Space Shuttle Program
FLIGHT DATA FILE

JSC-48024-135

EVA Checklist

STS-135 Flight Supplement

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

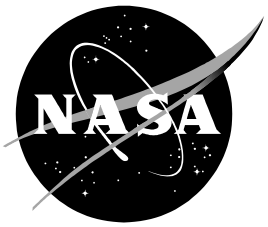
Final
June 1, 2011

NOTE

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

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas



Verify this is the correct version for the pending operation (training, simulation or flight).
Electronic copies of FDF books are available. URL: http://mod.jsc.nasa.gov/do3/FDF/index.html

EVA CHECKLIST STS-135 FLT SUPPL	FINAL (June 1, 2011)

PCN-1 (June 24, 2011) Sheet 1 of 1

List of Implemented Change Requests (482s):

EVA FS-00424
EVA FS-00425
EVA FS-00426
EVA FS-00427
EVA FS-00428
EVA FS-00429

Incorporate the following:

1. Replace FS v thru FS xiv
2. Replace section 2 (18 pages)
3. Replace TEMP FS 3-1 and TEMP FS 3-2
   After 3-12, add FS 3-13 thru FS 3-22
4. Replace section 7 (68 pages)
5. Replace FS 8-9 and FS 8-10, FS 8-15 thru FS 8-18
6. Replace TEMP FS 10-1 and TEMP FS 10-2, FS CC 10-15 and FS CC 10-16
7. Replace FS 16-3 thru FS 16-8, FS 16-17 and FS 16-18
   After FS 16-18, add FS 16-18a and FS 16-18b
   Replace FS 16-19 and FS 16-20, FS 16-51 and FS 16-52, FS 16-65 and FS 16-66

Prepared by: Darren Weld
Book Manager

Approved by: [signature]
Lead, EVA Systems Group

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Lead, EVA Task Group

Accepted by: [signature]
Chief, EVA and Crew Systems
Operations Branch

Encl: 134 pages

File this PCN immediately behind the front cover as a permanent record

MISSION OPERATIONS DIRECTORATE

EVA CHECKLIST
STS-135 FLIGHT SUPPLEMENT

FINAL
June 1, 2011

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This document is under the configuration control of the Crew Procedures Control Board (CPCB). All proposed changes must be submitted via Change Request Workflow (CRW) to DO3/FDF Manager.

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Incorporates the following:		
482#:	EVA FS-00394	EVA FS-00419
	EVA FS-00406A	EVA FS-00420
	EVA FS-00416	EVA FS-00421
	EVA FS-00417	EVA FS-00422
	EVA FS-00418	EVA FS-00423

AREAS OF TECHNICAL RESPONSIBILITY

Book Manager	DX32/L. Welsh	281-244-1058

EVA CHECKLIST
STS-135 FLIGHT SUPPLEMENT

LIST OF EFFECTIVE PAGES

FINAL 06/01/11
PCN-1 06/24/11

Sign Off	*	135/FIN
FS ii	*	135/FIN
iii	*	generic
iv	*	generic
FS v	*	135/FIN 1
FS vi	*	135/FIN 1
FS vii	*	135/FIN 1
FS viii	*	135/FIN 1
FS ix	*	135/FIN 1
FS x	*	135/FIN
FS xi		135/FIN 1
FS xii		135/FIN 1
FS xiii		135/FIN 1
FS xiv		135/FIN
FS xv		135/FIN
FS xvi		135/FIN
1-1		generic
1-2		generic
1-3		generic
1-4		generic
1-5		generic
1-6		generic
1-7		generic
1-8		generic
1-9		generic
1-10		generic
TEMP FS 2-1		135/FIN 1
TEMP FS 2-2		ALL/FIN
TEMP FS 2-3		135/FIN 1
TEMP FS 2-4		135/FIN
TEMP FS 2-5		135/FIN 1
TEMP FS 2-6		ALL/FIN
FS 2-7		135/FIN 1
FS 2-8		135/FIN 1
FS 2-9		135/FIN 1
FS 2-10		135/FIN 1
FS 2-11		135/FIN 1
FS 2-12	⊗	135/FIN 1
FS 2-13	⊗	135/FIN 1
FS 2-14		135/FIN 1
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TEMP FS 3-2		ALL/FIN 1
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CC A6-2		generic
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CC 6-4		generic
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9-3 ..... generic
9-4 ..... generic
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9-6 ..... generic
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14-8 ..... generic
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14-12 ..... generic
14-13 ..... generic
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17-1 ..... * generic
17-2 ..... * generic
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EVA CUE CARDS

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SAFER STATUS TROUBLESHOOTING (Back)	CC 3-11	generic
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FAILED LEAK CHECK (Back of DEPRESS/REPRESS)	CC 6-4	generic
STS-135 CONSUMABLES TRACKING CUE CARD (Front)	FS CC 10-15	EVA-4a/135/O/B
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EMERGENCY UNDOCKING EVA TRANSFER (Front)	FS CC 12-27	EVA-5a/135/O/A
EXPEDITED SUIT DOFFING CUE CARD (Back)	FS CC 12-28	EVA-5b/135/O/A

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AIRLOCK PREP (50 min)

AIRLOCK CONFIG

Retrieve or unstow following equipment:

MF28G — 3/8-in breaker bar, 4-in ext w/3/8-in drive
IFM Tool Kit — 1/2-in socket w/3/8-in drive
Vol H — EMU Equipment Bag – attach to middeck wall
Helmet Lights
EVA Bag
Contamination Detection Kit (location flight specific)
FDF Locker — Cuff Checklists (2) – stow in EMU Equipment Bag
DEPRESS/REPRESS Cue Card

1. √Inner hatch Equal vlv (two) – OFF

AW18A

2. LTG FLOOD (four) – ON
3. Remove from airlock, as reqd:
   - Airlock Stowage Bag
   - Airlock Floor Pallet using 3/8-in breaker bar, 4-in ext w/3/8-in drive, and 1/2-in socket w/3/8-in drive
4. Stow Vol H Bags in Vol H
5. Transfer to airlock:
   - EVA Bag – install on airlock wall
   - DEPRESS/REPRESS Cue Card
   - Helmet Lights
   - Contamination Detection Kit – install on airlock wall
6. Install IVA foot restraint, as reqd
7. Unbuckle SCU straps, Velcro SCU to wall
8. Install EMU lights on helmets (EMU 1,EMU 2) and perform pull test to verify latches fully seated in helmet brackets
9. Disconnect helmets from Airlock EMUs, temp stow
10. Remove comm caps from LTA Restraint Bags and connect to electrical harnesses
11. Install helmets (not reqd if proceeding directly to EMU Checkout)
12. Remove LTA Restraint Bags
13. Disconnect waist rings; remove and stow any equipment stowed in HUT/LTA
14. Stow LTA Restraint Bags on AAPs
15. √Thermal cover clear of waist ring
16. Waist ring – engage posn
17. Connect LTA to HUT, lock
18. Remove 20-g Crash Bag from middeck EMU, as reqd

AIRLOCK PREP FOR DOCKING (30 min)

1. √Inner hatch Equal vlv (two) – OFF

AW18A 2. LTG FLOOD (four) – ON

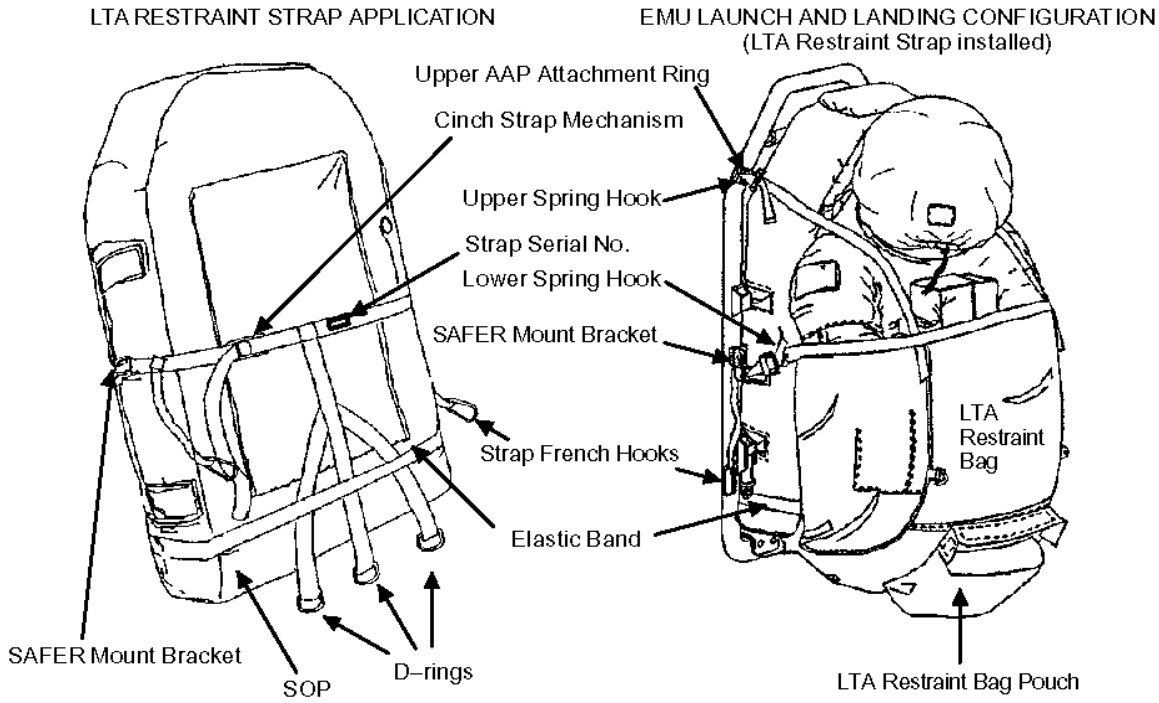
NOTE

Removing EMU from AAP will make it easier to install LTA Restraint Bag

3. Release LTA Spring hooks (four) from AAP
4. Release EMU from AAP so back of PLSS can be accessed
5. Remove LTA Restraint Bags from the lower AAP Bar and transfer to LTA Restraint strap D-rings (ref: figure below)
6. Attach LTA spring hooks (four) to SAFER mount brackets

BOTH EMUs/ DCM
7. √PWR – SCU
8. √PURGE vlv – op (up)
9. √WATER – OFF, switch guard installed
10. √O2 ACT – OFF

11. Stow EMU, as required (in Middeck or on AAP)



NOTE

French hooks should be attached to SAFER mount brackets for launch and landing

BOOSTER FAN DEACTIVATION/REMOVAL (15 min)

MO13Q 1. ARLK FAN A,B (two) – OFF
MA73C:G 2. cb AC1,2 ARLK TNL FAN A,B (six) – op
EXT A/L 3. Disconnect flex duct from booster fan muffler inlet, direct airflow into airlock, temp secure
4. Disconnect vent duct from booster fan outlet and external airlock duct inlet; temp stow in middeck

If booster fan to be removed:

5. Disconnect flex duct from booster fan inlet; rotate and stow in launch bracket
6. Demate booster fan electrical connectors from J1,J2 (two) on tunnel extension wall; loosen cable harnesses (two) from Velcro strips (four)
7. Stow electrical connectors (two) on booster fan dummy fittings, secure cable harnesses with Velcro strips
8. Loosen booster fan fasteners (four)
9. Remove booster fan assy, temp stow in middeck

BOOSTER FAN INSTALLATION/ACTIVATION (15 min)

If booster fan to be installed:

MA73C:G 1. √cb AC1,2 ARLK TNL FAN A,B (six) – op
MO13Q 2. √ARLK FAN A,B (two) – OFF
EXT A/L 3. Install booster fan assy, secure fasteners (four)
4. Demate electrical connectors (two) from booster fan dummy fittings and Velcro strips
5. Mate booster fan electrical connectors J1,J2 (two) on tunnel extension wall; secure cable harnesses (two) with Velcro strips (four)
6. Unstow/connect flex duct from launch bracket to booster fan inlet
7. Unstow/connect vent duct to external airlock duct inlet and booster fan outlet
8. Unstow/connect flex duct from middeck to fan muffler inlet

MA73C:G 9. cb AC1,2 ARLK TNL FAN A,B (six) – cl
MO13Q 10. ARLK FAN A(B) – ON
11. Check for airflow at top of external airlock halo

EMU REMOVAL (15 min)

1. As reqd, install gloves
2. As reqd, perform LTA RESTRAINT STRAP INSTALLATION
3. As reqd, relocate LTA spring hooks (four) from AAP rings to SAFER mount brackets
4. Disconnect EMUs from AAPs, stow in middeck

EMU INSTALLATION (30 min)

1. Transfer EMUs to A/L, connect to AAPs
2. Remove LTA Restraint strap from D-rings on LTA Restraint Strap and transfer to lower AAP Bar
3. Relocate LTA spring hooks (four) from SAFER mount brackets to AAP rings

EMU CHECKOUT PREP (30 min)

NOTE
For use with Shuttle A/L related EVA

Airlock
1. LTG FLOOD (four) – on
2. Remove Airlock Floor Bag from Airlock, as required
3. Unbuckle SCU straps, Velcro SCU to wall
4. Disconnect helmets from EMUs, temp stow
5. √DIDB Restraint Bags installed
6. Remove comm caps (3) from LTA Restraint Bags (kangaroo pouches)
   For EMU 3015 – Starboard Side (Wh)
   Connect comm cap Wh1 to EMU electrical harness
   Temp stow comm cap Wh2 (for Wh ECOK, step 9)
   For EMU 3006 – Port Side (Mg)
   Connect comm cap Mg 1 to EMU electrical harness
7. Disconnect LTA Restraint Bag from EMUs; temp stow on bottom of AAP
8. Disconnect waist rings; remove Wh, Mg ECOKs and LCVGs
9. Stow comm caps: Wh2 in Wh ECOK
10. Temp stow LCVGs for EMU checkout
11. √Thermal cover clear of waist rings
12. Waist rings – engage position
13. Connect LTAs to HUTs, lock

Middeck Vol H (MD23R)
14. Unstow from Volume H Bags:
    EVA 1 INBD Bag:
    EMU Servicing Kit s/n 5004 – Temp Stow
15. Restow Volume H Bags
16. If performing EMU checkout on shuttle, assemble EMU Equipment Bag and temp stow in Middeck. Will be used for EMU checkout

ISS EMU CHECKOUT PREP (30 min)

ISS A/L
1. Remove EMUs s/n 3010 (Fs) and 3009 (Ga) from EDDAs and temp stow in Crewlock
2. Install EMU s/n 3015 in Aft EDDA (Wh)
3. Install EMU s/n 3006 in FWD EDDA (Mg)
4. Remove prime comm caps (Wh1 and Mg1) from LTA Restraint Bags (kangaroo pouches)
5. Remove LTA restraint bags to allow access to waist ring
6. Disconnect waist rings; remove Wh, Mg ECOKs and LCVGs
7. Temp stow ECOKs for EMU checkout
8. Disconnect helmets from EMUs, temp stow. (Will remain off until ISS EMU checkout)
9. √DIDB Restraint Bags installed
10. For EMU 3015 – Aft EDDA (Wh)
    Connect comm cap Wh1 to EMU electrical harness
    For EMU 3006 – Fwd EDDA (Mg)
    Connect comm cap Mg1 to EMU electrical harness
11. √Thermal cover clear of waist rings
12. Waist rings – engage position
13. Connect LTAs to HUTs, lock

LTA RESTRAINT STRAP REMOVAL (15 min)

NOTE

May be performed on EMU 1 and 2 simultaneously.
Perform steps as reqd for current EMU config

1. As reqd, remove comm cap from LTA Restraint Bag; temp stow
2. Remove EMU from AAP
3. Disconnect all restraint attachments from SAFER mount brackets (two)
4. Loosen cinch strap mechanism, remove SAFER mount brackets
5. Remove strap from PLSS
6. Stow strap in LTA Restraint Bag Pouch with D-rings (three) connected
7. Engage EMU in AAP
8. Stow LTA Restraint Bag/strap

LTA RESTRAINT STRAP INSTALLATION (15 min)

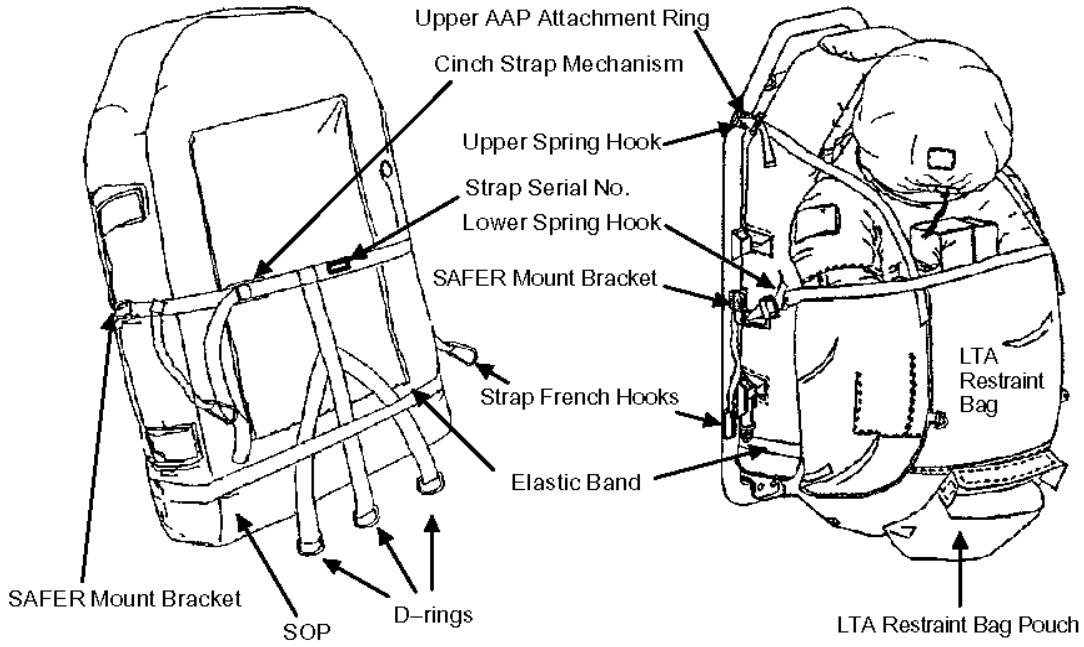
NOTE

May be performed on EMU 1 and 2 simultaneously. Perform steps as reqd for current EMU config. Procedure written to install in Launch/Landing config shown below

1. Unstow LTA Restraint Bag/strap
2. Remove EMU from AAP
3. Install SAFER mount brackets (two)
4. Install elastic band of strap around SOP
5. Tighten cinch strap mechanism
6. Attach strap French hooks (two) to SAFER mount brackets
7. Engage EMU in AAP
8. Stow LTA, suit arms inside LTA Restraint Bag
9. Connect upper spring hooks (two) over suit shoulders to upper AAP attachment rings (two)
10. Connect lower spring hooks (two) around suit arms to SAFER mount brackets (two)
11. Tighten all LTA bag straps with bag as high as possible on EMU

LTA RESTRAINT STRAP APPLICATION

EMU LAUNCH AND LANDING CONFIGURATION
(LTA Restraint Strap installed)



NOTE

French hooks should be attached to SAFER mount brackets for launch and landing

EVA PREP FOR TRANSFER TO ISS (30 min)

Bag D

1. Retrieve Fs and Ga combined ECOK from Bag D, remove EVA Sys Xfer Bags 1 & 2 from inside combined ECOK
2. Retrieve PMA3 cover from Bag D
3. Place combined ECOK in EVA Sys Xfer Bag 1

Airlock/

4. Retrieve the following: Middeck

EVA Sys Xfer Bag 1 (w/combined ECOK)
EVA Sys Xfer Bag 2
PMA3 Cover

5. Retrieve spare <u>EXPEDITED SUIT DOFFING/EMERGENCY UNDOCKING EVA TRANSFER CUE CARD</u> from FDF/SODF Locker MF57K and stow with EMU 3006 (Mg)
6. Verify/configure items according to tables below:

<u>EMU 3015 (Wh)</u>	**<u>EMU 3006 (Mg)</u>**
☐ LTA Restraint Bag installed ☐ Helmet (√sun shade down, cover installed) ☐ EMU Gloves (Wh1) ☐☐ Comm Caps (Wh1 and Wh2) in LTA Restraint Pouch	☐ LTA Restraint Bag installed ☐ Helmet (√sun shade down, cover installed) ☐ EMU Gloves (Mg1) ☐ Comm Cap (Mg1) in LTA Restraint Pouch

EVA SYS XFER BAG 1	**FROM**
☐ ISS EVA Systems Checklist (1) with Red Stripe (Green remains in locker for IV) ☐ ISS EVA Systems Checklist (1) with no stripe (Not to use during STS-135/ULF7) ☐ FDF: EVA Checklist STS-135 (1) with Red Stripe currently in use (Green remains in locker for IV) ☐ EVA Ziplock ☐ <u>STS-135 CONSUMABLES TRACKING CUE CARD</u> ☐ ☐ <u>EXPEDITED SUIT DOFFING/EMERGENCY UNDOCKING EVA TRANSFER CUE CARD</u> ☐ <u>ISLE EVA PREBREATHE CUE CARD</u> ☐ <u>CREWLOCK DEPRESS/REPRESS CUE CARD</u> ☐ <u>AMMONIA CONTAMINATION TEST/ HYDRAZINE CONTAMINATION TEST CUE CARD</u> ☐ <u>JOINT EXPEDITED EGRESS CUE CARD</u> ☐ <u>CEVIS EXERCISE PREBREATHE CUE CARD</u> ☐ <u>CREWLOCK DEPRESS/REPRESS CUE CARD WITHOUT IV</u>	FDF/SODF Locker MF57K
☐ ☐ Contingency Operation LAPA Tool (COLT) (2) s/n 1001 and 1002 ☐ ☐ COLT Caps (2) s/n 1001 and 1003 ☐ D-ring Extender s/n 1003 ☐ Gap Spanner s/n 1096	Bag D
☐ ☐ LiOH (CCC) (2) (s/n 2014 & 2025)	Airlock Floor Bag – Bag I
☐ ☐ PBA Mask Assembly (2)	Bag B
☐ Nikon 10.5mm Lens (marked for EVA use)	Still Camera Bag, Locker A17
☐ EVA Camera Thermal Blanket (s/n 1012) ☐ Lens Cap Assembly, 28mm, 35mm, 50mm (s/n 1035)	DTV Bag, Locker A16

EVA PREP FOR TRANSFER TO ISS (30 min) (Cont)

EVA SYS XFER BAG 2	**FROM**
☐ EMU Servicing Kit (s/n 5004) ☐ SOP Checkout Fixture (SCOF) s/n 1012 ☐ SOP Checkout Fixture (SCOF) s/n 1014	Volume H – EMU Equipment Bag
☐ Bends Treatment Adapter w/wrench s/n 1003 ☐ ☐ DIDBs unused (2) ☐ 85-ft Safety Tether #25 ☐ 85-ft Safety Tether #27	Airlock Floor Bag – Bag I

Fs and Ga Combined ECOKs (Reference only, no need to verify) **FROM BAG D**	
☐ ECOK (Fs) ☐ Fs EVA 1 Ziplock Bags • MAGs (2 w/Ziplock Bags) • TCUs (top, bottom) • Socks • Wristlets • Comfort Gloves, Spectra • EV identifier stripes (EV1) • Fresnel Lens (2) • Elastic Glasses Retention Device • Moleskin • Mission patch • US flag	☐ ECOK (Ga) ☐ Ga EVA 1 Ziplock Bags • MAGs (2 w/Ziplock Bags) • TCUs (top, bottom) • Socks • Wristlets • Comfort Gloves, Manzella • EV identifier stripes (EV2) • Moleskin • Mission patch • US flag

POST DOCKING EVA TRANSFER AND RECONFIG (35 min)

NOTE

This procedure assumes that transfer items were preconfigured per EVA PREP FOR TRANSFER TO ISS

1. Transfer the following EVA equipment to ISS:

Item	Final Destination	Xfer Status
EVA Sys Xfer Bag 1	E-Lk	
EVA Sys Xfer Bag 2	Node 1 (Deck 1)	
PMA3 Cover	Crew Lock	

EVA Sys Xfer Bag 1

2. Unstow (Fs/Ga) combined ECOK and temp stow in E-Lk

3. Unstow following items and position in E-Lk Xfer Bag 1

   From EVA Sys Xfer Bag 1:
   - ☐ ISS EVA Sys Checklist with Red Stripe
   - ☐ STS-135 FDF EVA Checklist with Red Stripe
   - ☐ STS-135 CONSUMABLES TRACKING CUE CARD
   - ☐ EXPEDITED SUIT DOFFING/EMERGENCY UNDOCKING EVA TRANSFER CUE CARD
   - ☐ JOINT EXPEDITED EGRESS CUE CARD
   - ☐ ISLE EVA PREBREATHE CUE CARD
   - ☐ CREWLOCK DEPRESS/REPRESS CUE CARD (Deploy/replace in Crewlock)
   - ☐ AMMONIA CONTAMINATION TEST/HYDRAZINE CONTAMINATION TEST CUE CARD (Deploy/replace in Crewlock IV Bag)

EVA Sys Xfer Bag 1

4. Stow the following cue cards from EVA Sys Xfer Bag 1 into the large top pocket of the EMU Equipment Bag:
   - ☐ CEVIS EXERCISE PREBREATHE CUE CARD
   - ☐ CREWLOCK DEPRESS/REPRESS CUE CARD WITHOUT IV

5. Unstow LiOH canisters (s/n 2014 & 2025). Holding LiOH cartridge with aluminum plate serial number facing self, remove caps (right first) inspect O-rings for damage and verify O-rings are seated properly in grooves. Remove Vent Port Plugs and install LiOH s/n 2014 in EMU 3010 (Fs) and LiOH s/n 2025 in EMU 3009 (Ga). Stow LiOH Caps and Vent Port Plugs in EMU Equipment Bag

6. Unstow PBA Mask Assemblies (2) and change out with PHA side pocket PBAs assemblies. Check **MCC-H** for stowage location of old mask

7. Unstow COLT (2), COLT Caps (2). RET to Crewlock Bag per EVA 1 TOOL CONFIG

8. Unstow Gap Spanner and PMA Cover; stow in Medium ORU bag per EVA 1 TOOL CONFIG

9. Unstow Nikon 10.5mm Lens, Thermal Blanket and Lens Cap Assembly and configure per EVA P/TV Setup

10. Gather old ISS EVA Sys Checklist, Ammonia CC & Depress/Repress CC from Airlock and stow in EVA Sys Xfer Bag 1

EVA Sys Xfer Bag 2

11. Stow EVA Sys Xfer Bag 2 in the NOD1 D1. Items in this bag will not be used during the EVA and will be deployed post EVA

12. Report transfer status to **MCC-H** as time permits

POST-EVA EMU RESIZE (120 min)

OBJECTIVE

This procedure will swap Garan's EMU 3009 and Walheim EMU 3015 HUTs. This will configure EMU 3015 to leave on ISS and EMU 3009 for Walheim return. Figures 1 and 2 contain final sizing information. To complete this activity, all components will be removed from one HUT and installed on the other HUT

NOTE

Reference 1.550 EMU RESIZE (SODF: ISS EVA SYS: EMU MAINTENANCE) for component changeout steps

CAUTION
Remove rings and other jewelry before exposing EMU bladder
√All seals are clean and free of debris before making connections

EMU 3006 (Mg) 1. Remove EMU 3006 (Mg) from FWD EDDA and stow in Crewlock

EMU 3009 (Ga) 2. Retrieve EMU 3009 (Ga) and install on FWD EDDA

3. Remove Helmet (s/n 1080) and Comm Cap; temp stow. Remove DIDB and stow in wet trash (leave restraint in EMU)

EMU 3015 (Wh)/ 3009 (Ga) 4. Remove Helmet (s/n 1077) and install on EMU 3009 (Ga)
Install Helmet and Comm Cap from EMU 3009 (Ga) on EMU 3015 (Wh)

5. Install protective cover on helmets

Swap Lower Arms of EMUs 3015 (Wh) to 3009 (Ga)

EMU 3009 (Ga) 6. Disconnect Lower Arm Power Harness ←|→ Upper Arm Power Cable (2)
Remove Lower Arms (s/n 380/379) w/gloves (Ga) attached; temp stow

EMU 3015 (Wh)/ 3009 (Ga) 7. Disconnect Lower Arm Power Harness ←|→ Upper Arm Power Cable (2)
Remove Lower Arms (s/n 419/420) w/gloves (Wh) attached and install on EMU 3009 (Ga)

EMU 3015 (Wh) 8. Install Lower Arms (s/n 380/379) w/gloves (Ga) on EMU 3015 (Wh)

9. Verify Both EMUs:
Red disconnect is right arm, blue disconnect is left arm
Cams (8) are Short/Long for each EMU
Check lock tab 1 engaged for each arm
Lower Arm Power Harness →|← Upper Arm Power Cable (2)

Swap Lower LTA Assembly of EMUs 3015 (Wh) to 3009 (Ga)

EMU 3009 (Ga) 10. Remove LTA Assembly (waist brief s/n 052) and temp stow

EMU 3015 (Wh) 11. Remove LTA Assembly and ECOK (Wh) from EMU 3015 (Wh)

EMU 3009 (Ga) 12. Stow ECOK (Wh) inside of EMU 3009 (Ga) and install LTA Assembly (waist brief s/n 039) on EMU 3009 (Ga)

EMU 3015 13. Install LTA Assembly (s/n 052) on EMU 3015

POST EVA EMU RESIZE (60 min) (Cont)

Swap LiOHs and Mission Patches of EMUs 3009 (Ga) to 3015 (Wh)

EMU 3009

14. Remove LiOH from EMU 3009 (Ga) (expended), install caps from EMU Equipment Bag and stow in EVA Sys Xfer Bag 1

15. Remove EMU Battery and stow in 0.5 CTB (1025) inside M-O2 Bag 1038

EMU 3015/ 3009

16. Remove LiOH and Battery from EMU 3015 (Wh) and install in EMU 3009 (Ga). Install Vent Port Plugs from EMU Equipment Bag in EMU 3015 (Wh) Reference 1.515 EMU METOX/LiOH/BATTERY REPLACEMENT (SODF: ISS EVA SYS: EMU MAINTENANCE) as necessary

EMU 3009

17. Install LTA Restraint Bag and Restraint Strap from EMU 3015 and install on EMU 3009 for transfer back to shuttle (Wh) return suit

18. Swap mission patches and stripes

19. Stow shuttle EMUs (s/n 3006 and 3009) per crew preference

POST EVA EMU RESIZE (60 min) (Cont)

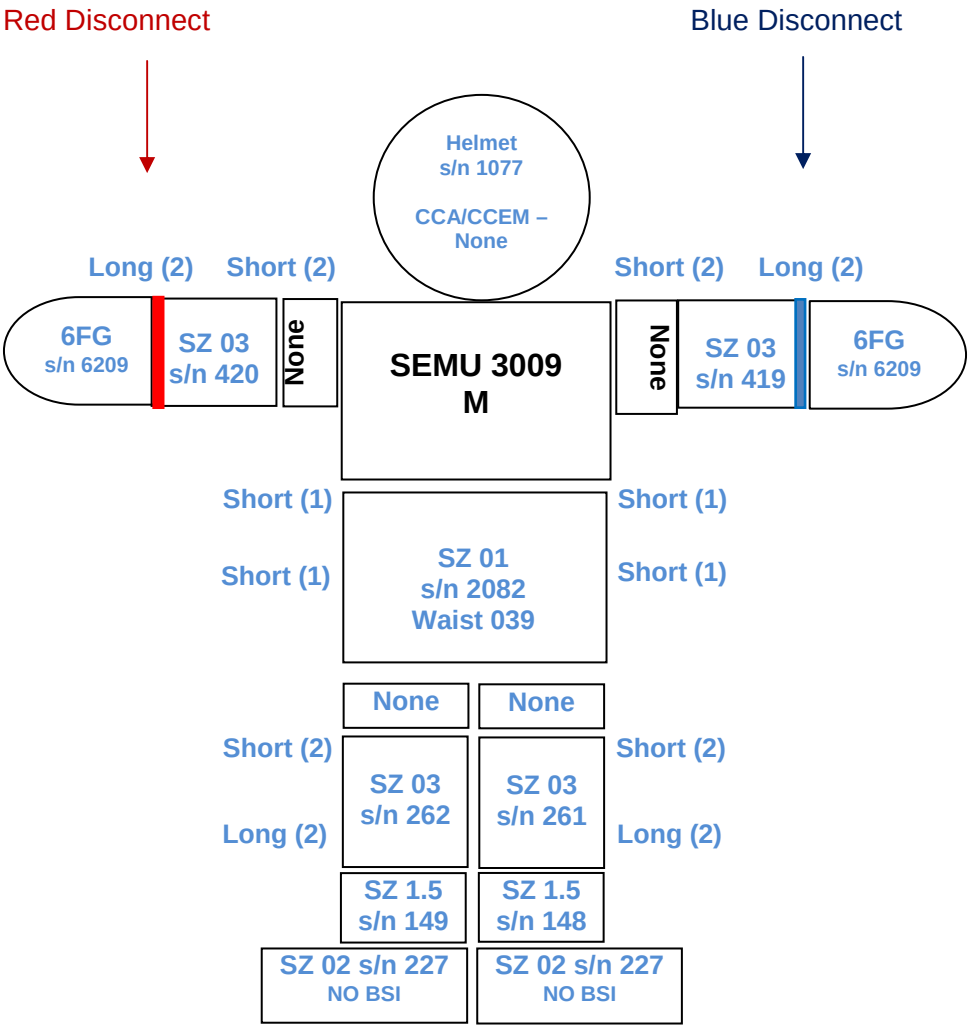


Figure 1.- EMU 3009 sized Walheim final configuration.

Blue Font – Indicates components that come from EMU 3015
Black Font – Indicates hardware already installed on EMU 3009

POST EVA EMU RESIZE (60 min) (Cont)

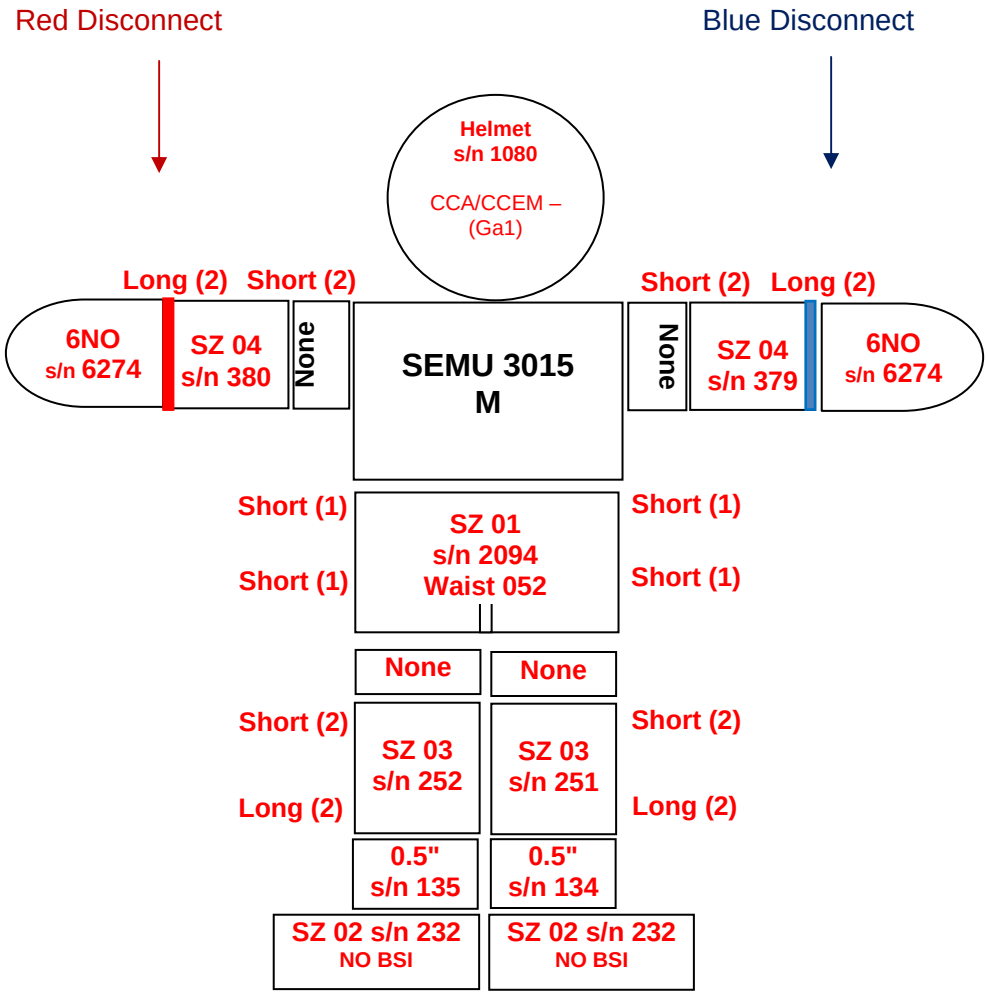


Figure 2.- EMU 3015 sized for Garan ISS.

Red Font – Indicates components that come from EMU 3009
Black Font – Indicated hardware already installed on EMU 3015

POST EVA RECONFIG AND TRANSFER TO SHUTTLE (30 min)

NOTE

This procedure assumes 1.240 POST EVA (SODF: ISS EVA SYS: EVA PREP/POST) has been completed following the EVA

EMU 3010 (Fs)

1. Install EMU 3010 in FWD EDDA and remove LiOH and install vent port plugs from the EMU Equipment Bag. Remove EMU LIB Battery and stow in 0.5 CTB (s/n 1025) inside M-O2 Bag (s/n 1038). Stow expended LiOH in EVA Sys Xfer Bag 1

2. Gather COLT Caps (2) from EMU s/n 3010 trash bag and stow in EVA Sys Xfer Bag 2

3. Gather Nikon 10.5mm Lens (used during EVA), EVA Camera Thermal Blanket (s/n 1007) and Lens Cap Assembly, 28mm, 35mm, 50mm (s/n 1037) stow in EVA Sys Xfer Bag 1

EMU 3006/3009

4. Verify Installed and connected:
   - ☐ Gloves
   - ☐ Helmets
   - ☐ DIDB Restraint Bag
   - ☐ ECOKS stowed inside of HUT
   - ☐ LTAs
   - ☐ LTA Restraint Bag for transfer
   - ☐ Comm Caps (Wh (2) and Mg (1)) stowed in LTA Restraint Bag Pouch

5. √Helmet sun shades down, cover installed

Deploy items from EVA Sys Xfer Bag 2

6. Remove EMU Servicing Kit s/n 5004 from EVA Sys Xfer Bag 2 and deploy in E-Lk

7. Gather EMU Servicing Kit s/n 5002 and stow in EVA Sys Xfer Bag 2

8. Remove SCOFs s/n 1012 and 1014 and stow in EMU Equipment Bag

9. Gather SCOFs s/n 1011 and 1013 and stow in EVA Sys Xfer Bag 2

10. Remove BTA Assembly s/n 1003 from EVA Sys Xfer Bag 2 and stow in the outside pocket of MO-2 bag 1038

11. Gather BTA Assembly s/n 1004 and stow in EVA Sys Xfer Bag 2

12. Remove 85-ft Safety Tethers #25 and #27 and D-ring Extender s/n 1003 and deploy on Tether Staging area

13. Gather 85-ft Safety Tethers #22 and #21 and stow in EVA Sys Xfer Bag 2

14. Remove DIDBs unused (2) and stow in A/L1D1_B2

15. Gather SODF/FDF Cue Cards from ISS airlock per EVA Sys Xfer Bag 1 table below

16. Config/verify items listed below are in specified bags
    Transfer bags and EMUs to shuttle

POST EVA RECONFIG AND TRANSFER TO SHUTTLE (30 min) (Cont)

EMU 3009 (Wh)	EMU 3006 (Mg)
☐ DIDB Restraint Bag	☐ DIDB Restraint Bag
☐ ECOK	☐ ECOK
☐ LCVG (Wh)	☐ LCVG (Mg)☐
☐ Helmet (√sun shade down, cover installed)	Helmet (√sun shade down, cover installed)
☐ Valsalva	☐ Valsalva
☐ EMU Gloves (Wh1)	☐ EMU Gloves (Mg1)
☐ EMU Battery (s/n 2099)	☐ EMU Battery (s/n 2100)
☐ LiOH (2002)	☐ LiOH (2012)
☐ LTA	☐ LTA
☐ ☐ 2 Comm Caps	☐ 1 Comm Cap

EVA SYS XFER BAG 1
☐ ☐ LiOH (CCC) (2) (expended from EVA 1) s/n 2014 & 2025
☐ ISS EVA Systems Checklist (2) with Red Stripe and No Stripe (Old ISS Checklist) ☐ FDF: EVA Checklist STS-135 (1) with Red Stripe ☐ EVA Ziplock ☐ STS-135 CONSUMABLES TRACKING CUE CARD ☐ ☐ EXPEDITED SUIT DOFFING/EMERGENCY UNDOCKING EVA TRANSFER CUE CARD ☐ ISLE PREBREATHE CUE CARD (Old ISS CC) ☐ AMMONIA CONTAMINATION TEST CUE CARD ☐ EXERCISE PREBREATHE CUE CARD (Old ISS CC) ☐ CREWLOCK DEPRESS/REPRESS CUE CARD (Old ISS CC) ☐ CREWLOCK DEPRESS/REPRESS CUE CARD WITHOUT IV (Old ISS CC) ☐ JOINT EXPEDITED EGRESS CUE CARD
☐ Nikon 10.5mm Lens (used during EVA) ☐ EVA Camera Thermal Blanket (s/n 1007) ☐ Lens Cap Assembly, 28mm, 35mm, 50mm (s/n 1037)

EVA SYS XFER BAG 2
☐ EMU Servicing Kit (s/n 5002) ☐ SOP Checkout Fixture (SCOF) s/n 1011 ☐ SOP Checkout Fixture (SCOF) s/n 1013
☐ 85-ft Safety Tether #22 ☐ 85-ft Safety Tether #21
☐ Bends Treatment Adapter w/wrench s/n 1004
☐ ☐ COLT Caps (2) s/n 1001 and 1003

17. Report to **MCC-H** when transfer complete

Item	Destination	Xfer Status
EMU s/n 3006	Middeck	
EMU s/n 3009	Middeck	
EVA Sys Xfer Bag 1	Middeck	
EVA Sys Xfer Bag 2	Middeck	

EVA UNPACK AND STOW (60 min)

NOTE

This procedure assumes that transfer items were preconfigured per EVA PREP FOR TRANSFER TO SHUTTLE

1. Unpack and stow items per table below; report status to **MCC-H** when complete:

Item	Initial Location (After Transfer)	Final Destination (On Shuttle)	Transfer Status
☐ EMU 3009 (Wh)		Stbd – AAP	
☐ EMU 3006 (Mg)		Port – AAP	
☐ SOP Checkout Fixture (SCOF) s/n 1011 ☐ SOP Checkout Fixture (SCOF) s/n 1013	EVA Sys Xfer Bag 2	Vol H (MD23R) EMU Equipment Bag main compartment	
☐ EMU Servicing Kit s/n 5002	EVA Sys Xfer Bag 2	Vol H (MD23R) EVA 1 INBD Bag	
☐ ISS EVA Systems Checklist (2) ☐ FDF: EVA Checklist ☐ STS-135 CONSUMABLES TRACKING CUE CARD ☐☐ EXPEDITED SUIT DOFFING/EMERGENCY UNDOCKING EVA TRANSFER CUE CARD (2) ☐ ISLE PREBREATHE CUE CARD ☐ EXERCISE PREBREATHE CUE CARD ☐ CREWLOCK DEPRESS/REPRESS CUE CARD ☐ CREWLOCK DEPRESS/REPRESS CUE CARD WITHOUT IV ☐ AMMONIA CONTAMINATION TEST CUE CARD ☐ JOINT EXPEDITED EGRESS CUE CARD	EVA Sys Xfer Bag 1	SODF Locker (MF57K)	
☐ Nikon 10.5mm Lens (marked for EVA use)	EVA Sys Xfer Bag 1	Still Camera Bag, Locker A17	
☐ EVA Camera Thermal Blanket (s/n 1007) ☐ Lens Cap Assembly, 28mm, 35mm, 50mm (s/n 1035)	EVA Sys Xfer Bag 1	DTV Bag, Locker A16	
☐ 85-ft Safety Tethers (2) ☐ Bends Treatment Adapter w/wrench 1004	EVA Sys Xfer Bag 2	A/L Floor Bag	
☐ LiOH s/n 2014 ☐ LiOH s/n 2025	EVA Sys Xfer Bag 1	Bag D	
☐ ☐ COLT Caps (2) s/n 1001 and 1003	EVA Sys Xfer Bag 2	Bag D	
☐ ☐ EVA Systems Xfer Bags 1 & 2 (2)	Middeck	A/L Floor Bag	

EMU PLSS TAB INSTALL (10 min)

OBJECTIVE:
To assemble Kapton lanyard for PLSS zippers. This procedure allows crewmembers to easily unzip PLSS with gloved hands in case of a Metox canister changeout

NOTE: Tape will be installed on EMUs 3006 and 3015 prior to launch

MATERIALS:
Kapton Tape – NOD1O4_B1 .5 CTB 1178 (1 inch width)

TOOLS:
Scissors – EMU Servicing Kit, E-Lk Deployed

1. Gather Kapton tape and scissors

2. Cut 8-in piece of Kapton tape

3. Fold tape lengthwise over onto itself in half, twice

Figure 1.- Fold tape.

4. Smooth out creases to make flat surface
   NOTE: Tape does not have to be completely flat

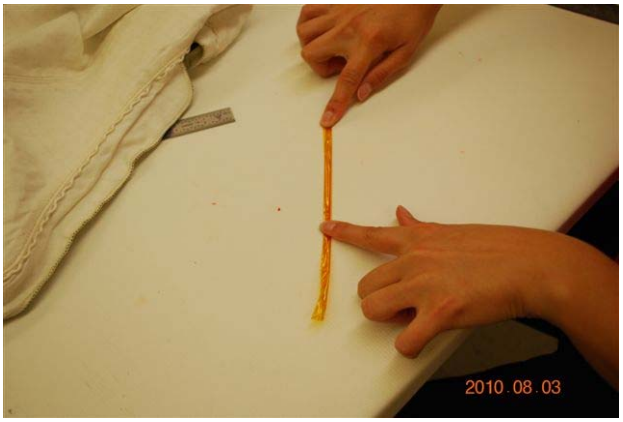


Figure 2.- Creasing tape.

EMU PLSS TAB INSTALL (10 min) (Cont)

5. Hold one end of tape and fold over the tip lengthwise, then thread it through hole on the zipper

Figure 3.- Threading tape.

6. Pull through zipper hole doubling the tape, making lanyard tails

7. Wrap a second piece of tape onto the lanyard tails starting at the tail end with adhesive side down

Figure 4.- Wrapping lanyard.

8. Continue wrapping tape in a corkscrew pattern

9. Tuck Kapton lanyard under TMG and Velcro down

EMU CHECKOUT ..... TEMP FS 3-2
EMU POWERUP AND COMM CHECK ..... TEMP FS 3-2
PRIMARY REGULATOR/FAN/PUMP CHECK 3-4
SOP CHECK 3-5
BATTERY CHARGE CHECK INIT 3-6
BATTERY CHARGE CHECK TERM 3-6
EMU SWAP DURING CHECKOUT 3-7
POST EMU C/O RECONFIG 3-7
SAFER CHECKOUT 3-8
SELF TEST SEQUENCE 3-9
SAFER CHECKOUT RESULTS ..... CC 3-10
SAFER STATUS TROUBLESHOOTING ..... CC 3-11
REBA POWERED HARDWARE CHECKOUT 3-12
ISS EMU CHECKOUT ..... FS 3-13

EMU CHECKOUT

NOTE

Procedures are written for simultaneous C/O of EMUs #_____ (stbd) and #_____ (port) in airlock. An additional C/O of EMU(s) #_____ uses same procedure after performing EMU SWAP during C/O

X: SM 60 SM TABLE MAINT

☐ 1. Contact MCC for uplink of SM ALERT TMBU (if desired)
Changes enclosed in [ ]

Param Name	Param ID	Lower Limit	Upper Limit
EXT A/L H2O LINE T			
EXT A/L H2O SPLY ZN 1 T	0640181	43	100
EXT A/L LCG 2 SPLY ZN 1 T	0640182	36	85
EXT A/L H2O LINE T 2			
EXT A/L H2O SPLY ZN 2 T	0640184	48	100
EXT A/L LCG 2 SPLY ZN 2 T	0640185	36	82
EXT A/L O2 LN T			
EXT A/L O2 SPLY ZN 2 T	0640186	OSL	80
EXT A/L BATT CHARGER			
VOLTS EMU 1	0640210	OSL	OSH
VOLTS EMU 2	0640213	OSL	OSH

EMU POWERUP AND COMM CHECK (15 min)

NOTE

If procedure is being repeated for 3rd EMU #_____ only, other previously checked EMU #_____ is reqd in airlock to perform EMU POWERUP and COMM CHECK procedures to verify EMU-to-EMU comm.

PWR RESTART msg and BITE light should be illuminated whenever EMU power is cycled. Display and tone tests only occur during cold restarts

BOTH DCM ☐☐ 2. Retrieve, position SCUs; remove DCM covers
☐☐ 3. Connect SCUs to DCM, √locked
☐☐ 4. PWR – BATT

CAUTION

EMU must be on BATT pwr when airlock power supply is turned on

AW18H ☐☐ 5. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
BUS SEL (two) – MNA(MNB)
☐☐ 6. √EMU INPUT 1,2 volts = 18.0-20.0
EV AW18D ☐☐ 7. √AIRLK AUD PWR – OFF
BOTH DCM ☐☐ 8. COMM mode – ALT
☐☐ 9. √Comm FREQ – LOW
IV A1R ☐☐ 10. √AUD CTR UHF A/G 1,2 (two) – OFF
A/A – T/R
R14:C ☐☐ 11. √cb MNA UHF EVA – cl
√MNC UHF EVA – cl

ISS EMU CHECKOUT (105 min)

OBJECTIVE:

Verify all systems on the Extravehicular Mobility Unit (EMU) are functional prior to use. Shuttle EMUs will remain in ISS A/L after checkout until post Resize. LTA Restraint Bags will be unbuttoned and left attached to the LTA Strap D-Rings for reinstallation.

NOTE

1. Procedure is written for simultaneous checkout of two EMUs.
2. PWR RESTART message occurs and BITE light is illuminated whenever EMU power is cycled. Display and tone tests only occur during cold restarts.

EMU	1.	√Helmet ←|→ HUT
	2.	√Comm cap →|← electrical harness
	3.	√LTA installed
	4.	√LiOH Canister installed
		√Battery installed
UIA	5.	√OXYGEN EMU 1,2 vlv (two) – CLOSE
	6.	CONFIGURING O2 SYSTEM
MCC-H		Airlock: ECLSS: O2 Hi Pressure Supply Valve AL O2 Hi Pressure Supply Valve
		cmd Open (√Actual Position – Open)
		POWERING UP EMUs/CHECKING HARDLINE COMM
UIA	7.	√sw PWR EV-1,2 (two) – OFF
		√PWR EV-1,2 LEDs (four) – Off
		√EMU O2 SUPPLY PRESS gauge: 850 to 950
C-Lk wall	8.	Remove SCU from stowage straps and pouches.
		Transfer SCU to E-Lk.
DCM	9.	Remove DCM Cover and affix with Velcro to DCM.
	10.	SCU →|← DCM
		√SCU locked
	11.	sw POWER → BATT

			CAUTION EMU must be on BATT power when UIA suit power is turned on.
	PSA	12.	√sw SUIT SELECT (two) – OFF
			√sw EMU MODE EMU 1,2 (two) – PWR
		13.	sw MAIN POWER → ON
			√MAIN POWER LED – On
		14.	sw SUIT SELECT (two) → EMU 1,2
			√EMU 1,2 LEDs (two) – On
			√EMU 1,2 Volts: 18.0 to 19.0
	UIA	15.	sw PWR EV-1,2 (two) → ON
			√PWR EV-1,2 EMU LEDs (two) – On
	ATU 4,5	16.	√EACP Y-cable →|← ATUs
	EACP	17.	√EACP Y-cable →|← EACP
			sw PWR → ON
			√EMU 1,2 mode sel (two) – DUAL
IV	ATU 6	18.	Connect headset.
	ATUs 4,5,6	19.	pb PTT → Press
			pb 5 → Press
			√Display – '**5T**' and other loops, as required
			√Display – '**DUAL**'
EV1,2		20.	Don Comm Caps
	DCM	21.	sw COMM mode → HL
			NOTE After the next step, be prepared to verify no missing segments on display and that all tones are audible.
		22.	sw POWER → SCU
		23.	Verify no missing segments during display test.
			Verify BITE light extinguishes.

Verify status (continuous) tone and warble tone are audible.

Report any anomalies to **MCC-H**.

24. Perform IV/EV comm check. (Any ATU with Loop **5T** called up)

IV ATU 4,5,6 25. pb HANG UP → Press

pb 5 → Press

EACP 26. sw PWR → OFF

27. CONFIGURING FOR CONTINUOUS EMU DATA

DCM sw DISP → STATUS, until DATA?COMBO displayed

sw DISP → YES (hold for 2 seconds)

sw DISP → STATUS, until DATA EMU? displayed

sw DISP → YES (hold for 2 seconds)

Verify DATA?EMU displayed

CHECKING EMU RADIOS/417.1 MHZ

IV ATU 6 28. pb 1 → PRESS

√Display – '**1TG**' and other loops, as required

√Display – '**DUAL**'

NOTE
The EMUs will be hot mic to **MCC-H** on Public 1 once the COMM modes are taken out of hardline (HL) and the Comm FREQs are in LOW.

EV1,2 DCM 29 sw COMM mode → PRI

30. sw Comm FREQ → HIGH

NOTE
The Big Loop will be disabled while ISS UHF is in high frequency. (Steps 31 - 37)

31. Inform Shuttle crew that the Big Loop will be disabled while in High Frequency ~ 10 mins.

ISS EMU CHECKOUT (105 min) (Cont)

MCC-H 32. Switching UHF 2 to High Frequency

C&T: UHF: Configuration
UHF Configuration
'Frequency'

cmd High Freq

√Pending Frequency: 417.1 MHz

'Set Actual Configuration'

cmd Set Actual

Verify no lighted boxes in the Miscompare columns.

√Actual Frequency: 417.1 MHz

EV1,2 33. Perform IV/EV/**MCC-H** comm check.

EV1,2 DCM 34. sw COMM mode → ALT

35. Perform IV/EV comm check.

CHECKING EMU RADIOS/414.2 MHZ

EV1,2 DCM 36. sw Comm FREQ → LOW

MCC-H 37. Switching UHF 2 to Low Frequency

C&T: UHF: Configuration
UHF Configuration
'Frequency'

cmd Low Freq

√Pending Frequency: 414.2 MHz

'Set Actual Configuration'

cmd Set Actual

Verify no lighted boxes in the Miscompare columns.

√Actual Frequency: 414.2 MHz

EV1,2 38. Perform IV/EV comm check.

EV1,2 DCM 39. sw COMM mode → PRI

40. Perform IV/EV comm check.

41. Doff comm caps.
Stow in left suit arm.

ISS EMU CHECKOUT (105 min) (Cont)

DCM 42. √STATUS: O2 P: 800 to 950

EMU	1	2	3
O2 P: 800 to 950 psi	_____	_____	_____

UIA 43. OXYGEN EMU 1,2 vlv (two) → OPEN

44. Install Helmet, lock.

45. √Suit arms aligned

√Gloves locked

√Helmet purge vlv – cl, locked

DCM 46. PURGE vlv → cl (dn)

47. O2 ACT → IV

48. √STATUS: SUIT P: 0.4 to 1.4 and stable (compare with gauge)

EMU	1	2	3
SUIT P (IV): 0.4 to 1.4	_____	_____	_____

49. O2 ACT → PRESS

50. √STATUS: SUIT P: 4.2 to 4.4 and stable (compare with gauge)

√STATUS: H2O GP: 14.0 to 16.0

√STATUS: H2O WP: 14.0 to 16.0

EMU	1	2	3
SUIT P (PRESS): 4.2 to 4.4	_____	_____	_____
H2O GP: 14.0 to 16.0	_____	_____	_____
H2O WP: 14.0 to 16.0	_____	_____	_____

51. sw DISP →STATUS, until LEAK CHECK? displayed

sw DISP → YES (hold for 2 seconds)

Follow displayed instructions.

EMU	1	2	3
SUIT ΔP: ≤ 0.3 psi	_____	_____	_____

****
*
* If LEAKAGE/HI SUIT P msg occurs
*
Perform 2.115 FAILED LEAK CHECK (14.7/10.2 PSIA) (SODF: ISS EVA SYS: EMU CONTINGENCY), then:
****

52. O2 ACT → OFF

53. PURGE vlv → op (up)

54. √STATUS: SUIT P < 0.4 (compare with gauge)

55. To completely equalize EMU ΔP

    55.1 Glove ←|→ EMU

    55.2 Glove →|← EMU

56. Helmet ←|→ HUT

    Stow Helmet

57. Waist ring ←|→ HUT

    Secure LTA.

    Remove Multiple Water Connector cover.

58. Cooling loop jumper →|← Multiple Water Connector

59. √Multiple Water Connector locked

DCM 60. √Temp control vlv – Max C

NOTE
Steps 61 - 75 operations will be completed serially.

CAUTION
Minimize fan operation with O2 ACT → OFF (~2 minutes).

ISS EMU CHECKOUT (105 min) (Cont)

DCM 61. sw POWER → BATT

UIA 62. sw PWR EV-1,2 (two) → OFF

√PWR EV-1,2 LEDs (four) – Off

√PWR EV-1,2 VOLTS: ~00.0

> NOTE
> The SCU will be disconnected so that SCU water will not be circulated through the suit during fan on activities.

DCM 63. SCU ←|→ DCM

64. Install DCM cover.

C-Lk wall 65. Insert SCU in stowage pouch.

66. sw FAN → ON

Expect BAT AMPS HI message

Sw DISP→ PRO

Verify flow at neck ring vent port.

DCM 67. √STATUS: BAT AMPS: 2.4 to 6.5

EMU	1	2	3
BATT AMPS: 2.4 to 6.5	_____	_____	_____

EMU 68. Install SCOF, lock.

> NOTE
> To ensure good pump flow verify bubbles moving in the cooling loop jumper after the O2 Act taken to IV mode. The bubbles may dissipate quickly after flow started.

69. O2 ACT → IV (Possible O2 USE HI message)

Expect NO VENT FLOW message, sw DISP → PRO

Verify Flow in Cooling Loop Jumper (LCVG).

****

* If no flow in Cooling Loop Jumper

* ⏐ Depress and hold pump priming valve on back of EMU,

* ⏐ while slowly cycling TCV between 7 and Max C (30 seconds minimum).

⏐

****

DCM

70. √STATUS: BAT VDC ≥ 16.8

    √STATUS: BAT AMPS: 2.4 to 4.0 (decrease from step 67)

    √STATUS: RPM: 19.0 to 20.0 K

EMU	1	2	3
BAT VDC: ≥ 16.5	_____	_____	_____
BAT AMPS: 2.4 to 4.0	_____	_____	_____
RPM: 19.0 to 20.0k	_____	_____	_____

71. √Fan noise steady

72. O2 ACT → OFF (expect O2 IS OFF message)

73. sw FAN → OFF

74. sw POWER → SCU (wait 10 seconds)

75. sw POWER → BATT (to reset X-State)

NOTE
Steps 76 - 86 operations will be completed serially.

CHECKING SOP (2 MINUTES/EMU)

76. CONFIGURING FOR CONTINUOUS EMU DATA

DCM

sw DISP → STATUS, until DATA?COMBO displayed

sw DISP → YES (hold for 2 seconds)

sw DISP → STATUS, until DATA EMU? displayed

sw DISP → YES (hold for 2 seconds)

Verify DATA?EMU displayed

ISS EMU CHECKOUT (105 min) (Cont)

77. √STATUS: SOP P: 5410 to 6800

EMU	1	2	3
SOP P: 5410 to 6800	_____	_____	_____

SOP 78. √SOP gauge 5400 to 6800 (reference Figure 1)

Note SOP interstage gauge.

EMU	1	2	3
SOP GAUGE: 5400 to 6800	_____	_____	_____
INT GAUGE: 0 to 600	_____	_____	_____

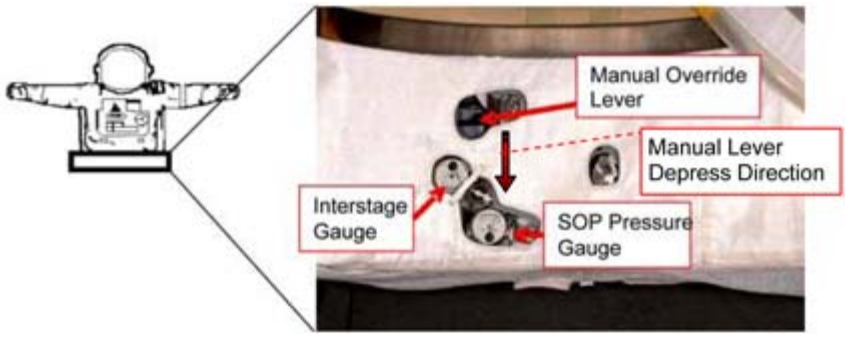


Figure 1.- SOP Gauges and Manual Override Lever.

PCS 79. √**MCC-H** if Cabin Temp required

Airlock: ECLSS
Airlock ECLSS
'Equipment Lock'

√Cab Temp

CAB TEMP	_____

DCM 80. sw DISP → STATUS until SUIT P displayed

sw DISP → YES (hold for 2 seconds) to lock parameter

NOTE
Minimize the duration of pressing down on the manual override to conserve SOP pressure.

81. While pressing down on the SOP manual override (30 seconds ≃ maximum)

SOP √SOP interstage gauge < 600

ISS EMU CHECKOUT (105 min) (Cont)

DCM √STATUS: SUIT P: 3.4 to 3.9 and stable

EMU	1	2	3
INT GAUGE: < 600	_____	_____	_____
SUIT P: 3.4 to 3.9	_____	_____	_____

82. √STATUS: SOP P: 5410 to 6800

EMU	1	2	3
SOP P: 5410 to 6800	_____	_____	_____

83. Remove SCOF, stow in EMU Equipment Bag.

84. sw COMM mode → OFF

85. √sw Comm FREQ → LOW

86. sw POWER → SCU

87. LCVG (cooling loop jumper) ←|→ Multiple Water Connector

    Stow LCVG in HUT.

    Install Multiple Water Connector cover.

88. Remove Comm Caps and stow in LTA Restraint Bag pouch.
    Install Helmet →|← HUT
    Re-stow ECOKs inside EMUs.
    Install LTA →|← HUT
    Bundle suit up, install LTA Restraint Bag on EMU 3006 (Mg) only.

UIA 89. OXYGEN EMU 1,2 vlv (two) → CLOSE

PSA 90. sw SUIT SELECT (two) → OFF

√SUIT SELECT LEDs (four) – Off

91. sw MAIN POWER → OFF

√MAIN POWER LED – Off

92. Check **MCC-H** if data reporting required.

MCC-H 93. RECONFIGURING O2 SYSTEM

Airlock: ECLSS: O2 Hi Pressure Supply Valve
AL O2 Hi Pressure Supply Valve

cmd Close (√Actual Position – Closed)

TIMELINES

EVA 1

- EVA 1 SUMMARY TIMELINE ..... FS 7-3
- EVA 1 TOOL CONFIG ..... FS 7-4
- EVA 1 BRIEFING CARD ..... FS 7-6
- EVA 1 INHIBIT PAD ..... FS 7-7
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- REMOVE PM FRAM FROM ESP-2 ..... FS 7-20
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- TRANSFER RRM FRAM TO EOTP ..... FS 7-24
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- MISSE 8 ORMATE III R/W INSTALL ON ELC-2 ..... FS 7-26
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- EVA 1 TASK DATA – RRM TRANSFER ..... FS 7-33
- EVA 1 TASK DATA – MISSE 8 ORMATE III ..... FS 7-38
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- EVA 1 TASK DATA – PMA3 COVER INSTALL ..... FS 7-43

GET-AHEADS

- STS-135 GET-AHEADS ..... FS 7-45
- FGB PDGF 1553 DATA CABLE INSTALL ..... FS 7-46
- FGB PDGF 1553 DATA CABLE INSTALL – TASK DATA ..... FS 7-48
- PORT CETA CART RECONFIG ..... FS 7-51
- SSRMS BASE B ELBOW CLPA R&R ..... FS 7-53
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- S1 FHRC P-CLAMP RELEASE ..... FS 7-56
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- TOOL RECONFIGURATION ..... FS 7-59
- GAP SPANNER INSTALL ..... FS 7-66

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EVA 1 SUMMARY TIMELINE

PET HR : MIN	IV/SSRMS	EV1	EV2	
00:00	• SSRMS at ST install position near ESP-2	EGRESS/SETUP (01:00) • Post Depress and Egress • Install COLTs	EGRESS/SETUP (01:00) • Post Depress and Egress • SSRMS Setup	00:00
	• SSRMS Maneuver to PM FRAM release			
01:00	• ESP-2 PM FRAM inhibits in place	REMOVE PM FRAM FROM ESP-2 (00:30)	REMOVE PM FRAM FROM ESP-2 (00:30) • Rotate PM	01:00
	• SSRMS Maneuver to ESP-2 clearance (~00:30 to PLB)	TRANSFER PM FRAM TO PLB (00:30)	TRANSFER PM FRAM TO PLB (00:30)	
02:00		INSTALL PM FRAM ON LMC (00:30) • Swap Crew on SSRMS	INSTALL PM FRAM ON LMC (00:30) • Swap Crew on SSRMS	02:00
	• LMC RRM FRAM inhibits in place	REMOVE RRM FRAM FROM LMC (00:20)	REMOVE RRM FRAM FROM LMC (00:20)	
03:00	• SSRMS Maneuver to EOTP (~00:30)	TRANSFER RRM FRAM TO EOTP (00:30)	TRANSFER RRM FRAM TO EOTP (00:30)	03:00
	• EOTP RRM FRAM inhibits in place	INSTALL RRM FRAM ON EOTP (00:20)	INSTALL RRM FRAM ON EOTP (00:20)	
	• SSRMS Maneuver to ESP-2 egress position (~00:15)	SSRMS CLEANUP (00:45)	MISSE 8 ORMATE-III R/W INSTALL ON ELC-2 (01:20)	
04:00	• ELC-2 MISSE 8 inhibits in place			04:00
	• SSRMS Maneuver to park position • SSRMS RWS in Backup	FGB PDGF TROUBLESHOOTING (00:35)		
05:00		PMA3 COVER INSTALL (00:45)	PMA3 COVER INSTALL (00:45)	05:00
		CLEANUP/INGRESS (00:45) • Cleanup (00:15) • Ingress and Pre-Repress (00:30)	CLEANUP/INGRESS (00:45) • Cleanup (00:15) • Ingress and Pre-Repress (00:30)	
06:00				06:00
06:30				06:30

EVA 1 TOOL CONFIG

EV1

- ☐☐ MWS
  - ☐☐ BRT (L)
    - ☐☐ RET (sm-sm)
    - ☐☐ Wire Tie (2 short, 2 long)
  - ☐☐ T-Bar
    - ☐☐ Wire Tie (3)
    - ☐☐ RET (sm-sm)
    - ☐☐ WIF Adapter (w/PIP Pin)
    - ☐☐ RET w/PIP Pin
    - ☐☐ RET (sm-sm) (*from COLT & gap spanner stow*)
    - ☐☐ Adj Equip Tether (sm-sm) (behind MWS)
    - ☐☐ Adj Equip Tether (sm-sm) (behind MWS)
    - ☐☐ Adj Equip Tether (sm-sm) (Left D-ring)
    - ☐☐ Adj Equip Tether (sm-sm) (Right D-ring)
    - ☐☐ Small ISS Trash Bag
      (Left/Outer short wire tied – 3 twists)
      - ☐☐ COLT Cap
      - ☐☐ COLT Cap
  - ☐☐ Swing Arm (R)
    - ☐☐ RET (sm-sm)
      - ☐☐ PGT [**A4** 6.3 ft-lb, **CAL**, MTL **30.5**] s/n_____
        - ☐☐ PGT Battery s/n _____
        - ☐☐ 7/16 (wobble) Socket-6 ext
- ☐☐ D-ring Extender (2, R & L D-ring)
  - ☐☐ ST Pack (85-ft + 85-ft to R D-ring Ext)
  - ☐☐ Waist Tether (L on D-ring Ext)
- ☐☐ Waist Tether (R on D-ring, to Crew ST reel)
- ☐☐ SAFER
- ☐☐ WVS

NOTE: Prior to use, inspect the following hardware:

- ❑ RET cords for fraying
- ❑ Inspect Load Alleviating Straps and D-ring Extenders; ref CREW TETHER INSPECTIONS, ISS EVA Tasks Checklist:
  1. MMOD/general damage
  2. Discoloration
  3. Tack Stitching
  4. Red Band
- ❑ ISS Trash Bag: Zipper closed
  Bristle deformation/damage, after having stowed tools
- ❑ BRT joint screws not loose
- ❑❑ COLT sliders in OPEN position
- ❑❑ COLT unlock caps installed, with Velcro & RET

Highlighted items are transferred from Shuttle

Tether Counts: **GREEN RETs**
RETs (sm-sm) = 16/16 RETs (PIP Pin) = 4/5
RETs (Lg-sm) = 5/8 Adj Eq Tethers = 10/10 sm; 2/2 Lg

EV2

- ☐☐ MWS
  - ☐☐ BRT (L)
    - ☐☐ RET (sm-sm)
    - ☐☐ Wire Tie (2 short, 2 long)
  - ☐☐ T-Bar
    - ☐☐ Wire Tie (3)
    - ☐☐ RET (sm-sm)
    - ☐☐ RET w/PIP Pin
    - ☐☐ Adj Equip Tether (sm-sm) (behind MWS)
    - ☐☐ Adj Equip Tether (sm-sm) (Fairlead)
    - ☐☐ Adj Equip Tether (sm-sm) (Fairlead)
    - ☐☐ Small ISS Trash Bag
      (Left/Outer short wire tied – 3 twists)
      - ☐☐ RET w/PIP Pin
        - ☐☐ WIF Adapter (w/PIP Pin)
  - ☐☐ Swing Arm (R)
    - ☐☐ RET (sm-sm)
      - ☐☐ PGT [**A4** 6.3 ft-lb, **CAL**, MTL **30.5**] s/n_____
        - ☐☐ PGT Battery s/n _____
        - ☐☐ 7/16 (wobble) Socket-6 ext
- ☐☐ D-ring Extender (2, R & L D-ring)
  - ☐☐ 85-ft Safety Tether (R D-ring Ext) (Anchor – *A/L*)
  - ☐☐ 85-ft Safety Tether (R D-ring Ext) (Crew – *SSRMS*)
  - ☐☐ Waist Tether (L on D-ring Ext)
- ☐☐ Waist Tether (R on D-ring, to Anchor ST reel)
- ☐☐ SAFER
- ☐☐ WVS

- ☐☐ RET (Lg-sm) (stays in A/L)
- ☐☐ Adj Equip Tethers (sm-sm) (stays on ORU Bag)
  - ☐☐ **Medium ORU Bag (PMA3 Cover)**
    - ☐☐ Gap Spanner (fully extend) (on int tethers) (-307/42"-72")
    - ☐☐ RET (sm-sm)
      - ☐☐ PMA3 Cover (Cover key near bag flap hinge)
    - ☐☐ EVA Camera (w/bracket and Int RET)
    - ☐☐ RET (sm-sm)
      - ☐☐ Needle Nose Pliers

- ☐☐ RET (Lg-sm) (stays in A/L)
  - ☐☐ **Medium ORU Bag (CLPA)**
    - ☐☐ RET (sm-sm)
      - ☐☐ Square Scoop
        - ☐☐ CLPA
    - ☐☐ RET (sm-sm)
      - ☐☐ Square Scoop (*on top, for failed CLPA)*

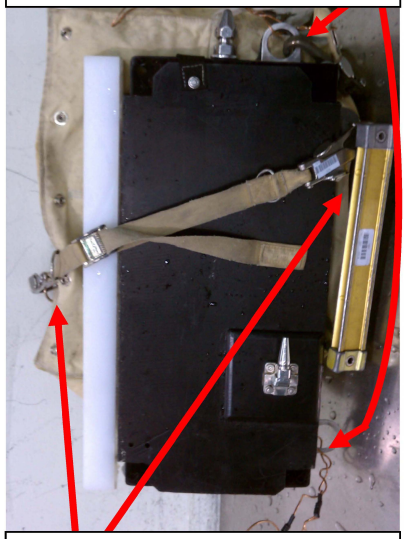
- ☐☐ Adj Equip Tether (sm-sm)
- ☐☐ RET (Lg-sm) (stays in A/L)
  - ☐☐ **Crewlock Bag (COLT)**
    - ☐☐ Wire Ties (2 long – 3 twists)
    - ☐☐ COLT (short/aft, used second)
      - ☐ Int RET 1
      - ☐ Wire tied closest to bag, along external HR
      - ☐☐ RET (sm-sm) (Cap to COLT)
        - ☐☐ COLT Cap (installed on COLT)
    - ☐☐ COLT (long/fwd, used first)
      - ☐ Int RET 2
      - ☐ Wire tied 2nd to bag, along external HR
      - ☐☐ RET (sm-sm) (Cap to COLT)
        (*used for gap spanner stow*)
        - ☐☐ COLT Cap (installed on COLT)
    - ☐☐ ERAD w/7/16" socket 2" ext (Int RET 3)
      (*for RRM FRAM contingency bolt down)*
    - ☐☐ RET (sm-sm)
      - ☐☐ EVA Camera (w/bracket and int RET)
    - ☐☐ RET (sm-sm)
      - ☐☐ Fisheye Camera (w/bracket and int RET)
- ☐☐ Adj Equip Tether (sm-sm)
- ☐☐ RET (Lg-sm) (Stays in A/L)
  - ☐☐ **Crewlock Bag (MISSE/Get-ahead)**
    - ☐☐ Wire Ties (1 short, 1 long – 3 twists)
    - ☐☐ Adj Equip Tether (sm-sm) (from internal D-ring around MISSE to HR)
      - ☐☐ MISSE 8 ORMATE (Int RET 1; wire tied to back of bag; configure during pre-breathe)
    - ☐☐ Ratchet w/7/16" socket 2" ext (Int RET 2)
    - ☐☐ RET (sm-sm)
      - ☐☐ EVA Camera (w/bracket and Int RET)
    - ☐☐ Wire Tie Caddy (Int RET 3) (3 short; 6 long)
    - ☐☐ Socket Caddy (Int RET 4)
    - ☐☐ RET (sm-sm)
      - ☐☐ EVA Fisheye Camera (w/bracket and Int RET)
- ☐☐ RET (Lg-sm) (stays in A/L)
- ☐☐ Adj Equip Tether (Lg-sm)
- ☐☐ Adj Equip Tether (Lg-sm)
  - ☐☐ **1553 Data Cable Bag**
    - ☐☐ 1553 Cable
    - ☐☐ Fish Stringer
      - ☐☐ Node 3 Terminator MLI
      - ☐☐ Node 3 Terminator MLI
      - ☐☐ Node 3 Terminator Cap
      - ☐☐ Node 3 Terminator Cap
      - ☐☐ 1553 P1 cap
      - ☐☐ 1553 P2 cap

EVA 1 TOOL CONFIG (Cont)

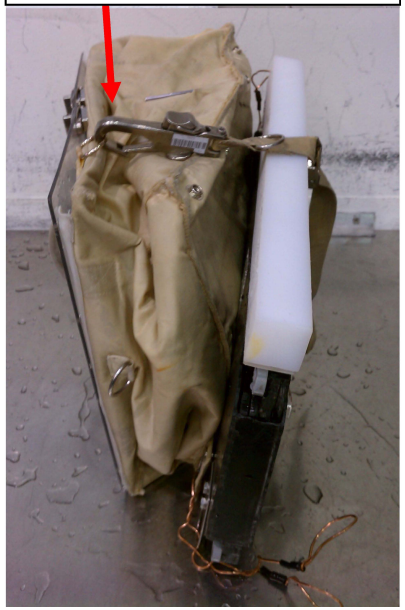
- ☐☐ **IV Bag**
  - ☐☐ Towels (2)
  - ☐☐ Contamination Detection Kit
  - ☐☐ RET (sm-sm, Black)
    - ☐☐ GP Caddy
      - ☐☐ Adjustable Thermal Mittens (2)
    - ☐☐ GP Caddy
      - ☐☐ Adjustable Thermal Mittens (2)
  - ☐☐ RET (sm-sm, Black)
    - ☐☐ Socket Caddy (hatch contingencies)
      - ☐☐ 1/2 Socket-8 ext
      - ☐☐ 7/16 (wobble) Socket-6 ext (spare)
  - ☐☐ RET (sm-sm, Black)
    - ☐☐ DCM Plug (SAFER Hardmount) (2)

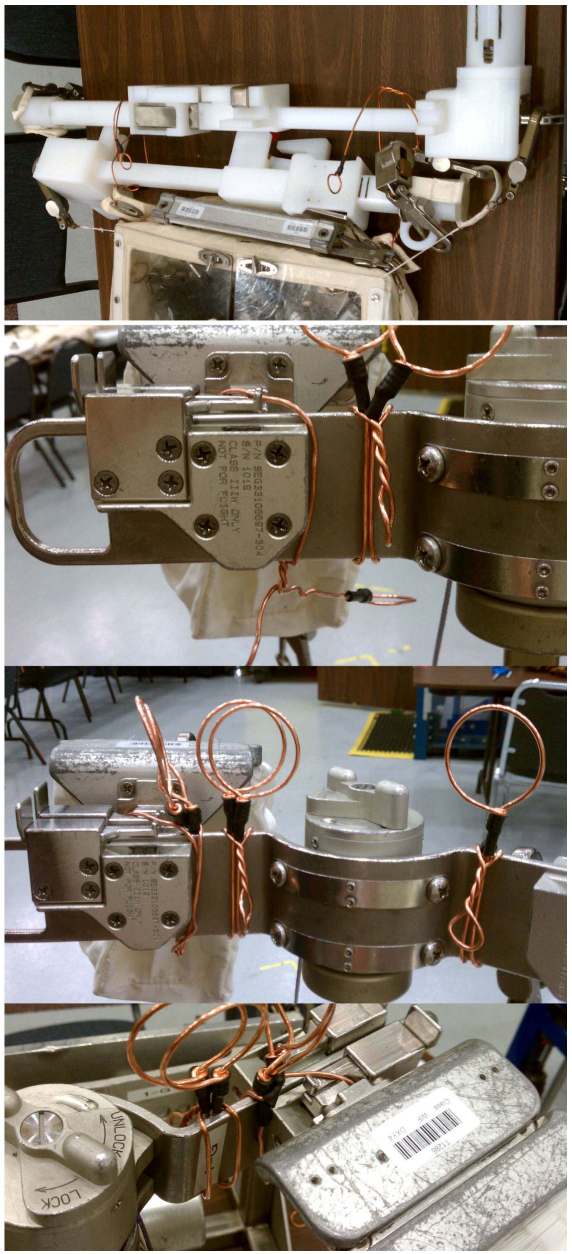
- ☐☐ **Staging Bag**
  - ☐☐ Fish Stringer Tether #1
    - ☐☐ Wire Tie Caddy (6 short; 3 long)
    - ☐☐ Velcro/Tape Caddy
    - ☐☐ PGT s/n _____
      - ☐☐ PGT Battery s/n _____
      - ☐☐ 7/16 (wobble) Socket-6 ext
    - ☐☐ Ratchet Wrench
    - ☐☐ Spare WIF Adapter (w/PIP Pin)
    - ☐☐ Long Duration Tie-Down Tether
    - ☐☐ Long Duration Tie-Down Tether
    - ☐☐ Spare 85-ft Safety Tether
  - ☐☐ Fish Stringer Tether #2 (inside tether)
    - ☐☐ Connector Cleaner Tool Kit
    - ☐☐ Pry Bar
    - ☐☐ MWS Key Strap Assy (on wire tie, to strap)
  - ☐☐ **Crewlock Bag (Tool Relocations) (hook to outside of Staging Bag)**
    - ☐☐ Vise Grips (stbd toolbox) (Int RET 1)
    - ☐☐ Probe (stbd toolbox) (Int RET 2)
    - ☐☐ Pin Straightener Assy (port toolbox) (Int RET 3)
    - ☐☐ Adj Equip Tether (sm-sm) (Int RET 4)
      - ☐☐ Short MMOD T-Handle Tool (port toolbox)
      - ☐☐ Short MMOD T-Handle Tool (port toolbox)
    - ☐☐ RET w/PIP Pin
      - ☐☐ 1" QD Cap Tool (stbd QD Bag)
      - ☐☐ General Purpose Cutters (Large Cutters) (from port toolbox)

Wire ties anchored on Bag eyelet and tied to MISSE tether point



Adj Tether from internal ring to HR





EVA 1 BRIEFING CARD

EVA Prep

- Review Morning Timeline/Plan/Tethers
- Work With a Purpose
- Pure O2 Protocol
- Suit Donning Plan – special requests, boot bladder manipulation
- Safer, MWS, Tools, CL, Bag Stowage in A/L
- Airlock Depress Review

Procedure Review

- Egress Plan (tethers)
- Order of Tasks (summary timeline)
- Translation Paths, Fairleads
- Hazards (no touch, no damage, keep outs, notes, cautions, warnings)
    - Opened MISSE PECs – no touch; PEC hinges – pinch point
- Contingencies – section 16
- Task Constraints, Potential Get-aheads
- Ingress Plan

Post EVA

- Suit Doffing
- Tool Reconfig Plan

Emergencies

- Comm Fail (hand signals, Term EVA, Abort EVA)
- EMU Malfunctions
- Lost Tools/Crewmember (velocity and direction)
- DCS
- Safer Ops
- Crew Rescue

Reminders/Top Ten

- Gate Closed, Slider Locked, Tether Reel Unlocked
- Pins Straight, No FOD, Good EMI
- PGT Read-back, Turns and Torque with light
- Worksite Departure – tethers and tools clear
- Move Slow – no hopping (slower is faster)
- Body Position is Everything (use space)
- Tether Awareness – all of them
- Suit/Tool Awareness – BRT/PGT/ORU Stowage
- Suit MAL – read down DCM messages
- Discipline and Attention to detail until the end
- Day/Night Checks (Settings, tools, tethers)

Contingency

EVA 1 INHIBIT PAD

Orbiter

ALL EVAs

TCS *(Prior to Egress – Crew)*
IV L12 1. √TCS POWER – OFF
2. Install Switch Guard to remain in place through EVA

TriDAR *(Prior to Egress – Crew)*
IV L12L (SSP2) 1. √TriDAR POWER – OFF (tb-bp)

KU-Band Antenna *(Prior to Egress – INCO)*
MCC-H 1. √KU-BAND Mask – active
2. √KU-BAND EVA Protect Box – active

RCS *(Prior to translation into payload bay – Crew/PROP/GNC)*
If EV crew < 27 ft from FRCS
IV 1. √DAP: VERN, FREE, LO Z
O14,15,16 2. √RJDF F1, F2, F3, F4 MANF DRIVER (four) – OFF
LOGIC (four) – OFF
MCC-H 3. √Above RCS config
IV 4. √RCS F – ITEM 1 EXEC (*)
√JET DES F1U – ITEM 17 (*)
F3U – ITEM 19 (*)
F2U – ITEM 21 (*)

LOCATION DEPENDENT INHIBITS

S-Band Antennas *(Prior to translation into payload bay – Crew)*

NOTE

Possible loss of comm when forced LL FWD antenna

IV If EV crew < 2 ft from S-Band antenna
A1R 1. S-BAND FM ANT – XMIT LOWER/RCVR UPPER
2. √**MCC**, lower antenna selected
If no comm, or on **MCC GO**
C3 3. S-BAND PM ANT – LL FWD
When EVA crewmember at least 2 ft away from all S-Band upper antennas
C3 4. S-BAND PM ANT – GPC

TASK SPECIFIC INHIBITS

Failed PM Install on LMC *(Prior to Egress)*
(No inhibits required)

RRM Removal from LMC *(Prior to Egress – Crew)*
IV R1 PL AFT MNC – OFF

USOS (1)

ALL EVAs

PCU *(Prior to Egress – PHALCON)*

NOTE

PCUs may require up to a 1-hr warmup period before they are operational

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

CUCU *(Prior to Egress – Crew)*
IV – (LAB1O4)
1. √cb POWER A, B [two] – OPEN
2. √cb LINK 1,2 [two] – OPEN

MISSE 8 *(Prior to Egress – POD)*
POIC Prior to EV Hatch Open
1. ELC-2 ExPA-2 Discrete Channel 6 – Disabled

Ground

ALL EVAs

Ground Radar *(Prior to Egress – TOPO)*
MCC-H 1. √TOPO console, ground radar restrictions in place for EVA

EVA 1 INHIBIT PAD (Cont)

RSOS

ALL EVAs

SM Antennas *(Prior to Egress – RIO)*

IV
1. ARISS (Ham Radio) – Deactivate

MCC-M
2. GTS – Deactivate
3. Napor (РСПИ) – Deactivate

JEM

ALL EVAs

ICS-EF Antenna *(Prior to Egress – SSIPC)*

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

COL

ALL EVAs

HAM Radio *(Prior to Egress – Crew)*

IV
1. HAM Radio – Deactivate

USOS (2)

LOCATION DEPENDENT INHIBITS

Lab Window (*Prior to Egress – Crew*)

IV
If EV crew less than 10 ft from window or in window FOV, close window shutter

Cupola Windows (*Prior to Starting Task – PMA3 Cover Install – Crew*)

IV
If EV crew less than 10 ft from window, coordinate shutter opening/closing with EV crew and minimize time shutter is open

Bluetooth Stethoscope *(Prior to Egress – SSIPC)*

SSIPC
If EV crew translating on JEM
1. Electronic Stethoscope – OFF
2. JEM Medical Laptop – Bluetooth Disabled

Mobile Transporter (*Prior to Egress – ROBO*)

MCC-H
If EV crew < 1.5 meters from MT
1. √MT latched

SPDM *(Prior to Egress – ROBO)*

MCC-H
If EV crew translating or working on SPDM
1. √SPDM in Keep Alive configuration
2. √PSU – Operational
3. √SACU1(2) – Operational
4. √Body Prime(Redundant) – Keep Alive or Off
5. √SPDM Arm 1(2) – Keep Alive

SSPTS *(Prior to Egress – PHALCON)*

MCC-H
If EV crew working within 2 ft of SSPTS cables
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

TASK SPECIFIC INHIBITS

Failed PM Removal from ESP-2 *(Prior to Task – PHALCON)*

MCC-H
RPCM S04B_F RPC 10 Open/Close Inh – PM Heater 1 Pwr
RPCM N1RS2_B RPC 6 Open/Close Inh – PM Heater 2 Pwr

RRM Install on SPDM EOTP *(Prior to Egress – ROBO)*

MCC-H
Verify SPDM PSU Output Bank A(B) Port #7 – OFF (two)

EVA 1 INHIBIT PAD (Cont)

GET-AHEADS

LOCATION DEPENDENT INHIBITS

Starboard TRRJ *(Prior to Egress – ORMatE III Install & FHRC P-Clamps – THOR)*
MCC-H If EV crew working within 2 ft of S1 TRRJ rotation envelope (Includes ELC 4)
1. √DLA 1(2) – LOCKED 0°
2. √DLA 2(1) – ENGAGED

Port TRRJ *(Prior to EVA – PMA3 Cover Install – THOR)*
MCC-H If EV crew working within 2 ft of P1 TRRJ rotation envelope (Includes Node 3 Port Endcone and PMA3)
1. √DLA 1(2) – LOCKED -45°
2. √DLA 2(1) – ENGAGED

SSRMS Base B Elbow CLPA *(Prior to Starting Task – ROBO)*
MCC-H RPCM S04B C RPC 4 – Open, Close Cmd Inhibit
RPCM S03A C RPC 2 – Open, Close Cmd Inhibit

RSOS (2)

EVAs ON PMA1 OR RSOS (LOCATION DEPENDENT)

RSOS and RSOS Visiting Vehicle Antennas (Includes FGB, SM, DC-1, MRM-1, MRM-2, Progress)
MCC-M 1. √KURS P [КУРС Р] – Deactivated
2. √KURS A [КУРС А] – Deactivated

USOS (3)

TASK SPECIFIC INHIBITS (2)

MISSE 8 *(Prior to Starting Task – ORMatE III Install on ELC-2 – POD)*
POIC If EV crew working zenith of plane of MISSE 8
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

Starboard SARJ *(Prior to Egress – ORMatE III Install – PHALCON)*
MCC-H If EV crew working within 2 ft, outboard of SARJ or reqd per loads FR (Includes Outboard faces of Outboard ELCs/ESPs)
1. √DLA (1) – LOCKED at 225°
2. All motor setpoints set to zero
3. All motors deselected

MCS Configuration *(PM xfer, RRM xfer, ORMatE-III Install – ADCO)*
MCC-H When EV on SSRMS w/PM or RRM < 2 ft from structure; when EV on ELC-2 for ORMatE-III Install
1. √Desat Request – Inh
2. √Auto Att Control handover to RS – Inh (MOD)

Node 3 J1 FGB and J2 FGB 1553 (*Once SSRMS at Park position and prior to 1553 Get-ahead – ROBO*)
MCC-H If any RWS active, cmd 'Active Assert Backup'

FGB PDGF Power (*Prior to 1553 or PDGF Get-ahead – RIO)*
MCC-M 1. √RACU-6 – OFF
2. √RACU-5 – OFF
System power panel (ППС) 313
RS Crew 1. √**БКС** Cable 77КМ-7228-110-01 – Demated
2. √**БКС** Cable 77КМ-7228-110 – Demated

RSOS (3)

ADDITIONAL ANTENNA INHIBITS FOR EVAs ON RSOS (LOCATION DEPENDENT)

FGB Antennas
MCC-M
1. √TORU [ТОРУ] – Deactivated
2. √TV System [ТВС] – Deactivated
3. Radiotelemetry [БР-9ЦУ-8] – Deactivate
4. √TV System [КЛ-108А] – Deactivated
5. √CNPMS [СИТНП] – Deactivated
6. √KOMPARUS [КИС] – Deactivated

EVA 1 NOTES/CAUTIONS/WARNINGS

NOTES

1. Bolt install: Report torque and turns
2. Bolt release: Report torque and turns if different from published range
3. EVA connectors: After disconnection and prior to connection; verify pin and EMI band integrity; verify connector free of FOD
4. Inspect QDs for damage prior to mating
5. Toolbox doors must be closed with one latch per door when EV crew not in immediate vicinity
6. 85-ft safety tether retract force may affect body positioning
7. CETA Cart brake handle wire ties must be replaced after crew loading
8. For HTV N/C/W refer to 6.100.180 HTV NOTES, CAUTIONS, & WARNINGS (SODF: EVA TASK)

CAUTION

ISS Generic Constraints

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

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

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

D. Fluid line flex hoses and QDs
   1. Avoid bend radii < 14 in for hoses with a diameter ≥ 1 in
   2. Additional care should be taken to not exceed bend radii when applying loads at the flexible hose to rigid tube stub interfaces
   3. Ensure fluid QD booties are fully closed prior to leaving worksite; wire tie if reqd
   4. Avoid bend radii < 5 in for hoses with diameter < 1 in on LAB, S0, S1, P1, and 10 in for hoses with diameter < 1 in on all other elements

CAUTION

ISS Generic Constraints (Cont)

E. For structural reasons
   1. Avoid vigorous body motions, quick grabs and kickoffs against tether restraints
   2. Avoid performing shaking motions (sinusoidal functions) more than four cycles

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

CAUTION

ISS Truss Constraints

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

B. For structural reasons
1. Avoid kicking S1/P1 radiator beam. If any of these occur, wait 2 to 5 min to allow structural response to dissipate

CAUTION

ISS Truss Constraints (Cont)

C. Other
1. WIS antennas: Do not use as handholds [NODE 1,LAB,P6,Z1]
2. Lubricant from Ku-Band SGANT gimbals [Z1], CMGs [Z1], and RTAS ground strap fasteners [P6,P4,S4,S6] can contaminate EMU
3. Prevent inadvertent contact of the tether shuttle with ETRS when the S3/P3 tether shuttle stop is raised away from the rail

CAUTION

ISS U.S. Pressurized Elements Constraints

A. Avoid inadvertent contact with
1. EVA crane [PMA1]
2. TCS reflectors [PMA2,PMA3]
3. APAS hardware [PMA2,PMA3]
4. CETA lights (Z-93 paint) [LAB,S1,S3, NODE 1]
5. UHF antennas [LAB,P1]
6. Open CBM petal covers, LAB and Cupola window shutters
7. S0/NODE 2 fluid tray hardlines at NODE 2 end, which are limited to 25 lb

B. Other
1. WIS antennas: Do not use as handholds [NODE 1,LAB,P6,Z1]
2. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged

CAUTION

ISS I.P. Elements Constraints

COL

A. Avoid inadvertent contact with
   1. COL ARISS and AIS antennas [COL-Nadir]

JEM

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

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

CAUTION

Shuttle Constraints

A. Avoid inadvertent contact with
   1. OBSS and SRMS composite sections joint torque arms, grapple fixture shafts, and cable harnesses
   2. LCS (silver Teflon) and LDRI (silver Teflon) and ITVC (gold foil) [OBSS]
   3. WVS antenna [ODS truss and PLB sill]
   4. Payload bay and camera wire harnesses, cables, cable guides, and connectors
   5. OBSS striker bars (drylube)

B. No touch
   1. LDRI diffuser [OBSS]
   2. OBSS saddle contacts (when OBSS unberthed) [OBSS]
   3. Monkey fur [PLB]
   4. Cameras: Metallic surfaces [PLB]
   5. Ku-Band antenna black dish and gold thermal blankets [PLB]

WARNING

ISS Generic Constraints

A. Avoid inadvertent contact with
   1. Grapple fixture targets and target pins

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

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

D. Sharp Edges
   1. Inner edges of WIF sockets
   2. APFR active WIF probes
   3. Mating surfaces of EVA connectors Avoid side loads during connector mating
   4. Back side of MMOD shield fasteners
   5. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM, RTAS, SARJ Covers); the end of the spring may protrude
   6. SPDM OTCM gripper jaws
   7. Keep hands away from SSRMS LEE/POA/SPDM LEE opening, snares, and PDGF curvic coupling (teeth)
   8. MMOD strikes on ISS exterior

WARNING

ISS Generic Constraints (Cont)

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

WARNING

ISS Truss Constraints

A. 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. Stay inboard of SARJ when active
   3. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate
   4. Stay 5 ft from moving MT on face 1
   5. Stay 3.3 ft from Ku-Band (SGANT antenna) when powered
   6. Stay 1 ft from top of STP-H3 (ELC-3)
   7. Deployed MISSEs and ORMatE-III R/W

B. 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 1 ft from UHF antenna when powered [LAB,P1]

C. Sharp Edges
   1. Solar array blanket box [P6,S6]
   2. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing
   3. Outboard MT rail attachment lug near P6 handrail 5333 and gap spanner
   4. P2 connector on EWIS box TAA-06 [Zenith/Forward Corner 1 of P5 – SARJ at 0 deg]

WARNING

ISS Truss Constraints (Cont)

C. Sharp Edges (Cont)
5. Nickel coated braided copper ground straps may contain frayed wires [P6,P4,S4,S6]
6. MMOD strikes on Z1 toolboxes
7. POA FSE (CSA Logo below MBS Mast Camera)
8. AMS Star Trackers

D. 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)

E. Thermal
1. ELC may exceed touch temperatures when β > 75 deg

WARNING

ISS U.S. Pressurized Elements Constraints

A. 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 Nad/Fwd and Port/Fwd, P6 5389]

B. 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

C. RF Radiation Exposure
1. Stay 1 ft from UHF antenna when powered [LAB,P1]

D. Sharp Edges
1. PMA umbilical launch restraints – exposed bolt threads
2. Adjustable fuse tether (Fish Stringer) buckles stowed in Node bag
3. Port/Aft portion of A/L circular HR [HR 0506]
4. A/L HR 0537 (Eq Lock Zenith)
5. ESP-2 HR 8012
6. PMM ROEU and ROFU panels (zenith endcone)

E. Thermal
1. PMA handrails may be hot. Handling may need to be limited.
2. Stay ≥ 1 ft away from PMAs and MMOD shields > 270 degF if EMU sun visor up; limit time to 15 min or less if > 300 degF

WARNING

ISS U.S. Pressurized Elements Constraints (Cont)

E. Thermal (Cont)
3. Stay at least 0.5 ft away from PMA and MMOD shields > 325 degF
4. No EMU TMG contact with PMAs and MMOD shields > 320 degF

F. Electrical Shock
1. Stay ≥ 2 ft from ungrounded floating connectors if powered. SSPTS connectors include NOD1 Stbd/Fwd HR 0130, LAB Stbd/Fwd HR 0273, PMA2 Stbd

G. Fluid QDs
1. Do not translate on gap spanners restraining NODE 3 – LAB NH3 jumpers

WARNING

ISS I.P. Elements Constraints

COL
A. Avoid inadvertent contact with
1. SOLAR [COL EPF]

B. Thermal
1. Columbus end cones may violate touch temperature constraints when $-75 \leq \beta \leq -60$ or $60 \leq \beta \leq 75$

JEM
A. Avoid inadvertent contact with
1. ICS-EF sensors

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

WARNING

ISS I.P. Elements Constraints (Cont)

JEM (Cont)
C. Sharp Edges
1. Interior of JEMRMS HRMs
2. JEMRMS EE opening and snares
3. JEM A/L hatch corners
4. ICS-EF AHM gears
5. MAXI visual star camera
6. SMILES baffles (two), baffle base bare bolts, and Cold Sky Terminator (CST)
7. HREP baffles (four) [Star tracker aperture Zenith and three instrument baffles Aft]
8. SFA Electro-Mechanical GF (EMGF)

D. RF Radiation Exposure
1. Stay 0.3 ft from Fwd/Aft JPM PROX antenna

E. Thermal
1. JPM Port End Cones and JLP Port Nadir may violate touch temperature constraints when $\beta > 60$ deg
2. JEMRMS/JTVE/JEFVE operating cameras and lights may radiate large amounts of heat

WARNING

Shuttle Constraints

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

B. Pinch
1. PRLA operation [PLB]

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

WARNING

Shuttle Constraints (Cont)

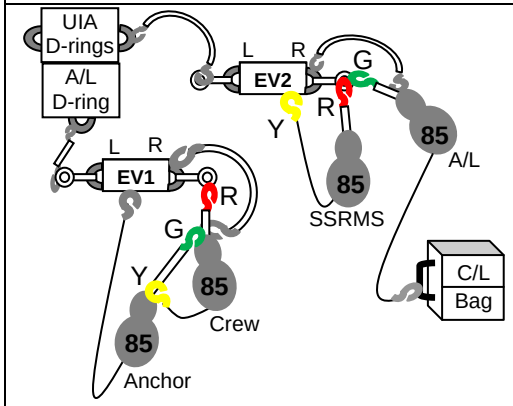
D. Sharp Edges
1. PRLA grounding wipers [PLB]
2. LDRI baffles (also an entrapment hazard) [OBSS]
3. Keep hands away from SRMS EE opening and snares
4. TCS connector backshells have exposed threads [ODS]

E. Thermal
1. Illuminated PLB lights; do not touch
2. OBSS grapple fixture shafts/cams may be hot. Limit handling if required
3. Stay 27 ft from PRCS when powered
4. Stay 3 ft from VRCS when powered
5. Stay 3 ft from APU when operating

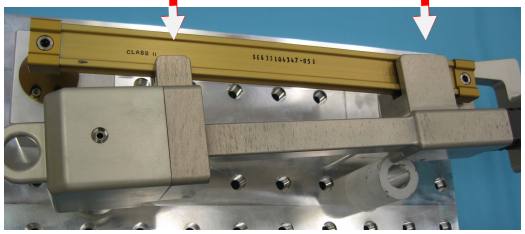
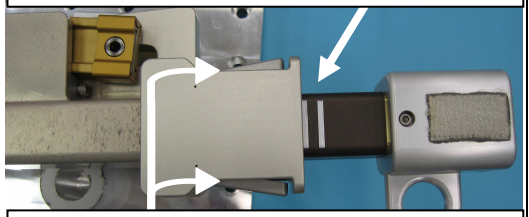
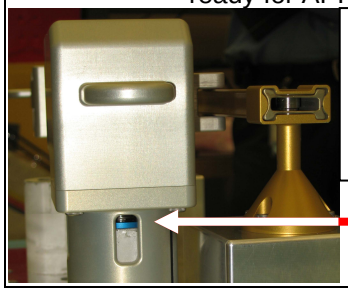
F. Contamination
1. Stay out of the immediate vicinity of leaking jet or APU

G. Lasers
1. Do not look at LDRI diffuser or LCS laser aperture window

EVA 1 EGRESS/SETUP (01:00)

IV/SSRMS	EV1	EV2
	**Initial Configuration:** 1. √All gates closed & hooks locked ❑ L Waist Tether to A/L internal D-ring extender ❑ L Waist Tether to D-ring extender ❑ R Waist Tether to crew tether reel ❑ R Waist Tether to D-ring ❑ Green hook to crew ST reel ❑ Anchor hook to MWS ❑ Red hook to R D-ring extender ❑ Yellow hook to anchor tether reel	**Initial Configuration:** 1. √All gates closed & hooks locked ❑ L Waist Tether to UIA fwd D-ring ❑ L Waist Tether to D-ring extender ❑ R Waist Tether to A/L tether reel ❑ R Waist Tether to D-ring ❑ Green hook to R D-ring extender ❑ A/L 85-ft ST anchor hook to COLT C/L Bag ❑ Red hook to R D-ring extender ❑ Yellow hook to MWS ❑ Lg-sm RET to UIA aft D-ring (*for COLT Crewlock Bag upon ingress*)
	<u>EGRESS</u> (00:15) 2. ← Open hatch thermal cover 3. Egress A/L 4. Attach EV1 anchor hook to aft external D-ring ❑ √Bail closed, slider locked, double locked, reel unlockedy 5. Release Waist Tether from internal D-ring extender 6. Temp stow COLT Crewlock Bag on BRT 7. Attach EV2 anchor hook to fwd external D-ring ❑ √Bail closed, slider locked, double locked, reel unlocked	<u>EGRESS</u> (00:15)
1. Start Hatch Thermal Cover clock PET (30 min) ___ : ___		2. Transfer COLT Crewlock Bag with anchor hook attached to EV1
		3. Release Waist Tether from UIA D-ring; egress A/L
2. Post crew egress: WVS Software: Select page – RF camera Sel 'Advanced Controls' S-Band Level (two) – Max	8. Verify SAFER config ❑ √L handle down (MAN ISOL Vlv – Open) ❑ √R handle down, door closed (HCM – Closed) 9. ❑ √WVS – green LED	4. Verify SAFER config ❑ √L handle down (MAN ISOL Vlv – Open) ❑ √R handle down, door closed (HCM – Closed) 5. ❑ √WVS – green LED
3. Stop Hatch Thermal Cover clock PET (30 min) ___ : ___	10. Perform translation adaptation	6. ← Close hatch thermal cover 7. Perform translation adaptation

EVA 1 EGRESS/SETUP (01:00) (Cont)

IV/SSRMS	EV1	EV2
Both "U" brackets engage HR 	WARNING Stay 1 ft from UHF Antenna Avoid contact with sharp edge on ESP-2 HR 8012	WARNING Stay 1 ft from UHF Antenna Avoid contact with sharp edge on ESP-2 HR 8012
	INSTALL COLTS (00:45) 1. Translate to ESP-2 aft/port (low road) 2. Stow Crewlock Bag on ESP-2 HR 8015 (aft/port/zenith) 3. Release gap spanner between Lab and ESP-2, stow with RET	SSRMS SETUP (00:45) 1. Translate to ESP-2 fwd (high road)
4. **SSRMS:** GCA as required for ST install	4. Retrieve long COLT from Crewlock Bag	2. **GCA SSRMS** as required for ST install
Two lines visible after slider installation  Both slider paddles popped up	5. Install Long COLT onto FRAM (ISS fwd) ❑ √Both "U" brackets engage HR ❑ √Two lines visible after slider installation ❑ √Both slider paddles popped up ❑ √Washer flush w/end of contingency pin housing (gap < washer thickness OK)	NOTE Monitor clearance to AGB on FHRC 3. Safety Tether swap to SSRMS LEE HR ❑ √Bail closed, slider locked, double locked, reel unlocked 4. Attach green hook onto ESP-2 HR 8011 _____
5. **SSRMS:** Maneuver to APFR Install position	6. Remove COLT cap, stow in trash bag 7. Retrieve RET from COLT cap, stow on MWS	5. Give **SSRMS GO** for maneuver to APFR Install position
6. **SSRMS:** Notify EV: Brakes on, ready for APFR install  Washer flush w/end of contingency pin housing	8. Retrieve short COLT from C/L Bag; install onto FRAM (ISS aft) ❑ √Both "U" brackets engage HR ❑ √Two lines visible after slider installation ❑ √Both slider paddles popped up ❑ √Washer flush w/end of contingency pin housing (gap < washer thickness OK) 9. Remove COLT cap, stow in trash bag 10. Retrieve RET from COLT cap, stow in Crewlock Bag	6. On **SSRMS GO**, install WIF Adapter into SSRMS PFR socket with tether point toward LEE (PIP Pin required; not hitch pin)

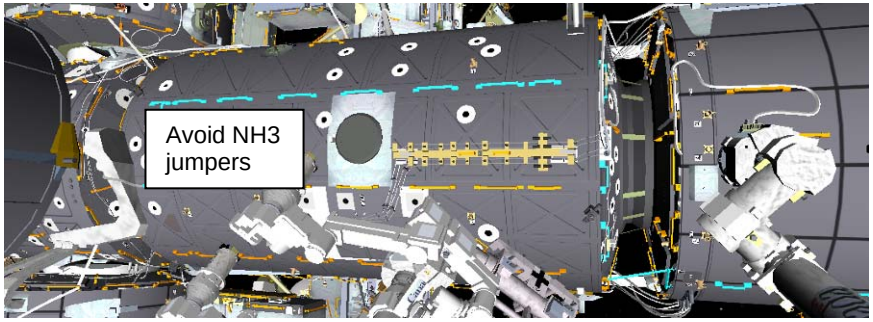
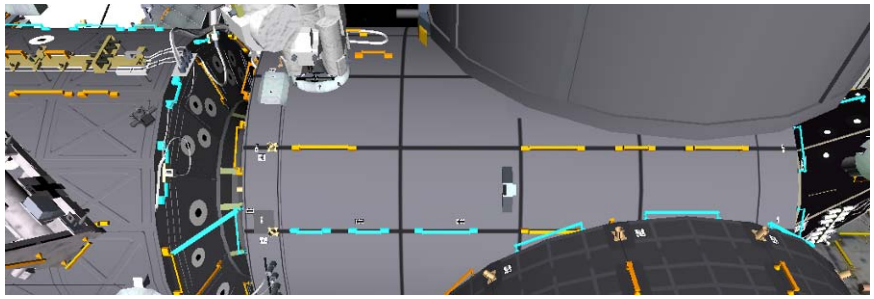
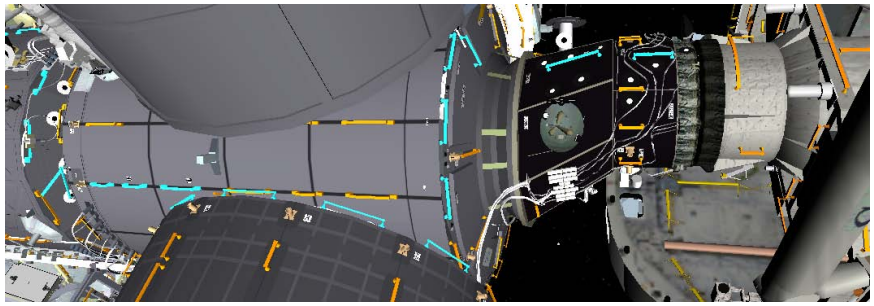
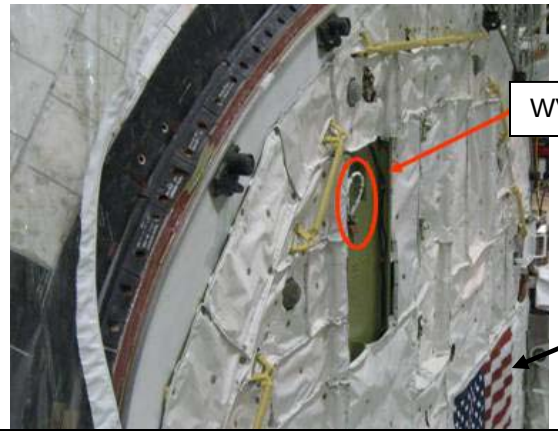
EVA 1 EGRESS/SETUP (01:00) (Cont)

