Space Shuttle Program
FLIGHT DATA FILE

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EVA Checklist

STS-132 Flight Supplement

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

Final
May 5, 2010

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

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MISSION OPERATIONS DIRECTORATE

EVA CHECKLIST
STS-132 FLIGHT SUPPLEMENT

FINAL
May 5, 2010

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482#:	EVA FS-00336	EVA FS-00367A
	EVA FS-00363A	EVA FS-00368
	EVA FS-00364A	EVA FS-00369
	EVA FS-00365A	EVA FS-00370
	EVA FS-00366A	EVA FS-00371

AREAS OF TECHNICAL RESPONSIBILITY

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EVA CHECKLIST
STS-132 FLIGHT SUPPLEMENT

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AIRLOCK PREP (50 min)

	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

AIRLOCK CONFIG

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)
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

EMU CHECKOUT PREP (30 min)

AW18A
1. LTG FLOOD (four) – on
2. Remove External Airlock Floor Bag from Airlock
3. Unbuckle SCU straps, velcro SCU to wall

Middeck
4. Remove 20-g Crash Bag from middeck EMU 3018 (RM)

Airlock
5. Disconnect helmets from airlock EMUs, temp stow
6. √DIDB restraint bags in correct position
7. Remove Comm Caps (4) from LTA Restraint Bag kangaroo pouches
   For EMU 3004 (BW) on stbd AAP, connect Comm Cap labeled 'BW1' to electrical harness on suit. Temp stow Comm Cap labeled 'BW2'
   For EMU 3011 (Spare) on port AAP, connect Comm Cap labeled 'G1' to electrical harness on suit. Temp stow Comm Cap labeled 'RM1' for EMU Checkout
8. Remove LTA Restraint Bags and stow on AAP
9. Disconnect waist rings; remove BW & RM ECOKs (mesh bags)
10. Remove EVA Sys Xfer Bag from BW ECOK
11. Stow Comm Cap labeled 'BW2' in BW ECOK
12. Temp stow BW & RM LCVGs for EMU Checkout

Middeck Vol H
13. Unstow:
    Inboard Bag:
    - ☐ SCOFs (2), from EMU Equipment Bag shared compartment – temp stow for EMU Checkout
    - ☐ LTA Donning Handles (2), from EMU Equipment Bag shared compartment – temp stow for EMU Checkout
    - ☐ EMU Servicing Kit (s/n 5004)
    - ☐ EVA Helmet Light Assembly (s/n 1008)

    Outboard Bag:
    - ☐ Shuttle Crew Specific Compartment (1), from EMU Equipment Bag
    - ☐ EVA Helmet Light Assembly (s/n 1006)
14. Stow EMU Servicing Kit (s/n 5004) and EVA Helmet Light Assembly (s/n 1008) in EVA Sys Xfer Bag
15. Stow Shuttle Crew Specific Compartment (1) in BW ECOK
16. Restow Vol H Bags

EMUs
17. √Thermal cover clear of waist rings
18. Waist rings – engage position
19. Connect LTAs to HUTs, lock

EMU 3004 (BW)
20. Install EVA Helmet Light Assembly (s/n 1006) onto BW helmet
    Perform pull test to verify all latches fully seated
21. Transfer ECOKs to Middeck

External A/L Floor Bag
22. Unstow EMU Battery (s/n _____) and stow in EVA Sys Xfer Bag
23. Unstow contingency LiOH canisters (4) and stow in Bag E to stay on STS

Bag C
24. Gather EMU lower arm covers (4) and stow in EVA Sys Xfer Bag
25. Temp stow ECOKs and EVA Sys Xfer Bag for "EVA Prep for Transfer to ISS"

LTA RESTRAINT STRAP REMOVAL (15 min)

