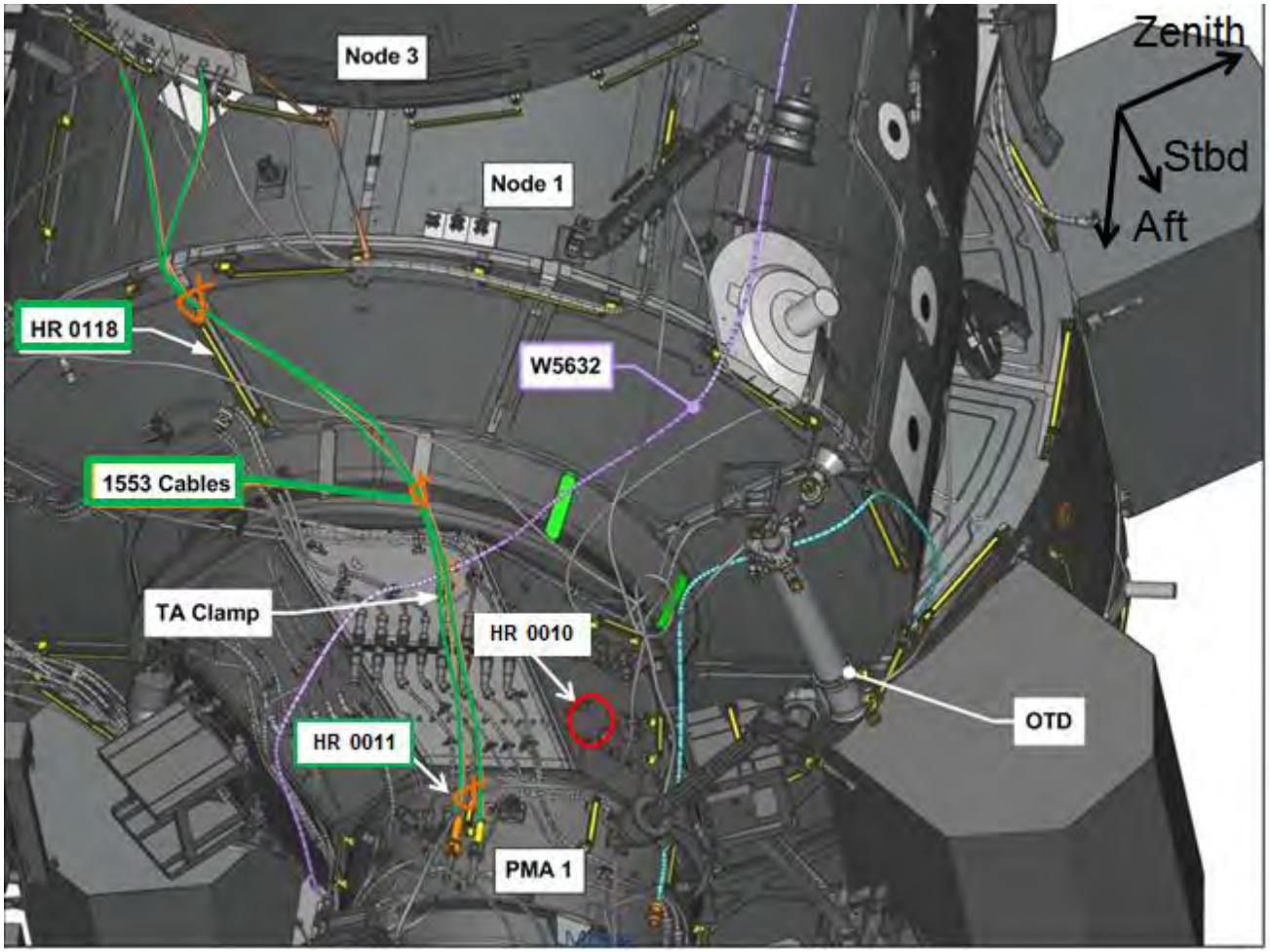


Expected Config of Russian 1553 Jumper (wire tied to Nadir tether point on FGB PDGF)



- ☐ Attach short wire tie at low profile location
  - ☐ Attach short wire tie on X53 cable/connector
    - ☐ Twist one remaining end of wire tie around cap tether point
    - ☐ Twist other end of wire tie around bootie tether point
  - ☐ Attach short wire tie on X54 cable/connector
    - ☐ Twist one remaining end of wire tie around cap tether point
    - ☐ Twist other end of wire tie around bootie tether point
- ☐ Attach taped short wire tie around both Russian cables
- ☐ Attach short wire tie around both Node 3 cables
- ☐ Coil Node 3 end toward Russian end 3 loops – twist Node 3 wire tie around coils
  - ☐ Continue coiling Node 3 end – twist taped wire tie (Russian) around whole bundle

Expected on orbit Configuration of 1553 Cable



US 1553 Cable Routing PMA 1 Port, Node 3 Aft

This Page Intentionally Blank