IV/SSRMS	EV1	EV2
	11. Verify PM clear of structure for release and SSRMS maneuver (port & aft sides) ❑ √Fwd COLT clear of gap spanner ❑ √Aft COLT clear of ESP-2 bracket	7. Retrieve APFR from ESP-2 WIF 6 (fwd by PM) 8. Install APFR into WIF Adapter **[12, NN, F, 6]** ❑ √Locking collar black-on-black, pull & twist test 9. Extend and lock APFR Ingress Aid handle WARNING Extended APFR Ingress Aid handle may exceed EVA touch temperature limits
7. **SSRMS:** Maneuver to APFR ingress position		10. Give **SSRMS GO** for maneuver to APFR ingress position
8. **SSRMS:** Notify EV: Brakes on, ready for APFR ingress		11. On **SSRMS GO**, attach local tether and ingress APFR
	12. √EV2 heels engaged in APFR	12. Check Ingress Aid snug against body; PM clear for release
9. **SSRMS:** Maneuver to PM FRAM release		13. Give **SSRMS GO** for maneuver to PM FRAM release 14. Inspect gloves
10. √**MCC-H** – ESP-2 PM FRAM inhibits in place		
11. Start MBSU thermal clock PET (8-hr) ___ : ___		

REMOVE PM FRAM FROM ESP-2 (00:30)

IV/SSRMS	EV1	EV2
	REMOVE PM FRAM FROM ESP-2 (00:30)	REMOVE PM FRAM FROM ESP-2 (00:30)
	1. Translate to PM FRAM primary bolt	
	2. Engage PGT socket into both forward contingency pins on PM FRAM and verify anti-rotation device can be defeated	
	3. Position for driving primary bolt; BRT on HR 8018; local tether on 8023	
	4. Assist EV2 with attaching RET to AFRAM	1. Attach two RETs in series to AFRAM handrail (near primary bolt); keep lock box near EV2
	5. Verify PM clear of structure for release and SSRMS maneuver (stbd & fwd sides)	2. Configure PGT (*for install at LMC*)
	6. Configure PGT ❑ [**A4-TBD**, **CCW2**, 30.5], 6" ext 7/16"	❑ [**A4-TBD**, **CCW2**, 30.5], 6" ext 7/16"
		3. Stow PGT
		4. Open PM MLI for access to PM handrails
		5. Configure for maneuver (visor, cooling, glove heaters)
		6. Hold AFRAM handrails and give **EV1 GO** to release
	7. On **EV2 GO**, release FRAM primary bolt, expect 11.1 turns to hard stop (Push ~10 lb to release locking tabs)	
	8. √Status indicator "in"	
	9. Stow PGT	
	10. Visually verify AFRAM is clear; assist EV2 with maneuver to ESP-2 stbd	7. Lift AFRAM from PFRAM
1. **SSRMS:** Maneuver to PM yaw position	11. Monitor clearance of PM to ESP-2 ORUs	8. Give **SSRMS GO** for maneuver to PM yaw position
2. **SSRMS:** Notify EV: Ready for AFRAM 90° yaw	12. Assist EV2 with AFRAM rotation	9. On **SSRMS GO**, rotate AFRAM 90° yaw for SSRMS maneuver
		10. Lock one of RETs in series to AFRAM
3. **SSRMS:** Maneuver to ESP-2 clearance (~00:30 to PLB)	13. Retrieve COLT Crewlock Bag from ESP-2 HR 8015, stow on BRT	11. Give **SSRMS GO** for maneuver to ESP-2 clearance
4. **SSRMS:** Notify EV: Ready to roll AFRAM 180°	14. Inspect gloves	12. On **SSRMS GO**, roll AFRAM 180° (PM near legs)
5. **SSRMS:** Continue maneuver to PLB		13. Give **SSRMS GO** to continue to PLB

TRANSFER PM FRAM TO PLB (00:30)

IV/SSRMS	EV1
1. √**MCC-H** – Put Orbiter S-band inhibits in place (before EV1 translates onto Node 2 forward)	TRANSLATE TO PLB (00:30)
	1. Translate forward along HR path just starboard of window, past window to Lab HR 265, then to HR 297 (EWIS antenna)
	2. Translate port between SPDM and SSRMS base LEE to gap spanner between Lab and Node 2 HR 364
2. √**MCC-H** – Reconfigure Orbiter S-band inhibits (after EV1 translates past PMA1)	3. Translate forward along Node 2 between JEM endcone and MPLM to Node 2 forward endcone HR 308
	4. Translate down Node 2 HR 323 to Node 2 HR 306 5. Attach green hook onto Node 2 HR 306 _____ ❑ √Bail closed, slider locked, double locked, reel unlocked
	6. Translate to port TSA; attach Adjustable Tether fairlead
	CAUTION Avoid contact with Payload Bay cameras
	7. Translate aft to LMC; attach Adjustable Tether fairlead on LMC port/fwd HR 8. Translate to support position for PM install (clearance calls on aft bulkhead, specifically watch for WVS receiver antenna cable)
	

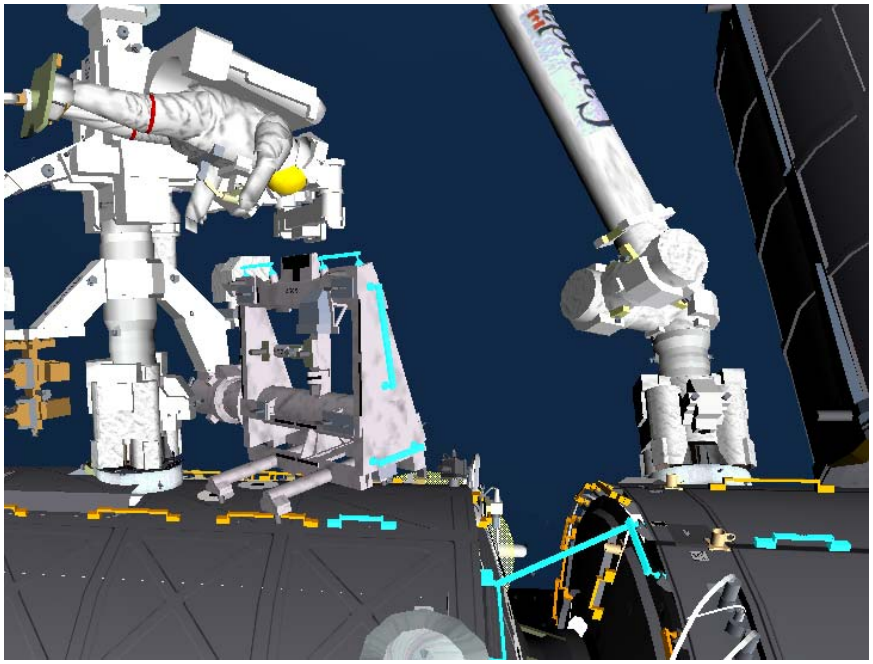
INSTALL PM FRAM ON LMC (00:30)

IV/SSRMS	EV1	EV2
NOTE No inhibits required for PM installation onto LMC	INSTALL PM FRAM ON LMC (00:30)	INSTALL PM FRAM ON LMC (00:30)
1. **SSRMS:** GCA as required to PM install position	1. Assist EV2 with AFRAM rotation and installation 2. **GCA SSRMS** as required to PM install position	1. Position AFRAM for installation on PFRAM 2. Verify PGT settings: ❑ [**A4-TBD**, CW2, 30.5]
2. Record PM FRAM bolt data: Turns: (11.2) Torque (ft-lb): (6.3)	3. When aligned and seated on PFRAM, give **EV2 GO** to drive primary AFRAM bolt	3. On **EV1 GO**, engage primary AFRAM bolt, expect 11.2 turns to hard stop (Push ~10 lb to release locking tabs) 4. √Status indicator "out" 5. Perform pull test on AFRAM 6. Retrieve two RETs from AFRAM
	4. Verify PM MLI is configured for return 5. Verify COLTs are configured for return	7. Verify PM MLI is configured for return 8. Inspect gloves
3. **IV:** √📷 WVS close-out imagery of PM on LMC	6. Inspect gloves 7. Translate to starboard side of EV2	9. 📷 WVS close-out imagery of PM in return config
	WARNING Only the two handrails on LMC zenith near PM are certified for safety tethering (handrails on fwd edge are not certified)	
	8. Attach Waist Tether to stbd/top LMC HR ❑ √Large hook – Bail closed, slider locked ❑ √Small hook – Bail closed, slider locked 9. Move EV1 ST (red hook) to EV2 R D-ring extender (EV2 now on ST Pack) ❑ √Bail closed, slider locked, double locked, reel unlocked 10. Retrieve EV2 red hook and attach to EV1 R D-ring extender (EV1 ST now on SSRMS) ❑ √Bail closed, slider locked, double locked, reel unlocked 11. Retrieve Waist Tether	10. **After attaching EV1 ST to EV2**, provide EV1 with EV2 red hook
4. **SSRMS:** Maneuver to crew swap 5. **SSRMS:** Notify EV: Brakes on, ready for APFR egress/ingress		11. Give **SSRMS GO** for maneuver to crew swap 12. On **SSRMS GO**, egress SSRMS

REMOVE RRM FRAM FROM LMC (00:20)

IV/SSRMS	EV1	EV2
	REMOVE RRM FRAM FROM LMC (00:20)	REMOVE RRM FRAM FROM LMC (00:20)
1. √**MCC-H** – LMC RRM FRAM inhibits in place	WARNING To avoid sharp edges, entrapments, and sensitive hardware, limit contact to FRAM, EVA handrails, and microfixtures	WARNING To avoid sharp edges, entrapments, and sensitive hardware, limit contact to FRAM, EVA handrails, and microfixtures
	CAUTION Do not touch Z-93 paint on RRM back radiator and avoid kicking top, front, and left faces (relative to FRAM primary bolt)	CAUTION Do not touch Z-93 paint on RRM back radiator and avoid kicking top, front, and left faces (relative to FRAM primary bolt)
	1. Attach local tether and ingress SSRMS APFR 2. Check Ingress Aid snug against body	1. √EV1 heels engaged in APFR 2. Translate into position (port) to support RRM FRAM removal
2. **SSRMS:** Maneuver to RRM FRAM release	3. Give **SSRMS GO** for maneuver to RRM FRAM release 4. Attach two RETs in series to AFRAM handrail, lock one RET 5. Configure PGT ❑ [**A4-TBD**, **CCW2**, 30.5], 6" ext 7/16" 6. On **EV2 GO**, release FRAM primary bolt, expect 11 turns to hard stop (Push ~10 lb to release locking tabs) 7. √Status indicator "in" 8. Configure PGT (*for install at EOTP*) ❑ [**A4-TBD**, **CW2**, 30.5], 6" ext 7/16" 9. Stow PGT 10. Configure for maneuver (visor, cooling, glove heaters, BRT) 11. Lift AFRAM from PFRAM	CAUTION Avoid contact with Payload Bay cameras 3. Hold AFRAM handrails and give **EV1 GO** to release 4. Visually verify AFRAM is clear ❑ √Safety Tether routing
3. **SSRMS:** Maneuver to LMC back away		5. Give **SSRMS GO** for maneuver to LMC back away
4. **SSRMS:** Maneuver to EOTP (~00:30)		6. Inspect gloves

TRANSFER RRM FRAM TO EOTP (00:30)

IV/SSRMS	EV2
1. √**MCC-H** – Put Orbiter S-band inhibits in place (before EV1 translates onto ODS) 2. **IV:** Tool Inventory 3. √**MCC-H** – Reconfigure Orbiter S-band inhibits (after EV1 translates past Node 2 forward) 	<u>TRANSLATE TO EOTP</u> (00:30) 1. Retrieve both Adjustable Tether fairleads ❑ LMC ❑ Port TSA 2. Tool Inventory 3. Translate to Node 2 HR 306 4. Retrieve green hook; attach to crew tether ❑ √Bail closed, slider locked, double locked, reel unlocked 5. Inspect gloves 6. Translate port along Node 2 between JEM endcone and MPLM to Node 2 aft endcone HR 364 (with gap spanner) 7. Position to support RRM install onto EOTP zenith PFRAM ❑ √Clearance of RRM to Lab

INSTALL RRM FRAM ON EOTP (00:20)

IV/SSRMS	EV1	EV2
	INSTALL RRM FRAM ON EOTP (00:20)	INSTALL RRM FRAM ON EOTP (00:20)
1. √**MCC-H** – EOTP RRM FRAM inhibits in place		
2. **SSRMS:** Notify EV: Ready to roll AFRAM 180°	1. On **SSRMS GO**, rotate AFRAM 180° roll for installation on EOTP 2. √Ingress Aid position	1. Assist EV1 with AFRAM rotation and installation 2. Provide clearance calls for ❑ RRM to Lab ❑ RRM to EOTP "goal posts"
3. **SSRMS:** Maneuver to RRM install position	3. Give **SSRMS GO** for maneuver to RRM install position 4. Position AFRAM on EOTP 5. Verify PGT settings: ❑ [**A4-TBD**, CW2, 30.5]	
4. Record PM FRAM bolt data: Turns: (11.2) Torque (ft-lb): (6.3)	6. On **EV2 GO**, engage primary AFRAM bolt, expect 11 turns to hard stop (Push ~10 lb to release locking tabs) 7. √Status indicator "out" 8. Perform pull test on AFRAM 9. Retrieve two RETs from AFRAM	3. When aligned and seated on PFRAM, give **EV1 GO** to drive primary AFRAM bolt
	10. Transfer COLT Bag to EV2	4. Receive COLT Bag from EV1; stow on BRT
5. **On EV2 GO**: Give **MCC-H GO** for EOTP RRM FRAM heater power	11. Give **IV GO** when clear of EOTP ❑ √All tethers and tools are clear of RRM before SSRMS maneuver	5. Inspect gloves
6. **IV:** √ WVS close-out imagery of RRM on EOTP	12. WVS close-out imagery of RRM on EOTP 13. Inspect gloves	
7. **SSRMS:** Maneuver clear of EOTP	14. Give **SSRMS GO** to maneuver clear of EOTP	6. Translate to A/L

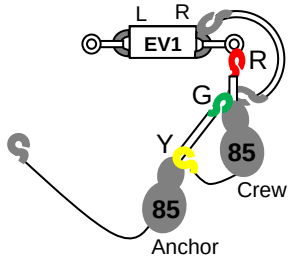
MISSE 8 ORMATE III R/W INSTALL ON ELC-2 (01:20)

IV	EV2
PLANNED PET 03:40 1. Start Hatch Thermal Cover clock PET (30 min) ___ : ___ 2. Stop Hatch Thermal Cover clock PET (30 min) ___ : ___ 3. Give **MCC-H GO** to put MISSE 8 inhibits in place 4. Start MISSE 8 thermal clock PET (2-hr) ___ : ___	MISSE 8 ORMATE III R/W INSTALL ON ELC-2 (01:20) 1. ← Open hatch thermal cover 2. Transfer EVA Camera from COLT Bag into PMA3 Cover Bag 3. Transfer Fisheye Camera from COLT Bag into MISSE/Get-ahead C/L Bag; stow COLT Bag in A/L 4. Stow PMA3 Cover Bag onto A/L circular HR 5. Retrieve MISSE/Get-ahead C/L Bag; stow on BRT 6. ← Close hatch thermal cover NOTE Avoid contacting the CETA Cart brake handles during translation to avoid reconfiguring wire ties 7. Translate up CETA Spur to S1 face 6 – HR 3292, then starboard along “low road” forward around CETA light to HR 3246 (half-way between CETA light and S1 lower outboard ETVCG) 8. Attach green hook onto S1 HR 3246 _____ ❑ √Bail closed, slider locked, double locked, reel unlocked 9. Translate along face 1 CETA rail to mid S3 (bay 19 label) 10. Translate zenith to S3 HR 3038 (just inside bay 19 face 1 zenith) 11. Attach Adjustable Tether fairlead at S3 HR 3038 12. Translate zenith to ELC-2 fwd/nadir trunnion and HR 8604 (on inboard side of trunnion) 13. Temp stow C/L Bag on CTC FRAM HR _____ 14. Tether to ORMATE tether point near probe (captures both ORMATE and cover) 15. Release ORMATE from C/L Bag; stow on MWS WARNING Avoid sharp edge on AMS star trackers CAUTION Avoid inadvertent contact with deployed MISSE PECs, which have shatterable materials, and the silver avionics boxes atop the ExPA 16. Translate zenith along ELC-2 forward/inboard edge and CTC to ELC-2 fwd/zenith trunnion and HR 8603 17. BRT to HR 8603 or CTC FRAM HR 18. Release PIP pins (2) on MISSE ExPA forward socket 19. Install ORMATE into socket (RAM side to ISS velocity vector, bayonet probe away) ❑ √Alignment marks match up 20. Install PIP pins (2) ❑ Verify PIP pins fully engaged, loops out of the way 21. Use second RET to tether to ORMATE cover (tether point away from probe)

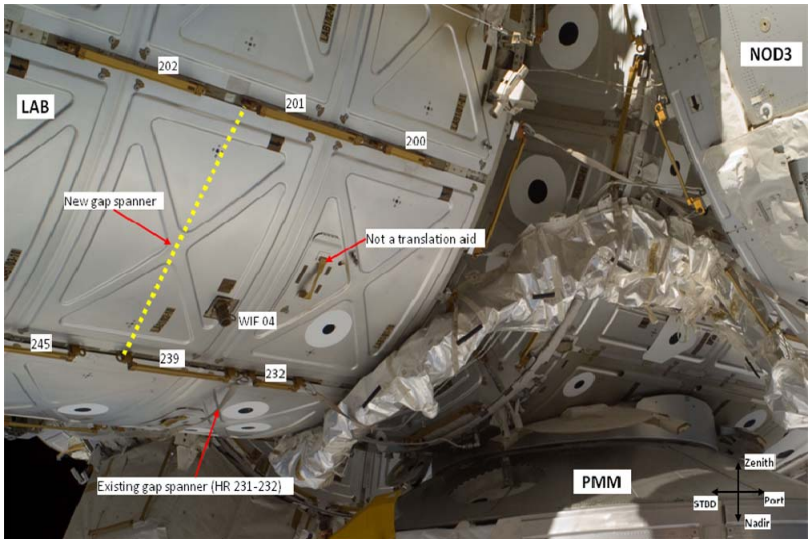
MISSE 8 ORMATE III R/W INSTALL ON ELC-2 (01:20) (Cont)

IV	EV2
	22. Remove RET from ORMATE near probe 23. Release Velcro strap and remove protective cover from ORMATE 24. Translate nadir to Crewlock Bag 25. Stow cover on Crewlock Bag using RET and Adjustable Equipment Tether (wire tie only if necessary) 26. Retrieve camera from Crewlock Bag CAUTION Avoid contact with FRGF grapple shaft and target pin 27. Photograph MISSE 8 Required ORMATE ❑ Fwd – Translate zenith along ELC-2 forward edge to HR 8603 ❑ Aft – Translate nadir around CTC on inboard face, then zenith If time allows PEC 8 ❑ Zenith – From inboard face, aft of CTC, translate zenith to zenith edge of ELC-2 ❑ Nadir – Translate nadir, near CTC Overview of ExPA (❑❑ 2 angles) 28. Translate to Crewlock Bag on ELC-2 HR 8604 29. Stow camera in Crewlock Bag
5. **IV:** Tool Inventory	30. Tool Inventory 31. Stow Crewlock Bag on BRT
6. When EV1 is clear of ELC-2, give **MCC-H GO** to power up MISSE 8 (except for MISSE 8 WVS inhibit)	32. When clear of ELC-2, give **IV GO** for MISSE 8 power up 33. Translate nadir to S3 HR 3038 34. Retrieve Adjustable Tether fairlead at S3 HR 3038
7. Stop MISSE 8 thermal clock PET (2-hr) ___ : ___	35. Glove Check
8. √**MCC-H** – Timing for FHRC P-Clamps Release get-ahead	
	36. Translate inboard to S1 HR 3246 37. Retrieve green hook from S1 HR 3246 ❑ √Bail closed, slider locked, double locked, reel unlocked

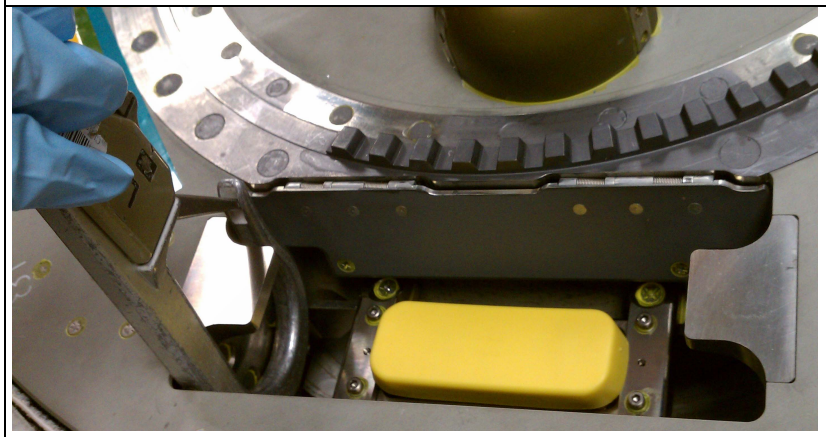
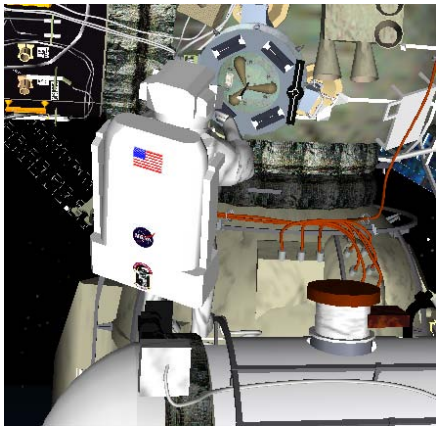
SSRMS CLEANUP (00:45)

IV/SSRMS	EV1
	SSRMS CLEANUP (00:45)
1. **SSRMS:** Maneuver to ESP-2 egress position (~00:15 from EOTP)	
2. **SSRMS:** Notify EV: Brakes on, ready for APFR egress	1. On **SSRMS GO**, egress APFR
3. **SSRMS:** Maneuver to APFR retrieval position	2. Give **SSRMS GO** for maneuver to APFR retrieval position 3. Locate anchor ST (green hook) on ESP-2 HR 8011 _____
4. **SSRMS:** Notify EV: Brakes on, ready for APFR retrieval  	4. On **SSRMS GO**, Safety Tether swap to anchor ST, retrieve crew ST from SSRMS ❑ √Bail closed, slider locked, double locked, reel unlocked ❑ Optional: Configure to ST Pack per diagram
	5. Retrieve APFR; stow in ESP-2 WIF 5 [low profile] ❑ √Locking collar black-on-black, pull and twist test 6. Report APFR settings 7. Stow Ingress Aid and configure against boot plate 8. Retrieve WIF Adapter; stow on MWS
5. **SSRMS:** Maneuver to park position	9. Give **SSRMS GO** to maneuver to park position 10. Inspect gloves 11. Translate to ESP-2 forward 12. Reconfigure Gap Spanner between Lab HR 293 and ESP-2 HR 8013 (buckle can rotate 90°) 13. Retrieve RET from Gap Spanner 14. Translate to A/L

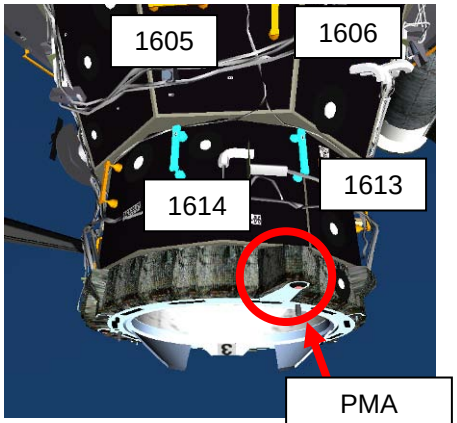
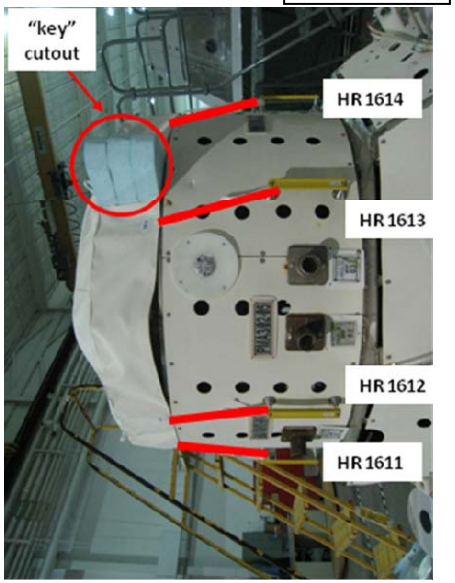
FGB PDGF TROUBLESHOOTING (00:35)

IV/SSRMS	EV1
1. √RSOS inhibits in place  	FGB PDGF TROUBLESHOOTING (00:35) 1. Retrieve PMA3 Cover Bag; stow on BRT 2. Translate from A/L via nadir route along Lab aft end cone (port between ESP-2 and A/L around high pressure gas tank, equipment lock to Lab gap spanner, then nadir under Lab to gap spanner 231-232) CAUTION Do not use Node 3 jumpers as a translation aid 3. OPTIONAL – Install Gap Spanner a. Attach one end of gap spanner to forward stanchion of Lab HR 239 b. Translate to Lab HR 201 (OK to use WIF 4) c. Attach other end of gap spanner to fwd stanchion of Lab HR 201 ❑ Tighten gap spanner until buckle can twist 90° 4. Translate zenith around Node 3 jumpers to Node 3 stbd, then nadir under Node 3 to Node 1 aft 5. Stow PMA3 Cover Bag onto Node 1 HR 107 _____ WARNING Avoid inadvertent 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 inadvertent contact with zenith PMA1 MDM and above 22" of EVA crane 6. Translate zenith to Node 1 HR 105, aft to PMA1 HR 6, then via PMA1 HR 11 & 12 to PDGF NOTE VSC cover should not be used as a translation aid

FGB PDGF TROUBLESHOOTING (00:35) (Cont)

IV/SSRMS	EV1
	7. Position head zenith, feet nadir; BRT to PAMA HR, MWS EE to PDGF tether point 8. Insert large crew hook in nadir/fwd electrical connector doors, near umbilical connectors, to hold open – orient hook perpendicular to doors so hook cannot damage pins 9. Inspect grounding wire attachment point and grounding wire routing for damage or potential snag concerns for wire slack removal 10. Open nadir/forward PDGF MLI 11. Pull grounding wire slack out of PDGF housing 12. Loop and tuck grounding wire slack between PDGF housing and MLI, close PDGF MLI and secure Velcro
2. **IV:** √ WVS close-out imagery	13. Insert large crew hook in nadir/fwd electrical connector doors, near umbilical connectors, to hold open – orient hook perpendicular to doors so hook cannot damage pins 14. WVS close-out imagery and crew inspection inside PDGF connector door
 	15. Translate zenith of PDGF and rotate to position head nadir, feet zenith; BRT to PAMA HR, MWS EE to PDGF tether point 16. Insert large crew hook in zenith/fwd electrical connector doors, near umbilical connectors, to hold open – orient hook perpendicular to doors so hook cannot damage pins 17. Inspect grounding wire attachment point and grounding wire routing for damage or potential snag concerns for wire slack removal 18. Open zenith/forward PDGF MLI 19. Pull grounding wire slack out of PDGF housing 20. Loop and tuck grounding wire slack between PDGF housing and MLI, close PDGF MLI and secure Velcro
3. **IV:** √ WVS close-out imagery	21. Insert large crew hook in zenith/fwd electrical connector doors, near umbilical connectors, to hold open – orient hook perpendicular to doors so hook cannot damage pins 22. WVS close-out imagery and crew inspection inside PDGF connector door 23. If time allows, inspect remaining two connector doors
4. Perform EV Final Tool Inventory	24. Glove Check 25. Perform MWS Tool Inventory

PMA3 COVER INSTALL (00:45)

IV/SSRMS	EV1	EV2
1. √**MCC-H** – Inhibits in place (Port TRRJ & Cupola Windows) 2. √**MCC-H** – Time for 1553 Data Cable Install get-ahead   	PMA3 COVER INSTALL (00:45) 1. Translate to Node 1 2. Retrieve PMA3 Cover Bag from Node 1 HR 107; stow on BRT 3. Translate nadir on Node 3 end cone to Node 3 fwd CAUTION Do not use Node 3 jumpers as a translation aid 4. Translate zenith between ESP-1 and Node 3 to Node 3 HR 663, then on HR 600 path port to PMA3 WARNING Avoid contact with APAS mating surface and reflector 5. Temp stow PMA3 Cover Bag on PMA3 zenith; hinge line stbd 6. Secure ORU Bag lid straps to HRs 1605 and 1606 7. EV1 work from fwd side of PMA 8. Remove PMA3 cover from ORU Bag without unfolding; PMA3 cover label on top 9. Align "key" cutout with PMA reflector 10. Attach Velcro strap to HR 1614. (Start with straps loose, then come back to tighten) 11. Continue to unfold PMA3 cover, while attaching Velcro straps on fwd circumferential HRs ❑ 1615 ❑ 1618 ❑ 1616 ❑ 1617 12. Work back zenith toward bag, retightening straps as required 13. WVS close-out imagery of PMA3 cover 14. Inspect gloves 15. Retrieve PMA3 Cover Bag, stow on BRT	PMA3 COVER INSTALL (00:45) 1. Translate to A/L 2. Stow MISSE Bag outside A/L 3. If time allows for 1553 Data Cable Install get-ahead, retrieve 1553 Data Cable Bag, stow on BRT 4. Translate aft and port on equipment lock along trunnion pins to Node 1 5. Translate port to Node 1 HR 104 CAUTION Avoid inadvertent contact with zenith PMA1 MDM and above 22" of EVA crane 6. Stow 1553 Data Cable Bag onto PMA1 HR 6 7. Translate back onto Node 1, then nadir to gap spanner onto Node 3 8. Translate port to PMA3 WARNING Avoid contact with APAS mating surface and reflector 9. Assist EV1 from aft side of PMA3 10. Attach Velcro strap to HR 1613. (Start with straps loose, then come back to tighten) 11. Continue to unfold PMA3 cover, while attaching Velcro straps on aft circumferential HRs ❑ 1612 ❑ 1611 ❑ 1610 12. Work back zenith toward bag, retightening straps as required 13. WVS close-out imagery of PMA3 cover 14. Inspect gloves

EVA 1 CLEANUP/INGRESS (00:45)

IV/SSRMS	EV1	EV2
	CLEANUP (00:15)	CLEANUP (00:15)
1. **IV**: Perform WVS PWRDWN (PHOTO/TV, WVS CUE CARD)	1. Final Tool Inventory 2. Translate to A/L	1. Final Tool Inventory 2. Translate to A/L
	INGRESS AND PRE-REPRESS (00:30)	INGRESS AND PRE-REPRESS (00:30)
2. Give **MCC-H GO** to release ESP-2 inhibits 3. Stop MBSU thermal clock PET (8-hr) ___ : ___ 4. Start Hatch Thermal Cover clock PET (30 min) ___ : ___		3. ← Open hatch thermal cover 4. Stow bags in A/L (Crewlock and ORU) 5. Attach L Waist Tether to UIA fwd D-ring ❑ √Bail closed, slider locked
	3. On **EV2 GO**, release EV2 ST anchor hook	6. Retrieve EV2 anchor hook, attach to MWS 7. Ingress Airlock
	4. On **EV2 GO**, ingress A/L 5. Attach L Waist Tether to A/L Internal D-ring extender ❑ √Bail closed, slider locked 6. Retrieve EV1 anchor hook, attach to MWS	8. Give **EV1 GO** to ingress
	7. Remove SCU from stowage pouch 8. Remove DCM cover; Velcro to DCM 9. 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	NOTE A TCV setting 8 – Max C minimizes time for SCU cooling
	10. WATER – OFF (fwd), expect 'H2O IS OFF' msg	12. WATER – OFF (fwd), expect 'H2O IS OFF' msg
5. Stop Hatch Thermal Cover clock PET (30 min) ___ : ___	11. ← Close hatch thermal cover; attach Velcro strap CAUTION Do not close hatch until EMU water OFF for 2 min 12. Verify outer hatch clear of hardware 13. Verify handle position per hatch decal 14. Close and lock hatch	
	Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card)	Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card)

EVA 1 TASK DATA – PM TRANSFER

Estimated Task Duration:

	With RMS	Without RMS
One EV Crew		
Two EV Crew		

Tools:

EV1	EV2
PGT w/7/16" socket	PGT w/7/16" socket

EVA Fasteners:

Fastener Name	Head Size	Qty	Nominal Install Torque (ft-lb)	Nominal Release Torque (ft-lb)	Max Expected Break Away Torque (ft-lb)	Max On-Orbit Install Torque (ft-lb)	Min On-Orbit Install Torque (ft-lb)	Max Torque not to exceed (ft-lb)	Turns	RPM
FRAM Primary Bolt	7/16"	1	6.3 (A4)	6.3 (A4)	13.3 (Release) 11.6 (Install)	10	2.5	21	11.1	30
FRAM Contingency Pin (Forward)	7/16"	4	6.3 (A4)		8.9	10	2.5	34	14.11	30
FRAM Contingency Pin (Aft)	7/16"	4	6.3 (A4)		8.9	10	2.5	34	16.858	30

ORUs:

Item	Mass (lb)	Dimensions (in)
Pump Module (w/10 lb of NH3) on AFRAM	1393	62 x 72 x 56

Foot Restraints:

Task	WIF	APFR Setting
PM Transfer	SSRMS	12, NN, F, 6

Notes:

1. COLT Assembly, Pin 3 – SEG33122635-301 (long/fwd)
2. COLT Assembly, Pin 4 – SEG33122635-302 (short/aft)

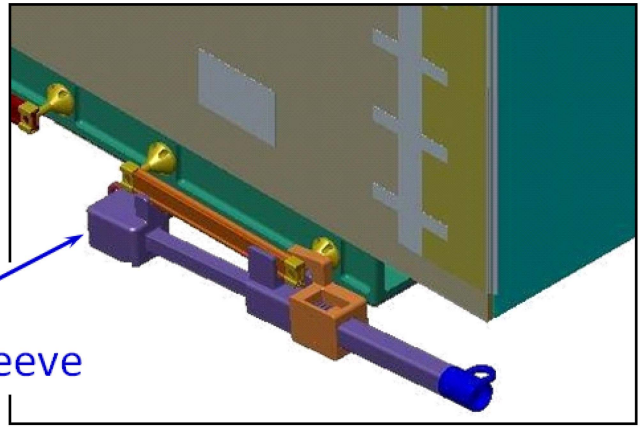
Cautions:

1. Minimize loads into PM MLI handholds. It is possible that handholds may tear off

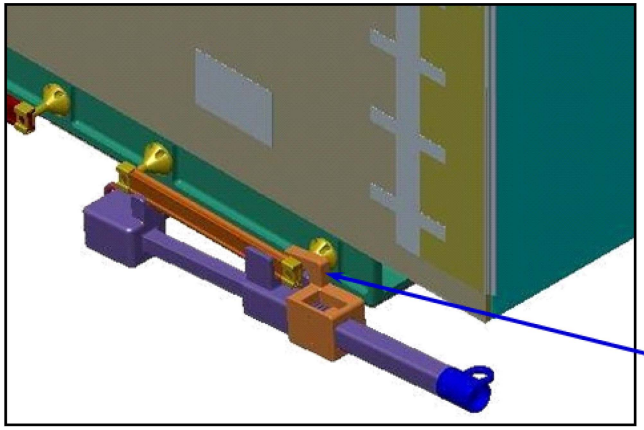
Timeline Considerations:

1. 8-hour thermal clock

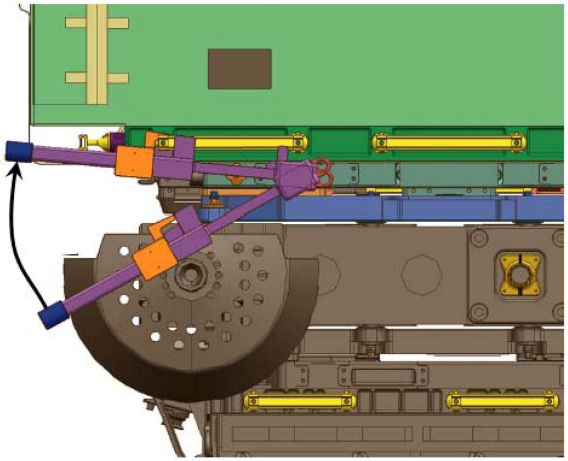
EVA 1 TASK DATA – PM TRANSFER (Cont)



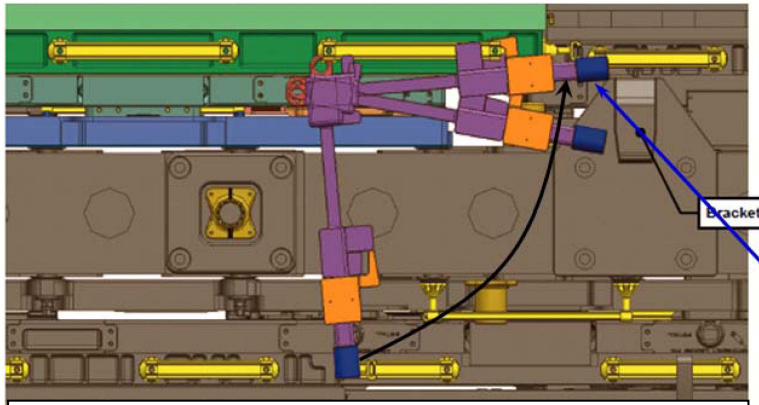
Coarse Alignment Sleeve



Slide Lock



Rotated to Handrail



Rotate to Handrail

Do not rotate COLT this far due to limitation of cut-out in COLT to accommodate screw at 12 o'clock position on FRAM LAPA contingency pin shaft

EVA 1 TASK DATA – RRM TRANSFER

Estimated Task Duration:

	With RMS	Without RMS
One EV Crew		
Two EV Crew		

Tools:

EV1	EV2
PGT w/7/16" socket	PGT w/7/16" socket
Square Scoop (optional)	

EVA Fasteners:

Fastener Name	Head Size	Qty	Nominal Install Torque (ft-lb)	Nominal Release Torque (ft-lb)	Max Expected Break Away Torque (ft-lb)	Max On-Orbit Install Torque (ft-lb)	Min On-Orbit Install Torque (ft-lb)	Max Torque not to exceed (ft-lb)	Turns	RPM
FRAM Primary Bolt	7/16"	1	6.3 (A4)	6.3 (A4)	13.3 (Release) 11.6 (Install)	10	2.5	21	11.1	30
FRAM Contingency Pin (Forward)	7/16"	4	6.3 (A4)		8.9	10	2.5	34	14.11	30
FRAM Contingency Pin (Aft)	7/16"	4	12.0 (B1)	12.0 (B1)	7.2	12.5	8.4	29.8 (Release) 23.6 (Install)	2.6	30

ORUs:

Item	Mass (lb)	Dimensions (in)
RRM	820 lb with FRAM	45 x 33 x 43

Foot Restraints:

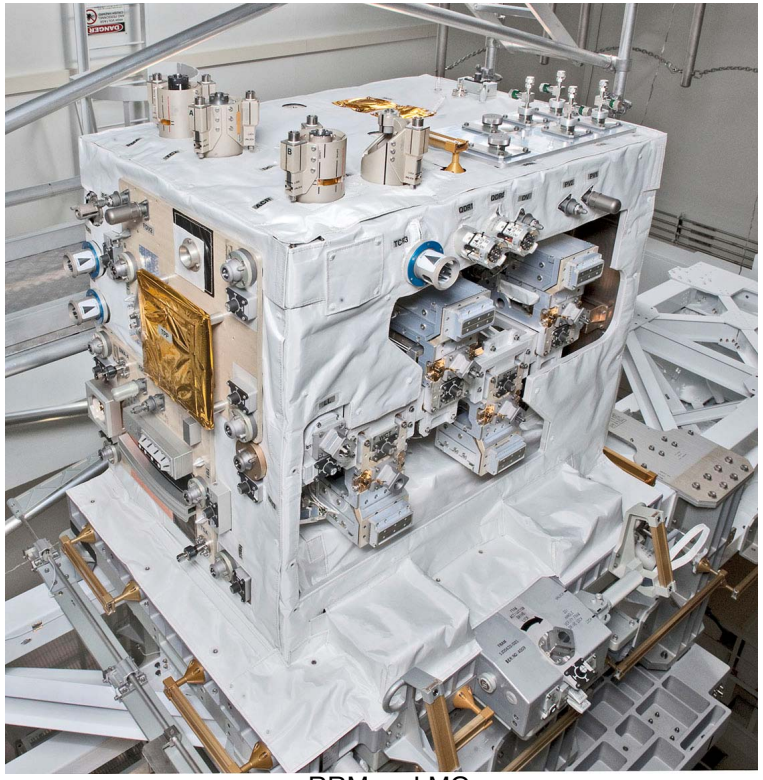
Task	WIF	APFR Setting
RRM Transfer	SSRMS	12, NN, F, 6

Notes:

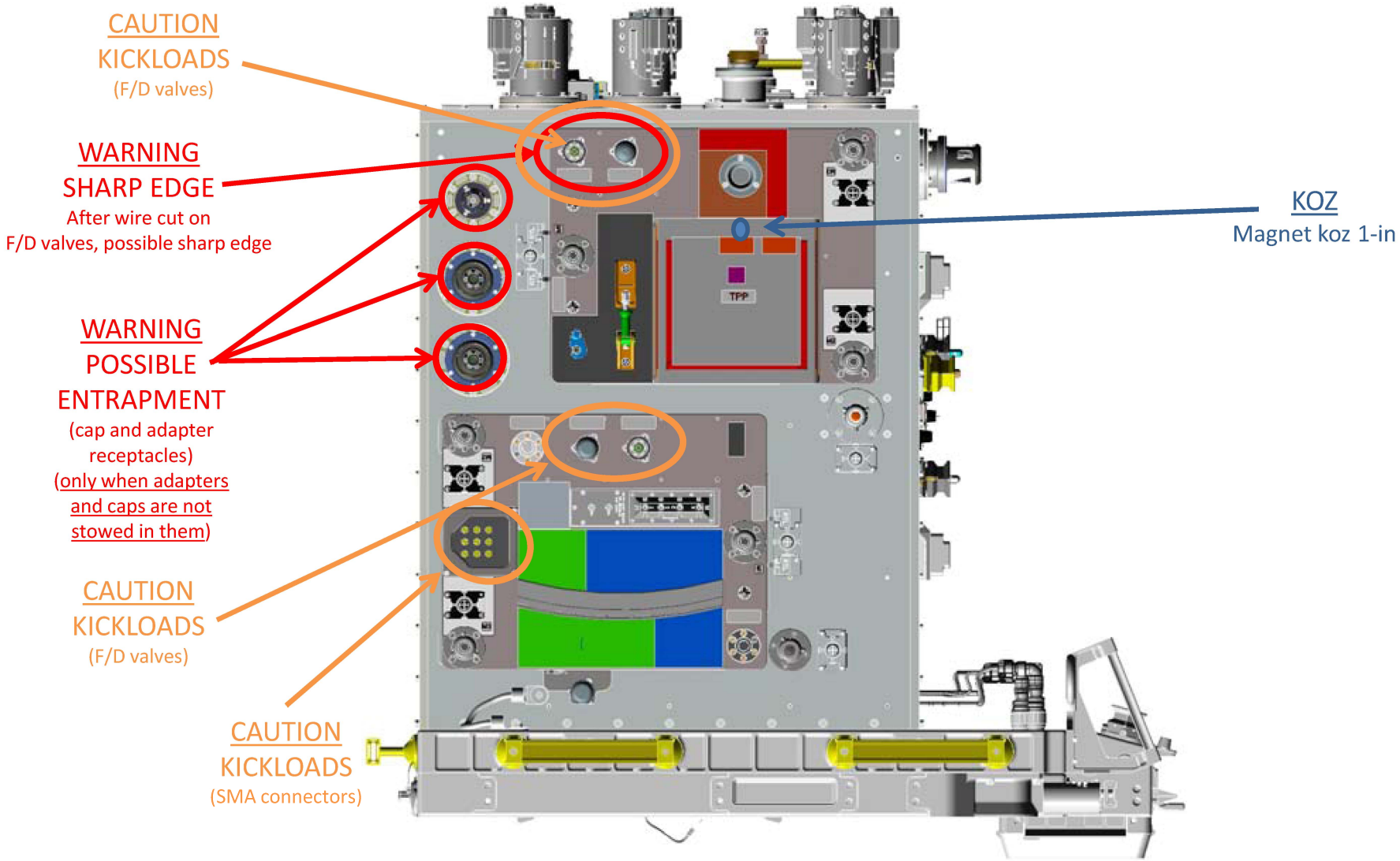
1.
2.
3.
4.
5.

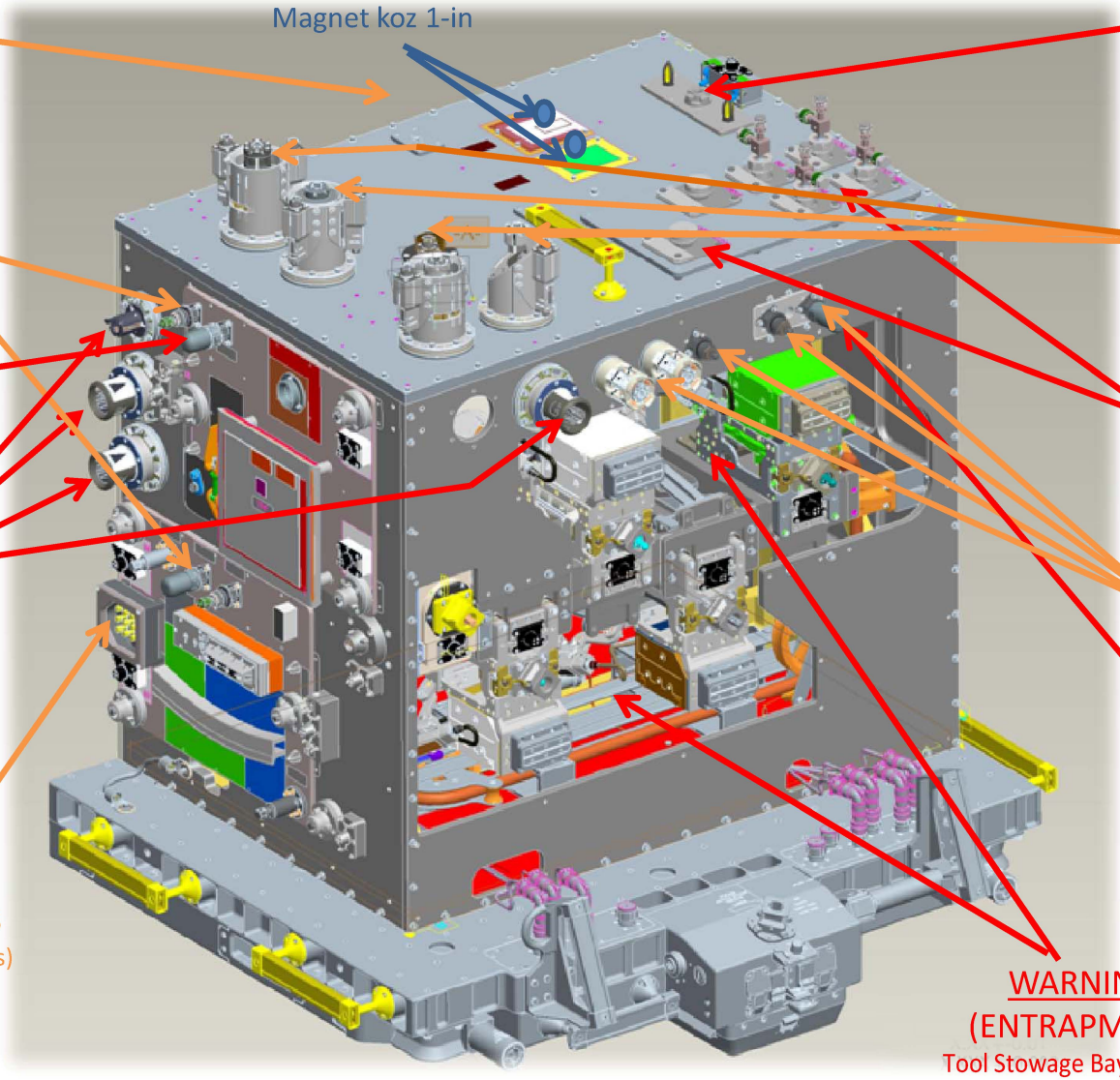
Timeline Considerations:

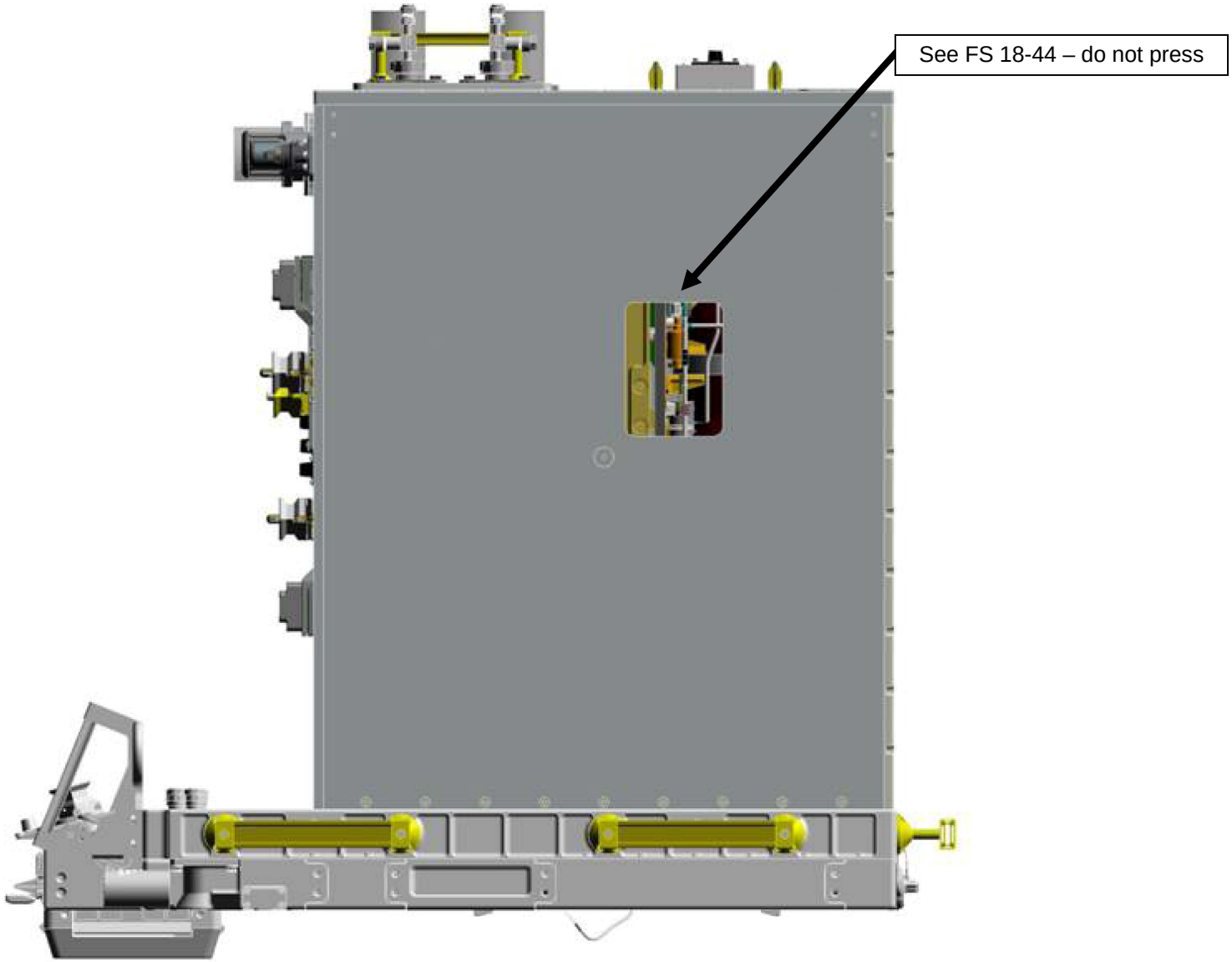
1. 12-hour thermal clock (LMC heater off to EOTP heater on)

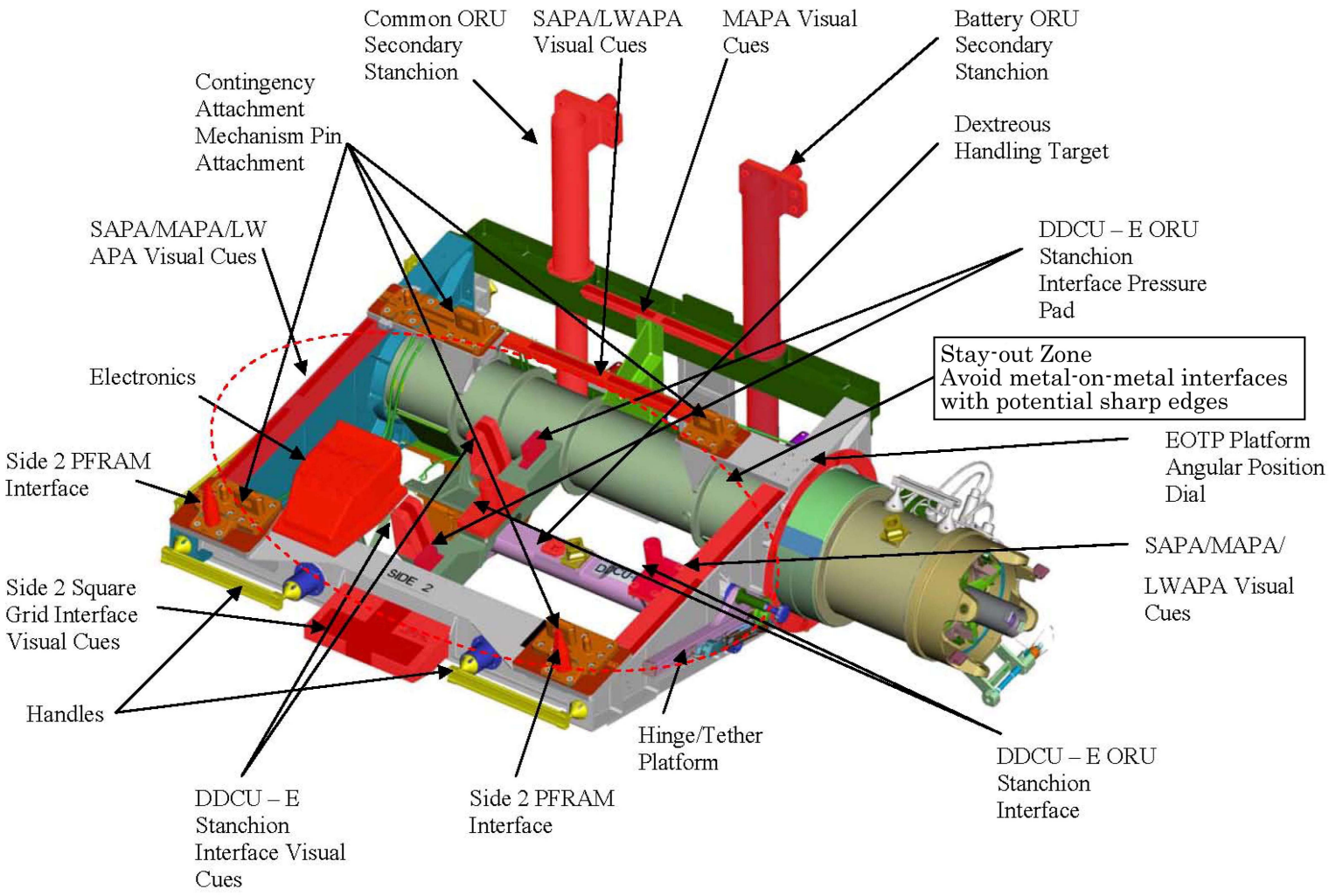


RRM on LMC


CAUTION
KICKLOADS
(F/D valves)
WARNING
SHARP EDGE
After wire cut on
F/D valves, possible sharp edge
WARNING
POSSIBLE
ENTRAPMENT
(cap and adapter
receptacles)
(only when adapters
and caps are not
stowed in them)
CAUTION
KICKLOADS
(F/D valves)
CAUTION
KICKLOADS
(SMA connectors)
KOZ
Magnet koz 1-in
TPP


KOZ
Magnet koz 1-in
CAUTION
(NO TOUCH)
(back radiator – can't see in this view)
Z-93 paint
CAUTION
(KICKLOADS)
(F/D valves)
WARNING
(SHARP EDGE)
possible sharp edge on wires: F/D valves (FDV2, FDV4)
WARNING
POSSIBLE
PINCH/ENTRAPMENT
(cap and adapter receptacles)
CAUTION
KICKLOADS
(SMA connectors)
WARNING
ENTRAPMENT
(Spare task Board Bolt Hole)
CAUTION
(KICKLOADS)
(adapters in receptacles)
WARNING
(SHARP EDGE)
possible sharp edge on wires: All T-Valves and Ambient Cap #2
CAUTION
(KICKLOADS)
(F/D-Valves and QDRs)
WARNING
(SHARP EDGE)
possible sharp edge on wires: F/D valve (PV1)
WARNING
(ENTRAPMENT)
Tool Stowage Bay Opening


See FS 18-44 – do not press


Common ORU Secondary Stanchion
SAPA/LWAPA Visual Cues
MAPA Visual Cues
Battery ORU Secondary Stanchion
Contingency Attachment Mechanism Pin Attachment
Dextreous Handling Target
SAPA/MAPA/LW APA Visual Cues
DDCU – E ORU Stanchion Interface Pressure Pad
Stay-out Zone
Avoid metal-on-metal interfaces with potential sharp edges
Electronics
EOTP Platform Angular Position Dial
Side 2 PFRAM Interface
SAPA/MAPA/ LWAPA Visual Cues
Side 2 Square Grid Interface Visual Cues
Handles
Hinge/Tether Platform
DDCU – E ORU Stanchion Interface
DDCU – E Stanchion Interface Visual Cues
Side 2 PFRAM Interface

EVA 1 TASK DATA – MISSE 8 ORMATE III

Estimated Task Duration:

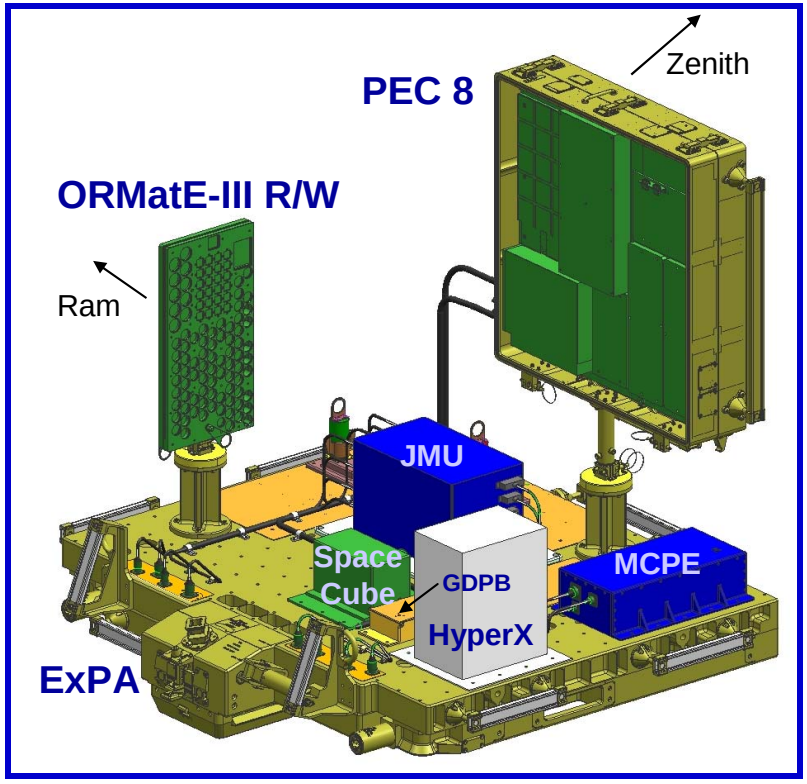
	With RMS	Without RMS
One EV Crew	N/A	01:20
Two EV Crew	N/A	N/A

Tools:

EV1
Hammer (contingency only)
Pry Bar (contingency only)
BMRRM Tool (contingency only)

ORUs:

Item	Mass (lb)	Dimensions (in)
ORMatE III R/W	12.9 (experiment), 6.0 (cover)	19.92" x 10.83" x 3.62"



Notes:

1. Avoid contacting the CETA Cart brake handles during translation to avoid reconfiguring wire ties
2. 2-hr thermal clock when power is removed from MISSE 8

Cautions:

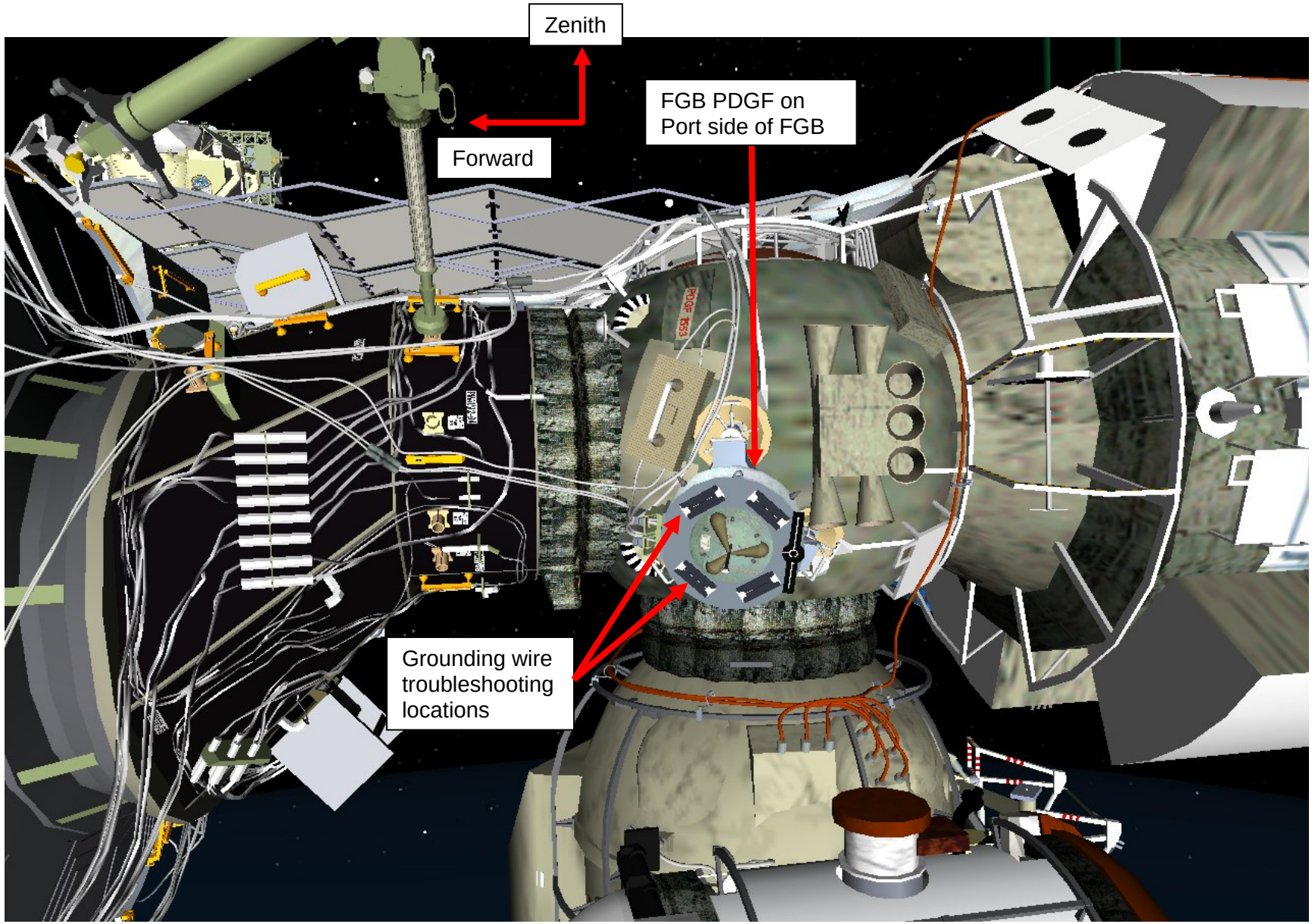
1. Avoid inadvertent contact with deployed MISSE PECs, which have shatterable materials, and the silver avionics boxes atop the ExPA
2. Avoid contact with FRGF grapple shaft and target pin

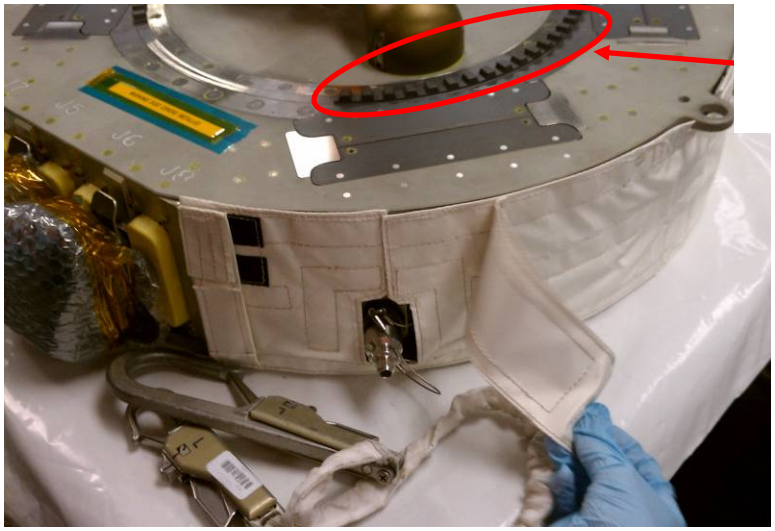
Warnings:

1. Avoid sharp edge on AMS star trackers

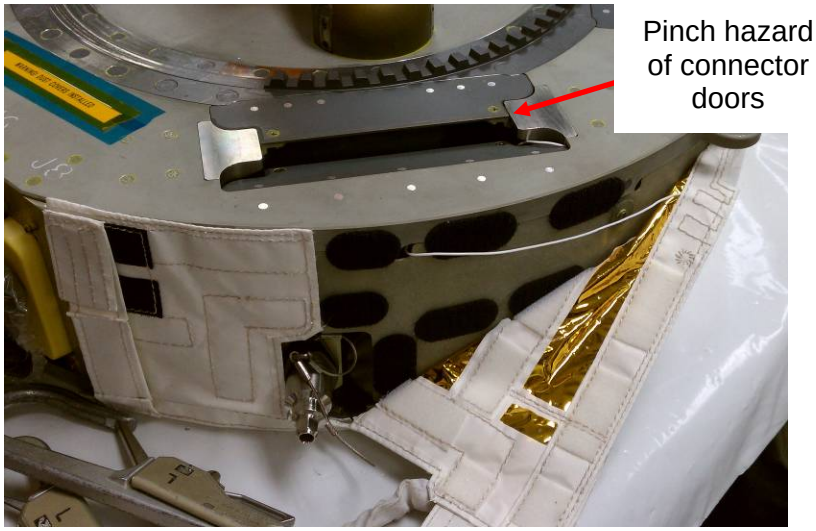
Timeline Considerations:

1.

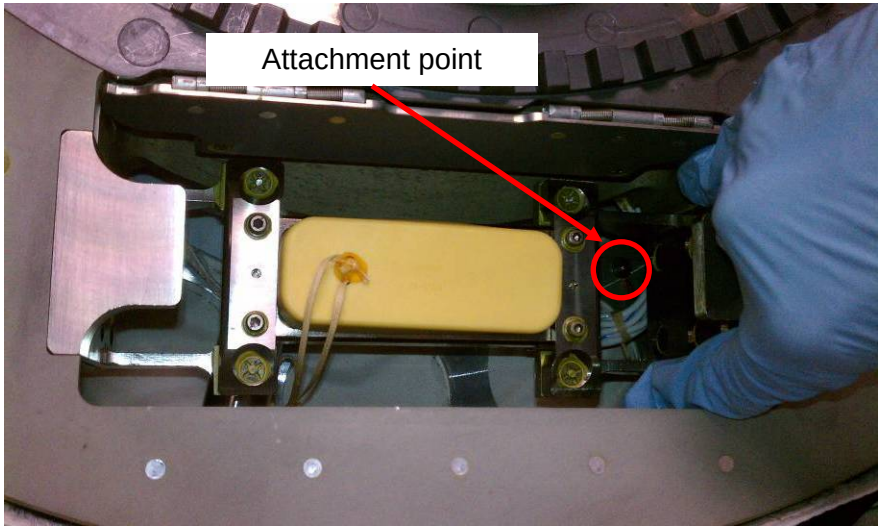

Zenith
Forward
FGB PDGF on
Port side of FGB
Grounding wire
troubleshooting
locations



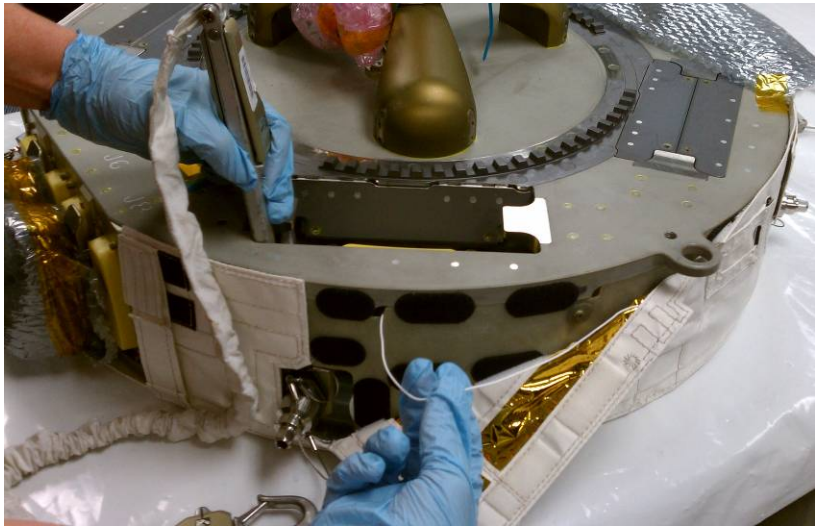
Peeling back MLI tab



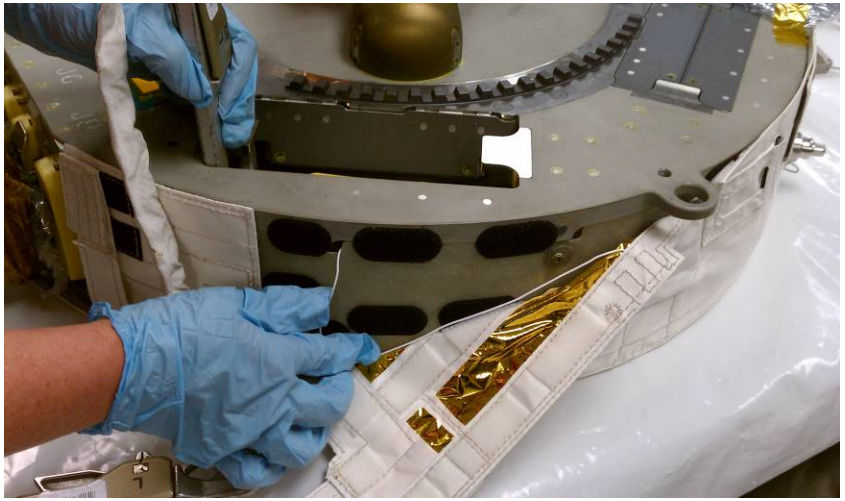
Peeling back MLI to expose grounding wire



Inspecting grounding tab attachment point

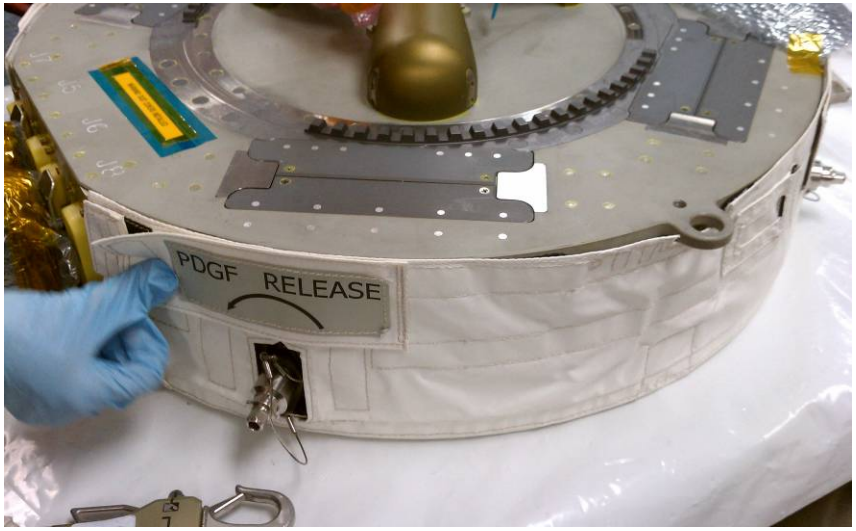


Large crew hook inserted into electrical connector housing to hold open doors. Grounding wire slack being pulled out of PDGF housing

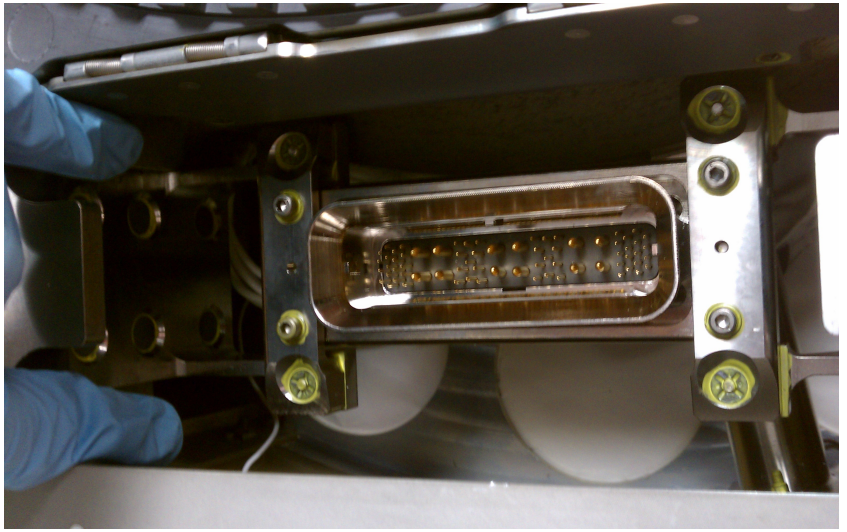


Grounding wire slack being stowed so that Velcro will hold it in place when MLI closed

Closing MLI

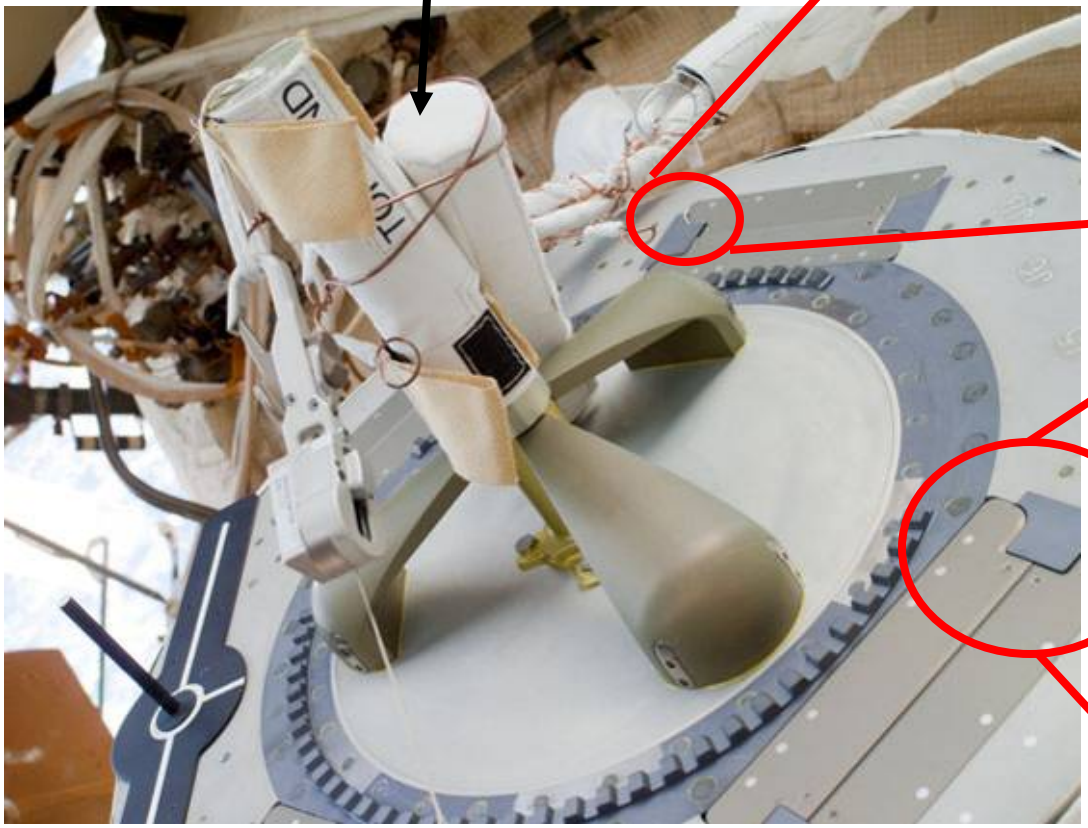


Closing MLI tab

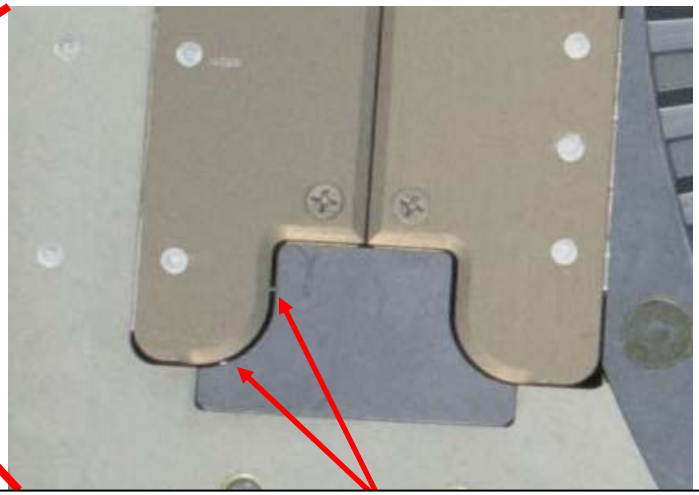


Pins in electrical connector

Grapple fixture cover removed on STS-134



Grounding wire protruding from forward/nadir electrical connector doors



Grounding wire possibly visible through connector doors on forward/zenith electrical connector housing

EVA 1 TASK DATA – PMA3 COVER INSTALL

Estimated Task Duration:

	Without RMS
Two EV Crew	00:45

Tools:

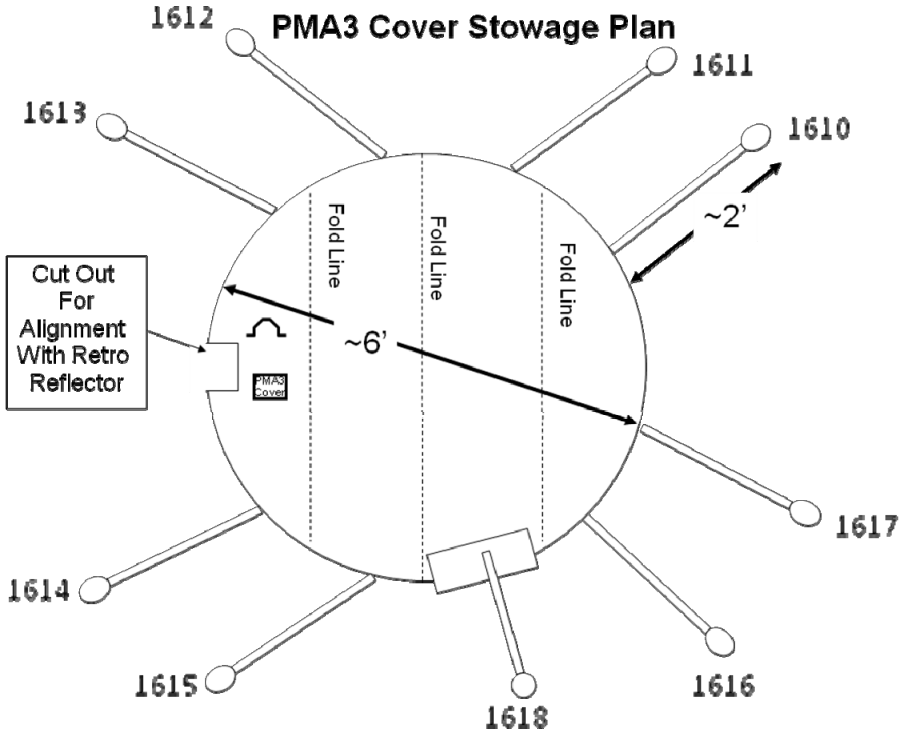
EV1
PMA3 Cover

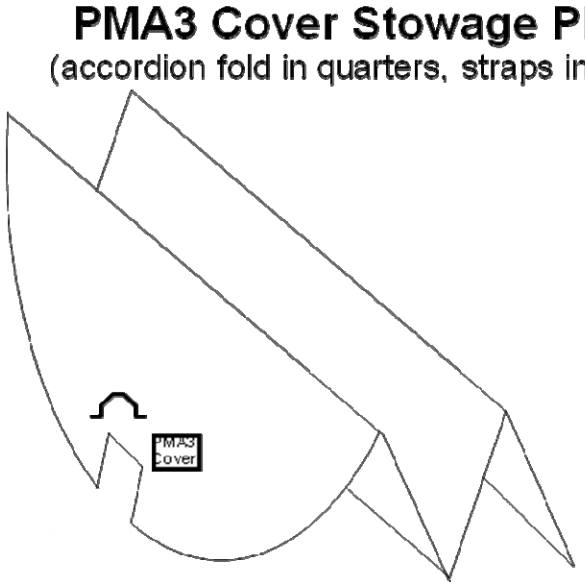
Notes:

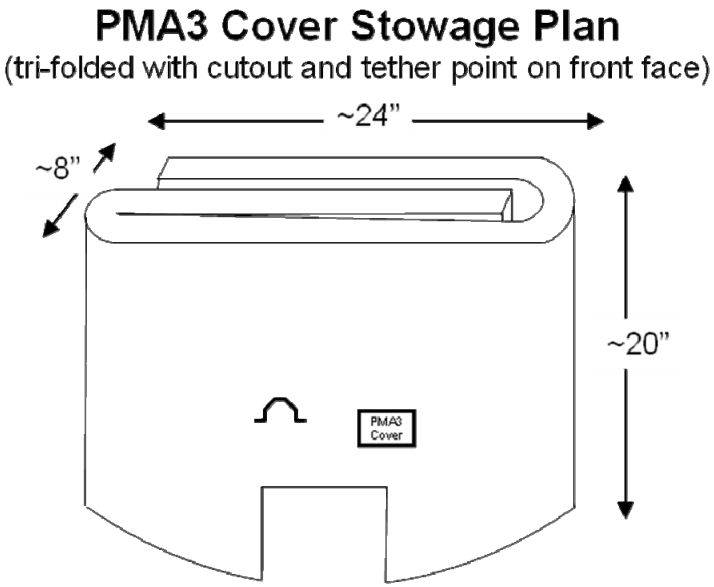
1.

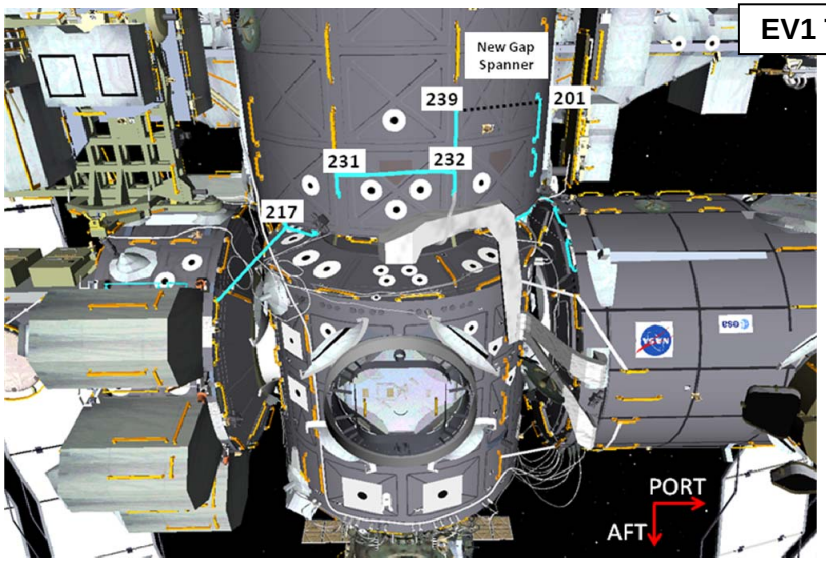
Timeline Considerations:

1. Gap spanner installation can be skipped to gain ~5 min

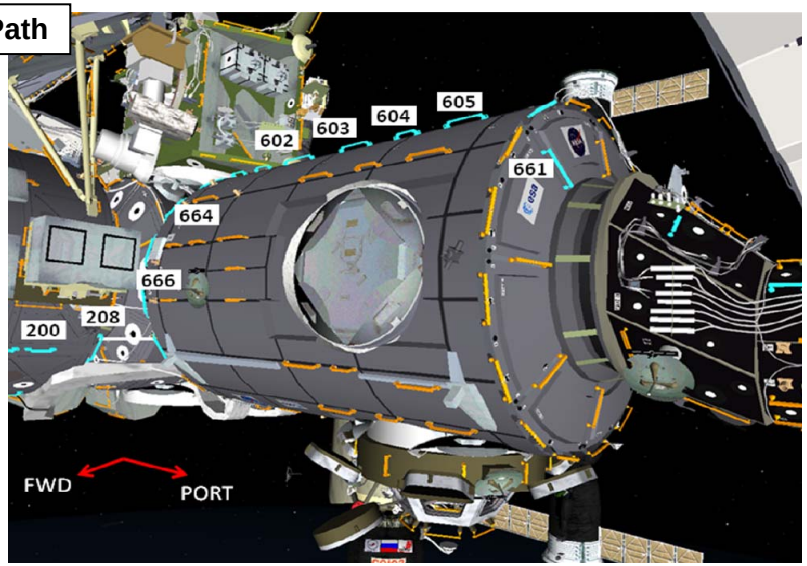


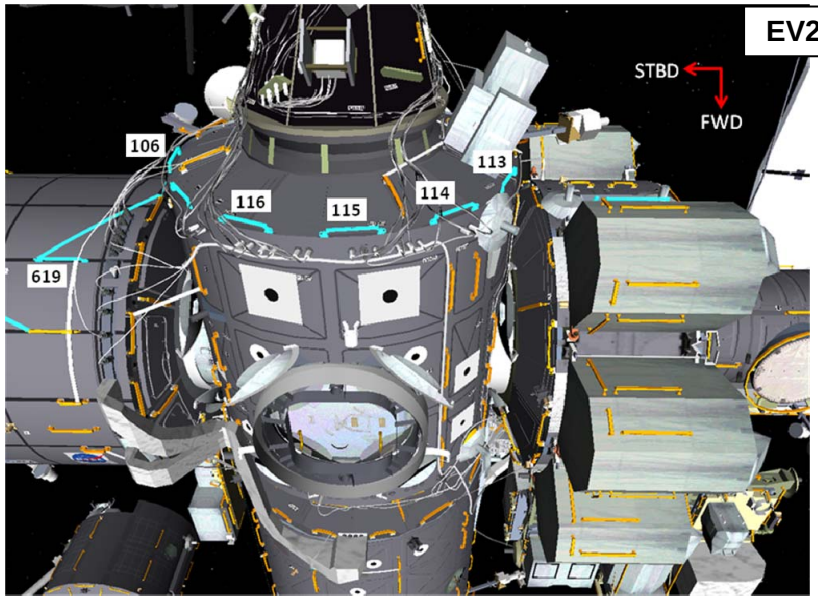




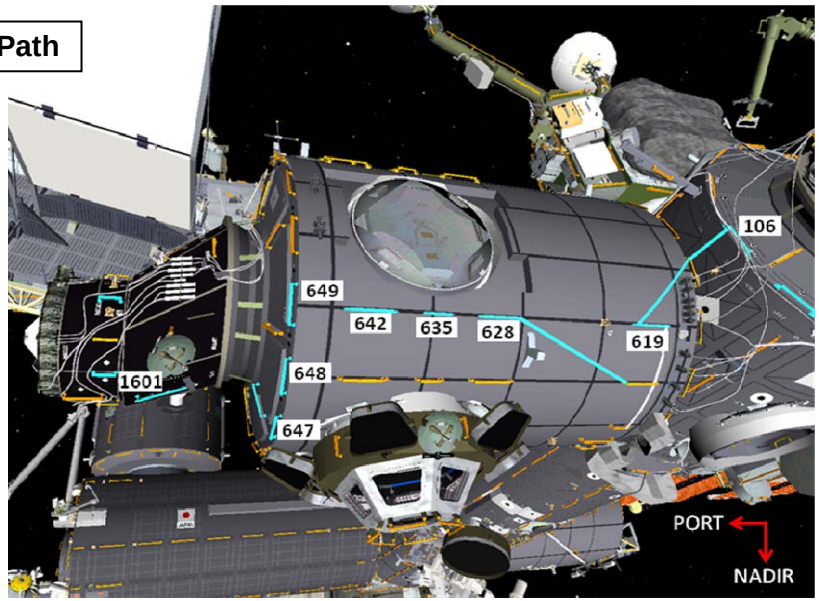


EV1 Translation Path





EV2 Translation Path



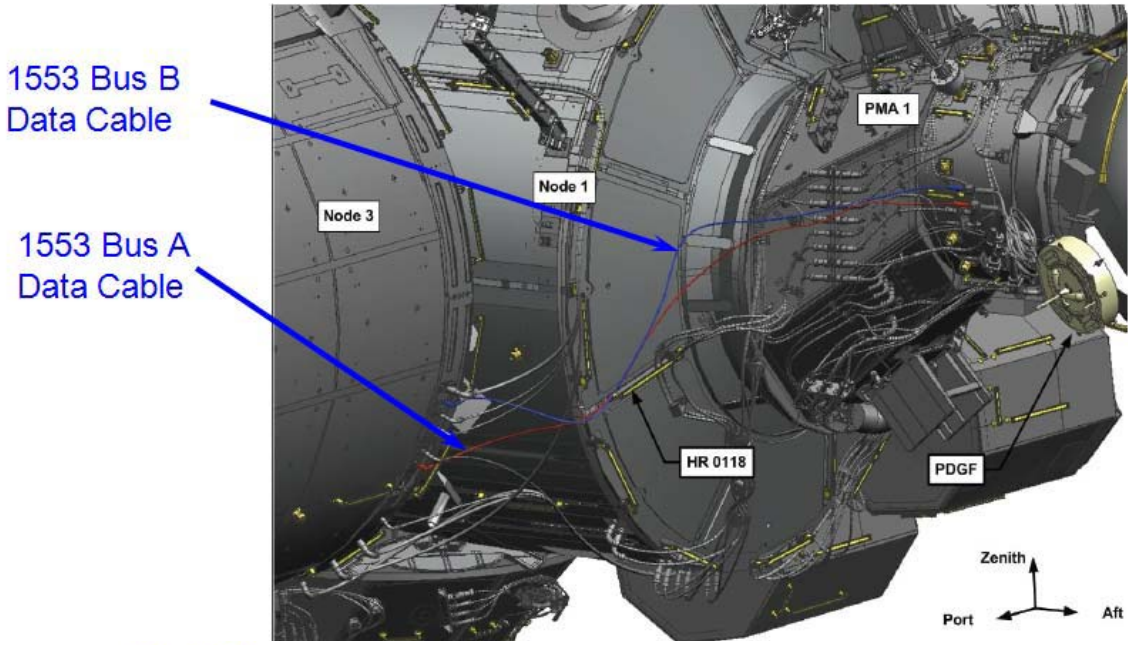
EVA Get-ahead Tasks (Order indicates priority)	Duration	Crew	Tools/Bags	Inhibits	Bingo Time
FGB PDGF 1553 Data Cable Install	00:45 (post PMA3 Cover Install); 01:15 (from A/L)	2	1553 Data Cable Bag	1. All RWS – Active Assert Backup 2. √RACU-5 – OFF 3. √RACU-6 – OFF 4. √KURS A [КУРС А] – Deactivated 5. √KURS P [КУРС Р] – Deactivated 6. √TORU [ТОРУ] – Deactivated 7. √TV System [ТВС] – Deactivated 8. Radiotelemetry [БР-9ЦУ-8] – Deactivate 9. √TV System [КЛ-108А] – Deactivated 10. √CNPMS [СИТНП] – Deactivated 11. √KOMPARUS [КИС] – Deactivated	05:00 PET (from PMA3; 04:30 from A/L)
Port CETA Cart Reconfig	00:30	1	2 Long Wire Ties	MT Latched	
SSRMS Base B Elbow CLPA R&R	01:15	1	CLPA ORU Bag, 2 Square Scoops, PGT w/7/16" x 6"	1. RPCs – Open, Close Cmd Inhibit a. S04B C RPC 4 b. S03A C RPC 2	04:30 PET (SSRMS powered up and maneuvering to position for task)
S1 FHRC P-Clamp Release	00:45	1	MISSE/Get-ahead C/L Bag Ratchet w/7/16" x 2"; 7/16" x 18" socket (from Z1 Tool Box)	Stbd TRRJ Locked at 0°	
Tool Reconfiguration	00:30	1	Tool Relocations C/L Bag (in Staging Bag)	None	
Gap Spanner Install	00:20	1	45"-72" Gap Spanner (-307) (in PMA3 Cover Bag)	None	

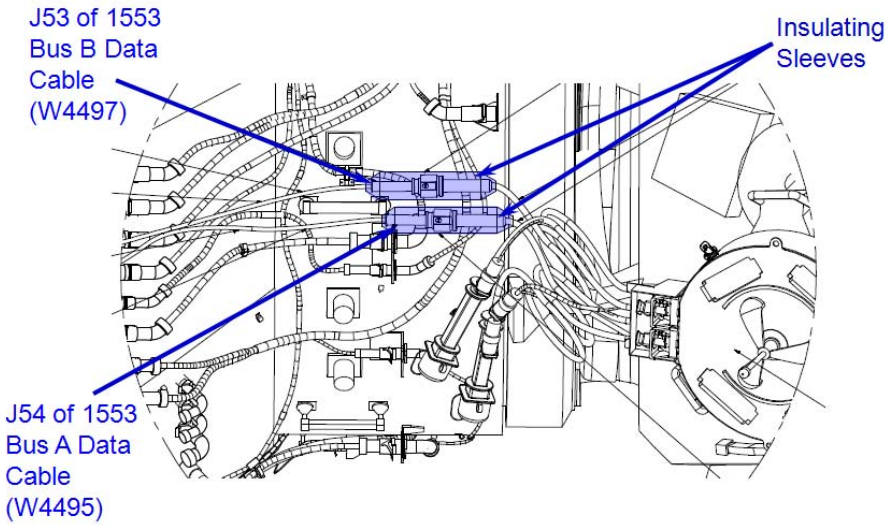
FGB PDGF 1553 DATA CABLE INSTALL (00:45 from PMA3 Cover Task; 01:15 from A/L)

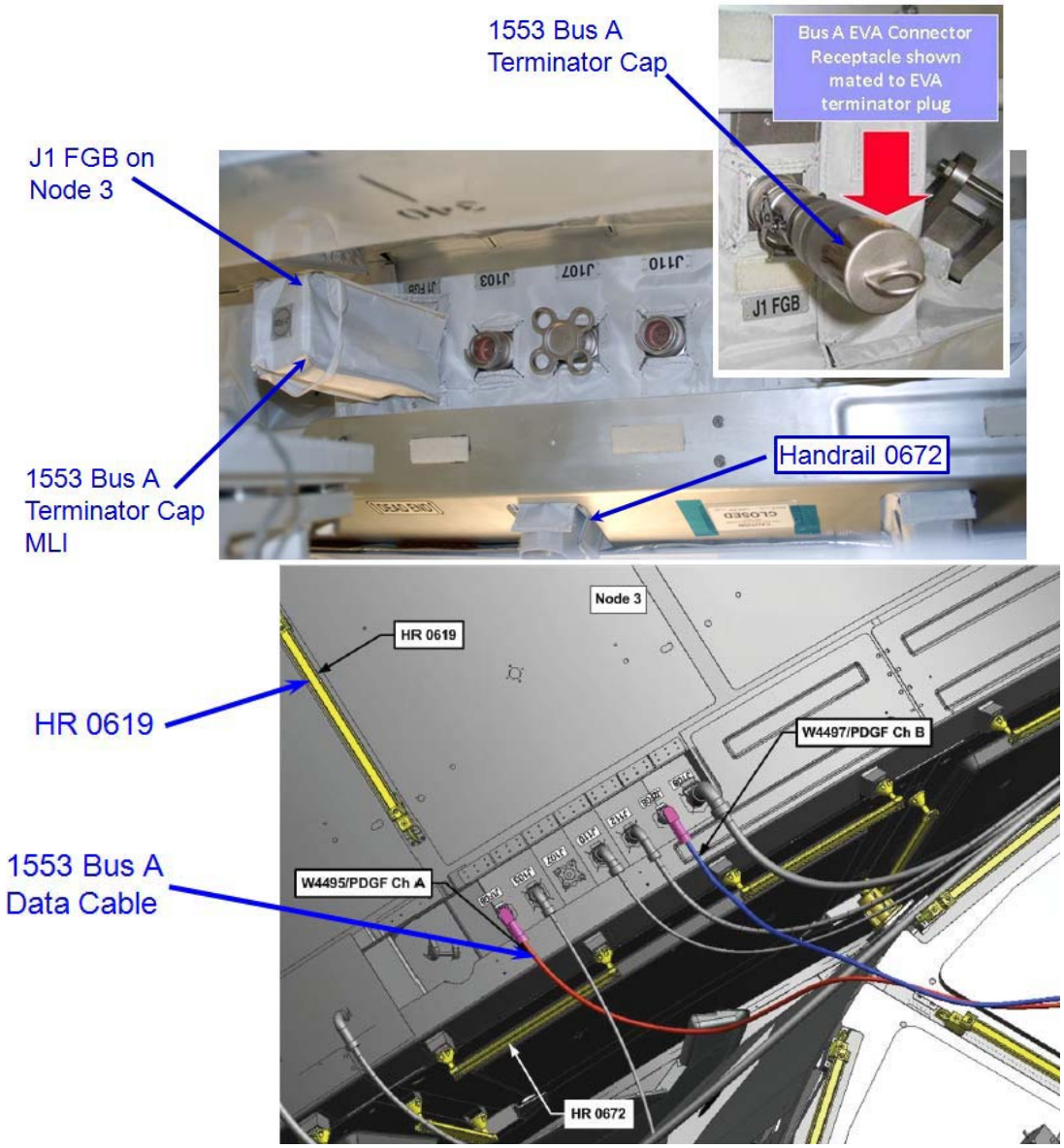
IV/SSRMS	EV1	EV2
	WARNING Avoid inadvertent contact with grapple fixture target, target pin, connector doors, and PDGF curvic coupling (teeth) Avoid contact with FGB sun sensors (possible sharp edges) CAUTION Avoid inadvertent contact with zenith PMA1 MDM and above 22" of EVA crane	
1. √RSOS inhibits in place	FGB PDGF 1553 DATA CABLE INSTALL (00:45) 1. Translate to Node 3 HR 667 (fwd/stbd); stow PMA3 Cover Bag 2. Translate nadir under Node 3 to Node 1 aft 3. Translate to FGB 4. Retrieve 1553 cable and fish stringer from bag ❑ RET to connector bail or cable 5. Untwist taped wire tie to release Node 3 end 6. Attach taped wire tie (FGB end) to PMA1 HR 0011 7. Translate nadir/port to Node 3 connector panel (along Node 1 HR 0118), reel out 1553 cable as required 8. Temp stow fish stringer near Node 3 connector panel (add RET if extra length needed)	FGB PDGF 1553 DATA CABLE INSTALL (00:45) 1. ** If starting at A/L, retrieve 1553 Data Cable Bag and translate via Node 1 HR 104 (aft/zenith) to PMA1 HR 6; stow bag onto HR 6 2. Translate to FGB 3. Translate to PAMA/PDGF forward between foot 2 and 3 4. Release wire tie from PDGF for the 1553 cables 5. Route PDGF harness cables toward PMA1 HR 0011 ❑ Verify ST routed over the cables
2. √1553 Cable Inhibits in place	9. Remove Node 3 terminator MLI (2); stow on fish stringer ❑ J1 FGB ❑ J2 FGB	6. On **IV GO:** Remove caps (4); verify caps are securely wire tied to cables NOTE Russian connectors reminder: – 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

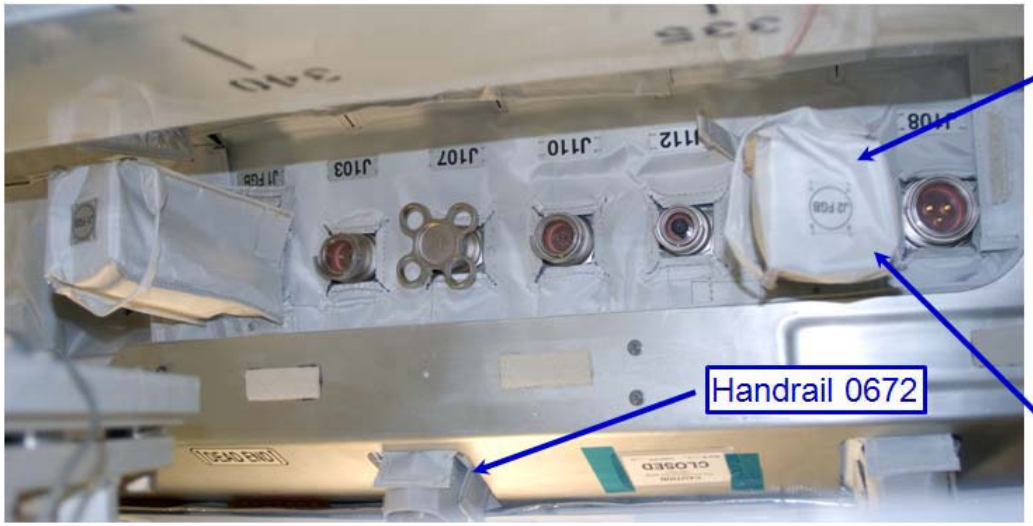
FGB PDGF 1553 DATA CABLE INSTALL (01:10) (Cont)

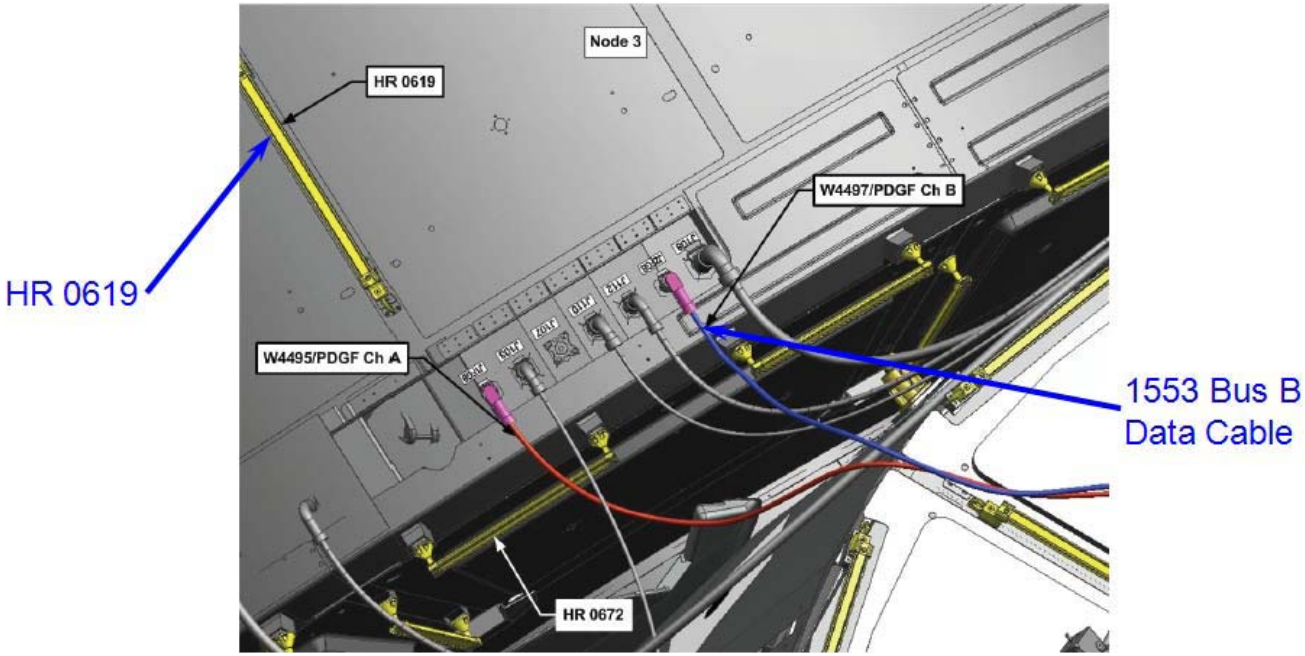
IV/SSRMS	EV1	EV2
		7. Mate 1553 cable connectors to PDGF harness and lock connector: ❑ √Good pins; no FOD ❑ PDGF harness 1800-X54 →|← J54 (Bus A) ❑ PDGF harness 1800-X53 →|← J53 (Bus B)
	10. On **IV GO**: Remove Node 3 terminator caps (2) from aft avionics panel; stow on fish stringer ❑ Terminator cap ←|→ Node 3 J1 FGB ❑ Terminator cap ←|→ Node 3 J2 FGB	8. Secure FPP booties around 1553/PDGF harness connections; adjust wire ties as required
	11. Remove cap from 1553 P1 cable; stow on fish stringer	
	12. Mate 1553 cable P1 to Node 3 J1 FGB ❑ √Good pins & EMI band; no FOD ❑ 1553 cable P1 →|← J1 FGB (Node 3)	
	13. Remove cap from 1553 P2 cable; stow on fish stringer	
3. Give **MCC-H GO** to check both data channels	14. Mate 1553 cable P2 to Node 3 J2 FGB ❑ √Good pins & EMI band; no FOD ❑ 1553 cable P2 →|← J2 FGB (Node 3)	
	15. Retrieve fish stringer	
	16. Wire tie 1553 cable and any slack to Node 1 HR 0118 (low profile wire tie) and PMA1 HR 0006	9. Wire tie any slack to PMA1 HR 0011 using integrated PDGF harness wire tie
	17. Translate to Node 3 bag; stow fish stringer in Node 3 bag	10. Retrieve 1553 Data Cable Bag, stow on BRT
	18. Glove Check	10. Glove Check
4. Perform EV Tool Inventory	19. Perform MWS Tool Inventory	11. Perform MWS Tool Inventory
	20. Translate to Node 3 HR 667 (fwd/stbd)	
	21. Retrieve PMA3 Cable bag; stow on BRT	
	22. Translate to A/L	12. Translate to A/L