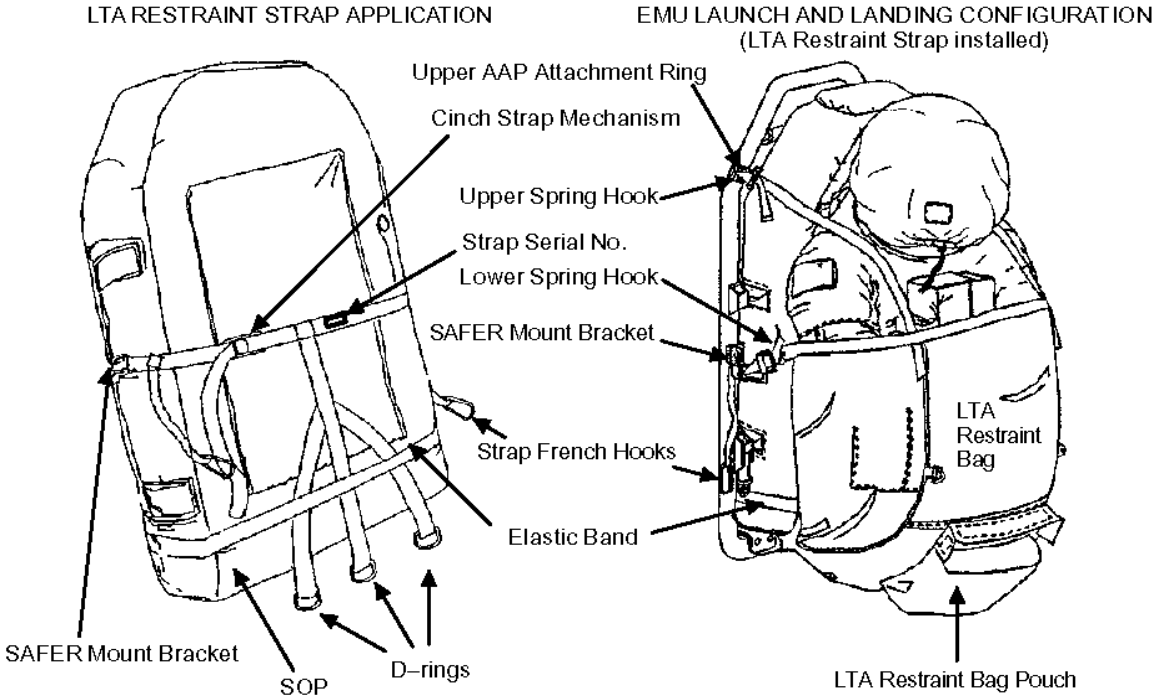
NOTE
May be performed on EMU 1 and 2 simultaneously.
Perform steps as reqd for current EMU config

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



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

EVA PREP FOR TRANSFER TO ISS (90 min)

ALL EMUs/ DCM
1. √PWR – SCU
2. √PURGE vlv – op (up)
3. √WATER – OFF, switch guard installed
4. √O2 ACT – OFF

Bag C
5. Install MWS (baseplate, t-bar) on EMU 3018 (RM) and EMU 3004 (BW)
6. Retrieve BW ECOK, RM ECOK, G ECOK and EVA Sys Xfer Bag
7. Configure/verify items according to table below:

Verify items on EMU 3004 (BW)	**Verify items on EMU 3018 (RM)**
☐ Comm Cap (BW1) ☐ Helmet (√sun visors down, cover installed) ☐ Valsalva ☐ Fresnel Lens ☐ EVA Helmet Light Assy (s/n 1006) ☐☐ EMU gloves (BW1) ☐☐ Wrist mirror (2) ☐☐ Adjustable Equipment Tether (2) ☐ Waist tether ☐ MWS (baseplate [-305], t-bar) ☐ EMU battery (s/n 2078) ☐ LiOH ☐ LTA	☐ Comm Cap (RM1) ☐ Helmet (√sun visors down, cover installed) ☐ Valsalva ☐ EVA Helmet Light Assy (s/n 1008) ☐☐ EMU gloves (RM1) ☐☐ Wrist mirror (2) ☐☐ Waist tether (2) ☐ MWS (baseplate [-305], t-bar) ☐ EMU battery (s/n 2085) ☐ REBA battery (s/n _____) ☐ LiOH ☐ LTA
Verify items below in BW ECOK: ☐☐ BW EVA 1 & 2 ziplocks (each bag): ☐☐ MAGs (2) ☐ TCUs (top & bottom) ☐ Spectra comfort gloves ☐ Tube socks ☐ Wristlets ☐ Croakie (1) EVA 2 bag also includes: ☐ Crew identifier stripes (EV1) ☐ STS-132 mission patch ☐ American flag ☐ 'CM CALDWELL SOCKS' ziplock ☐ Woodsman socks ☐ LCVG (BW1) ☐ Comm Cap (BW2) ☐ Shuttle Shared Crew Compartment	**Verify items below in RM ECOK:** ☐☐ RM EVA 1 & 3 ziplocks (each bag): ☐☐ MAGs (2) ☐ TCUs (top & bottom) ☐ Custom comfort gloves ☐ Thermal poly liners socks EVA 3 bag also includes: ☐ Crew identifier stripes (EV2) ☐ STS-132 mission patch ☐ American flag ☐ 1/8-in Heel Pad ☐ LCVG (RM1) ☐ Comm Cap (RM2) ☐ Xfer to Shuttle Bag (empty) ☐ Spare Mesh Bag (empty)