1553 Bus B Data Cable
1553 Bus A Data Cable
PMA 1
Node 1
Node 3
HR 0118
PDGF
Zenith
Port
Aft

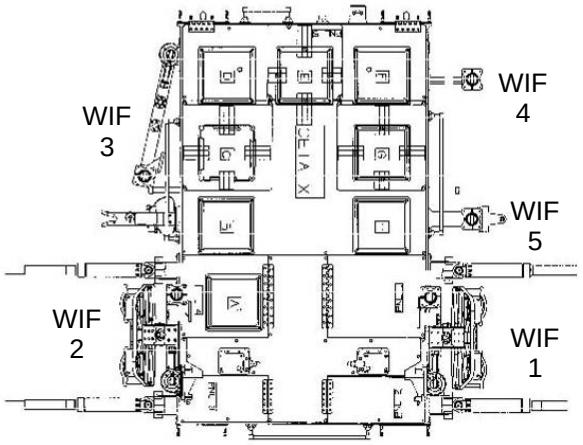
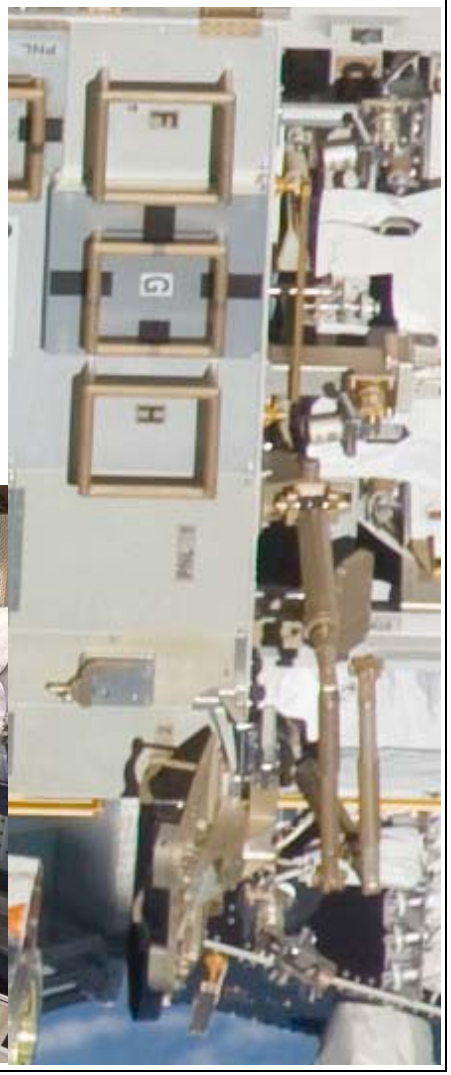

J53 of 1553 Bus B Data Cable (W4497)
Insulating Sleeves
J54 of 1553 Bus A Data Cable (W4495)


1553 Bus A
Terminator Cap
Bus A EVA Connector Receptacle shown mated to EVA terminator plug
J1 FGB
J1 FGB on
Node 3
1553 Bus A
Terminator Cap
MLI
Handrail 0672
Node 3
HR 0619
HR 0619
W4497/PDGF Ch B
1553 Bus A
Data Cable
W4495/PDGF Ch A
HR 0672


J2 FGB on
Node 3
Handrail 0672
1553 Bus B
Terminator Cap
MLI


Node 3
HR 0619
W4497/PDGF Ch B
HR 0619
W4495/PDGF Ch A
1553 Bus B
Data Cable
HR 0672

PORT CETA CART RECONFIG (00:30)

IV/SSRMS	EV
Tools Required: ❑ 2 long wire ties, 1 short (optional) Inhibits Required: Mobile Transporter **MCC-H** EV crew expected < 1.5 meters from MT (ROBO) 1. √MT latched  NOTE TFR is at 0 in this graphic, but should be fully deployed to 30 on ISS	PORT CETA CART RECONFIG (00:30) 1. Retrieve at least two long wire tires 2. Translate to Port CETA Cart 3. √Port TFR nadir 180 deg full nadir (position 30) 4. If not ❑ Release Port nadir TFR swing arm, move to position 30 ❑ Lock TFR swing arm 5. Attach Waist Tether to WIF 1 tether pt 6. Rotate Port brake handles forward and tie down (one long wire tie per handle) ❑ Nadir brake handle to zenith TFR Toe Clip ❑ Zenith brake handle to Sq Grid H (port/nadir corner) ❑ √Three twists at each end of wire ties ❑ √Brake handles bent at elbow and secured together with wire tie (optional) 7. √Outboard WIFs pitched inboard at least 45° ❑ WIF 4 ❑ WIF 5 8. Perform WVS survey of CETA Cart 9. Glove Check   

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SSRMS BASE B ELBOW CLPA R&R (01:15)

IV/SSRMS	EV1
1. **SSRMS:** Maneuver to CLPA Setup position (~00:10)	SSRMS BASE B ELBOW CLPA R&R (01:15)
2. Start Hatch Thermal Cover clock PET (30 min) ___ : ___	1. ← Retrieve CLPA Bag from A/L
3. Stop Hatch Thermal Cover clock PET (30 min) ___ : ___	2. ← Close A/L hatch thermal cover 3. Temp stow CLPA Bag onto APFR (w/Ingress Aid, from ESP-2 WIF 5) 4. Retrieve APFR; stow on BRT 5. Translate nadir to Lab HR 231 (one with nadir gap spanner), then translate forward past window to Lab WIF 9 WARNING Stay 1 ft from UHF Antenna 6. Install APFR into Lab WIF 9 [11, KK, F, 5] 7. Stow CLPA Bag onto BRT 8. Extend Ingress Aid 9. Attach local tether to Ingress Aid 10. Ingress APFR 11. Position CLPA Bag on BRT for easy access
4. **SSRMS:** Maneuver to CLPA R&R position	12. Give **SSRMS GO** for maneuver and GCA into position for CLPA R&R √Access to CLPA micro-square and VDU (Texas) tether point (for temp stow of failed CLPA) √Lean back assessment for CLPA R&R Adjust APFR roll, if necessary
5. **SSRMS:** On **EV GO**, safe SSRMS 6. **SSRMS:** Inform **MCC-H** SSRMS safed, ready for SSRMS power down	13. Give **SSRMS GO** for safing 14. Retrieve Square Scoop from CLPA Bag (on BRT) 15. Install Square Scoop onto CLPA 16. Transfer Square Scoop RET from bag to VDU (Texas) tether point (to right of CLPA, on “top” of VDU) 17. Configure PGT ❑ [**B7**, **CCW2**, 30.5], 6" ext 7/16"
7. √**MCC-H** – CLPA inhibits in place	

SSRMS BASE B ELBOW CLPA R&R (01:15) (Cont)

<table>
<tr><th>IV/SSRMS</th><th>EV1</th></tr>
<tr><td>
8. Record failed CLPA bolt data:
<table>
<tr><th>Bolt</th><th>Turns</th></tr>
<tr><td>Primary</td><td>(22)</td></tr>
</table>
9. Record new CLPA bolt data:
<table>
<tr><th>Bolt</th><th>Turns</th><th>Torque</th></tr>
<tr><td>Primary</td><td>(22)</td><td>(16.0)</td></tr>
</table>
10. Give MCC-H GO to power up SSRMS

11. Start Hatch Thermal Cover clock
PET (30 min) ___ : ___

12. Stop Hatch Thermal Cover clock
PET (30 min) ___ : ___
</td><td>
18. On MCC-H GO, release CLPA bolt 22 turns – do NOT drive to hard stop
(CLPA will come loose at 14 turns, continue driving to retract exposed bolt threads)
19. Remove failed CLPA (~5 lb soft-dock force); temp stow via RET to VDU (Texas)
20. Retrieve spare CLPA from CLPA Bag (on BRT); install into soft dock
21. Configure PGT
❑ [B2, CW2, 30.5], 6" ext 7/16"

22. Drive CLPA bolt to torque (expect 22-23 turns)
23. Stow PGT
24. Verify lens cover is fully installed
25. Release Square Scoop from spare CLPA; stow in CLPA Bag
26. √Pop-up indicator fully “in” (only visible with scoop removed)
27. Stow failed CLPA in CLPA Bag; retrieve RET from VDU (Texas)
28. √All tethers and equipment clear of SSRMS
29. Egress APFR
30. Stow Ingress Aid and lay against boot plate
31. Temp stow CLPA Bag onto APFR
32. Retrieve APFR and Bag bundle

33. When clear of SSRMS, give MCC-H GO to power up SSRMS
34. Translate to ESP-2 forward edge
35. Stow APFR in ESP-2 WIF 5, low profile settings
36. Report APFR settings
37. Retrieve CLPA Bag

38. ← Stow CLPA Bag in A/L

39. ← Close A/L hatch thermal cover

40. Inspect gloves
</td></tr>
</table>

SSRMS BASE B ELBOW CLPA R&R – TASK DATA

Estimated Task Duration:

	With APFR	Without APFR
One EV Crew		
Two EV Crew	N/A	N/A

Tools:

EV1
CLPA ORU Bag (w/spare)
2 Square Scoops
PGT w/7/16" socket 6" extension

EVA Fasteners:

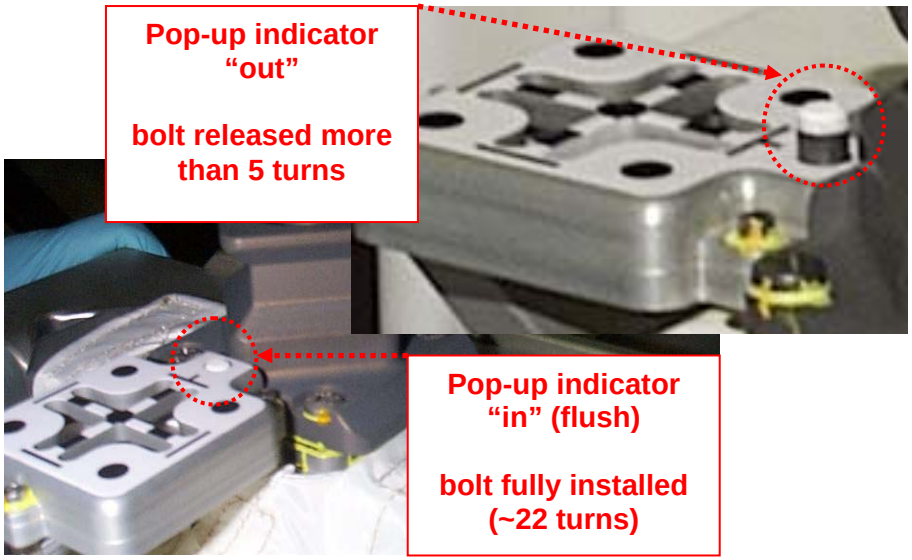
Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
CLPA Tie-Down Bolt	None	7/16"	1	10.8-16.7	25.5	43.0	23-25	30

ORUs:

Item	P/N	Base B s/n	Spare s/n	Mass (lb)	Dimensions (in)
CLPA	51612-3004-1	202	208	50.59 lb	16.82" x 22.47" x 17.00"

Foot Restraints:

Task	WIF	APFR Setting
SSRMS Base B Elbow CLPA R&R	Lab WIF 9	11, KK, F, 5

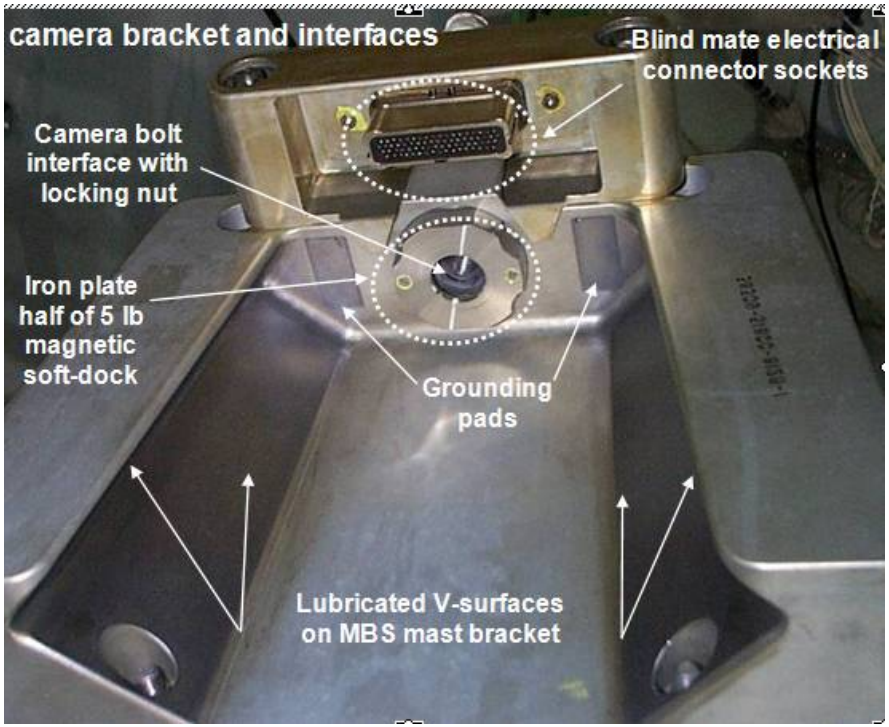


Notes:

1. Bolt is not free spinning. Drive to turn count, not hard stops
2. 20 turns provides structural integrity
3. 22 turns achieves electrical connectivity
4. Pop-up indicator indicates when CLPA is fully installed

Timeline Considerations:

1. EV2 may assist in setup/cleanup of this task by carrying CLPA ORU Bag to and from worksite while EV2 transports the APFR



S1 FHRC P-CLAMP RELEASE (00:45)

IV/SSRMS

1. Record P-clamps:

Hose Box S1 Bay 13

	P-clamp	Tool	Socket
❑	**1 (N)**	PGT	6-in ext
❑	**2 (N)**	PGT	6-in ext
❑	**3 (N)**	Ratchet	2-in ext
❑	**1 (Z)**	PGT	6-in ext
√	**2 (Z)**	PGT	6-in ext
√	**3 (Z)**	Ratchet	2-in ext

2. Verify inhibits in place
   √Stbd TRRJ locked at 0 deg

3. Record P-clamps:

Stinger S1 Bay 11

	P-clamp	Tool	Socket
❑	**1**	PGT	6- or 18-in ext
❑	**2**	PGT	18-in ext
❑	**3**	PGT	6-in ext
❑	**4**	PGT	6- or 18-in ext
❑	**5**	PGT	6- or 18-in ext
❑	**6**	PGT	6***** or 18-in ext

*****wobble reqd w/6-in

EV

S1 FHRC HOSE BOX P-CLAMP RELEASE – BAY 13 (00:20)

1. √Ratchet w/7/16" socket 2" ext in MISSE/Get-ahead Bag is with you
   ❑ Consider translation to Z1 stbd Tool Box to pick up 18" socket

2. Translate to S1 FHRC Bay 13

> CAUTION
> Do not impart loads greater than 15 lb into FHRC Hose Box fluid lines

3. Configure PGT:
   [A7 (9.2), CCW2, 30.5] 7/16 socket 6 ext

4. Release Hose Box P-clamps (4) [P-clamp #3N requires ratchet] ~6-12.5 turns

5. Egress Bay 13
6. Verify SAFER handles:
   ❑ √R Handle down (HCM door – Closed)
   ❑ √L Handle down (MAN ISO Valve – Open)

S1 FHRC STINGER P-CLAMPS – BAY 11 (00:25)

7. Translate S1 FHRC Bay 11
8. Configure **PGT**
   [A7 (9.2), CCW2, 30.5] 7/16 socket 6 ext

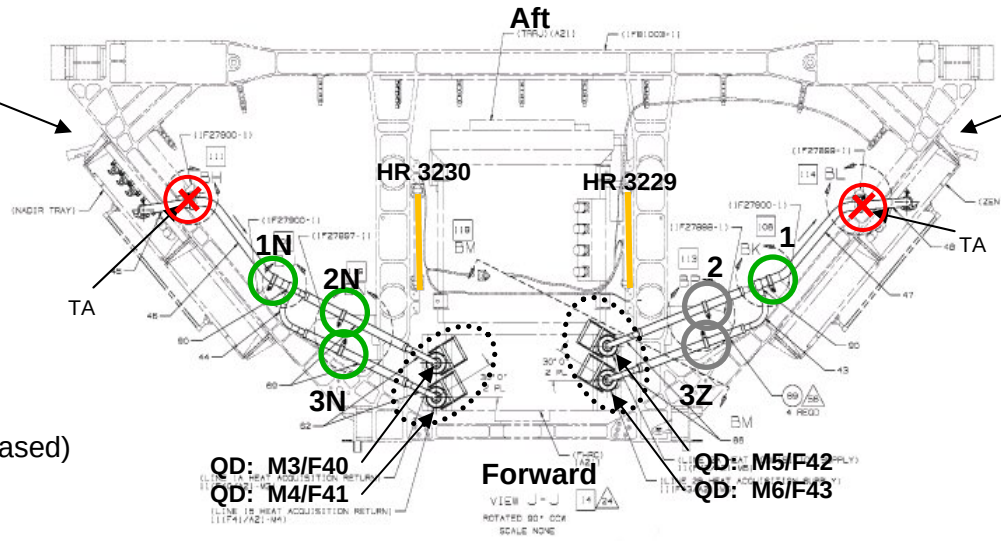
9. Release Stinger P-clamps (5) [P-clamp #2 requires 18 in ext] ~7-12.5 turns
   Do not release P-clamp on hardline
   P-clamps are not numbered
   Release 3 P-clamps closest to QD

10. Egress Bay 11
11. Verify SAFER handles:
    ❑ √R Handle down (HCM door – Closed)
    ❑ √L Handle down (MAN ISO Valve – Open)

12. Glove Check

S1 FHRC P-CLAMP RELEASE – TASK DATA

FHRC P-clamps – Hose Box (Outboard)



○ = P-clamp Location

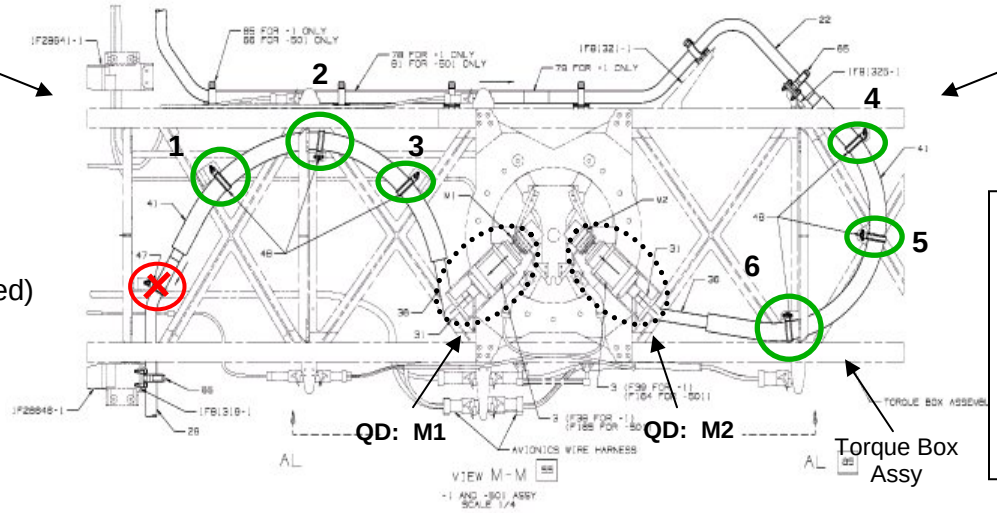
⊗ = TA-clamp (not released)

Hose Box clamps 2Z & 3Z were released on 15A/STS-119

Hose Box S1 Bay 13

	P-clamp	Tool	Socket
❑	1 (N)	PGT	6-in ext
❑	2 (N)	PGT	6-in ext
❑	3 (N)	Ratchet	2-in ext
❑	1 (Z)	PGT	6-in ext
√	2 (Z)	PGT	6-in ext
√	3 (Z)	Ratchet	2-in ext

FHRC P-clamps – Stinger (Inboard)



○ = P-clamp Location

⊗ = P-clamp (not released)

Stinger S1 Bay 11

	P-clamp	Tool	Socket
❑	1	PGT	6- or 18-in ext
❑	2	PGT	18-in ext
❑	3	PGT	6-in ext
❑	4	PGT	6- or 18-in ext
❑	5	PGT	6- or 18-in ext
❑	6	PGT	6* or 18-in ext

***wobble reqd w/6-in**

S1 FHRC P-CLAMP RELEASE – TASK DATA (Cont)

Estimated Task Duration:

	With SSRMS	Without SSRMS
One EV Crew	N/A	N/A
Two EV Crew	N/A	00:45

Tools:

EV1
PGT w/7/16 (wobble) Socket-6 ext
Ratchet wrench w/7/16-2 in ext

EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	RPM
Hosebox P-clamp bolts	1,2,3	7/16	6	N/A	6.0	12.6	6-12.5	30
Stinger P-clamp bolts	Arrow	7/16	6	N/A	6.0	12.6	7-12.5	30

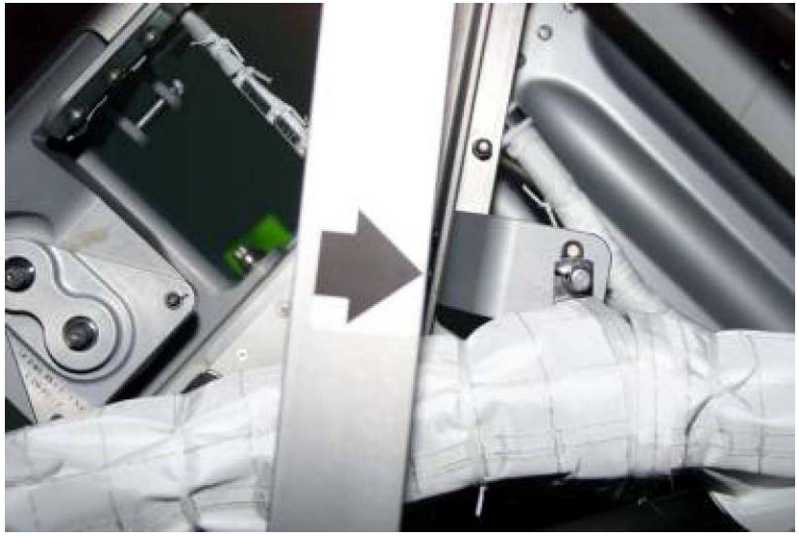
Inhibits:

ORU/Task	Location	Inhibit
S1 P-clamps	Prior to translation to S1	Stbd TRRJ √DLA (1) – LOCKED (0 deg)

Caution:

1. Do not impart more than 15 lbf load into the hose box fluid lines

Hose box P-clamps have labels with bolt numbers



Stinger P-clamps have arrow labels for bolts

TOOL RECONFIGURATION (00:30)

IV/SSRMS	EV1
1. Start Hatch Thermal Cover clock PET (30 min) ___ : ___	1. ← Retrieve Tool Relocate Bag from A/L Staging bag
2. Stop Hatch Thermal Cover clock PET (30 min) ___ : ___	2. ← Close A/L hatch thermal cover 3. Translate to A/L Toolboxes NOTE Tether to toolboard prior to removal for tool stow 4. Stow following tools in the Port A/L Toolbox (figure 3): ❑ Behind Zenith Door – Slot 1 (figure 4) ❑ Pin Straightener ❑ Behind Nadir Door – Slot 5 (figures 5-8) ❑ Short MMOD T-handle tool (tether point aligned with angled slot) ❑ Short MMOD T-handle tool (tether point aligned with angled slot) 5. Retrieve Large Cutters from Port A/L Toolbox behind Nadir Door (figure 3) 6. Close both doors ❑ Verify at least one lever in lock position for each door 7. Stow following tools in Starboard A/L Toolbox (figure 2): ❑ Inside Zenith Door – Panel 9 (figure 9) ❑ Probe ❑ Behind Zenith Door – Slot 5 (figure 10) ❑ Vise Grips 8. Close both doors ❑ Verify at least one lever in lock position for each door 9. Translate to A/L zenith, QD Tool Bag #1 (stbd) 10. Stow 1" QD Cap Tool in 1" Cap Tool pocket 11. Retrieve Tool Relocate Bag; stow in A/L 12. Inspect gloves

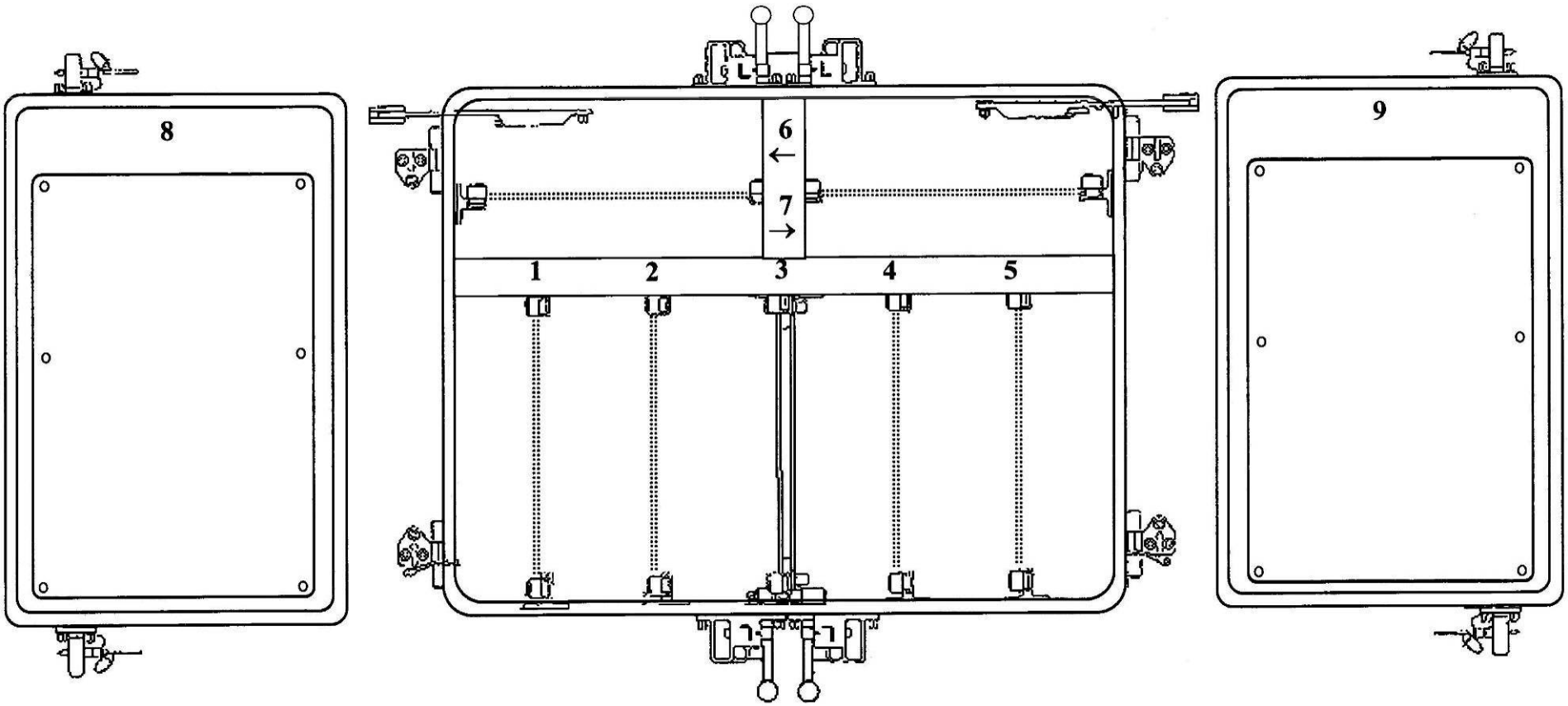


Figure 1.- A/L Toolbox Panel and Slot Labels.

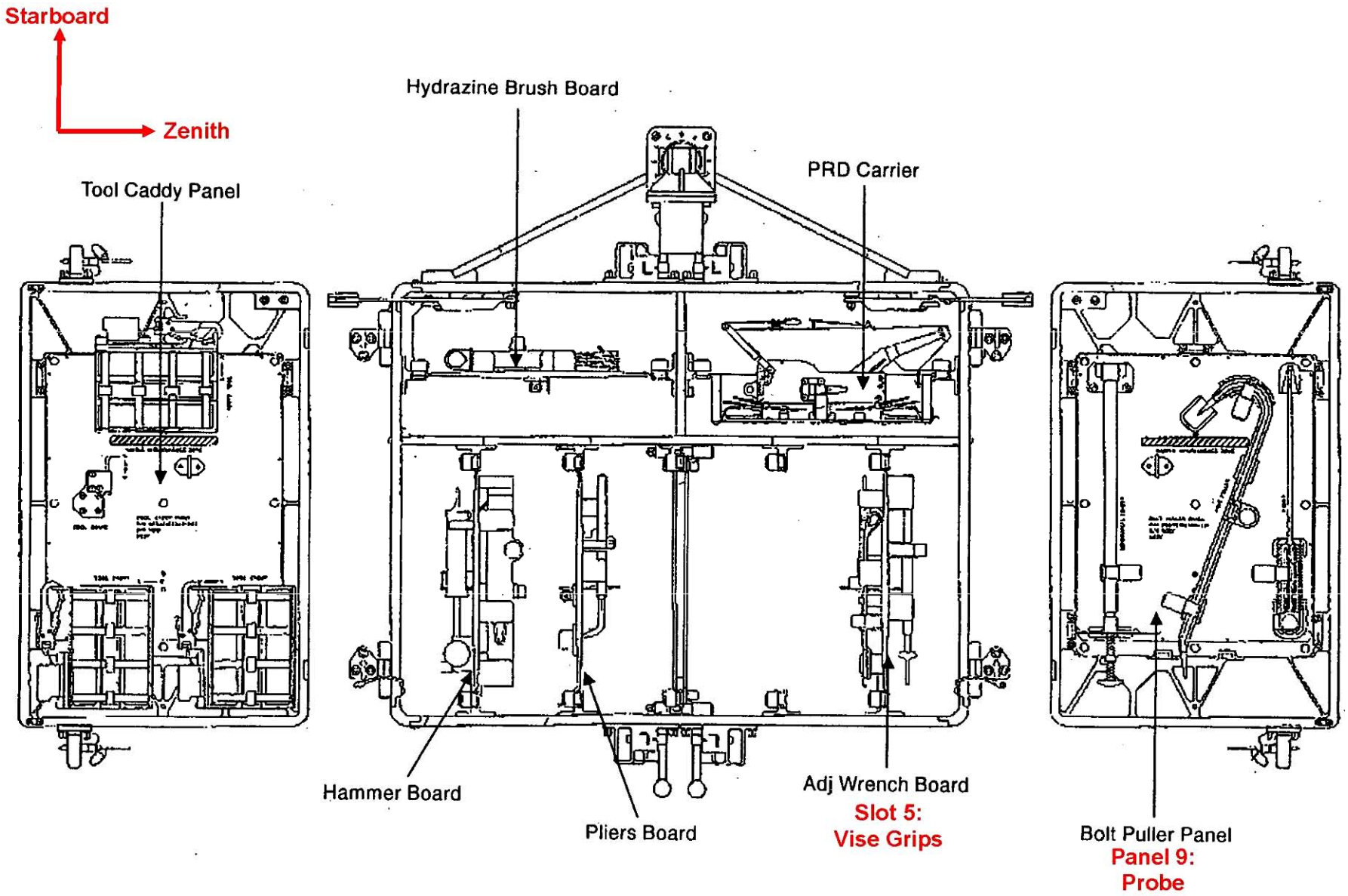


Figure 2.- A/L Toolbox 1 Stbd.

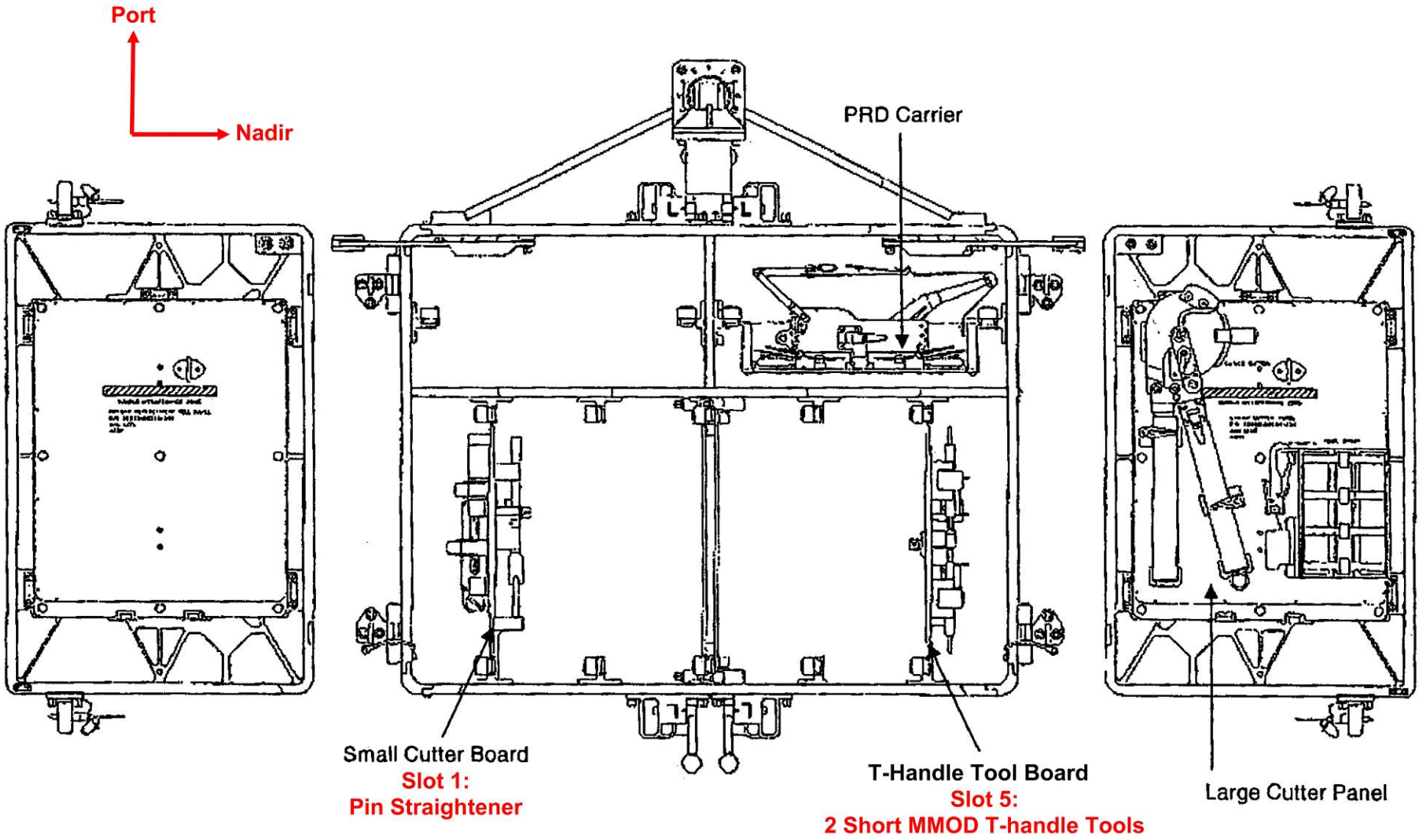


Figure 3.- A/L Toolbox 2 Port.

TOOL RECONFIGURATION (00:30) (Cont)

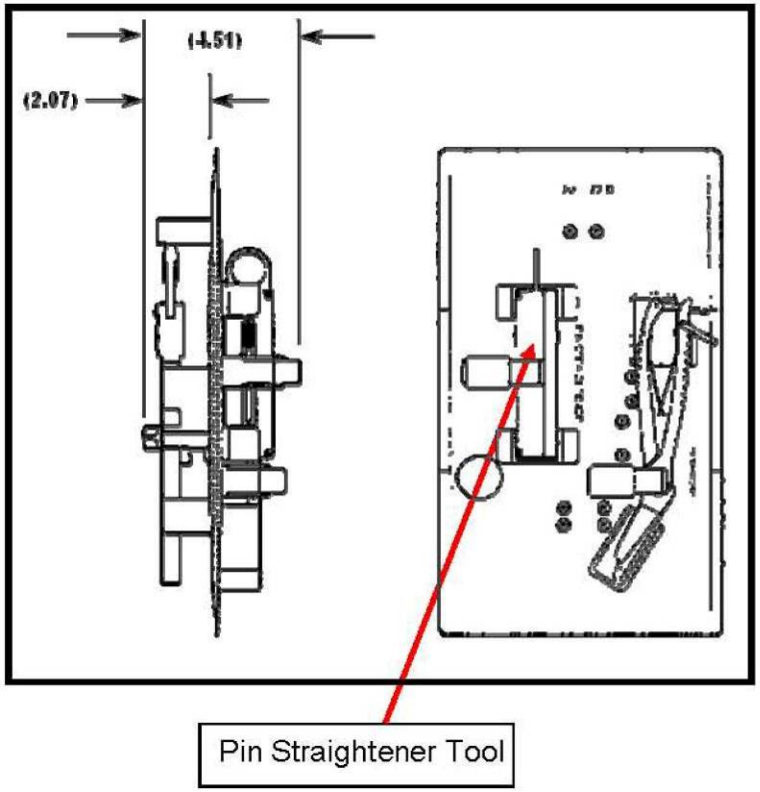


Figure 4.- Small Cutter Board.

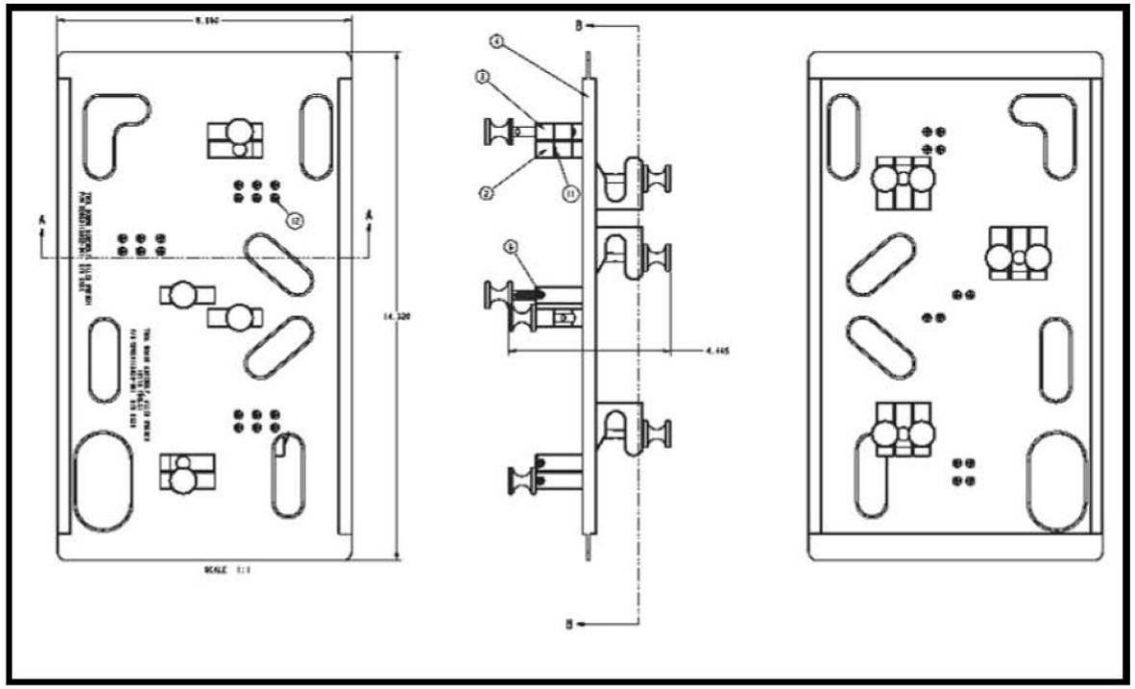
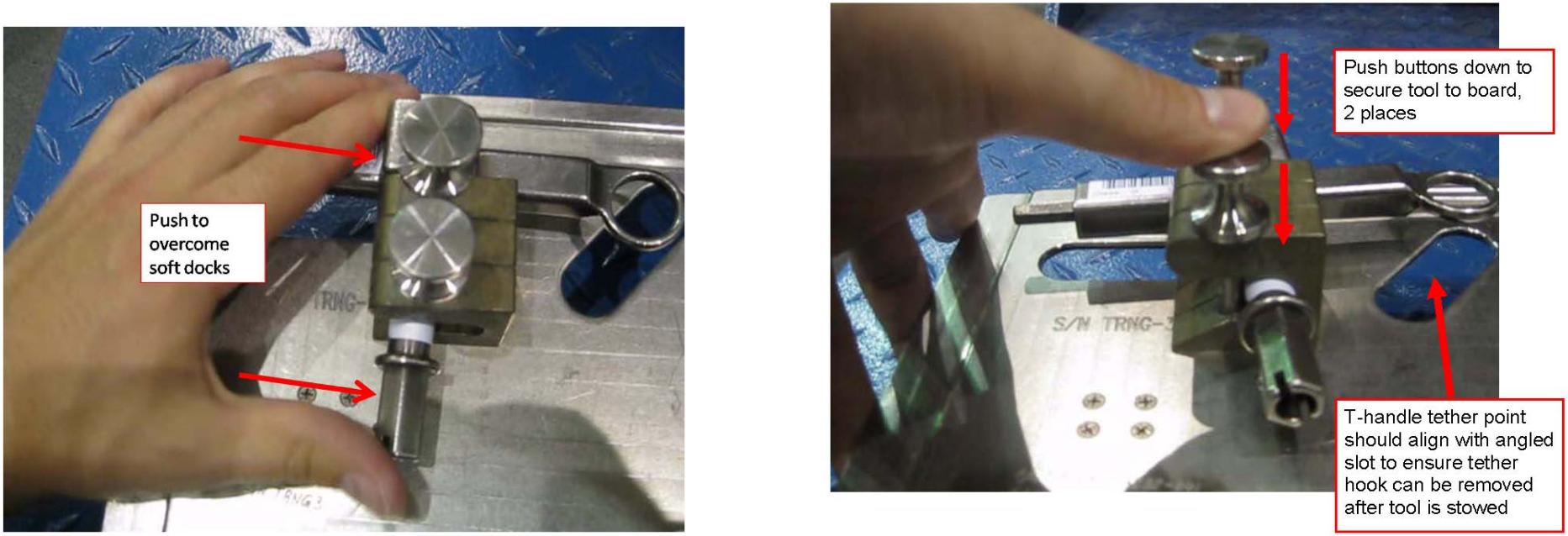


Figure 5.- T-Handle Tool Board.



Figures 6-7.- T-Handle Tool Board Operation.

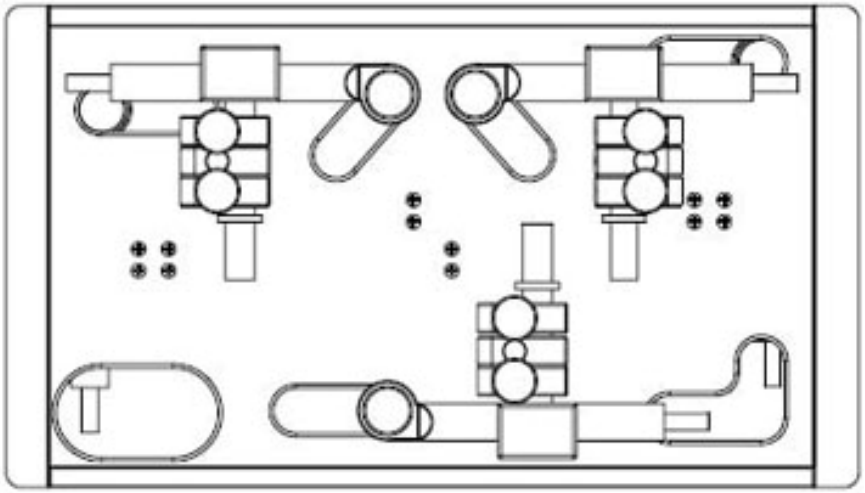


Figure 8.- T-Handle Tools Stowed on Tool Board.

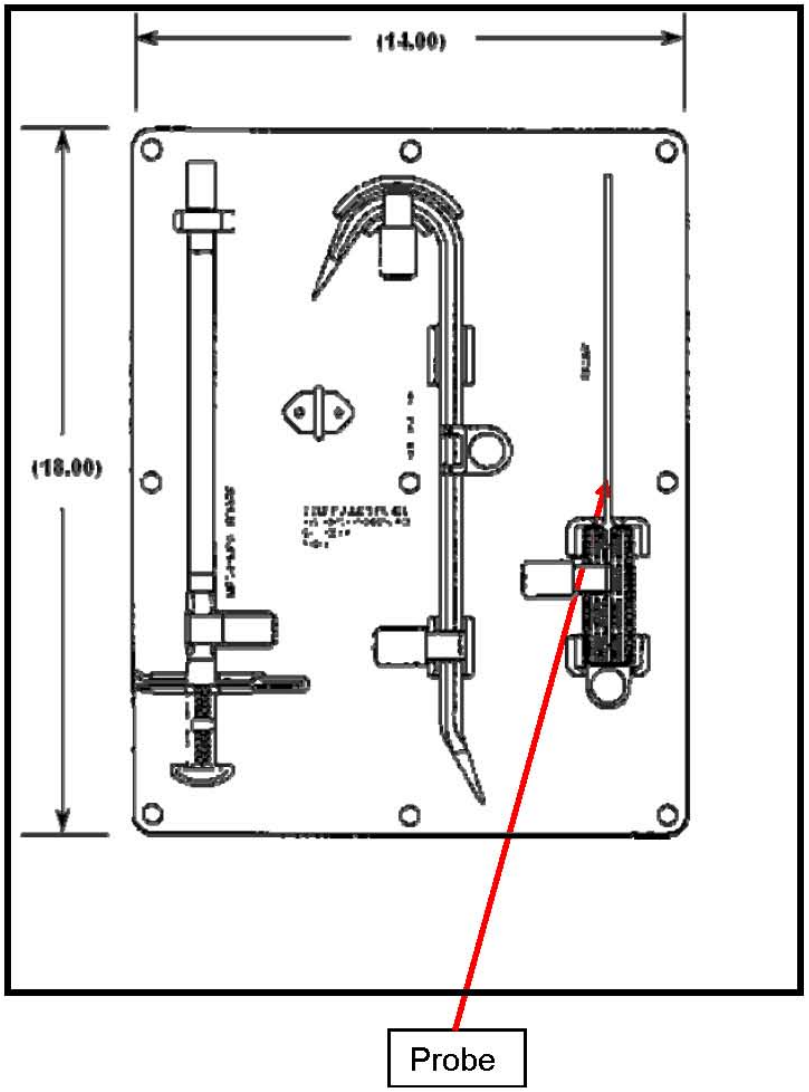


Figure 9.- Bolt Puller Panel.

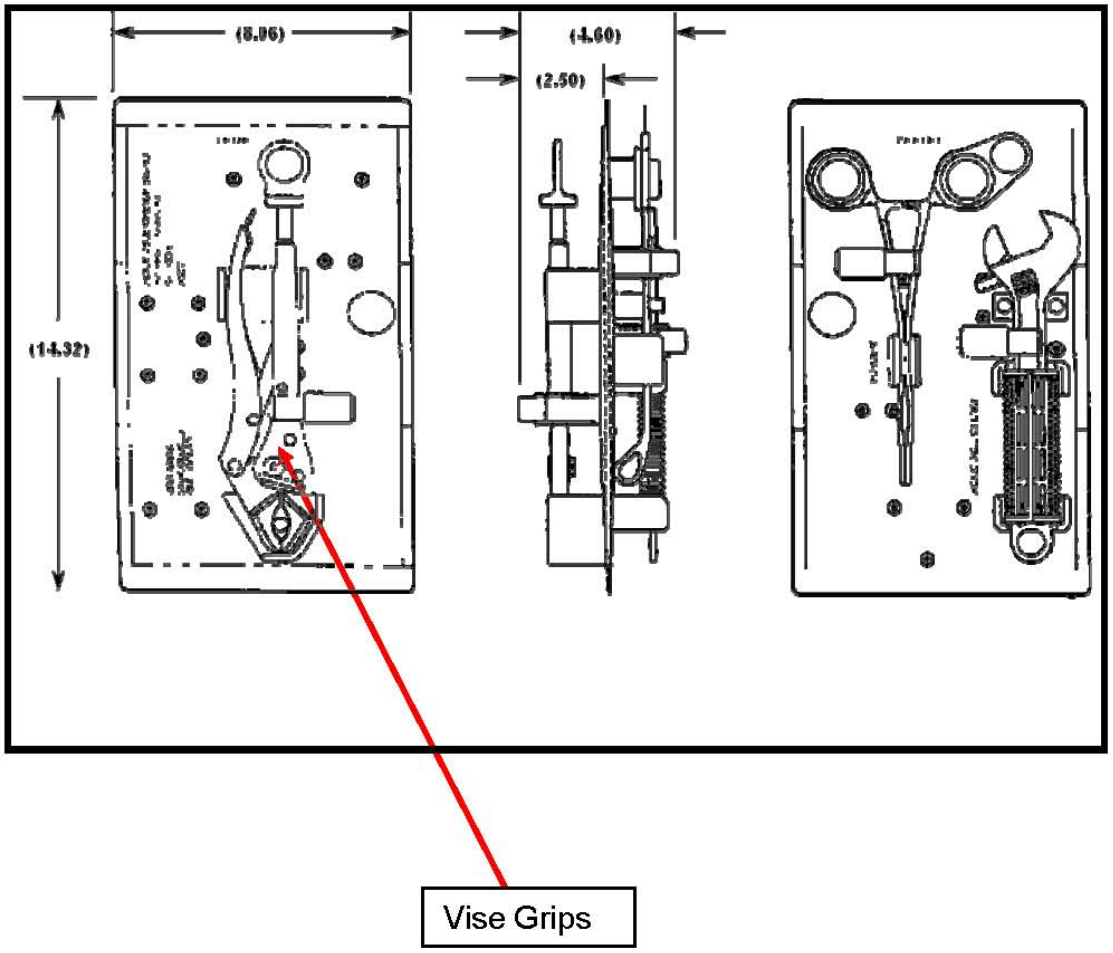
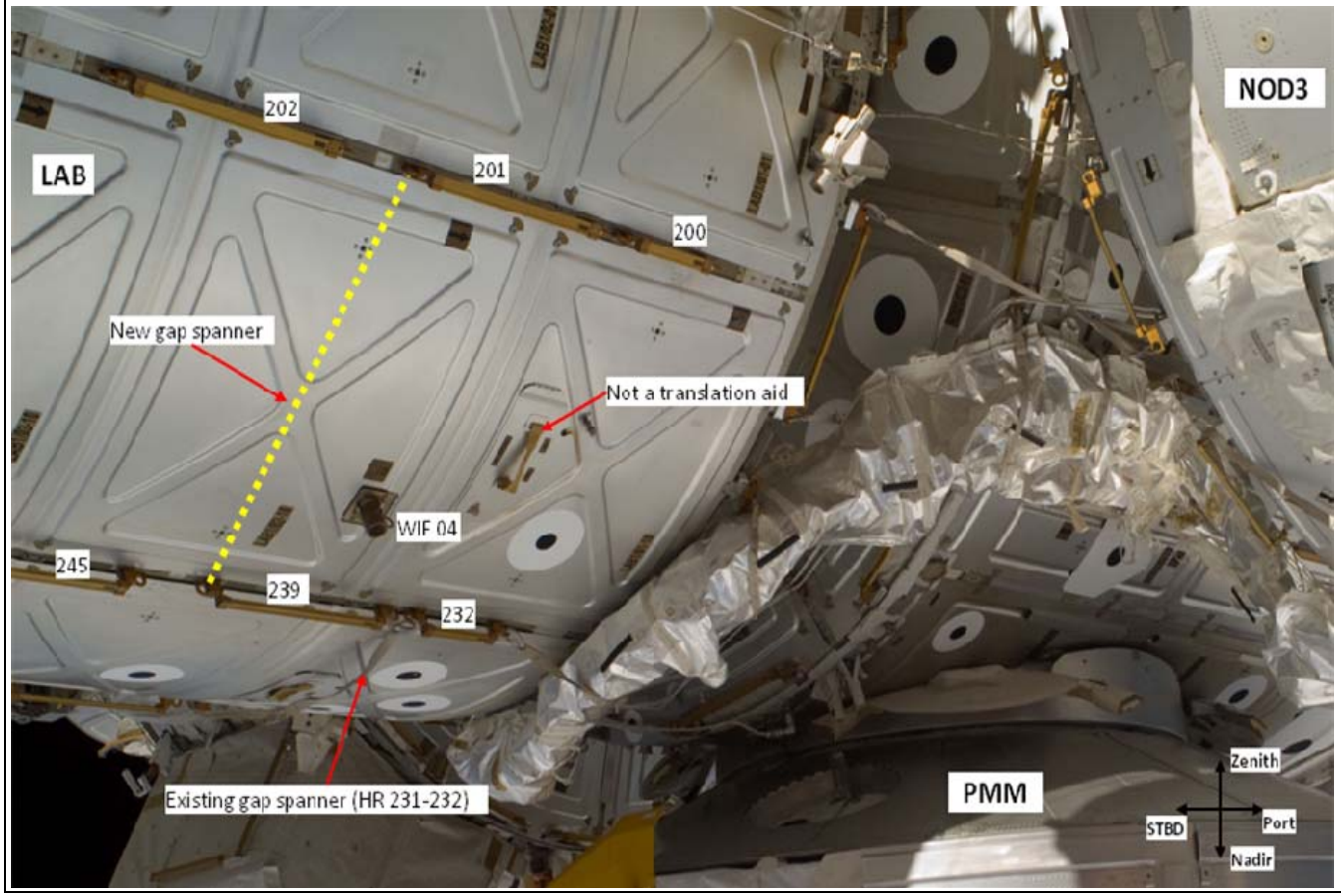


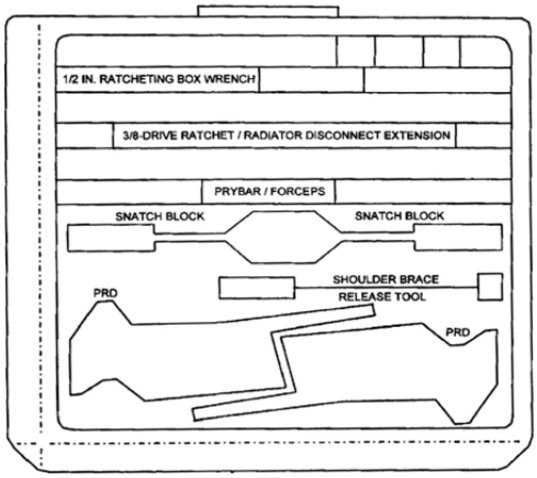
Figure 10.- Adjustable Wrench Board.

GAP SPANNER INSTALL (00:20)

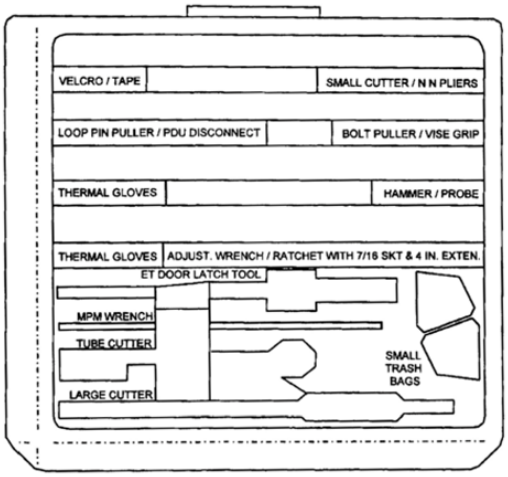
IV/SSRMS	EV1
	GAP SPANNER INSTALL (00:20) 1. Retrieve Gap Spanner CAUTION Do not use Node 3 jumpers as a translation aid 2. Translate to nadir to Lab HR 239 via existing gap spanner 3. Attach local tether 4. Attach one end of gap spanner to forward stanchion of Lab HR 239 5. Translate to Lab HR 201 (okay to use WIF 4) 6. Attach second end of gap spanner to forward stanchion of Lab HR 201 7. Tighten gap spanner until buckle can twist 90°

STARBOARD LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (TSA)..... TEMP FS 8-2
PGT CHECKOUT 8-3
PGSC-PGT CONNECTION (A31P AND 760XD) 8-4
PROGRAM PGT SETTINGS 8-5
DOWNLOAD/ERASE EVENT LOG 8-5
PGT CONTINGENCIES..... 8-6
PGT STANDARD SETTINGS..... 8-7
SAFETY TETHERS – STS-135 (ULF7)..... FS 8-9
APFR MANAGEMENT – STS-135 (ULF7) ..... FS 8-10
CETA CART WIF AND SWINGARM MANAGEMENT TABLE – STS-135/ULF7 .... FS 8-11
TOOLBOX STOWAGE – STS-135 (ULF7)..... FS 8-12
TOOLBOX PANEL AND SLOT LABELS ..... FS 8-13
Z1 TOOLBOX INTERNAL LAYOUT ..... FS 8-14
AIRLOCK TOOLBOX INTERNAL LAYOUT..... FS 8-15
FLUID QD BAG LAYOUT ..... FS 8-16
CREW TETHER INSPECTIONS ..... FS 8-19
CLPA IVA UNPACKING ..... FS 8-26
CLPA CONFIGURE AND PACK FOR STOWAGE..... FS 8-29
MISSE 8 ORMATE III R/W PREP FOR EVA..... FS 8-39
MISSE 8 ORMATE III R/W POST EVA COVER STOWAGE ..... FS 8-40

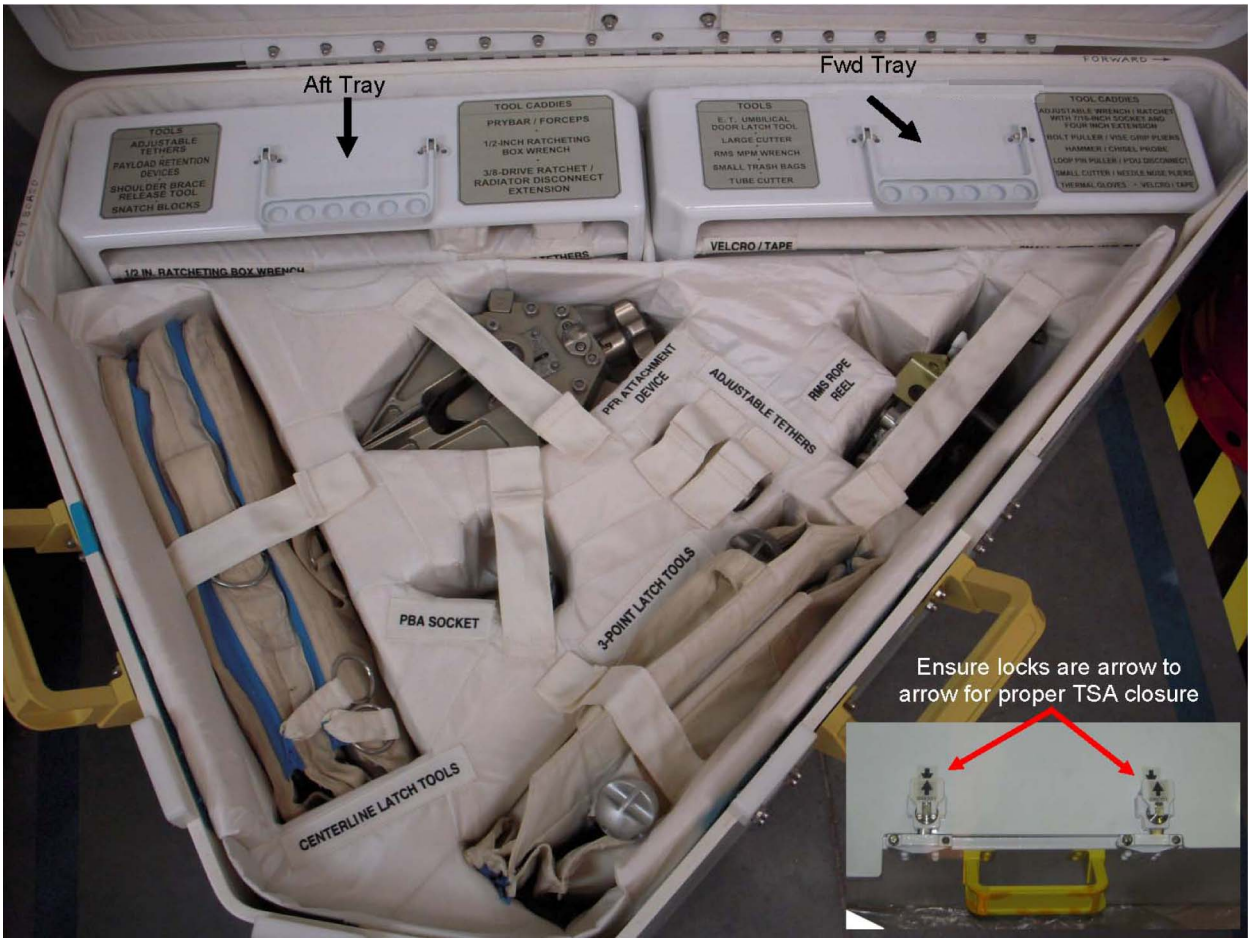
STARBOARD LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (TSA)



Aft Tray Layout and Labels



Forward Tray Layout and Labels



SAFETY TETHERS – STS-135 (ULF7)

55-FT SAFETY TETHERS

	#67 s/n 1017 Lg-sm	#68 s/n 1018 Lg-sm (retracting issues – ULF4)	#69 s/n 1019 Lg-sm	#72 s/n 1022 Lg-sm
ULF6 Stage	INSIDE: Tether staging area	INSIDE: Tether staging area	INSIDE: Tether staging area	INSIDE: Tether staging area
Post EVA 1	INSIDE: Tether staging area	INSIDE: Tether staging area	INSIDE: Tether staging area	INSIDE: Tether staging area

STP = Safety Tether Pack

85-FT SAFETY TETHERS

	#21 s/n 1001 Lg-sm (GMT201 Tether Inspect – only 1 through tack stitch)	#22 s/n 1002 Lg-sm (2 J/A – retracting issue)	#24 s/n 1004 Lg-sm	#23 s/n 1003 Lg-sm	#26 s/n 1006 Lg-sm	#29 s/n 1009 Lg-sm	#25 s/n 1005 Lg-sm	#27 s/n 1007 Lg-sm
ULF6 Stage	INSIDE: Tether staging area	INSIDE: C/L deployed in STP	INSIDE: C/L deployed in STP	INSIDE: C/L deployed in STP	INSIDE: C/L deployed in STP	INSIDE: Tether staging area		
ULF7 EVA 1	INSIDE: Tether staging area	**Used in STP w/#24**	**Used in STP w/#22**	**Used in STP w/#26**	**Used in STP w/#23**	**Spare in Staging Bag**	**STS-135/ULF7 Middeck**	**STS-135/ULF7 Middeck**
ULF7 Stage	**RETURNED: STS-135/ULF7 Middeck**	**RETURNED: STS-135/ULF7 Middeck**	INSIDE: Tether staging area	INSIDE: Tether staging area	INSIDE: Tether staging area	INSIDE: Tether staging area	INSIDE: Tether staging area	INSIDE: Tether staging area

APFR MANAGEMENT – STS-135 (ULF7)

APFR DESIGNATOR	APFR 1 s/n 1004 (sticky pitch knob – 8A, 13A.1, 1JA)	APFR 2 s/n 1006 (sticky pitch knob – US 7 & 9, sticky locking collar – 10A)	APFR 3 s/n 1005 (suspected sharp edge on locking collar and possible sticky locking collar – US 7)	APFR 4 s/n 1002 (heat shield removed on ULF5)	APFR 5 s/n 1003 (sticky pitch knob – ULF4; heat shield removed on ULF3)	APFR 6 s/n 1007 (sticky pitch knob – 20A; heat shield removed on 12A.1 stage)	APFR 7 s/n 1008 (possible sticky locking collar – ULF4)	IAPFR 1	IAPFR 2	OTSD	WIF Extender
ULF6 Stage	Z1 WIF 13 [3,QQ,F,12] TS	P1 WIF 3 [6,PP,F,11] TS	**ESP-2 WIF 06 [10,FF,A,3] Ingress Aid**	Stbd CETA Cart WIF 4 [12,GG] [9,PP,F,6]	Port CETA Cart WIF 2 [6,GG] [12,TT,F,6]	COL WIF 3 [6,NN,F,6] Ingress Aid	P6 WIF 12 [3,OO,F,12] Ingress Aid	Z1 WIF 5 [12,PP,F,12]	Z1 WIF 3 [6,PP,F,12]	S0 WIF 7 CL=7	ESP-2 WIF 3 [3,A,1]
ULF7 EVA 1	Z1 WIF 13 [3,QQ,F,12] TS	P1 WIF 3 [6,PP,F,11] TS	**SSRMS [12,NN,F,6] Ingress Aid**	Stbd CETA Cart WIF 4 [12,GG] [9,PP,F,6]	Port CETA Cart WIF 2 [6,GG] [12,TT,F,6]	COL WIF 3 [6,NN,F,6] Ingress Aid	P6 WIF 12 [3,OO,F,12] Ingress Aid	Z1 WIF 5 [12,PP,F,12]	Z1 WIF 3 [6,PP,F,12]	S0 WIF 7 CL=7	ESP-2 WIF 3 [3,A,1]
ULF7 Stage	Z1 WIF 13 [3,QQ,F,12] TS	P1 WIF 3 [6,PP,F,11] TS	**ESP-2 WIF 05 [low profile] Ingress Aid**	Stbd CETA Cart WIF 4 [12,GG] [9,PP,F,6]	Port CETA Cart WIF 2 [6,GG] [12,TT,F,6]	COL WIF 3 [6,NN,F,6] Ingress Aid	P6 WIF 12 [3,OO,F,12] Ingress Aid	Z1 WIF 5 [12,PP,F,12]	Z1 WIF 3 [6,PP,F,12]	S0 WIF 7 CL=7	ESP-2 WIF 3 [3,A,1]

Crane (old ORU tether)	ORU Stanchion/TERA Headless	APFR 2 Tool Stanchion	APFR 1 Tool Stanchion	Tool Stanchion
PMA1 WIF 5	S0 port wedge face	Hex pointed ISS zenith, tool head pointed ISS stbd, and oriented ISS Zenith/Nadir	Tool stanchion port, pointed zenith	S0 port wedge face

CETA CART WIF AND SWINGARM MANAGEMENT TABLE – STS-135/ULF7

WIF Designator	CETA 1 (port) WIF 1 Port-nadir	CETA 1 (port) WIF 2 Stbd-nadir	CETA 1 (port) WIF 3 Stbd-zenith	CETA 1 (port) WIF 4 Port-zenith	CETA 1 (port) WIF 5 Port-middle	CETA 2 (stbd) WIF 1 Port-nadir	CETA 2 (stbd) WIF 2 Stbd-nadir ULF4: Pitch setting stuck in FF	CETA 2 (stbd) WIF 3 Stbd-zenith	CETA 2 (stbd) WIF 4 Port-zenith	CETA 2 (stbd) WIF 5 Port-middle
Post STS 133	**[30,1,LL]**	**[0,6,GG]**	**[1,12,GG]**	**[12,DD]**	**[12,DD]**	**[0,12,GG]**	**[0,12,FF]**	**[1,12,GG]**	**[12,GG]**	**[12,GG]**
Post STS 135	**…**	**…**	**…**	**…**	**…**	**…**	**…**	**…**	**…**	**…**

CETA 1 (port) Port Brake Handles	CETA 1 (port) Stbd Brake Handles	CETA 2 (Stbd) Port Brake Handles	CETA 2 (Stbd) Stbd Brake Handles
Folded over and wire tied to each other Handles FWD and NOT wire tied to cart	Straight and Locked No Wire Ties	Straight and Locked No Wire Ties	Straight and Locked No Wire Ties

NOTE

1. Settings highlighted red are unconfirmed. This table was created during STS-132/ULF4. All WIFs and swingarms not used on ULF4 are assumed unconfirmed
2. PORT CETA cart is NOT configured for translation to WS 8 unless the SARJ is parked for the duration
3. STBD CETA cart is NOT configured for translation to WS 1 unless the SARJ is parked for the duration

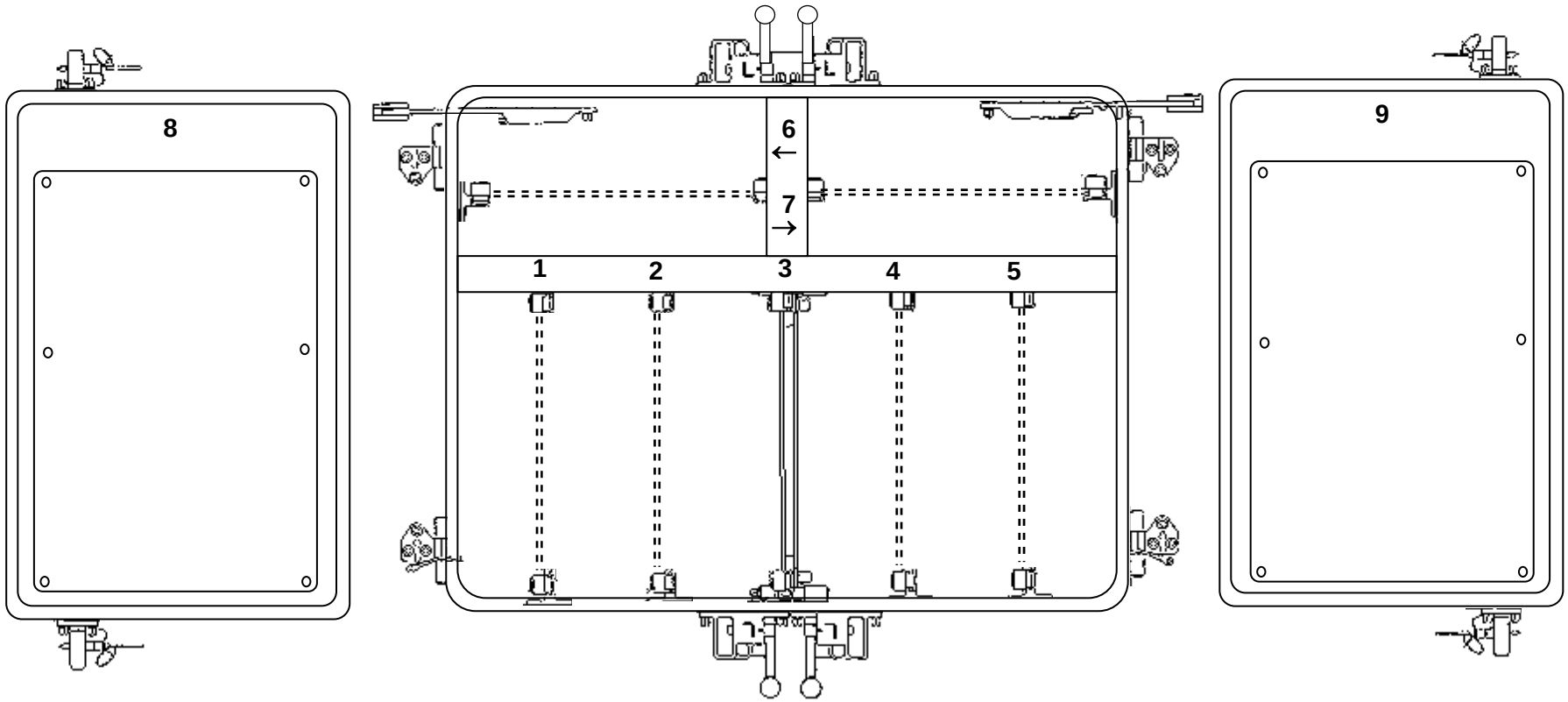
TOOLBOX STOWAGE – STS-135 (ULF7)

	Z1 PORT TOOLBOX (MMOD Damage – potential sharp edges) {all slots have sliders}	**Z1 STBD TOOLBOX (MMOD Damage – potential sharp edges)** {all slots have sliders}	**A/L TOOLBOX 1 (STBD)**	**A/L TOOLBOX 2 (PORT)**
SLOT # 1	SQUARE TM BOARD {stbd door} SQ TORQUE MULTIPLIER 7/16" FLUSH SQ SOCKET 7/16" PROUD SQ SOCKET 7/16" RECESSED SQ SOCKET		HAMMER BOARD {nadir door} HAMMER	CABLE CUTTER BOARD {zenith door} COMPOUND CUTTERS (SM) SCISSORS
SLOT # 2		QD BAIL TOOL BOARD {stbd door} BMRRM LATCH TOOL QD BAIL DRIVE TOOL (1")	PLIERS BOARD {nadir door} NEEDLE NOSE PLIERS	
SLOT # 3	RATCHET BOARD {middle} 7/16" X 12" WOBBLE SOCKET 7/16" X 2" RIGID SOCKET	RATCHET BOARD {middle} 7/16" X 6" WOBBLE SOCKET 7/16" X 12" WOBBLE SOCKET RATCHET WRENCH RIGHT ANGLE DRIVE	{only slot with slider}	{only slot with slider}
SLOT # 4				
SLOT # 5	ROUND TM BOARD {port door} RND TORQUE MULTIPLIER 5/8" PROUD RND SOCKET 7/16" FLUSH RND SOCKET 7/16" PROUD RND SOCKET		ADJ WRENCH BOARD {zenith door} FORCEPS WRENCH, ADJ	T-HANDLE TOOL BOARD {nadir door} 1-8" T-TOOLS
SLOT # 6	TRASH BAG BOARD {stbd door} SMALL TRASH BAG	TRASH BAG BOARD {stbd door}	HYDRAZINE BRUSH BOARD { nadir door} HYDRAZINE BRUSH	
SLOT # 7	SOCKET BOARD {port door} 5/32" BALL END ALLEN DR 1/2" X 8" WOBBLE SOCKET 5/16" X 7" RIGID SOCKET	SOCKET BOARD {port door} 5/32" BALL END ALLEN DR 1/2" X 8" WOBBLE SOCKET 5/16" X 7" RIGID SOCKET	PRD (Toolboard) {zenith door} PRD	PRD (Toolboard) {nadir door} PRD
PANEL # 8	CHEATER BAR PANEL {stbd door} CHEATER BAR GP CADDY CANNON CONNECTOR TOOLS (2)	CHEATER BAR PANEL {stbd door} CHEATER BAR ADJ EQUIP TETHER	TOOL CADDY PANEL {nadir door}	
PANEL # 9	18" SOCKET PANEL {port door} 7/16" X 18" WOBBLE SOCKET	18" SOCKET PANEL {port door} 7/16" X 18" WOBBLE SOCKET	BOLT PULLER PANEL {zenith door} BOLT PULLER MECHANICAL FINGER	LARGE CUTTER PANEL {nadir door} LARGE CUTTERS (-303)
EXTERNAL	1 ROUND SCOOP w/D-HANDLE (on zenith micro) (D-handle taped over repaired MMOD damage) D-HANDLE on port side of toolbox	NOTE D-Handle will not stow on the side of this toolbox due to an interference with the CMG MLI		

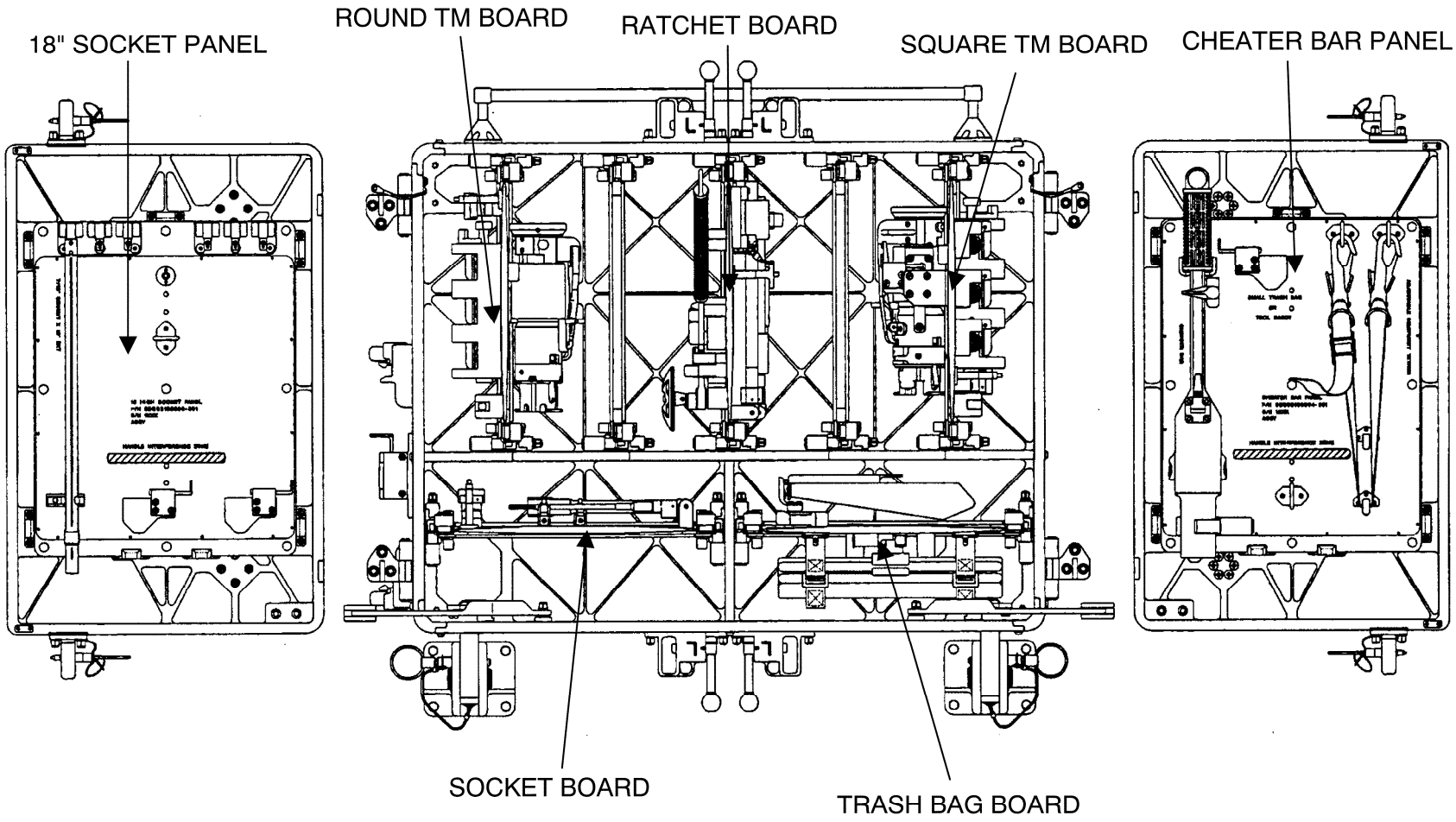
TOOLBOX PANEL AND SLOT LABELS

NOTE

- A/L Toolbox: Slider feature located in center slot only (#3)
- Z1/CETA Toolbox: Slider feature located in all slots

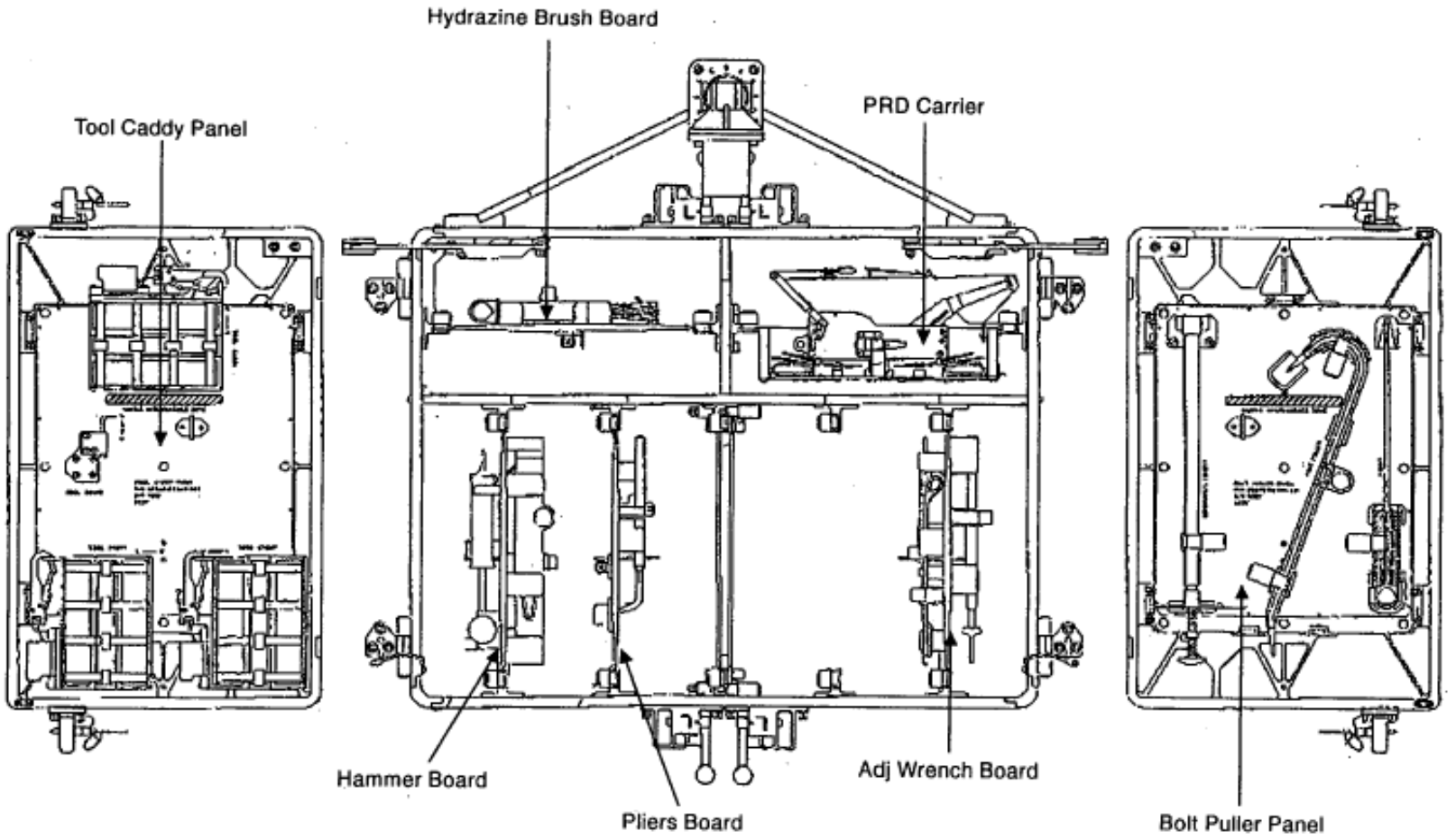


Z1 TOOLBOX INTERNAL LAYOUT



DOORS SHOWN REMOVED AND ROTATED 180° FROM CLOSED POSITION FOR CLARITY.

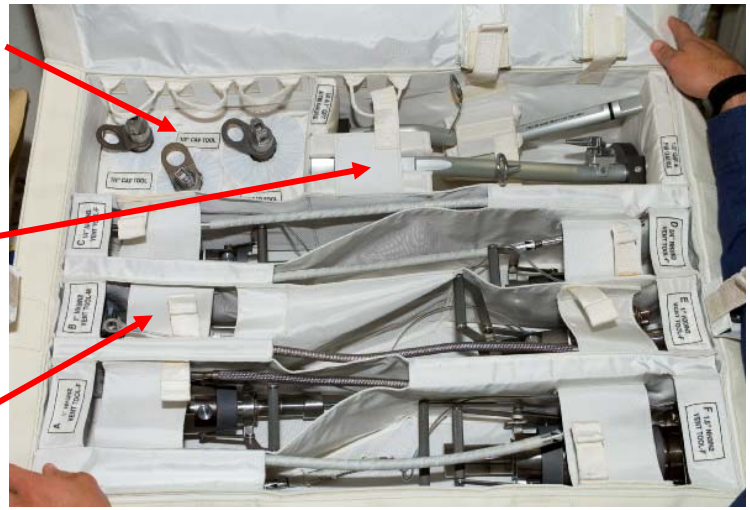
AIRLOCK TOOLBOX INTERNAL LAYOUT

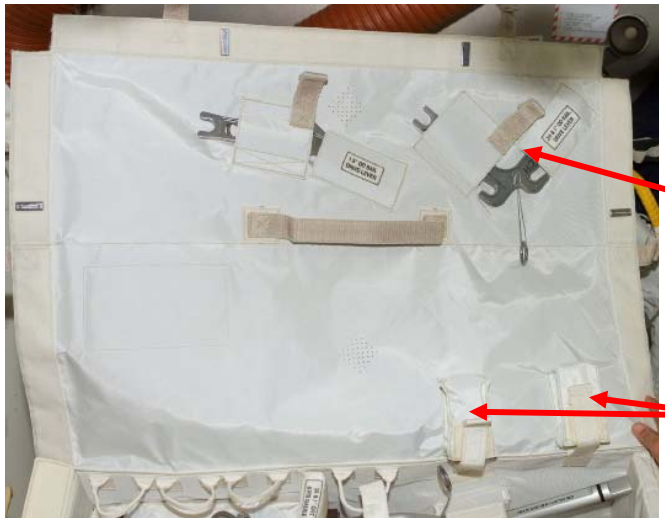


FLUID QD BAG LAYOUT

QD TOOL BAG #1, STBD (SEG33114667-301/1001)			
#	TOOL	PART#/SERIAL #	LOCATION IN BAG
1.	¼" CAP TOOL	GD2043725	¼" Cap Tool Pkt
2.	½" CAP TOOL	GD2043730	½" Cap Tool Pkt
3.	1" CAP TOOL	GD2043325	ISS A/L Internal
4.	¾" & 1' QD BAIL DRIVE LEVER	SDG33113838-703	¾" & 1" QD Bail Drive Lever Pouch on Lid
5.	1.5" QD BAIL DRIVE LEVER	SDG33113837-701	1.5" QD Bail Drive Lever Pouch on Lid
6.	1.5" NH3/N2 VENT TOOL – F	1F9859-1/01	Pkt F: 1.5" NH3/N2
7.	1" H20/N2 VENT TOOL – F	1F98593-1/01	Pkt E: 1" H2O/N2
8.	¾" NH3/N2 VENT TOOL – F	1F98597-1/01	Pkt D: ¾" NH3/N2
9.	1" NH3/N2 VENT TOOL – F	1F98589-1/T	Pkt A: 1" NH3/N2
10.	1" NH3/N2 VENT TOOL – M	1F98596-1/01	Pkt B: 1" NH3/N2 (male tool)
11.	¼" NH3/N2 VENT TOOL – F	1F98592-1/01	Pkt C: ¼" NH3/N2
12.	1.5" QRT & FID GAUGE	SEG33114617-701	Pkt FID/Gauge
13.	¾" & 1" QRT & FID GAUGE	SEG33114616-701	Pkt FID/Gauge

- ❑ Ensure cap tools (3) are friction fitted
- ❑ Close all QRT tool flaps (2)
- ❑ Close all vent tool flaps (6)





- ❑ Close bail drive lever flaps (2)
- ❑ Internal bag straps (2) should be stowed in pouches

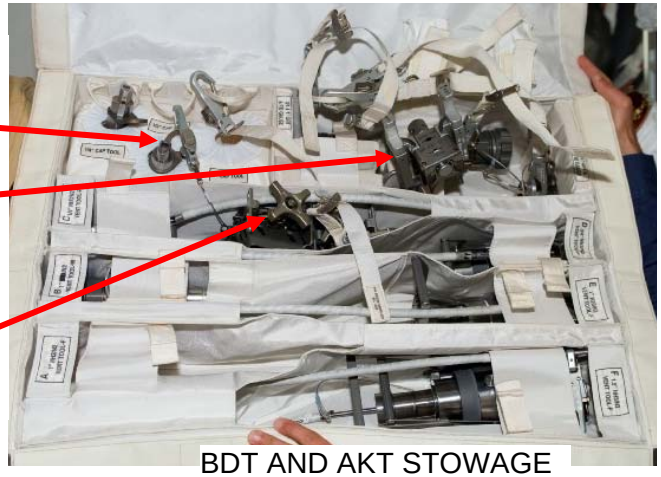
FLUID QD BAG LAYOUT (Cont)

QD TOOL BAG #2, PORT (SEG33114667-301/1002)			
#	**TOOL**	**PART #/SERIAL #**	**LOCATION IN BAG**
1.	¼" Cap Tool	GD2043725	¼" Cap Tool Pkt
2.	½" Cap Tool	GD2043730	½" Cap Tool Pkt
3.	1.5" NH3/N2 Vent Tool – F	1F9859-1/02	Pkt F: 1.5" NH3/N2
4.	1" H20/N2 Vent Tool – F	1F98593-1/02	Pkt E: H2O/N2
5.	¾" NH3/N2 Vent Tool – F	1F98597-1/02	Pkt D: ¾" NH3/N2
6.	¼" NH3/N2 Vent Tool – F	1F98592-1/02	Pkt C: ¼" NH3/N2
7.	¼" BDT	SEG33114984-301/001	Pkt C: ¼" NH3/N2 w/adj tether
8.	¾" BDT	SEG33114986-301/001	Pkt C: ¼" NH3/N2 w/adj tether
9.	¾" AKT	SEG33114983-301/1001	Pkt FID/Gauge: Stowed w/Adj tether to int loop
10.	Vent Tool Adapter	SEG33119079-301	Pkt FID/Gauge: Stowed w/Adj tether to int loop

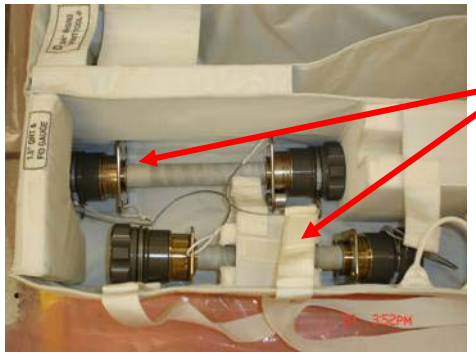
¾" BDT is tethered to internal bag loop using integral tool tether

¾" AKT stowed with VTAs in QRT/FID pouch

¼" and ¾" BDTs are stowed on top of ¼" vent tool



BDT AND AKT STOWAGE



VENT TOOL ADAPTER STOWAGE

Vent Tool Adapters (2) are stowed in QRT/FID gauge pockets and need adj tethers

Only 1 currently in QD bag

FLUID QD BAG LAYOUT (Cont)

VENT TOOL EXTENSION BAG (SEG33119100-301/1001)			
	TOOL	**PART#**	**LOCATION POST ULF5**
1.	Vent Tool Extension	SEG33119090-301	VTEB with VTE plug
2.	MUT EE		VTEB Connected to VTE L-bracket
3.	Vent Tool Adapter	SEG33119079-301	VTEB
4.	1" NH3/N2 Vent Tool – F	1F98589-1	VTEB
5.	Vent Tool Extension Plug		VTEB Mated to VTE – french hook to VTE


S116E06137

PUMP MODULE JUMPER BAG (SEG33119100-301)			
#	**TOOL**	**PART #**	**LOCATION IN BAG**
1.	PUMP MODULE JUMPER ASSY	1F15818	❑ TETHERED BY 1 INTEGRAL TETHER TO HR ON JUMPER

CREW TETHER INSPECTIONS

OBJECTIVE:

Inspect Load Alleviating Strap (LAS) on Safety Tethers, Waist Tethers and soft strap on D-Ring extenders. Prior to each set of EVAs (shuttle or ISS), all on-board tethers are to be inspected. Between each EVA, only those tethers used during the previous EVA require inspection.

DURATION:

1 hour 30 minutes (Parts 1 and 2 on six waist tethers, six D-Ring extenders, and eight safety tethers)

Additional 30 minutes required to perform Part 3 on two tethers.

NOTE
Standard tool config prep times only protect for performing Part 1 between EVAs on tethers used during the previous EVA.

ITEMS REQUIRED (PART 2 OR 3):

MATERIALS:

Sharpie

Ziplock Bag

TOOLS:

Camera

IS IVA Toolbox:

Drawer 5:

Tape Measure

Tape Pantry

EVA Tape (1" Permacel Glass Cloth Tape) P/N P-213

PART 1: PRIOR TO EACH EVA

1. Prior to EVA use, soft goods on each safety tether (LAS), waist tether (LAS) and D-Ring extender (strap) for that EVA must be inspected.

   1.1 MMOD Inspection

   Inspect the soft goods (LAS) of the Waist Tether and ERCM/Safety Tether and soft strap of the D-Ring extender for MMOD damage and discoloration, manipulating the sheath as needed to inspect between folds. The damage may appear as small or large holes in the LAS or as a tear/rip in the sheath. The MMOD damage may also appear in small concentrated areas of excessive fraying (as would be expected to be found in the vicinity of a hole). Soft goods should be white to yellow or tan in appearance. Soft goods showing a burnt brown or black discoloration should not be used.
   Refer to Figures 1, 2, 3.

1.2 D-Ring Extender

Inspect the soft strap of the D-Ring extender for MMOD damage, excessive wear and fraying.
Refer to Figures 1, 2, 3.

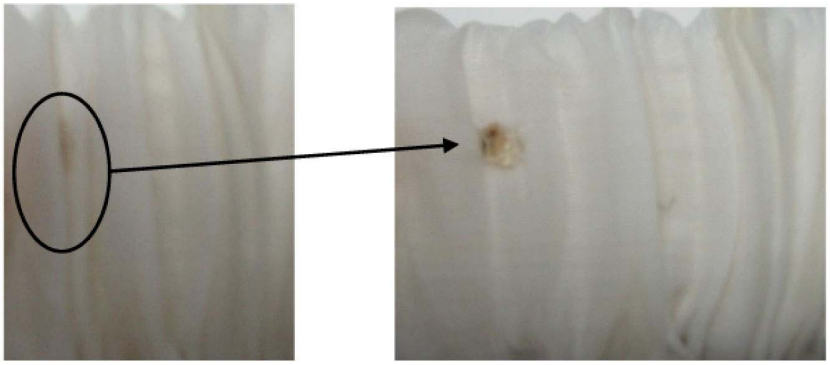


Figure 1. Damage Masked by Folds in LAS Sheath Exposed When Unbunched. (Note: Photo of ground-created damage.)

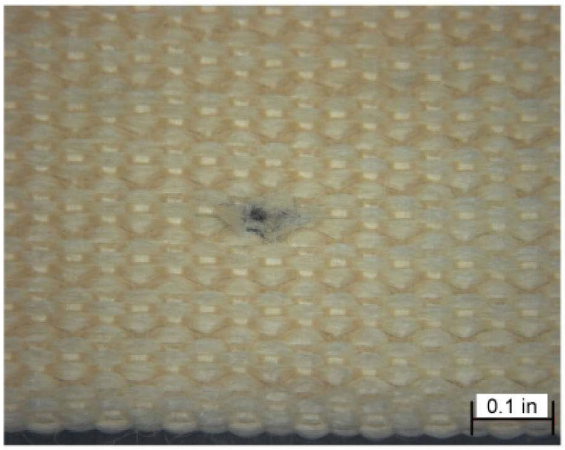


Figure 2. Picture Showing MMOD Damage Found in Flight AET.

Figure 3. Frayed D-Ring Extender; No-GO for Use.

1.3 LAS Base Inspection

Inspect base of LAS where strap attaches to ERCM D-Ring for any damage.
Refer to Figure 4.

1.3.1 Smudging is acceptable.

1.3.2 If safety tether anchor hook is taped, inspect tape for wear or damage.

Figure 4. LAS Attachment to ERCM D-Ring.

1.4 Tack Stitching Inspection

Verify two surface and two through tack stitches still present on each LAS (waist tether and safety tether).

1.4.1 Verify through stitches still intact by gently moving sheath away from hook to expose threads through Nomex.
Refer to Figures 5 and 6.
Once verified, gently replace sheath over red indicator.

1.4.2 Visually verify surface stitches on nonseam side of tether

1.5 Red Indicator Inspection

If red showing and all tack stitches present

1.5.1 Gently pull the sheath back to cover red indicator. Due to tolerances, some red may still show (tether is GO as long as tack stitching still present.)

1.5.2 Note width of any remaining red showing.

1.5.3 Report S/N of any tethers with red still showing to **MCC-H**.

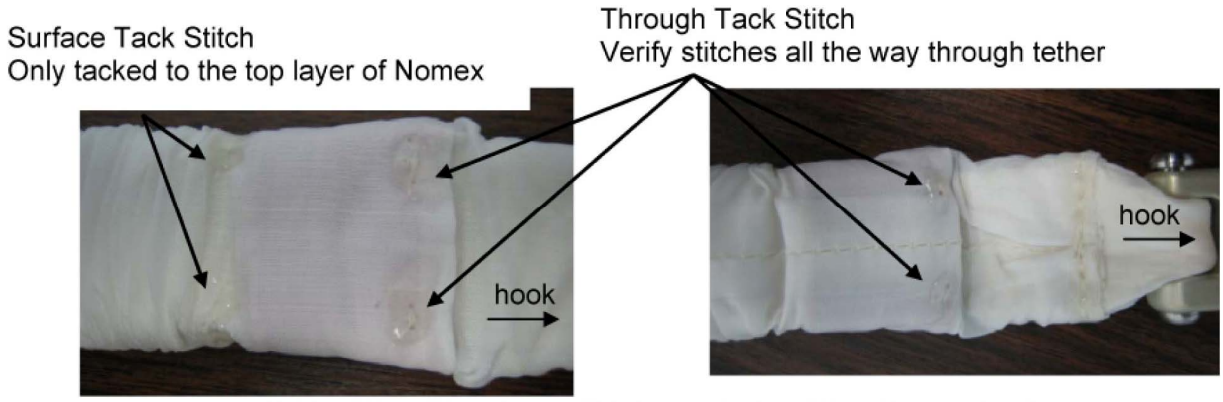


Figure 5. Top View (Non-Seam Side) and Bottom View (Seam Side).

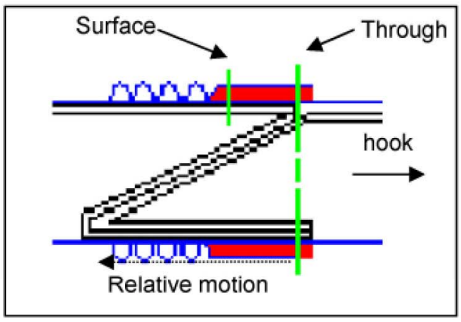


Figure 6. Cross-Section of Tack Stitching.

2. Report serial numbers to **MCC-H** with inspection results.

3. For any tethers with MMOD/other damage, fraying or missing tack stitching, proceed to Part 2.

4. Restow remaining tethers.

PART 2: MMOD DAMAGE/MISSING TACK STITCHING EVALUATION

5. Retrieve Camera and Ziplock Bag(s).

6. If MMOD damage is found on LAS

   6.1 Smooth out the sheath at the damage location and take detailed photos of damage (with serial number in photo if possible).
   Refer to Figures 7 and 8.
   Note if any damage to the underlying Nomex strap is visible.

   6.2 Remove tether from usable inventory.
   Place tether in Ziplock Bag labeled, "No-GO for use".
   Report location and S/N to **MCC-H**.

   6.3 Report results to **MCC-H**.

Figure 7. Photo of Partial Red Indicator Showing with Serial Number.

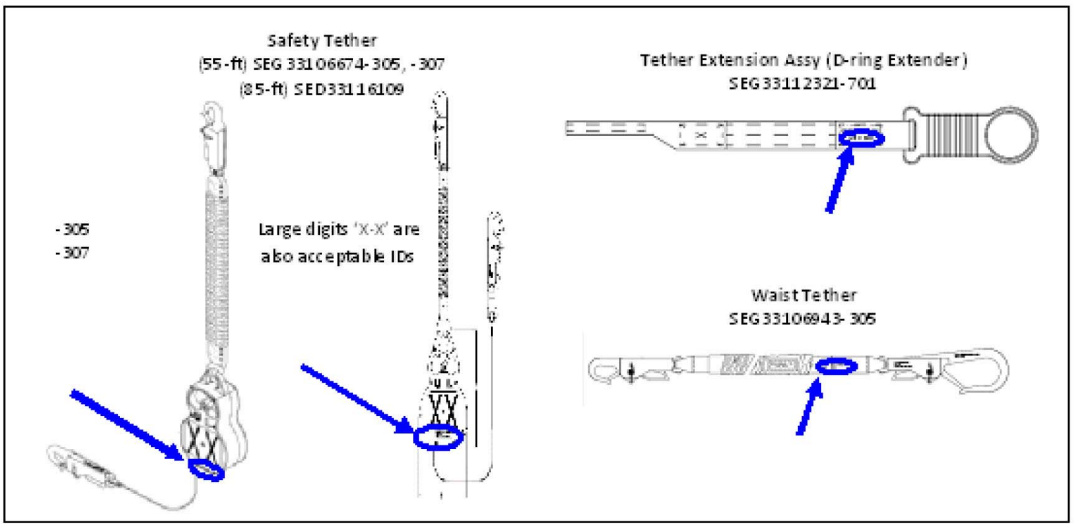


Figure 8. Serial Number References.

7. If tack stitches are broken

   7.1 Take detailed photos of tack stitches (with serial number in photo) for further engineering evaluation.
   Refer to Figure 7.

   7.2 Stow tethers per Table 1.

Table 1. Tether GO/No-GO Criteria

Broken Stitch	Action
One or both surface stitches broken	Gently smooth sheath away from hook so only a single layer covers the red indicator area. Return tether to usable inventory.
One through stitch broken, one through stitch intact and zero to two surface tack stitches intact	Return tether to usable inventory.
Two through stitches broken	Remove tether from usable inventory. Place tether in Ziplock Bag labeled "No-GO for use." Report location to **MCC-H**.

   7.3 Report results to **MCC-H**.

8. If fraying or MMOD damage is found on D-Ring extender

   8.1 Take detailed photos of damage showing S/N of extender (if possible).
   Refer to Figure 9.

   8.2 Remove tether from usable inventory.
   Place tether in Ziplock Bag labeled "No-GO for use."
   Report location and S/N to **MCC-H**.

~

8.3 Report results to **MCC-H**.

Figure 9. D-Ring Extender Showing Serial Number.

9. If damage found on LAS base

   9.1 Take detailed photos of damage with at least one photo showing tether number.

   9.2 Swap tether for spare.

   9.3 Remove tether from usable inventory.
   Place tether in Ziplock Bag labeled "No-GO for use."
   Report location and S/N to **MCC-H**.

   9.4 If tape damaged/worn on anchor hook, take detailed photos.
   Replace tape as necessary using EVA tape.

   9.5 Report results to **MCC-H**.

PART 3: MEASURE LAS LENGTH (ON MCC-H GO)

10. Retrieve quarantined tethers, tape measure, Sharpie, and Camera.

11. Mark the desired length on a stable surface.
    Refer to Figures 10 and 11 for required lengths.

12. Measure quarantined tether against markings.
    Photograph results.

13. Report findings to **MCC-H**.

14. Stow tethers per **MCC-H** direction.

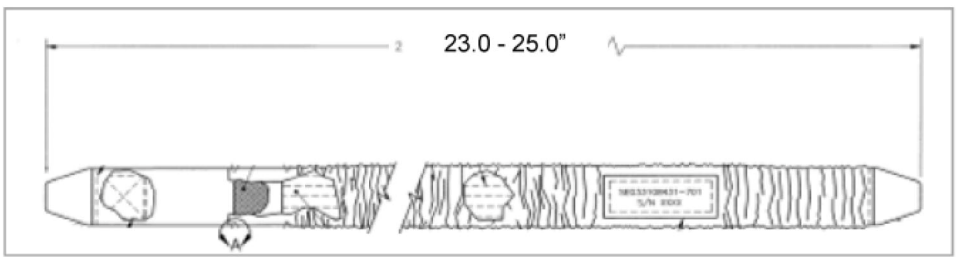


Figure 10. Waist Tether.

CREW TETHER INSPECTIONS (Cont)

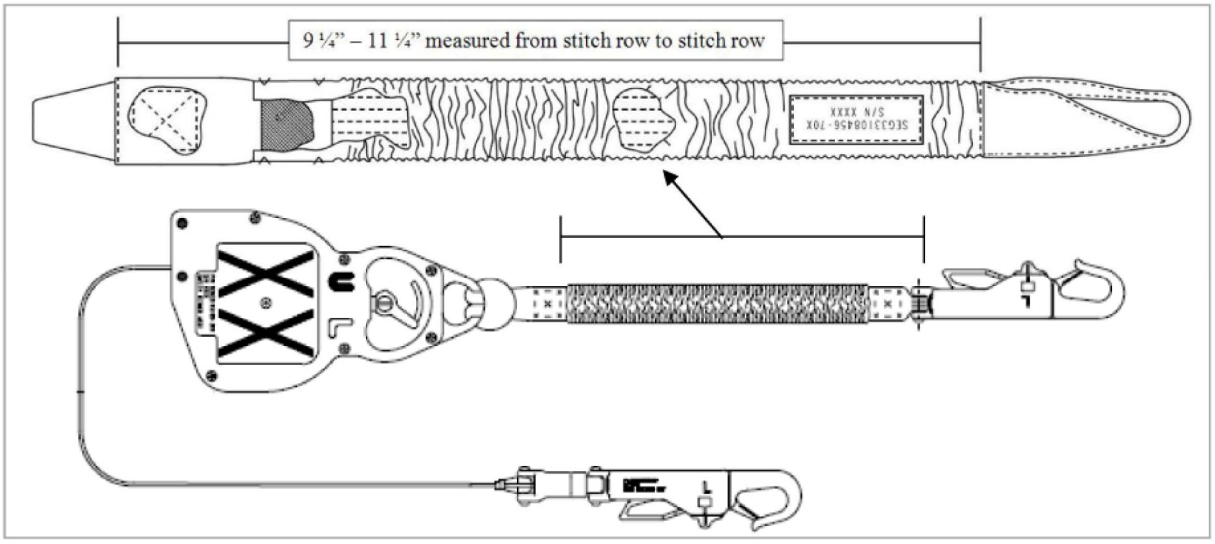


Figure 11. Safety Tether.

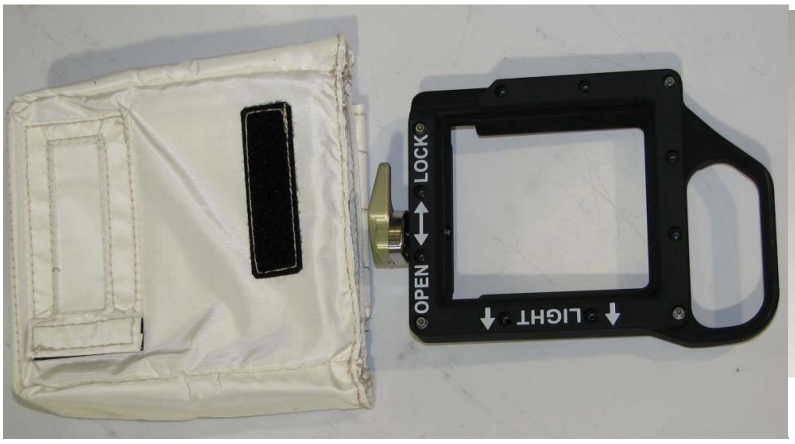
Table 2. Inspection Results

Tether Type	Tether S/N	Damage Description	Tether Location

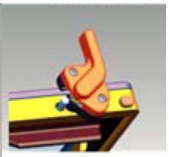
CLPA IVA UNPACKING

CAUTION
Extreme care should be exercised to avoid touching the white thermal paint on the camera, as it is easily removed. Scuffing the paint may reduce the CLPA life due to overheating, or it may reduce the allowed operational timelines to prevent overheating
The electrical grounding tabs and the connectors at the base of the unit should not be touched
The unit has an awkward center of mass, making it uncomfortable to handle. When possible, it is recommended to hold the unit from the tether point and micro fixture

1. Retrieve CLPA Protective Case
2. Release belts, pull-tabs, and beta cloth cover (in order); fold beta cloth cover on itself
3. Open two shells to expose mounted CLPA on base plate and ORU interface (fig 1)
4. Using a ratchet wrench w/7/16-in socket, drive EVA bolt ccw, ~22-23 turns
   NOTE: Running torque should not exceed 75 in-lb (fig 2)
5. Verify EVA bolt driven out to hard stop
6. CLPA should slide freely from the base plate. It may be necessary to loosen four nuts on top of alignment guides (fig 3)
7. Visually verify blindmate connector cover removed
8. Retrieve MSS camera cover (P/N 51612-4968-551) (1.0 CTB 1078)
9. Rotate locking lever to open/unlocked position (lever perpendicular to plane of lens)
10. Install MSS camera cover onto CLPA by inserting spring loaded flange to depress spring
11. Rotate cover to seat against camera bracket for full installation
12. Rotate locking lever to closed/locked position (lever parallel to plane of lens)
13. Perform pull test
14. Install Sq scoop and place CLPA in ORU bag per tool config
15. Close shells on base. Secure Velcro straps, belts, and beta cloth cover
16. Stow CLPA Protective Case and MSS camera cover case (in mesh bag for use post EVA 1)



MSS Camera Cover
(Shown in Unlocked Position)



Latch Pin

CLPA IVA UNPACKING (Cont)

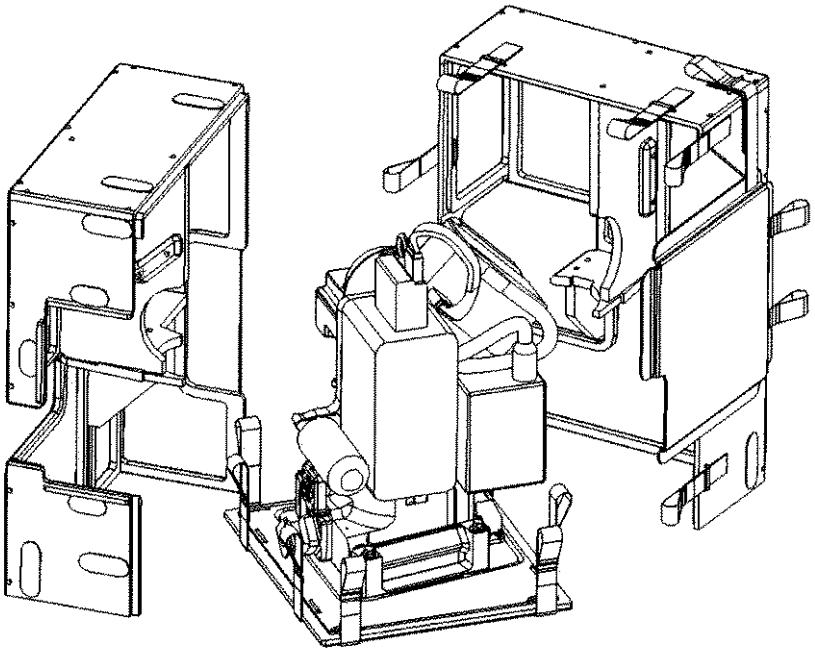


Figure 1

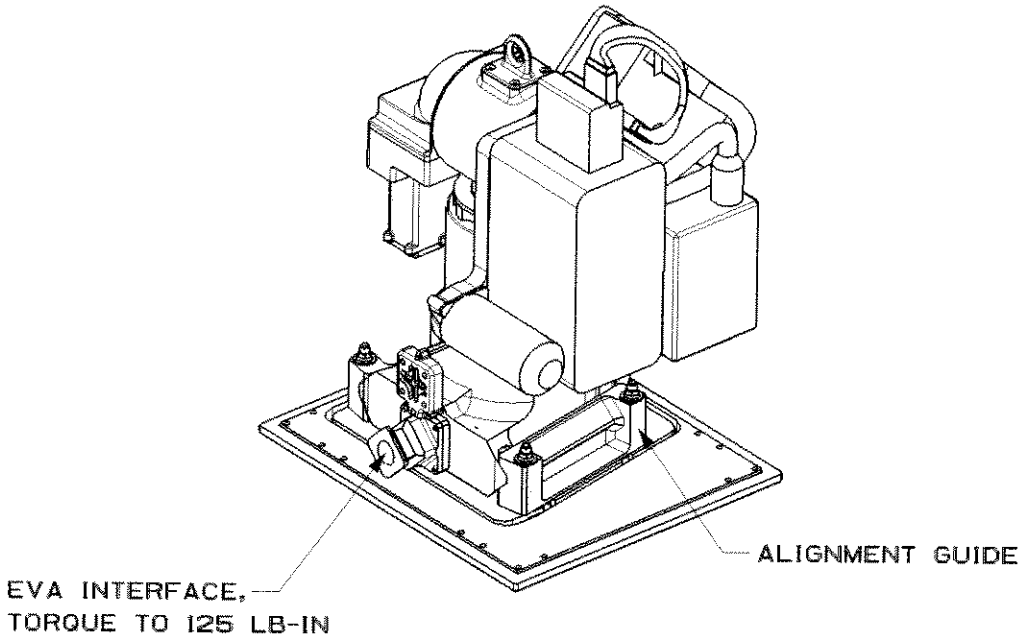


Figure 2

CLPA IVA UNPACKING (Cont)

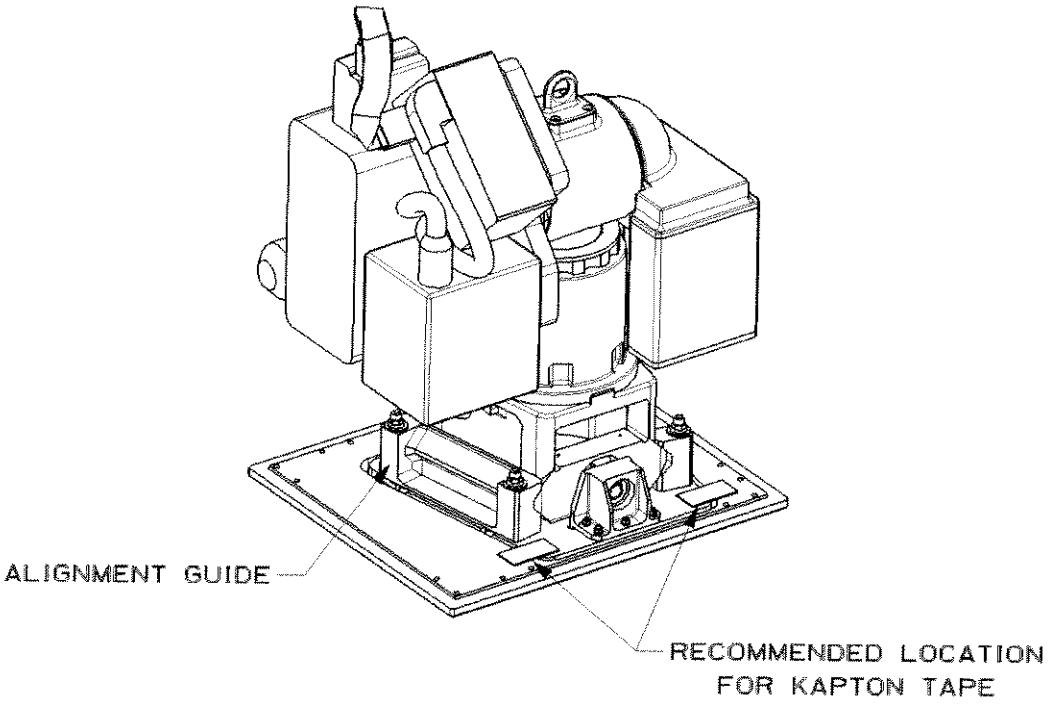


Figure 3

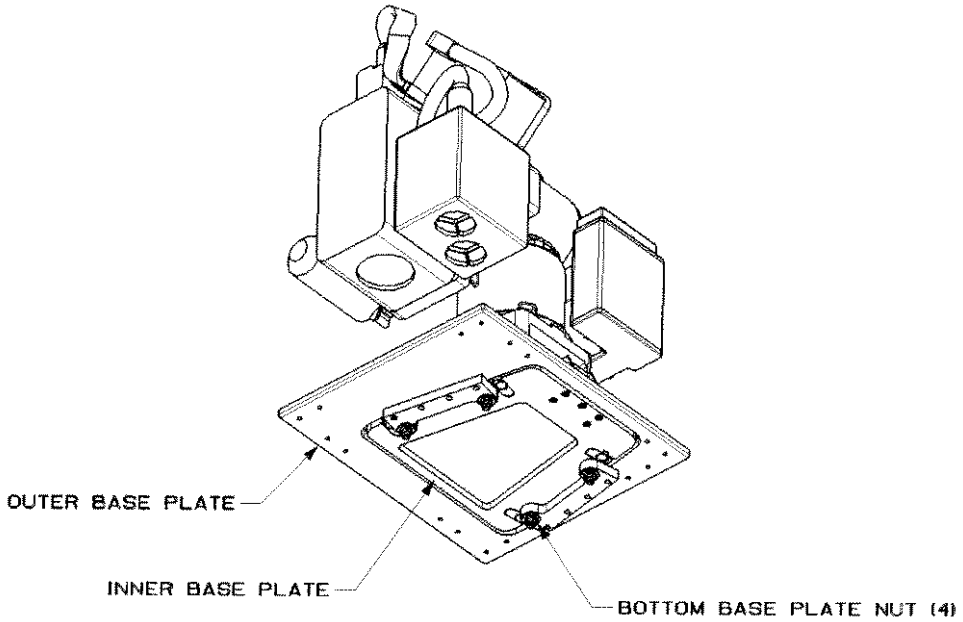


Figure 4

CLPA CONFIGURE AND PACK FOR STOWAGE

OBJECTIVE:
Rotate the CLPA Camera Joints (Yaw and Pitch) into position then pack in protective gear for stowage and return.

LOCATION:
US Lab

DURATION:
If no Star Block (18.1 thru 18.11) required
30 mins / 1 crew

If Star Block (18.1 thru 18.11) required
1hr 15 min / 1 crew

PARTS:
CLPA Camera
MSS Camera Cover
MSS Camera Cover Bag
3.0 CTB S/N 1088, B/C 006745J, Label: CAMERA LIGHT AND PAN/A ASSEMBLY
1.0 CTB S/N 1078, B/C 004072J

MATERIALS:
MWA Utility Kit
Seat Track Restraints (2)
ORU Clamps (2)

TOOLS REQUIRED:
Drawer 2:
Ratchet, 3/8” Drive;
7/16" Deep Socket, 3/8" Drive
(40-200 in-lbs) Trq Wrench, 3/8" Drive
7/16" EVA Socket, 3/8" Drive

REFERENCED PROCEDURE(S):
A.2.6 MAINTENANCE WORK AREA (MWA) INSTALLATION

CAUTION
KEEP OUT ZONES - Do not touch the area of the Camera Lens, Light Lens, Cables, grounding tabs and connectors. Touching them may contaminate a ground analysis of space environment degradation or may damage connector for future use.

SECURE CAMERA TO SEAT TRACK

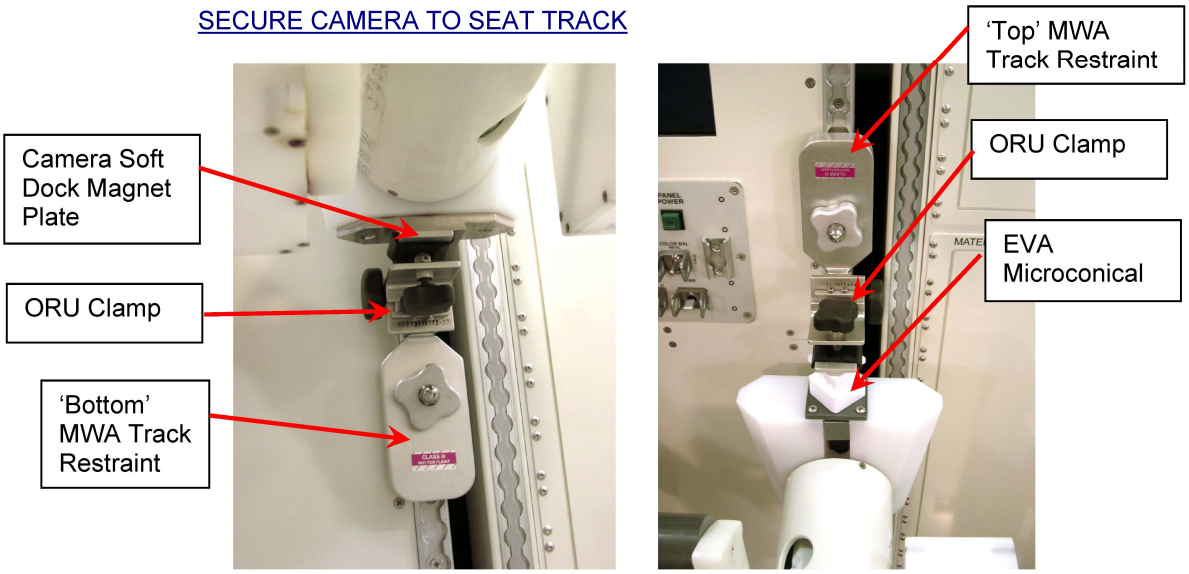


Figure 1: MWA Track Restraints with ORU Clamps

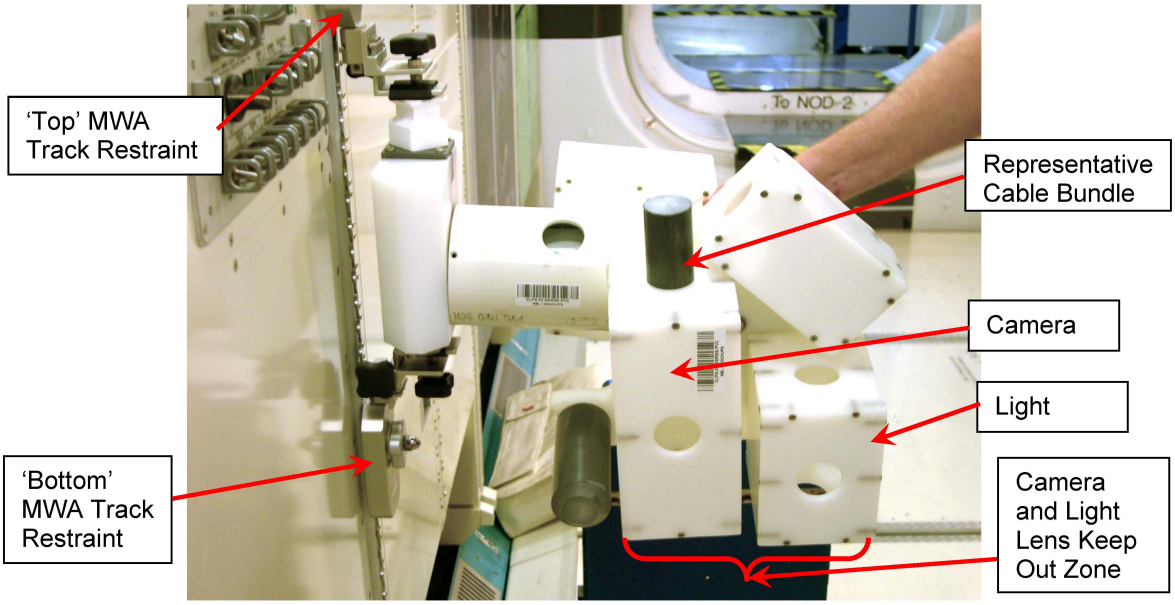


Figure 2: Initial Position of Camera: Installed on Rack Seat Track using MWA Track Restraints with ORU Clamps

1. Remove Sq scoop and stow in EVA done mesh bag
2. Install 'bottom' MWA Track Restraint with ORU Clamp onto Rack seat track (reference A.2.6 MAINTENANCE WORK AREA (MWA) INSTALLATION) as shown in Figures 1 and 2.

3. On Camera Base, turn EVA Microconical Tie Down Bolt counter clockwise (loosen) to hardstop to ensure bolt is fully retracted [Ratchet, 3/8” Drive; 7/16" EVA Socket, 3/8" Drive].

4. Place Camera Soft Dock Magnet Plate onto ‘bottom’ MWA Track Restraint with ORU Clamp and secure Camera using ‘top’ MWA Track Restraint with ORU Clamp as shown in Figures 1 and 2.

ROTATE CAMERA INTO STOWAGE CONFIGURATION

NOTE
Torque required to overcome motor gearing and begin rotational motion is estimated to be 20 to 30 foot pounds. Once rotation begins, it is estimated to take 5 to 10 foot pounds to continue rotational motion.

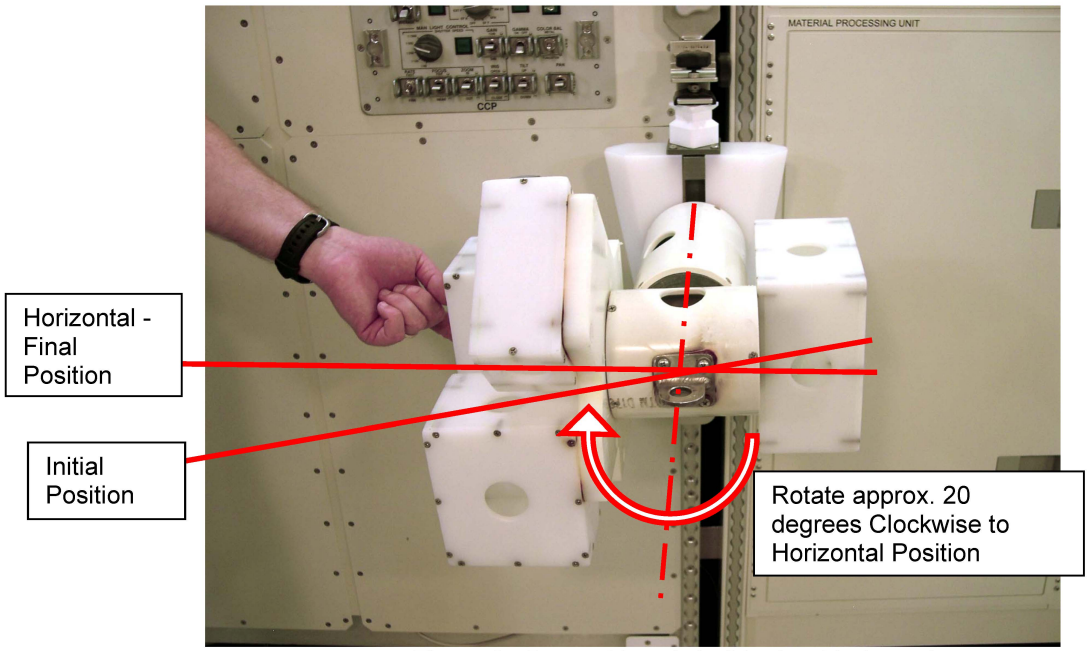


Figure 3: Rotate Mast Axis (Yaw) to Horizontal

5. Rotate the camera and light around Mast Axis (Camera Yaw) approximately 20 degrees until aligned horizontally as shown in Figure 3.

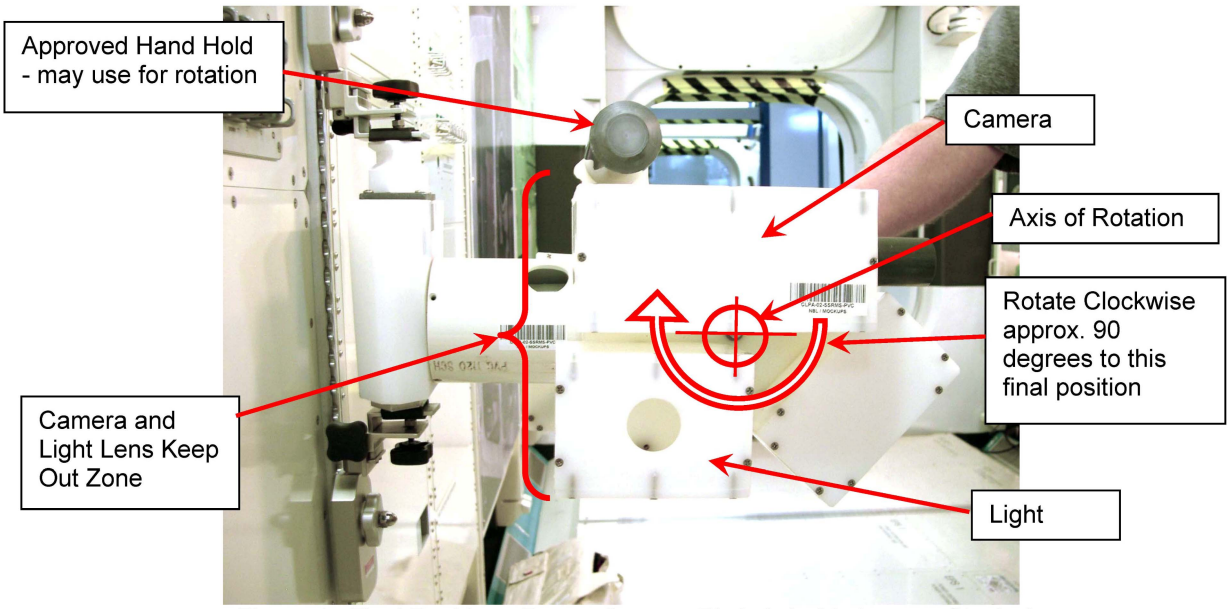


Figure 4: Final Position - Rotate Camera Pitch Axis 90 degrees Clockwise

6. Rotate the camera and light around the Camera Axis (Camera Pitch) approximately 90 degrees until aligned as shown in Figure 4.

STOW CAMERA

7. Remove Camera from the MWA Track Restraints with ORU Clamps and temp stow.

8. Install 1/2" Thick Baseplate with Delrin Blocks inbetween the MWA Track Restraints with ORU Clamps. Move MWA Track Restraints on Seat Track as required.

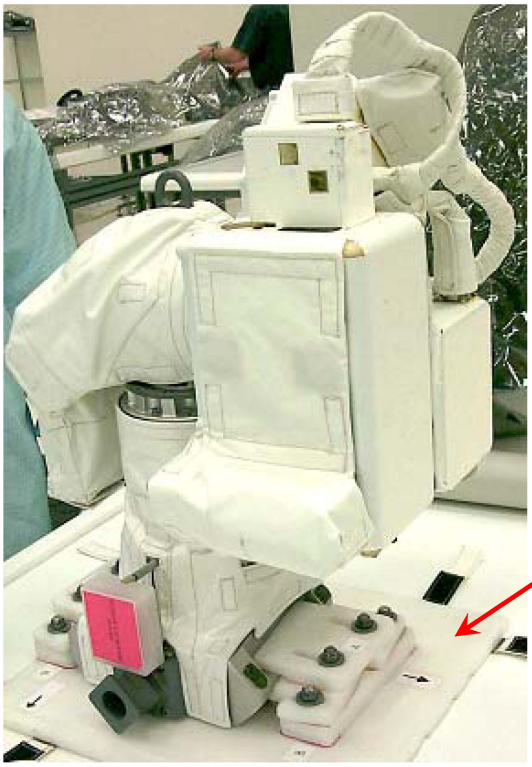


Figure 5: Camera Installation onto 1/2” Thick Baseplate

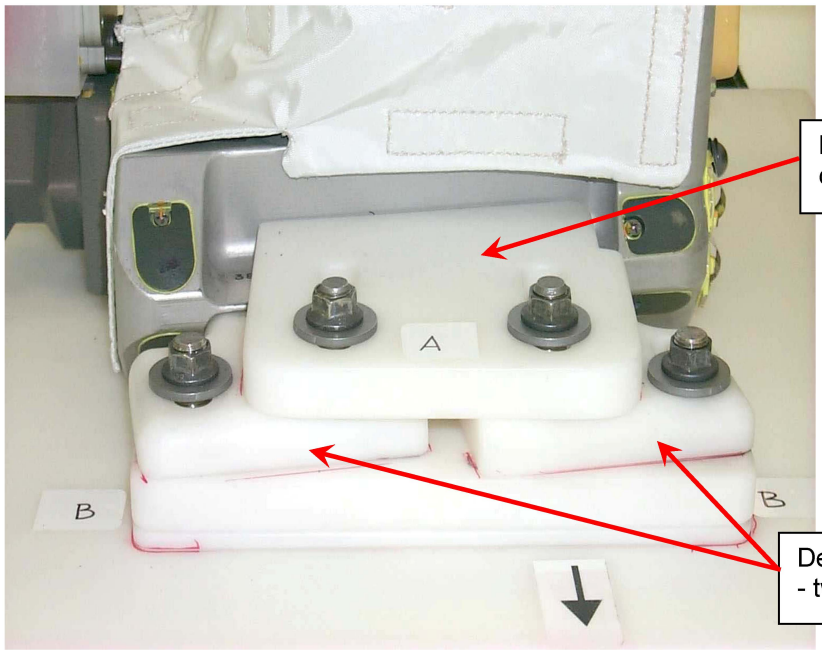


Figure 6: Detail: 1/2” Thick Baseplate and Delrin Blocks “A” and “B” interface

CLPA CONFIGURE AND PACK FOR STOWAGE (Cont)

9. Loosen but do not remove base plate nuts (four) on each Delrin Block “A” [Ratchet, 3/8” Drive; 7/16" Deep Socket, 3/8" Drive]. Reference Figures 5 and 6.

10. Slide each block “A” outward.

11. Align and install Camera on the 1/2” Thick Baseplate and slide each Delrin Block “A” against the Camera guides. Tighten base plate nuts (four) on each Delrin Block “A” [Ratchet, 3/8” Drive; 7/16" Deep Socket, 3/8" Drive].

12. Torque base plate nuts (four) on each Delrin Block “A” to 50 in-lbs. [(40-200 in-lbs) Trq Wrench, 3/8" Drive; 7/16" Deep Socket, 3/8" Drive].

13. Rotate locking lever of CLPA MSS camera cover to the open/unlocked position (lever perpendicular to plane of lens)

14. Remove MSS camera cover from CLPA by depressing spring and rotating cover

15. Rotate locking lever to the closed/locked position (lever parallel to plane of lens)

16. Stow MSS camera cover into camera cover bag

17. Stow cover and bag into 1.0 CTB 1078

CLPA CONFIGURE AND PACK FOR STOWAGE (Cont)

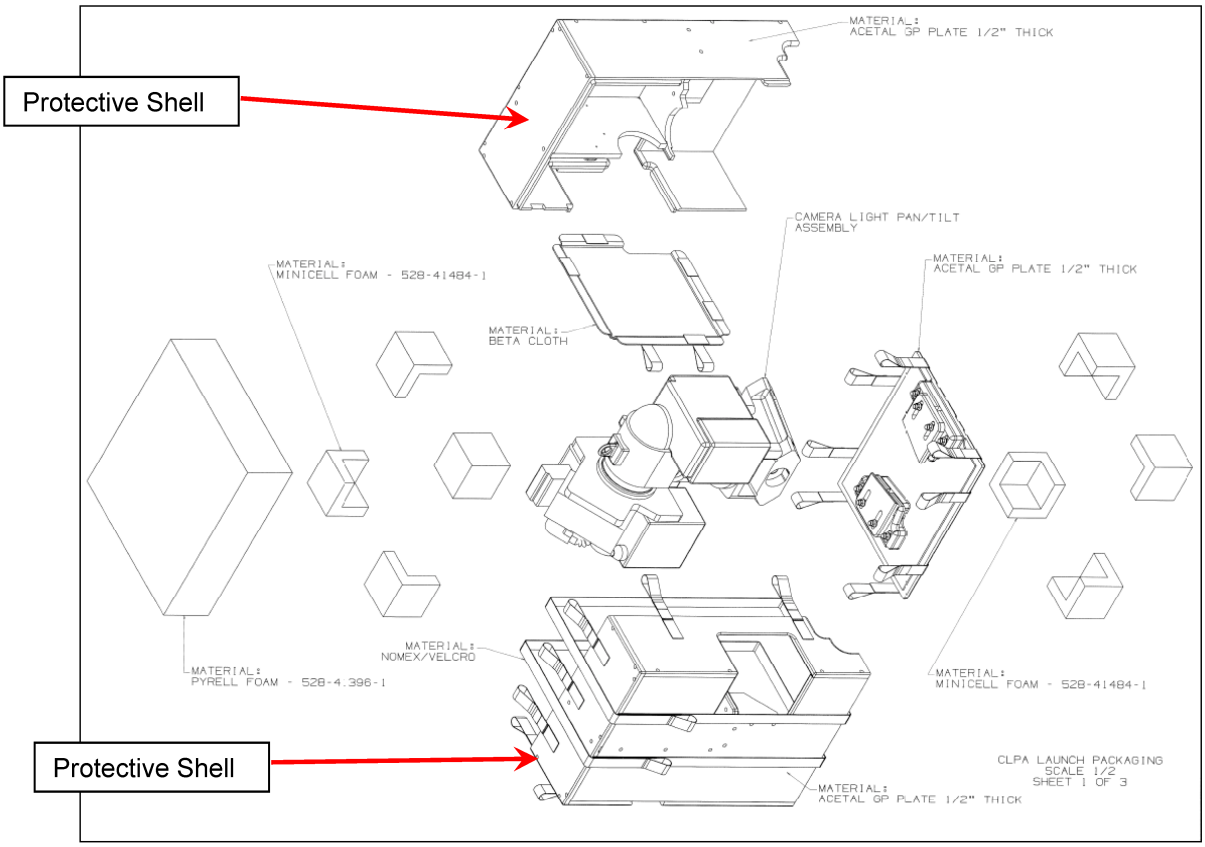


Figure 7: Camera Packaging Exploded View

18. Assemble the two Protective Shells around the Camera, reference Figure 7. Ensure interlocking side feature and interlocking feature to baseplate is engaged and closed completely.

****

If Protective Shell interlocking side feature or interlocking baseplate feature does not engage correctly, adjust Camera on Baseplate as follows:

18.1 Remove Protective Shells

18.2 Loosen but do not remove base plate nuts (eight) on each Delrin Block “A” and each Delrin Block “B” [Ratchet, 3/8” Drive; 7/16" Deep Socket, 3/8" Drive]. Reference Figures 5 and 6

18.3 Slide all six Delrin Blocks outboard.

18.4 Center Camera within the loosened Delrin Blocks, slide all six Delrin Blocks against the Camera guide, then by hand tighten lightly base plate nuts (eight) on each Delrin Block “A” and each Delrin Block “B”.

NOTE
Since Camera is not tight, it should self-center as the closed shells locate the camera to the correct position within its internal clamps. Adjust sliding blocks (A and B) on the base plate as required to allow camera to center between the Protective Shells.

18.5 Assemble the two Protective Shells around the Camera such that they are centered on the base plate, reference Figure 7. Ensure interlocking side feature and interlocking feature to baseplate is engaged and closed completely.

18.6 Remove Protective Shells without moving Camera on the base plate.

18.7 Without moving the Camera, slide one of the Delrin Block ‘A’ away from the Camera. Ensure one corner for each of the Delrin Blocks “B” (two) is now pressed against the Camera base and adjust as required. Torque baseplate nuts (two) on Delrin Block “B” to 50 in-lbs. [(40-200 in-lbs) Trq Wrench, 3/8" Drive; 7/16" Deep Socket, 3/8" Drive].

18.8 Repeat adjustment and torquing for the opposite side of Delrin Blocks “B”.

18.9 Verify that the Camera can move out of plane with the base plate and that it realigns to base plate such that only one position is possible. Repeat Delrin Block B adjustment as required to obtain this alignment. After final positioning, install Camera onto baseplate.

CLPA CONFIGURE AND PACK FOR STOWAGE (Cont)

18.10 Slide Delrin Block “A” into position over Camera guide and torque base plate nuts (four) on each Delrin Block “A” to 50 in-lbs. [(40-200 in-lbs) Trq Wrench, 3/8" Drive; 7/16" Deep Socket, 3/8" Drive].

18.11 Assemble the two Protective Shells around the Camera, reference Figure 7. Ensure interlocking side feature and interlocking feature to baseplate is engaged and closed completely.

****

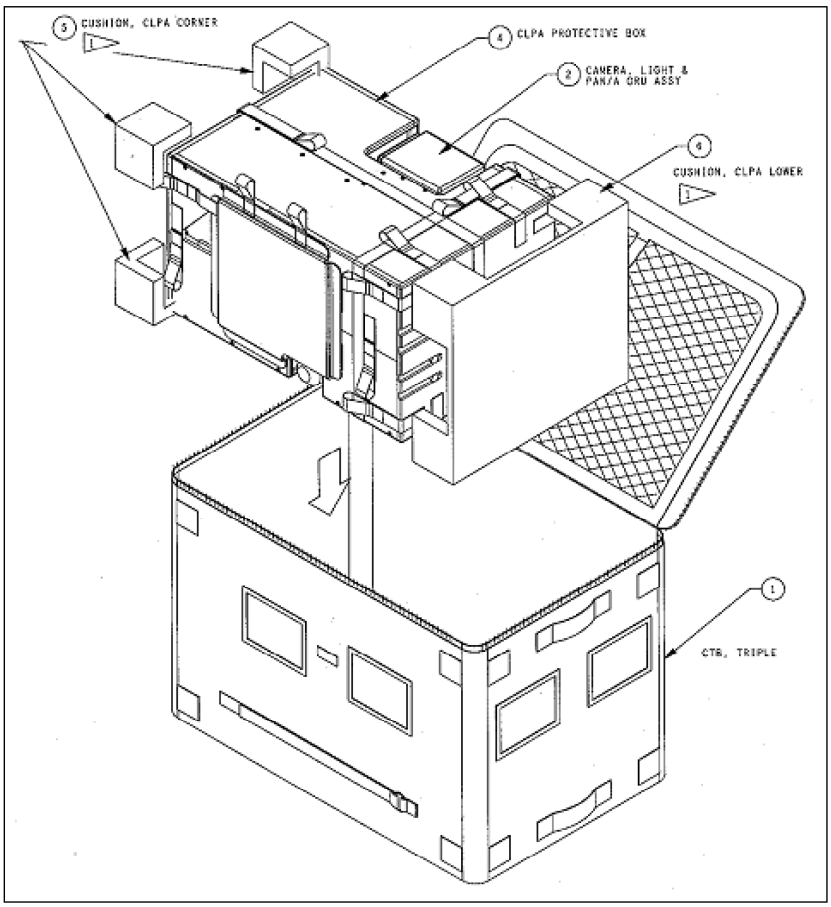


Figure 8: Final Packaging in 3.0 CTB

19. Secure Protective Shell Velcro ensuring case is closed. Install Beta cloth blanket cover on side cut out. Secure base plate Velcro. Reference Figure 8.

20. Install Shorter Velcro belt tightly around Protective Shells and over baseplate Velcros.

21. Install Longer Velcro belt by passing it under the baseplate.

CLPA CONFIGURE AND PACK FOR STOWAGE (Cont)

22. Install Foam Pads as shown in Figures 7 and 8.

23. Photo document Camera package.

24. Transfer camera package to Shuttle for return.

POST MAINTENANCE

25. Update IMS with stowage location of stowed Camera

26. Inform MCC-H of task completion

27. Stow tools, materials, equipment --

MISSE 8 ORMATE III R/W PREP FOR EVA

1. Retrieve MISSE 8 ORMATE III R/W
2. Remove MISSE 8 ORMATE III R/W from bag
3. Verify Velcro strap holding cover is secure
4. Configure MISSE 8 ORMATE III R/W per EVA Tool Config
5. Fold bag opening over and tape closed to prevent FOD from contaminating bag. (Type of tape does not matter)
6. Stow bag in Equipment Lock for use post EVA

MISSE 8 ORMATE III R/W POST EVA COVER STOWAGE

1. Retrieve MISSE 8 ORMATE III R/W cover from Crew Lock
2. Stow cover in protective bag (stowed in Equipment Lock for EVA)
3. Fold bag opening over and tape closed to prevent FOD from contaminating bag. (Type of tape does not matter)
4. Stow bag in mesh bag labeled “Done Tools”

WATER RECHARGE ..... TEMP FS 10-2
EMU POWERUP ..... TEMP FS 10-2
WATER FILL ..... TEMP FS 10-2
WATER FILL VERIFICATION ..... TEMP FS 10-2
EMU LiOH CHANGEOUT 10-4
MIDDECK EMU BATTERY RECHARGE (STAND-ALONE) 10-4a
MIDDECK EMU BATTERY RECHARGE/LiOH REPLACEMENT 10-5
INITIATE 10-5
TERMINATE 10-6
IN-SUIT EMU BATTERY RECHARGE/CHARGE VERIFICATION 10-7
INITIATE 10-7
TERMINATE 10-7
EMU POWERDOWN 10-7
HELMET LIGHT/PGT BATTERY RECHARGE 10-8
INITIATE 10-8
TERMINATE 10-9
REBA BATTERY INSTALLATION 10-9
EMU BATTERY REMOVAL/INSTALL 10-10
HELMET LIGHT BULB CHANGEOUT 10-11
REBA BATTERY RECHARGE 10-12
INITIATE 10-12
TERMINATE 10-13
STS-135 CONSUMABLES TRACKING CUE CARD ..... FS CC 10-15

WATER RECHARGE

IF EMU NOT ALREADY POWERED UP:

EMU POWERUP

BOTH DCM
1. Retrieve, position SCUs; remove DCM covers
2. Connect SCUs to DCM, √locked
3. PWR – BATT

CAUTION
EMU must be on BATT pwr when airlock pwr supply is turned on

AW18H 4. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
BUS SEL (two) – MNA(MNB)

MD(flr) 5. √EMU O2 ISOL VLV – OP

AW82B 6. EV1,2 O2 vlv (two) – OP

DCM 7. PWR – SCU

WATER FILL

MO13Q 8. √ARLK H2O S/O VLV – OPEN (tb-OP)

R11L 9. √SPLY H2O TKA OUTLET – CL (tb-CL)

SM 60 TABLE MAINT

CRT 10. Use TKB quantity:
PARAM ID – ITEM 1 +0 6 2 0 4 2 0 EXEC

11. Log value before recharge

Recharge #	H2O TKB %
1	
2	
3	
4	
5	

AW82D 12. √EMU 1,2 H2O WASTE tb (two) – CL
SPLY (two) – OP (tb-OP)

13. √H2O TKB quantity decreasing

NOTE
Full charge requires ~15 min

WATER FILL VERIFICATION

DCM 14. √STATUS: H2O WP 8-15 psi and stable for ~30 sec (indicates charging complete)

SM 60 TABLE MAINT

CRT 15. Use TKB quantity:
PARAM ID – ITEM 1 +0 6 2 0 4 2 0 EXEC

16. Log value after recharge

Recharge #	H2O TKB %
1	
2	
3	
4	
5	

Cont next page

TOP

HOOK
VELCRO

STS-135 CONSUMABLES TRACKING CUE CARD

		EVA 1
METOX for CO2 Removal in A/L	**Serial Numbers**	07, 11

PWR Usage: 1015 as required
Dump CWC: 1059 as required

	EV	EMU	LiOH (s/n)	EMU LIB Batt (s/n)	REBA (s/n)	EHIP (HL) Batts (s/n)	ERCA (address)	SAFER (s/n)	PGT Batt (s/n)	PGT Batt Spare (s/n)
EVA 1	EV1 Fs	3010	2014	3004	1008	1022 1025	20	1005	1005	1008
	EV2 Ga	3009	2025	3005	1012	1026 1028	18	1007	1006	

EVA-4a/135/O/B

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TOP
BACK OF ‘STS-135 CONSUMABLES TRACKING CUE CARD’

HOOK VELCRO

EVA-4b/135/O/B

(reduced copy)

DISPLAY LOSS DURING POWER TRANSFER (WARM RESTART)..... TEMP FS 12-2
VACUUM H2O RECHARGE (MANNED)..... TEMP FS 12-2
LiOH REPLACEMENT (MANNED)..... 12-3
BATTERY REPLACEMENT (MANNED) 12-4
WATER DUMP 12-6
SCU SWAP (UNMANNED)..... 12-7
SCU SWAP (MANNED)..... 12-7
EMU COLD RESTART (MANNED) 12-7
12.1 STS EVA DECONTAMINATION..... 12-8
CONTAMINATION TEST..... 12-15
SAFER BATTERY CHANGEOUT 12-18
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BTA PREP 12-19
BTA TREATMENT 12-20
BENDS TREATMENT ADAPTER (BTA) INSTALLATION (POST SUIT DOFFING) 12-21
BTA PREP 12-21
BTA TREATMENT 12-22
EMU RESIZE..... 12-25
EMERGENCY UNDOCKING EVA TRANSFER ..... FS CC 12-27
EXPEDITED SUIT DOFFING CUE CARD ..... FS CC 12-28
STS-135 NOMINAL EMU SIZING ..... FS 12-29
EMU CONTINGENCY RESIZE MATRIX (STS-135/ULF7) ..... FS 12-31

DISPLAY LOSS DURING POWER TRANSFER (WARM RESTART)

DCM If PWR – BATT and SCU connected:
AW18H 1. √PWR/BATT CHGR EMU 1(2) BUS SEL – OFF
DCM If PWR – SCU:
2. PWR – BATT
AW18H 3. PWR/BATT CHGR EMU 1(2) BUS SEL – OFF

> WARNING
> Fan will be off from steps 4 to 9 during which time CO2 buildup is a concern

> NOTE
> Affected EMU will be without comm after step 6. Steps 6 and 7 should be read together before step 6 is performed

DCM 4. FAN – OFF (expect FAN SW OFF msg, DISP – PRO)
IV 5. Inform affected EV crewmember of impending comm loss
DCM 6. PWR – SCU (7 sec)
7. PWR – BATT
When power restart complete:
8. √Display – O2 POS XX, expect FAN SW OFF msg, DISP – PRO
9. As reqd, FAN – ON
If display blank or locked up:
10. Contact MCC
If SCU power desired:
11. √SCU connected to DCM
AW18H 12. PWR/BATT CHGR EMU 1(2) MODE – PWR
BUS SEL – MNA(MNB)
13. √EMU INPUT 1(2) Volts = 18.0 – 20.0
DCM 14. PWR – SCU
DCM 15. √Display – O2 POS XX

VACUUM H2O RECHARGE (MANNED)

> WARNING
> Procedure should be used only if performing a contingency EVA

EV 1. Perform AIRLOCK INGRESS, Cuff C/L, 30 (Close hatch, partially engage latches)
2. √Helmet purge vlv – cl, locked
DCM 3. √PURGE vlv – cl (dn)
4. √WATER – OFF
IV MO13Q 5. √ARLK H2O S/O VLV – OPEN (tb-OP)
MD(flr) 6. √EMU O2 ISOL VLV – OP
ML86B:C 7. √cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – op
AW82B 8. √EV-1(EV-2) O2 vlv – OP
EV AW18H 9. PWR/BATT CHGR EMU 1(2) BUS SEL – MNA(MNB)
DCM 10. PWR – SCU (fwd), WARN TONE
IV R11L If SPLY H2O XOVR VLV closed (tb-CL or bp) (water transfer config):
11. SPLY H2O TKA OUTLET – CL (tb-CL)
If SPLY H2O XOVR VLV open (tb-OP) (nominal config):
L1 12. √RAD CNTLR OUT TEMP – NORM
13. √FLASH EVAP CNTLR PRI A,B (two) – OFF
ML31C 14. SPLY H2O TKD OUTLET – CL (tb-CL)
R11L 15. SPLY H2O TKB OUTLET – CL (tb-CL)
√TKA OUTLET – CL (tb-CL)
TKC INLET – CL (tb-CL)
TKC OUTLET – OP (tb-OP)

TOP

HOOK
VELCRO

EMERGENCY UNDOCKING
EVA TRANSFER

Critical

- ☐ Wh & Mg
  - ☐ EMUs
  - ☐ CCAs
  - ☐ Batteries
  - ☐ Gloves
  - ☐ LCVGs
- ☐ EVA SYS XFER BAG 2

Desired (rotate items below)

- ☐ EVA SYS XFER BAG 2
  - ☐ 85-ft Safety Tethers, prefer #22 & #21
  - ☐ SCOFs, prefer s/n 1011 & 1013
  - ☐ BTA Assembly, prefer s/n 1004
  - ☐ EMU Servicing Kit, prefer s/n 5002

EVA-5a/135/O/A

(reduced copy)

TOP
BACK OF 'EMERGENCY UNDOCKING EVA TRANSFER'

HOOK
VELCRO

EXPEDITED SUIT DOFFING CUE CARD

CAUTION
Verify EV crew is clear of hatch mechanism

IV — When equalization complete:
1. Open IV Hatch per decal

SUIT DOFFING

DCM
2. O2 ACT → OFF
3. PURGE vlv → op (up)
4. sw REBA → OFF (toward left arm of suit)
5. EMU TV Power Cable ←|→ EMU TV
6. √STATUS: SUIT P < 0.4 (compare with gauge)
7. Glove ←|→ EMU (leave donned, disconnected)
8. Helmet ←|→ EMU

DCM
9. sw FAN → OFF

SAFER DOFFING

SAFER
10. Latch → ENG
11. Latch ↶ until release (~90 deg)
12. PLSS ←|→ Thruster Towers

SUIT DOFFING (Cont)

PLSS
13. Engage EMU in EDDA
14. Lower Arm Cables ←|→ Gloves
15. Gloves ←|→ EMU
16. Comm Mode → OFF
17. Disconnect CCA, MWC, and Biomed
18. Doff EMU

If taking EMUs to shuttle:

UIA
19. sw PWR EV-1,2 (two) → OFF
    √PWR EV-1,2 LEDs (four) – Off

DCM
20. SCU ←|→ DCM
21. LTA →|← HUT
22. Gloves →|← EMU
23. Helmet →|← EMU
24. Go to **EMERGENCY UNDOCKING EVA TRANSFER** on reverse side

EVA-5b/135/O/A

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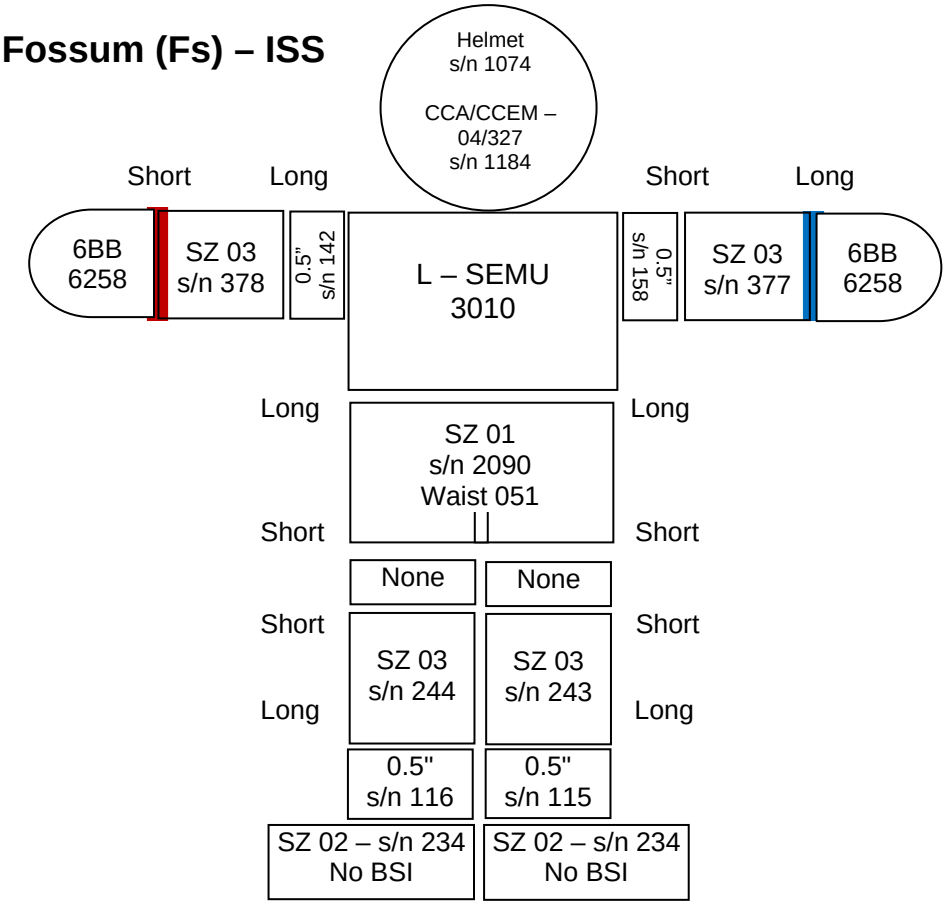
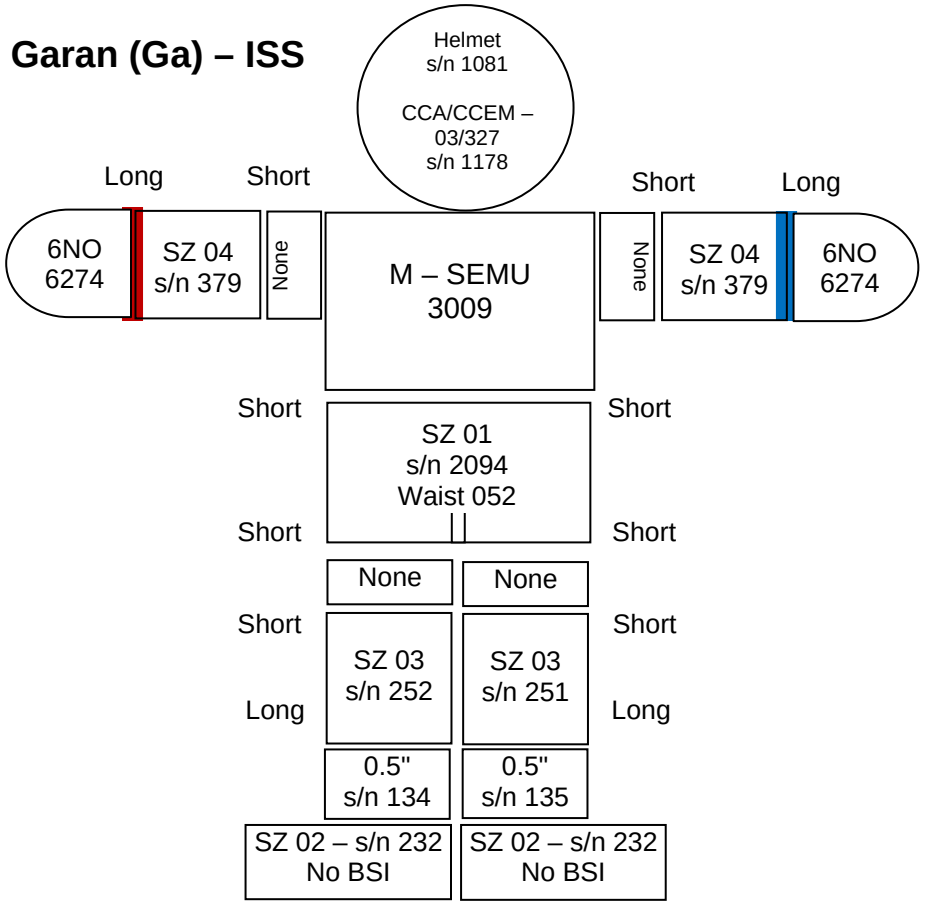
STS-135 NOMINAL EMU SIZING

Fossum (Fs) – ISS



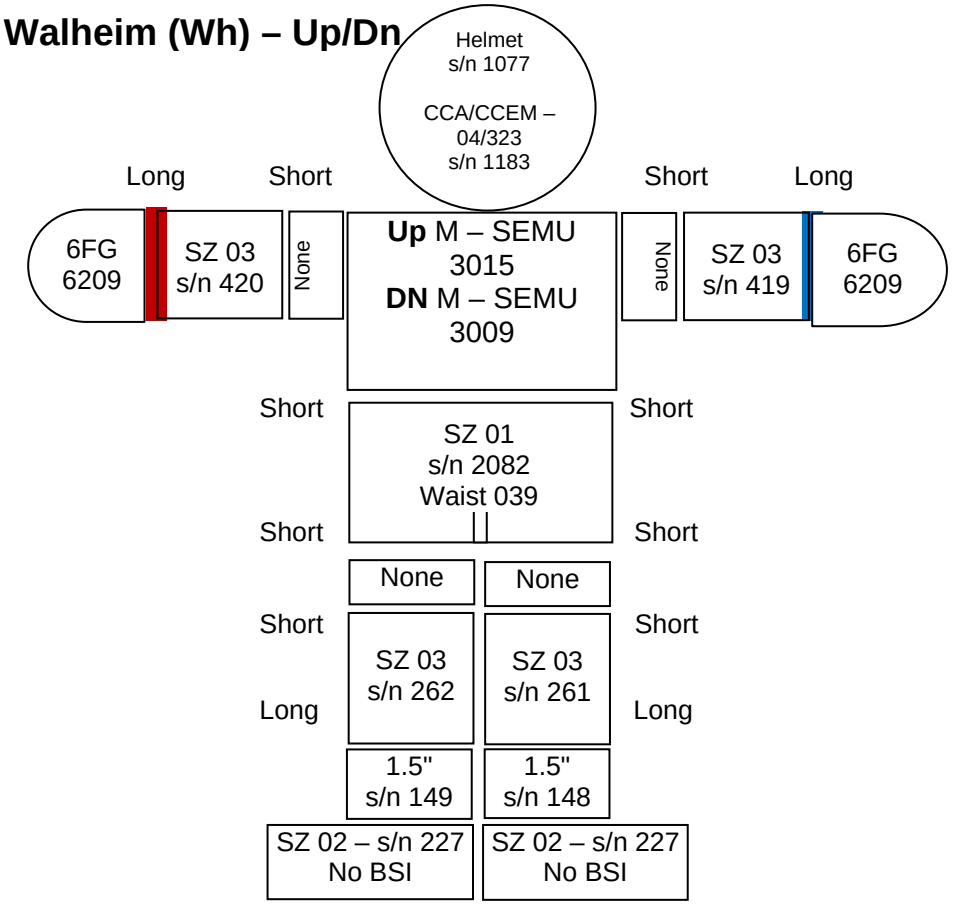
Garan (Ga) – ISS



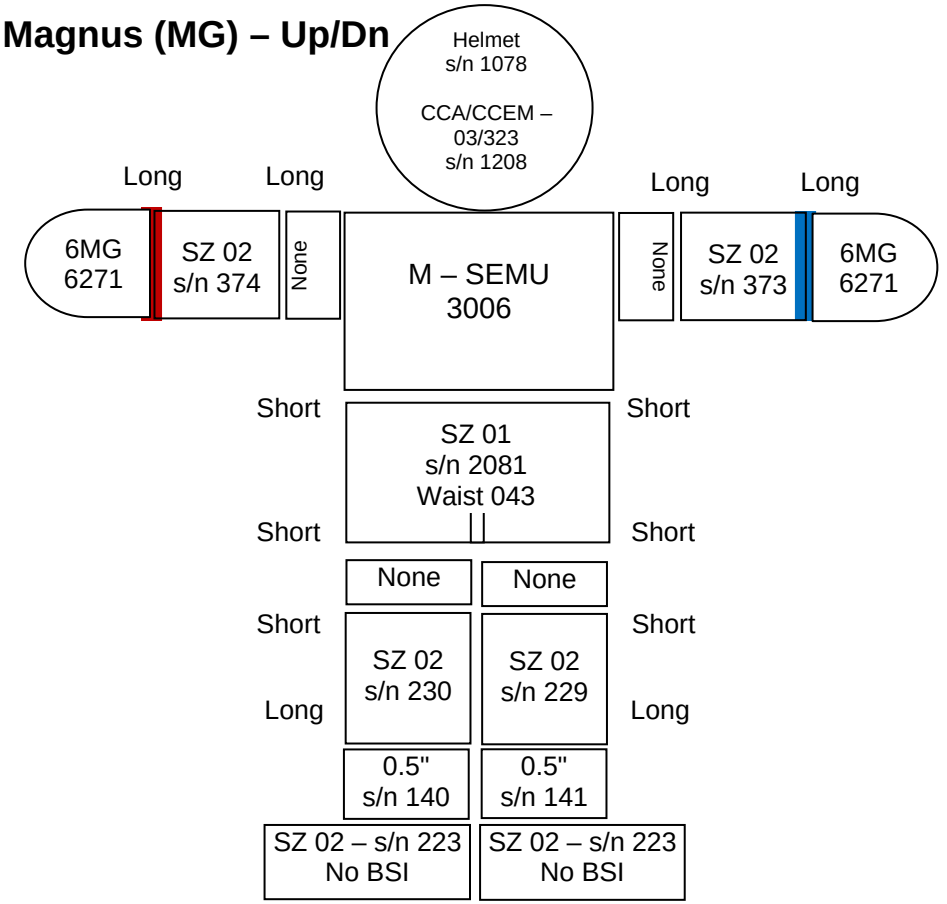
	Croakie	Fresnel	Valsalva	LCVG/BLVD	MAG	TCU Top	TCU Bottom	Comfort Gloves	Socks
Fs	-002 [M]	-011 & -019	309	3240/315		Med	L	Spectra LG Thick	Crew 10-13
Mg	Mod M	N/A	309	3222/282		Lg	XL	Med Manzella	Crew 9-11

STS-135 NOMINAL EMU SIZING (Cont)

Walheim (Wh) – Up/Dn



Magnus (MG) – Up/Dn



	Croakie	Fresnel	Valsalva	LCVG/BLVD	MAG	TCU Top	TCU Bottom	Comfort Gloves	Socks
Wh	N/A	1.0 and 1.5 Diopter	309	3252/337	709	M	M	Spectra LG Thin	Thermax – Lg
Mg	S GRD	N/A	309	3198/288	709	S	M	Spectra MG	Woodsman – M

EMU CONTINGENCY RESIZE MATRIX (STS-135/ULF7)

FOR LOSS OF:	EV1 – Fossum	EV2 – Garan	EV – Walheim
HUT/PLSS	EMU 3011, M 1. Remove glove/arm assys 2. Use primary arms, gloves 3. √Arm red connects to right, √locks, √cams 4. Use primary LTA 5 Swap EMU PLSS identifier stripes, national flag 6. Swap helmet, comm cap, LiOH/Metox, EMU battery, REBA	EMU 3011, M 1. Remove ring/glove/arm assys 2. Use primary ring, arms, gloves 3. √Arm red connects to right, √locks, √cams 4. Use primary LTA 5. Swap EMU PLSS identifier stripes, national flag 6. Swap helmet, comm cap, LiOH/Metox, EMU battery, REBA	EMU 3011, M 1. Remove ring/glove/arm assys 2. Use primary ring, arms, gloves 3. √Arm red connects to right, √locks, √cams 4. Use primary LTA 5. Swap EMU PLSS identifier stripes, national flag 6. Swap helmet, comm cap, LiOH/Metox, EMU battery, REBA
CCA	Size 04/327 s/n 1198/1070 Location: ECOK (Fs)	Size 03/327 CCA s/n 1178/1055 Location: ECOK (Ga)	Size 04/323 CCA s/n 1181/5019 Location: ECOK (Wh)
Lower Arm Segment	Size 03 arm s/n 422/421 Location: A/L1D2 CTB 1078. Cams S/S (red = right, blue = left) 1. √Locks, √cams	Size 04 arm s/n 409/410 Location: A/L1O1 M-02 Bag 1010. Cams S/L (red = right, blue = left) 1. √Locks, √cams	Size 03 arm s/n 422/421 Location: A/L1O1 M-02 Bag 1010. Cams S/L (red = right, blue = left) 1. √Locks, √cams
Gloves	6BB gloves s/n 6231 Location: ECOK (Fs) Swap Arm Cams to S/L	6NO gloves s/n 6328 Location: ECOK (Ga) Arm Cams remain S/L	6FG gloves s/n 6330 Location: ECOK (Wh) Arm Cams remain S/L
Waist Brief	Size 01 waist brief s/n 2076/045 from EMU 3010. Cams S/S 1. Use prime legs, leg rings, and boots 2. √Locks, √cams 3. Swap EMU brief identifier stripes	Size 01 waist brief s/n 2076/045 from EMU 3010 Cams S/S 1. Use prime legs, leg rings, and boots 2. √Locks, √cams 3. Swap EMU brief identifier stripes	Size 01 waist brief s/n 2076/045 from EMU 3010. Cams S/S 1. Use prime legs, leg rings, and boots 2. √Locks, √cams 3. Swap EMU brief identifier stripes
Leg Segment	Use size 03 leg s/n 243/244 Location: TBD Cams L/L √Locks, √cams	Use size 03 leg s/n 243/244 Location: TBD Cams S/L √Locks, √cams Or Use size 02 leg s/n 249/250 Location EMU 3005 Cams L/L √Locks, √cams 0.5" thigh rings s/n 145/146 1.5" Leg sizing rings s/n 141/142 Location A/L1O1 CTB 1010	Use size 03 leg s/n 243/244 Location: TBD Cams S/L √Locks, √cams
Boot	Use size 02 boots s/n 232 from EMU 3010 1. No BSI & Toe Cap 2. √Locks	Use size 02 boots s/n 232 EMU 3010 1. No BSI & Toe Cap 2. √Locks	Use size 02 boots s/n 232 EMU 3010 1. No BSI & Toe Cap 2. √Locks
Sizing Rings	• 0.5" Arm: Use s/n 145/146 from EMU 3005 • 1.5" Leg: Use s/n 121/122 Location: A/L1O1 M-O2 1010	1.5" Leg: Use s/n 121/122 Location: A/L1O1 M-O2 1010	1.5" Leg: Use s/n 121/122 Location: A/L1O1 M-O2 1010
LCVG	(04/05) 1. Use s/n 3195 Location: Bag "C" 2. Transfer biomed and dosimeter	(04/05) 1. Use s/n 3195 Location: Bag "C" 2. Transfer biomed and dosimeter	(04/05) 1. Use s/n 3202 Location: Bag "C" 2. Transfer biomed and dosimeter

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TPS REPAIR

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

A PDF and a WORD version of the procedures can be found at: http://mod.jsc.nasa.gov/do3/FDF/FDFBooks/Status%20Sheets/index.html. Select the "As Flown" Status sheet for STS-134 and the link to the procedures can be found with the link to the EVA FS. The procedures can also be found on the FDF Books CD provided to the FAO console

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STS-135/ULF7 WORKAROUNDS CRIBSHEET

EVA 1 CONTINGENCIES

TASK	FAILURE	ACTION
COLT Install	A. COLT will not engage contingency pin housing	Check for geometry conflicts and check with **MCC-H**
	B. COLT will not rotate with socket engaged on contingency pin	1. Verify cap is installed 2. Test COLT with socket: a. Remove COLT from contingency pin housing b. Remove cap from COLT c. Insert socket into COLT to disengage anti-rotation device d. Turn socket and verify both ends of COLT rotate 3. With COLT removed from cont. pin housing, verify screw on contingency pin housing is at 12 o'clock (zenith) position as expected
	C. Both "U" brackets fail to engage handrail	1. Verify slider in open position 2. Disengage COLT from contingency pin housing and reattempt installation and rotation. Ensure pressure (~10 lbf) against contingency pin housing during installation and rotation 3. Verify soft dock latch can be depressed 4. Check for geometry conflicts and check with **MCC-H**
	D. Slider will not move to closed position	1. Verify both paddles are depressed 2. Check for FOD or tethers in slider path
	E. Two lines not visible after slider installation	One line is acceptable if slider captures handrail stanchion and paddles are popped out. Perform pull test on slider and wiggle test on COLT
	F. Slider paddle will not pop up	1. Depress stuck paddle and push slider to closed position 2. Push slider to closed position with force 3. Contact **MCC-H** for options to tap slider
	G. Gap between washer & end of contingency pin housing > washer thickness	1. Test COLT spring-loaded socket: a. Remove COLT b. Use tool (not glove) to depress and cycle COLT spring-loaded socket (~10 lbf) c. Report movement to **MCC-H**. Attempt to reinstall. (Perform all checks again) 2. With COLT installed, report to **MCC-H**: a. Position of pin on opposite side of housing from spring-loaded socket (recessed, flush, protruding) b. Position of washer relative to window
	H. Cap cannot be removed	1. Attach large crew hook to cap tether point for improved handling 2. Contact **MCC-H** for options to pry cap loose

EVA 1 CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
PM FRAM Transfer	A. Primary FRAM bolt fails to release NOTE 3 of 4 contingency pins reqd for On-Orbit stowage. FRAM electrical connectivity fully lost at 0.95 turns on primary bolt. Partial electrical connectivity lost at 0.45 turns on primary bolt Minimum mechanical configuration is maintained with less than 2.2 turns on primary bolt (but pins highly desired time permitting) NOTE for Removal: For primary drive turn count of 2.2-4.7 turns, go for install of rear contingency pins due to uncertainty in PGT/Turn count. Failure to engage rear contingency pin to INSTALL location confirms turn count is 4.7 or less. Rear Contingency Pins, aft contingency pins can only be installed if the primary bolt turn count is 4.7 turns or more. With less than 4.7 turns on the primary bolt, the contingency pins are not needed and cannot be installed	1. Confirm socket fully engaged to release anti-rotation mechanism 2. Increase PGT setting: **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A4 (6.3) for full run-out of bolt** 3. On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A4 (6.3) for full run-out of bolt** 4. Reattempt engagement of primary drive with nominal PGT settings 5. Engage contingency pins: – Front pins (all FRAMs) **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** 0.11 + (1.25 * Turns on Primary Bolt) turns – Aft pins **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** If Primary Drive disengaged more than 8.8 turns: – Insert Contingency Pins to hardstop at 13.8 turns If the Primary Drive disengaged less than 8.8 turns use the following equation for turns needed: 2.858 + (1.25* Turns on Primary Bolt) = # of total turns needed [Stop on torque, verify turns]
	B. Active FRAM fails to seat on passive FRAM	1. Check for FOD in mechanism 2. Check alignment. (Engage 2 forward shear pins first to ensure connector door is not jamming)
	C. Primary FRAM bolt fails to engage NOTE 2 front and 1 of 2 aft contingency pins reqd for Shuttle PLB return. FRAM electrical connectivity begins at 10.25 turns on the primary bolt. Complete electrical mate is expected between 10.5-10.75 turns Minimum mechanical configuration is 9 turns on primary bolt, to not need contingency pins (but pins highly desired time permitting)	1. Verify FRAM seated 2. Check for FOD 3. Back out primary bolt fully at nominal setting. If removal isn't successful at nominal setting Increase PGT setting for disengagement: **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A4 (6.3) for full run-out of bolt** On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A4 (6.3) for full run-out of bolt** 4. Reattempt engagement **PGT: [A7 (9.2), CW2, 30.5], 7/16 - 6-ext** Increase PGT setting: **PGT: [B2 (16.0), CW2, 30.5], 7/16 - 6-ext** On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (19.4), CW2, 30.5], 7/16 - 6-ext** 5. Consider hold for thermal stabilization between active and passive FRAM

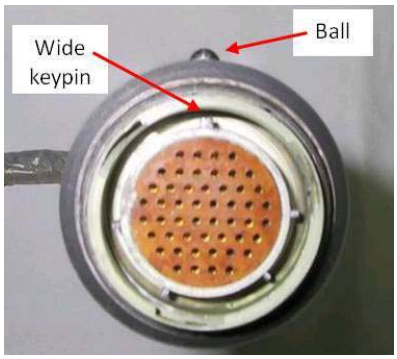
EVA 1 CONTINGENCIES (Cont)

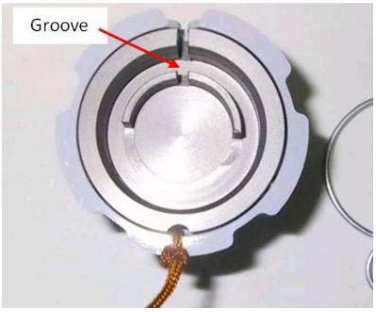
TASK	FAILURE	ACTION
	C. Primary FRAM bolt fails to engage (Cont) NOTE for Engage: For primary drive turn count of 6.5-9 turns, go for install of rear contingency pins due to uncertainty in PGT/Turn count. Failure to engage rear contingency pin to INSTALL location confirms turn count is 6.5 or more. Aft contingency pins can only be installed if the primary bolt turn count is 6.5 turns or less. With greater than 6.5 turns on the primary bolt, the contingency pins are not needed and cannot be installed	6. Engage contingency pins: – Front pins **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** 14.11 - (1.25 * Turns on Primary Bolt) turns – Aft pins **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** If Primary Drive inserted less than 2.4 turns: - Insert Contingency Pins to hardstop at 13.8 turns If the Primary Drive inserted greater than 2.4 turns use the following equation for turns needed: 16.858 - (1.25* Turns on Primary Bolt) = # of total turns needed [Stop on torque, verify turns]
RRM FRAM Transfer	A. Primary FRAM bolt fails to r**elease** NOTE 4 of 4 contingency pins reqd for Shuttle PLB return. FRAM electrical connectivity fully lost at 0.95 turns on primary bolt. Partial electrical connectivity lost at 0.45 turns on primary bolt Minimum mechanical configuration is maintained with less than 2.2 turns on primary bolt (but pins highly desired time permitting) NOTE for Removal: For primary drive turn count of 2.2-4.7 turns, go for install of rear contingency pins due to uncertainty in PGT/Turn count. Failure to engage rear contingency pin to INSTALL location confirms turn count is 4.7 or less. Rear Contingency Pins, aft contingency pins can only be installed if the primary bolt turn count is 4.7 turns or more. With less than 4.7 turns on the primary bolt, the contingency pins are not needed and cannot be installed	1. Confirm socket fully engaged to release anti-rotation mechanism 2. Increase PGT setting: **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A7 (9.2) for full run-out of bolt** 3. On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A7 (9.2) for full run-out of bolt** 4. Reattempt engagement of primary drive with nominal PGT settings 5. Engage contingency pins: – Front pins **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** 0.11 + (1.25 * Turns on Primary Bolt) turns – Aft pins for LMC FRAMs - Prep CPK by disengaging J-hook on locking mechanism; ensure J-hook fully seated in unlock position - Slide T-handle until contingency pin contact primary FRAM pin (# on locking mechanism counter – # of turns on primary FRAM bolt) - Engage J-hook lock (will “pop” into place if not precisely aligned with numbered slot); ensure J-hook fully seated in lock position
	B. Active FRAM fails to seat on passive FRAM	1. Check for FOD in mechanism 2. Check alignment (engage 2 forward shear pins first to ensure connector door is not jamming)

EVA 1 CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	C. Primary FRAM bolt fails to engage NOTE 3 of 4 contingency pins reqd for On-Orbit stowage. FRAM electrical connectivity begins at 10.25 turns on the primary bolt. Complete electrical mate is expected between 10.5-10.75 turns Minimum mechanical configuration is 9 turns on primary bolt, to not need contingency pins (but pins highly desired time permitting) NOTE for Engage: For primary drive turn count of 6.5-9 turns, go for install of rear contingency pins due to uncertainty in PGT/Turn count. Failure to engage rear contingency pin to INSTALL location confirms turn count is 6.5 or more. Aft contingency pins can only be installed if the primary bolt turn count is 6.5 turns or less. With greater than 6.5 turns on the primary bolt, the contingency pins are not needed and cannot be installed	1. Verify FRAM seated 2. Check for FOD 3. Back out primary bolt fully at nominal setting. If removal isn't successful at nominal setting Increase PGT setting for disengagement: **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A7 (9.2) for full run-out of bolt.** On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A7 (9.2) for full run-out of bolt.** 4. Reattempt engagement **PGT: [A7 (9.2), CW2, 30.5], 7/16 - 6-ext** Increase PGT setting: **PGT: [B2 (16.0), CW2, 30.5], 7/16 - 6-ext** On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (19.4), CW2, 30.5], 7/16 - 6-ext** 5. Consider hold for thermal stabilization between active and passive FRAM 6. Engage contingency pins: – Front pins **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** 14.11 - (1.25 * Turns on Primary Bolt) turns – Aft pins - Remove bolt from STOW location and engage in INSTALL location - Manually turn bolt as far as possible - **PGT: [B1 (12.0), CW2, 30.5], 7/16 - 6-ext**
MISSE 8 ORMATE III R/W Install	A. ExPA Socket PIP pin will not release	1. Push PIP pin button and increase force on pull ring; stop if deformation occurs 2. If no joy, assess side loads on PIP pin 3. If no joy, tap detent end of PIP pin with hook 4. If no joy, retrieve hammer (stbd A/L toolbox), pry bar (Staging Bag), and BMRRM tool (stbd Z1 toolbox, slot 2) 5. Tap detent end of PIP pin with hammer; 6" max stroke; use metal side of hammer; reattempt step 1 6. If no joy, place edge of pry bar along the detent end of PIP pins, tap with hammer; 6" max stroke; use metal side of hammer; reattempt step 1 7. If no joy, insert BMRRM tool axially into detent end of PIP pin, tap with hammer; 4" max stroke; use metal side of hammer; reattempt step 1
	B. ExPA Socket PIP pin will not engage	1. Verify ball detents can be depressed 2. Check alignment of ORMATE 3. Wiggle ORMATE to offload any misalignments while installing PIP pin 4. Install other PIP pin, if not already, and reattempt ******One PIP pin is sufficient to hold ORMATE in ExPA socket

GET-AHEAD CONTINGENCIES

<table>
<tr><th>TASK</th><th>FAILURE</th><th>ACTION</th></tr>
<tr><td rowspan="3">1553 CABLE INSTALL</td><td>A. NZGL Connectors</td><td>See Generic Section of Cribsheet</td></tr>
<tr><td>B. Russian connectors will not mate</td><td>1. Verify connector alignment: Wide keypin should align with ball on the exterior housing of the connector housing
 

Russian connector socket</td></tr>
<tr><td></td><td>2. If connector not aligned:
a. Turn connector cap around to use keypin groove
 

Russian connector cap
b. Place cap on connector so keypin enters groove on cap
 
Russian socket and cap
c. Rotate cap until ball on connector housing aligns with groove on cap
(may feel “detent” in rotation)
 

Russian connector properly aligned
d. Remove cap and verify keypin aligns with ball on connector housing
e. Reattempt connector mate</td></tr>
</table>

GET-AHEAD CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
SSRMS BOOM B CLPA R&R	A. Failed CLPA bolt does not release	1. Apply higher torque (using MTL): a. Turn PGT – Off, set to manual CCW ratchet (RCCW) with MTL setting of **30.5** b. After breaking torque, reset PGT to nominal settings for task (B7)
	B. CLPA fails to soft dock	1. Inspect for FOD or damage 2. Wiggle CLPA into V-guide
	C. Bolt fails to engage fully (> 20 turns)	Increase torque **PGT: [B7 (25.5), CW2, 30.5]** • Minimum number of turns for electrical connectivity is 22 • Max installation torque is 43.0 ft-lb
	D. Bolt fails to engage fully (< 20 turns)	1. Release bolt using PGT setting [**B7** (25.5 ft-lb), **CCW2** (30 rpm), **30.5** MTL] 2. Check for FOD or damage in interface 3. Reinstall CLPA using maximum torque settings, PGT: [**B7** 25.5 ft-lb), **CW2** (30 rpm), **30.5** MTL] 4. If no joy with max torque, remove camera and bring both cameras back to A/L
FHRC P-Clamp Release	A. Bolt fails to release	Increase torque **PGT: [B1 (12.0), CCW2, 30.5]** for 1 turn then return to nominal setting **PGT: [A7 (9.2), CCW2, 30.5]**
Tool Relocations	A. Toolbox door will not open	1. Verify both door locks are in open position (on either side of door panel) • If necessary, remove launch restraint PIP pin, place in stowage bracket, and open lock 2. Ingress APFR/IAPFR for better worksite access
	B. Toolbox door will not close	1. Verify no FOD or interference in door hinge 2. Verify door hinge in travel in groove
	C. Toolbox door lock stuck	1. Verify no FOD or interference 2. Use crew hook to apply additional force in desired direction 3. If door lock is stuck open, leave in open position and close door lock on the other side of door panel
	D. Toolboard tab will not open	1. Verify no FOD or interference in tab 2. Use equipment hook to tap toolboard tab into open position 3. If appropriate, utilize alternate tab (TB vs SL) to gain access to toolboard
	E. Toolboard tab will not close	1. Verify toolboard is fully seated in guide rail, reattempt 2. Verify no FOD or interference in tab 3. Stow toolboard in alternate location (mission specific): a. Alternate slot in same toolbox b. Alternate slot in alternate toolbox c. Return toolboard to Airlock for internal stowage

GENERIC CONTINGENCIES

TASK	FAILURE	ACTION
I. Generic	**AGB**	
	A. Bolt fails to release	1. Increase torque **PGT: [B1 (12.0), CCW2, 30.5], 7/16 - 6-ext (2-in required for ESP-2 FHRC)** 2. If no joy, increase torque **PGT: [B7 (25.5), CCW2, 30.5], 7/16 - 6-ext (2-in required for ESP-2 FHRC)**
	B. Bolt jams during AGB release due to PGT dimensions (on ESP-2 FHRC)	Use ratchet wrench a. Drive bolt back in **PGT: [A2 (3.8), CW2, 30.5], 7/16 - 2-ext** b. Retrieve ratchet wrench to perform release
	C. T-handle fails to unlock (release)	1. Check interface for FOD or damage 2. Increase force and reattempt 3. Use prybar as lever to release T-handle
	D. AGB fails to release from soft dock	Use bolt puller or prybar to pry the AGB from the PM near sticky plungers
	E. T-handle fails to engage into alignment hole	1. Slide AGB single pin side in and out a few inches while tapping T-handle into position 2. Install tether to hold 2 pin side to restraint engaged on ORU and push in single pin side. Then reattempt step 1
	F. AGB fails to soft dock	1. Check for FOD 2. Exercise plungers with bolt puller or prybar
	G. Slider mechanism overcomes soft-dock	1. Verify T-handle fully out – 2 white lines 2. Install tether to hold 2 pin side to restraint engaged on ORU and push in single pin side. Then slide AGB single pin side in and out a few inches while tapping T-handle into position
	H. Bolt fails to engage fully	1. Check interface for FOD or damage 2. Back out bolt **PGT: [A2 (3.8), CCW2, 30.5], 7/16 - 6-ext (2-in required for ESP-2 FHRC)** and reattempt installation at nominal setting **[A2 (3.8), CW2, 30.5], 7/16 - 6-ext (2-in required for ESP-2 FHRC)** 3. If green light achieved check with **MCC-H** if turn count is acceptable
	I. PGT interferes during AGB install (on ESP-2 FHRC)	Attempt turns by hand or with ratchet wrench palm wheel cw until bolt seated; do not put preload on bolt with ratchet
	APFR/IAPFR	
	A. APFR/IAPFR fails to install into WIF	1. Verify APFR collar in install position (black-on-black) 2. Check for FOD in WIF or structural interference 3. Attempt APFR install in alternate clocking 4. Attempt APFR install in alternate WIF 5. APFR failure • Use another APFR
	B. Joint fails to actuate	1. Verify no load is applied to joint and/or jiggle APFR joint while actuating • For pitch joint, push knob in during rotation. (Class I pitch joints known to be stiff) 2. Increase force applied in order to free joint
	C. Boot becomes stuck in APFR boot plate	1. Have other EV crewmember assist with getting boot out 2. Loosen 7/16-in EVA bolts (3) on heel clip using EVA ratchet or PGT: **PGT: [B1 (12.0), CCW2, 30.5], 7/16 - 6-ext** 3. Remove 7/16-in EVA bolts (3 – captive) on heel clip (non captive) using EVA ratchet or PGT: **PGT: [B1 (12.0), CCW2, 30.5], 7/16 - 6-ext** 5 turns total

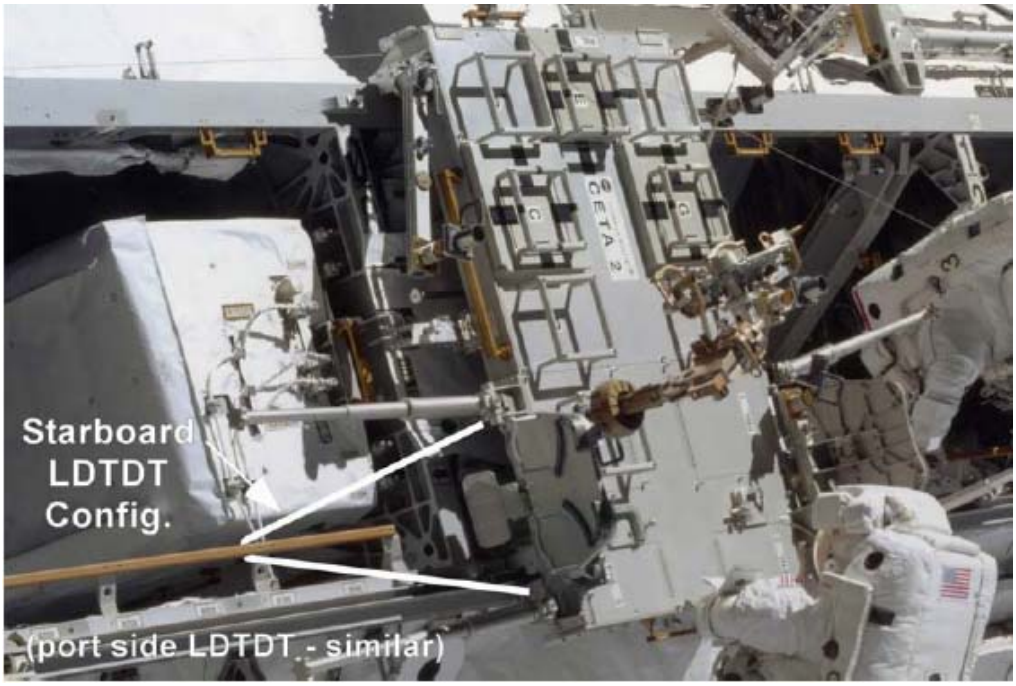
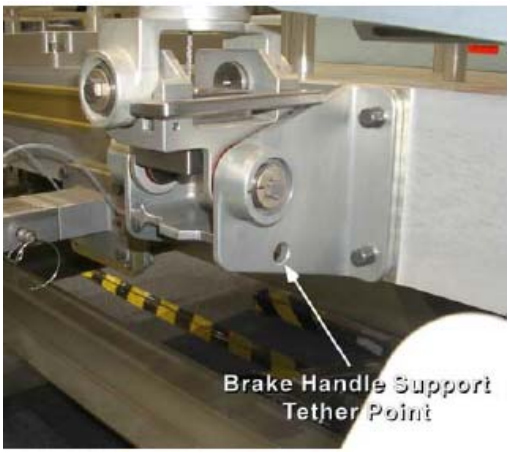
GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	D. Boot becomes stuck in IAPFR boot plate	1. Have other EV crewmember assist with getting boot out 2. If wearing Small EMU boot, have other EV crewmember adjust boot sizing to Large 3. Loosen 7/16-in EVA bolts (2) on heel clip using EVA ratchet or PGT: **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext** 4. Remove 7/16-in EVA bolts (2) on heel clip using EVA ratchet or PGT: **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext** 4 turns total
	Ballstack	
	A. ECOM fails to release from ISS Structure	On **MCC-H GO**: Tether ballstack to handrail and leave outside
	B. ECOM fails to release from MUT EE	Leave together and return inside
	C. Ballstack fails to rigidize	On **MCC-H GO**: Use secondary tethers to assist in restraining payload
	BRT	
	A. BRT jaws fail to release	1. Loosen rigidizing collar to relieve sideloads 2. Shake BRT while depressing paddles to alleviate sideloads from handrail 3. Detach BRT from suit and tether to structure
	Cannon Connector	
	A. Connector fails to release	1. Check for FOD, damage or misalignment 2. Verify cable routing is not impeding connector rotation. (Release TA-clamps as required) 3. Use cannon connector tool for more leverage
	B. Connector/Cap fails to softdock	1. Verify collar unlocked. (White on connector shell tip should align with white on receptacle backplate) 2. Check for FOD or damage
	C. Connector/Cap fails to lock	1. Remove connector/cap, check for FOD or damage 2. Check alignment, remate, rock connector back and forth as required. (Once locked, white on connector shell tip should align with black on receptacle backplate) 3. Use cannon connector tool for more leverage
	D. High cable stiffness prevents mating	1. Verify all TA-clamps are released 2. Use second crewmember 3. Use APFR
	E. Connector/Jack pin bent	1. Describe pin location and condition • Obtain WVS view of interface if possible 2. On **MCC-H GO**: For 16, 20, or 22 gauge pins only, retrieve pin straightener and attempt pin repair 3. On **MCC-H GO**: Retrieve needle nose pliers and attempt pin repair • **MCC-H** will verify pin size prior to retrieving tools
	F. Connector/Jack FOD	On **MCC-H GO**: Obtain connector cleaner tool to remove FOD
	G. Connector EMI band bent	On **MCC-H GO**: Obtain needle nose pliers or forceps to remove band
	CETA Cart	
	A. Wheel bogie fails to release from truss	1. Verify brakes are fully released 2. Ensure trigger is being depressed while attempting to rotate handle 3. On **MCC-H GO**: Perform 6.100.125 CETA CART WHEEL BOGIE R&R • There is no spare wheel bogie on-orbit, so after the CETA cart is relocated the failed wheel bogie will be reinstalled

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	B. Wheel bogie fails to install on truss	There is no spare wheel bogie on-orbit. 4 of 4 bogies are required. Real time call on whether MT couple or CETA cart tiedown required. For tiedown, see block G
	C. Parking brake fails to engage	1. Use parking brake handle on other side of CETA cart 2. Couple CETA cart to MT and utilize other WIF if possible
	D. Parking brake fails to disengage	1. Hold pedal down for brake release 2. Use pedal on other side of CETA cart to release parking brake
	E. Dynamic brake fails to engage	Limit translation rates to allow manual stopping
	F. CETA active coupler fails to capture or lock	1. Cycle active coupler 2. On **MCC-H GO**: Swap active couplers by removing PIP pins (2 on each coupler). (Port CETA Cart has short coupler.) (MT Coupler PIP pins restrained by lanyard which must be cut to remove PIP pins. Stbd Cart Coupler PIP pins restrained by wire tie. Wire tie does not need to be reinstalled) 3. On **MCC-H GO**: Tie down CETA cart. See block G
	G. CETA cart tiedown	On **MCC-H GO**: Perform the following tiedown procedure (see figure 1) a. Translate CETA cart to TBD location (not over truss segment joint) b. Engage parking brake c. Retrieve 2 Long Duration TieDown (LDTD) tethers d. Route 1 LDTD tether on stbd side of CETA cart as follows: 1. Attach 1 hook to zenith brake handle support tether point 2. Loop tether strap around CETA rail HR standoff 3. Attach second hook to nadir brake handle support tether point 4. Lightly cinch tether and close buckle 5. Close MLI flap over buckle and any excess strap e. Repeat on port side of CETA cart
	H. Coupler knob fails to unlock	1. On **MCC-H GO**: Release active coupler by removing PIP pins (2). (MT Coupler PIP pins restrained by lanyard which must be cut to remove PIP pins. Stbd Cart Coupler PIP pins restrained by wire tie. Wire tie does not need to be reinstalled) 2. On **MCC-H GO**: Release passive coupler via EVA bolt: **PGT: [B7 (25.5), CCW2, 30.5], 7/16 - 6-ext** 9 turns • Bolt is attached by lanyard
	I. Swing arm fails to deploy	Use alternate swing arm or WIF
	J. Swing arm fails to stow	On **MCC-H GO**: Remove swing arm via EVA bolts (4): **PGT: [B7 (25.5), CCW2, 30.5], 7/16 - 6-ext** TBD turns (Captive bolts?)
	K. Swing arm fails to lock	Restrain in stowed position with wire ties

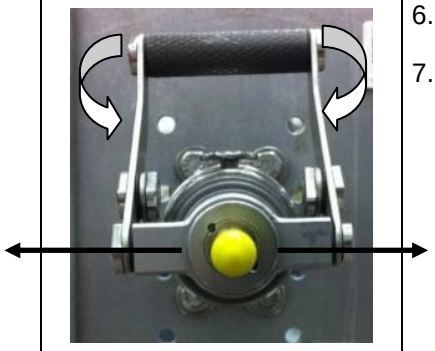
GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	   Figure 1 - CETA Cart Tie-down	
	EVA Wrench (Torque & Ratchet)	
	A. Ratchet teeth slip	Ratchet to new set of teeth and reapply torque
	B. Wrench does not ratchet	Hold the ratchet selector and socket in opposite hands and rotate in opposite directions
	Expandable Diameter Fasteners (EDFs)	
	A. EDF does not release with recommended torque	1. Increase torque to **PGT: [B7 (25.5), CCW2, 30.5]** for one turn only. Continue release at nominal setting 2. Increase torque to **PGT: [RCCW, 30.5]** for one turn only. Continue release at nominal setting 3. Use Ratchet Wrench (ccw) 4. Remove EDF with prybar (only if head not free spinning)

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	B. EDF cannot be removed from lug/clevis after untorqued	1. Twist outer washer (lanyard washer) back and forth while pulling outward 2. Verify lanyard not snagged 3. Drive EDF ccw 2 turns. (Start EDF by hand when re-installing) 4. Gently tap along EDF major axis with back of equipment hook or hammer (EDF head must not be free spinning), and pull outward with lanyards 5. Use equipment hook over EDF bolt head to remove (EDF head must not be free spinning) 6. Use EVA prybar (EDF head must not be free spinning)
	C. Cannot insert EDF into lug/clevis interface	1. Verify lug/clevis fully seated 2. Twist EDF bolt head by hand to seat on tip hex head 3. Drive EDF 2 addl turns ccw, retry insertion, verify head not free spinning 4. Remove EDF and verify collets not expanded 5. Cut EDF lanyards and replace failed EDF with spare EDF
	D. EDF is not captive after all EDFs at final torque	1. Increase torque to **PGT: [B7 (25.5), CW2, 30.5]**, ensure fully seated 2. Increase torque to **PGT: [RCW, 30.5]**, ensure fully seated 3. Pull EDF and re-insert (loosen collets as reqd), ensure fully seated, retry 4. Increase torque on all EDFs to **PGT: [RCW, 30.5]**, ensure fully seated 5. Cut EDF lanyards and replace failed EDF with spare EDF
	Fluid QD Ops	
	NOTE Troubleshooting steps outlined in this cribsheet are a generic starting point. Flight specific situations may require different actions. If troubleshooting requires the crew to leave the worksite, verify that female QDs are covered to prevent exposure to direct sunlight. For thermal clocks refer to flight rules	
	Mating Ops	
	A. QD fails to mate	1. Check alignment and verify side loads are counteracted 2. Verify fwd white band is not visible (release ring is retracted) 3. Inspect male and female QD for debris, damage, or NH3 4. Leave female QD engaged with male. (NH3 may sublimate between QDs) 5. Change body orientation for better access
	B. Release ring snap back test fails	1. Push release ring forward. (Release ring will not slide fwd if QD is in FID) 2. QD is in FID a. Demate QD b. Pull back on release ring c. Verify fwd white band not visible (release ring is retracted) d. Assess and counteract sideloads and remate QD

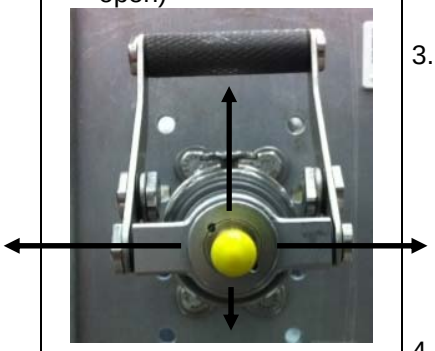
GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	C. Gap check fails (visual or FID gauge)	QD is in FID a. Demate QD b. Pull back on release ring c. Verify fwd white band not visible (release ring is retracted) d. Assess and counteract sideloads and remate QD
	D. Pull test fails	1. Verify fwd white band is not visible (release ring is retracted) 2. Assess and counteract sideloads and mate QD
	Valve Ops	
	E. Detent button is partially unthreaded	Rethread detent button a. Load bail handle (button will free spin if not loaded) • If valve is open (bail fwd), pull bail handle aft • If valve is closed (bail aft), push bail handle fwd b. Rotate button cw to hardstop (8 turns max)
	F. Detent button is missing NOTE Detent button is only required for BDT ops and 1 in SPD ops	1. Use equipment hook to depress detent button shaft 2. Use tether strap around gloved finger to depress detent button shaft 3. Retrieve and use Beta Gimbal Antirotation Latch Tool to depress detent button shaft 4. On **MCC-H GO**: Install spare detent button. (Buttons are stowed IVA and must be configured prior to EVA use)
	G. Bail fails to travel to fwd (valve open) position (button does not pop up if attempting to go to full fwd)	1. Assess and counteract sideloads 2. Apply greater opening force to QD bail handle in fwd direction 3. Retrieve and use QD bail drive lever (3/4, 1, & 1.5 in only) 4. If applicable, retrieve and install SPD; notify **MCC-H**
	H. Detent button fails to depress in preparation for valve closing WARNING Bail may kick back and contact crew when a stuck button is forcibly depressed due to pressure build-up in spring cavity 	1. Verify locking collar unlocked (1/2, 3/4, & 1 in only) 2. Push and hold bail handle fwd (to open) with significant force to relieve load on button while simultaneously depressing the detent button • If button depresses, vent by allowing bail aft until aft white band no longer visible 3. Twist bail handle/Rock QD from side-to-side and fwd/aft while depressing button to allow internal QD components to align 4. Retrieve QD bail drive lever and repeat step 2 (3/4, 1, & 1.5 in only) 5. Contact **MCC** to reduce NH3 pressure, if possible 6. On **MCC-H GO**: Retrieve and install QD button depress tool (BDT) (1/4, 3/4, & 1 in only) 7. On **MCC-H GO**: Retrieve hammer and tap center of button (Use plastic side of hammer) (Inspect tool and QD)
	I. Bail fails to travel to full aft (valve closed) position (button does not pop up)	1. Assess and counteract sideloads 2. Increase force on bail while depressing button 3. Retrieve and use QD bail drive lever (3/4, 1, & 1.5 in only) 4. Inspect QD for retaining wire protrusion

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	Demating Ops	
	J. Female QD fails to demate	1. Assess and counteract sideloads or manipulate flexhose to relieve mating forces on female QD 2. Verify release ring is fully retracted while attempting to demate 3. Verify TA or P clamps are released 4. Verify detent button is up (locking collar can be rotated under button) 5. Verify trigger linkage is still attached to release ring (1.5 in only) 6. Apply greater force to release ring and female QD 7. Retrieve and use QD release tool (QRT) to apply greater force (3/4, 1, & 1.5 in only) 8. On **MCC-H GO**: Shake QD vigorously while attempting to demate
	K. Thermal bootie fails to remain securely closed	Install wire tie around bootie to keep QD fully covered
	L. Cap will not demate	1. Verify pulling out on cap before rotating to ensure locking tab is disengaged 2. Wait for opposite thermal conditions if possible and reattempt cap removal 3. Retrieve QD cap tool (1/4, 1/2, & 1 in only) a. **PGT: [A4 (6.3), CCW1, 30.5]** with QD cap tool to turn stuck cap a maximum of 2 turns (cap vents at ~ 2 turns) b. Once venting is complete, finish removal of cap by hand (~ 1 additional turn) • If venting does not stop or cap cannot be removed by hand, notify **MCC-H** (Male QD may be leaking)
	M. Partial fwd white band visible after QD demate	1. Pull back on release ring to verify QD is not in FID 2. Verify detent button is up 3. If fwd white band is still partially visible this is likely a tolerance stackup; notify **MCC-H** and press with QD ops
	Leaks	
	CAUTION Do not fully open a leaking QD. Fully opening a leaking QD could trap NH3 and prevent depressing the button in the future. For 1.5 in QDs, insert fwd SPD spacer prior to opening valve	
	N. Mated QD leaks in valve open position (bail fwd)	1. Cycle valve a. Remove SPD if present (aft spacer only for 1.5 in) and fully close valve (bail aft); wait for ice crystals to dissipate b. Open valve halfway (bail fwd). (For 1.5 in, verify fwd SPD spacer installed prior to opening valve) c. Describe leak size and if leak rate is changing 2. If leak has stopped, on **MCC-H GO**: Complete valve open steps; else: Repeat step 1 3. On **MCC-H GO**: Remove SPD if in place; push bail full fwd to engage secondary seal, verify detent button is up and aft white band is visible 4. Close valve; notify **MCC-H** 5. If applicable, close valve of appropriate QD in flowpath, verify detent button is up, and fwd white band is visible

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	O. Female QD leaks due to FID	1. Return bail to aft position (valve closed) 2. Perform release ring snap back test • If FID is observed, demate and remate QD
	P. Male QD leaks after cap removal	1. If leak small, mate female QD; continue ops 2. Reinstall cap; notify **MCC-H** CAUTION Do not fully open a leaking QD. Fully opening a leaking QD could trap NH3 and prevent depressing the button in the future. For 1.5 in QDs, insert fwd SPD spacer prior to opening valve
	Q. QD leaks after valve close operation WARNING Bail may kick back and contact crew when a stuck button is forcibly depressed due to pressure build-up in spring cavity	1. Cycle Valve a. Open valve halfway (bail fwd). (For 1.5 in, install fwd SPD spacer prior to opening valve) b. Contact **MCC-H**; describe leak size and if leak rate is changing; wait for ice crystals to dissipate c. On **MCC-H GO**, re-close QD; inform **MCC-H** if leak still present and quantify leak 2. If still leaking, contact **MCC-H** to determine if male leaking. (THOR will monitor pressure drop) 3. On **MCC-H GO**, demate QD and inspect 4. If still leaking, contact **MCC-H** for direction. Depending on the situation further direction could include: Living with the leak, using a QD extender, additional cycles of the QD, apply radial force to tube stub with valve open or other real-time decisions
	R. Female QD leaks after demate	1. Contact **MCC-H**: Describe leak size and if leak rate is changing 2. Depending on the situation, **MCC-H** could recommend the following actions: Continuing ops, using a QD extender, or other real-time decisions
	S. Male QD leaks after demate (male sleeve may be visibly stuck open) 	1. Contact **MCC-H**: Describe leak size and if leak rate is changing 2. If leak is small and dissipating and does not interfere with EVA: Press with operations on **MCC-H GO** 3. If leak is large: Remate female QD and open valve (bail fwd) a. Depress button and use significant force to push bail forward; release button b. With QD in open position (bail fwd) apply significant force to aft end of the female QD in side-to-side & up and down directions (radially from tube stub) c. Attempt to close valve (bail aft) d. Demate QD and inspect 4. If applicable, close valve of appropriate QD in flowpath, verify detent button is up, and fwd white line is visible 5. On **MCC-H GO**: Install cap
	T. Frozen NH3 present on female or male QD	1. Leave QD exposed to vacuum; wait maximum of 5 min for sublimation (check periodically) 2. On **MCC-H GO**: Continue QD ops. (NH3 may sublimate during QD mating)

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	SPD	
	U. ½ in SPD cannot be installed	1. If aft portion of SPD not fully seated, move bail fwd slightly to allow SPD to fully seat 2. After bail secured in slot on slider, wire tie in place
	V. ½ in SPD cannot be removed	Increase force on SPD slider (1/2 in SPD sliders can be sticky)
	W. 1.5 in aft SPD spacer cannot be installed	1. Install fwd SPD spacer; ensure bail against fwd SPD 2. Wire tie bail to keep it against SPD; restrain aft SPD with wire tie, if reqd
	X. 1.5 in fwd SPD spacer cannot be installed	1. Install aft SPD spacer; ensure bail against aft SPD 2. Wire tie bail to keep it against SPD; restrain fwd SPD with wire tie, if reqd
	Vent Tool	
	Y. Tip of vent tool does not pass black mark during alignment check	Slide equipment hook further away from vent tool nozzle end
	Z. Vent tool cannot be mated to Vent Tool Extender	Hold VTE adapter in sunlight to warm it up. (Known tolerance issue between cold VTE adapter and vent tool nozzle)

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION

Mate QD

1. Remove QD caps as required
2. Inspect male and female QD for debris or damage
3. Verify female QD ready to mate
   - √Detent button – up
   - √Locking collar – locked position
   - √Fwd white band – not visible
4. Assess and counteract side loads prior to mate
5. Mate QD
   - √Fwd white band – visible
6. Perform snapback test
   - √Fwd white band visible
7. Perform pull test (Stay clear of button and release ring)
8. Perform visual gap test

Open Valve (1/4 inch)

1. Prior and during bail movement assess and counteract side loads
2. Depress detent button
3. Push bail to forward position
4. √Aft white band visible
5. √Detent button – up

Open Valve (1/2 inch)

1. Prior and during bail movement assess and counteract side loads
2. Rotate locking collar to unlocked position
3. Depress detent button
4. Push bail fwd, so aft white band just begins to show
5. Pull lock knob up on SPD
6. Slide SPD slider aft
7. Install SPD
8. Slide SPD slider fwd to engage bail handle
9. Push bail toward closed position up against slider
10. Push lock knob down on SPD; perform pull test on SPD

Open Valve (1 inch)

1. Prior and during bail movement assess and counteract side loads
2. Rotate locking collar to unlocked position
3. Depress detent button
4. Push bail to forward position
5. √Aft white band visible
6. √Detent button – up
7. Install 1 in SPD if present; verify locking tabs engage; perform pull test
8. Rotate locking collar to locked position, if present and no SPD

Demate QD

1. Assess and counteract side loads prior to demate
2. Pull back on release ring and demate QD
3. √Release ring – retracted (FWD white band not visible)
4. Inspect male and female QD for debris, damage, or anomalous conditions (ammonia crystals)
5. If complete with QD ops: Rotate locking collar to locked position (1/2, 3/4, & 1 in only)
6. Install QD caps as required; verify lock tab engaged

Close Valve

CAUTION

Do not fully open a leaking QD. Fully opening a leaking QD could trap NH3 and prevent depressing the button in the future. For 1.5 in QDs, insert fwd SPD spacer prior to opening valve

1. If present, remove SPD
2. Rotate locking collar to unlocked position (1/2, 3/4, & 1 in only)
3. √Aft white band visible
4. √Detent button fully installed
5. √Detent button up
6. √Detent button can be depressed
7. Prior and during bail movement assess and counteract side loads
8. Push bail toward open position with significant force while depressing detent button (unstick male sleeve seals)
9. Depress detent button, move bail aft (close valve)
10. √Fwd white band visible
11. √Detent button up
12. If complete with QD ops: Rotate locking collar to locked position (1/2, 3/4, & 1 in only)

Open Valve (3/4 inch)

1. Prior and during bail movement assess and counteract side loads
2. Rotate locking collar to unlocked position
3. Depress detent button
4. Push bail to forward position
5. √Aft white band visible
6. √Detent button – up
7. Rotate locking collar to locked position

Open Valve (1.5 inch)

1. Install forward SPD spacer aft of release ring
2. Prior and during bail movement assess and counteract side loads
3. Depress detent button
4. Push bail against fwd SPD spacer
5. Install aft SPD spacer

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	FRAM	
	A. Primary FRAM bolt fails to release NOTE 4 of 4 contingency pins reqd for Shuttle PLB return. 3 of 4 contingency pins reqd for On-Orbit stowage. FRAM electrical connectivity fully lost at 0.95 turns on primary bolt. Partial electrical connectivity lost at 0.45 turns on primary bolt. Minimum mechanical configuration is maintained with less 2.2 turns on primary bolt (but pins highly desired time permitting) NOTE for Removal: For LWAPA, SAPA, CEPA, and EXPA: For primary drive turn count of 2.2-4.7 turns, go for install of rear contingency pins due to uncertainty in PGT/Turn count. Failure to engage rear contingency pin to INSTALL location confirms turn count is 4.7 or less. Rear Contingency Pins, aft contingency pins can only be installed if the primary bolt turn count is 4.7 turns or more. With less than 4.7 turns on the primary bolt, the contingency pins are not needed and cannot be installed	1. Confirm socket fully engaged to release anti-rotation mechanism 2. Increase PGT setting: SAPA, MAPA, LAPA, LWAPA **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A4 (6.3) for full run-out of bolt** CEPA and ExPA **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A7 (9.2) for full run-out of bolt** 3. On **MCC-H GO**: Increase PGT setting: SAPA, MAPA, LAPA, LWAPA **PGT: [B4 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A4 (6.3) for full run-out of bolt** CEPA and ExPA **PGT: [B4 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A7 (9.2) for full run-out of bolt** 4. Reattempt engagement of primary drive with nominal PGT settings 5. Engage contingency pins: - Front pins (all FRAMs) **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** 0.11 + (1.25 * Turns on Primary Bolt) turns - Aft pins for MAPA and LAPA **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** If Primary Drive disengaged more than 8.8 turns: - Insert Contingency Pins to hardstop at 13.8 turns If the Primary Drive disengaged less than 8.8 turns use the following equation for turns needed: 2.858 + (1.25* Turns on Primary Bolt) = # of total turns needed [Stop on torque, verify turns] - Aft pins for LWAPA, SAPA, CEPA, and ExPA - Remove bolt from STOW location and engage in INSTALL location - Manually turn bolt as far as possible - PGT**: [B1 (12.0), CW2, 30.5], 7/16 - 6-ext** - Aft pins for LMC FRAMs - Prep CPK by disengaging J-hook on locking mechanism; ensure J-hook fully seated in unlock position - Slide T-handle until contingency pin contact primary FRAM pin (# on locking mechanism counter – # of turns on primary FRAM bolt) - Engage J-hook lock (will “pop” into place if not precisely aligned with numbered slot); ensure J-hook fully seated in lock position
	B. Active FRAM fails to seat on passive FRAM	1. Check for FOD in mechanism 2. Check alignment (engage 2 forward shear pins first to ensure connector door is not jamming)