EVA PREP FOR TRANSFER TO ISS (90 min) (Cont)

Verify items below in G ECOK: ☐☐ G EVA 2 & 3 bag includes (each bag): ☐☐ MAGs (2) ☐ TCUs (top & bottom) ☐ Spectra comfort gloves ☐ Thermal poly liners socks ☐ Croakie (1) ☐ Crew identifier stripes (EV4) ☐ STS-132 mission patch ☐ American flag ☐ LCVG (G1) ☐☐ EMU gloves (G1) (covers installed) **Gather and stow items below in G ECOK:** From EVA Sys Xfer Bag: ☐ Comm Cap (G1) ☐ Comm Cap (G2)	Retrieve BW/RM ECOK from Bag E **Verify items below in BW/RM ECOK:** ☐ BW Unscheduled ziplock ☐☐ MAGs (2) ☐ BW Contingency ziplock ☐☐☐ MAGs (3) ☐ Fresnel Lens ☐ RM Unscheduled ziplock ☐☐ MAGs (2) ☐ RM Contingency ziplock ☐☐☐ MAGs (3) After items verified above, stow BW/RM ECOK in Bag E to be left on shuttle
Verify items below in EVA Sys Xfer Bag: ☐ EMU Servicing Kit (s/n 5004) ☐ EMU Battery (s/n _____) ☐ Ziplock with crew specific luggage tags **Gather and stow items below in EVA Sys Xfer Bag:** From External A/L Floor Bag: ☐ SAFER Hardmount (s/n 08) ☐ 85-ft Safety Tethers (#25) ☐ 85-ft Safety Tethers (#27) From FDF Locker (MF57G): ☐ 'EVA Transfer' ziplock ☐☐☐ ISS EVA Cuff Checklists (3) ☐ STS-132 CONSUMABLES TRACKING CUE CARD ☐ STS-132 EVA BATTERY RECHARGE PLAN CUE CARD ☐ EMERGENCY UNDOCKING/ EXPEDITED SUIT DOFFING CUE CARD ☐ 10.102 Joint Emergency Egress CC ☐ ISS EVA Systems Checklist (STS-132 copy with Red stripe) ☐ FDF STS-132 EVA CHECKLIST	**Verify items below in C Bag:** ☐☐☐☐☐☐ DIDBs (6) – fill on FD3 ☐☐ EOTP Fuse Connectors (2) ☐☐ 7/16-in 2-in ext sockets (2) ☐ EOTP Contingency Socket ☐ PLSS Vent Port Plugs ☐ Wire ties (24) ☐ SGANT AGIT Heat Shield ☐ MWS Key Strap Assembly ☐ EOTP Input Drive ☐ Break torque on bracket and stow back in Bag C (7/16" ratchet from Vol H Outboard Bag) ☐ Spare EDF ☐ EOTP Maintenance Tether If not removed in MDDK XFER PREP, Non-EVA Items: ☐ FGB PDGF External Harness ☐☐ EVA Receptacle Protective Cover (2) ☐☐☐ Ziplocks of towels (3)
Verify items on EMU 3011 (Spare) ☐ DIDB restraint bag ☐ Helmet (√sun visors down, cover installed) ☐ Lower arm covers (installed in EMU C/O) ☐ LTA with lower leg covers (no boots) ☐ LTA Restraint Strap/Bag (installed in EMU C/O) ☐ LiOH	