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	C. Primary FRAM bolt fails to engage NOTE 4 of 4 contingency pins reqd for PLB shuttle return. 3 of 4 contingency pins reqd for On-Orbit stowage. FRAM electrical connectivity begins at 10.25 turns on the primary bolt. Complete electrical mate is expected between 10.5-10.75 turns. Minimum mechanical configuration is 9 turns on primary bolt, to not need contingency pins (but pins highly desired time permitting) NOTE for Engage: For LWAPA, SAPA, CEPA, and EXPA: For primary drive turn count of 6.5-9 turns, go for install of rear contingency pins due to uncertainty in PGT/Turn count. Failure to engage rear contingency pin to INSTALL location confirms turn count is 6.5 or more. Aft contingency pins can only be installed if the primary bolt turn count is 6.5 turns or less. With greater than 6.5 turns on the primary bolt, the contingency pins are not needed and cannot be installed	1. Verify FRAM 2. Check for FOD 3. Back out primary bolt fully at nominal setting. If removal isn't successful at nominal setting Increase PGT setting for disengagement: SAPA, MAPA, LAPA, LWAPA **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A4 (6.3) for full run-out of bolt** CEPA and ExPA **PGT: [B2 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A7 (9.2) for full run-out of bolt** On **MCC-H GO**: Increase PGT setting: SAPA, MAPA, LAPA, LWAPA **PGT: [B4 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A4 (6.3) for full run-out of bolt** CEPA and ExPA **PGT: [B4 (16.0), CCW2, 30.5], 7/16 - 6-ext 1 turn only to break torque; reset PGT to A7 (9.2) for full run-out of bolt** 4. Reattempt engagement SAPA, MAPA, LAPA, LWAPA, CEPA and ExPA **PGT: [A7 (9.2), CW2, 30.5], 7/16 - 6-ext** Increase PGT setting: SAPA, MAPA, LAPA, LWAPA, CEPA and ExPA **PGT: [B2 (16.0), CW2, 30.5], 7/16 - 6-ext** On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (19.4), CW2, 30.5], 7/16 - 6-ext** 5. Consider hold for thermal stabilization between active and passive FRAM 6. Engage contingency pins: - Front pins (all FRAMs) **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** 14.11 – (1.25 * Turns on Primary Bolt) turns - Aft pins for MAPA and LAPA **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** If Primary Drive inserted less than 2.4 turns: - Insert Contingency Pins to hardstop at 13.8 turns If the Primary Drive inserted greater than 2.4 turns, use the following equation for turns needed: 16.858 – (1.25* Turns on Primary Bolt) = # of total turns needed [Stop on torque, verify turns] - Aft pins for LWAPA, SAPA, CEPA, and ExPA - Remove bolt from STOW location and engage in INSTALL location - Manually turn bolt as far as possible - **PGT: [B1 (12.0), CW2, 30.5], 7/16 - 6-ext** - Aft pins for LMC FRAMs - Prep CPK by disengaging J-hook on locking mechanism; ensure J-hook fully seated in unlock position - Slide T-handle until contingency pin contact primary FRAM pin (# on locking mechanism counter – # of turns on primary FRAM bolt) - Engage J-hook lock (will "pop" into place if not precisely aligned with numbered slot); ensure J-hook fully seated in lock position

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GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	D. Rotating Latches fail to retract during FRAM removal from Square Grid Interface	1. Lift FRAM so that rotating latches contact square grid 2. Cycle primary drive bolt
	E. Rotating Latches not retracted prior to installation onto Square Grid Interface	Push rotating latches to retracted position with tool or tether hook
	MMOD Shield	
	A. MMOD shield Dzus fastener fails to release WARNING Do not touch back side of MMOD shield or handle fastener fragments due to sharp edges Fastener and shield/tool interface must be covered to avoid potential projectiles	On **MCC-H GO**: Use pry bar to release a. Retrieve pry bar and emptied med ORU bag b. Release other Dzus fasteners c. Assess clearance between MMOD shield and tools d. If possible, rotate fastener to position tangs off of tools e. Place med ORU bag over failed fastener f. Insert pry bar under MMOD shield by failed fastener and pry shield away from structure
	B. MMOD shield Dzus fastener fails to engage	1. Verify center fastener is engaged first 2. Check Dzus fastener aligned with bracket (floating receptacles on endcones) 3. Verify fastener clocking correct per alignment mark 4. Push firmly and rotate 5. Engage other fasteners: 2 out of 3 required 6. If 2 of 3 not achieved: • Option 1 (Wire Tie) (See figures 2-4): 1 properly secured wire tie = 1 Dzus fastener; Using a long wire tie, squish the loop on one end, feed it through the bracket on structure (may need to push floating receptacle inboard to get it out of way), secure wire tie w/3 twists. Feed one end of wire tie around Dzus head (on outside of shield) and secure with 3 twists. If HR nearby can also secure wire tie to HR. (Goal is for the wire tie to push shield in toward body of structure and toward center if endcone shield) • Option 2 (LDTDT): Use 1 adj. (Attach to tether point on T tool and to structure HR) and 1 LDTDT across shield to hold shield in position
	C. T-handle tool fails to engage shield	Remove adjacent fasteners and attempt reinstallation
	D. MLI grounding strap Dzus fails to release	On **MCC-H GO**: Cut ground wire near Dzus fastener

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION

Figure 2 - MMOD Shield Wire Tie Option

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION

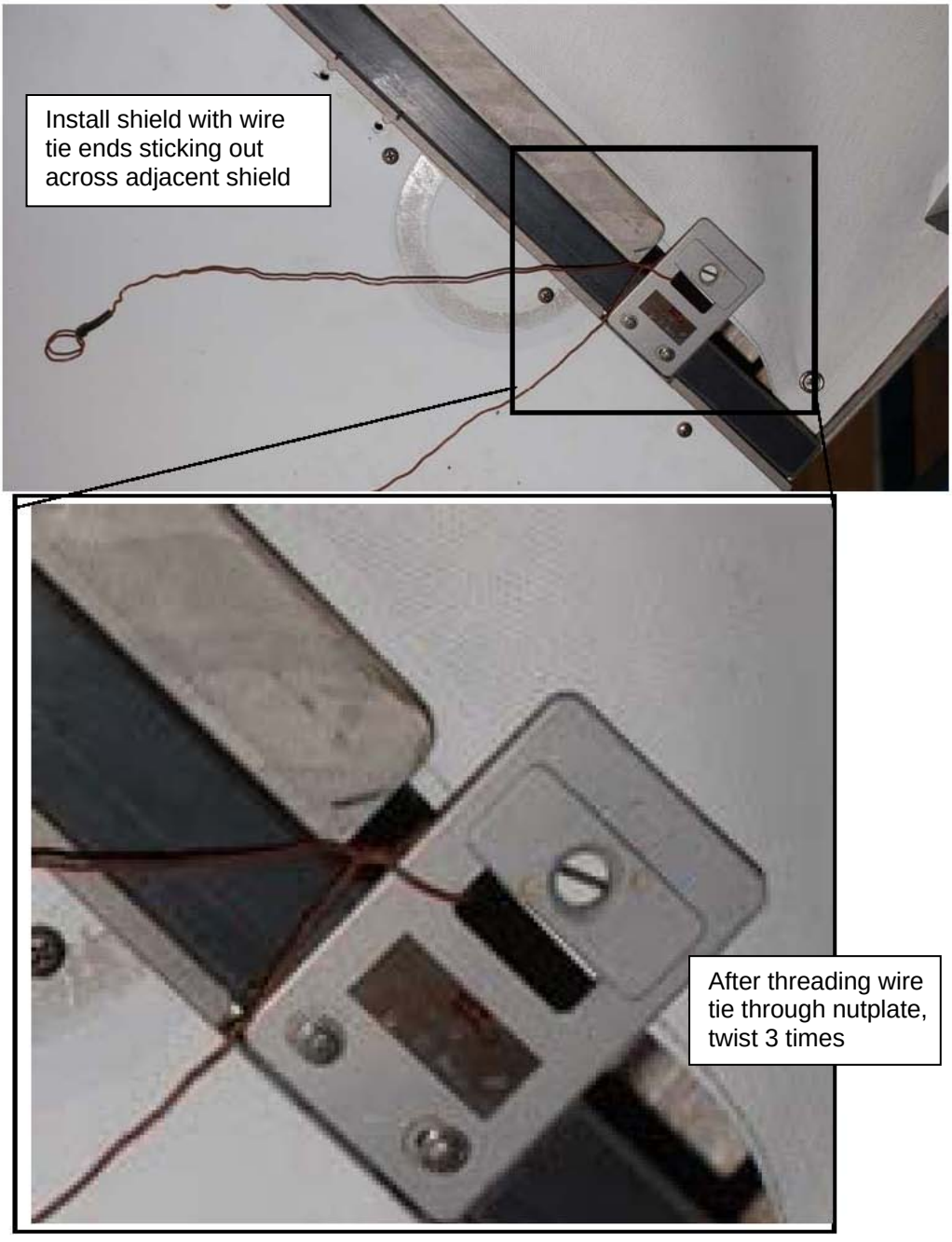
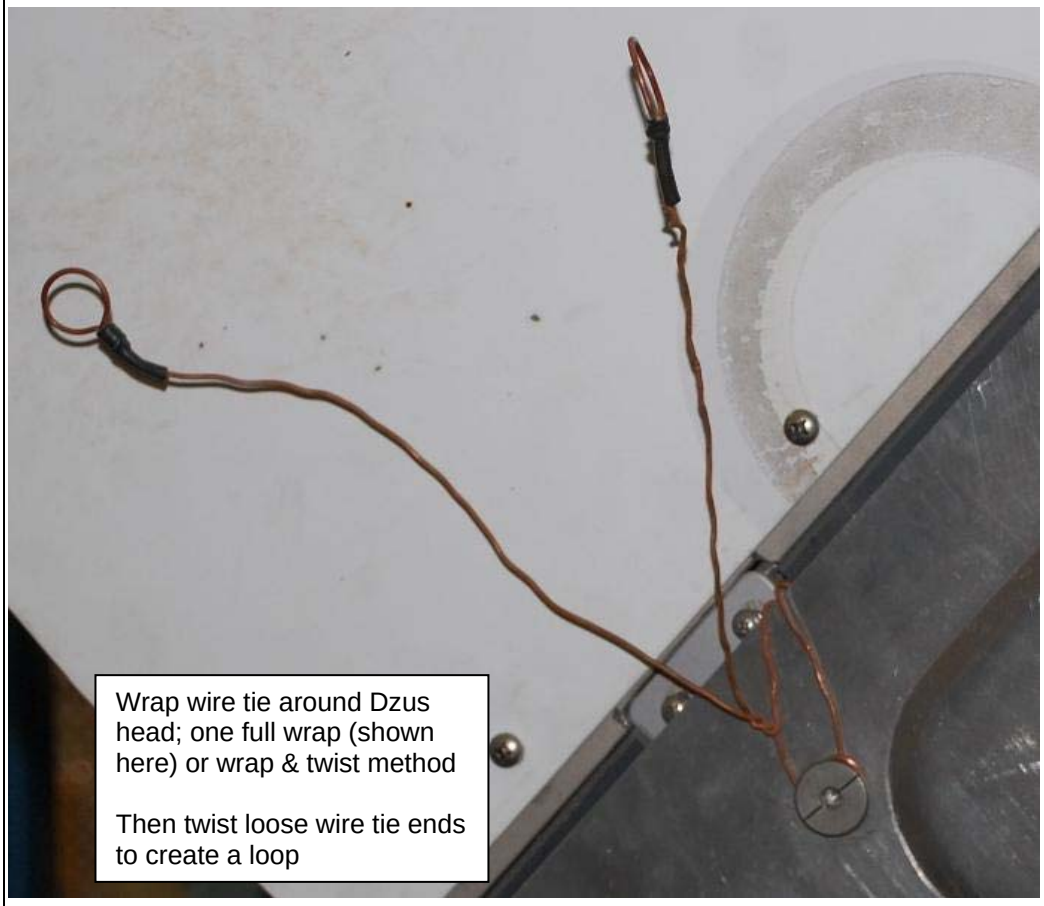


Figure 3 - MMOD Shield Wire Tie Option (Cont)

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	 Figure 4 - MMOD Shield Wire Tie Option (Cont)	
	MUT EE	
	A. MUT EE jaws fail to release	1. Verify locking collar fully released 2. Shake MUT EE while depressing paddles to alleviate sideloads from handrail 3. Release MUT EE ECOM socket and tether MUT EE to structure
	MWS	
	A. MWS EE is sticky	Known problem. Report degree of stickiness to **MCC-H** and any noted correlation with thermal environment. Post EVA, report s/n of affected unit (s/n located on "stem" of T-bar)
	B. MWS EE cord fails to retract	1. Verify MWS EE tether lock in unlock position 2. Cycle MWS EE tether lock 3. Check tether reel opening for FOD 4. Pull out small amount of tether and allow reel to retract while holding light tension on the tether
	C. MWS T-bar fails to pivot	1. Check sideloads on T-bar while depressing button 2. Slip T-bar clutch (40-60 lb force required)

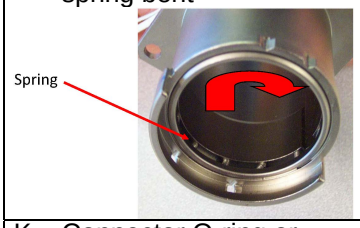
GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	NZGL Connectors	
	A. Bail bar fails to slide over-center	1. Inspect bail for FOD 2. Inspect bail linkage for damage and report to **MCC-H** 3. Check alignment and sideloads 4. Verify sufficient TA-clamps are open 5. Increase force on bail 6. Attach 2 hooks from adj tether to connector bail and use adj strap to pull bail into demated position 7. On **MCC-H GO**: Retrieve vise grips to help increase force on bail
	B. Backshell fails to slide (after over-center mechanism has been overcome)	1. Verify sufficient TA-clamps are open 2. Check for cable harness and hardware interference 3. Check alignment and sideloads 4. Inspect bail and connector for FOD 5. Inspect bail linkage for damage and report to **MCC-H** 6. Wiggle/jiggle connector while pushing or pulling on backshell 7. Attach 2 hooks from adj tether to connector bail and use adj strap to pull bail into demated position 8. On **MCC-H GO**: Retrieve vise grips to help increase force on bail
	C. Connector fails to release from soft dock	1. Verify bail fully thrown, undamaged, and backshell fully aft 2. If backshell springs forward, pull and hold in fully aft position (will have to overcome spring force, approx. 5-10 lb) while attempting to demate connector 3. Verify sufficient TA-clamps are open 4. Check for cable harness and hardware interference 5. Check alignment and sideloads 6. Relieve compression on connector interface due to cable loads by pulling backshell away from jack 7. Push the plug towards the jack to compress the soft dock 8. Wiggle/jiggle connector. (Use slight rolling motion)
	D. Connector fails to soft dock	1. Verify correct plug and jack 2. Verify bail fully aft 3. Verify backshell fully aft and remains fully aft. If backshell not fully aft, pull and hold in fully aft position while attempting to soft dock connector 4. Inspect the following: • O-ring seal • FOD • Bend radius • Soft dock springs • Connector keying feature 5. Verify alignment. (Avoid excessive rolling or rocking the plug as this could unseat soft dock springs) • Connector should snap into soft dock with little force once half shells are aligned

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	E. Connector fails to mate	1. Verify half-shells are fully seated on both sides 2. Verify cable and backshell free to move (no clamps) 3. Push forward on connector backshell while actuating bail 4. Detach from soft dock and inspect: • Pins • FOD • EMI band • Bend radius • TA clamps • P clamps • Bail linkages and rivets • Soft dock springs • O-ring seal and main joint gasket • Connector keying feature 5. Cycle bail while disconnected (push forward on connector backshell for additional leverage)
	F. Connector pin bent	1. Rotate connector to bail up position and describe pin location and condition • Obtain WVS view of interface if possible 2. On **MCC-H GO**: For 16, 20, or 22 gauge pins only, retrieve pin straightener and attempt pin repair • **MCC-H** will verify pin size prior to retrieving tools 3. On **MCC-H GO**: Retrieve needle nose pliers and attempt pin repair 4. Inspect plug and jack prior to re-mating
	G. Connector FOD	1. On **MCC-H GO**: Remove FOD with connector cleaner tool a. Retrieve connector cleaner tool NOTE One N2 cartridge is already captured in the tool (the other is lanyarded inside the caddy). In order to puncture the cartridge, it must be threaded into the tool until the indicator line passes out of sight under the collar of the tool. Puncture connector cleaner cartridge only when ready to perform actual cleaning. Use entire N2 cartridge prior to reentering airlock b. Attempt cleaning
	H. Connector EMI band bent 	On **MCC-H GO**: Retrieve needle nose pliers or forceps to remove band • Bail may need to be pushed forward while demated to expose EMI band for removal
	I. Connector bail linkage failure	1. On **MCC-H GO**: Re-attempt connector mate/demate with broken bail • Impart load through undamaged side of bail linkage • Assist bail motion with hand on backshell once bail linkage has passed over-center • May take multiple pushes on the bail to mate/demate connector 2. Tether hook or vise grips may be used for additional leverage

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	J. Connector soft dock spring bent 	On **MCC-H GO**: Retrieve needle nose pliers and remove bent spring
	K. Connector O-ring or main joint gasket seal loose (seal and O-ring required in 1-G only)	1. Remove seal with tether hook 2. On **MCC-H GO**: Retrieve additional tools to remove seal. (Ex., wire tie, needle nose pliers, probe, loop pin puller)
	L. Connector cap (Twist) will not release	1. Increase force 2. Use tether hook for additional leverage 3. On **MCC-H GO**: Attach equip hook to cap tether point and use strap of adj tether to release cap
	On-Orbit Installed HR	
	A. HR will not install in seat track or fails to soft dock	1. Verify HR installed in correct direction per arrow on underside of HR 2. Verify HR shoes are completely released and soft dock armed 3. Check for FOD on HR and seat track 4. Verify HR bolt completely released: **PGT [A1 (2.5), CCW2, 30.5], 7/16 - 6-ext** 5. If HR in seat track but soft dock will not engage, attempt to drive HR bolts 6. On **MCC-H GO**: Depending on HR priority, attempt to install 180 out or a different HR at this location
	B. HR bolt fails to fully engage	1. If torqued, remove HR: **PGT [A2 (3.8), CCW2, 30.5], 7/16 - 6-ext** • To break torque **PGT [A1 (2.5), CCW2, 30.5], 7/16 - 6-ext** • For removal: Check for FOD on HR and seat track and reinstall using original torque 2. Increase PGT setting: **PGT [A3 (4.8), CW2, 30.5], 7/16 - 6-ext** 3. On **MCC-H GO**: Depending on HR priority, attempt to install 180 out or a different HR at this location
	On-Orbit Installed WIF	
	A. WIF fails to soft dock	1. Check for FOD and structural interference, cycle soft dock pins; reattempt installation 2. Verify WIF is co-planar to structure 3. Install a different WIF at this location 4. On **MCC-H GO**: Attempt installation of WIF in a different location 5. Return WIF inside
	PAD	
	A. Release knob fails to rotate open	1. Verify knob in release position (J-hook not locked) 2. Attempt to rotate knob using ratchet on knob's 7/16 in hex stud 3. Release contingency release bar captive bolts (2) **PGT [A6 (8.3), CCW2, 30.5], 7/16 - 6 ext** 5 turns (Verify hook released from striker bar)
	PGT	
	A. No LEDs	1. Perform LED test 2. Use display torque
	B. LEDs and torque messages do not agree	Use torque message and notify **MCC-H**
	C. Mode switch breaks	Retrieve spare PGT

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	D. NEED TO CAL displayed during PGT operation after calibration complete	1. Power cycle and calibrate 2. Retrieve spare PGT 3. Power off and switch to ratchet mode
	E. TRIG TO CAL displayed with Mode collar set to MTR (Display should nominally read NEED TO CAL)	1. Set Mode collar to RCW or RCCW a. Depress Trigger; Verify CAL PASSED b. Set Mode collar to MTR c. Verify good LED Test 2. Power Off a. Set Mode collar to RCW or RCCW b. Verify Speed collar in CAL c. Power On d. Verify TRIG TO CAL on display e. Complete calibration; Continue Ops 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	F. PGT fails to drive with Mode collar set to MTR	1. Power cycle and calibrate 2. Set Mode collar to RCW or RCCW a. Depress Trigger; Verify CAL PASSED b. Set Mode collar to MTR c. Verify good LED Test 3. Power Off a. Set Mode collar to RCW or RCCW b. Verify Speed collar in CAL c. Power On d. Verify TRIG TO CAL on display e. Complete calibration; Continue Ops 4. Retrieve spare PGT 5. Power off and switch to ratchet mode
	LCD Messages	
	G. BATTRY HITEMP	1. Power off PGT 2. If alternate battery available; change battery 3. Retrieve spare PGT 4. Switch to ratchet mode
	H. BATTRY LOTEMP (blinking)	1. Drive tool with no load to increase battery temperature 2. If alternate battery available; power off and change battery 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	I. BATTRY LOVOLT (blinking)	1. Continue using tool until unable to deliver sufficient torque 2. Retrieve spare PGT 3. Power off and switch to ratchet mode
	J. CAL FAILED	1. Press, release trigger to repeat calibration 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	K. COLLAR ERROR	1. Cycle torque and speed collars to clear error 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	L. COMPAR ERROR	1. Cycle torque collar and A/B mode switch 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	M. EEPROM WR ERR (blinking) HYBRID HITEMP OVER CURR SLFTST FAIL X	1. Power cycle and calibrate 2. Retrieve spare PGT 3. Power off and switch to ratchet mode

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	N. HI TORQ	1. Contact **MCC-H** and report torque (Real time engineering assessment required) 2. On **MCC-H GO**: Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	O. HICURR	1. Reattempt operation • Can be caused by excessive rotation of the PGT body while torquing 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	P. LO TORQ (Expected during bolt release)	1. Reattempt operation until desired torque is reached 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	Q. LOCURR	1. Reattempt operation 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	R. LOG IS FULL (blinking)	1. Cycle torque and speed collars to clear message 2. Continue operation
	S. MOTOR HITEMP	1. Power off PGT 2. Retrieve spare PGT 3. Switch to ratchet mode
	Safety Tether	
	A. Safety tether fails to retract/tend	1. Verify reel is unlocked 2. Verify tether reel and/or cable guide (for 85-ft tethers) is clear of FOD 3. Pull out small amount of cable and allow reel to retract while holding light tension on the cable 4. Tap side of reel housing during retraction 5. Report ID # of faulty tether to **MCC-H** and use alternate safety tether 6. Coil safety tether to bring inside 7. For 85-ft tether. On **MCC-H GO**: If coiling tether is not practical, release level wind mechanism bypass on back of safety tether. (Red indicator will show around edge of bypass once released) NOTE Once level wind has been released cable guide will likely be frozen in place. This will limit the amount of tether that can be successfully retracted into the tether housing and may require coiling of excess tether. Level wind release will require safety tether be returned for ground servicing. If tether fails to retract due to thermal issue, normal tether function may return after tether brought IVA

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	B. Safety tether red stripe showing (any length)	1. Use alternate safety tether 2. Connect waist tether to ERCM body as alternative load alleviation (Double Tether) 3. Inspect "Through" tack stitches. Tether NO-GO until tack stitching inspected. (Reference Crew Tether Inspection procedure) a. 1 of 2 stitches is required for tether to be GO for use b. If both "Through" stitches are broken, safety tether NO-GO for use • Report ID # of faulty tether to **MCC-H** • Use alternate safety tether
	C. Crew hook fails	1. On load alleviating end: Use waist tether to replace alleviating strap • Report ID # of faulty tether to **MCC-H** • Retrieve replacement safety tether 2. On anchor end: Report ID # of faulty tether to **MCC-H** and use an alternate safety tether
	Scoops	
	A. Scoop will not release from fitting	1. If actuator will not pull back while in locked position, tap actuator with tool to release 2. On **MCC-H GO**: Leave scoop in place 3. On **MCC-H GO**: Remove non-captive contingency screws; 5 turns. Stow in trash bag **PGT [A1 (2.5), CCW2, 30.5], 5/32 Allen drive** • Square Scoop: 4 screws (figure 5) • Round Scoop: 7 screws (figure 6)

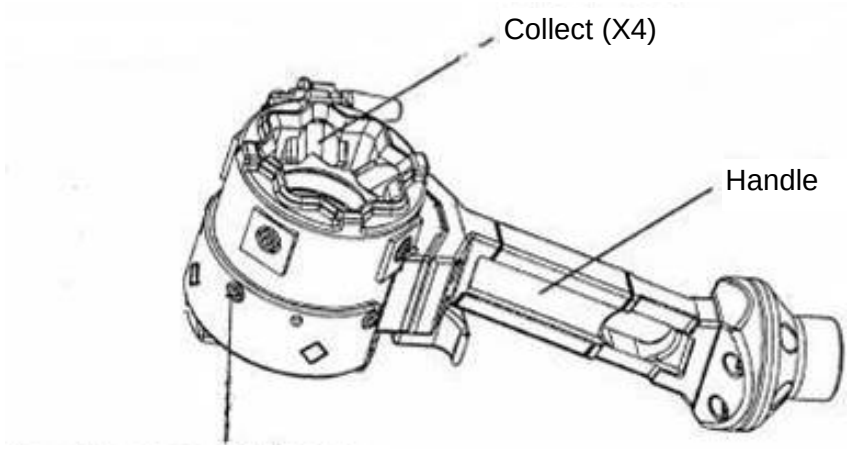
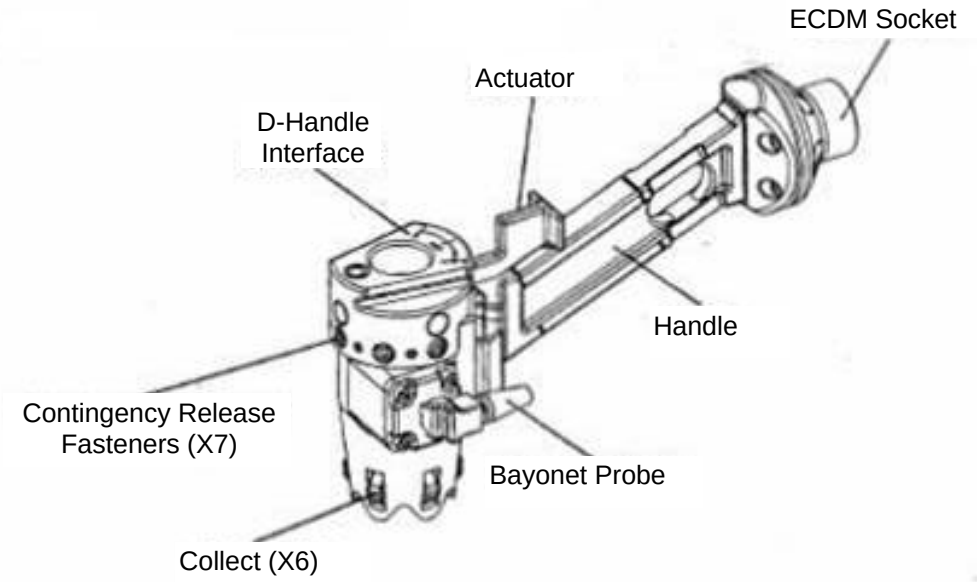
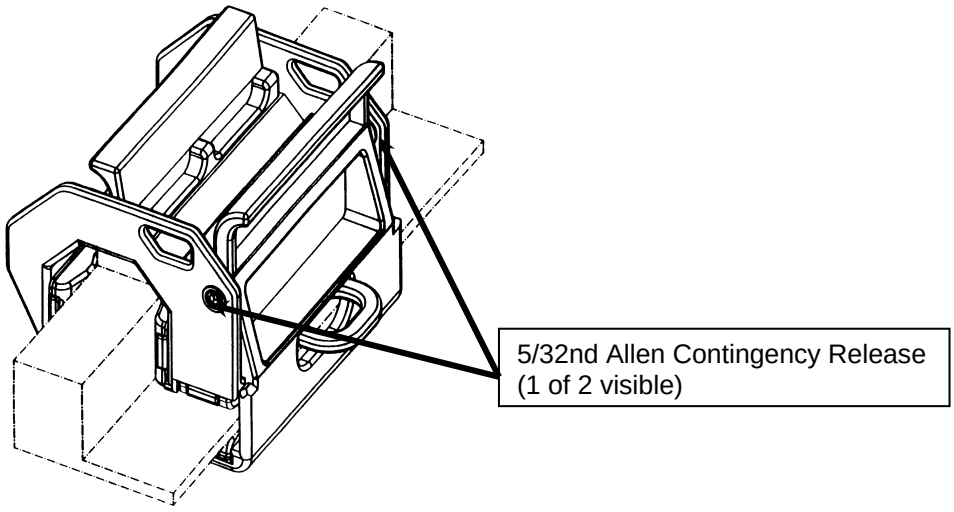
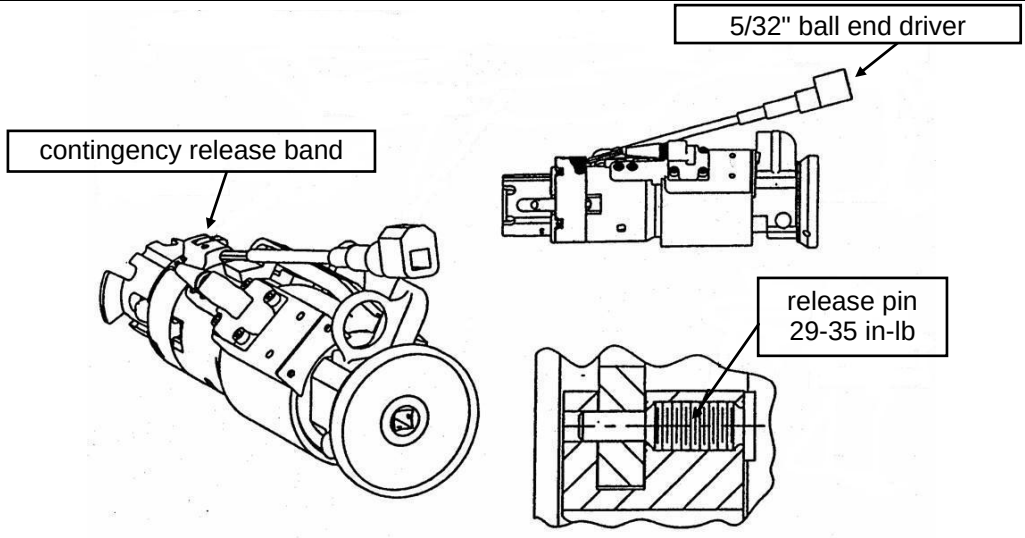


Figure 5 - Square Scoop

GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	 Figure 6 - Round Scoop	
	Socket Caddy	
	A. Socket fails to release from socket caddy	1. Verify PIP pin fully inserted into drop proof tether interface on socket 2. Reattempt using a different PIP pin
	TA Clamp	
	A. TA clamp fails to release	1. With handle up, press down on top of rounded clamp 2. With handle up, use tether hook to pry drawhook from capture pin
	Tether Shuttle	
	A. Tether shuttle will not release from CETA/MT rail	1. Verify slider in unlock and no obstructions to paddle actuation 2. Verify safety tethered to structure and safety tether removed from tether shuttle anchor point 3. On **MCC-H GO**: Remove non-captive screws (2) at hingeline to release nadir section with slide lock (not captive) (figure 7). TBD turns. Stow screws in trash bag **PGT [A1 (2.5), CCW1, 30.5], 5/32 Allen drive**

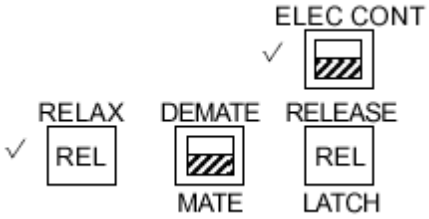
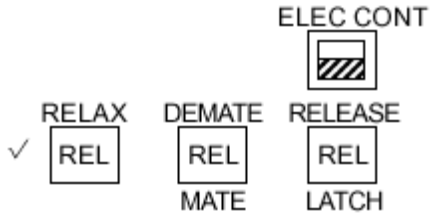
GENERIC CONTINGENCIES (Cont)

TASK	FAILURE	ACTION
	 Figure 7 - Tether Shuttle	
	Torque Multiplier	
	A. TM will not release from fitting	1. Place TM anti-backlash in neutral, if unable: **PGT [RCW, 30.5]** • Apply cw torque while pushing anti-backlash button to neutral. Reattempt removal 2. If able to lift TM off of bolt, attempt to rock off of fitting (Square TM only) 3. On **MCC-H GO**: Release TM contingency release band pin 20 turns (do not exceed 28 turns) (figure 8): **PGT [A1 (2.5), CCW2, 30.5], 5/32 ball end driver** • When band springs open remove TM
	 Figure 8 - Torque Multiplier	
	TSA	
	A. Latch fails to open	Release 7/16 EVA bolt on latch bracket; rotate bracket clear of latch **PGT [A2 (3.8), CCW2, 30.5], 7/16 - 6 ext** 1-2 turns
	B. Latch fails to close	Close remaining latches arrow to arrow (3 of 4 required for landing)

RELEASE ROEU LATCHES

IV	EV
1. DEADFACE ROEU CAUTION Deactivating APCU 2 will remove critical keep-alive power to LCH and IDC. Power must be reapplied within 105 min NOTE With following steps expect: 'S200 APCU 1(2) VOLT LMT' msgs 'S200 APCU 1(2) TRIP' msgs SSP1 √APCU 1 CONV – OFF √OUTPUT RLY – OP (tb-bp) APCU 2 CONV – OFF (tb-bp) OUTPUT RLY – OP (tb-bp) √MPLM CHAN 1,2 HTR PWR (two) – OFF (tb-bp) R1 PL PRI MNC – OFF (tb-OFF) 2. ROEU SAFING R13L √PL BAY MECH PWR SYS 1,2 (two) – OFF A6U √RETEN LOGIC PWR SYS 1,SYS 2 (two) – OFF PL SEL – 1 Give EV GO to release ROEU	Tools reqd: Ratchet with 3-in Ext (Airlock) WARNING For release, do not close access cover until ROEU stowed. Latches may not snap back to closed posn 1. On IV GO, open latch drive access cover: Break safety cord, release access cover (3/4 turn ccw) Open access cover (~120°) Manual drive to RELEASE: Rotate control lever to RELEASE Rotate latch drive cw (~9 ft-lb) to hard stop (~3/4 turn) Remove drive ratchet, clear worksite

RELEASE ROEU LATCHES (Cont)

IV	EV
3. <u>VERIFY TALKBACKS</u> A6U Install <u>ROEU A6U PANEL OVERLAY</u> PL RETEN PL SEL – 2  R13L PL BAY MECH PWR SYS 1,2 (two) – ON A6U PL RETEN LOGIC PWR SYS 1,SYS 2 (two) – ON Note single motor time (> 18 sec) DEMATE/MATE – DEMATE (tb-REL), 36 sec max – OFF  PL RETEN LOGIC PWR SYS 1, SYS 2 (two) – OFF PL SEL – 1 R13L PL BAY MECH PWR SYS 1,2 (two) – OFF	<u>WARNING</u> For release, remain clear of latches during access cover closing. Latches may snap back to closed posn

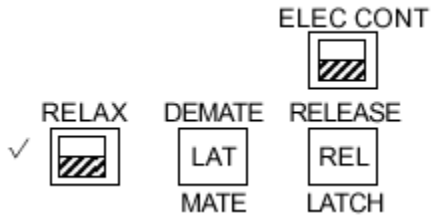
RELEASE ROEU LATCHES (Cont)

IV	EV
4. <u>ENABLE POWER</u> R1 PL PRI MNC – ON (tb-ON) Perform LCH ACTIVATION (LCS Cue Card, PHOTO/TV) Perform LCC ACTIVATION, step 2 (LCS Cue Card, PHOTO/TV) Perform LCC DEACTIVATION, step 1 (LCS Cue Card, PHOTO/TV) **Notify MCC:** "LCC Cue Card steps are complete"	2. Reengage latch actuator: Rotate control lever to neutral posn Close, secure access cover (3/4 turn cw) Clear worksite

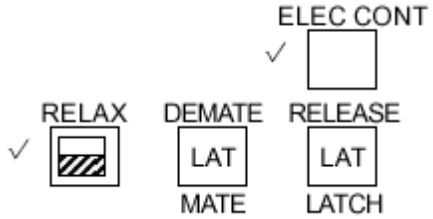
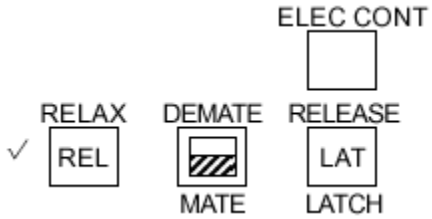
LATCH ROEU LATCHES

IV	EV
1. DEADFACE ROEU CAUTION Deactivating APCU 2 will remove critical keep-alive power to LCH and IDC. Power must be reapplied within 105 min NOTE With following steps expect: 'S200 APCU 1(2) VOLT LMT' msgs 'S200 APCU 1(2) TRIP' msgs SSP1 √APCU 1 CONV – OFF √OUTPUT RLY – OP (tb-bp) APCU 2 CONV – OFF (tb-bp) OUTPUT RLY – OP (tb-bp) √MPLM CHAN 1,2 HTR PWR (two) – OFF (tb-bp) R1 PL PRI MNC – OFF (tb-OFF) 2. CONFIGURE FOR ROEU MATE A6U Install ROEU A6U PANEL OVERLAY R13L √PL BAY MECH PWR SYS 1,2 (two) – OFF A6U RETEN LOGIC PWR SYS 1, SYS 2 (two) – OFF PL RETEN PL SEL – 2 SM 97 PL RETENTION CRT √LAT 1,2,3 (six): 0 * If LATCH 2,3 LAT msw shows 1, drive latch for single motor time *	Tools reqd: Ratchet with 3-in Ext (Airlock)

LATCH ROEU LATCHES (Cont)

IV	EV
3. <u>MATE ROEU</u> A6U PL RETEN LOGIC PWR SYS 1,2 (two) – ON R13L BAY MECH PWR SYS 1,2 (two) – ON Note single motor time (> 30 sec) A6U DEMATE/MATE – MATE (tb-LAT), 60 sec max – OFF  4. <u>ROEU SAFING</u> R13L PL BAY MECH PWR SYS 1,2 (two) – OFF A6U RETEN LOGIC PWR SYS 1, SYS 2 (two) – OFF PL SEL – 1 Give EV GO to latch ROEU	1. On IV GO, open latch drive access cover: Break safety cord, release access cover (3/4 turn ccw) Open access cover (~120°) Manual drive to LATCH: Rotate control lever to LATCH Rotate latch drive ccw (~9 ft-lb) to hard stop (~3/4 turn) Remove drive ratchet, clear worksite

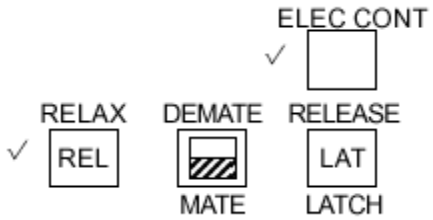
LATCH ROEU LATCHES (Cont)

IV	EV
5. <u>VERIFY TALKBACKS</u> A6U PL RETEN PL SEL – 2  6. <u>RELAX ROEU</u> R13L PL BAY MECH PWR SYS 1,2 (two) – ON A6U RETEN LOGIC PWR SYS 1,SYS 2 (two) – ON <u>NOTE</u> Monitor PL SEL 2 LATCH 1 REL SYS msws on SPEC 97 Note single motor time (> 12 sec) RELAX – RELAX (tb-REL), 24 sec max When LATCH 1 REL A(B) msw changes to 1: RELAX – OFF  PL RETEN LOGIC PWR SYS 1,2 (two) – OFF R13L BAY MECH PWR SYS 1,2 (two) – OFF	2. Reengage latch actuator: Rotate control lever to neutral posn Close, secure access cover (3/4 turn cw) Clear worksite

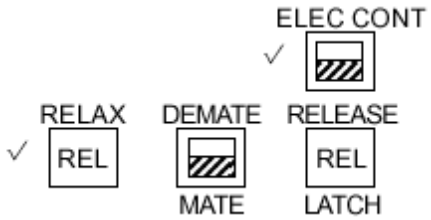
LATCH ROEU LATCHES (Cont)

IV	EV
7. <u>ENABLE POWER</u> R1 PL PRI MNC – ON (tb-ON) Perform LCH ACTIVATION (LCS Cue Card, PHOTO/TV) Perform LCC ACTIVATION, step 2 (LCS Cue Card, PHOTO/TV) Perform LCC DEACTIVATION, step 1 (LCS Cue Card, PHOTO/TV) **Notify MCC:** "LCC Cue Card steps are complete"	

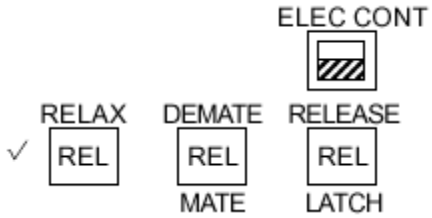
STOW ROEU ARM

IV	EV
1. DEADFACE ROEU CAUTION Deactivating APCU 2 will remove critical keep-alive power to LCH and IDC. Power must be reapplied within 105 min NOTE With following steps expect: 'S200 APCU 1(2) VOLT LMT' msgs 'S200 APCU 1(2) TRIP' msgs SSP1 √APCU 1 CONV – OFF √OUTPUT RLY – OP (tb-bp) APCU 2 CONV – OFF (tb-bp) OUTPUT RLY – OP (tb-bp) √MPLM CHAN 1,2 HTR PWR (two) – OFF (tb-bp) R1 PL PRI MNC – OFF (tb-OFF) A6U Install ROEU A6U PANEL OVERLAY √PL RETEN LAT (five) – OFF PL SEL – 2 SM 97 PL RETENTION √REL 2,3 (four) – 0 * * * If LATCH 2,3 REL msw shows 1, drive latch for single motor time * * *  	Tools reqd: Ratchet with 3-in Ext (Airlock)

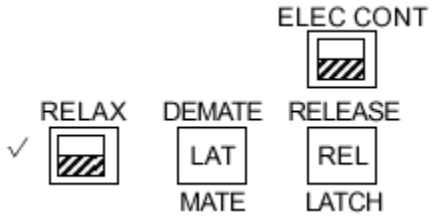
STOW ROEU ARM (Cont)

IV	EV
2. <u>RELEASE LATCHES</u> PL RETEN LOGIC PWR SYS 1,2 (two) – ON R13L BAY MECH PWR SYS 1,2 (two) – ON Note single motor time (> 20 sec) RELEASE/LATCH – REL (tb-REL), 40 sec max – OFF  3. <u>ROEU SAFING</u> R13L PL BAY MECH PWR SYS 1,2 (two) – OFF A6U RETEN LOGIC PWR SYS 1, SYS 2 (two) – OFF PL SEL – 1 Give EV GO to stow ROEU	1. On IV GO, open arm drive access cover: Break safety cord, release access cover (3/4 turn ccw) Open access cover (~120°) Manual drive to STOW: Rotate control lever to STOW Rotate arm drive ccw (~23 ft-lb) to hard stop and pull arm inboard to verify Remove drive ratchet

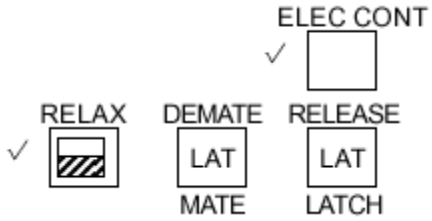
STOW ROEU ARM (Cont)

IV	EV
4. <u>VERIFY TALKBACKS</u> A6U PL RETEN PL SEL – 2  5. <u>ENABLE POWER</u> R1 PL PRI MNC – ON (tb-ON) Perform LCH ACTIVATION (LCS Cue Card, PHOTO/TV) Perform LCC ACTIVATION, step 2 (LCS Cue Card, PHOTO/TV) Perform LCC DEACTIVATION, step 1 (LCS Cue Card, PHOTO/TV) **Notify MCC:** “LCC Cue Card steps are complete”	2. Reengage arm actuator: Rotate control lever to neutral posn Close, secure access cover (3/4 turn cw) Clear worksite

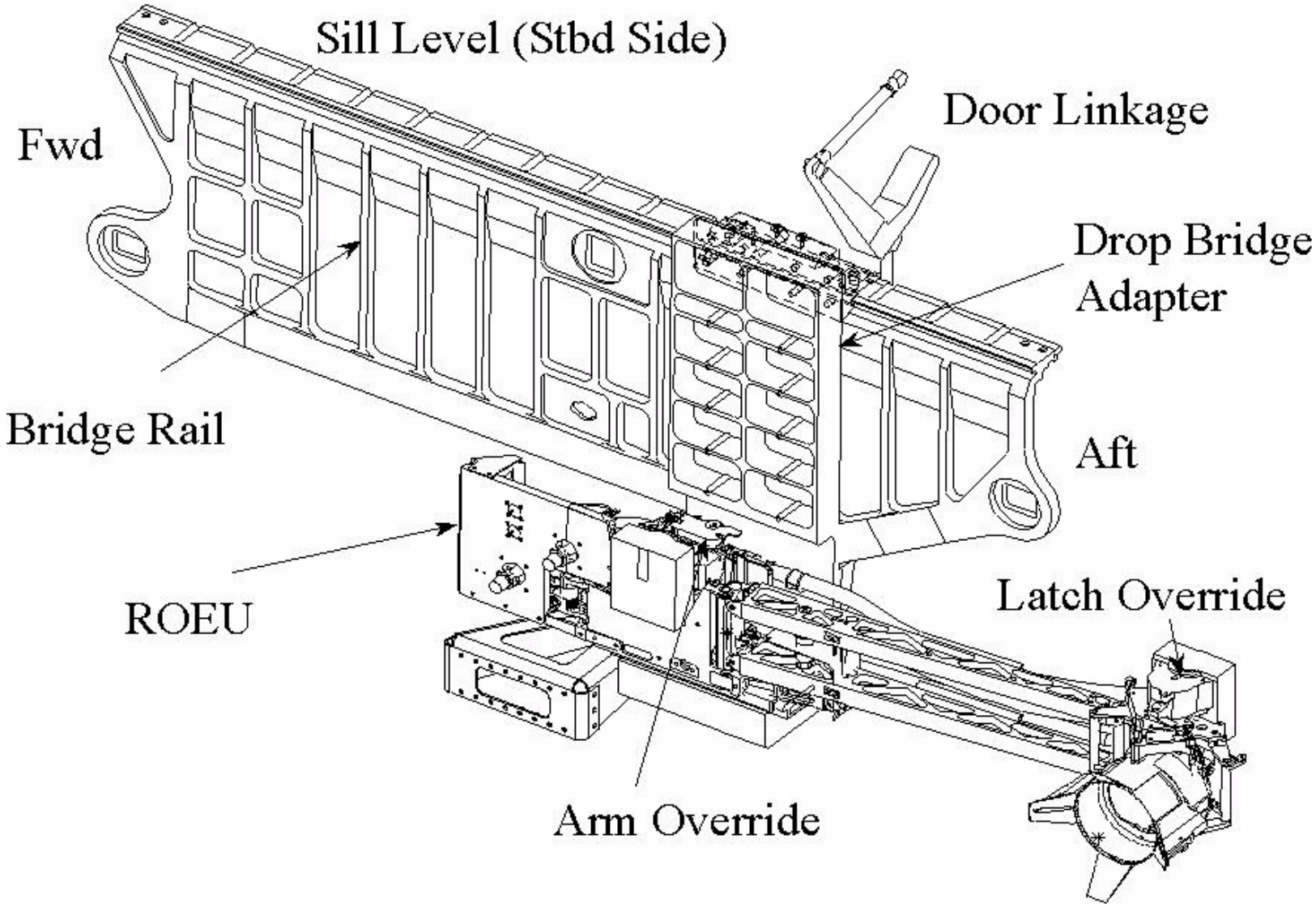
MATE ROEU ARM

IV	EV
1. DEADFACE ROEU CAUTION Deactivating APCU 2 will remove critical keep-alive power to LCH and IDC. Power must be reapplied within 105 min NOTE With following steps expect: 'S200 APCU 1(2) VOLT LMT' msgs 'S200 APCU 1(2) TRIP' msgs SSP1 √APCU 1 CONV – OFF √OUTPUT RLY – OP (tb-bp) APCU 2 CONV – OFF (tb-bp) OUTPUT RLY – OP (tb-bp) √MPLM CHAN 1,2 HTR PWR (two) – OFF (tb-bp) R1 PL PRI MNC – OFF (tb-OFF) 2. CONFIGURE ROEU A6U Install ROEU A6U PANEL OVERLAY 3. VERIFY TALKBACKS A6U PL RETEN PL SEL – 2  	Tools reqd: Ratchet with 3-in Ext (Airlock) 1. On IV GO, open arm drive access cover: Break safety cord, release access cover (3/4 turn ccw) Open access cover (~120°) Manual drive to MATE: Rotate control lever to MATE Ratchet arm drive cw (~25 ft-lb) until "READY TO LATCH" posn indicated on interface guide Remove drive ratchet Clear worksite (for latching)

MATE ROEU ARM (Cont)

IV	EV
4. <u>LATCH LATCHES</u> R13L PL BAY MECH PWR SYS 1,2 (two) – ON A6U RETEN LOGIC PWR SYS 1,SYS 2 (two) – ON Note single motor time (> 20 sec) RELEASE/LATCH – LATCH (tb-LAT), 40 sec max – OFF  PL RETEN LOGIC PWR SYS 1,SYS 2 (two) – OFF R13L BAY MECH PWR SYS 1,2 (two) – OFF 5. <u>RELAX ROEU (EVA)</u> Monitor PL RETEN LAT 1 tb Give EV GO to STOW arm, halt once RELAX tb – REL 6. <u>ENABLE POWER</u> R1 PL PRI MNC – ON (tb-ON) Perform LCH ACTIVATION (LCS Cue Card, PHOTO/TV) Perform LCC ACTIVATION, step 2 (LCS Cue Card, PHOTO/TV) Perform LCC DEACTIVATION, step 1 (LCS Cue Card, PHOTO/TV) **Notify MCC:** “LCC Cue Card steps are complete”	2. <u>RELAX ROEU (EVA)</u> On IV GO, rotate control lever to STOW: Ratchet arm drive ccw until IV receives RELAX 1 tb – REL Remove drive ratchet 3. Reengage arm actuator: Rotate control lever to neutral posn Close, secure access cover (3/4 turn cw) Clear worksite

ROEU OVERVIEW



SSRMS JOINT DRIVE

CAUTION
Avoid contact with the following:
1. ACU radiator surface [silver Teflon film (white in color)].
2. CLA and CLPA radiator surface [silver Teflon film (white in color)].
3. VDU radiator surface [silver Teflon film (white in color)].
4. JEU radiator surface (Z93 paint).

NOTE

1. Gear ratio: 3.26 EVA Drive turns/1 degree of joint movement.

2. CW input to the EVA drive will produce CCW motion of the joint.

3. Starting from LEE, the order of the joints: roll, yaw, pitch.

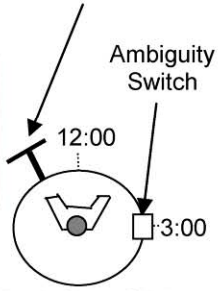
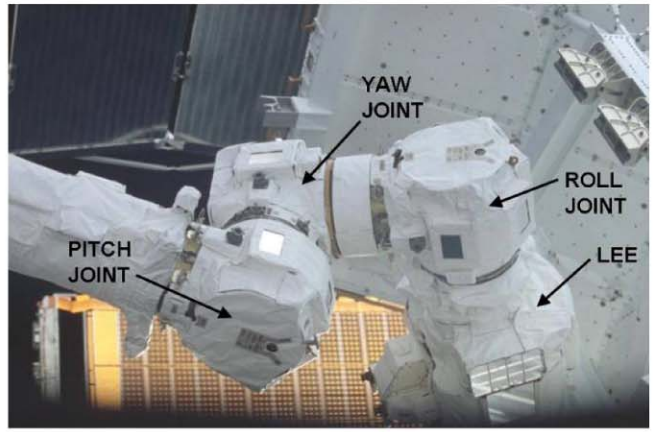
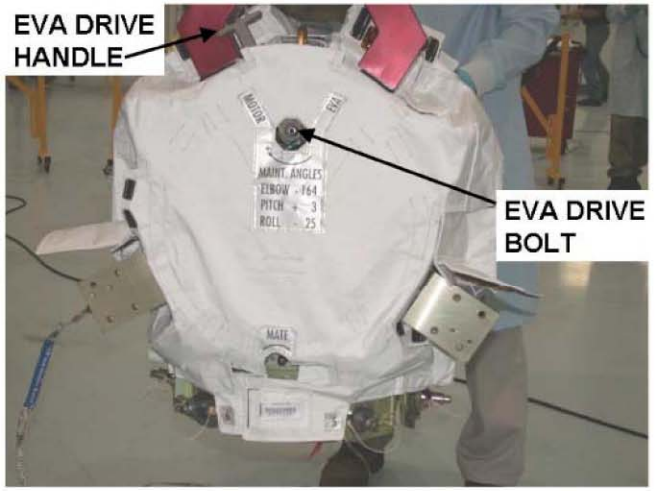
4. The signs of the logical (indicated on RWS or PCS) and physical (indicated on EVA scale) angles are reversed for the shoulder roll, shoulder yaw, and wrist roll joint (i.e., +73.2 logical = -73.2 physical) regardless of which end is base.

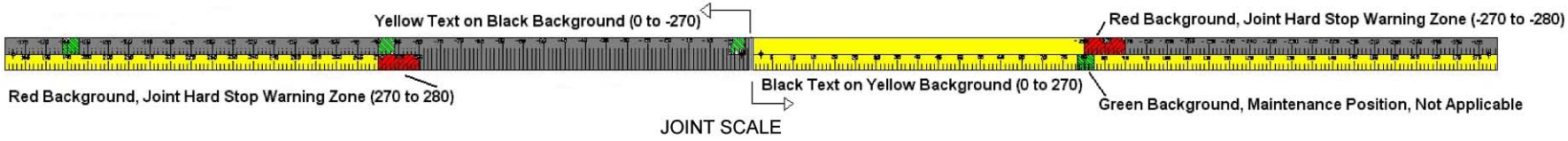
5. Scale and Ambiguity Switch: Since the SSRMS joints can be rotated more than 360 degrees, there is an ambiguity switch that tells the crewmember whether to use the positive or negative scale.

   The crew reads the scale using the black triangle on the fixed side of the joint. Located to the side of the black triangle (~90 degrees around the circumference of the joint) is the ambiguity switch. The switch has a pointer that indicates “+” or “-” to tell the crew which side of the scale to read. If the ambiguity switch points to “+”, the crew should read off the yellow scale (black text on yellow background). If the switch points to “-”, the crew should read off the black scale (yellow text on black background).

   EVA Drive handle is on back side of joint (away from LEE), and scale triangle is across from it towards the LEE side.

SSRMS JOINT DRIVE (Cont)

IV/RMS	EV1	REFERENCE
SSRMS EVA JOINT DRIVE POSITION IV 1. Record ambiguity sensor reading and joint angle:_____ 2. Monitor SSRMS joint angle. Report position to EV1. 3. Give EV1 STOP when joint angle is at desired position.  Joint Scale and Black Triangle  Ambiguity Switch  Back Side of Joint	1. Translate to failed joint. 2. If required for body stabilization, install square scoop on joint micro fitting and attach BRT. INITIAL POSITION VERIFICATION 1. Verify initial joint position using the following: ❑ Black triangle on fixed side of failed joint ❑ Ambiguity sensor (90 degrees CW from EVA drive, toward front side of joint) JOINT EVA DRIVE 1. Press button and move EVA Drive Handle to EVA. NOTE Joint will rotate in opposite direction of PGT. 2. **PGT[A1 2.5 ft-lb, CW2 or CCW2 30 RPM** (as required), **MTL 2.5]-6 ext 7/16:** Drive EVA bolt in ± direction _____ turns to specified position. 3. Verify joint angle using scale and ambiguity sensor. 4. If possible, verify joint angle with IV. If necessary, fine position joint using PGT in manual ratchet mode. 5. Press button and move EVA Drive Handle to MOTOR. 6. If used, retrieve square scoop.	 



TASK DATA

Table 1. Tools

EV1 (FF)
PGT
7/16 (wobble) Socket-6 ext
BRT
Square Scoop

Table 2. EVA Fasteners

Fastener Name	Label	Head Size	Qty	Min Drive Torque (ft-lb)	Max Drive Torque (ft-lb)	Failure Torque (ft-lb)	RPM
EVA Drive		7/16	1	1.25	2.5		30

Foot Restraints: N/A

SSRMS JOINT DRIVE (Cont)

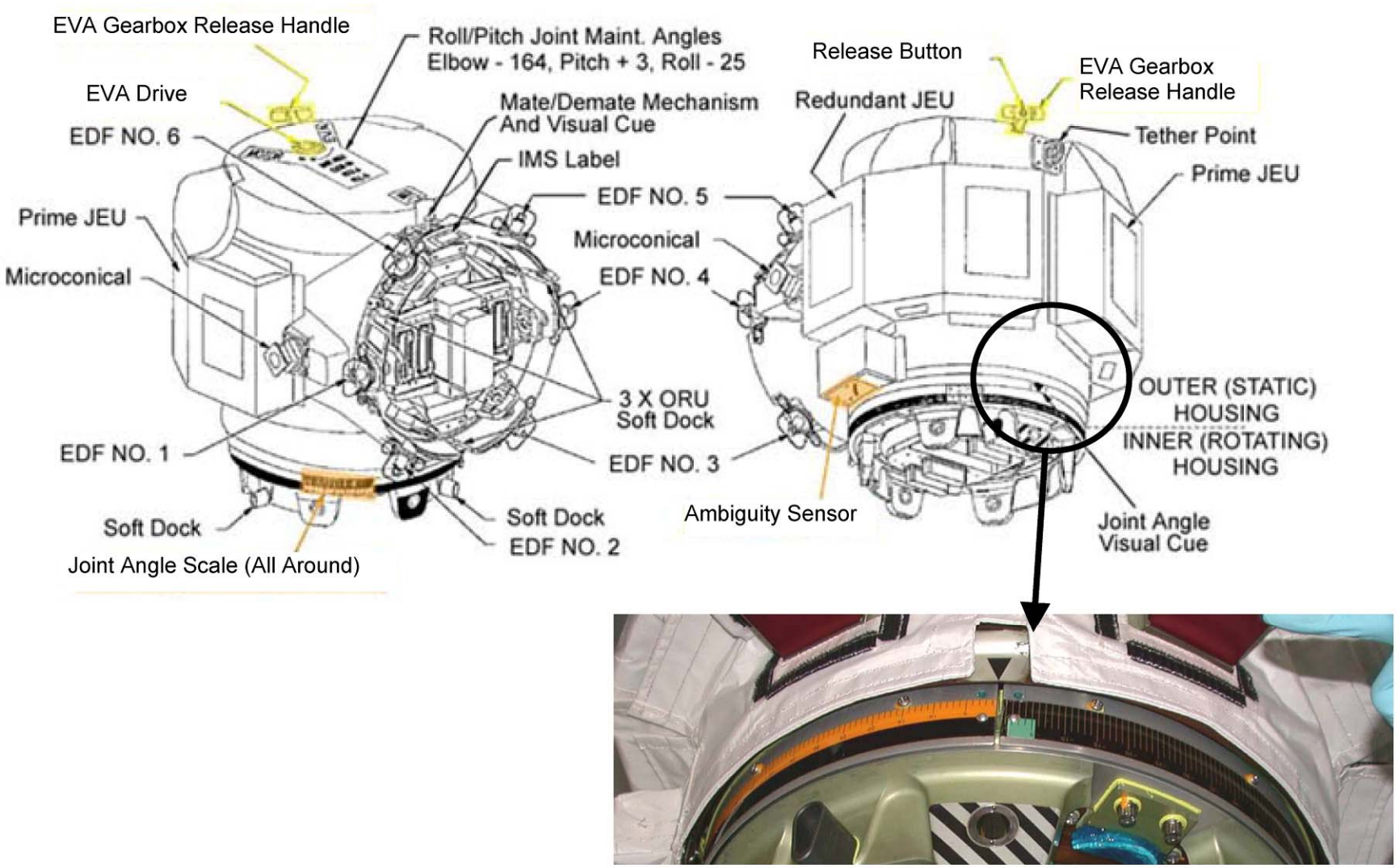


Figure 1.- Roll/Pitch Joint ORU.

SSRMS JOINT DRIVE (Cont)

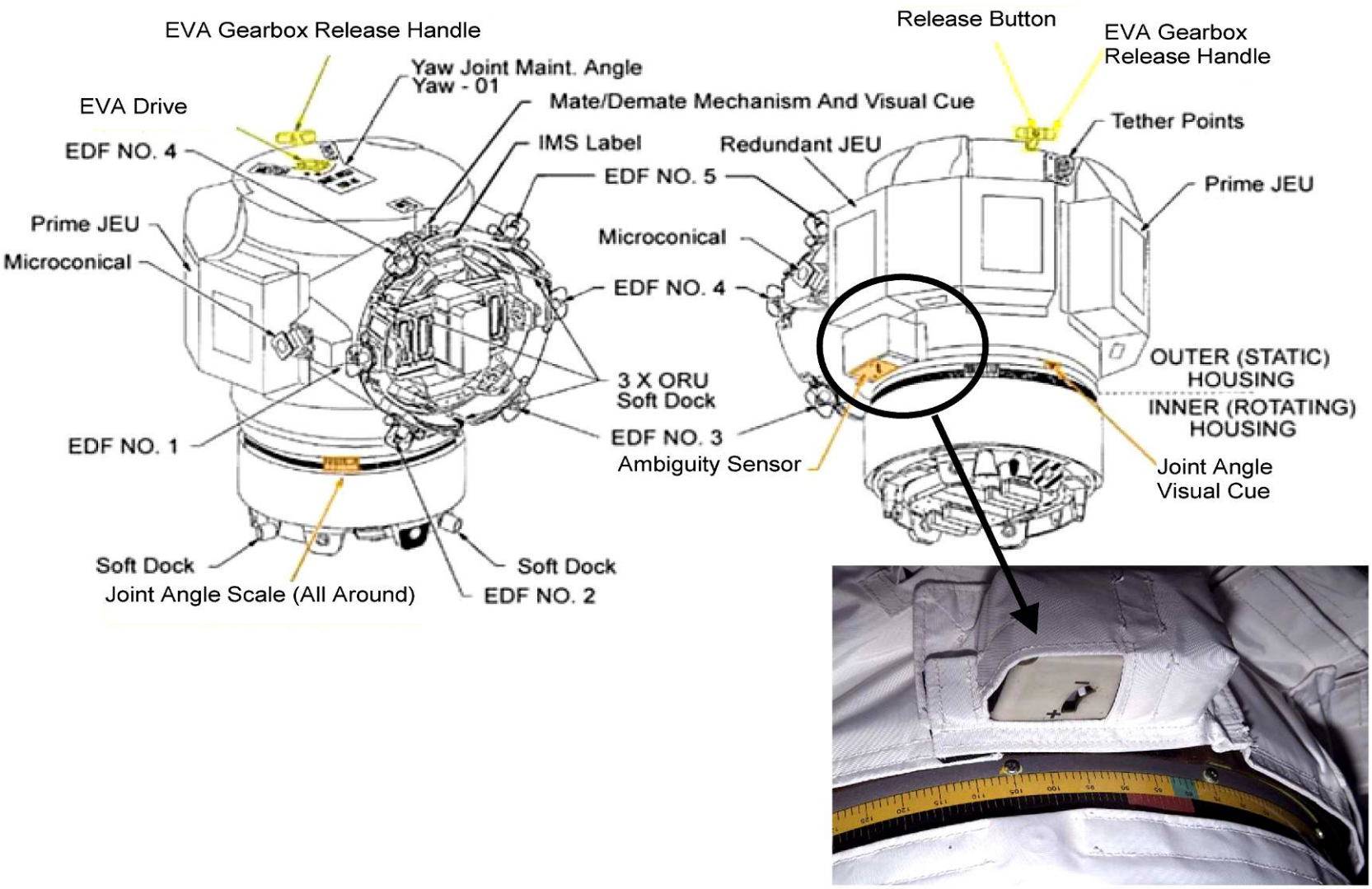


Figure 2.- YAW Joint ORU.

GENERIC EVA INHIBIT PAD

Orbiter (1)

ALL EVAs

TCS

L12	1. √TCS POWER – OFF

KU-Band Antenna

MCC-H	1. √KU-BAND Mask – active
	2. √KU-BAND EVA Protect Box – active

RCS

If EV crew < 27 feet from FRCS

IV	1. √DAP: VERN, FREE, LO Z (flt specific check with GNC)
O14,15,16	2. √RJDF F1, F2, F3, F4 MANF DRIVER (four) – OFF
	LOGIC (four) – OFF
MCC-H	3. √Above RCS config
IV	4. √RCS F – ITEM 1 EXEC (*)
	√JET DES F1U – ITEM 17 (*)
	F3U – ITEM 19 (*)
	F2U – ITEM 21 (*)

Ground

ALL EVAs

Ground Radar

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

Orbiter (2)

LOCATION DEPENDENT INHIBITS

OBSS - LDRI

TO INHIBIT LASER FIRING BUT LEAVE HEATER POWER ON

NOTE

This procedure works best when performed during orbital night, and OBSS must be positioned such that its diffuser window is visible in the Camera B view.

R12(VPU)	1. √Green Jumper – LDRI/ITVC
A7U	2. VIDEO OUT MON2 pb – push
	IN B pb – push
	OUT MON1 pb – push
	IN PL2(VPU) pb – push
	3. Center Cam B (ITVC) in the view of LDRI/ITVC
	4. VIDEO OUT MON2 pb – push
	5. Center LDRI/ITVC diffuser in the view of Cam B (ITVC)
	6. CAMR CMD ZOOM – IN (FULL)
	7. VIDEO OUT MUX 1 L pb – push
	IN MIDDECK pb – push

NOTE

The following step will power off the LDRI laser. Observe the LDRI diffuser in the Camera B view and verify the laser turns off. Report observation to **MCC-H**.

	8. LDRI MODE 1 pb – push
	9. VIDEO IN as desired (not MIDDECK)
	POINT PTU/LDRI AWAY FROM EV CREW
A7U	10. VIDEO OUT MON1 pb – push
	IN PL2(VPU) pb – push
	11. CAMR CMD PAN/TILT – HI RATE
	PAN – L (to hard stop)
	TILT – UP (to hard stop)
	PAN/TILT – RESET
	PAN/TILT – HI RATE (LO within 10°)
	PAN: TBD
	TILT: TBD
R12(OBSS)	12. ITVC ENA – OFF

GENERIC EVA INHIBIT PAD (Cont)

Orbiter (3)

LOCATION DEPENDENT INHIBITS (Cont)

OBSS - LCS
TO INHIBIT LASER FIRING BUT LEAVE HEATER POWER ON

IV 1. Perform LCC DEACTIVATION step 1 (FDF P/TV CUE CARD, LCS), then:

To shut down and remove all power to LCS (and ROEU if flown)

NOTE
These steps remove all power from LCS sensor and start a 105-minute thermal clock.

IV 2. Perform LCH DEACTIVATION (FDF P/TV CUE CARD, LCS), then:
R1 3. √PRI PL MNC – OFF (tb-OFF)
A6U 4. √PL RETEN PL SEL – 1

EFGF Connector

NOTE
These steps remove all power from both OBSS sensors and start a 90-minute thermal clock.

IV 1. √DEACTIVATION complete (FDF P/TV CUE CARD, LDRI/ITVC)
2. √LCC DEACTIVATION complete (FDF P/TV CUE CARD, LCS)
3. √LCH DEACTIVATION complete (FDF P/TV CUE CARD, LCS)

S-Band Antennas

NOTE
Possible loss of comm when forced LL FWD antenna.

IV If EV crew < 2 feet from S-Band antenna
A1R 1. S-BAND FM ANT – XMIT LOWER/RCVR UPPER
2. √**MCC**, lower antenna selected
If no comm, or **On MCC GO**
C3 3. S-BAND PM ANT – LL FWD
When EVA crewmember at least 2 feet away from all S-Band upper antennas
C3 4. S-BAND PM ANT – GPC

USOS (1)

ALL EVAs

PCU

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

MCC-H 1. √PCUs (two) operational in discharge mode and one of the following:
a. CCS PCU EVA hazard control FDIR enabled.
b. No more than two arrays unshunted and oriented <105º from velocity vector.
If one or both PCUs failed
2. No more than two arrays unshunted and oriented <105º from velocity vector.

CUCU
IV - (LAB1O4)
1. √cb POWER A, B (two) – OPEN
2. √cb LINK 1,2 (two) – OPEN

MISSE 8
POIC Prior to EV Hatch Open
1. ELC-2 ExPA-2 Discrete Channel 6 – Disabled

GENERIC EVA INHIBIT PAD (Cont)

LOCATION DEPENDENT INHIBITS

Lab Window

IV — If EV crew less than 10 feet from window or in window FOV, close window shutter.

Cupola Windows

IV — If EV crew less than 10 feet from window, coordinate shutter opening/closing with EV crew and minimize time shutter is open.

KU-Band (SGANT Antenna)

MCC-H — If EV crew < 3.3 feet from KU-BAND antenna

1. Park KU-BAND
   - 1.1 Pointing Mode – Inhibit
   - 1.2 PLC – Reset
   - 1.3 Autotrack Continuous Retry – Inhibit

S-Band (SASA) Antennas

MCC-H — If EV crew < 3.8 feet from S1 SASA [P1 SASA]

1. P1 SASA (S1 SASA) – Active
2. S1 SASA (P1 SASA) – Powered down and unavailable to FDIR

Mobile Transporter

MCC-H — If EV crew < 1.5 meters from MT

1. √MT latched

MISSE 8

POIC — If EV crew zenith of the plane of MISSE 8 (Includes ELC-2, ELC-3, and SSRMS)

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

EV Crew — If EV crew on ELC-2 in the vicinity of MISSE 8

4. MISSE 8 PEC – Closed
5. ORMATE-III RW – Cover Installed

SPDM

MCC-H — If EV crew translating or working on SPDM

1. √SPDM in Keep Alive configuration
   or
2. SPDM brakes on.

GENERIC EVA INHIBIT PAD (Cont)

USOS (2)

LOCATION DEPENDENT INHIBITS

SARJ

MCC-H If EV crew working within 2 feet, outboard of SARJ or reqd per loads FR (Includes Outboard faces of Outboard ELCs/ESPs)
1. √DLA (1) – LOCKED
2. All motor setpoints set to zero.
3. All motors deselected.

TRRJ

MCC-H If EV crew working within 2 feet of P1 TRRJ rotation envelope (Includes Node 3 Port Endcone and PMA 3)
1. √DLA 1(2) – LOCKED
2. √DLA 2(1) – ENGAGED

MCC-H If EV crew working within 2 feet of S1 TRRJ rotation envelope (Includes ELC 4)
1. √DLA 1(2) – LOCKED
2. √DLA 2(1) – ENGAGED

FPMU

MCC-H If 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

SSPTS

MCC-H If EV crew working within 2 feet of SSPTS cables
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

CBM

MCC-H If EV crew working within circumference of CBM
1. Verify CBM deactivated.
2. Petals Closed unless performing CBM component R&R.

Bluetooth Stethoscope

IV If EV crew translating on JEM
1. Electronic Stethoscope – OFF
2. JEM Medical Laptop – Bluetooth Disabled

ALL EVAs

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.

HTV

SSIPC When HTV docked to ISS, refer to 6.100.210 HTV INHIBIT PAD (SODF: EVA TASK: CONTINGENCY TASKS).

GENERIC EVA INHIBIT PAD (Cont)

JEM (1)

LOCATION DEPENDENT INHIBITS

JPM Windows

IV — If EV crew translating on JPM port end cone, close window shutters.

JEMRMS

SSIPC — If EV crew working within 5 feet of JEMRMS
1. RIP MA Brake – ON
2. MDP Main Mode – Stby Mode

or

1. JEMRMS Rack – OFF

JEMRMS EE, WVE and EVE

SSIPC — If EV crew working in vincity of EE opening
1. EE Enable 1 – Off
2. EE Enable 2 – Off

SSIPC — If EV crew working within 2 ft of WVE
1. VCU_b TVC WVE Sig Stat – No Signal
2. PDB RMS Ext4 Vout: 0.0 V
3. VLU EE Pwr – Off

SSIPC — If EV crew working within 2 ft of EVE
1. VCU_b TVC EVE Sig Stat – No Signal

JPM PROX Antenna

SSIPC — If EV crew working within 0.3 feet JPM PROX Antenna
1. TRX Power – OFF
2. TX Power – OFF

or

1. JPM PROX Antennas – OFF

JPM JTVE

SSIPC — If EV crew working within 2 feet of Fwd JPM JTVE
1. PDB WS RPC 8 – Open (for CPB a)

SSIPC — If EV crew working within 2 feet of Aft JPM JTVE
1. PDB b2 RPC 4 – Open (for CPB b)

JEF VE

SSIPC — If EV crew working within 2 feet of Fwd JEF VE
1. JEF PDB b RPC 22 – Open (for DCU/TVC/PTU Fwd)

SSIPC — If EV crew working within 2 feet of Aft JEF VE
1. JEF PDB a RPC 5 – Open (for DCU/TVC/PTU Aft)

SEDA-AP Mast and PLAM-S

SSIPC — If EV crew working within the SEDA-AP mast extension envelope
1. Mast Actuator – Off
2. PLAM-S – Off

GENERIC EVA INHIBIT PAD (Cont)

JEM (2)

LOCATION DEPENDENT INHIBITS

EFU

SSIPC If EV crew working within 2 feet of EFU
1. JEF PDB a RPC 03 – Open (for EDU a)
2. JEF PDB b RPC 20 – Open (for EDU b)
3. EFU[X] Sel Status – not selected [X=1 to 12]
4. EEU Mode – EFU stop

SSE SLM

SSIPC If SFA is not on SSE and EV crew working in the vicinity of the SSE SLM
1. SSE SLM Ops Ena/Inh Status 1 – Inhibit
2. SSE SLM Ops Ena/Inh Status 2 – Inhibit

SMILES

SSIPC If EV crew working in the vicinity of open end of SMILES
1. Antenna Main Reflector – Stop between 0 deg and -40 deg
2. ADE – Off
3. JEF PDB a RPC 15 – Open (for EFU3)

HREP

POIC If EV crew working in the vicinity of open end of HREP
1. RAIDS scanhead – Closed (0 deg rot) and unpowered

SSIPC
2. JEF PDB b RPC 31 – Open (for EFU6)

ICS-EF

SSIPC If EV crew working within the ICS-EF antenna dynamic envelope
1. ICS DM/DLM Pwr Status – Off
2. ICS DM Ena/Dis – Disable
3. ICS DM Step Sig – Stopped
4. ICS APM Pwr Status – Off
5. ICS APM X Ena Valid – Inhibit
6. ICS APM Y Ena Valid – Inhibit
7. ICS APM X Step Sig – Stopped
8. ICS APM Y Step Sig – Stopped

COL (1)

ALL EVAs

HAM Radio

IV 1. HAM Radio – Deactivate

RSOS (1)

ALL EVAs

SM Antennas

IV 1. ARISS (Ham Radio) – Deactivate

MCC-M 2. GTS – Deactivate

3. Napor (РСПИ) – Deactivate

EVAS ON PMA 1 OR RSOS (LOCATION DEPENDENT)

Soyuz Thrusters

MCC-M 1. Inhibited

RSOS and RSOS Visiting Vehicle Antennas (Includes FGB, SM, DC-1, MRM-1, MRM-2, Soyuz, Progress, and ATV)

MCC-M 1. √KURS P (КУРС Р) – Deactivated

2. √KURS A (КУРС А) – Deactivated

GENERIC EVA INHIBIT PAD (Cont)

RSOS (2)

ADDITIONAL ANTENNA INHIBITS FOR EVAS ON RSOS
(LOCATION DEPENDENT)

FGB Antennas

MCC-M
1. √TORU (TOPY) – Deactivated
2. √TV System (TBC) – Deactivated
3. Radiotelemetry (БР-9ЦУ-8) – Deactivate
4. √TV System (КЛ-108А) – Deactivated
5. √CNPMS (СИТНП) – Deactivated
6. √KOMPARUS (КИС) – Deactivated

SM Antennas

MCC-M
1. VHF-1, VHF-2 (CTTC) – Deactivate
2. BITS (БИТС2-12) – Deactivate
3. √TV System (TBC) – Deactivated
4. REGUL (РЕГУЛ) – Deactivate
5. √LIRA (ОНА) – Deactivated
6. √Orbit Radio Tracking System (РКО) – Deactivated

IV
7. ARISS VHF (Ham Radio) – Deactivate

Soyuz Antennas

MCC-M
1. √Teleoperator – Deactivated
2. √Telemetry – Deactivated
3. √TV – Deactivated
4. √Tracking – Deactivated
5. √Command (OMNI) – Deactivated

Progress Antennas

MCC-M
1. √Teleoperator – Deactivated
2. √Telemetry – Deactivated
3. √TV – Deactivated
4. √Tracking – Deactivated
5. √Command (OMNI) – Deactivated

ADDITIONAL THRUSTER INHIBITS FOR EVAS ON RSOS
(LOCATION DEPENDENT)

SM Thrusters

MCC-M
1. Inhibited

Progress Thrusters

MCC-M
1. Inhibited

ATV INHIBITS for EVAS ON RSOS
(LOCATION DEPENDENT)

ATV Antennas
ATV-CC
1. √TDRS/ARTEMIS – Deactivated
2. √PROXimity Link – Deactivated
3. √KURS A: KMTA 1&2 – Deactivated
4. √TV – Deactivated

ATV Thrusters
ATV-CC
1. √ATV Attitude Control Thruster Valves (56) – Closed
2. √Progress Main Engine Thruster Valves (8) – Closed

ATV Other Equipment (Lasers)
ATV-CC
1. √Telegoniometer – Deactivated
2. √Videometer – Deactivated

GENERIC NOTES, CAUTIONS, & WARNINGS

NOTES

1. Bolt install: report torque and turns
2. Bolt release: report torque and turns if different from published range
3. EVA connectors: after disconnection and prior to connection; verify pin and EMI band integrity; verify connector free of FOD
4. Inspect QDs for damage prior to mating
5. Toolbox doors must be closed with one latch per door when EV crew not in immediate vicinity
6. 85 ft safety tether retract force may affect body positioning
7. CETA Cart brake handle wire ties must be replaced after crew loading
8. For HTV N/C/W, refer to 6.100.180 HTV NOTES, CAUTIONS, & WARNINGS (SODF: EVA TASK: CONTINGENCY TASKS)

CAUTION

ISS Generic Constraints

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

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

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

D. Fluid line flex hoses and QDs
   1. Avoid bend radii < 14 in for hoses with a diameter ≥ 1 in
   2. Additional care should be taken to not exceed bend radii when applying loads at the flexible hose to rigid tube stub interfaces
   3. Ensure fluid QD booties are fully closed prior to leaving worksite; wire tie if required
   4. Avoid bend radii < 5 in for hoses with diameter < 1 in on LAB, S0, S1, P1, and 10 in for hoses with diameter < 1 in on all other elements

CAUTION

ISS Generic Constraints (Cont)

E. For structural reasons
   1. Avoid vigorous body motions, quick grabs and kickoffs against tether restraints
   2. Avoid performing shaking motions (sinusoidal functions) more than four cycles

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

CAUTION

ISS Truss Constraints

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

B. For structural reasons
1. Avoid kicking S1/P1 radiator beam. If any of these occur, wait 2 to 5 min to allow structural response to dissipate

CAUTION

ISS Truss Constraints (Cont)

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

CAUTION

ISS U.S. Pressurized Elements Constraints

A. Avoid inadvertent contact with
1. EVA crane [PMA1]
2. TCS reflectors [PMA2,PMA3]
3. APAS hardware [PMA2,PMA3]
4. CETA lights (Z-93 paint) [LAB,S1,S3, P3,Node 1]
5. UHF antennas [LAB,P1]
6. Open CBM petal covers, LAB and Cupola window shutters
7. S0/Node 2 fluid tray hardlines at Node 2 end, which are limited to 25 lb

B. Other
1. WIS antennas: do not use as handholds [Node 1,LAB,P6,Z1]
2. CBM petal covers may not be used as handholds unless both launch restraint pins are engaged

CAUTION

ISS I.P. Elements Constraints

COL

A. Avoid inadvertent contact with
   1. COL ARISS and AIS antennas [COL-Nadir]

JEM

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

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

CAUTION

Shuttle Constraints

A. Avoid inadvertent contact with
   1. OBSS and SRMS composite sections joint torque arms, grapple fixture shafts, and cable harnesses
   2. LCS (silver Teflon) and LDRI (silver Teflon) and ITVC (gold foil) [OBSS]
   3. WVS antenna [ODS truss and PLB sill]
   4. Payload bay and camera wire harnesses, cables, cable guides, and connectors
   5. OBSS striker bars (drylube)

B. No touch
   1. LDRI diffuser [OBSS]
   2. OBSS saddle contacts (when OBSS unberthed) [OBSS]
   3. Monkey fur [PLB]
   4. Cameras: metallic surfaces [PLB]
   5. Ku-Band antenna black dish and gold thermal blankets [PLB]

WARNING

ISS Generic Constraints

A. Avoid inadvertent contact with
1. Grapple fixture targets and target pins

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

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

D. Sharp Edges
1. Inner edges of WIF sockets
2. APFR active WIF probes
3. Mating surfaces of EVA connectors Avoid side loads during connector mating
4. Back side of MMOD shield fasteners
5. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM, RTAS, SARJ Covers); the end of the spring may protrude
6. SPDM OTCM gripper jaws
7. Keep hands away from SSRMS LEE/POA/SPDM LEE opening, snares, and PDGF curvic coupling (teeth)
8. MMOD strikes on ISS exterior

WARNING

ISS Generic Constraints (Cont)

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

WARNING

ISS Truss Constraints

A. 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. Stay inboard of SARJ when active
3. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate
4. Stay 5 ft from moving MT on face 1
5. Stay 3.3 ft from Ku-Band (SGANT Antenna) when powered
6. Stay 1 ft from top of STP-H3 (ELC-3)
7. Deployed MISSEs and ORMatE-III R/W (ELC-2)
8. RRM (ELC-4)

B. 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 1 ft from UHF Antenna when powered [LAB,P1]

C. Sharp Edges
1. Solar array blanket box [P6,S6]
2. Fastener threads on back of Z1 U-jumper male FQD panel, if nutplate cap missing
3. Outboard MT rail attachment lug near P6 handrail 5333 and gap spanner
4. P2 connector on EWIS box TAA-06 [Zenith/Forward Corner 1 of P5-SARJ at 0 deg]

GENERIC NOTES, CAUTIONS, & WARNINGS (Cont)

WARNING

ISS Truss Constraints (Cont)

C. Sharp Edges (cont)
5. Nickel coated braided copper ground straps may contain frayed wires [P6,P4,S4,S6]
6. MMOD strikes on Z1 toolboxes
7. MMOD strike on POA FSE (on CSA Logo below MBS Mast Camera)
8. AMS Star Trackers Baffles (2)

D. 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)
   ESP2 jumper (inside S0 Bay 03 Face 4)

E. Thermal
1. ELC may exceed touch temperatures when β > 75 deg

WARNING

ISS U.S. Pressurized Elements Constraints

A. 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 Nad/Fwd and Port/Fwd, P6 5389]

B. 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

C. RF radiation exposure
1. Stay 1 ft from UHF antenna when powered [LAB,P1]

D. Sharp Edges
1. PMA umbilical launch restraints - exposed bolt threads
2. Adjustable fuse tether (Fish Stringer) buckles stowed in Node bag
3. Port/Aft portion of A/L circular HR [HR 0506]
4. A/L HR 0537 (Eq Lock Zenith)
5. ESP-2 HR 8012
6. PMM ROEU and ROFU panels (Zenith endcone)

E. Thermal
1. PMA handrails may be hot. Handling may need to be limited
2. Stay ≥ 1 ft away from PMAs and MMOD shields > 270 degF if EMU sun visor up; limit time to 15 min or less if > 300 degF

WARNING

ISS U.S. Pressurized Elements Constraints (Cont)

E. Thermal (Cont)
3. Stay at least 0.5 ft away from PMA and MMOD shields > 325 degF
4. No EMU TMG contact with PMAs and MMOD shields > 320 degF

F. Electrical Shock
1. Stay ≥ 2 ft from ungrounded floating connectors if powered
   SSPTS connectors include NOD1 Stbd/Fwd HR 0130, LAB Stbd/Fwd HR 0273, PMA2 Stbd

G. Fluid QDs
1. Do not translate on gap spanners restraining NODE 3 - LAB NH3 jumpers

WARNING

ISS I.P. Elements Constraints

COL
A. Avoid inadvertent contact with
   1. SOLAR [COL EPF]

B. Thermal
   1. Columbus end cones may violate touch temperature constraints when $-75 \leq \beta \leq -60$ or $60 \leq \beta \leq 75$

JEM
A. Avoid inadvertent contact with
   1. ICS-EF sensors

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

WARNING

ISS I.P. Elements Constraints (Cont)

JEM (Cont)
C. Sharp Edges
   1. Interior of JEMRMS HRMs
   2. JEMRMS EE opening and snares
   3. JEM A/L hatch corners
   4. ICS-EF AHM gears
   5. MAXI visual star camera
   6. SMILES baffles (two), baffle base bare bolts, and Cold Sky Terminator (CST)
   7. HREP baffles (four) [Star tracker aperture Zenith and three instrument baffles Aft]
   8. SFA's Electro-Mechanical GF(EMGF)

D. RF radiation exposure
   1. Stay 0.3 ft from Fwd/Aft JPM PROX antenna

E. Thermal
   1. JPM Port End Cones and JLP Port Nadir may violate touch temperature constraints when $\beta > 60$ deg
   2. JEMRMS/JTVE/JEFVE operating cameras and lights may radiate large amounts of heat

WARNING

Shuttle Constraints

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

B. Pinch
   1. PRLA operation [PLB]

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

GENERIC NOTES, CAUTIONS, & WARNINGS (Cont)

WARNING

Shuttle Constraints (Cont)

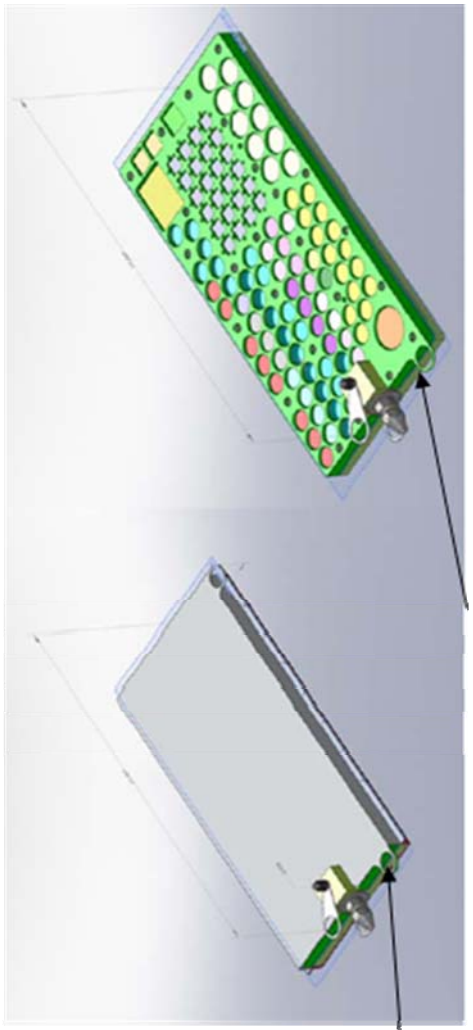
D. Sharp Edges
1. PRLA grounding wipers [PLB]
2. LDRI baffles (also an entrapment hazard) [OBSS]
3. Keep hands away from SRMS EE opening and snares
4. TCS connector backshells have exposed threads [ODS]

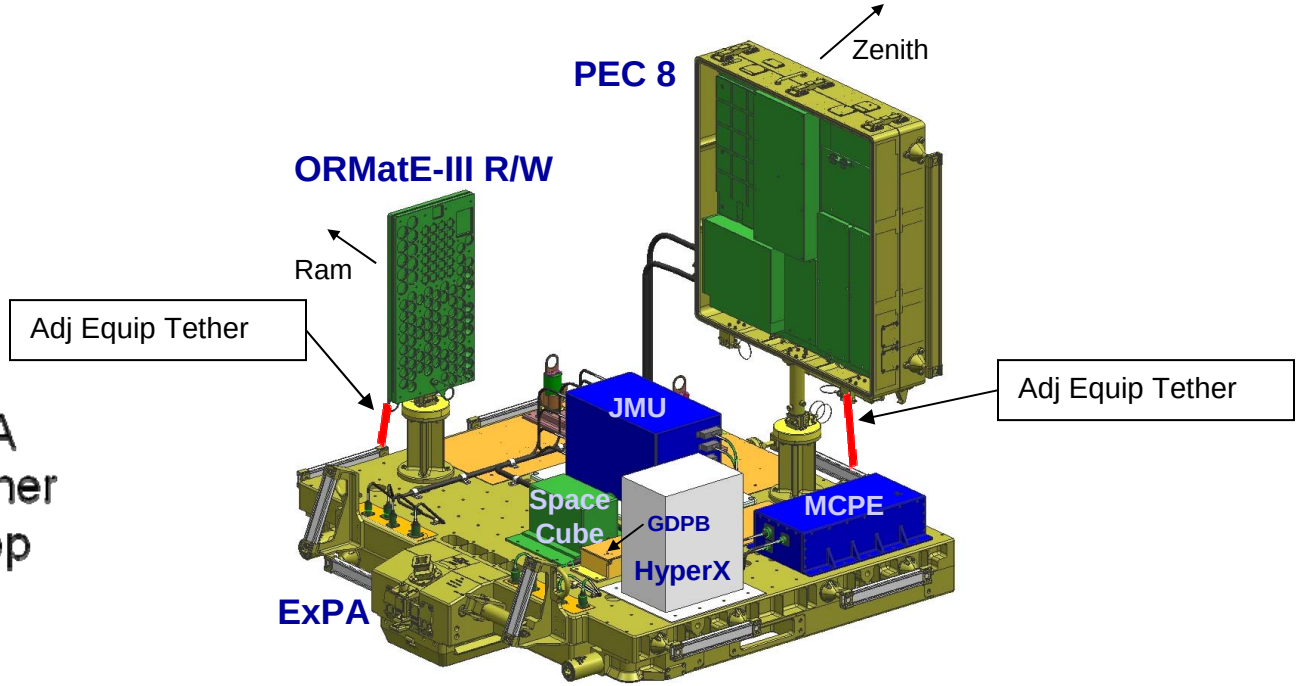
E. Thermal
1. Illuminated PLB lights; do not touch
2. OBSS grapple fixture shafts/cams may be hot. Limit handling if required
3. Stay 27 ft from PRCS when powered
4. Stay 3 ft from VRCS when powered
5. Stay 3 ft from APU when operating

F. Contamination
1. Stay out of the immediate vicinity of leaking jet or APU

G. Lasers
1. Do not look at LDRI diffuser or LCS laser aperture window

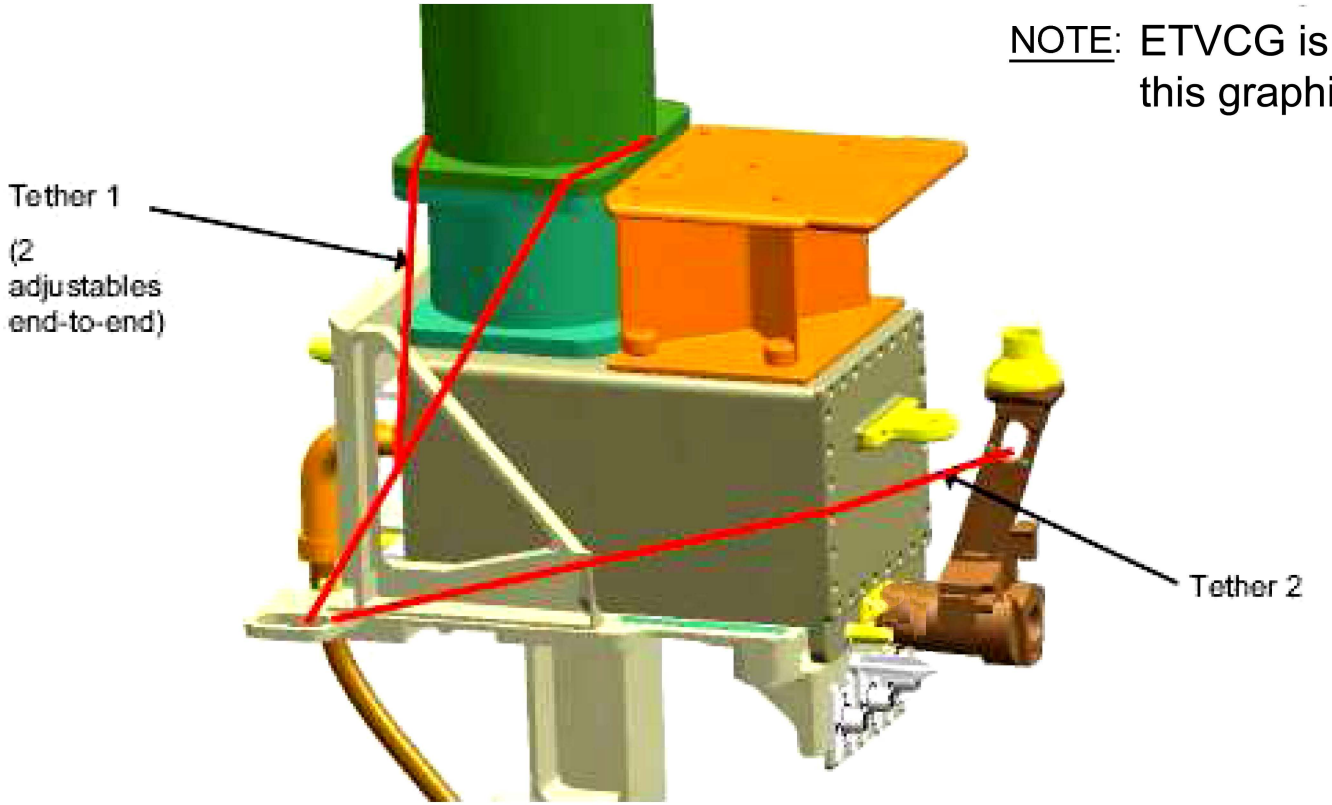
MISSE 8 ORMATE III R/W TIE-DOWN





CP7 ETVCG TIE-DOWN

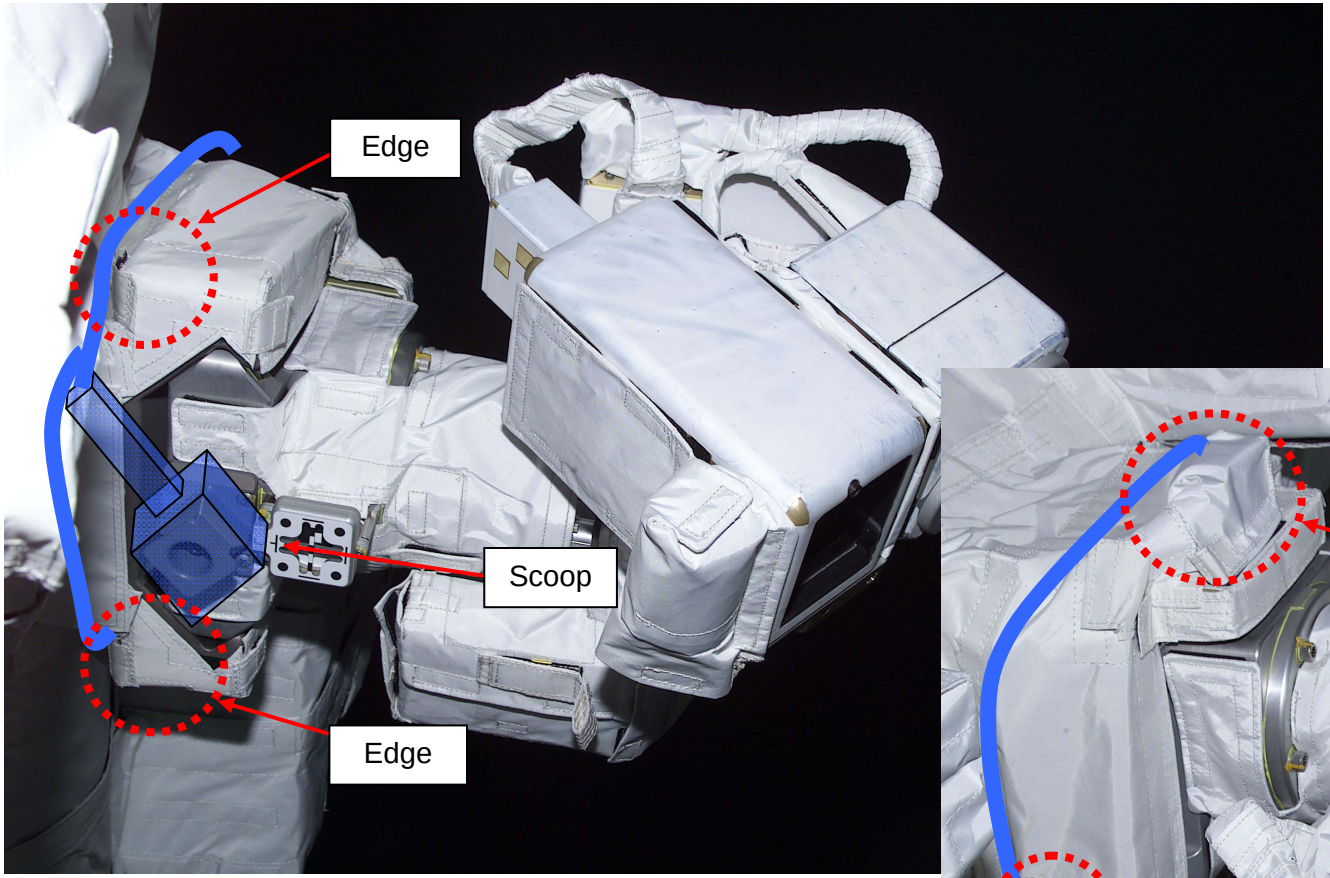
NOTE: ETVCG is depicted in this graphic

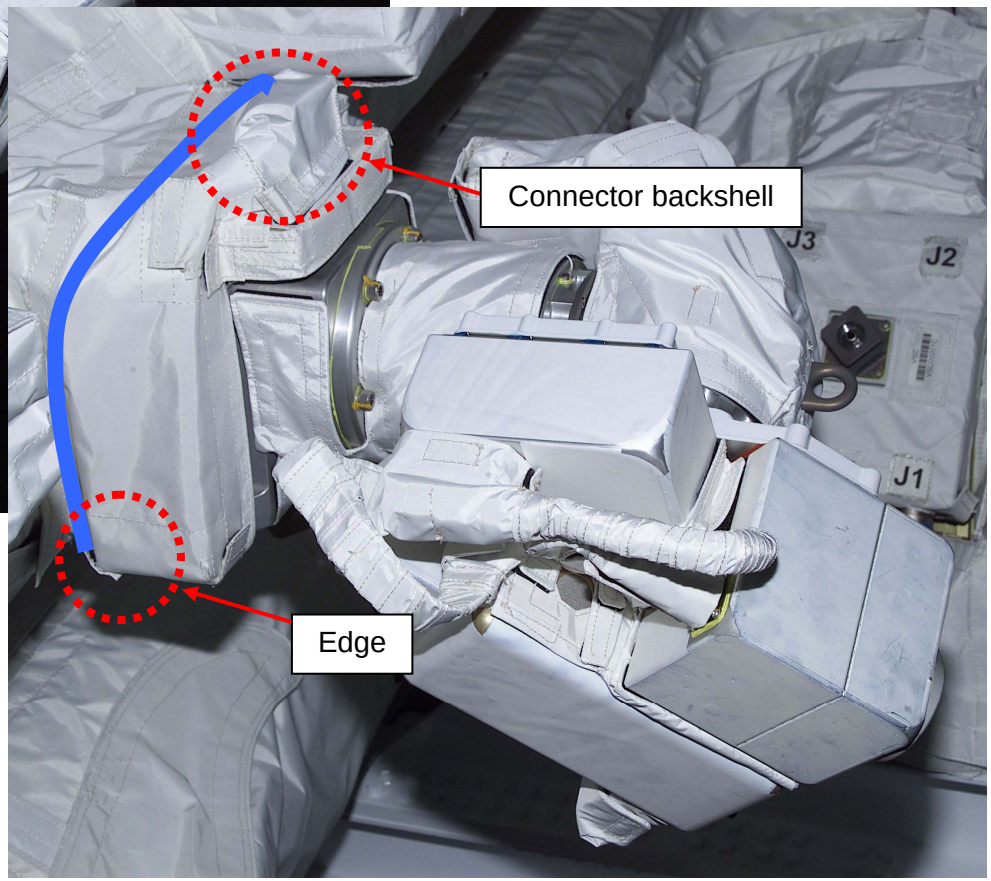


Tether 1 is actually 2 adjustable equipment tethers (small/small hooks) hooked end-to-end. Total length is approx 42". It goes from the tether loop on the stanchion - up and around the camera base (green part) and back down to the D-ring on the first tether. The two tethers will hook together approx around the camera base. The buckles are not a concern

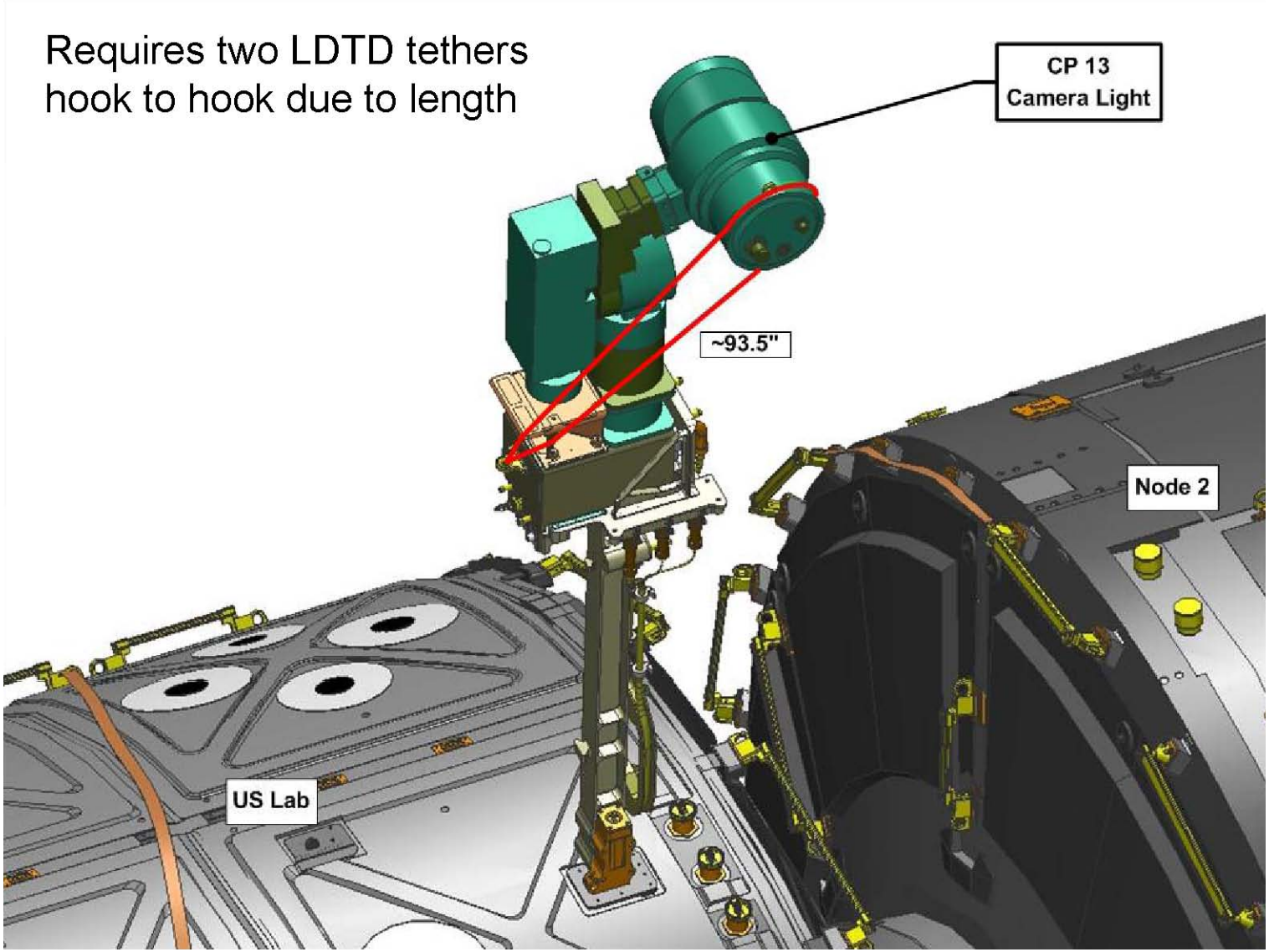
Tether 2 is an adjustable equipment tether (small/small hooks). Total length is approx 21". It goes from the tether loop on the stanchion to the tether loop on the MCF Round Scoop handle. The buckles are not a concern

SSRMS BASE B BOOM CLPA TIE-DOWN





CP13 ETVCG LIGHT TIE-DOWN



FLIGHT SPECIFIC EVA REFERENCE

ORBITER
- PAYLOAD BAY OVERVIEW ..... FS 18-3
- LMC ..... FS 18-9
- ROEU ..... FS 18-21
- PRLA ..... FS 18-23

EVA 1
- PM ..... FS 18-24
- COLT ..... FS 18-35
- RRM ..... FS 18-38
- FRAM ..... FS 18-45
- MISSE 8 ORMATE III R/W ..... FS 18-62
- SPDM ..... FS 18-69
- SPDM EOTP ..... FS 18-70

GET-AHEADS
- ETVCG ..... FS 18-75
- ETVCG LIGHT (VLA) ..... FS 18-79
- SSRMS BASE B CLPA ..... FS 18-81
- CP13 ..... FS 18-85
- S1 FHRC P-CLAMP RELEASE ..... FS 18-86
- PMA3 COVER (TBD) ..... FS 18-87
- LAB GAP SPANNER ..... FS 18-88

GENERIC ISS
- CETA CART OVERVIEW ..... FS 18-89

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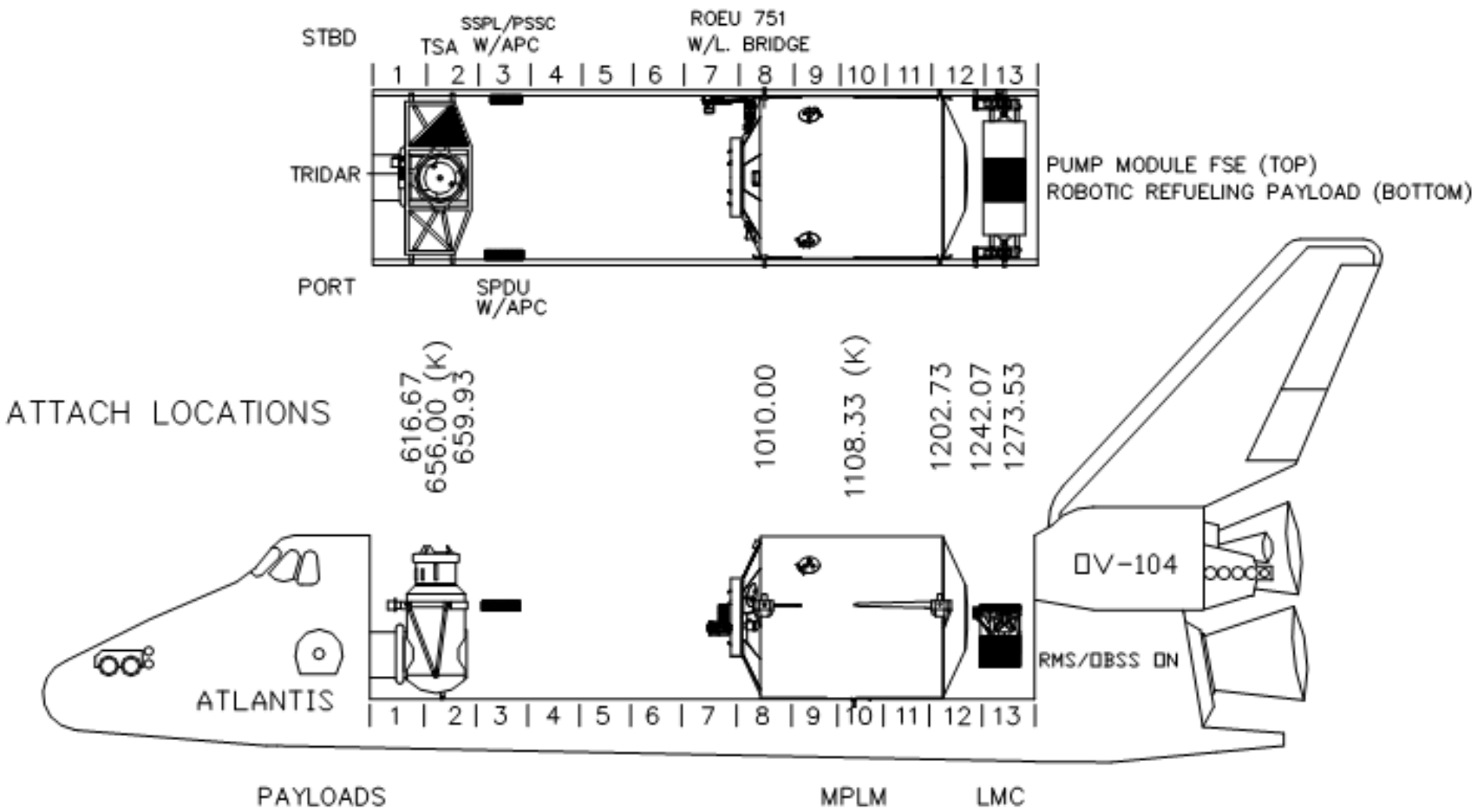
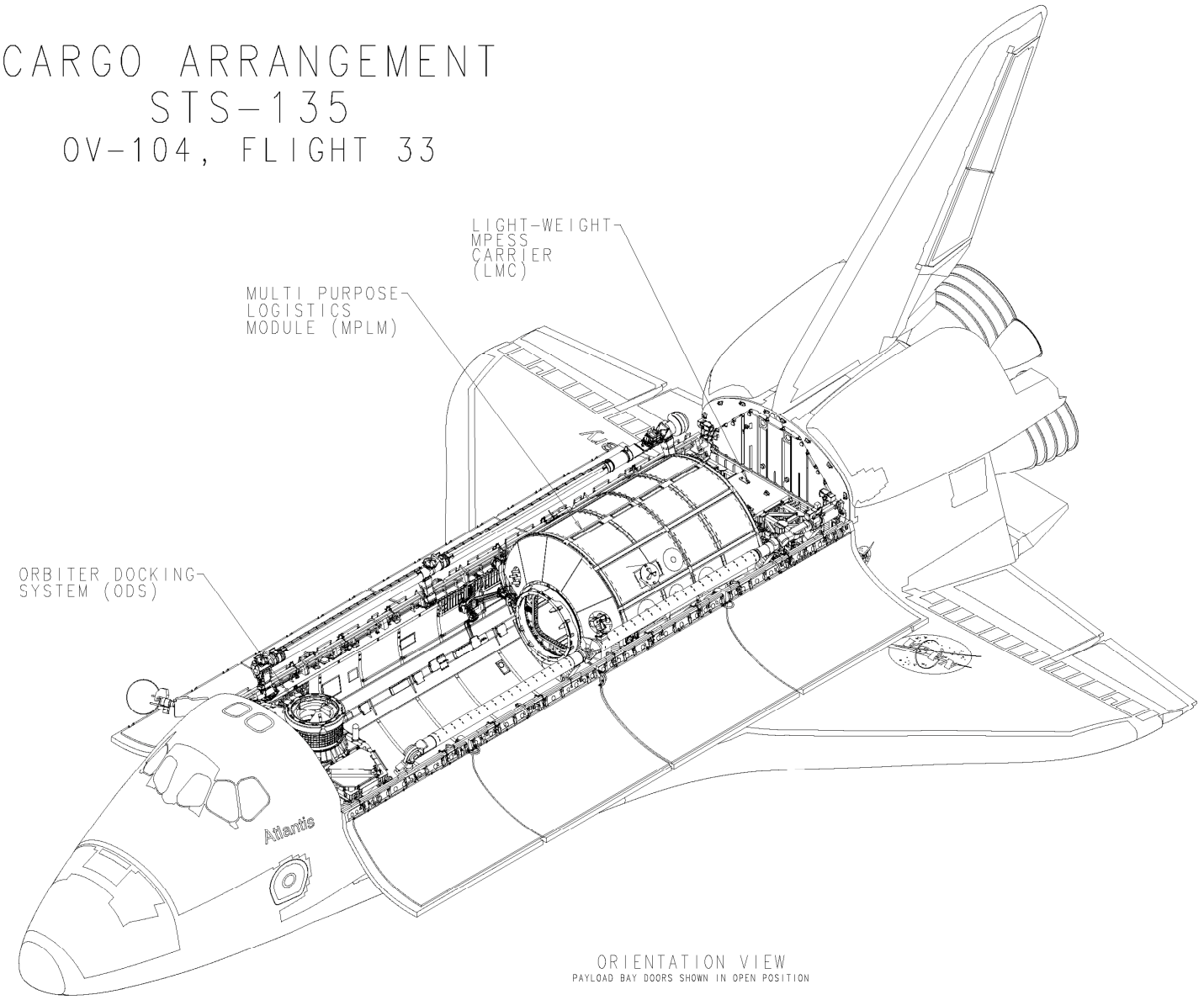
PAYLOAD BAY OVERVIEW



ORBITER

PAYLOAD BAY OVERVIEW (Cont)



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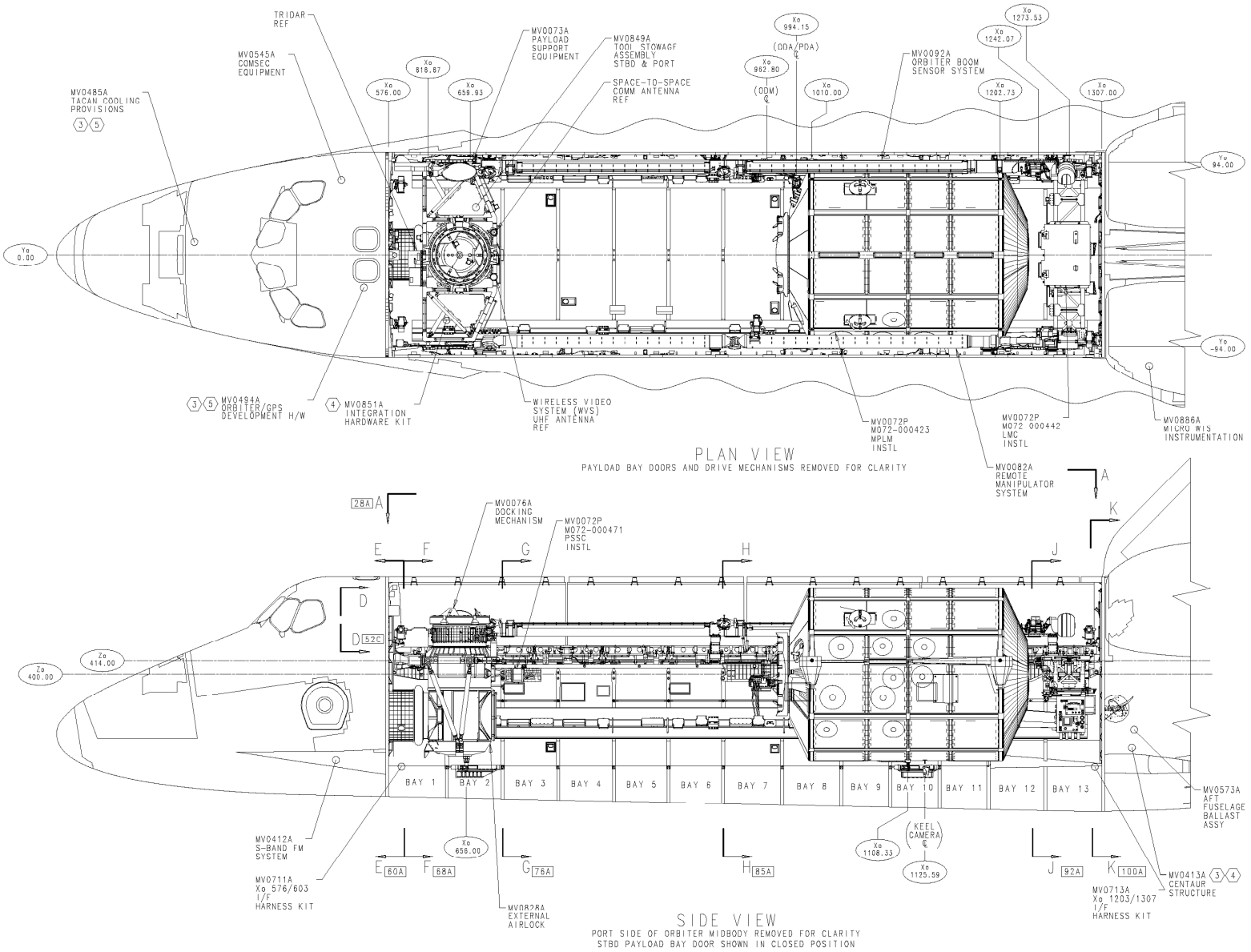

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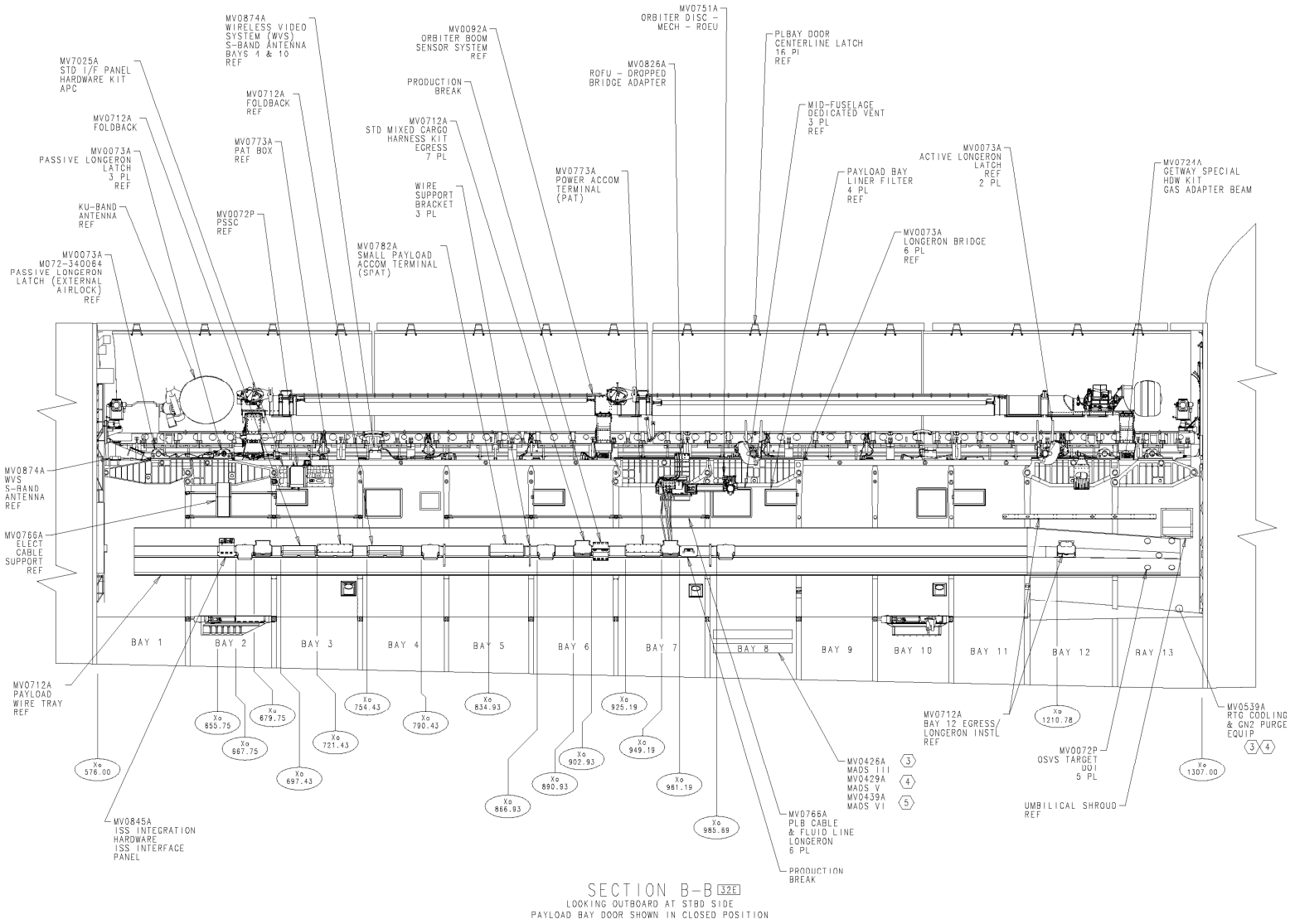
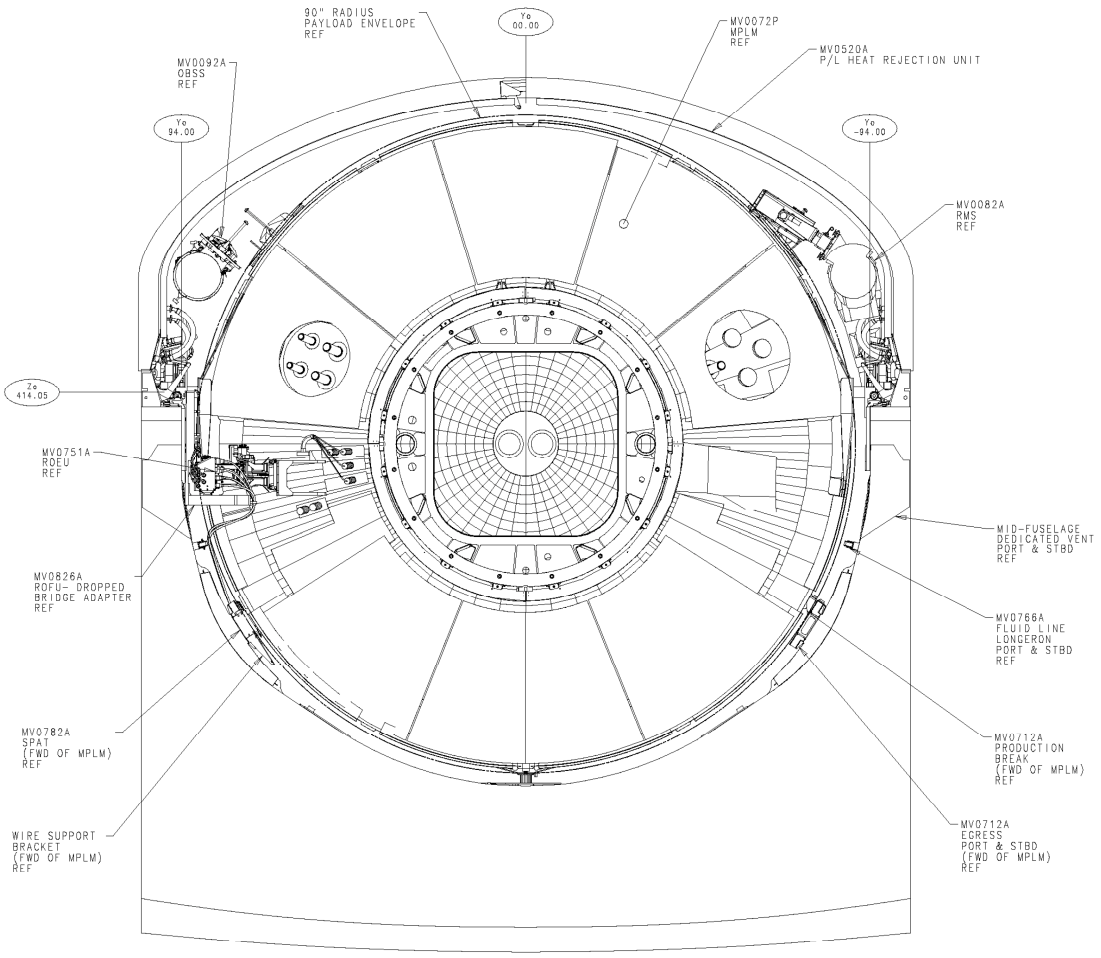
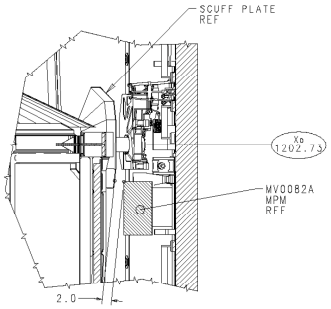


PAYLOAD BAY OVERVIEW (Cont)

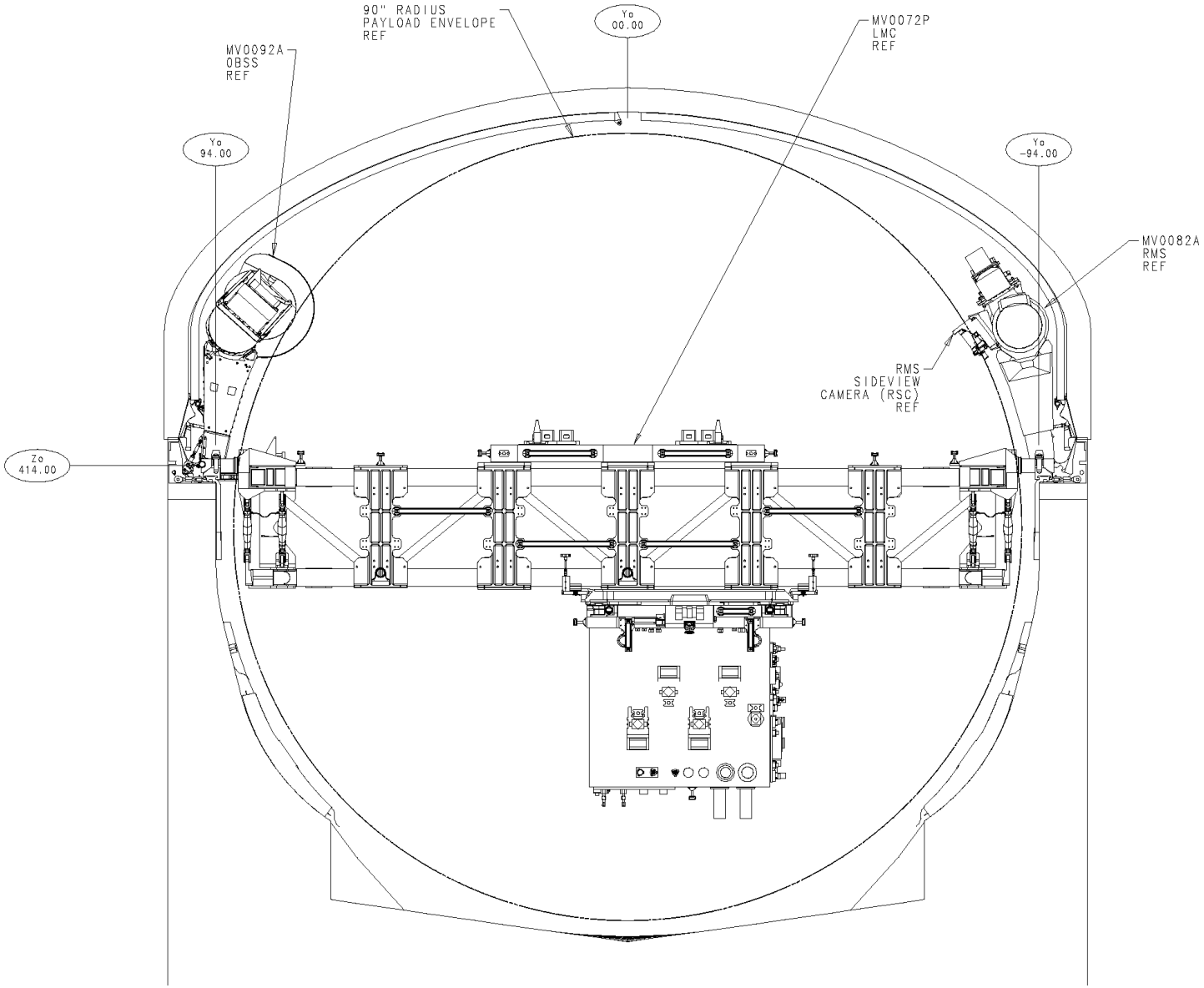


SECTION H-H 20A
LOOKING AFT AT MPLM
FROM Xo 919.00 TO Xo 1235.86

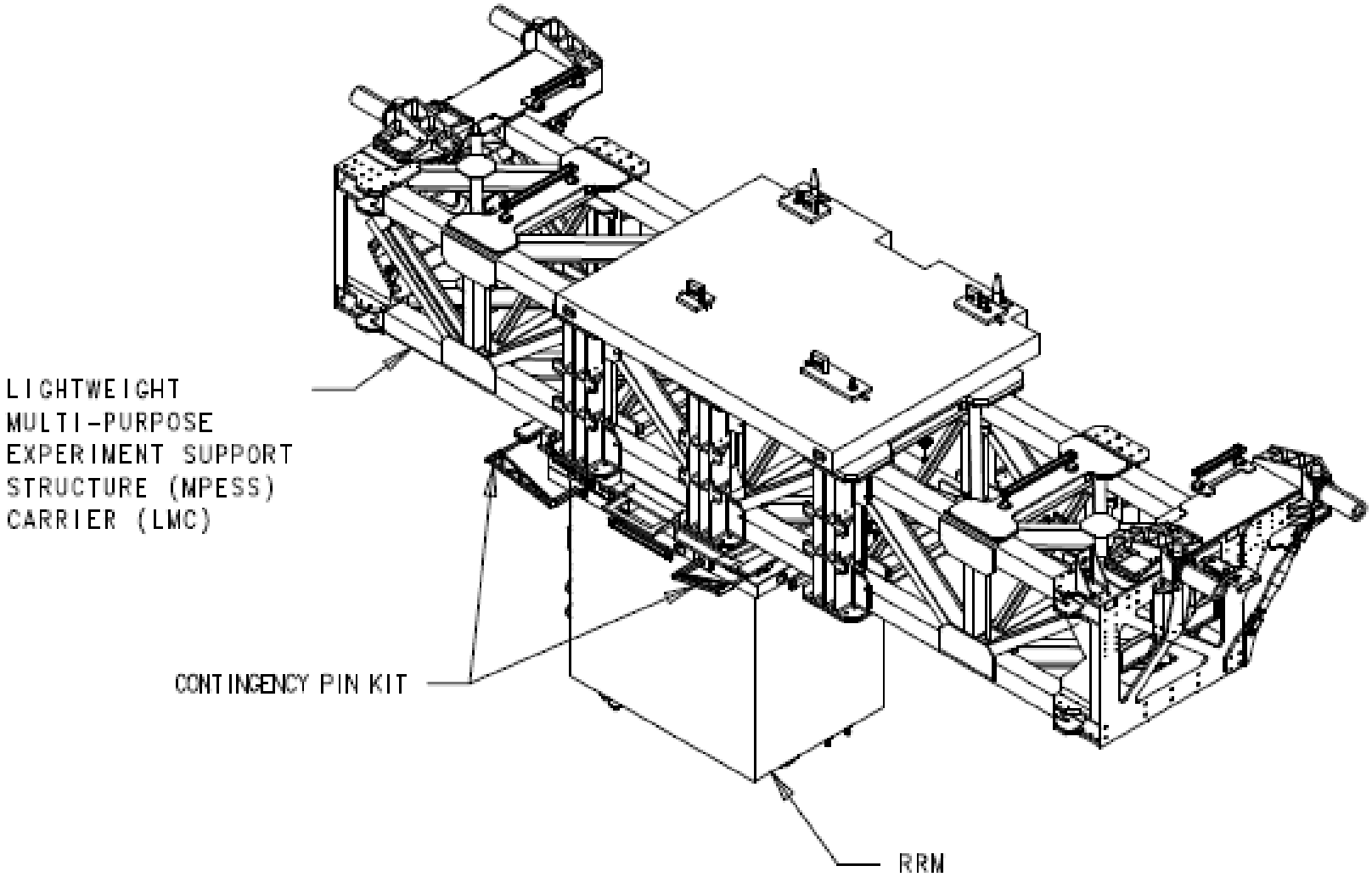


SECTION L-L 83F
ROTATED 11.61° CW
SHOWING CLEARANCE TO MANIPULATOR POSITIONING MECHANISM (MPM)

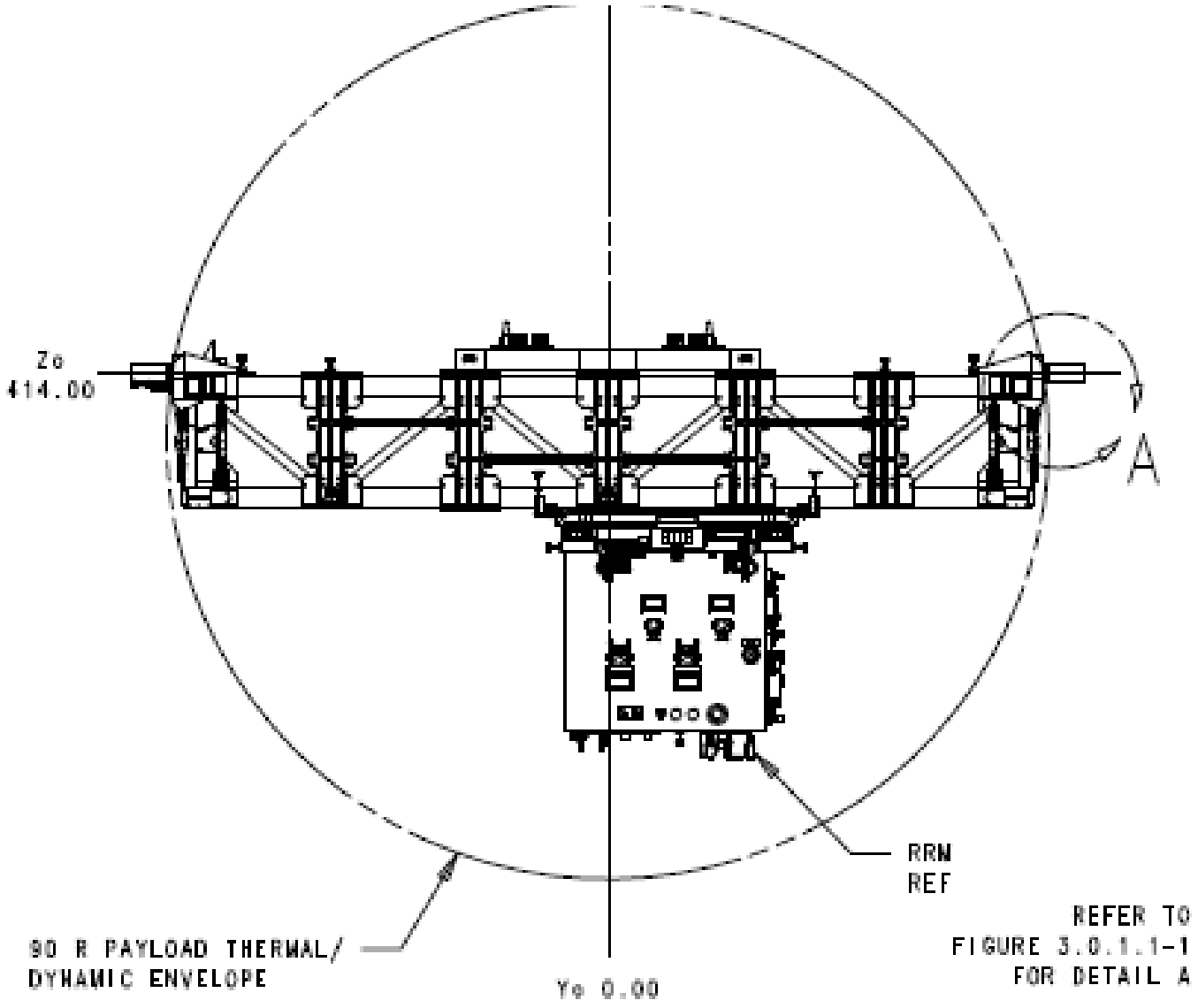
PAYLOAD BAY OVERVIEW (Cont)



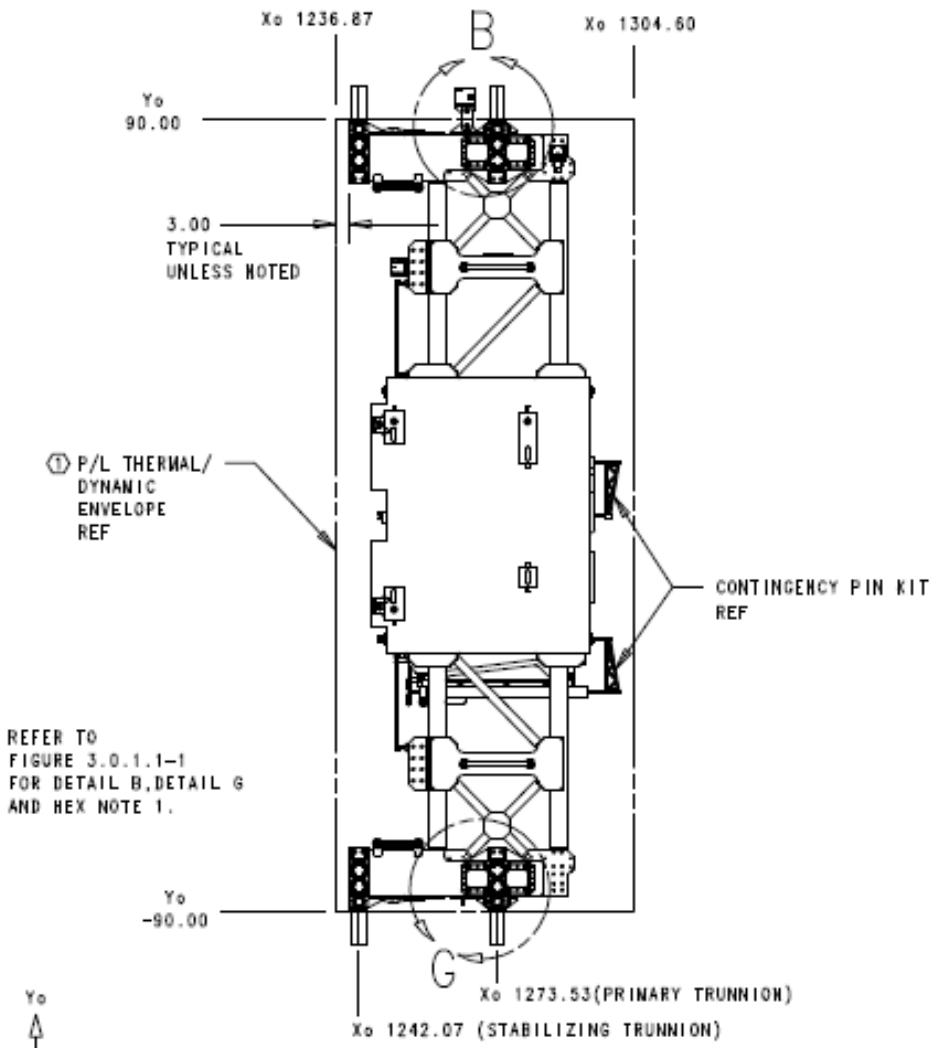
LMC


LIGHTWEIGHT
MULTI-PURPOSE
EXPERIMENT SUPPORT
STRUCTURE (MPESS)
CARRIER (LMC)
CONTINGENCY PIN KIT
RRM

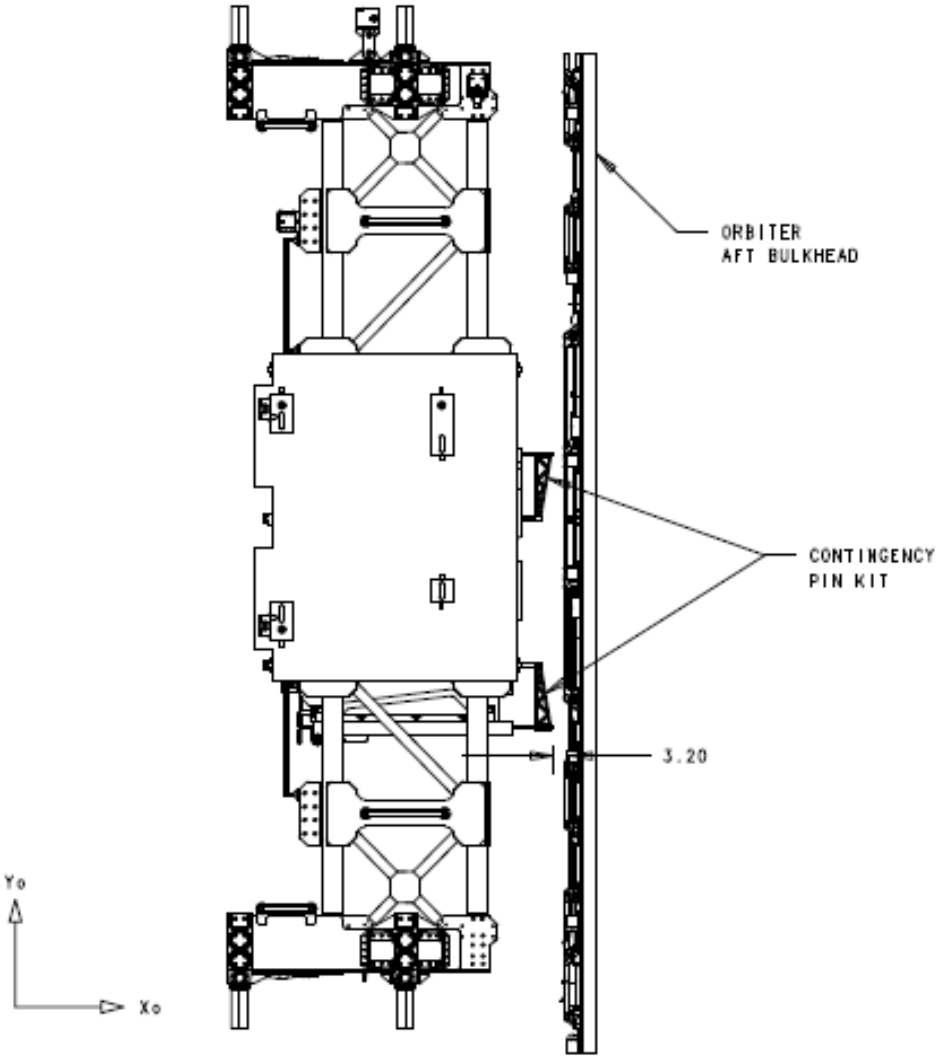
LMC (Cont)


Zo
414.00
A
RRM
REF
REFER TO
FIGURE 3.0.1.1-1
FOR DETAIL A
90 R PAYLOAD THERMAL/
DYNAMIC ENVELOPE
Yo 0.00

LMC (Cont)



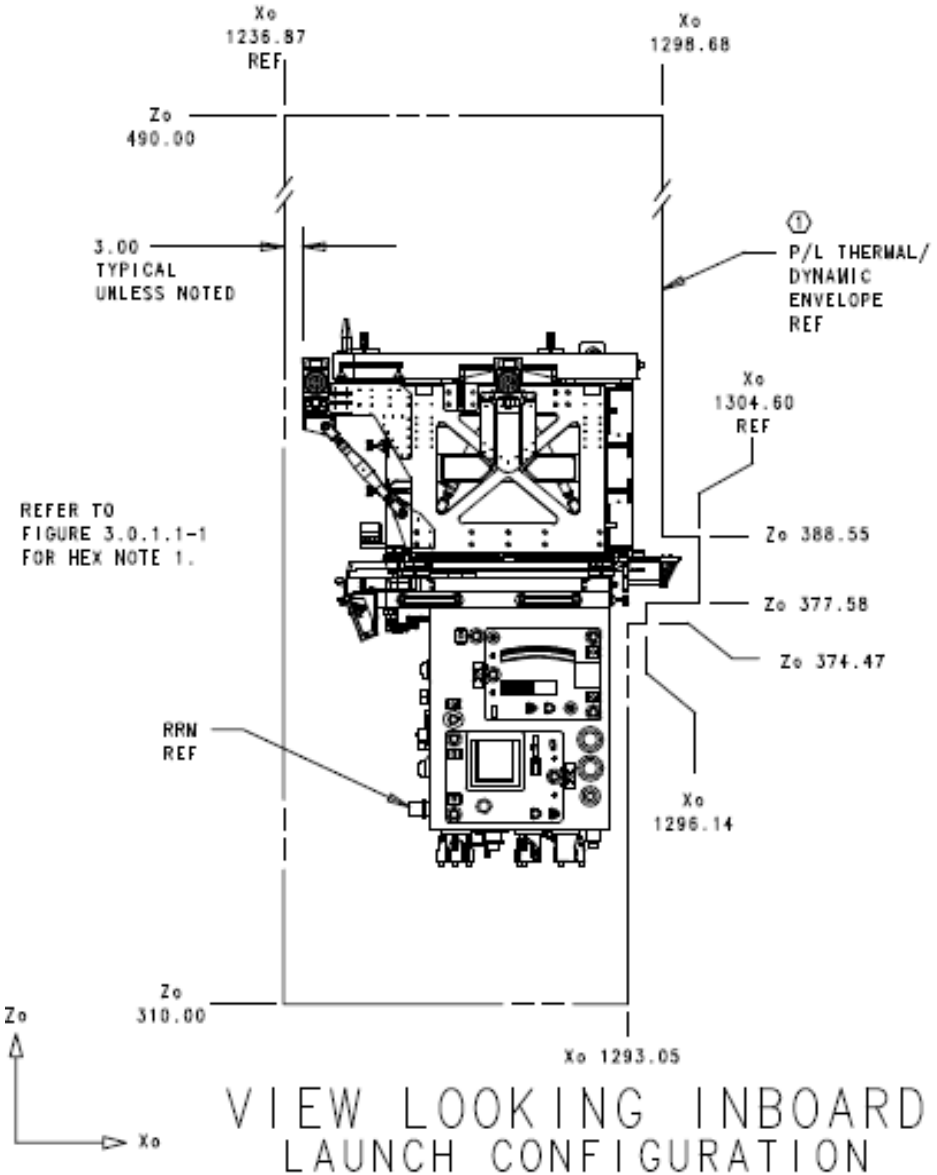
VIEW LOOKING DOWN
LAUNCH CONFIGURATION



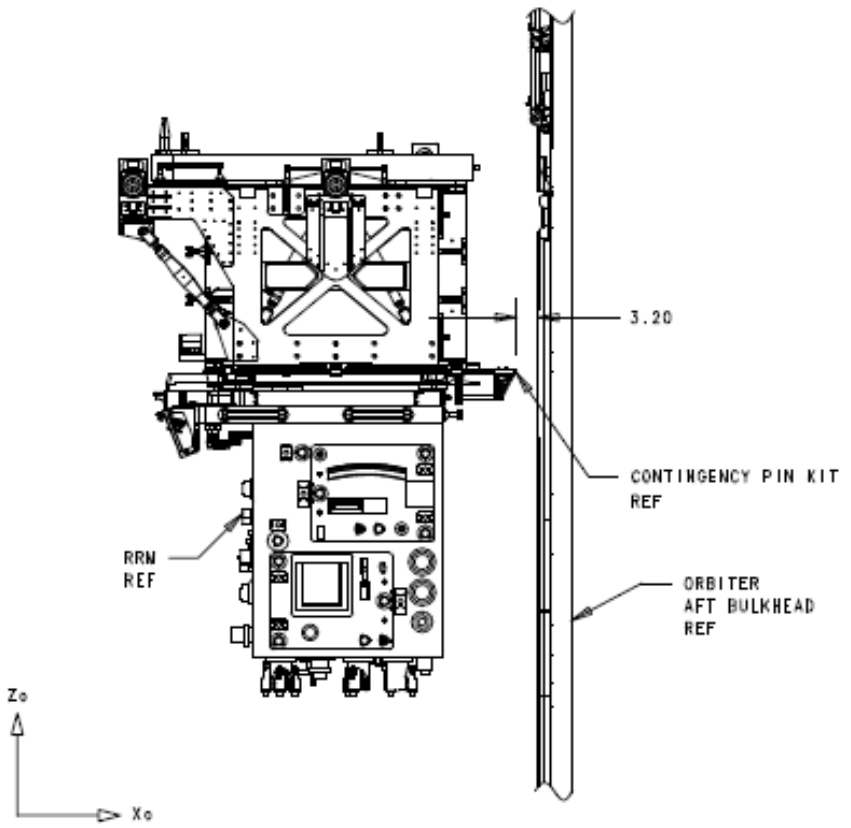
LAUNCH CONFIGURATION VIEW LOOKING DOWN

SELECT ORBITER HARDWARE OMITTED FOR CLARITY

LMC (Cont)

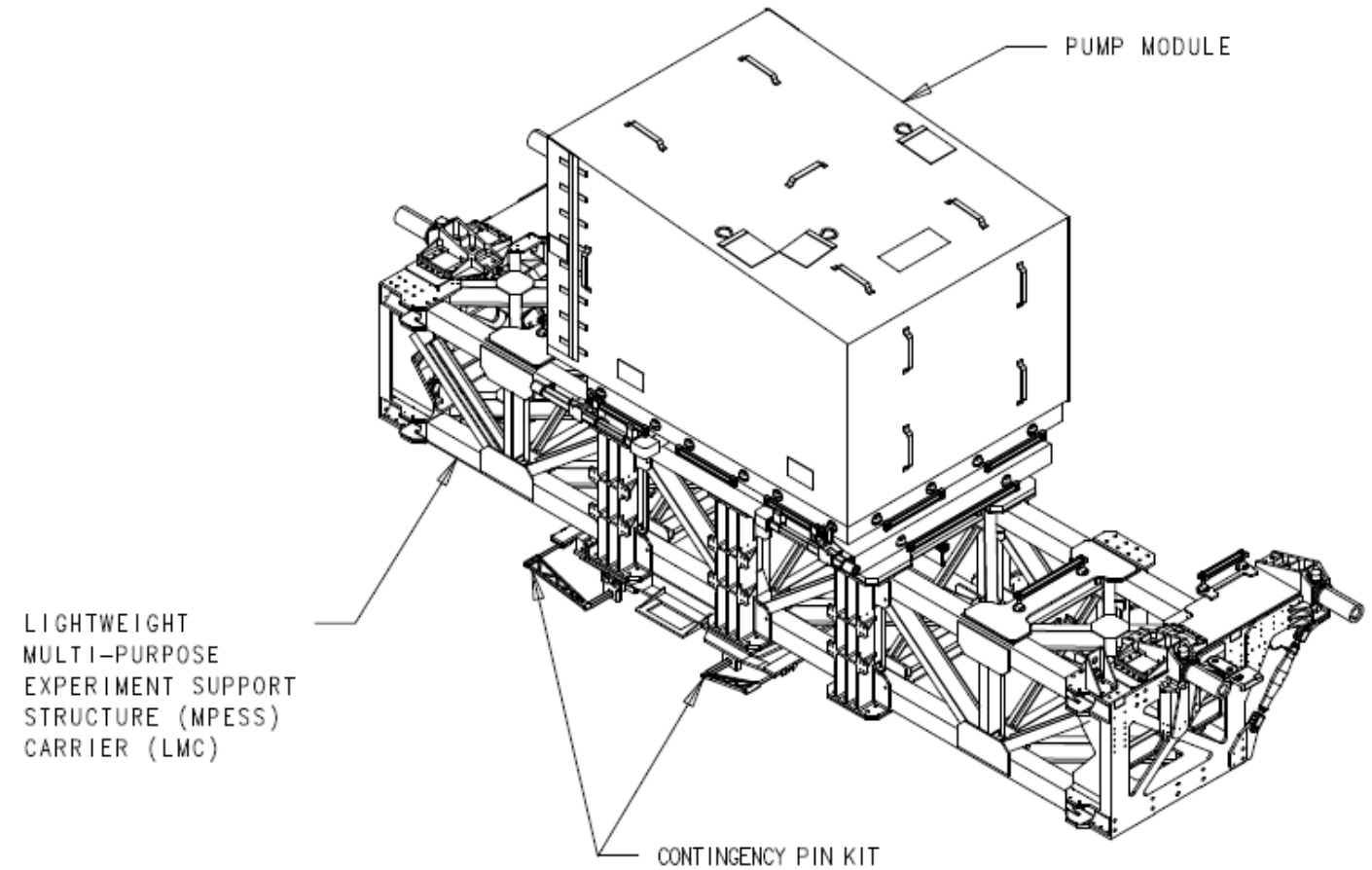


VIEW LOOKING INBOARD
LAUNCH CONFIGURATION



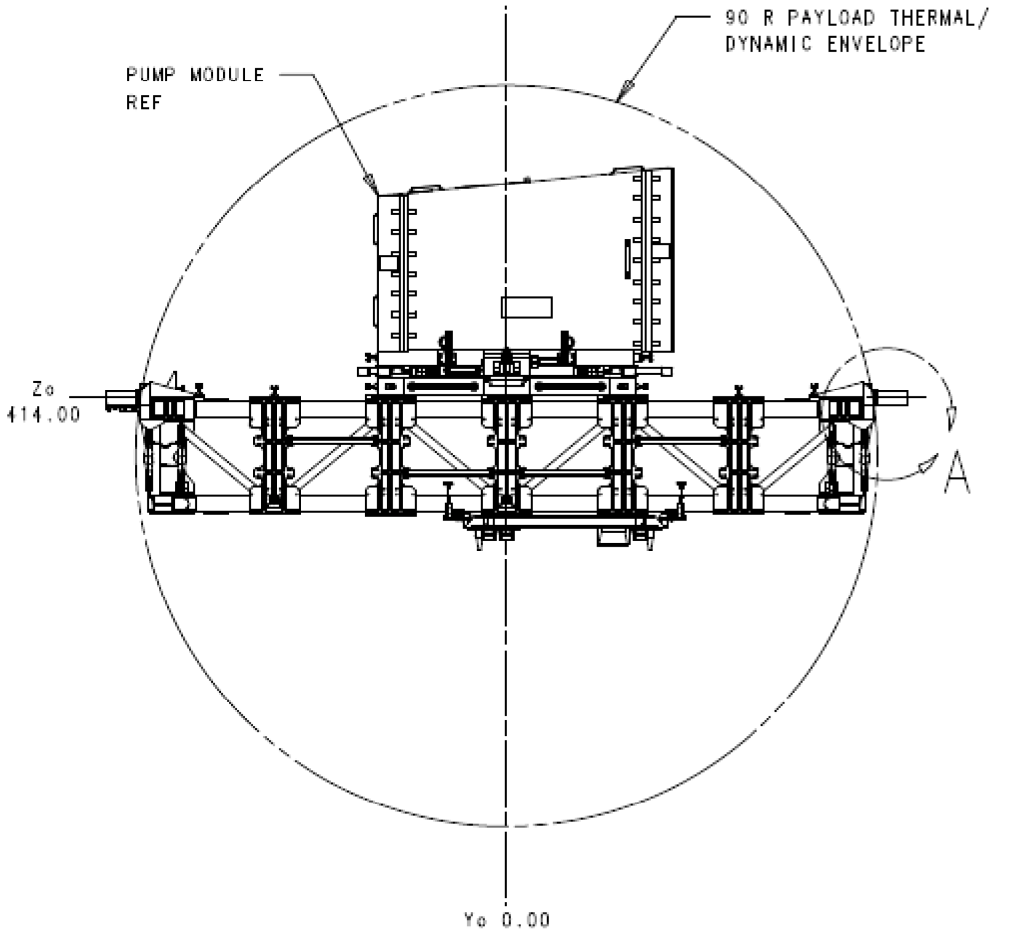
LAUNCH CONFIGURATION VIEW LOOKING INBOARD
SELECT ORBITER HARDWARE OMITTED FOR CLARITY

LMC (Cont)

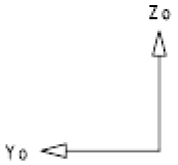


ORIENTATION VIEW
LANDING CONFIGURATION

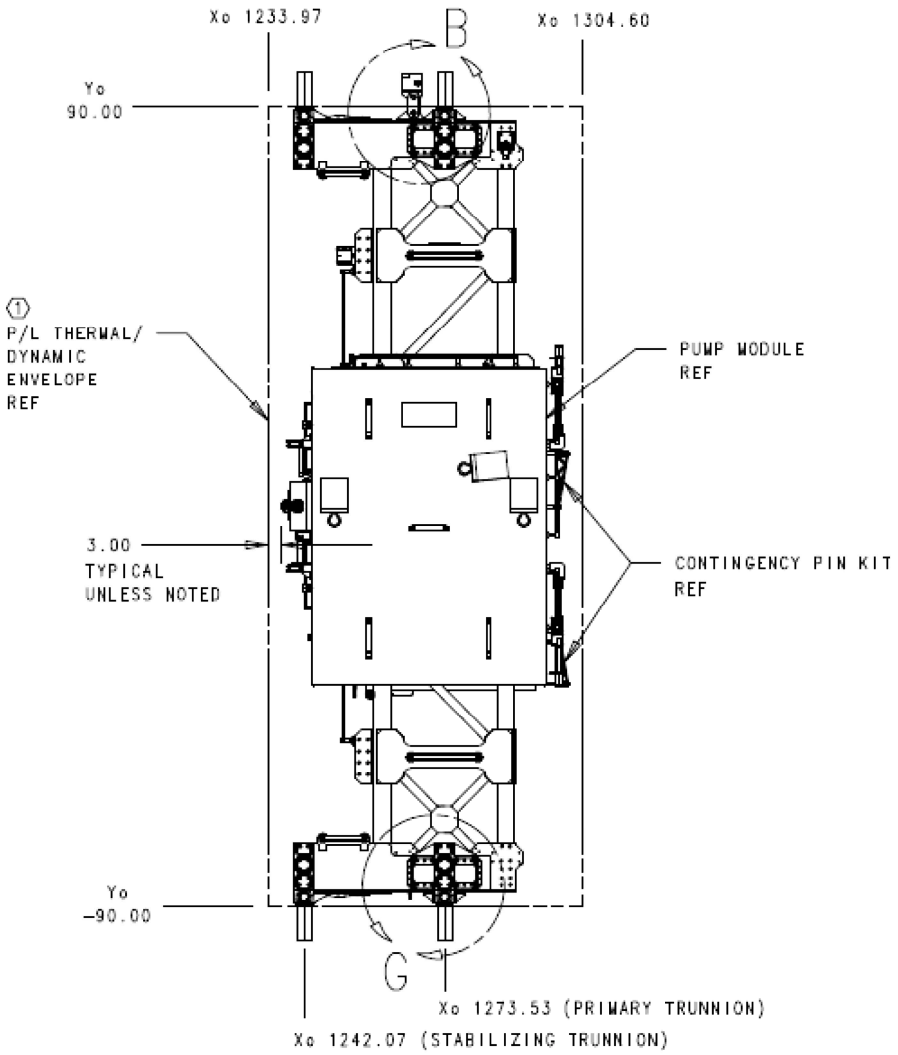
LMC (Cont)



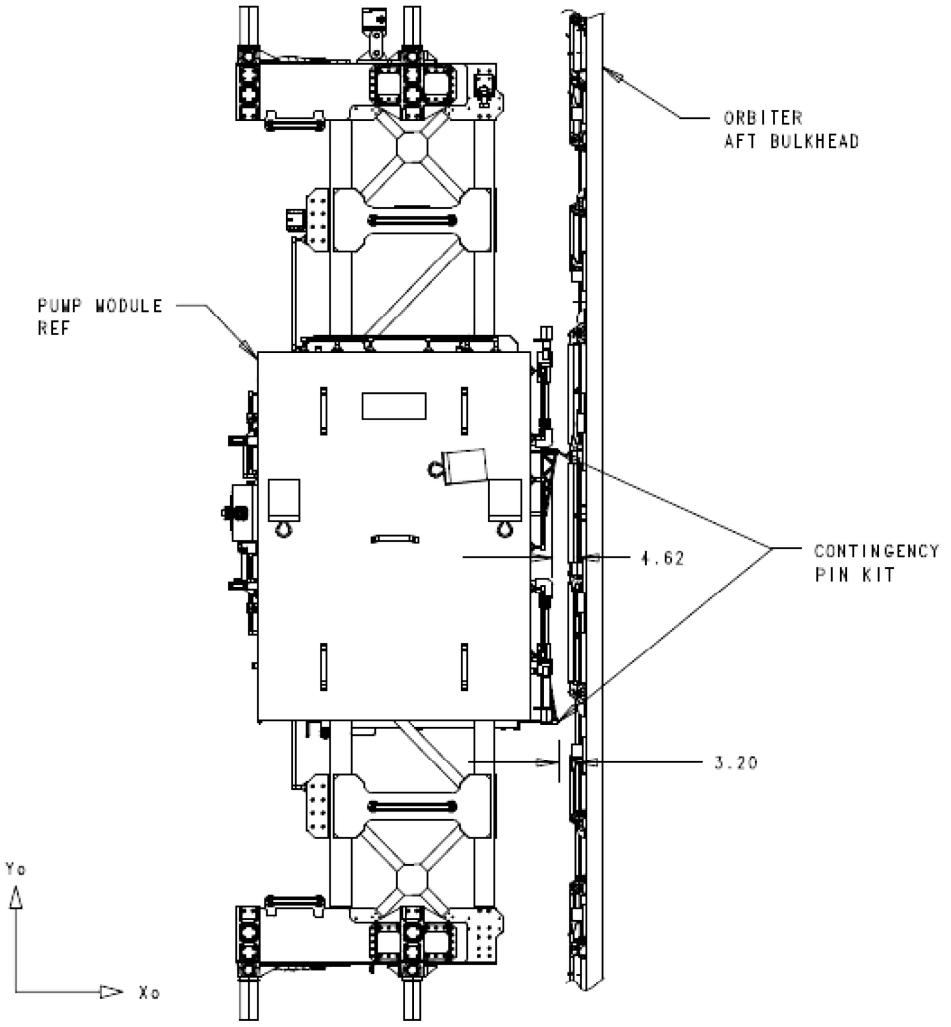
VIEW LOOKING AFT
LANDING CONFIGURATION



LMC (Cont)



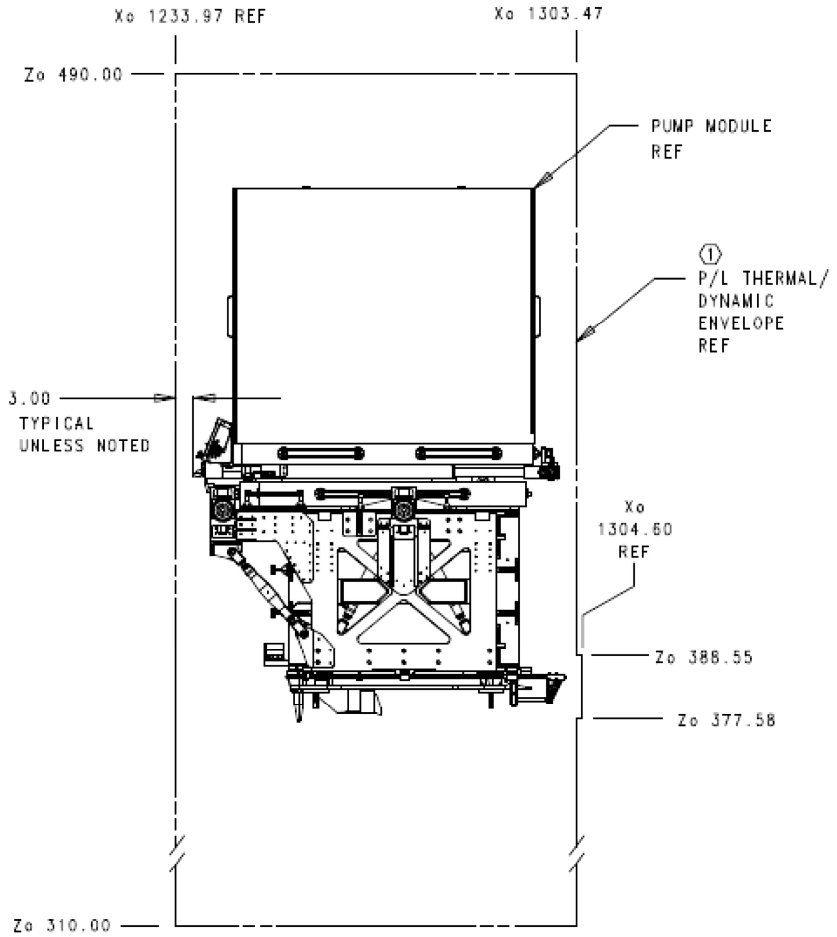
VIEW LOOKING DOWN
LANDING CONFIGURATION



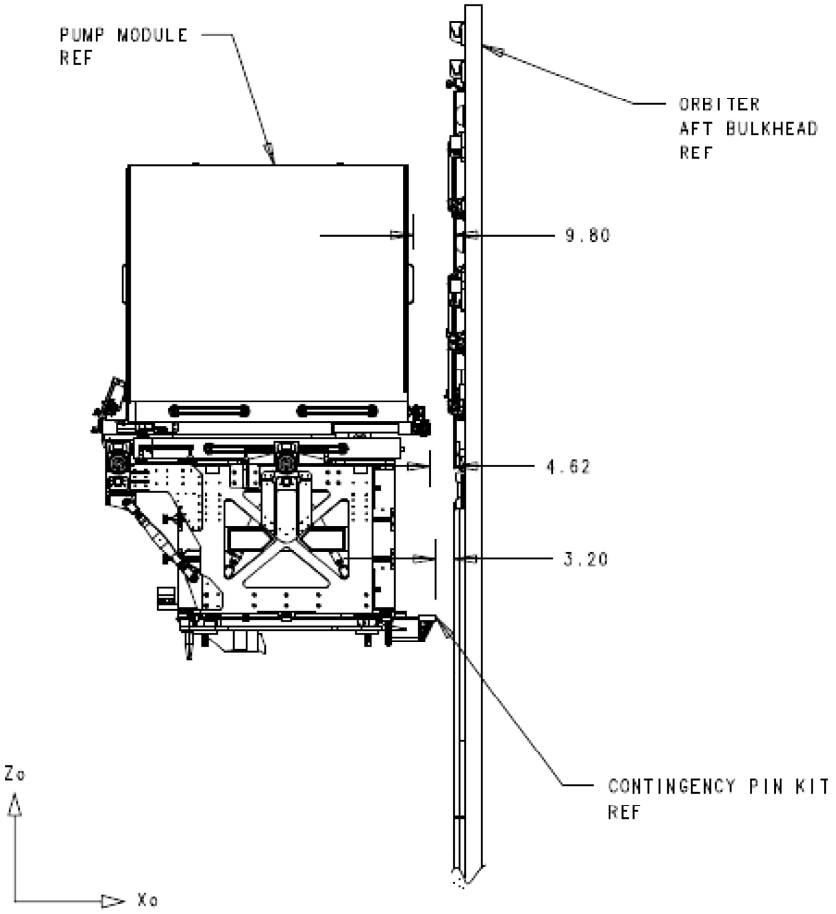
LANDING CONFIGURATION VIEW LOOKING DOWN

SELECT ORBITER HARDWARE OMITTED FOR CLARITY

LMC (Cont)

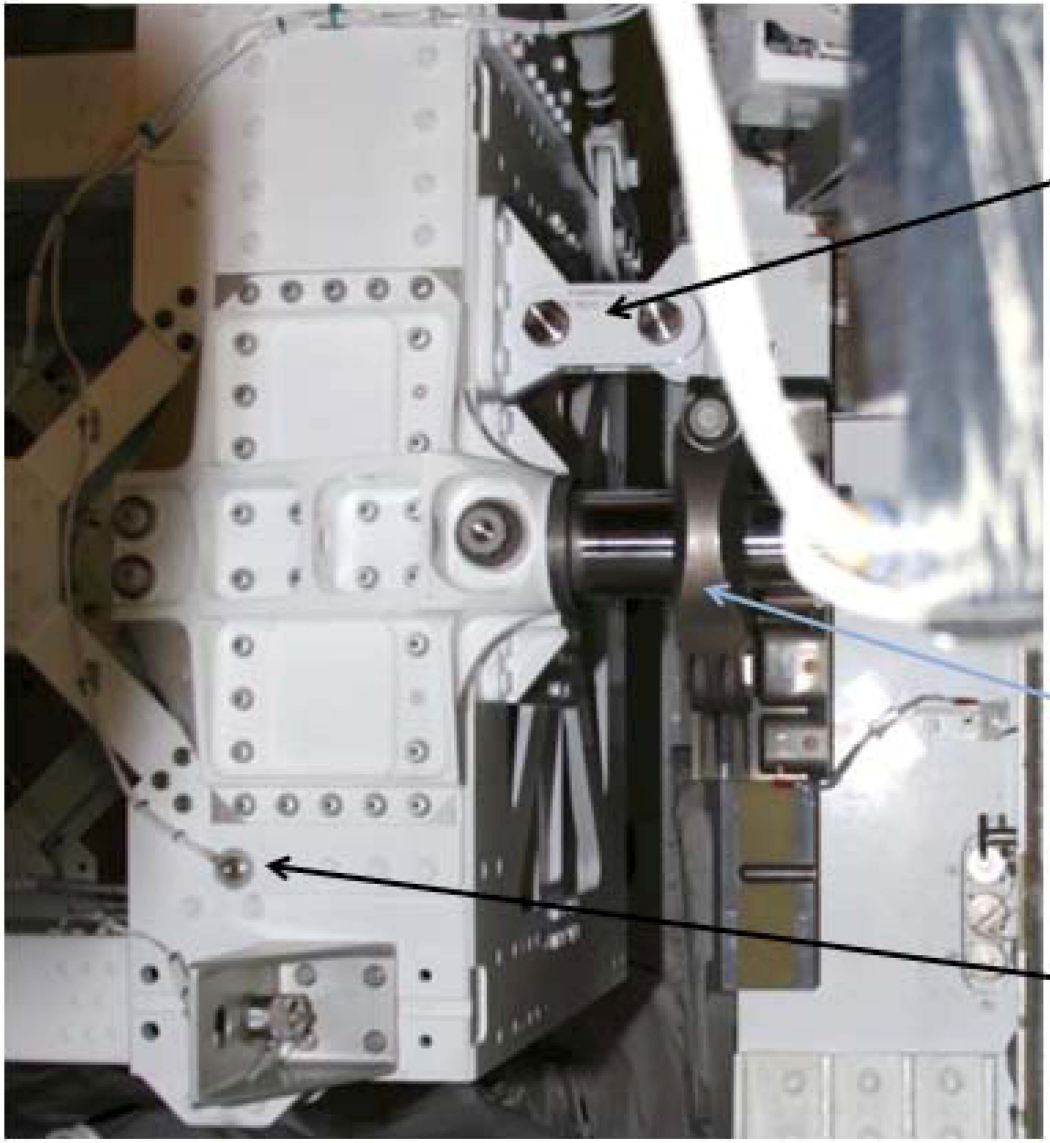


VIEW LOOKING INBOARD
LANDING CONFIGURATION

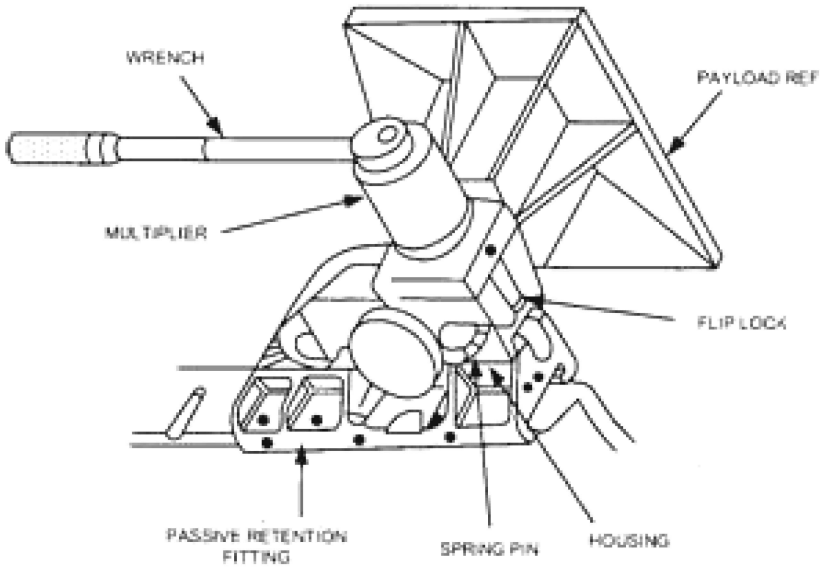


LANDING CONFIGURATION VIEW LOOKING INBOARD
SELECT ORBITER HARDWARE OMITTED FOR CLARITY

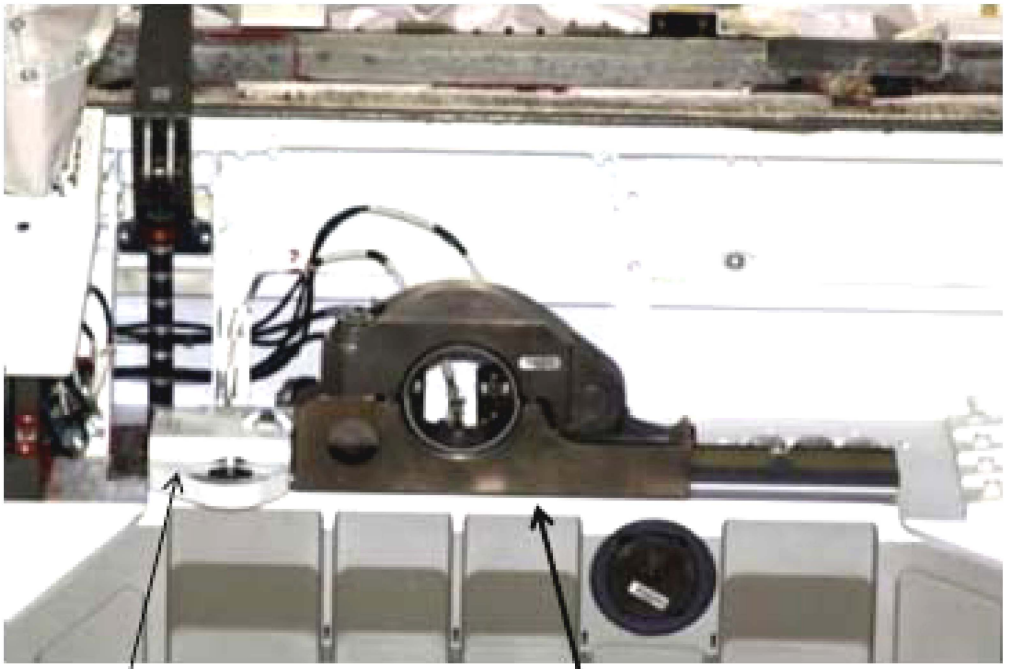
LMC (Cont)


Y-link
Attaches with two bolts,
2 nuts, 4 washers
Aft passive latch
Power cable bond wire
FWD
STBD side

LMC (Cont)



Passive latch w/torque multiplier and reaction adapter tool

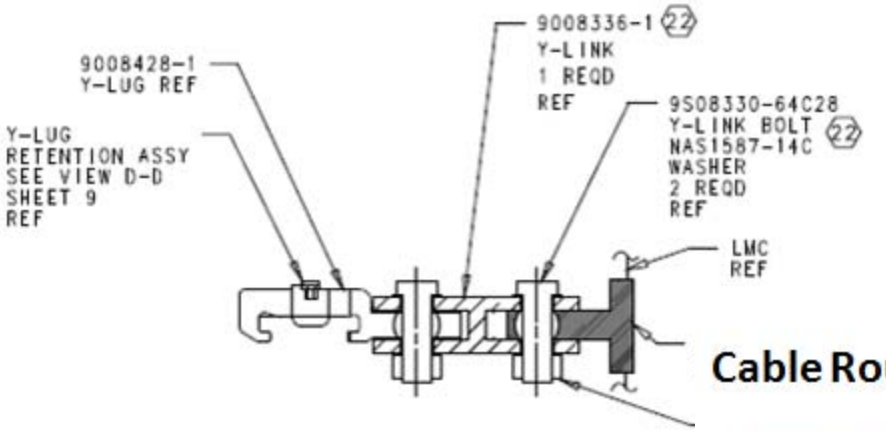


Y -lug

Bay 13 STBD
LMC aft passive latch

FWD

LMC (Cont)

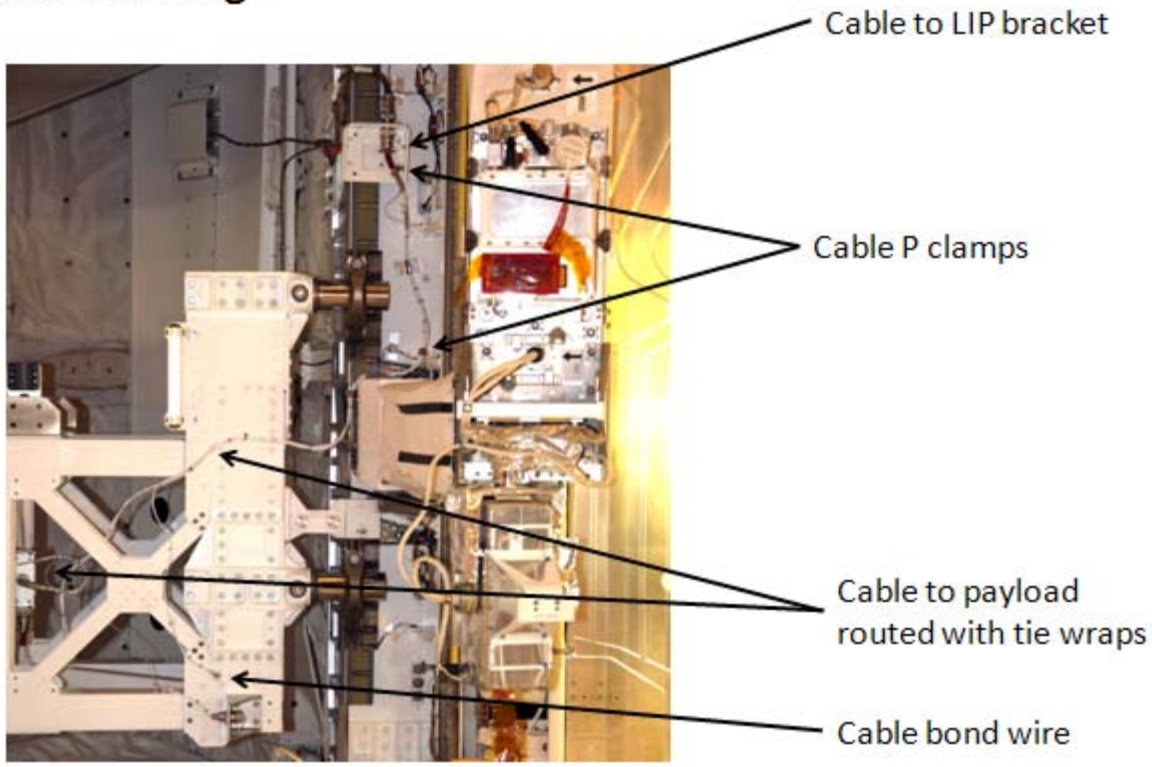


VIEW K-K

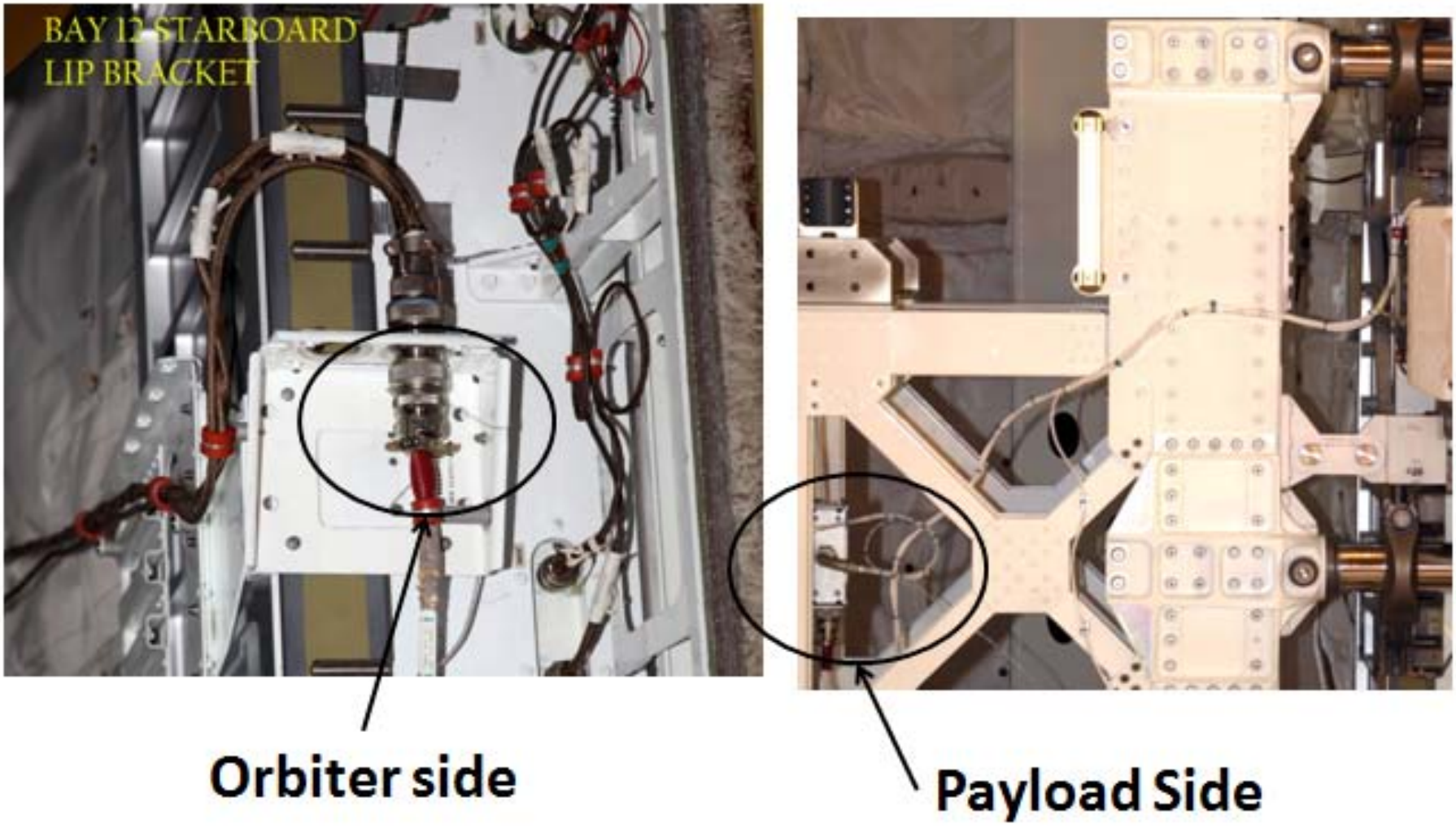
SECTION VIEW OF Y-LUG
AND Y-LINK ASSEMBLY

Y-link Assembly

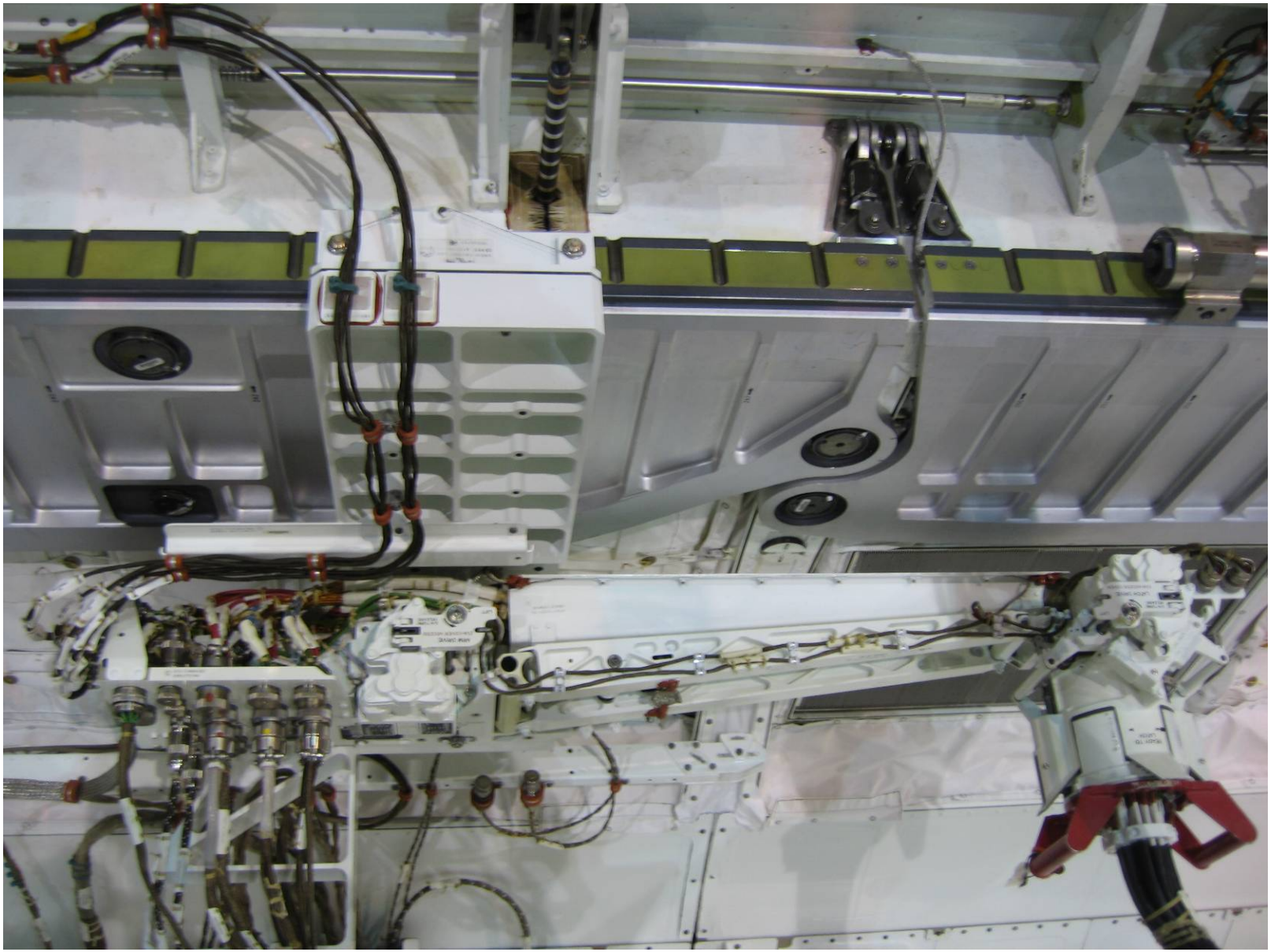
Cable Routing



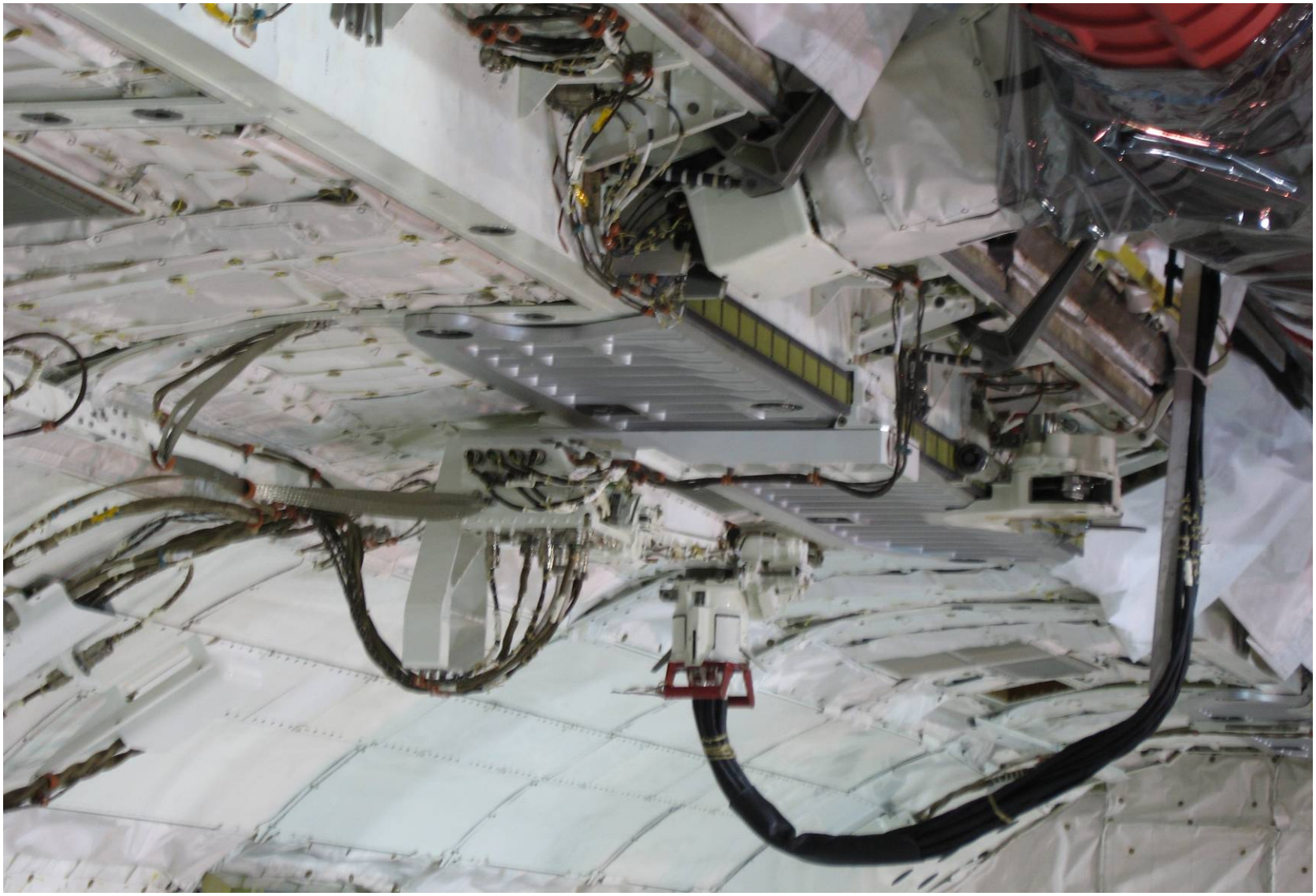
Cable Mates



ROEU

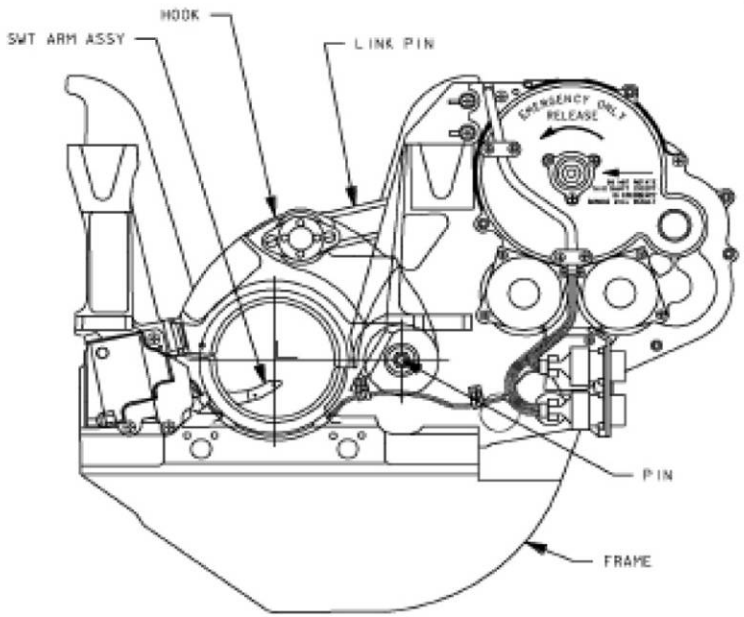


ROEU (Cont)



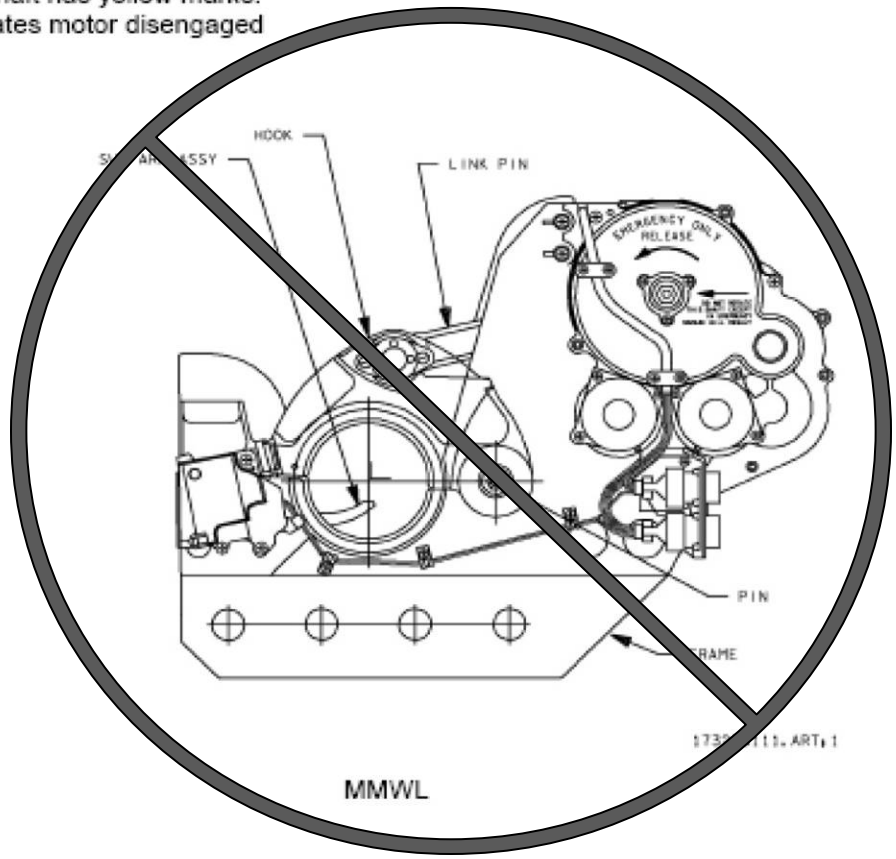
PRLA

In-board end of shaft has yellow marks.
Not aligned indicates motor disengaged



LWLL/MWLL/SMWLL

LIGHTWEIGHT LONGERON LATCH/
MIDDLEWEIGHT LONGERON LATCH/
SUPER MIDDLEWEIGHT LONGERON LATCH



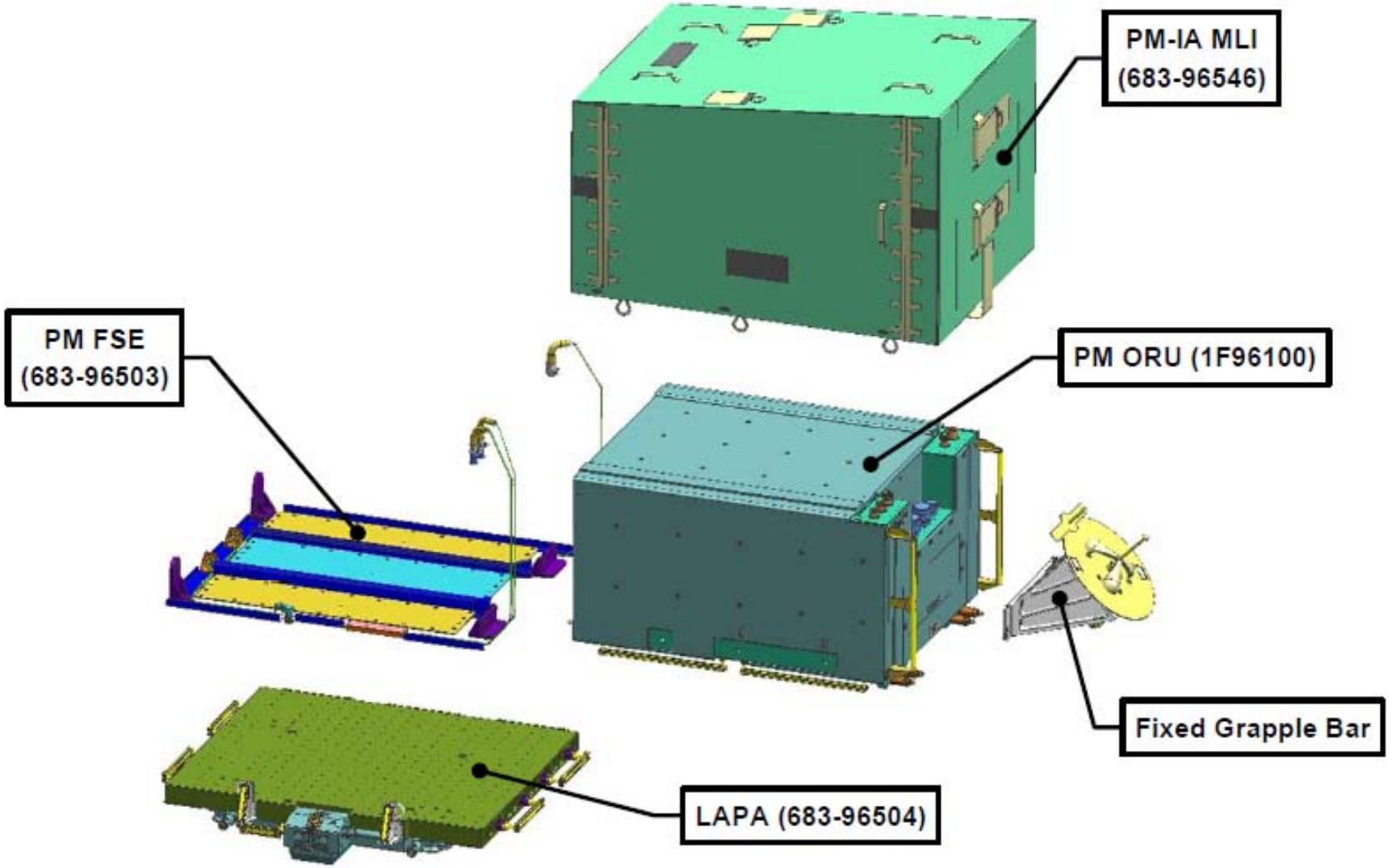
MMWL

MODIFIED MIDDLEWEIGHT LATCH

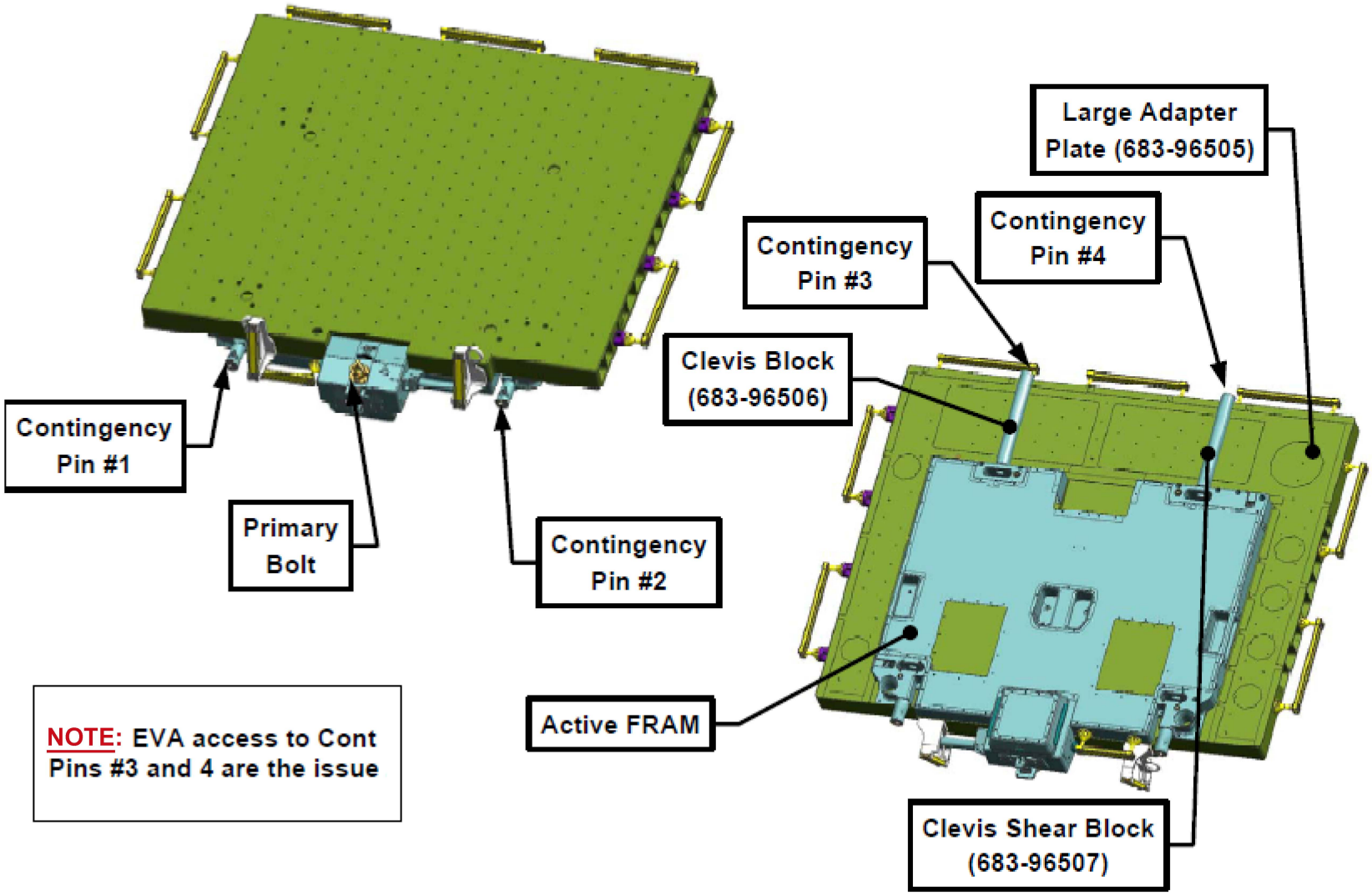
EVA RELEASABLE PAYLOAD RETENTION LATCHES

PM

Pump Module – Integrated Assembly (683-96501)



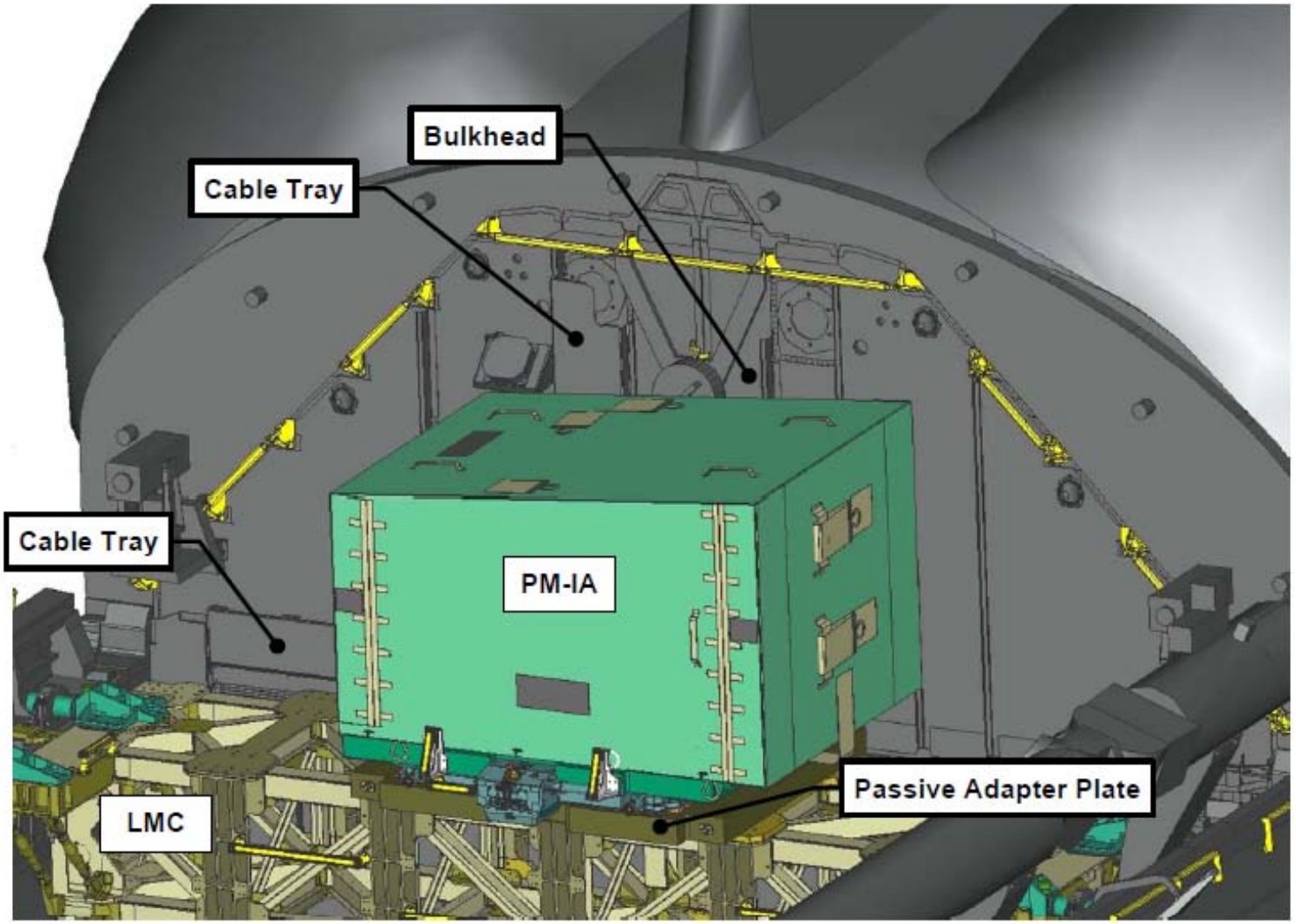
LAPA (683-96504)



NOTE: EVA access to Cont Pins #3 and 4 are the issue

PM (Cont)

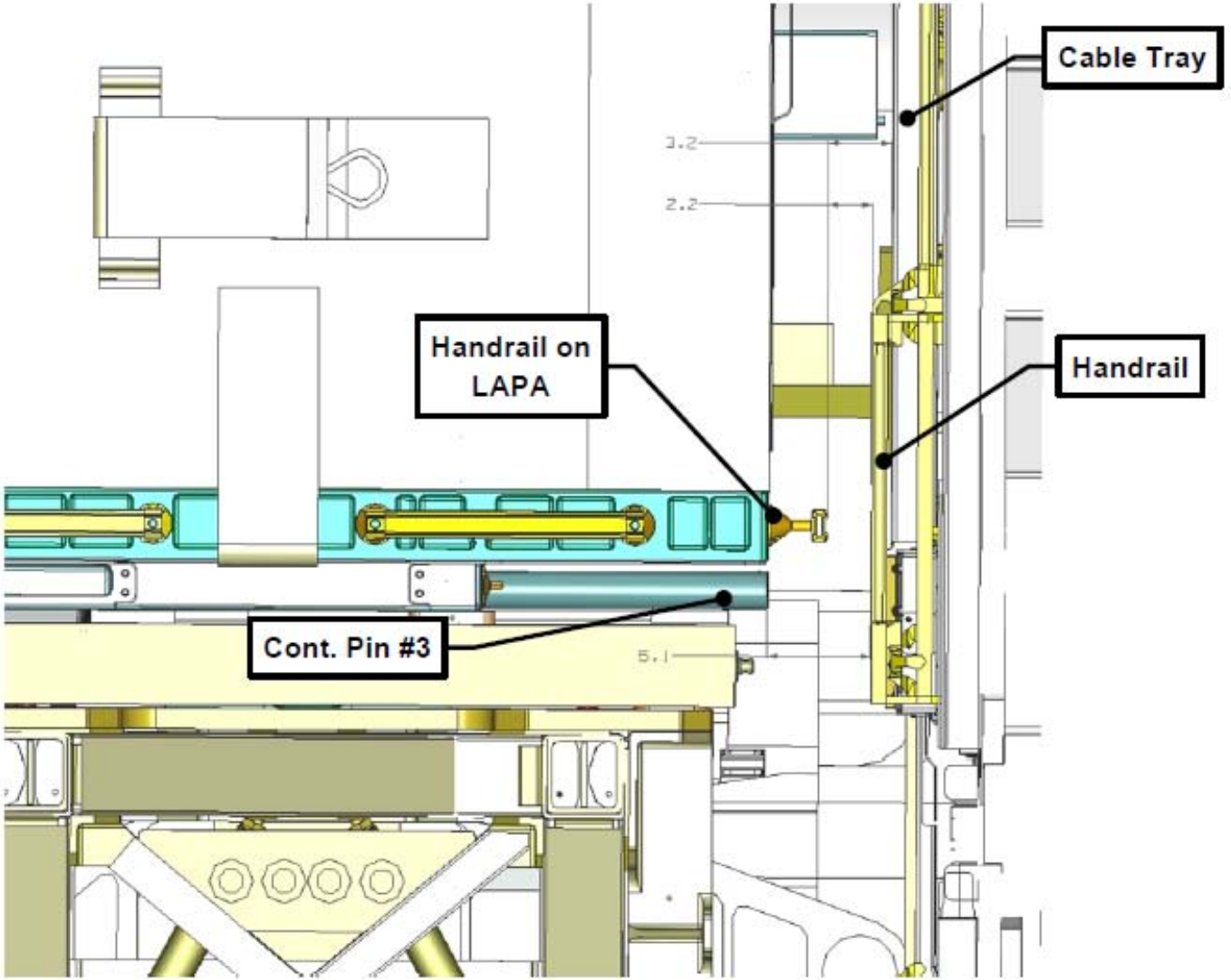
PM-IA on LMC



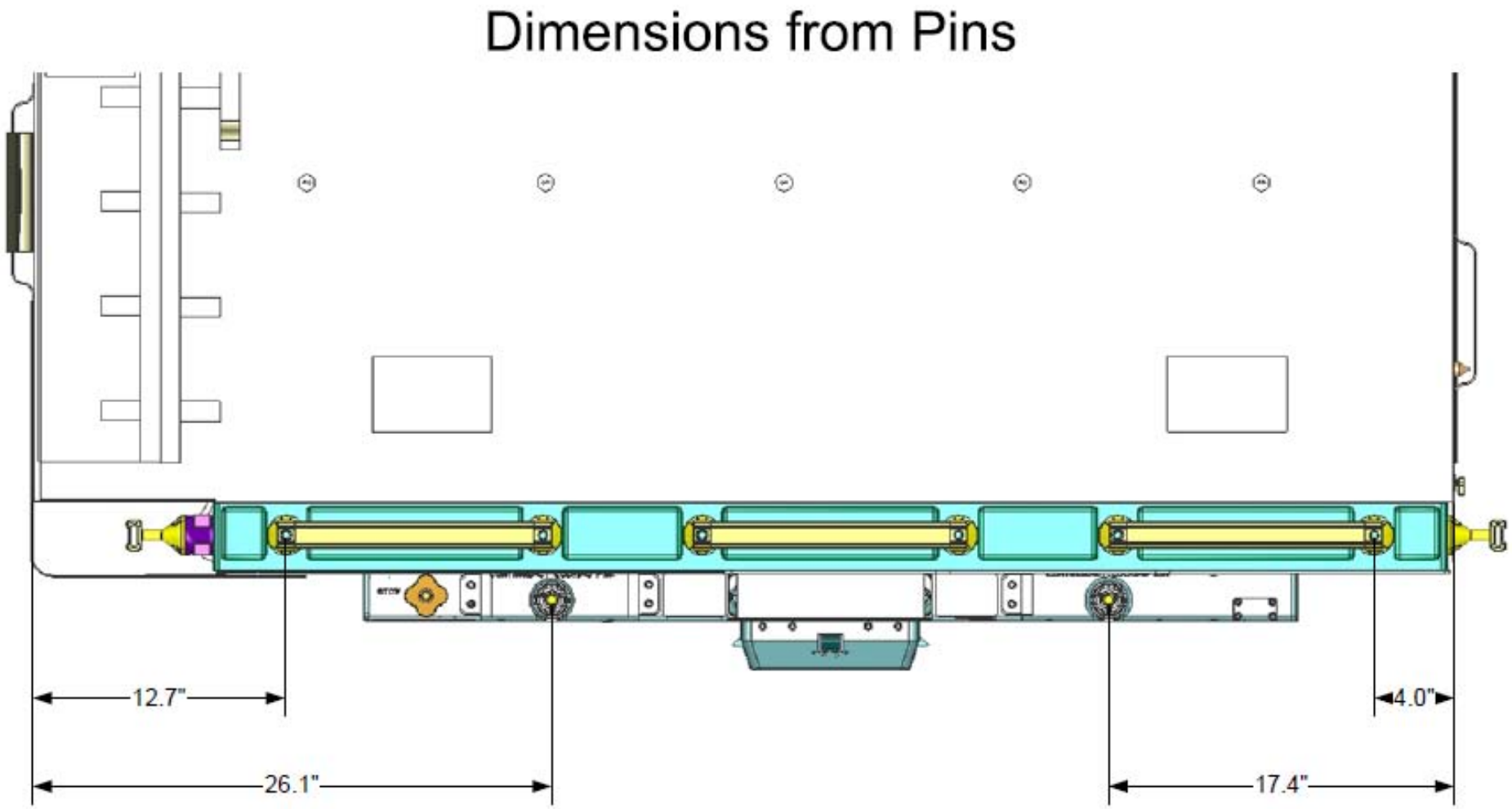
NOTE: Cable trays, aft winch, and WVS antenna not present on STS-135

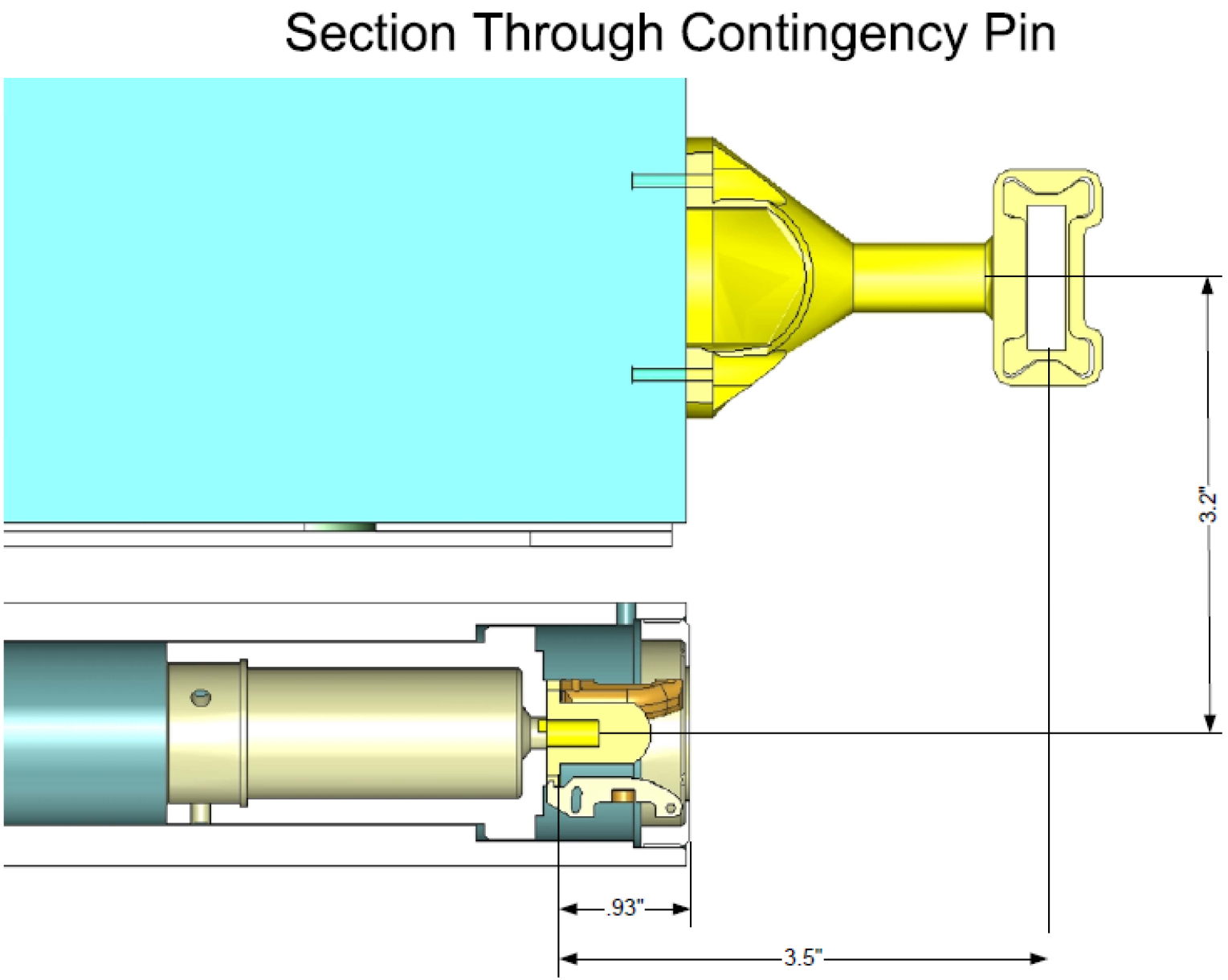
PM (Cont)

Dimensions from PM-IA to PLB Hardware

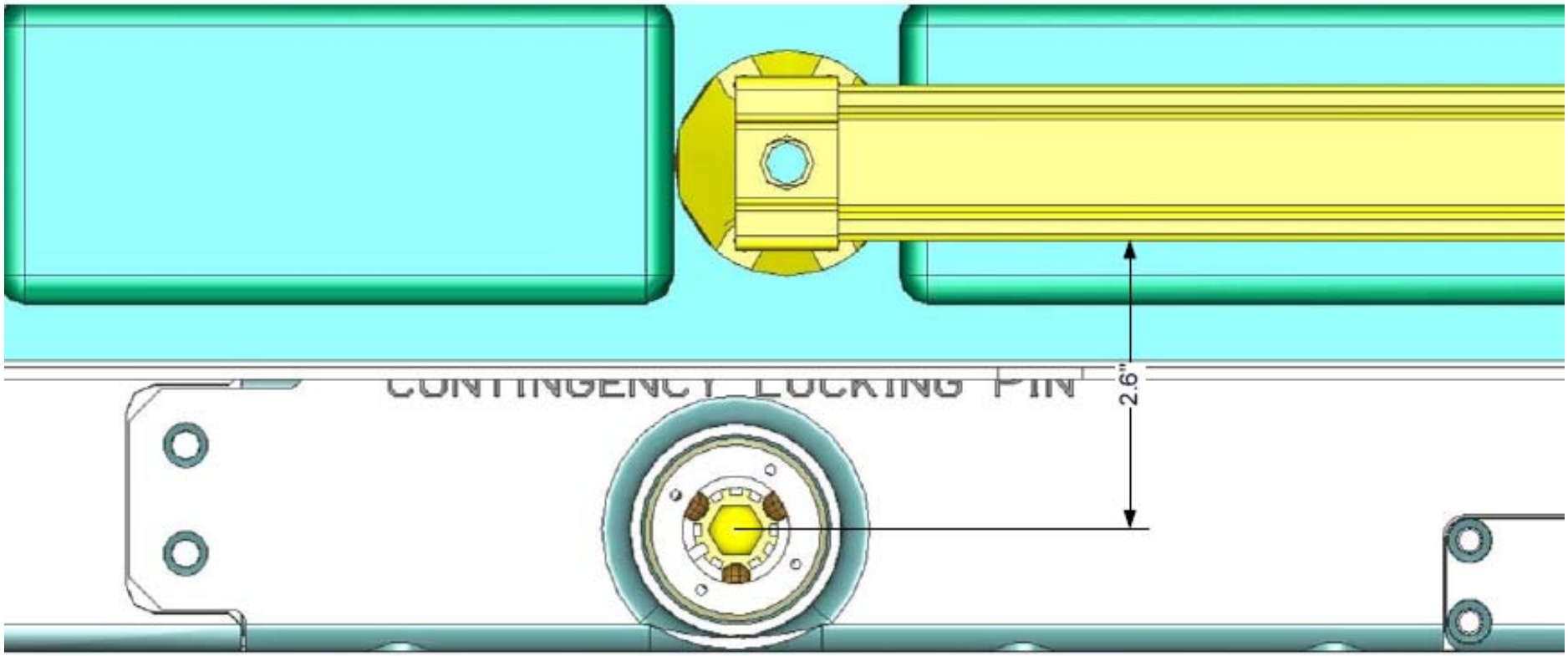


NOTE: Cable trays, aft winch, and WVS antenna not present on STS-135

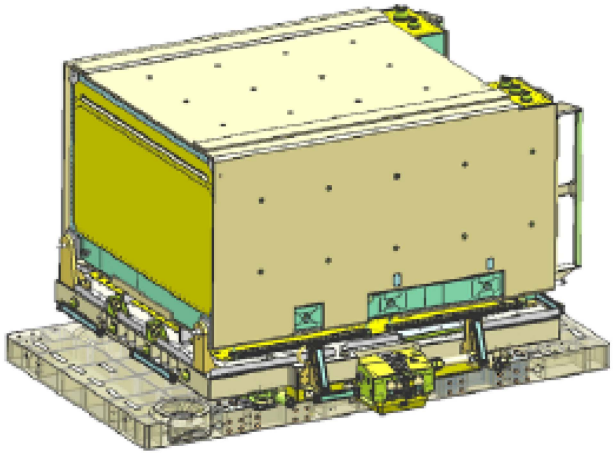

Dimensions from Pins
12.7"
26.1"
17.4"
4.0"

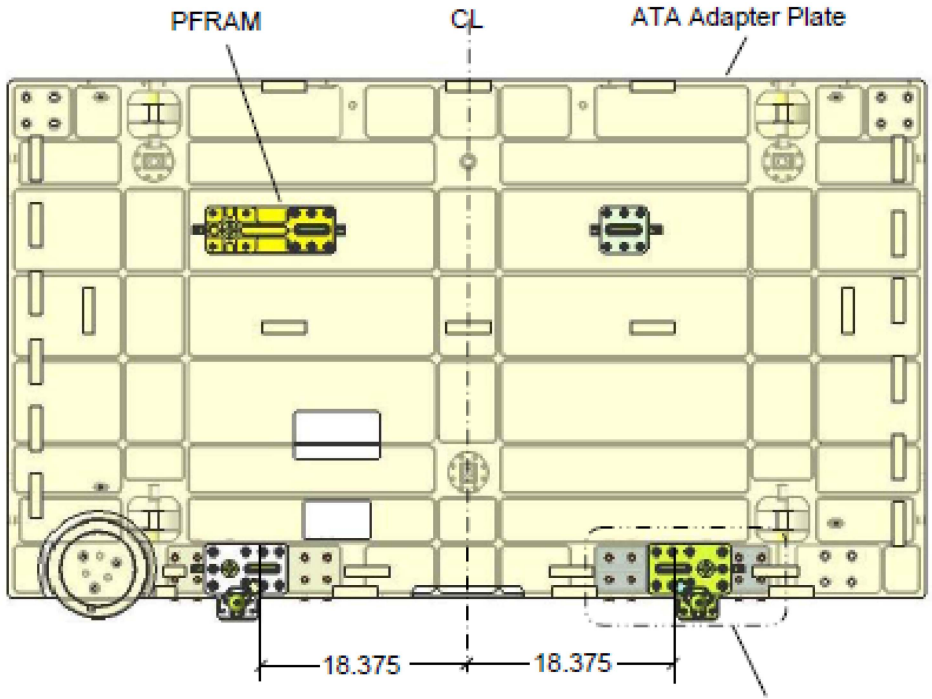

Section Through Contingency Pin
3.2"
.93"
3.5"

Distance from Contingency Pin and Bottom of Handrail



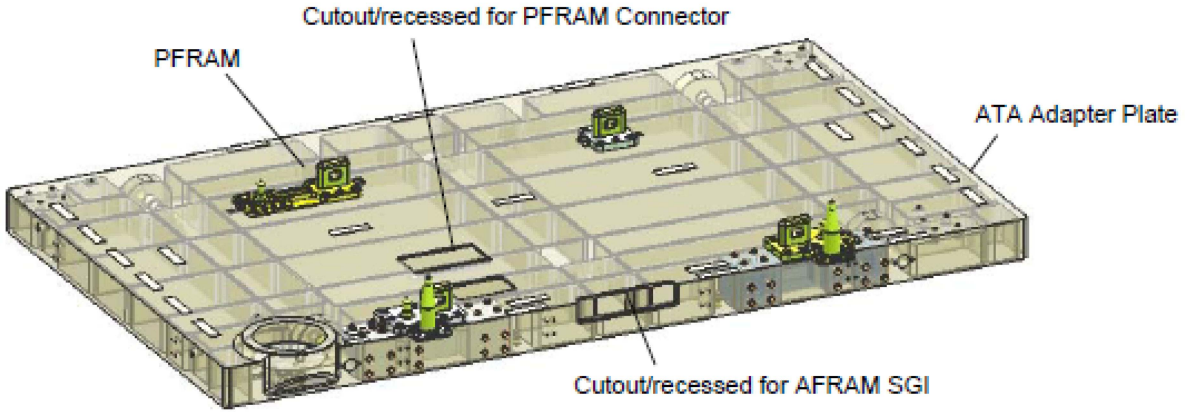
PFRAM Centered on Modified ATA LMC Adapter Plate



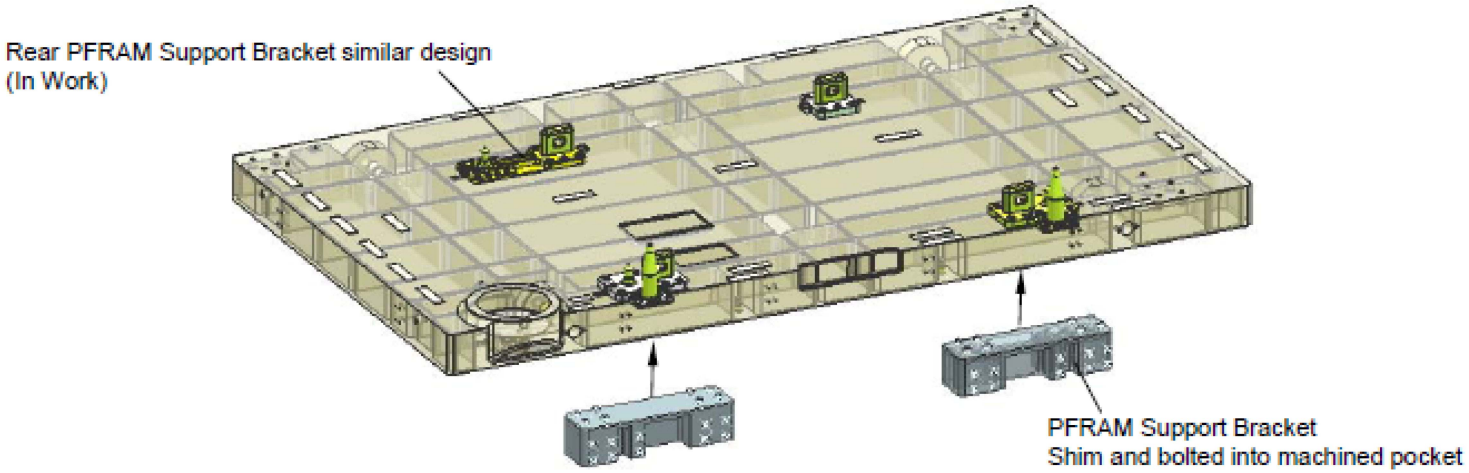


PFRAM Fitting centered in ATA Adapter Plate machined pocket
Alignment Guide overhangs Adapter Plate

PFRAM Centered on Modified ATA LMC Adapter Plate



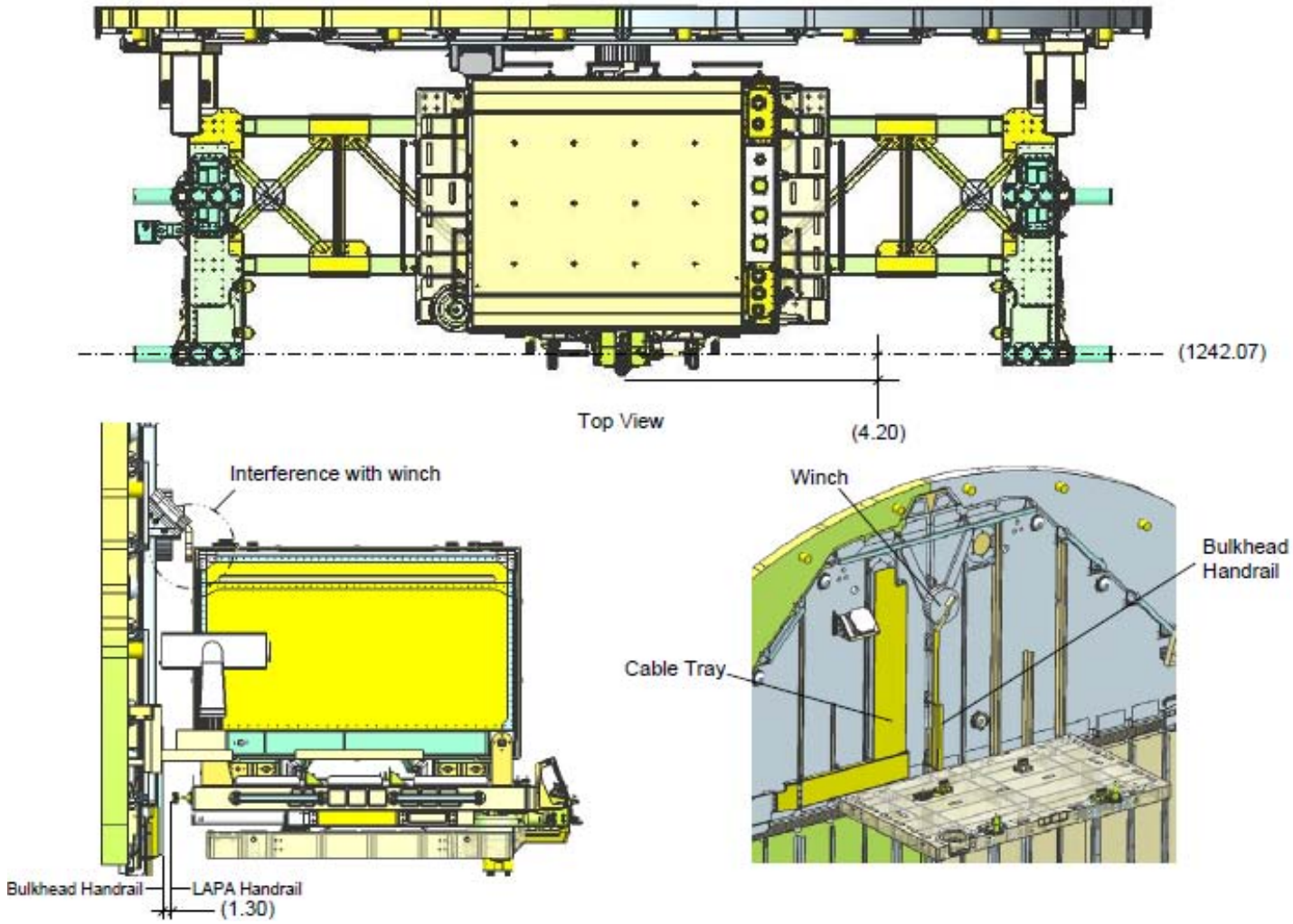
Modified ATA LMC Adapter Plate - Iso View



Modified ATA LMC Adapter Plate - Exploded View

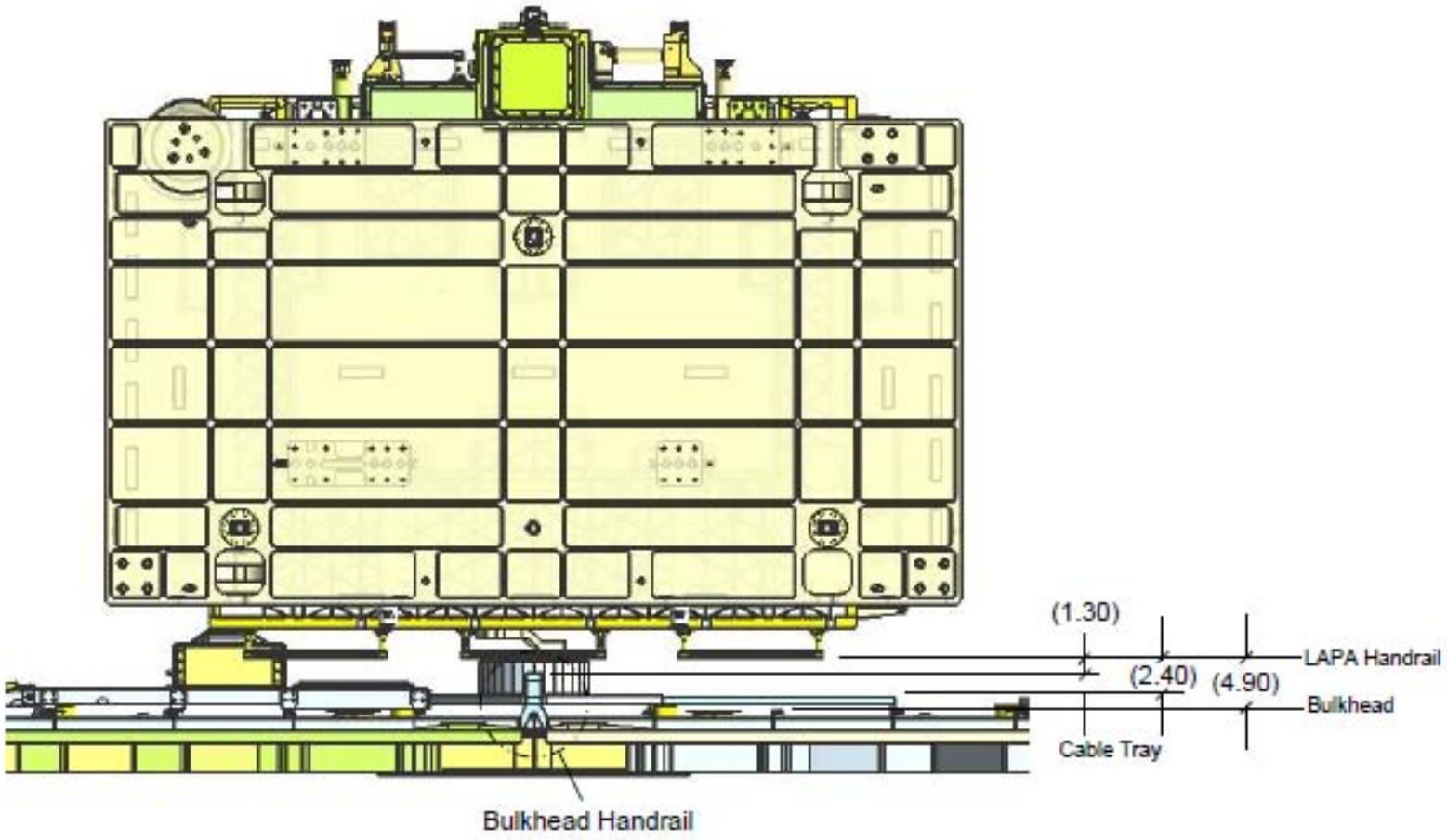
PM (Cont)

PFRAM Centered on Modified ATA LMC Adapter Plate – Bulkhead Envelope

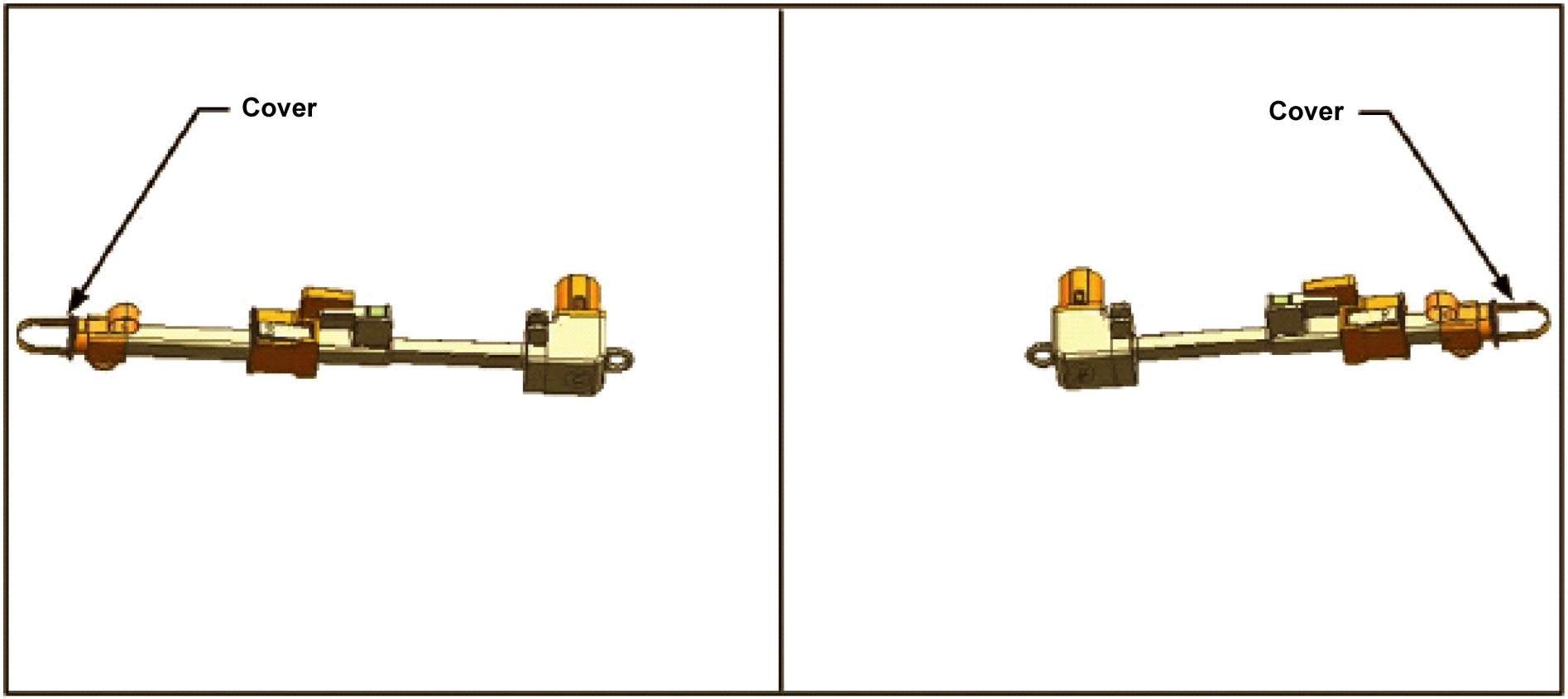


NOTE: Cable trays, aft winch, and WVS antenna not present on STS-135

PFRAM Centered on Modified ATA LMC Adapter Plate – Bulkhead Envelope



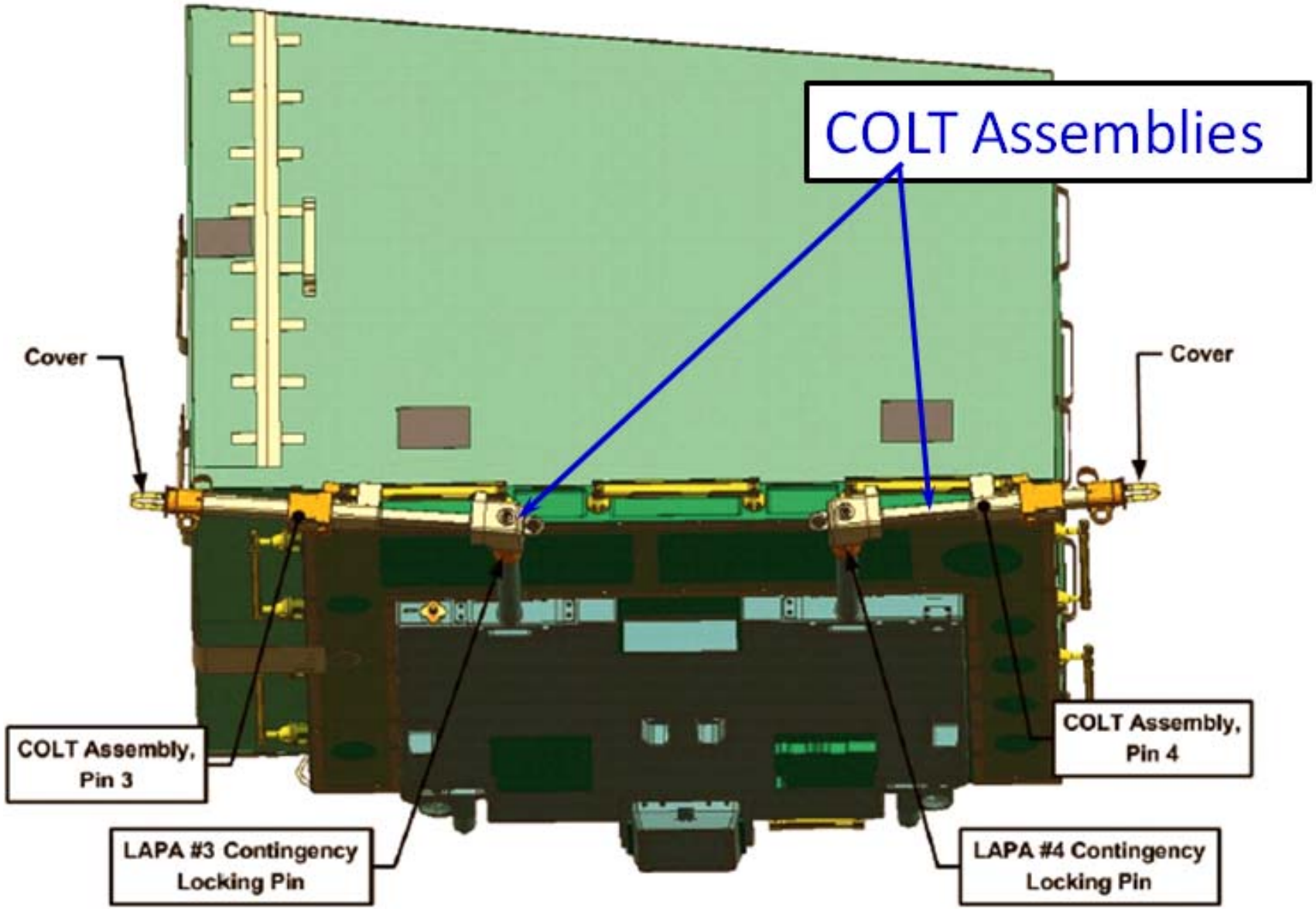
Bottom View



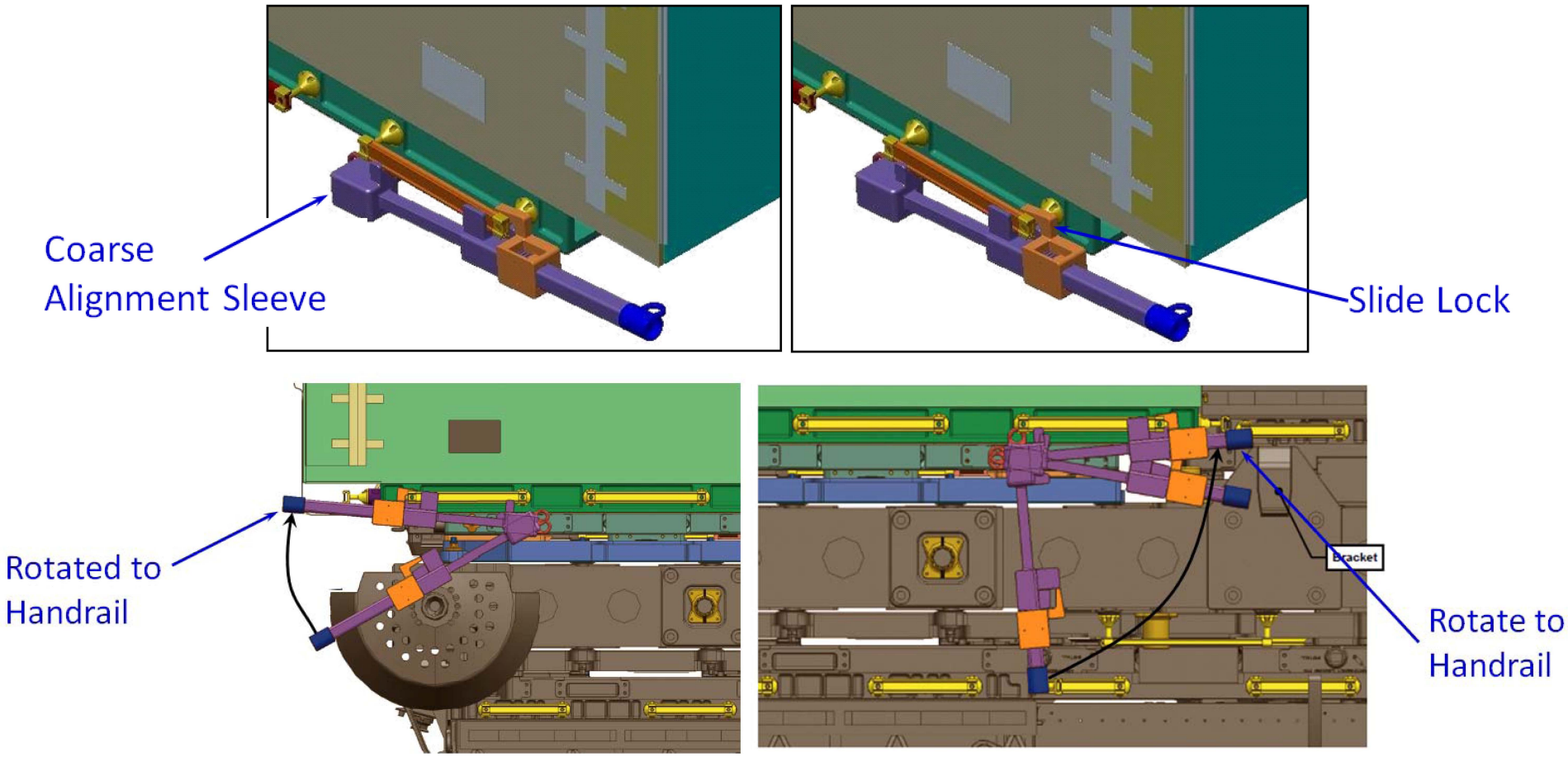
COLT Assembly, Pin 3
P/N SEG33122635-301
(LONG)

COLT Assembly, Pin 4
P/N SEG33122635-302
(SHORT)

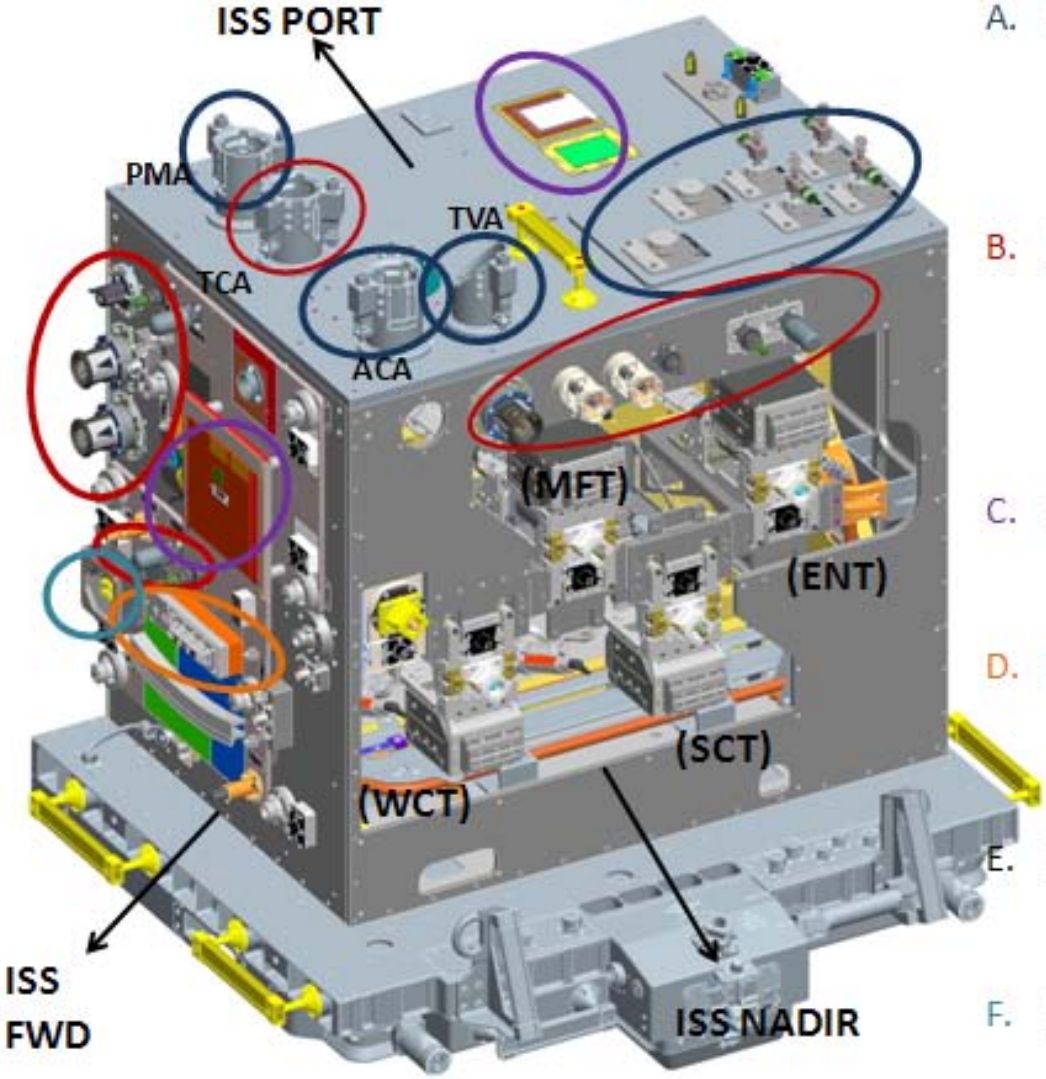
COLT (Cont)


COLT Assemblies
Cover
Cover
COLT Assembly, Pin 3
COLT Assembly, Pin 4
LAPA #3 Contingency Locking Pin
LAPA #4 Contingency Locking Pin

COLT (Cont)


Coarse
Alignment Sleeve
Slide Lock
Rotated to
Handrail
Bracket
Rotate to
Handrail

RRM



A. COOLANT VALVE TASK
   A. Coolant Valve Panel
      A. Cut wire on T-valve & Ambient Cap
      B. Remove T-valve & stow; remove ambient cap & stow, manipulate ambient plug

B. REFUELING TASK (practice and demo)
   A. Fill/Drain valves
      A. Cut wires – 3 places (FDV2, FDV4, PV1)
      B. Remove tertiary & safety caps, stow
      C. Open PV1 actuation nut, transfer ethanol, vent ethanol

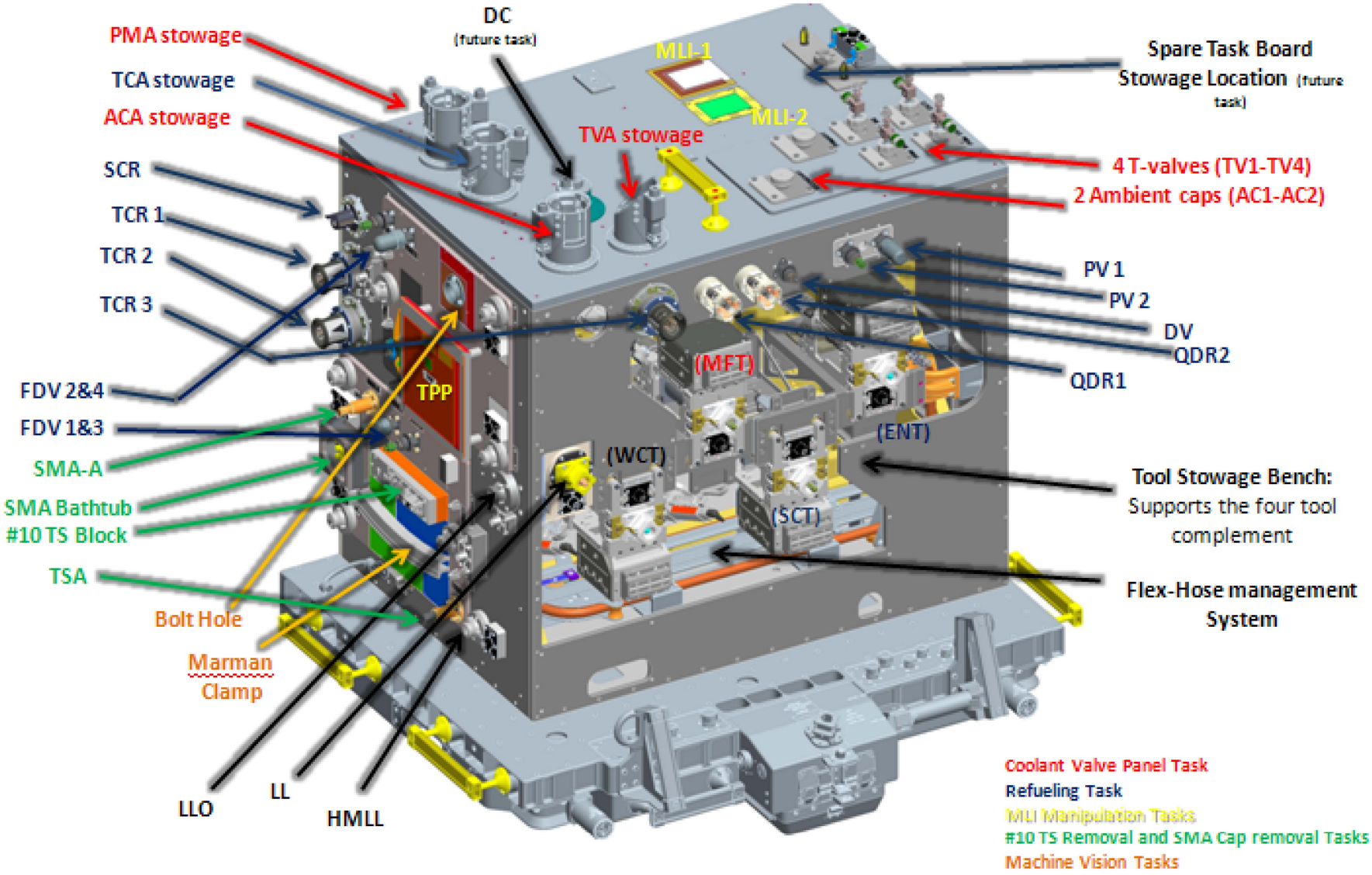
C. MLI MANIPULATION TASK
   A. 3 MLI Flaps: MLI-1, MLI-2, TPP
   B. Cut Kapton tape, peel MLI, hold flaps open with magnets

D. #10 TORQUE SET TASK
   A. Disengage #10 captive fasteners – 2 (no cage)
   B. Disengage #10 non-captive fasteners – 4 (with cage)

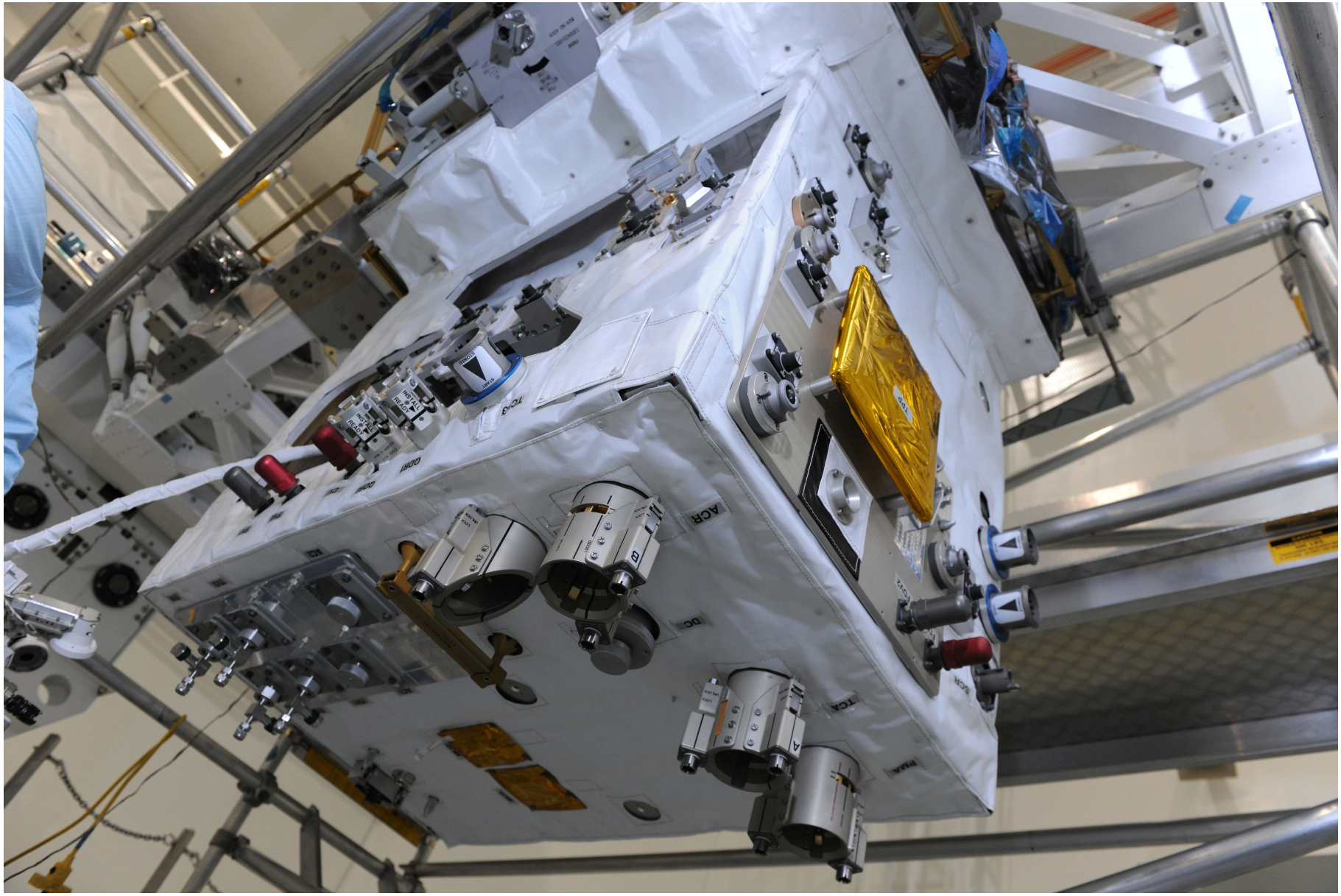
E. VISION TASK BOARDS
   A. Vision Processing
      - Marmon clamp, HST door latch and J-hook, bolt hole, #10 TS, SMA

F. SMA CAP REMOVAL TASK
   A. SMA caps; remove 4 of 9, stow

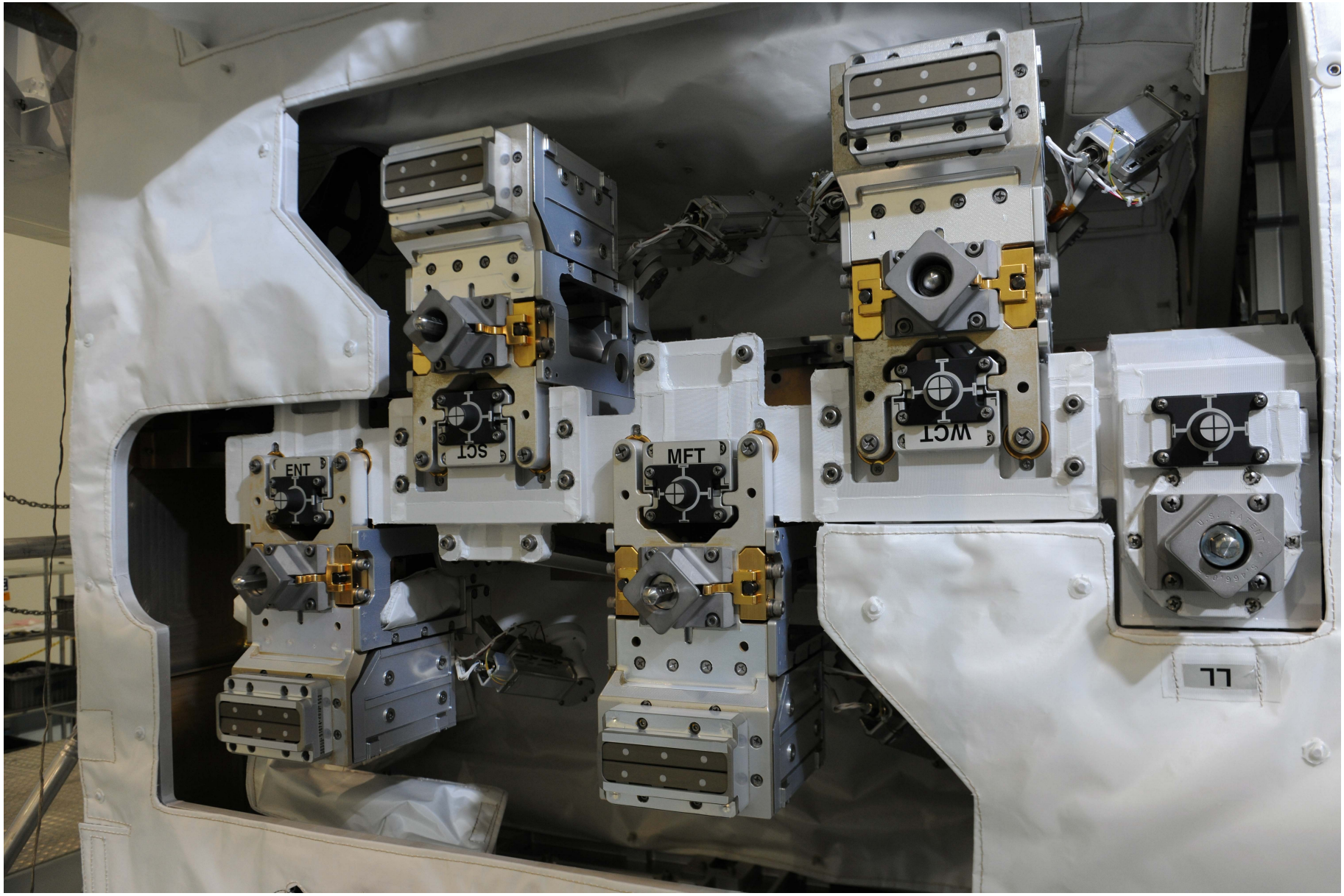
RRM (Cont)


PMA stowage
TCA stowage
ACA stowage
SCR
TCR 1
TCR 2
TCR 3
FDV 2&4
FDV 1&3
SMA-A
SMA Bathtub
#10 TS Block
TSA
Bolt Hole
Marman Clamp
LLO
LL
HMLL
DC
(future task)
MLI-1
MLI-2
TVA stowage
TPP
(MFT)
(WCT)
(SCT)
(ENT)
Spare Task Board Stowage Location (future task)
4 T-valves (TV1-TV4)
2 Ambient caps (AC1-AC2)
PV 1
PV 2
DV
QDR2
QDR1
Tool Stowage Bench: Supports the four tool complement
Flex-Hose management System
Coolant Valve Panel Task
Refueling Task
MLI Manipulation Tasks
#10 TS Removal and SMA Cap removal Tasks
Machine Vision Tasks

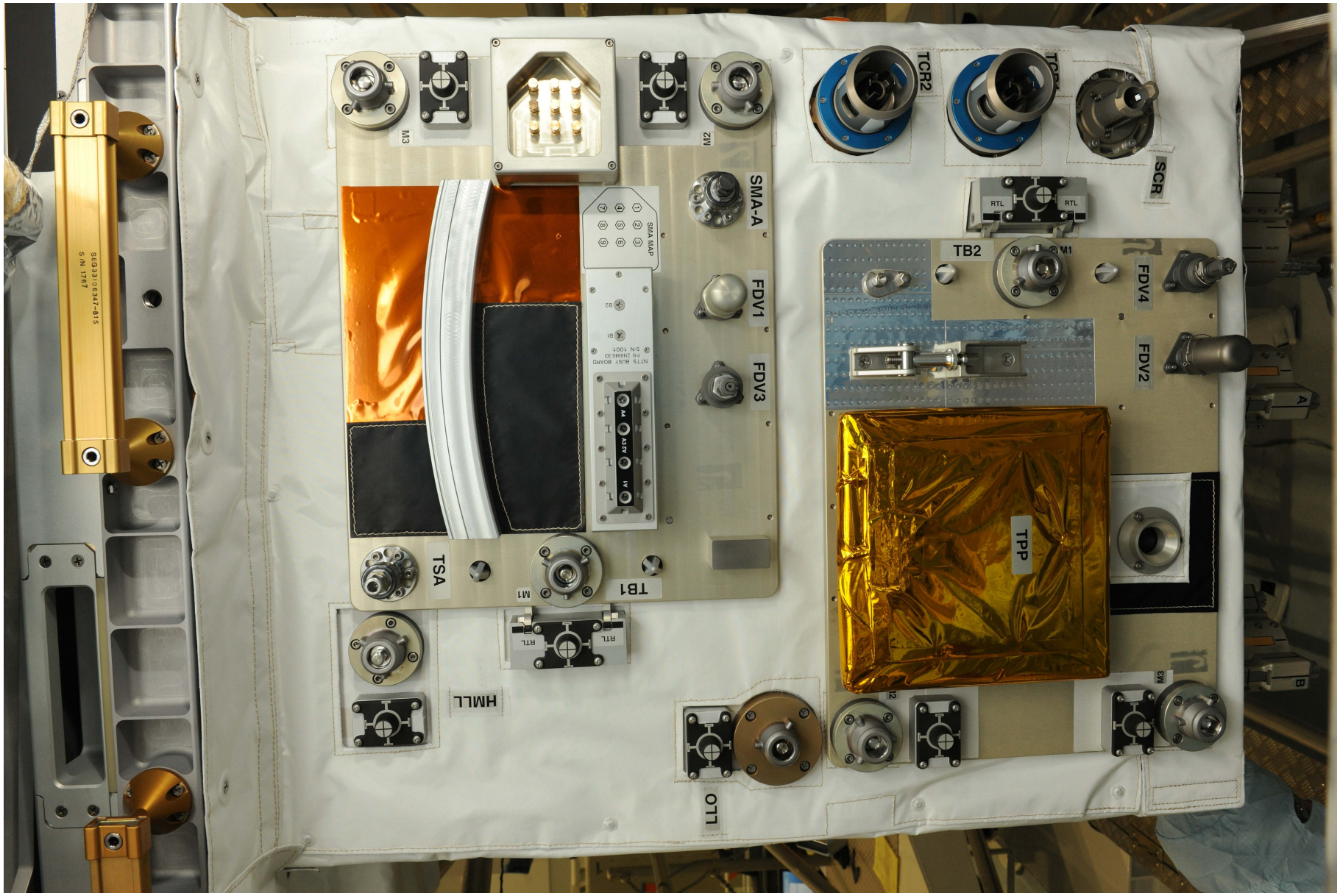
RRM (Cont)



RRM (Cont)



RRM (Cont)


TCR2
SCR
RTL
RTL
TB2
M1
FDV4
FDV2
SMA-A
FDV1
FDV3
M3
M2
SMA MAP
TSA
M1
TB1
RTL
RTL
HMLL
TPP
M3
LLO

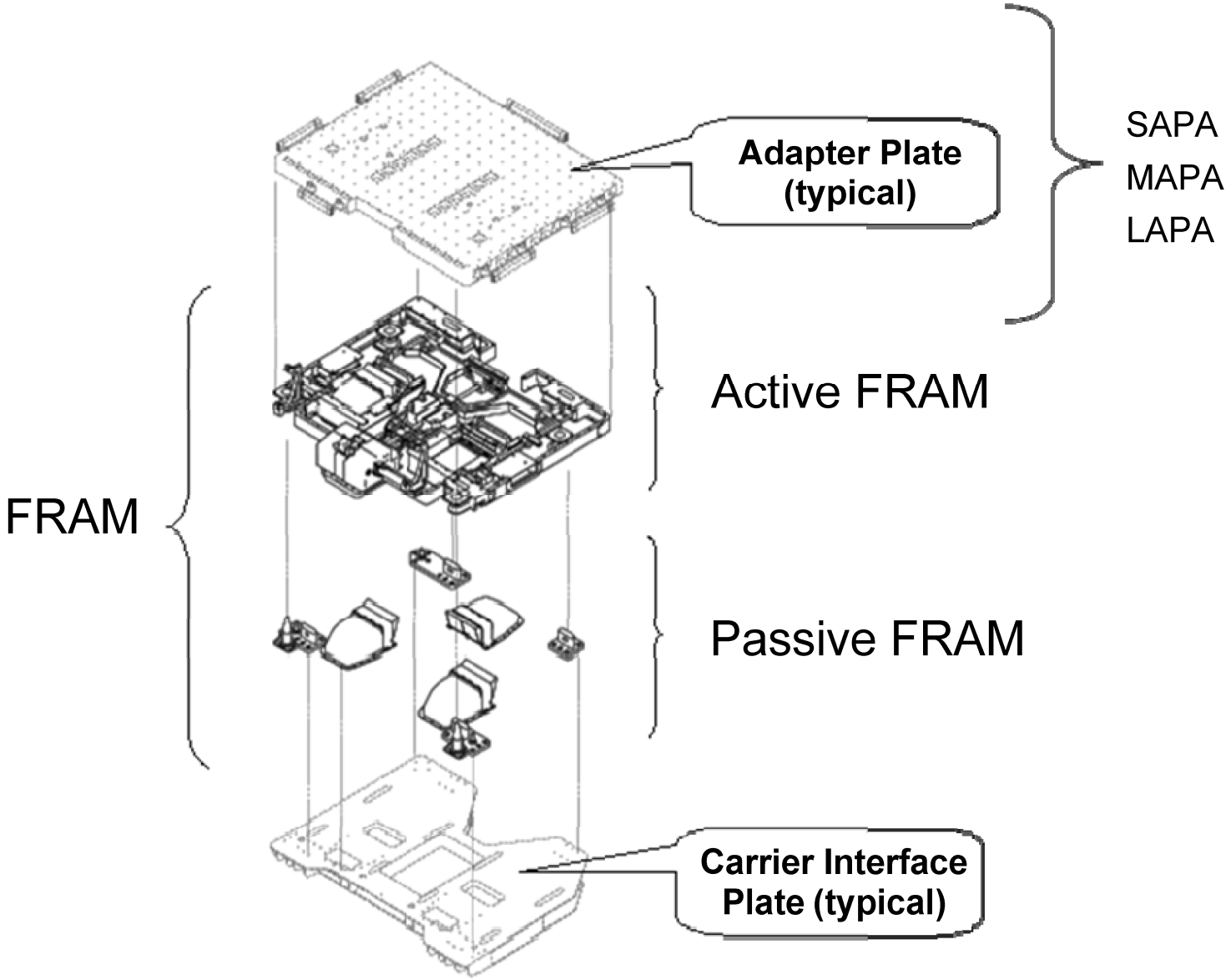
RRM (Cont)


TV4
TV3
AC2
PRIM (OUT)
PRIM (IN)
SECONDARY
SEC (OUT)
SEC (IN)
PRIMARY
TV2
TV1
AC1
TVA
DC
MLI2
MLI1

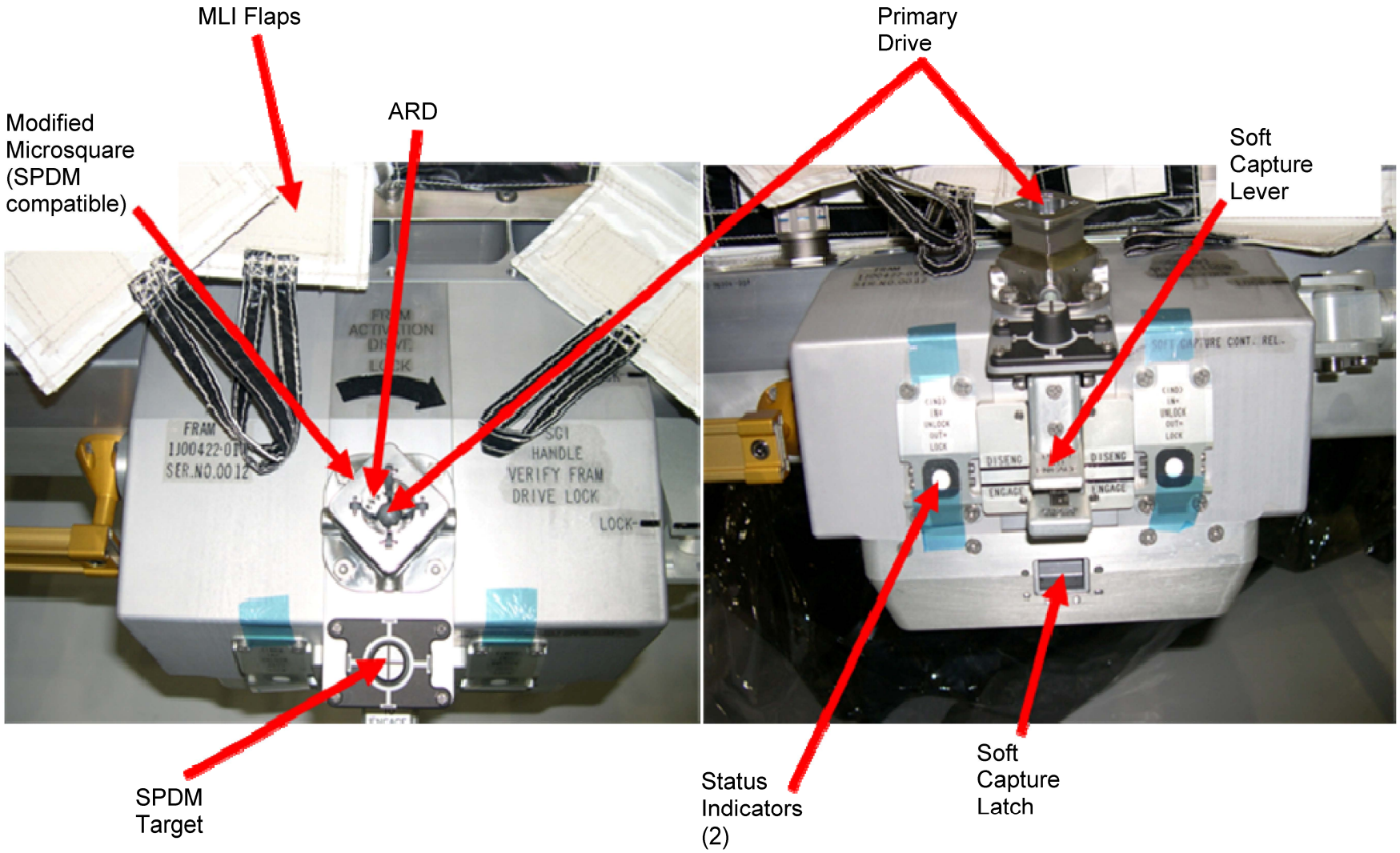

TVA
ACR
DC
TCA
PMA

RRM (Cont)

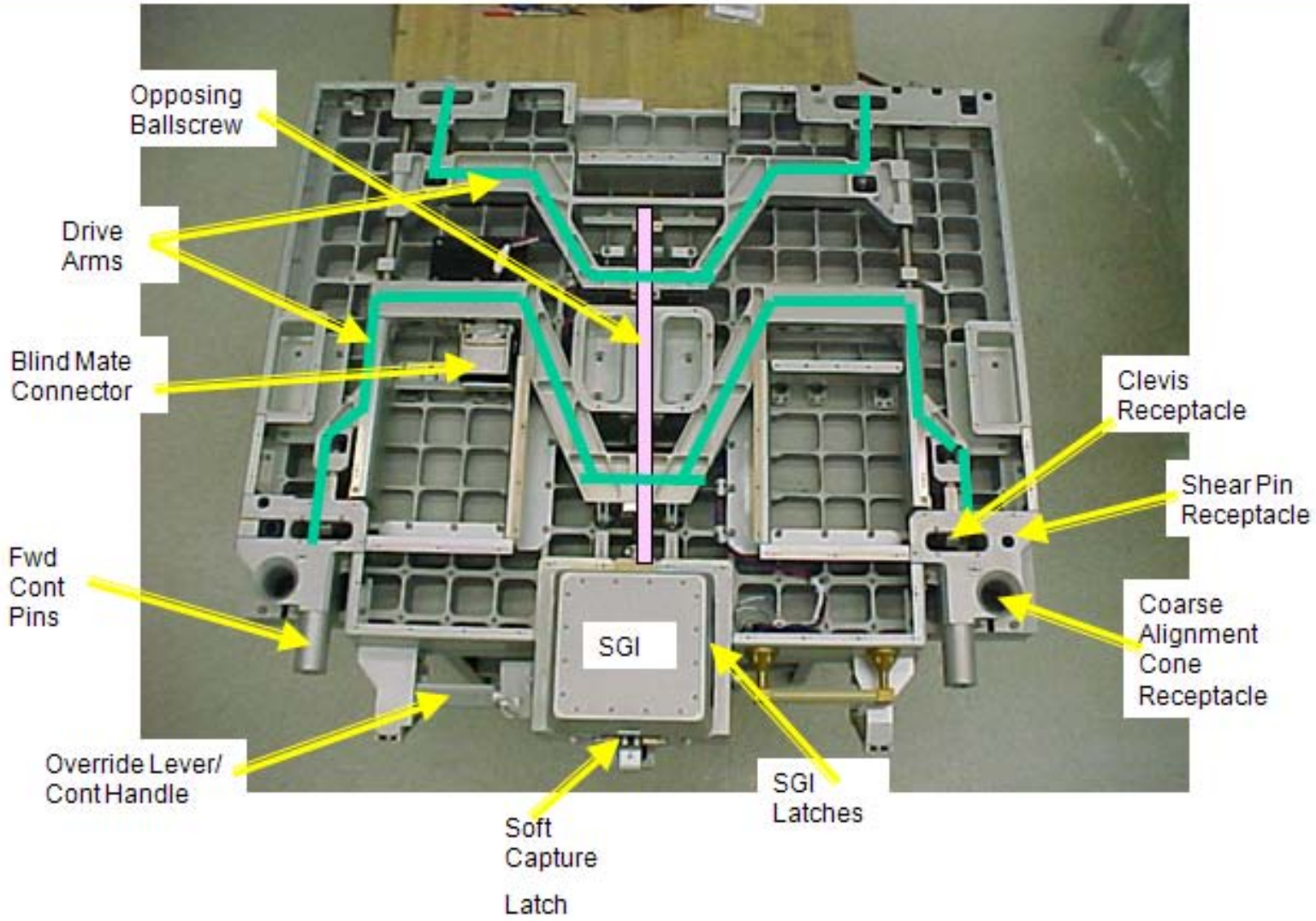
FRAM


Adapter Plate (typical)
SAPA
MAPA
LAPA
FRAM
Active FRAM
Passive FRAM
Carrier Interface Plate (typical)

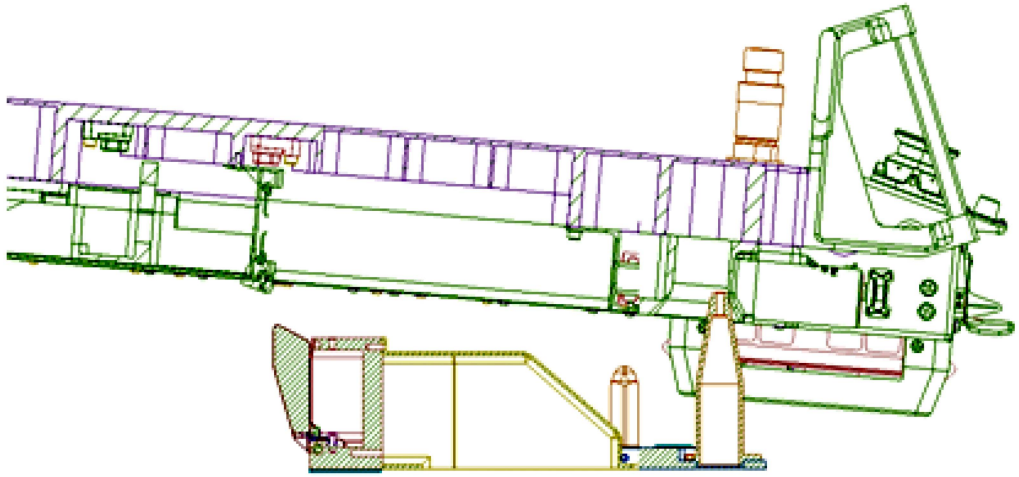
FRAM (Cont)


MLI Flaps
Primary Drive
Modified Microsquare (SPDM compatible)
ARD
Soft Capture Lever
SPDM Target
Status Indicators (2)
Soft Capture Latch

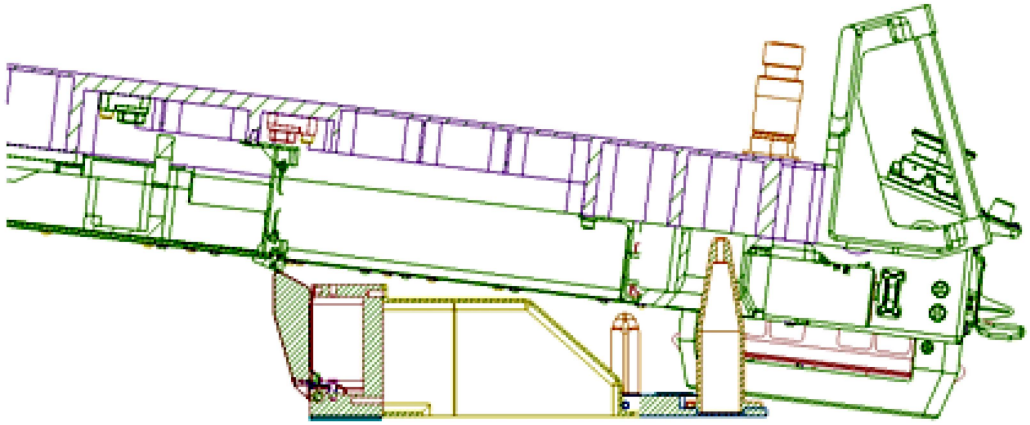
BOTTOM VIEW OF ACTIVE FRAM – W/O COVER



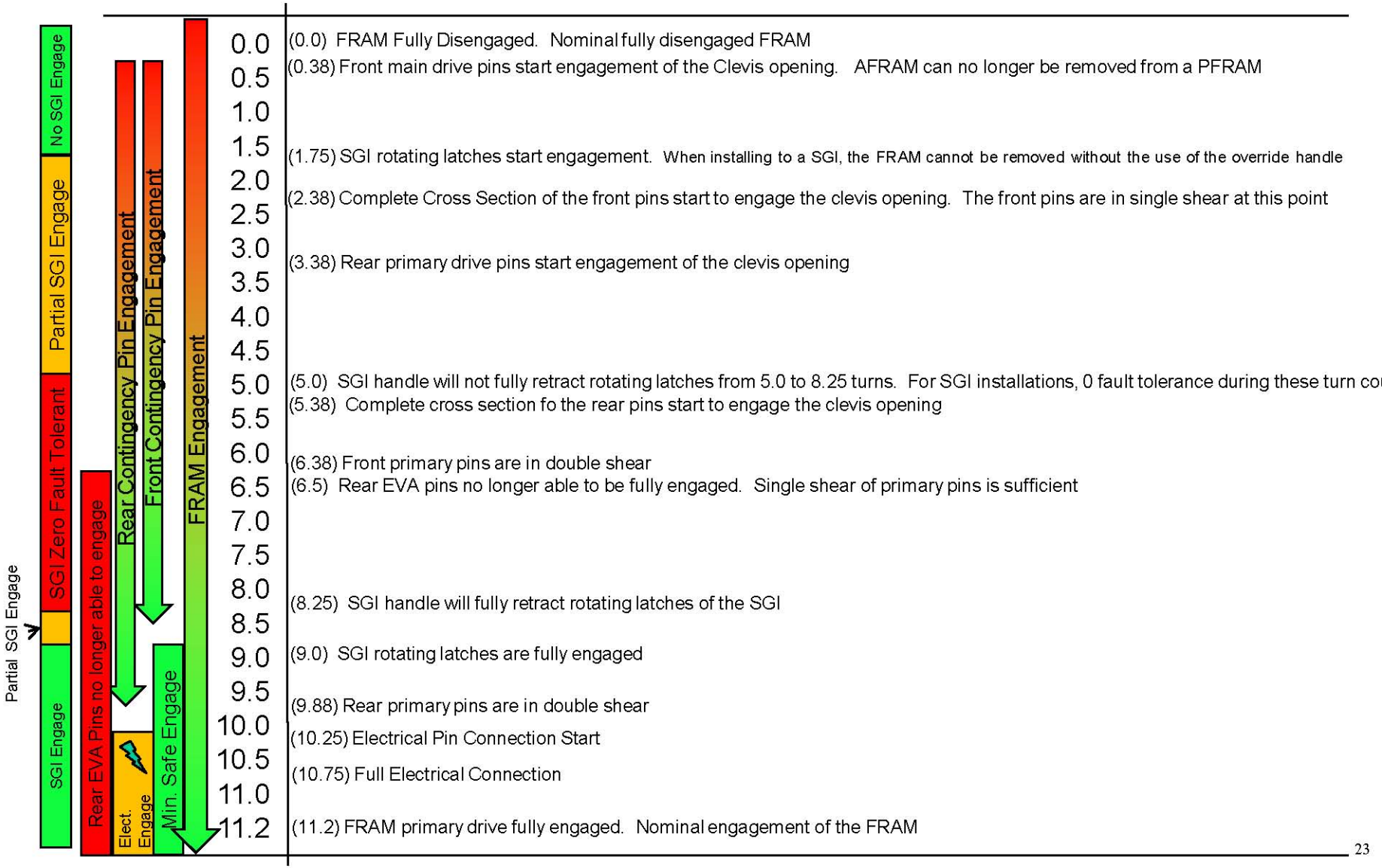
To avoid interference with the electrical connector flapper door, the AFRAM can be angled forward (shown at 7 deg)



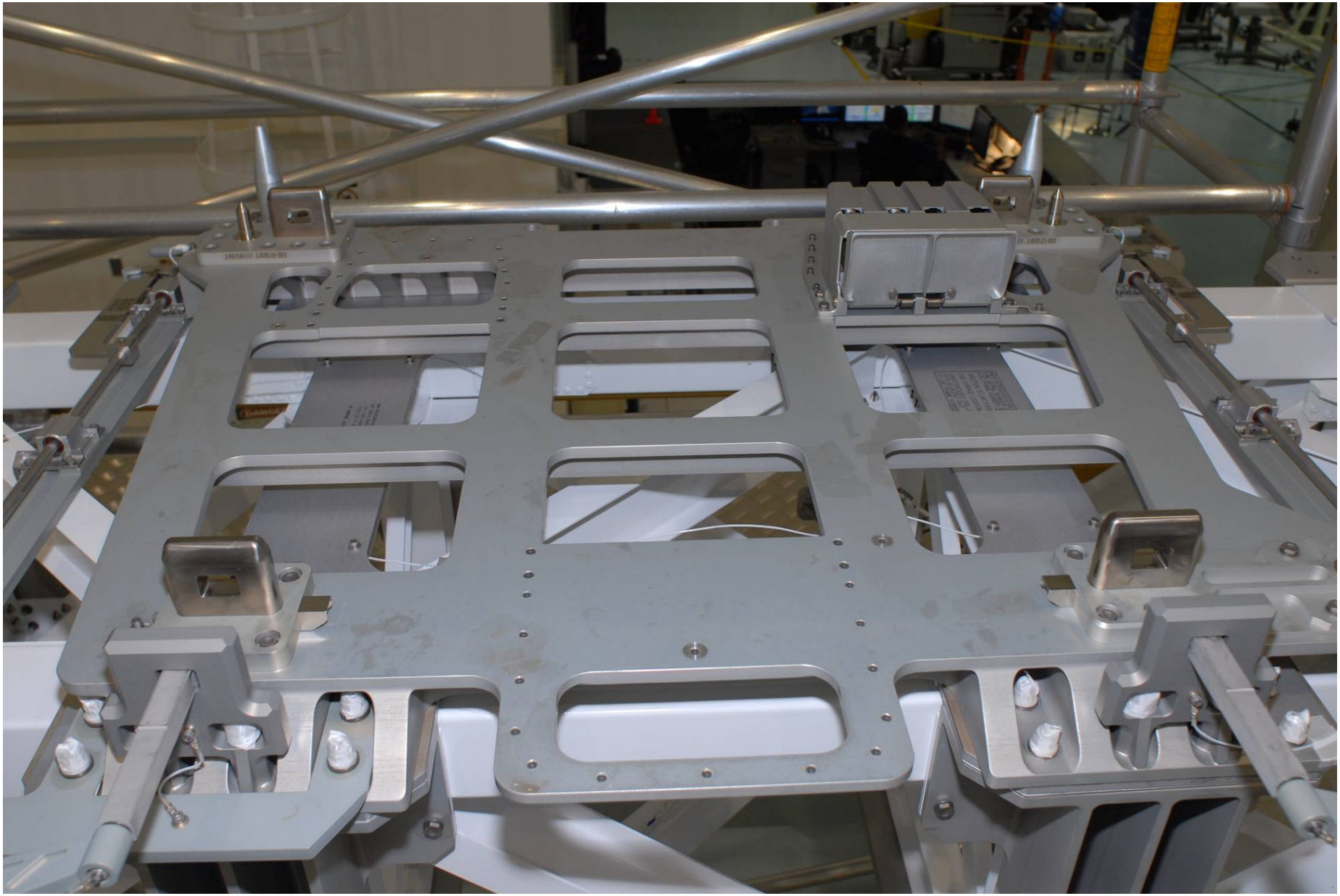
Even if the AFRAM is biased aft, the rough alignment guide will guide the AFRAM back forward enough so that the PFRAM door will properly contact the stiffener on the AFRAM. At this point, the FRAM can be rocked back into a parallel position relative to the PFRAM for successful installation



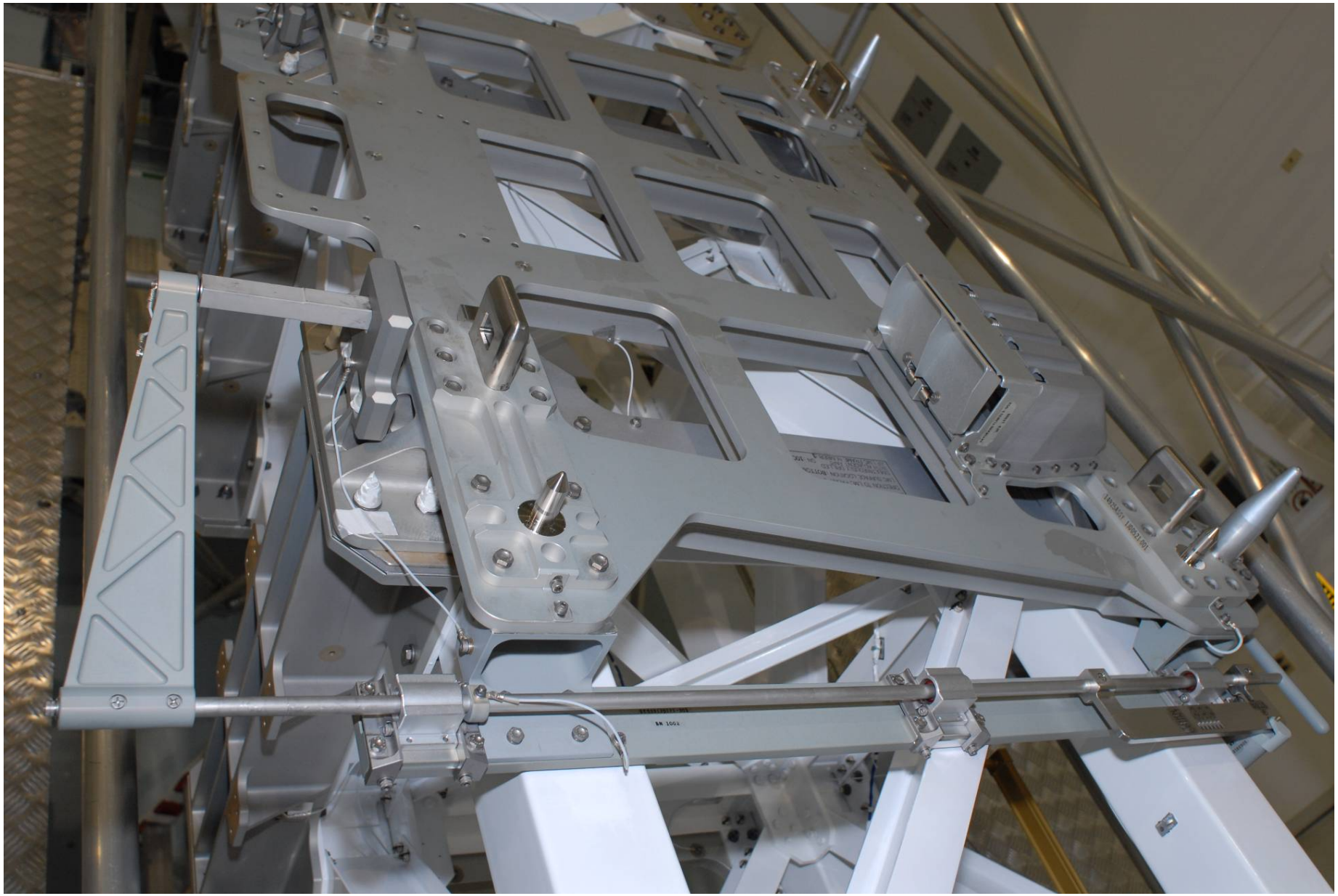
FRAM Mechanism Turn Count Table



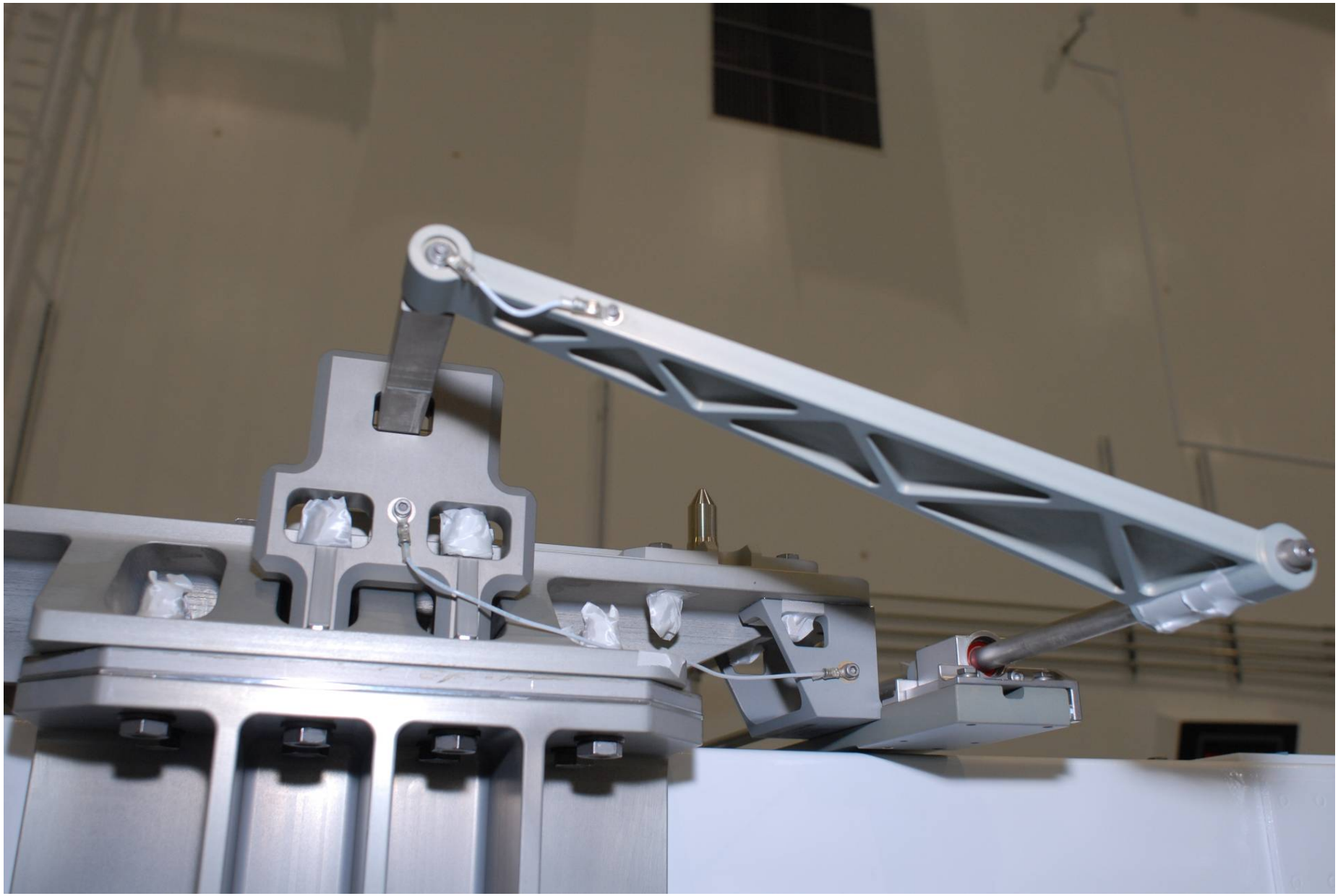
FRAM (Cont)



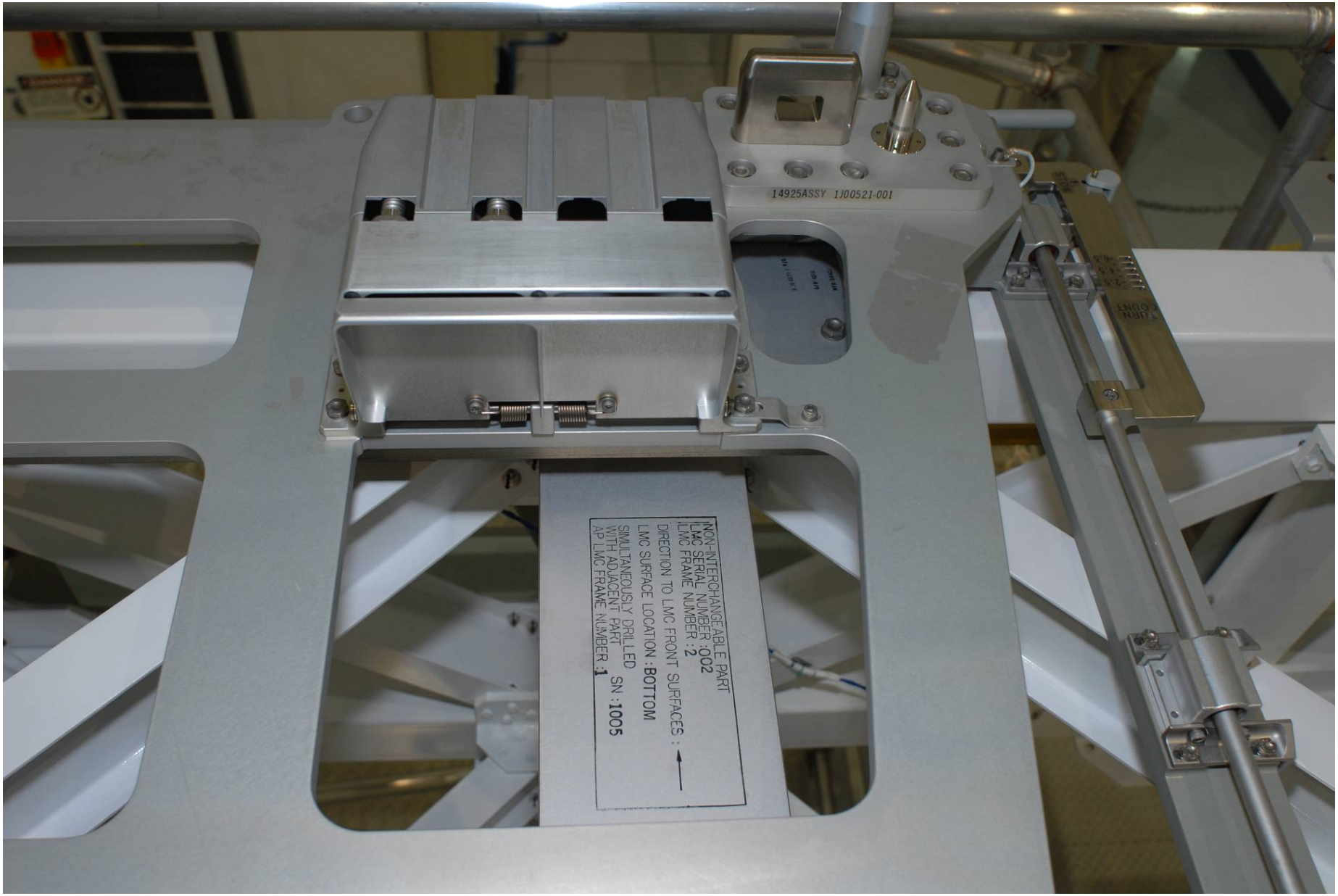
FRAM (Cont)



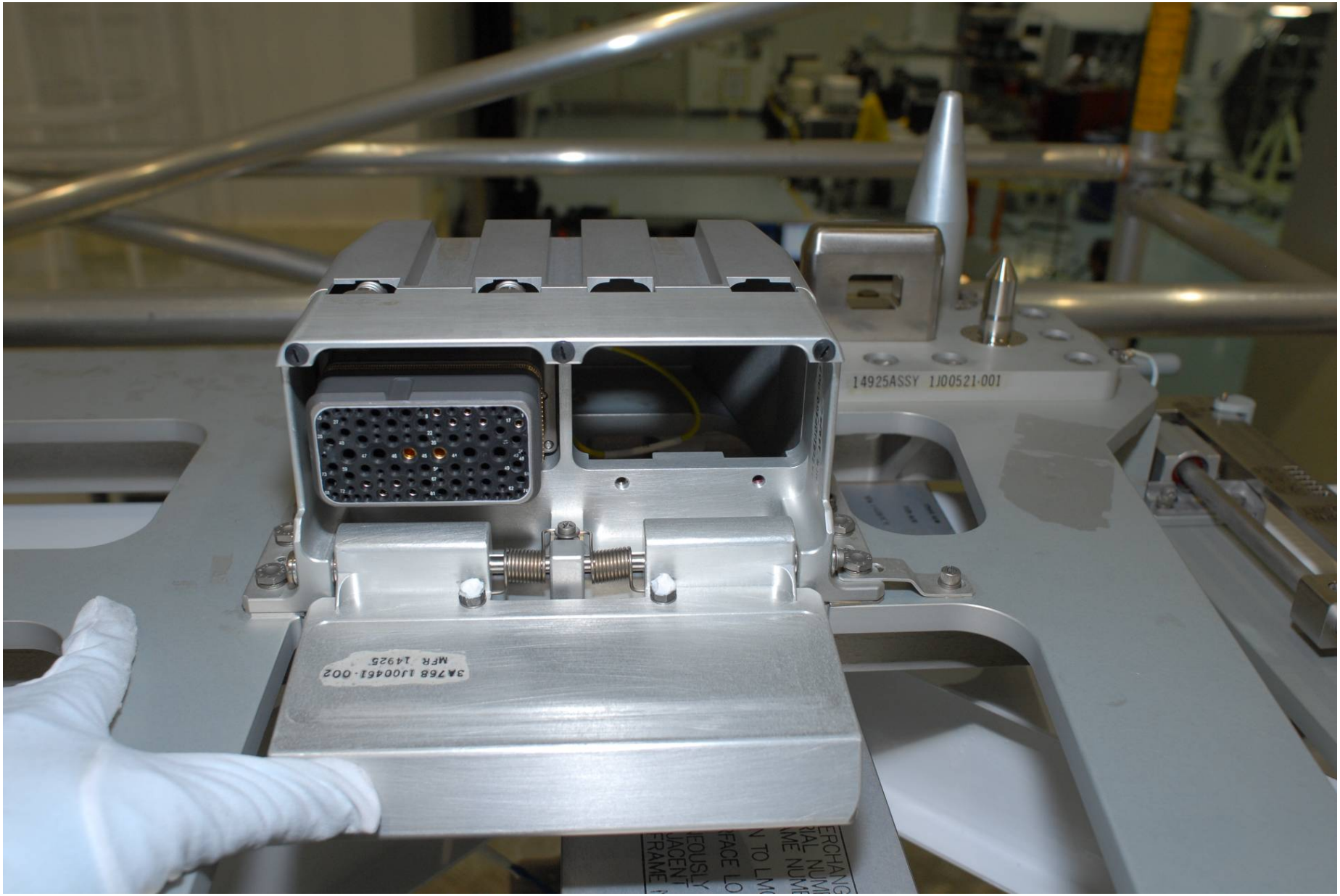
FRAM (Cont)



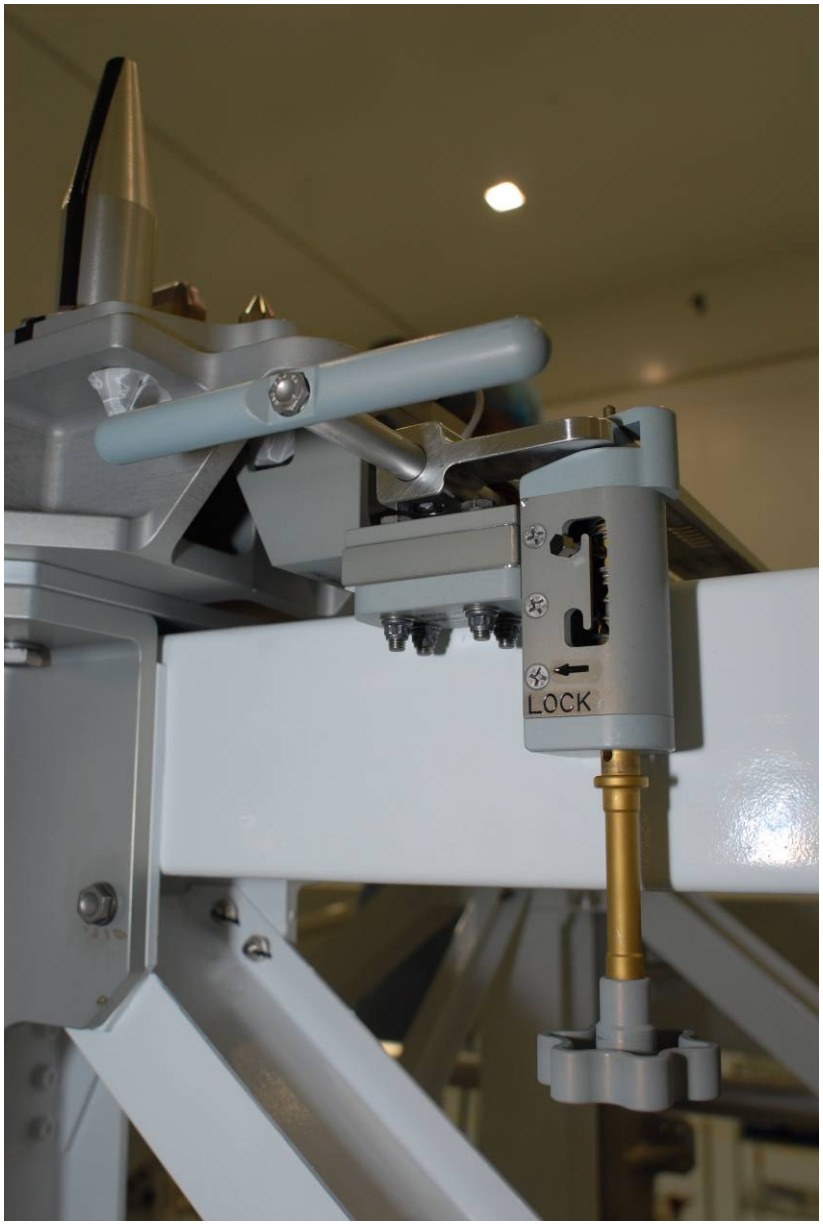
FRAM (Cont)


14925ASSY 1J00521-001
NON-INTERCHANGEABLE PART
LMC SERIAL NUMBER :002
LMC FRAME NUMBER :2
DIRECTION TO LMC FRONT SURFACES :
LMC SURFACE LOCATION : BOTTOM
SIMULTANEOUSLY DRILLED
WITH ADJACENT PART
AP LMC FRAME NUMBER :1
SN :1005

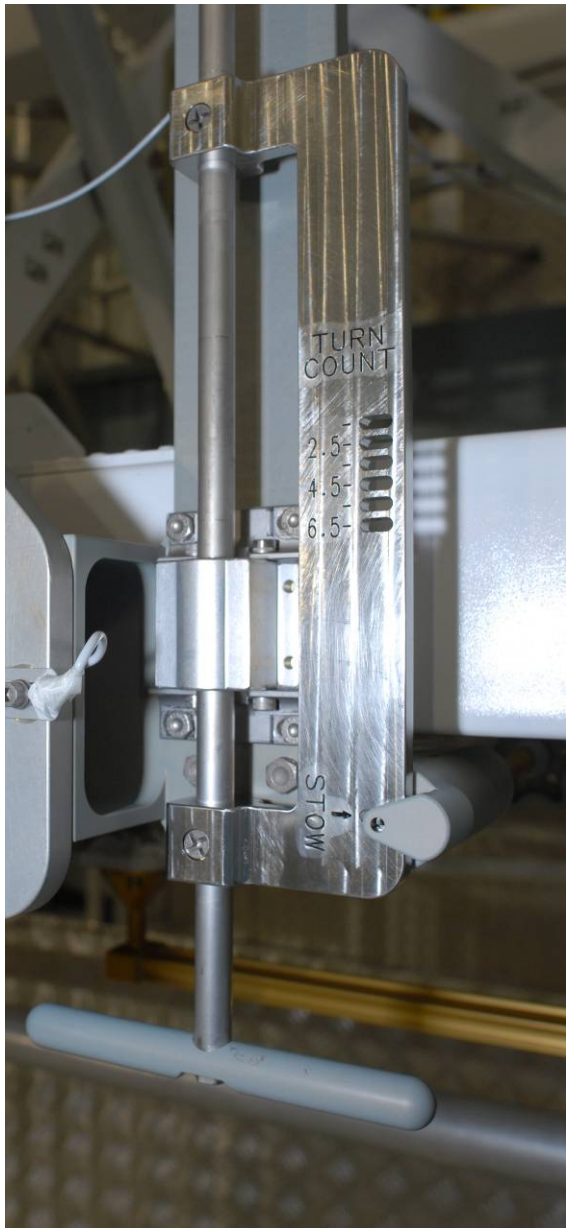
FRAM (Cont)

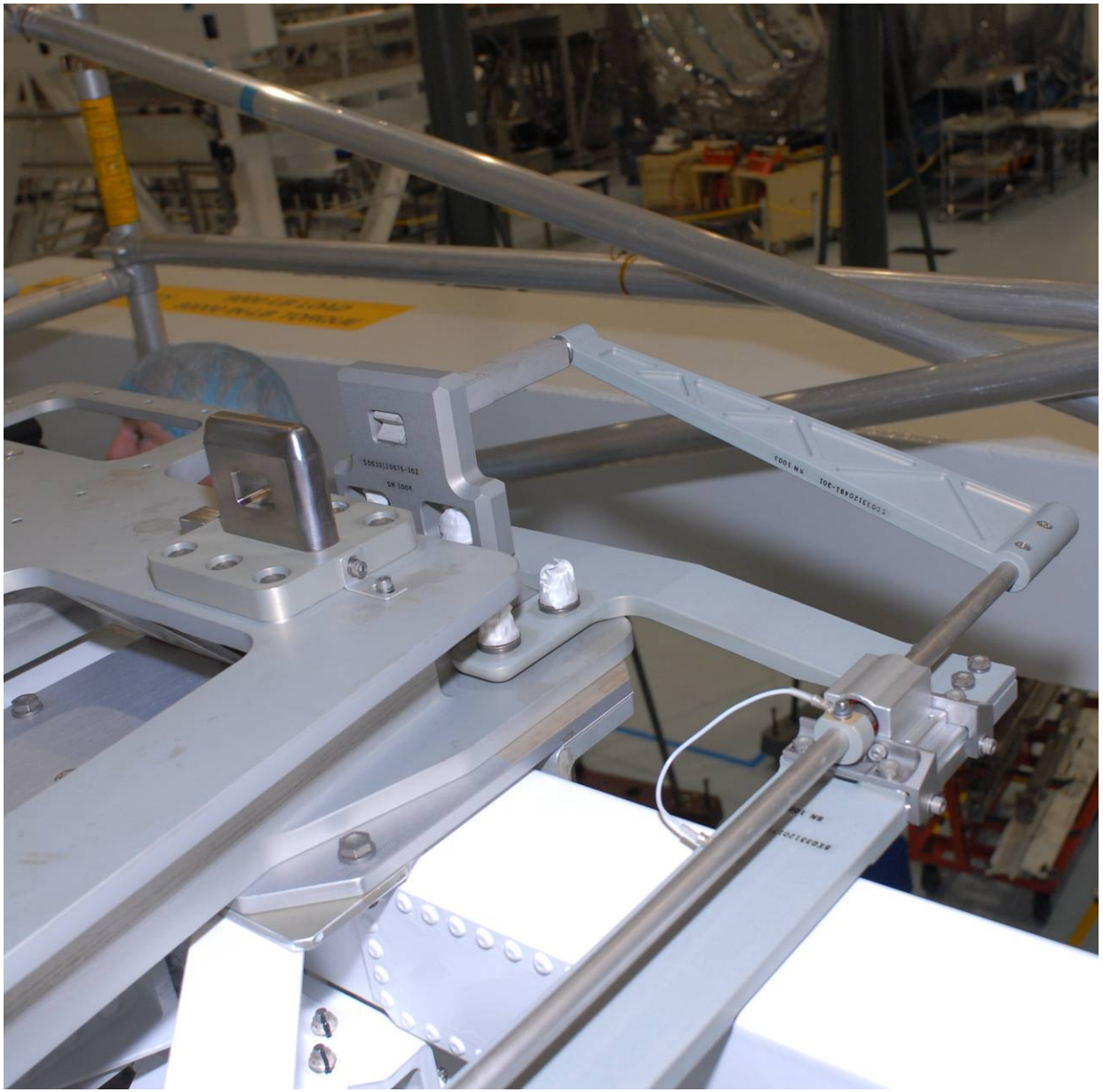


FRAM (Cont)

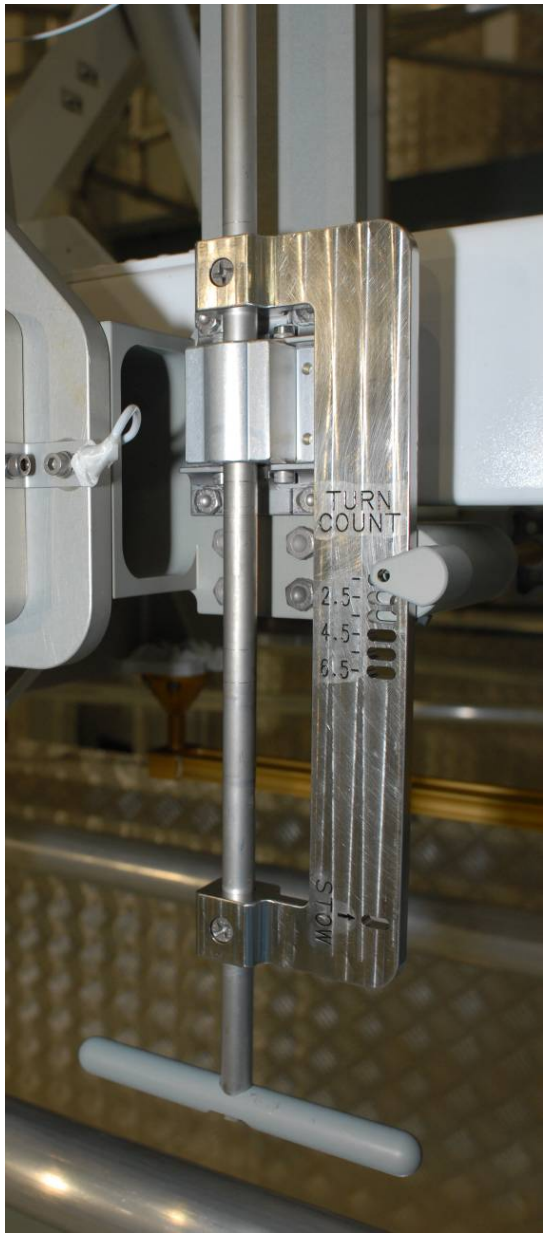


FRAM (Cont)

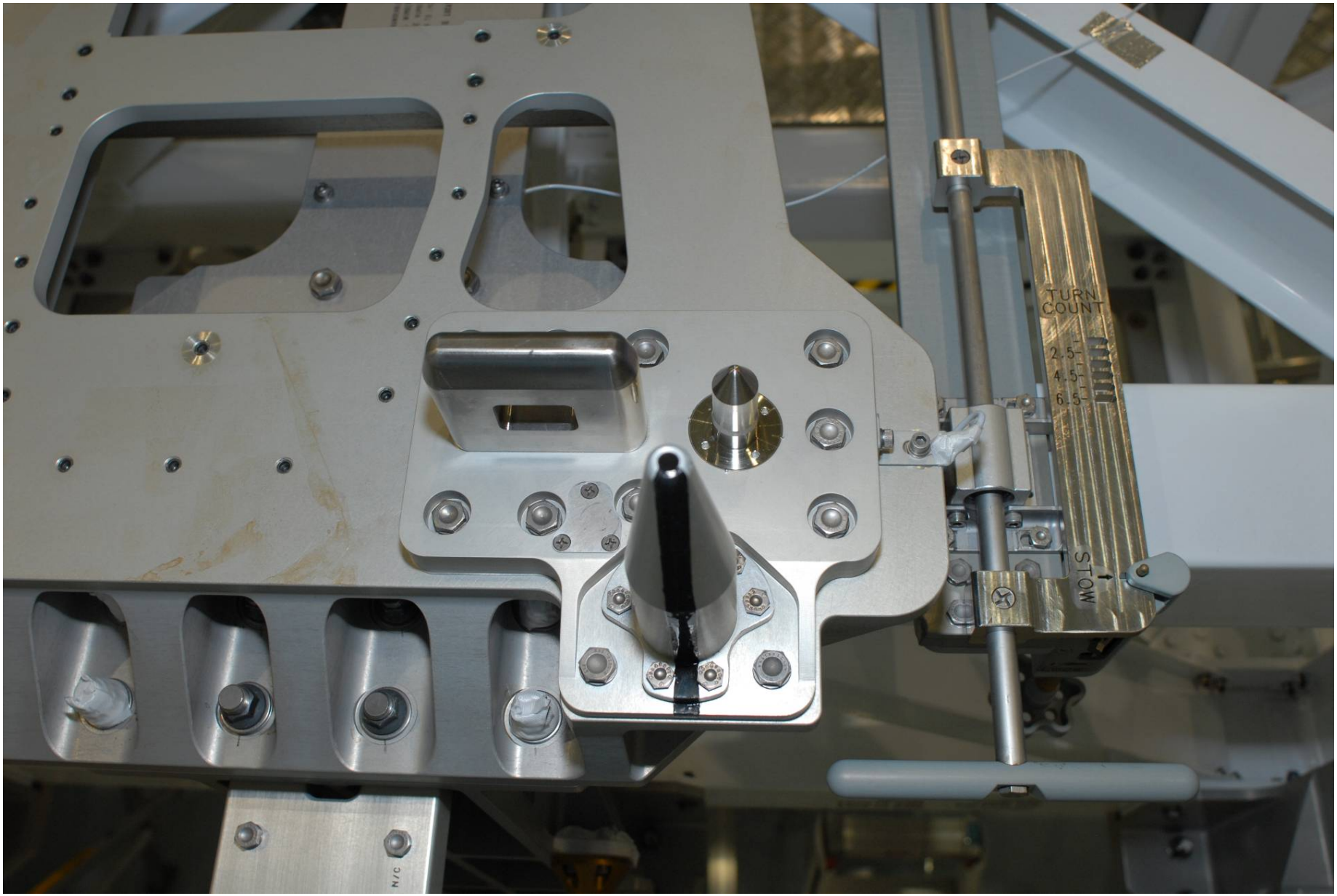




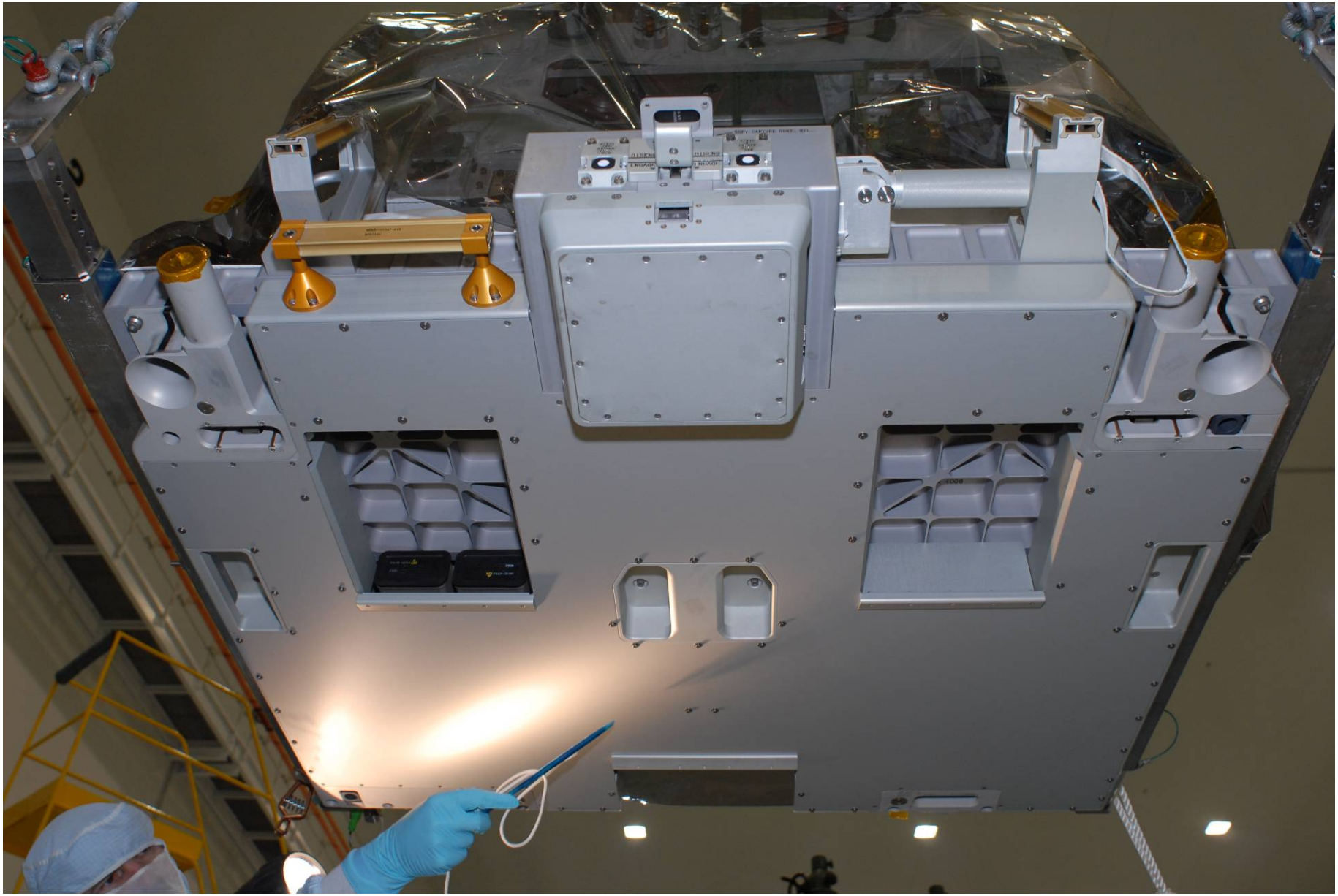
FRAM (Cont)



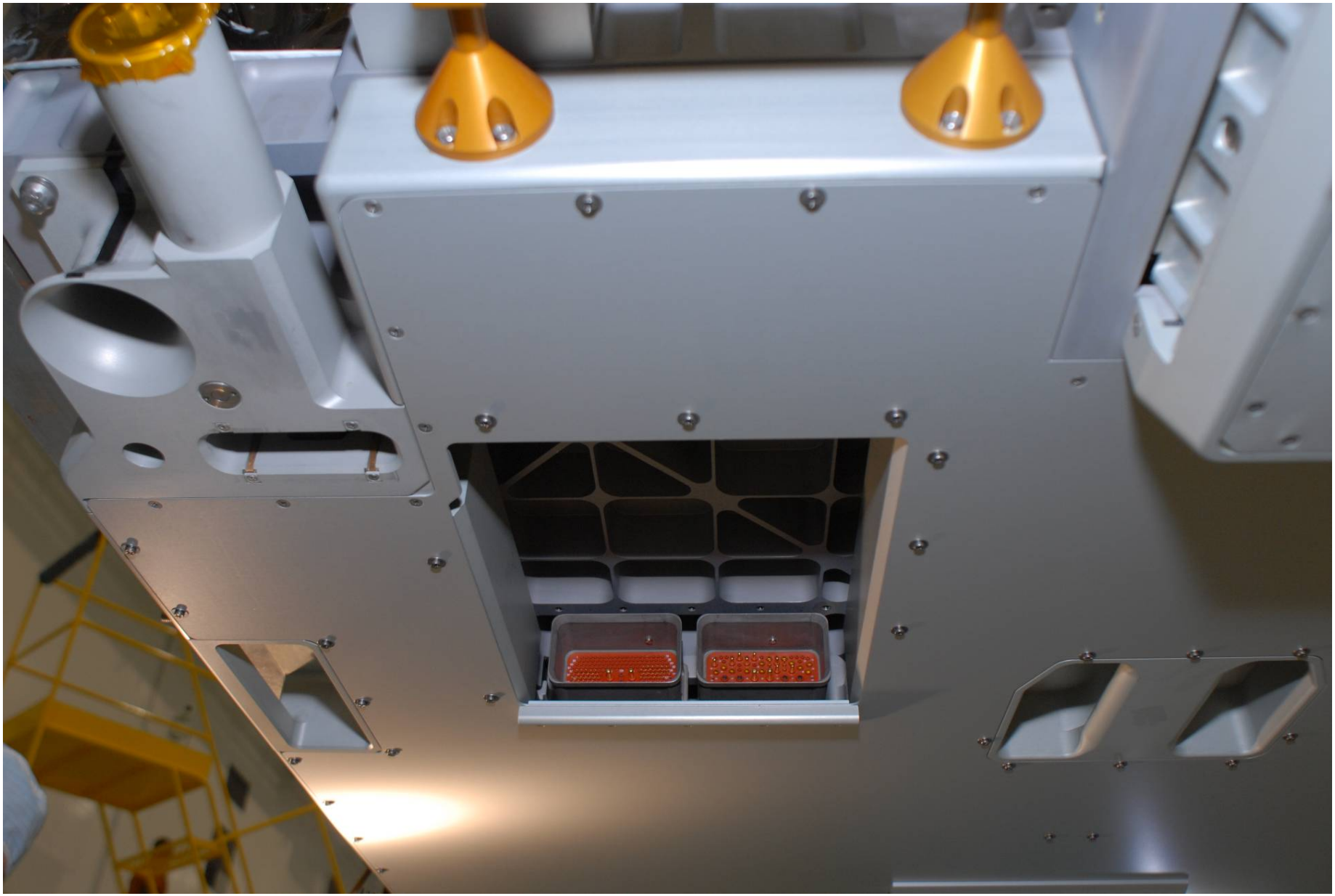
FRAM (Cont)



FRAM (Cont)



FRAM (Cont)



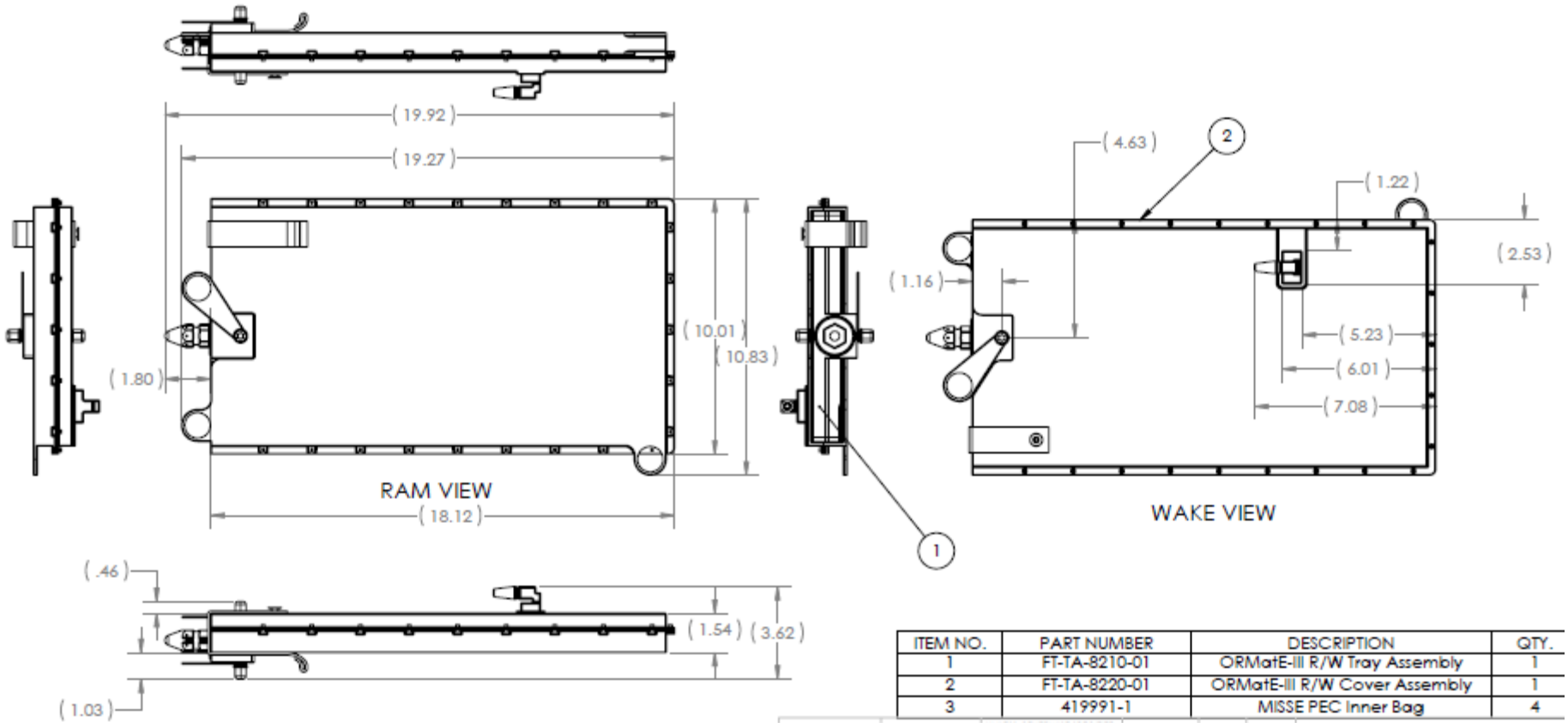
FRAM (Cont)

MISSE 8 ORMATE III R/W

MISSE 8 ORMATE III R/W (Cont)

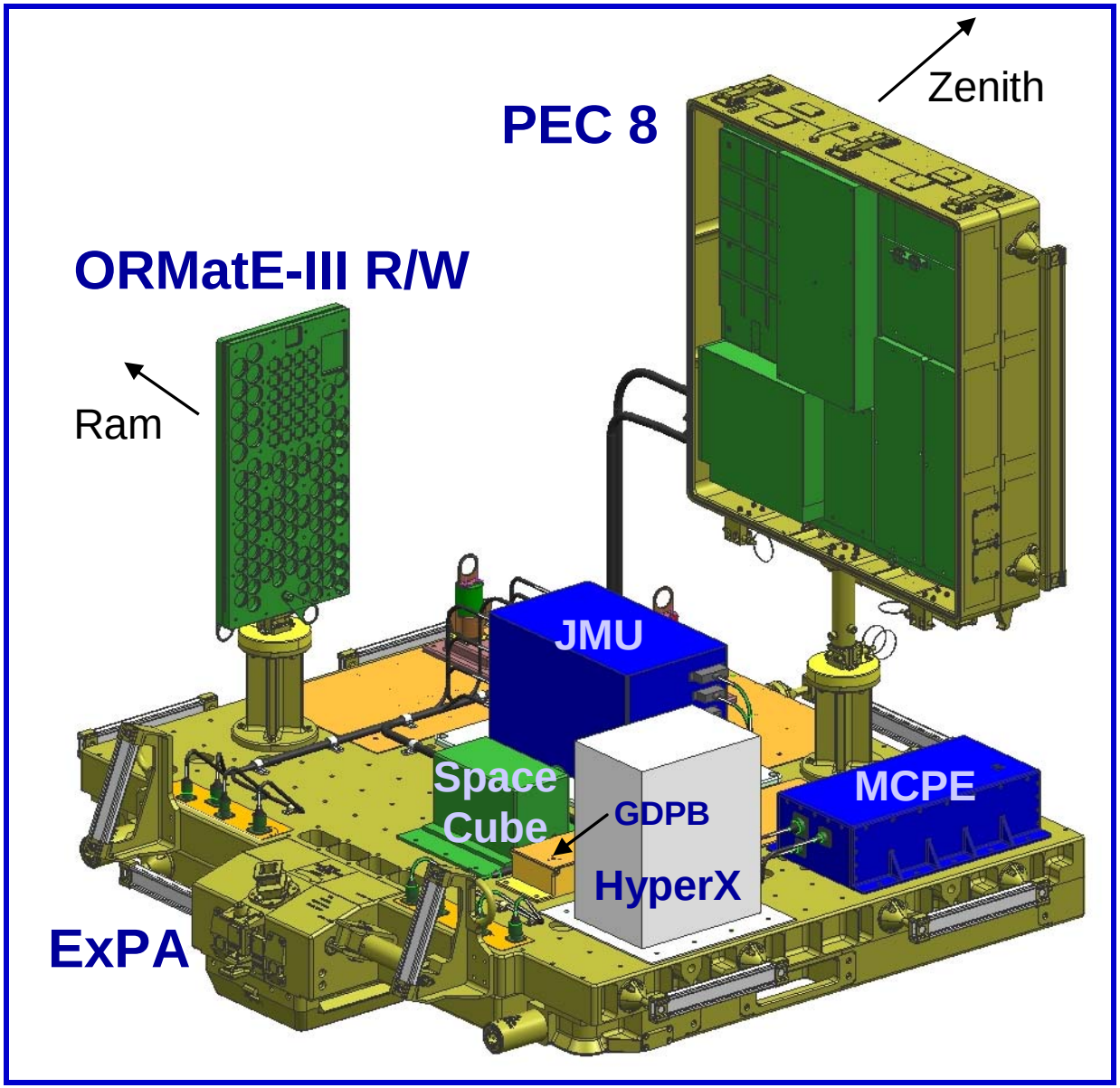
MISSE 8 ORMATE III R/W (Cont)

MISSE 8 ORMATE III R/W (Cont)

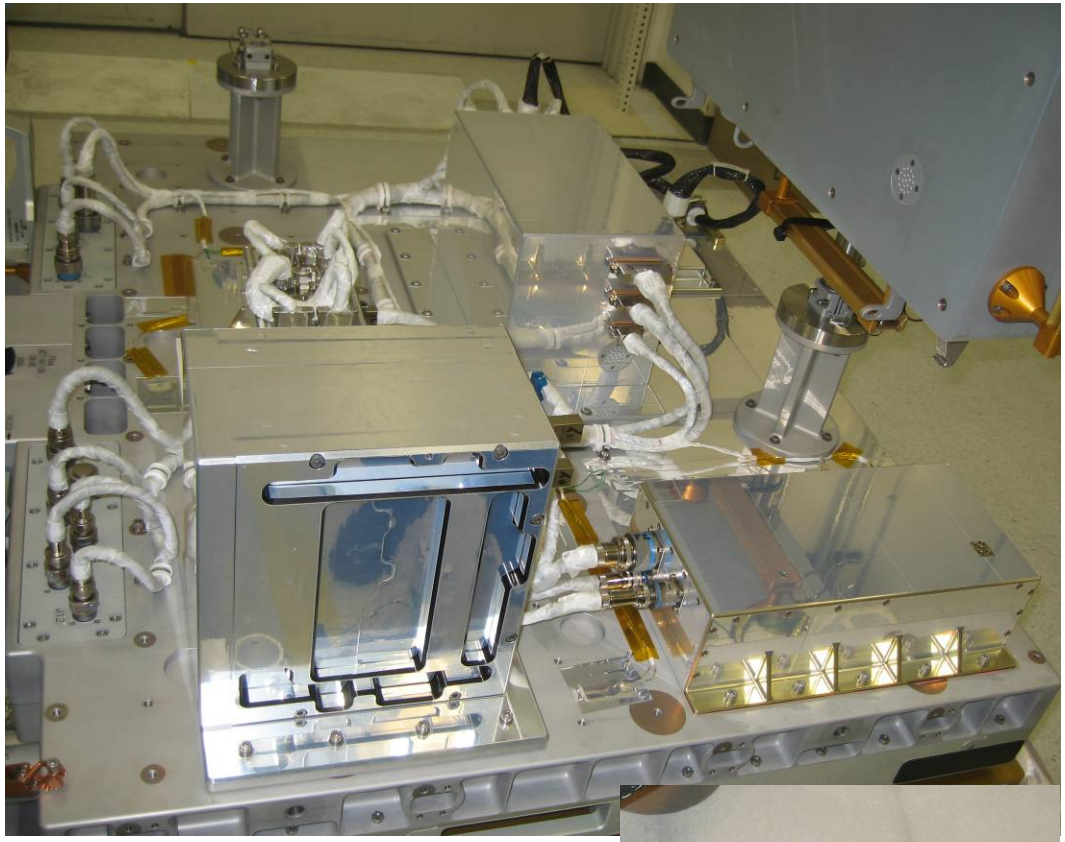


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	FT-TA-8210-01	ORMatE-III R/W Tray Assembly	1
2	FT-TA-8220-01	ORMatE-III R/W Cover Assembly	1
3	419991-1	MISSE PEC Inner Bag	4

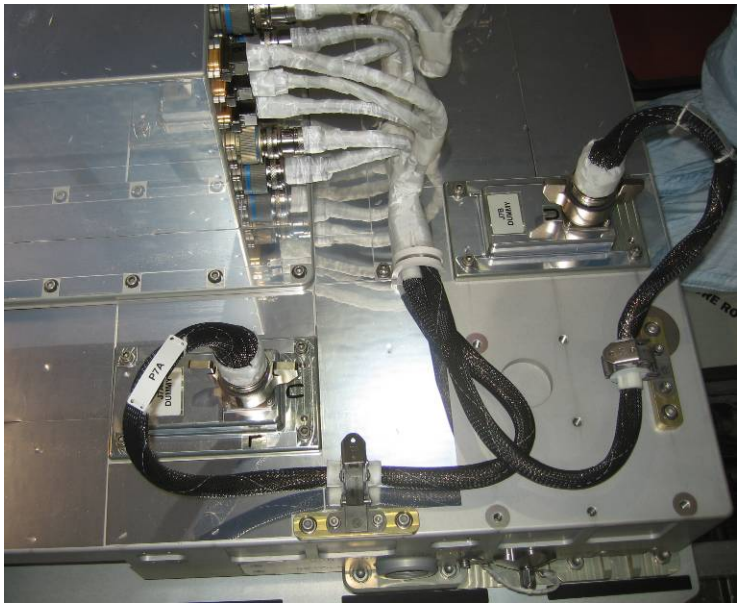
MISSE 8 ORMATE III R/W (Cont)

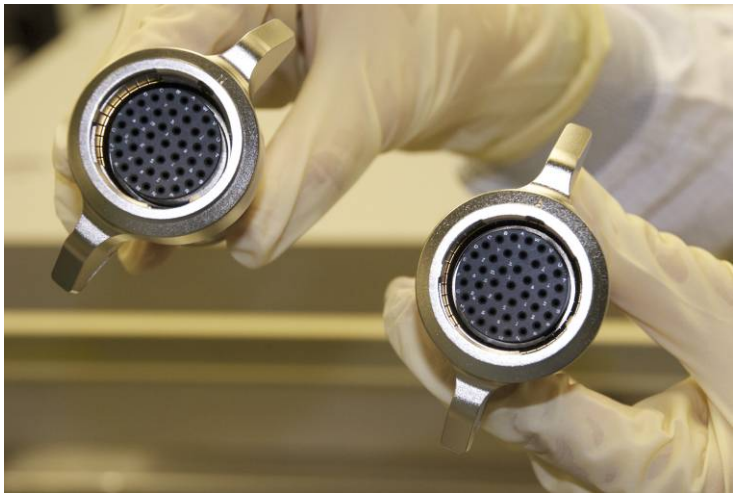


MISSE 8 ORMATE III R/W (Cont)

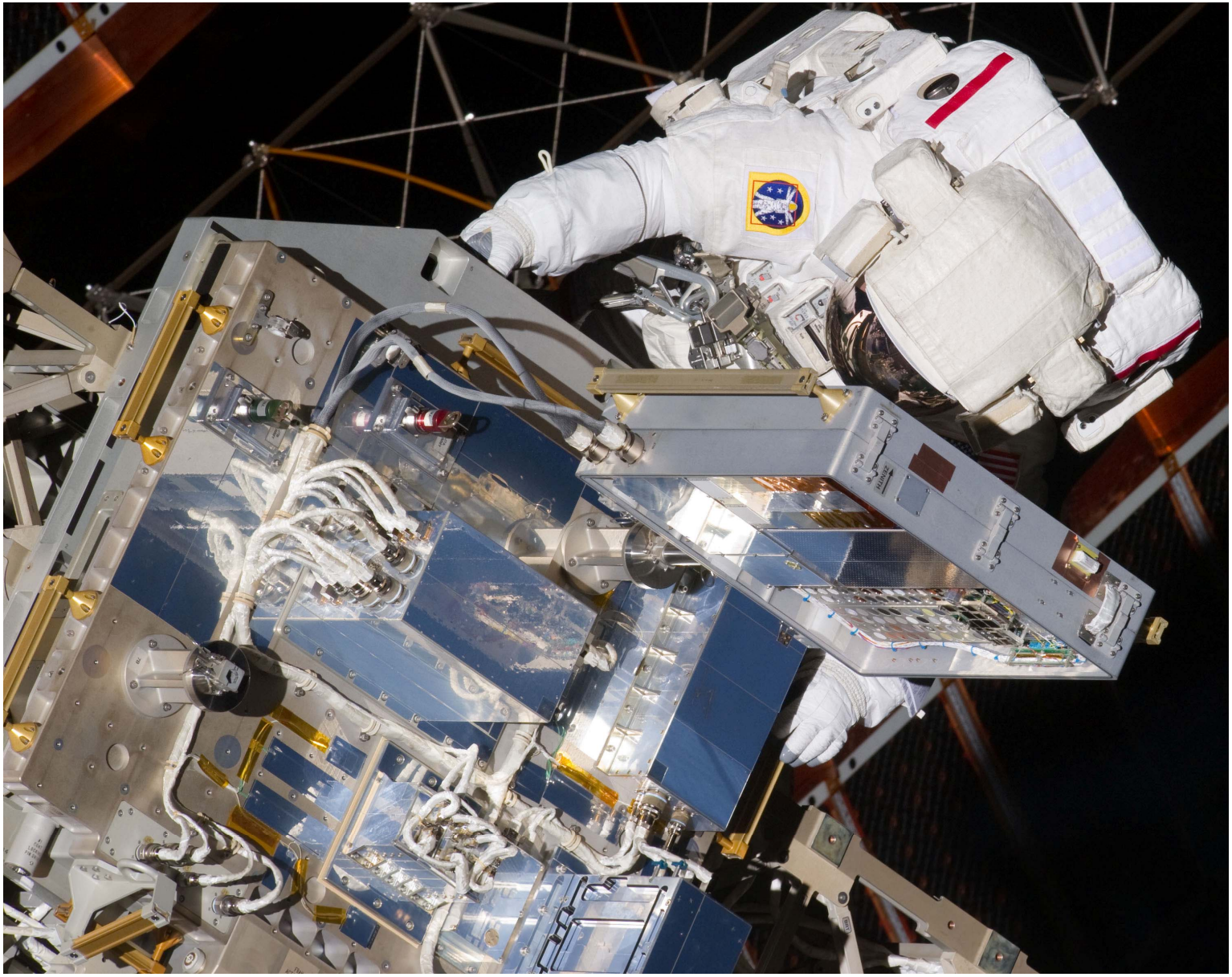


ELC-2 MISSE ExPA

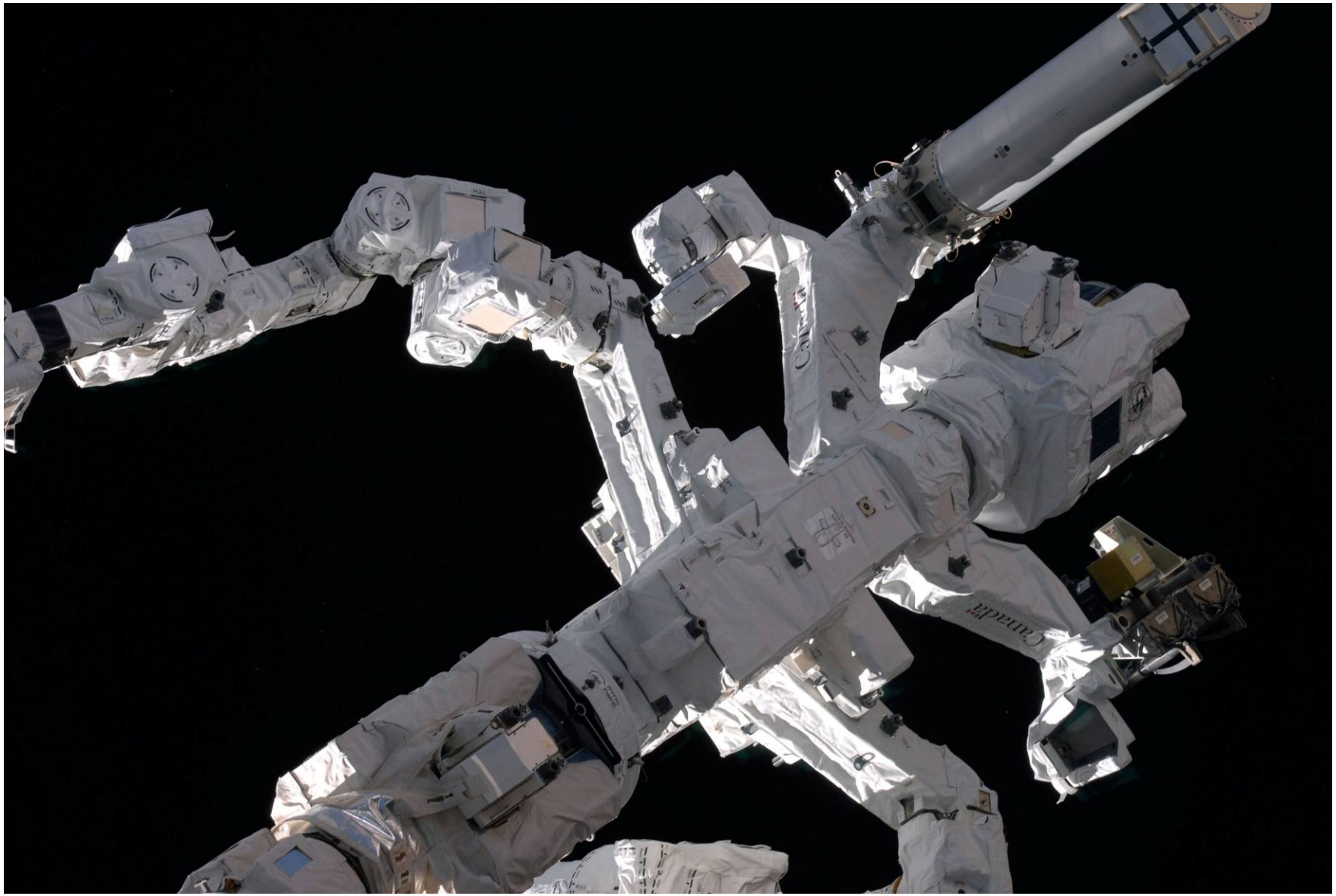




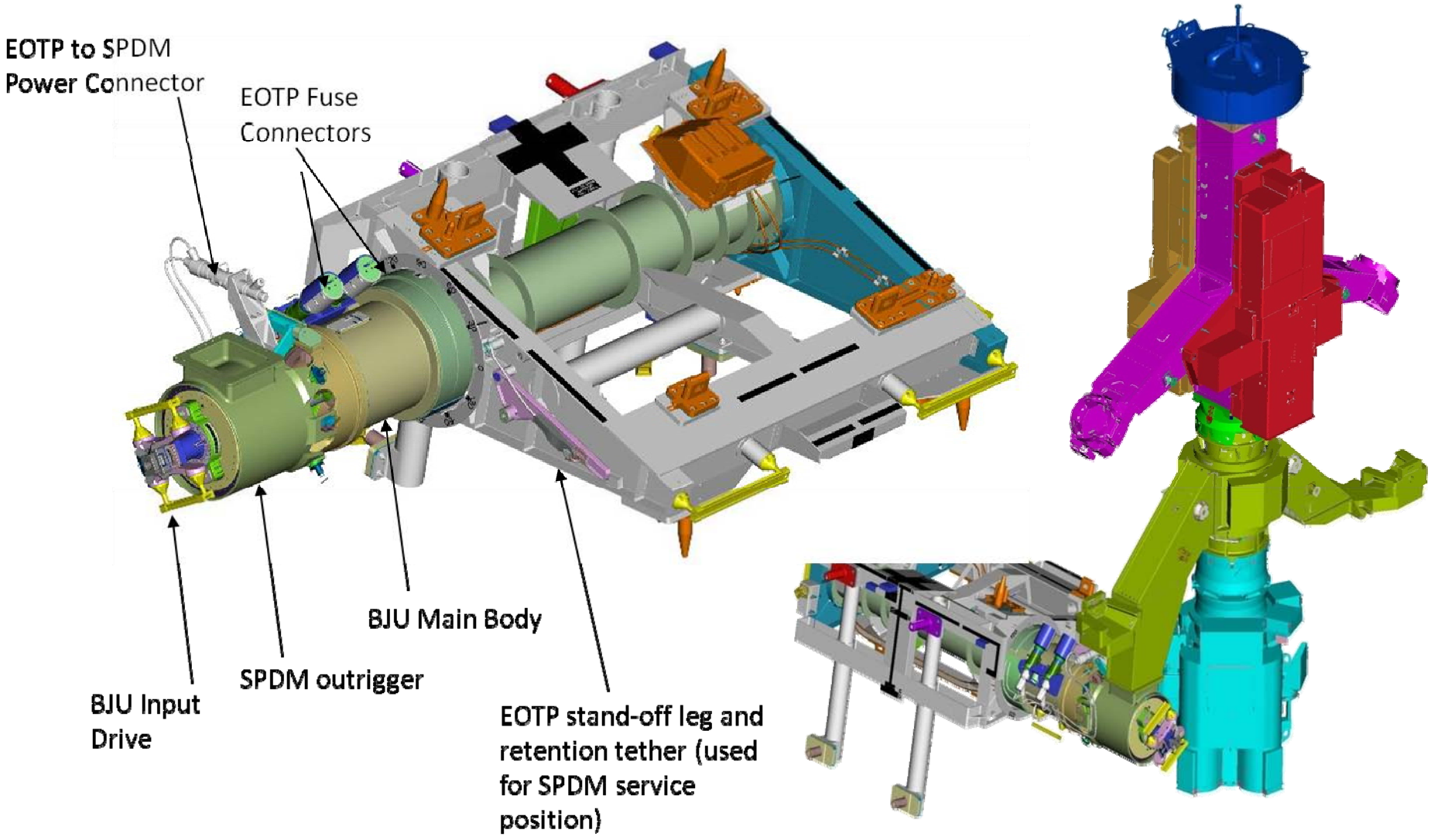
MISSE 8 ORMATE III R/W (Cont)



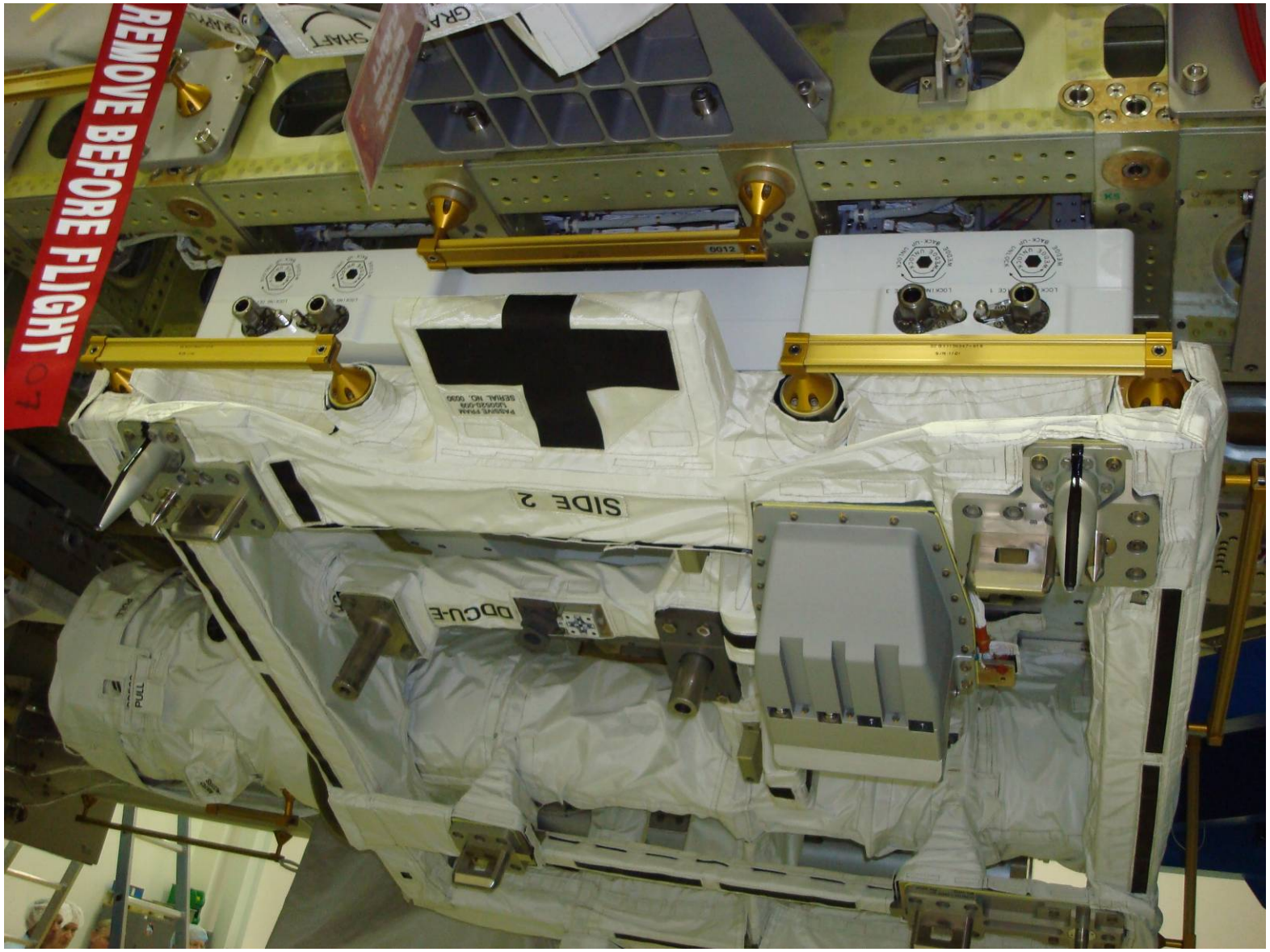
SPDM



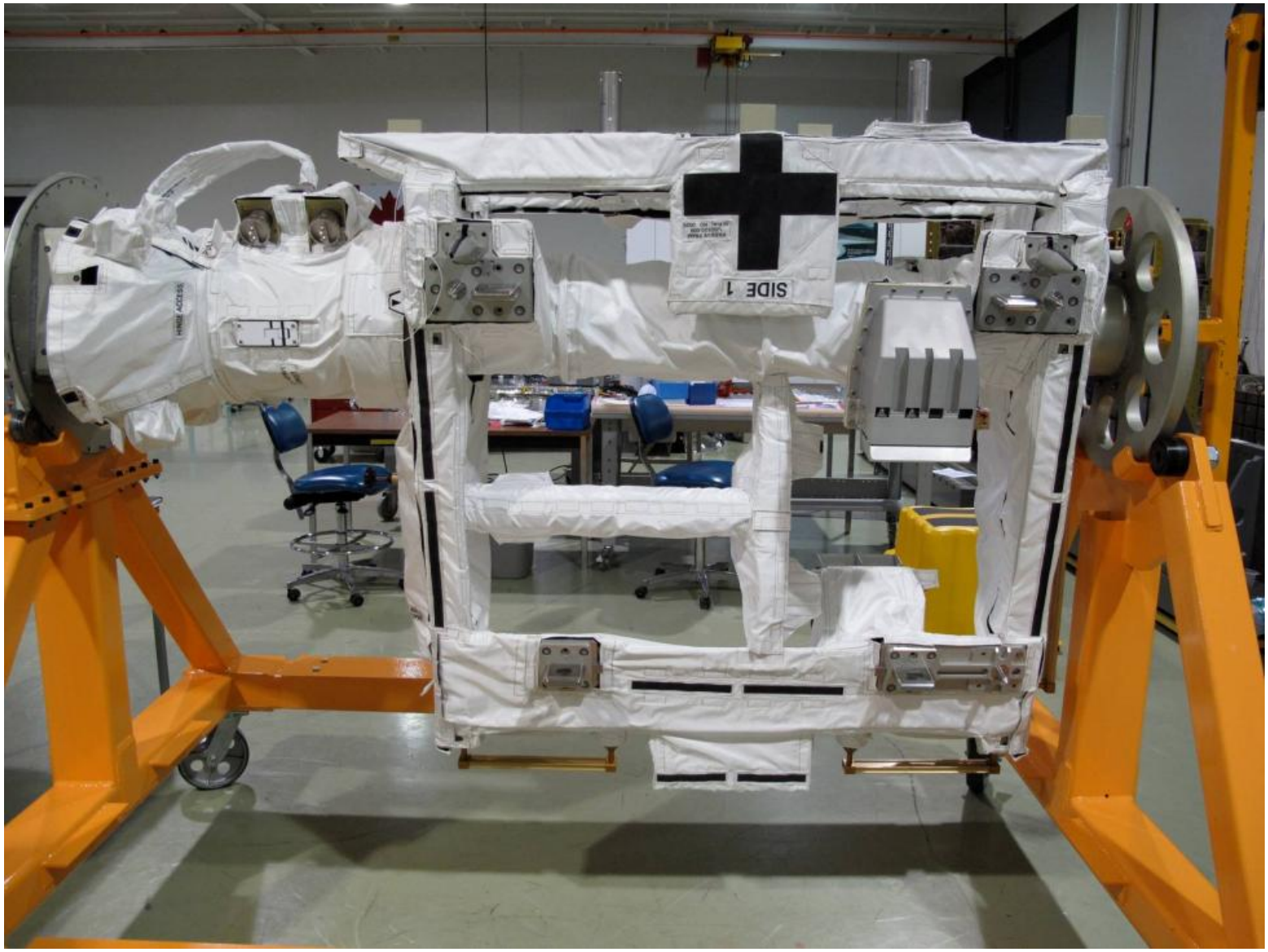
SPDM EOTP


EOTP to SPDM Power Connector
EOTP Fuse Connectors
BJU Main Body
BJU Input Drive
SPDM outrigger
EOTP stand-off leg and retention tether (used for SPDM service position)

SPDM EOTP (Cont)

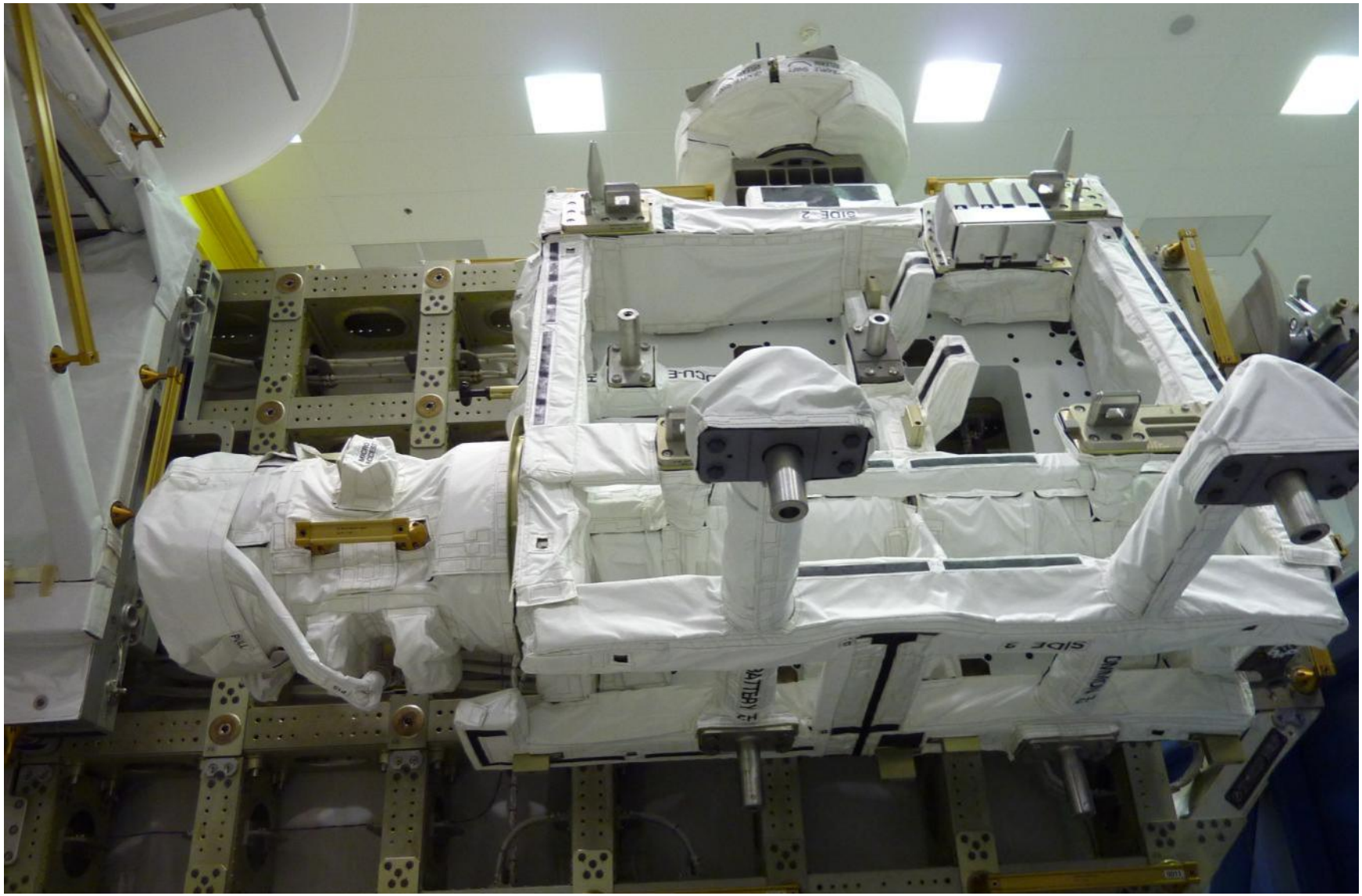


SPDM EOTP (Cont)

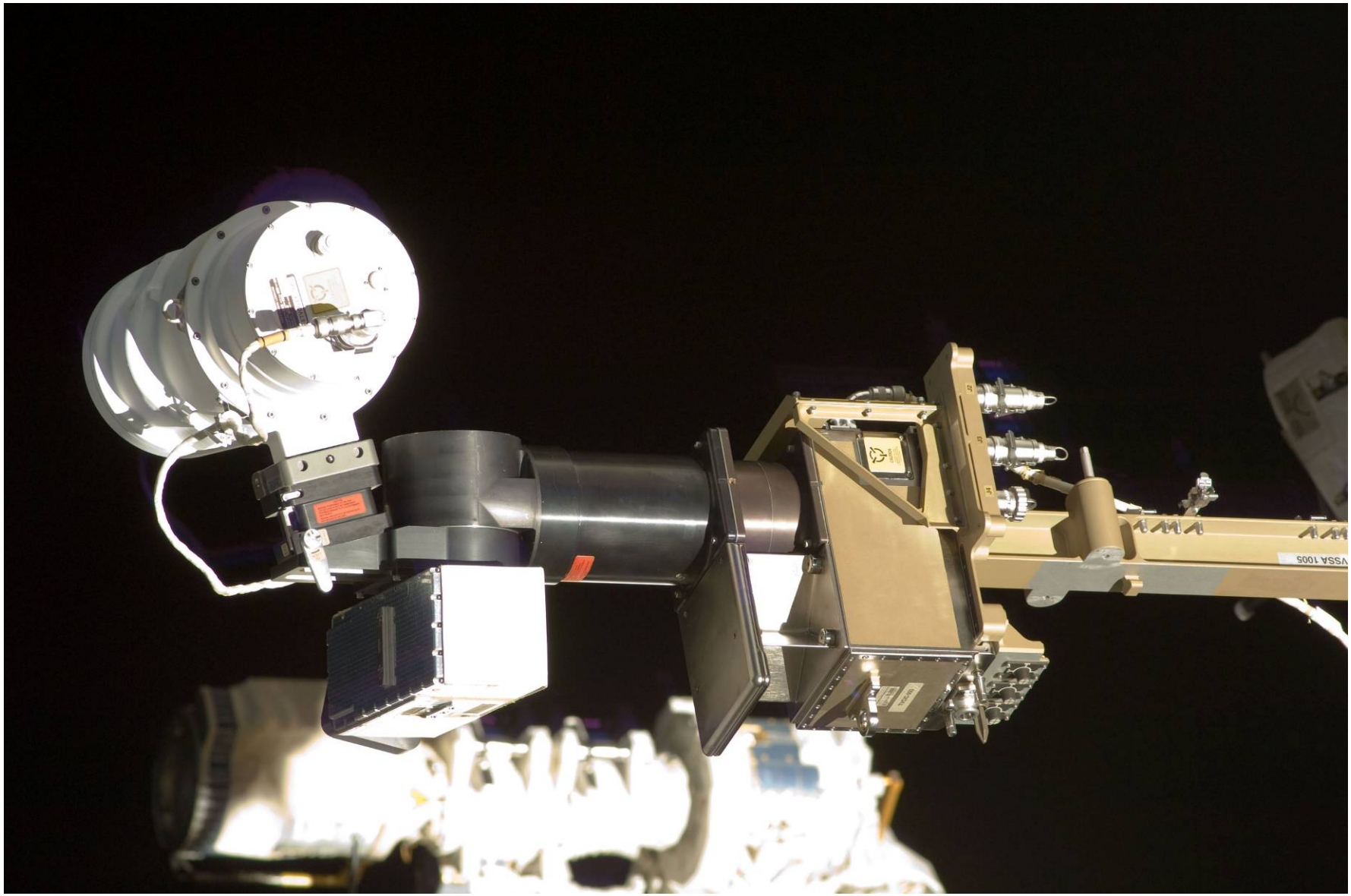


SPDM EOTP (Cont)

SPDM EOTP (Cont)



ETVCG



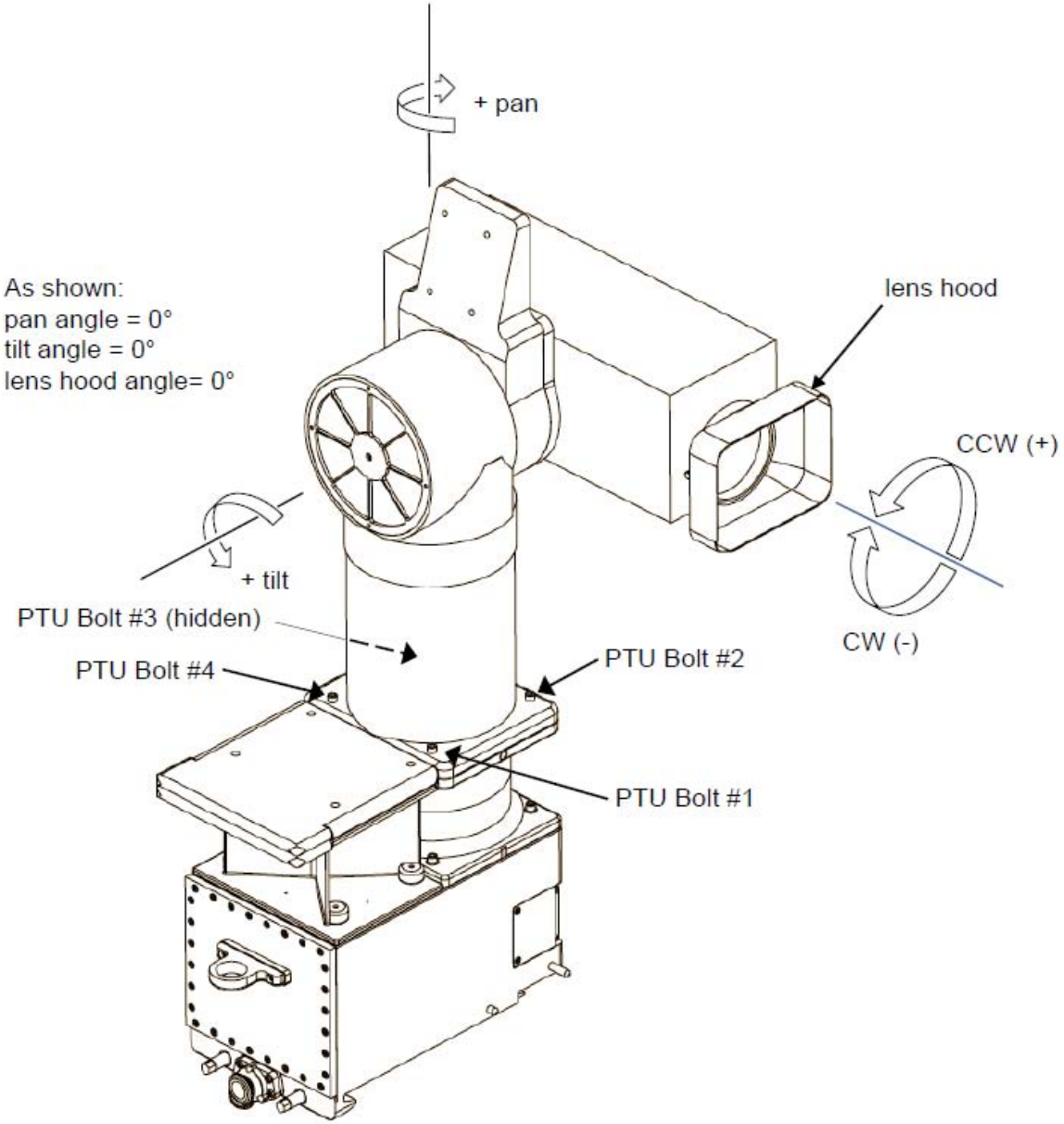
FS 18-75

EVA/135/FIN

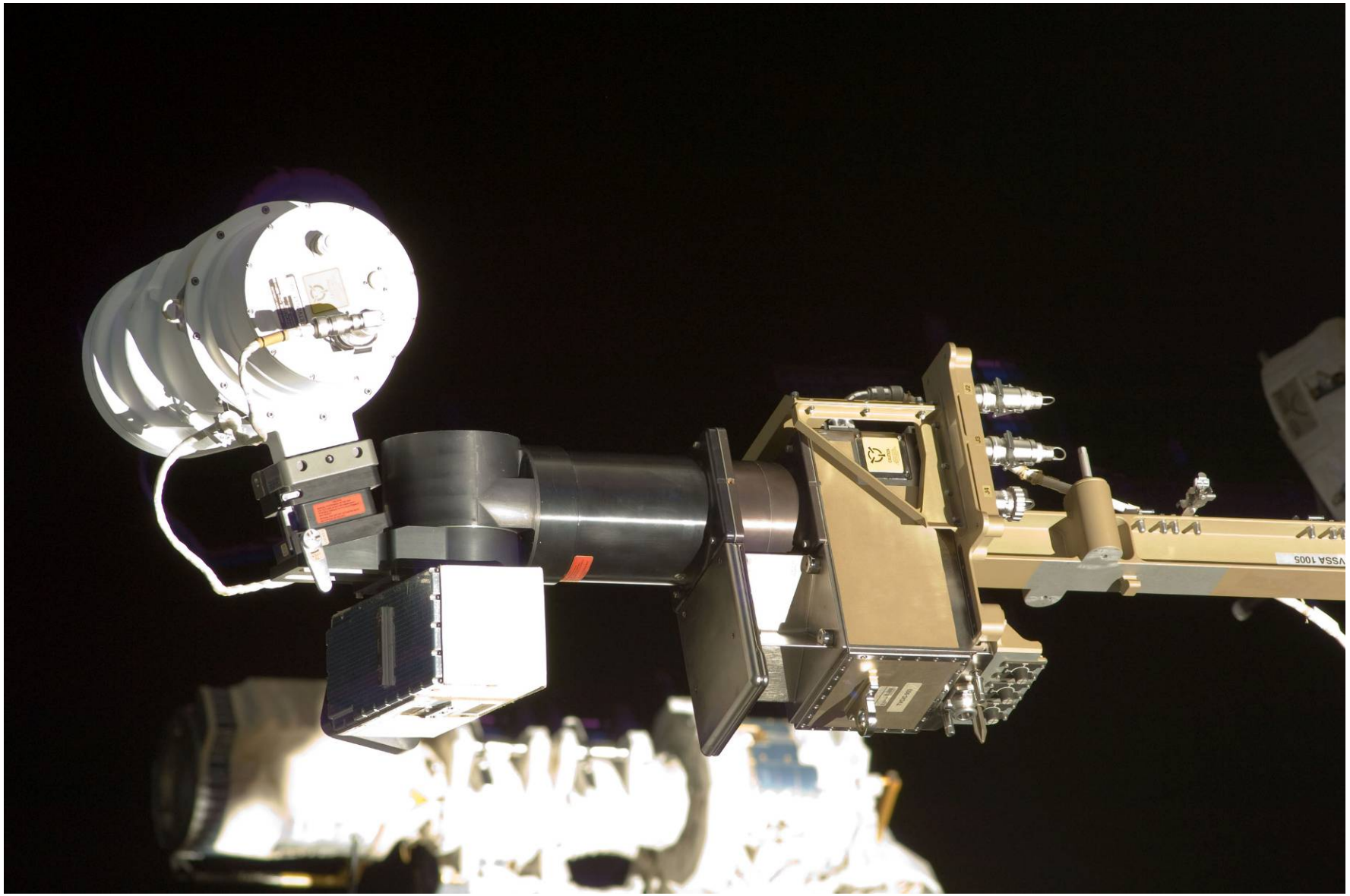
GET-AHEADS

ETVCG (Cont)

ETVCG (Cont)

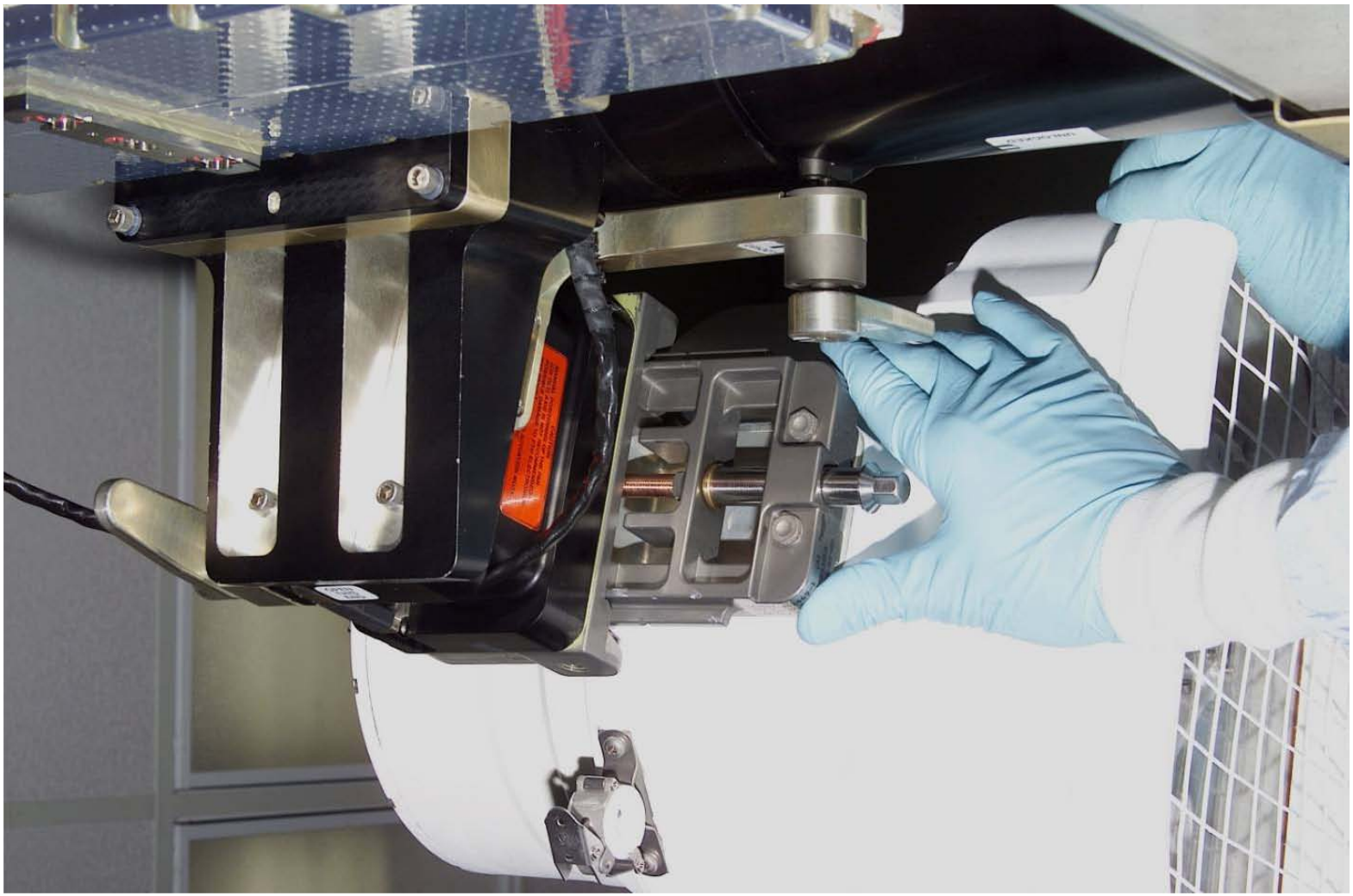

+ pan
As shown:
pan angle = 0°
tilt angle = 0°
lens hood angle= 0°
lens hood
CCW (+)
CW (-)
+ tilt
PTU Bolt #3 (hidden)
PTU Bolt #4
PTU Bolt #2
PTU Bolt #1

ETVCG (Cont)

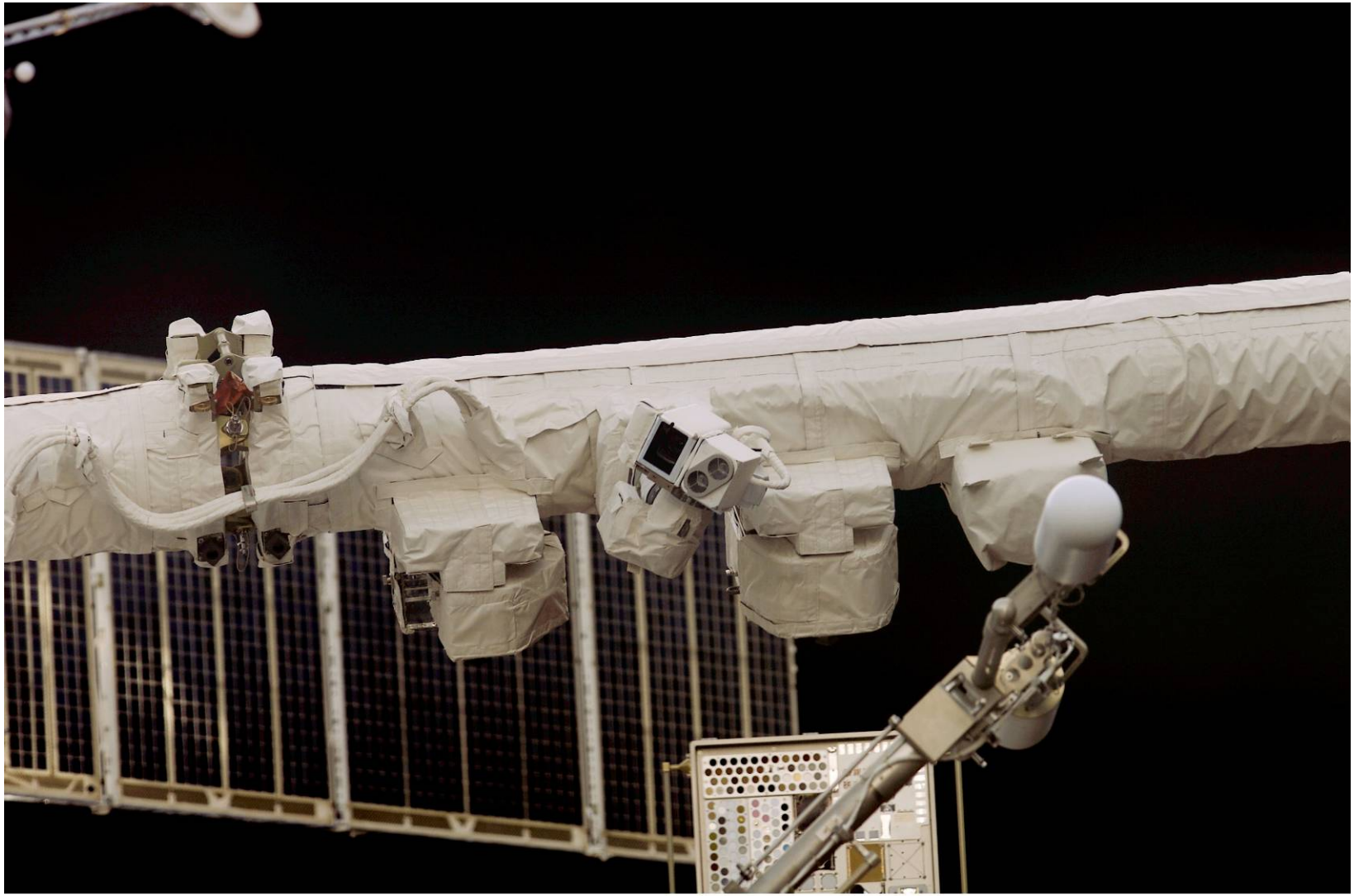


ETVCG LIGHT (VLA)

ETVCG LIGHT (VLA) (Cont)

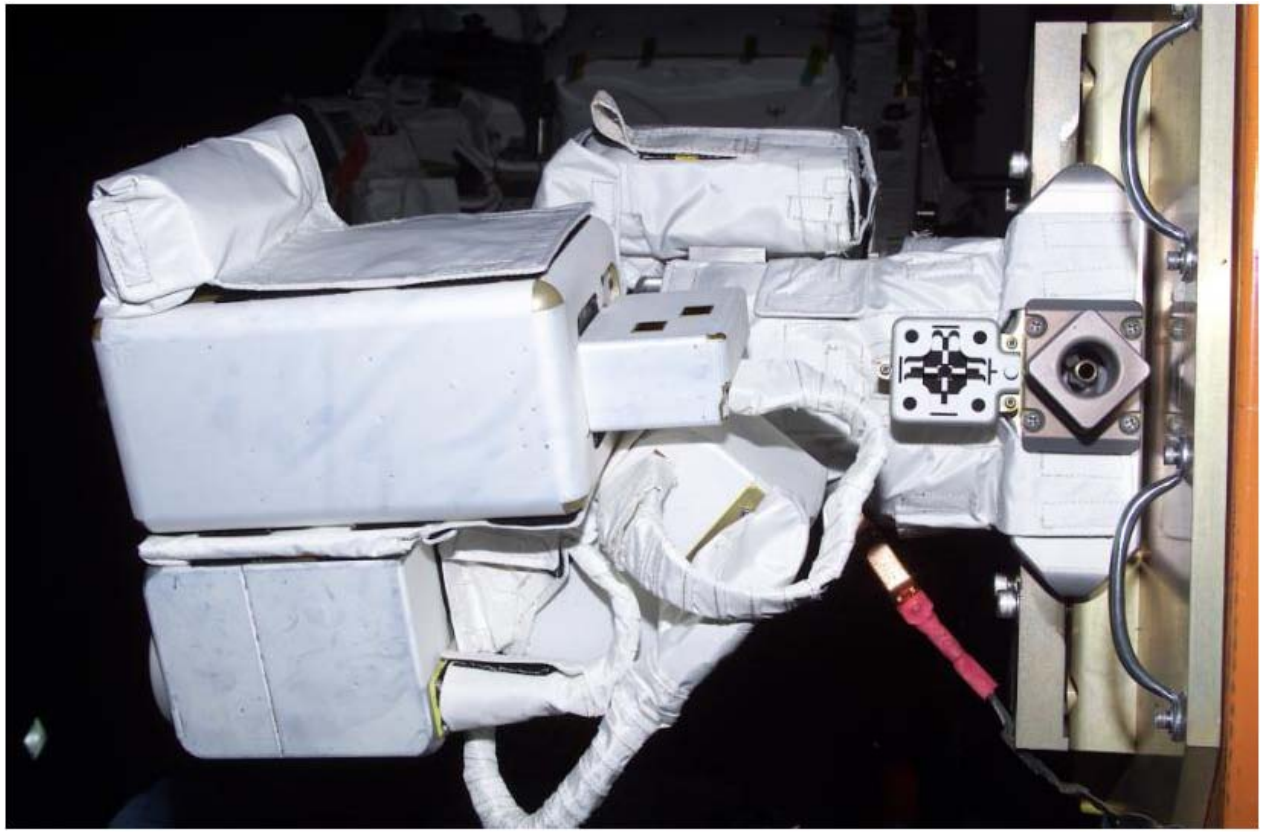


SSRMS BASE B CLPA

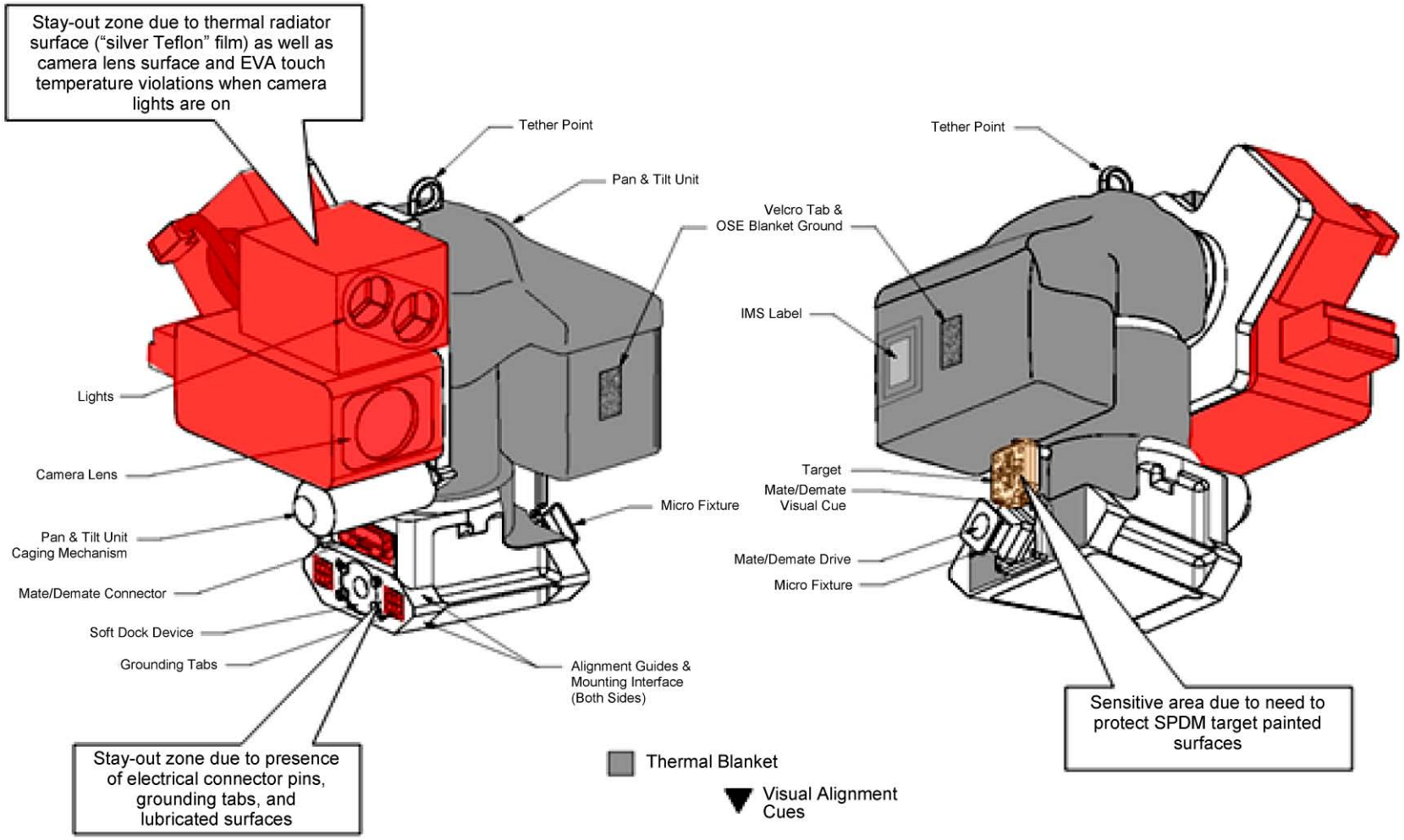


S108E5107 2001:12:07 19:43:30

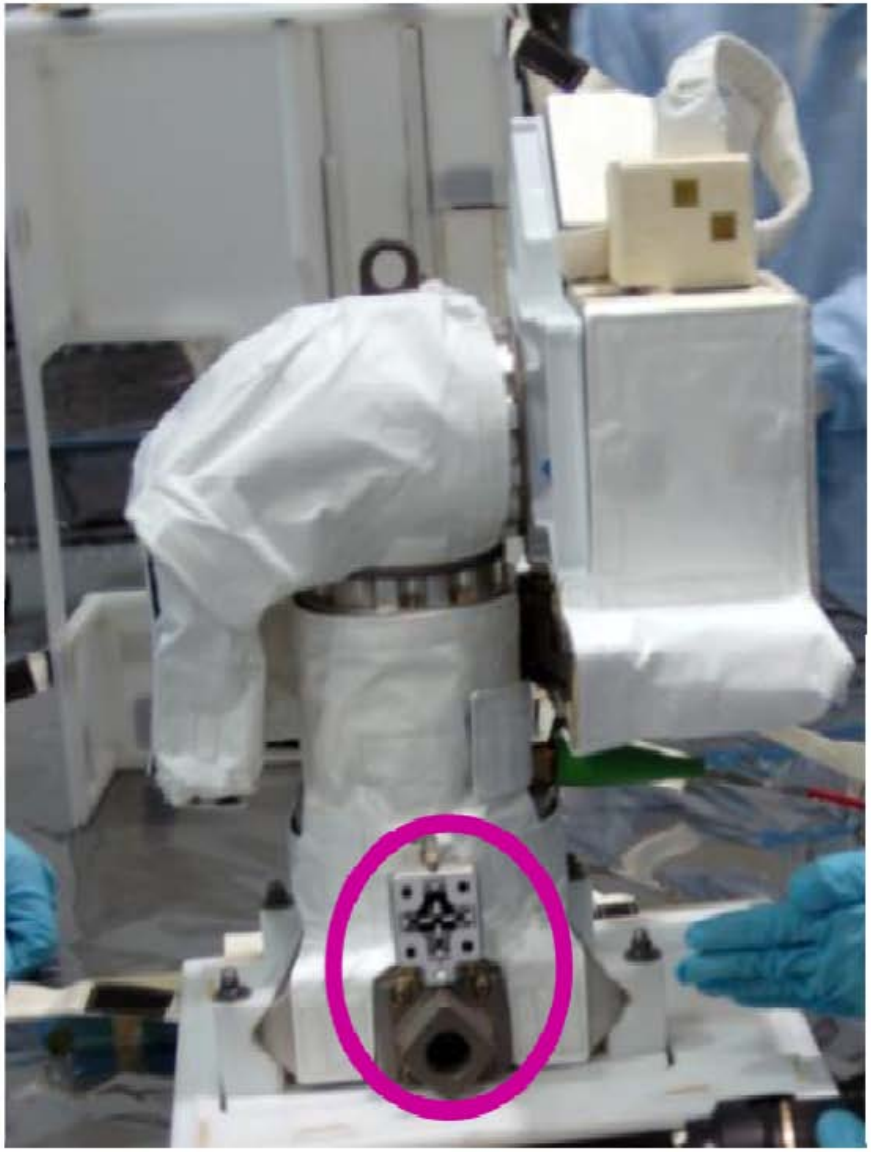
SSRMS BASE B CLPA (Cont)

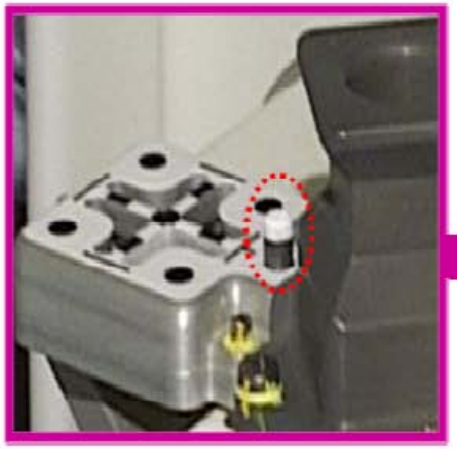


SSRMS BASE B CLPA (Cont)



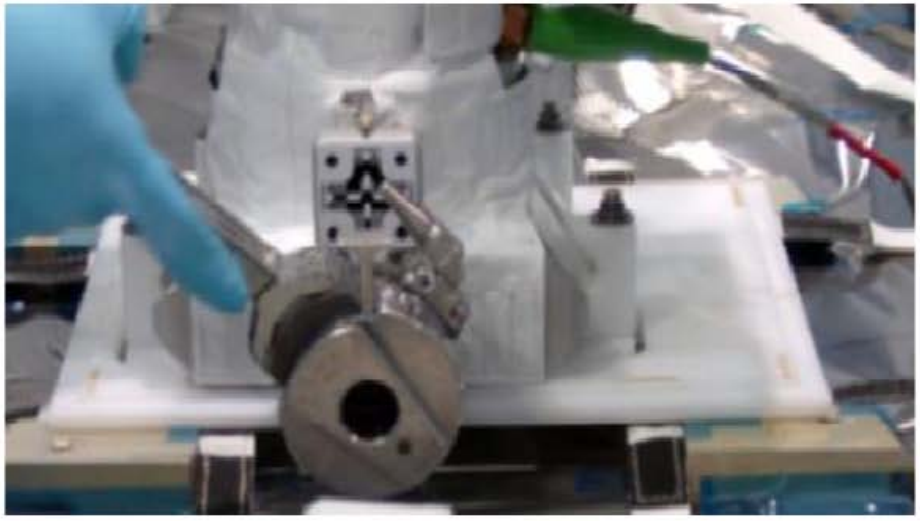
SSRMS BASE B CLPA (Cont)





Uninstalled

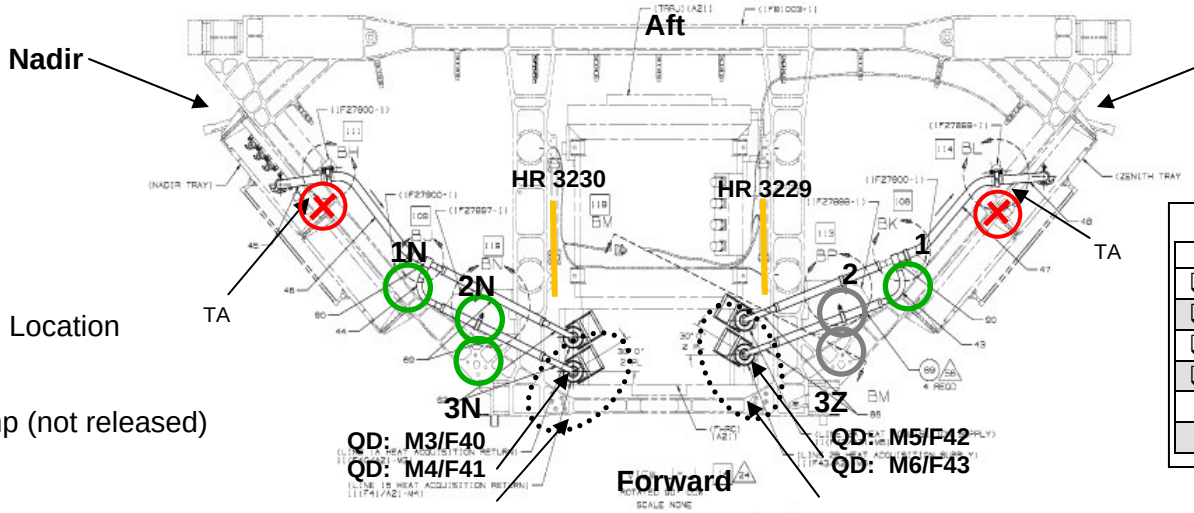
Installed (only white tip visible)



CP13

S1 FHRC P-CLAMP RELEASE

FHRC P-clamps – Hose Box (Outboard)



○ = P-clamp Location

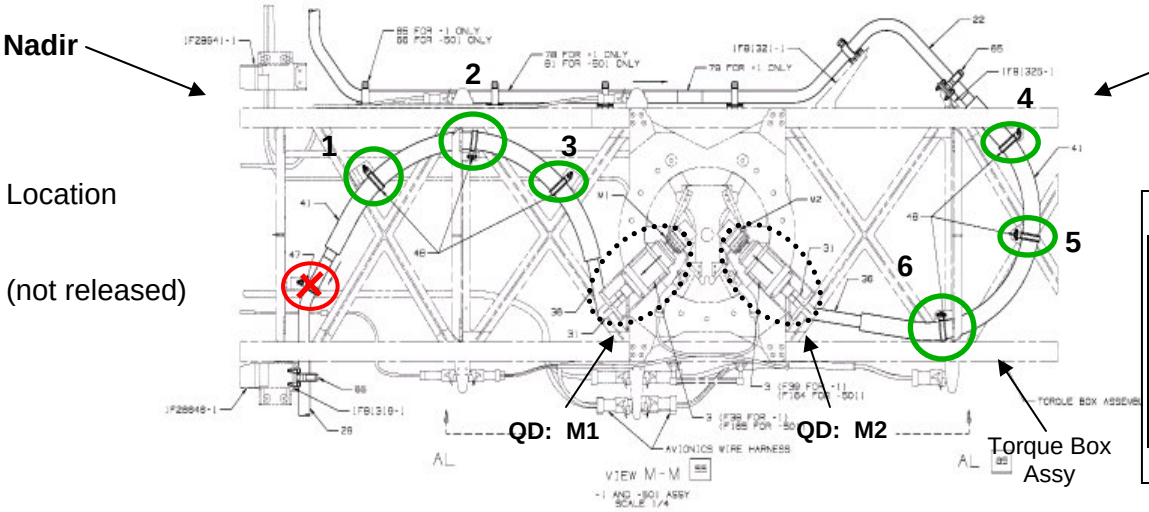
⊗ = TA-clamp (not released)

Hose Box clamps 2Z & 3Z were released on 15A/STS-119

Hose Box S1 Bay 13

	P-clamp	Tool	Socket
❑	1 (N)	PGT	6-in ext
❑	2 (N)	PGT	6-in ext
❑	3 (N)	Ratchet	2-in ext
❑	1 (Z)	PGT	6-in ext
√	2 (Z)	PGT	6-in ext
√	3 (Z)	Ratchet	2-in ext

FHRC P-clamps – Stinger (Inboard)



○ = P-clamp Location

⊗ = P-clamp (not released)

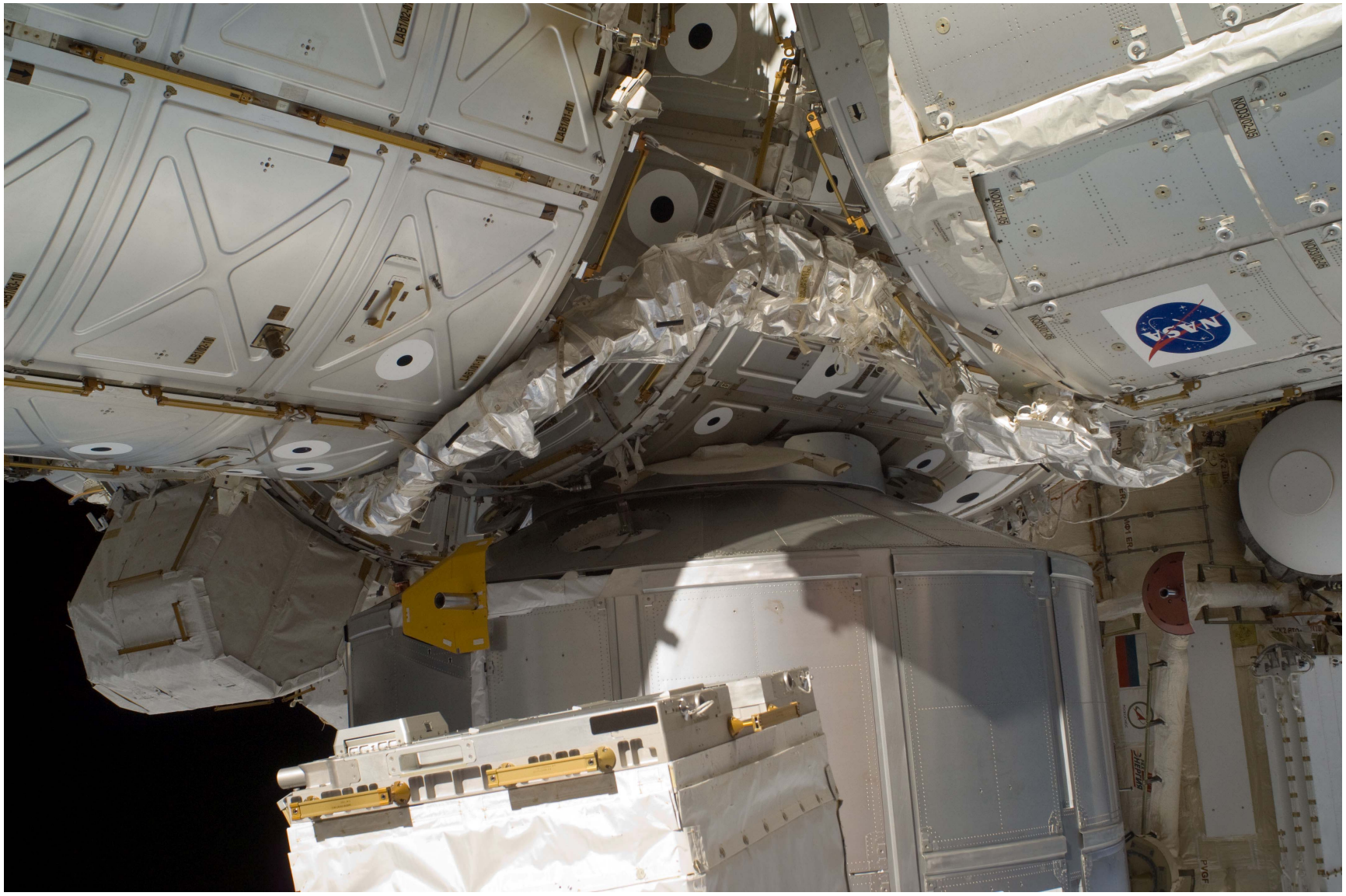
Stinger S1 Bay 11

	P-clamp	Tool	Socket
❑	1	PGT	6- or 18-in ext
❑	2	PGT	18-in ext
❑	3	PGT	6-in ext
❑	4	PGT	6- or 18-in ext
❑	5	PGT	6- or 18-in ext
❑	6	PGT	6* or 18-in ext

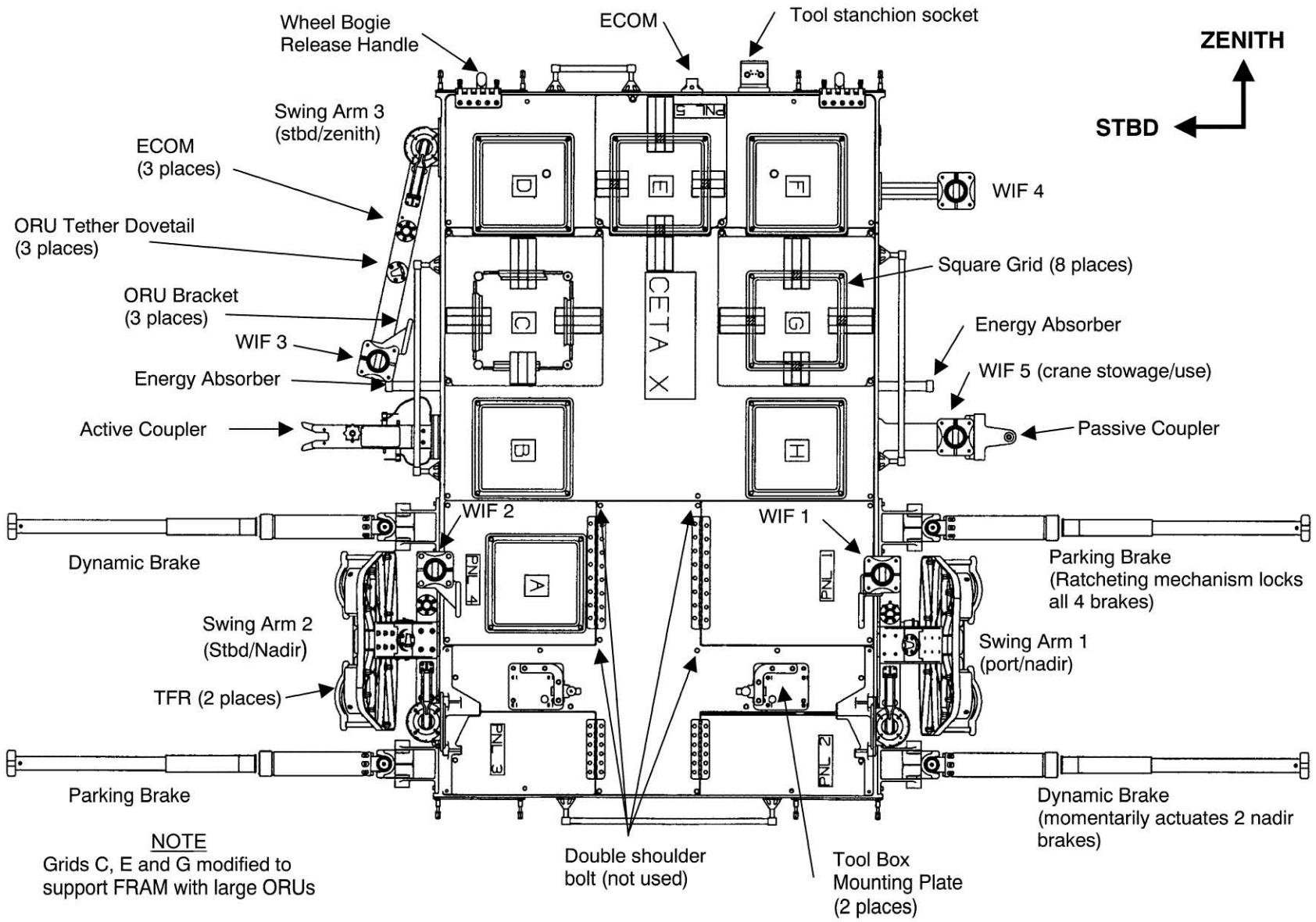
***wobble reqd w/6-in**

PMA3 COVER (TBD)

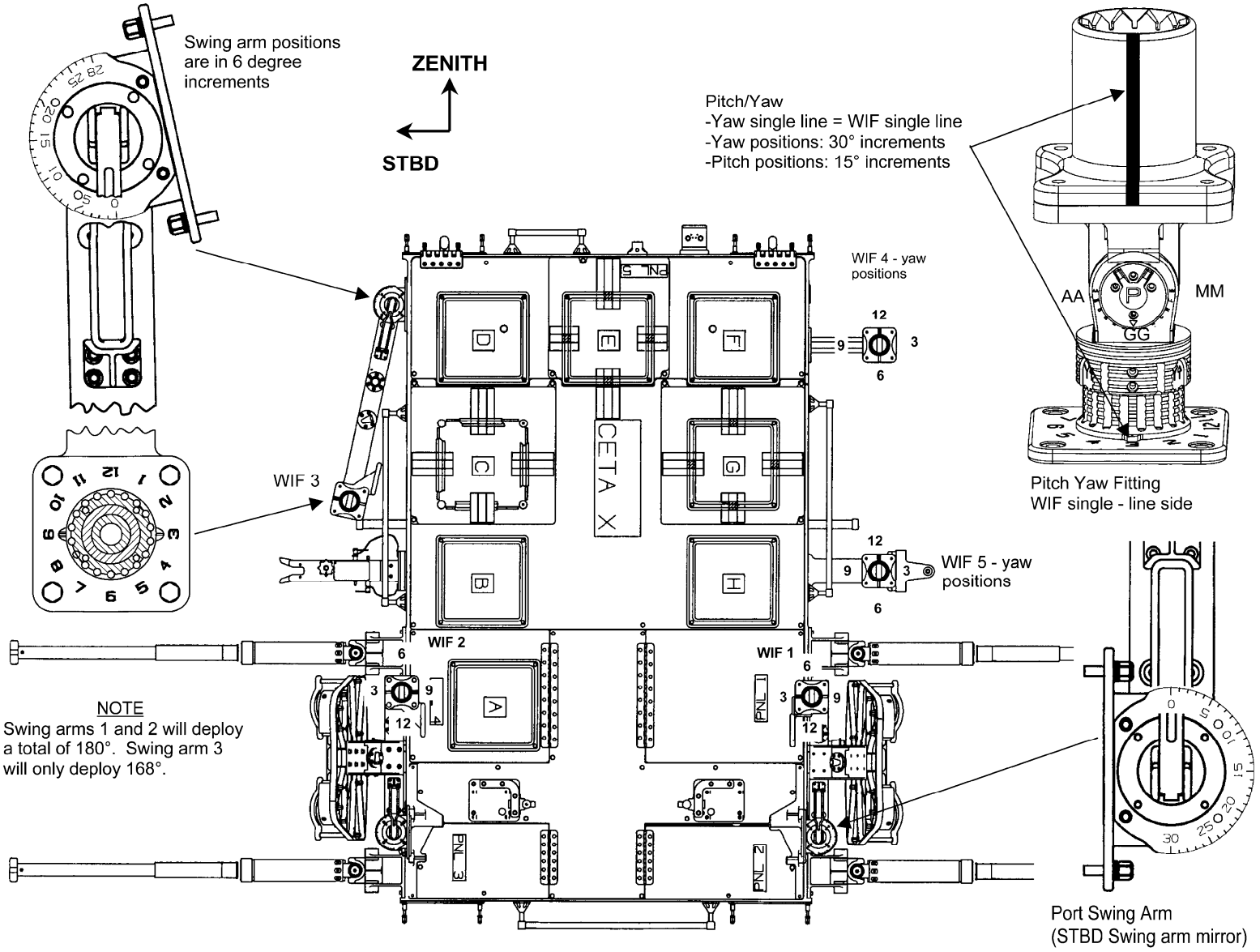
LAB GAP SPANNER



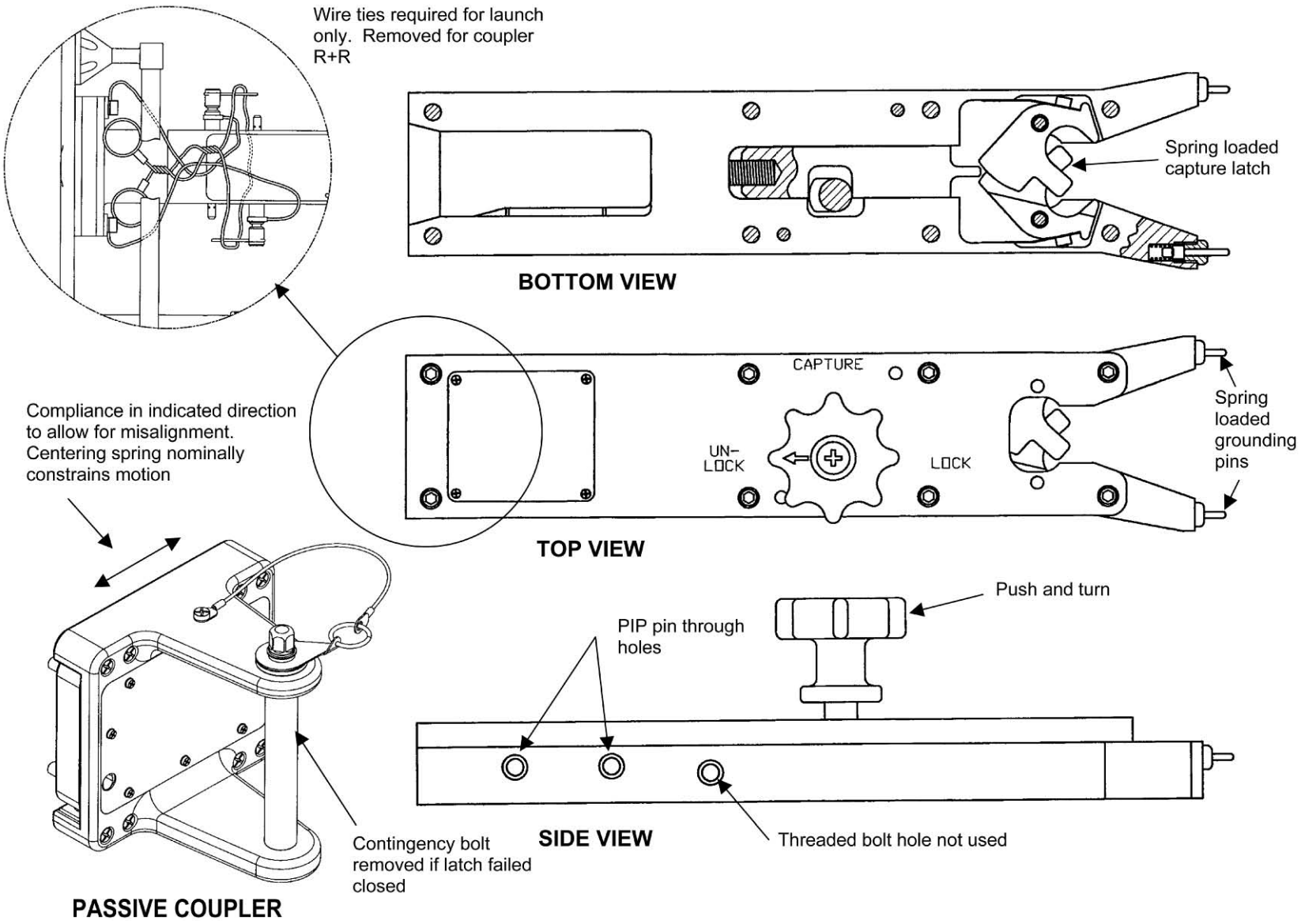
CETA CART OVERVIEW



CETA CART OVERVIEW (Cont)

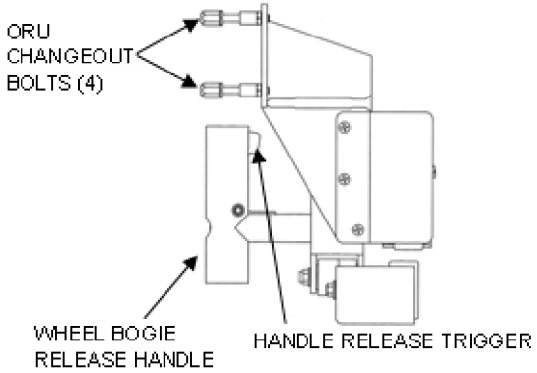


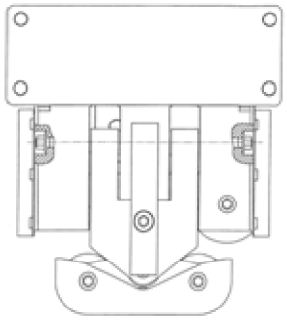
CETA CART OVERVIEW (Cont)



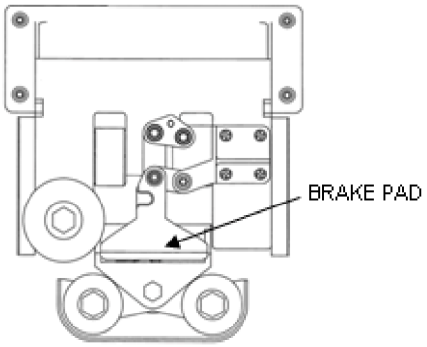
CETA CART OVERVIEW (Cont)

Zenith Stbd Shown, Port Opposite



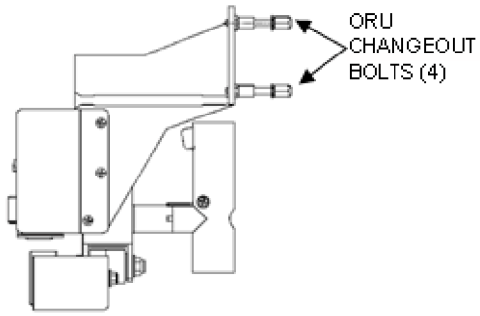


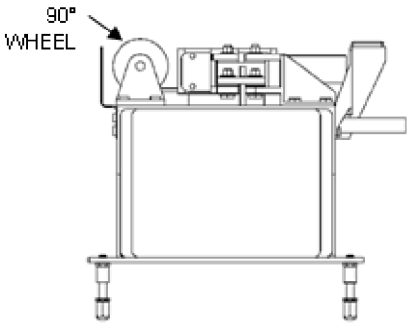
OUTBOARD SIDE



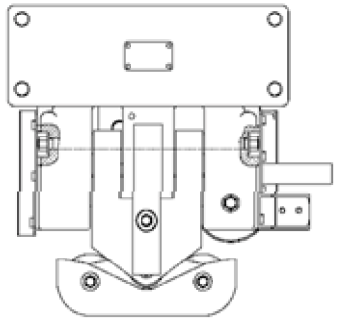
INBOARD SIDE

Nadir Port Shown, Stbd Opposite

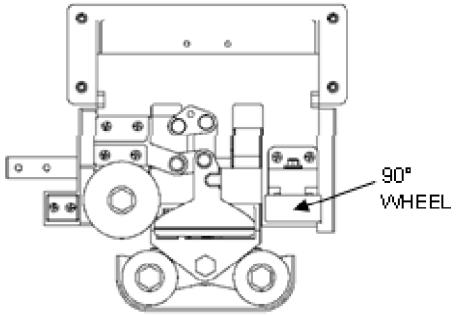




TOP VIEW

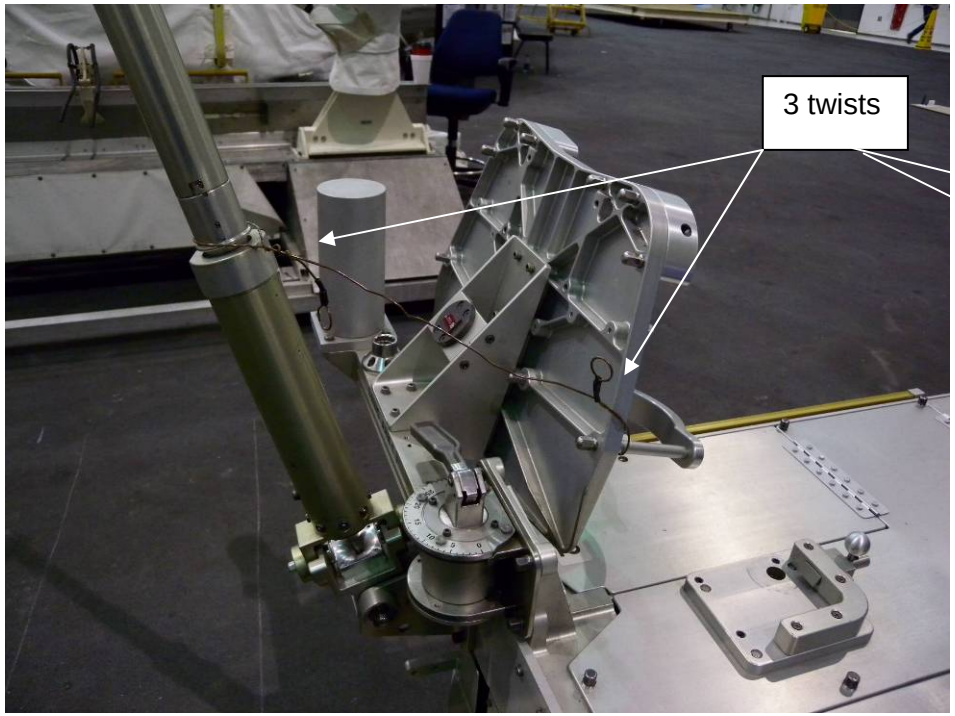


OUTBOARD
SIDE

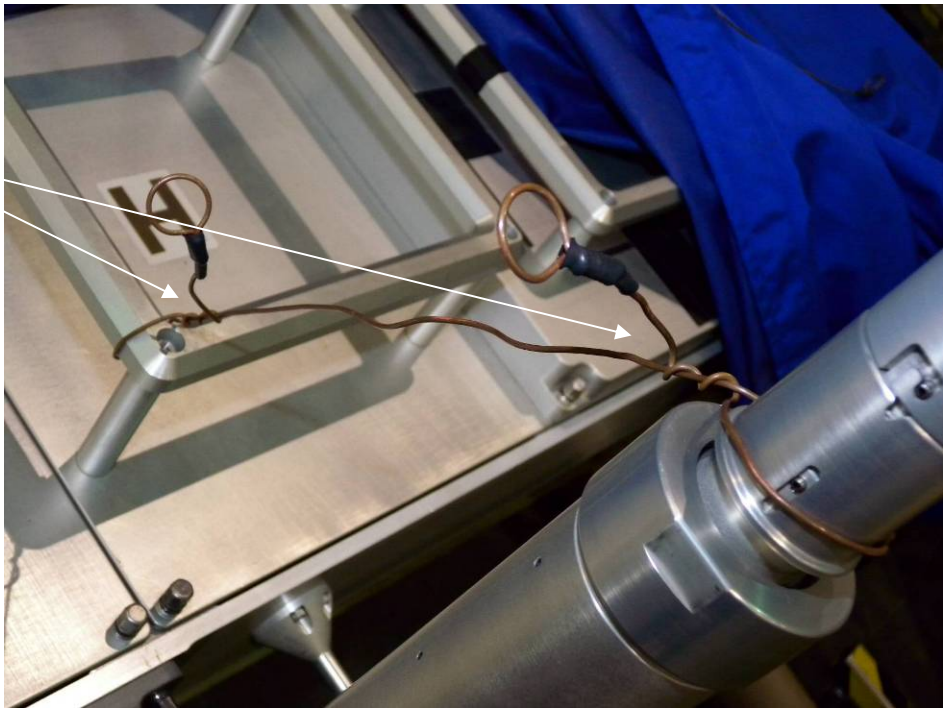


INBOARD SIDE

CETA CART OVERVIEW (Cont)

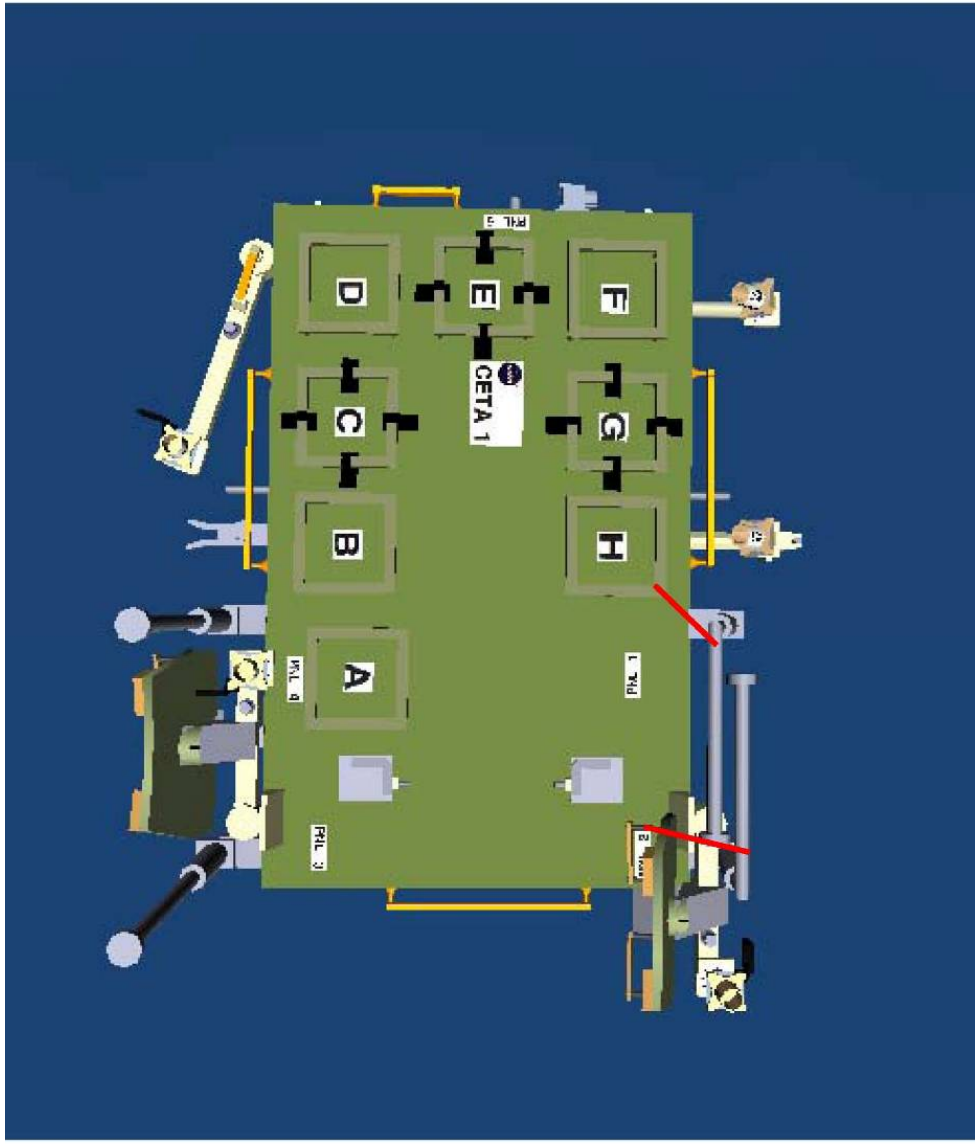


Zenith Port brake handle



Nadir Port brake handle

CETA CART OVERVIEW (Cont)



Space Shuttle Program
FLIGHT DATA FILE

JSC-48024-135
FINAL

EVA CHECKLIST

STS
135

Flight Cover (trim bottom to expose tabs)