NOTE

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

1. Transfer the following EVA equipment to ISS and update transfer list:

Item	Destination	Transfer list item #	Transfer Status
EMU 3004 (BW)	E-Lk fwd EDDA	Ref Transfer List	
EMU 3018 (RM)	E-Lk aft EDDA	Ref Transfer List	
EMU 3011 (Spare)	Node 3 Endcone	Ref Transfer List	
ECOK (BW)	E-Lk	Ref Transfer List	
ECOK (RM)	E-Lk	Ref Transfer List	
EVA Sys Xfer Bag	E-Lk	Ref Transfer List	
C Bag	Node 1 ditch	Ref Transfer List	
ECOK (G)	C Bag	Ref Transfer List	

RM ECOK

2. Remove Xfer to Shuttle Bag from RM ECOK and temp stow

BW ECOK

3. Remove 'CM CALDWELL SOCKS' ziplock and deliver to ISS crewmember TC

EVA Sys Xfer Bag

4. Unstow following items position in E-Lk:
   - ☐ From 'EVA Transfer' ziplock:
     - ☐ STS-132 CONSUMABLES TRACKING CUE CARD
     - ☐ STS-132 EVA BATTERY RECHARGE PLAN CUE CARD
     - ☐ EMERGENCY UNDOCKING/ EXPEDITED SUIT DOFFING CUE CARD
     - ☐ 10.102 Joint Emergency Egress CC
     - ☐ ISS EVA Systems Checklist (Red stripe)
   - ☐ FDF STS-132 EVA CHECKLIST
   - ☐ SAFER Hardmount (s/n 08), stow in IV Bag in C-Lk endcone

5. Unstow EMU Battery (s/n _____) and stow in 132 EVA Stuff bag

132 EVA Stuff

6. Gather, stow in EVA Sys Xfer Bag:
   - ☐ EVA Helmet Light Assembly (s/n 1003)
   - ☐ EVA Helmet Light Assembly (s/n 1005)
   - ☐ SAFER Hardmount (s/n 04)

7. Gather, stow in Xfer to Shuttle Bag:
   - ☐ ISS EVA Systems Checklist

8. Gather, stow in C Bag:
   - ☐☐☐ LiOH (3)

A/L1AO

9. Remove ISS Crew Specific Compartment from left side of EMU Equipment Bag and stow in G ECOK Bag until after EVA 1; unstow Shuttle Crew Specific Compartment from BW ECOK; install on EMU Equipment Bag

Both EMUs

10. Install EMU TV and Helmet Light batteries (from STS-132 Battery Bag) for EVA 1 per STS-132 CONSUMABLES TRACKING CUE CARD
    Perform pull test to verify all latches fully seated

11. Install respective ISS EVA Cuff C/Ls (EV1 & EV2) from EVA Sys Xfer Bag

C Bag

12. If Non-EVA items not removed yet,
    remove items and stow per transfer list
    (Ref Transfer List Items # _____)

NOD1

13. Stow both EVA Sys Xfer Bag and Xfer to Shuttle Bag in C Bag

NOTE

After EVA 1 Tool Config, will stow Old ISS MWS (2)
(baseplate, t-bar) into Xfer to Shuttle Bag for return

14. Report transfer status and whether step 12 was required to **MCC-H**

EMU SWAP FOR EVA 2 (50 min)

NOTE

This procedure assumes the following procedures have been completed following EVA 1:

{1.240 POST EVA} (SODF: ISS EVA SYS: EVA PREP/POST)
{1.605 BSA BATTERY RECHARGE - term} (SODF: ISS EVA SYS: BATTERY OPS)
{1.605 BSA BATTERY RECHARGE - init} (SODF: ISS EVA SYS: BATTERY OPS)

Both EMUs

☐ 1. Connect:
- ☐ Boots to LTA
- ☐ LTA to HUT

EMU 3018 (RM)

☐ 2. Connect gloves to lower arms

☐ 3. Remove, temp stow:
- ☐ Remove Helmet Lights and EMU TV
- ☐ MWS

☐ 4. √Helmet installed, sun visors down, cover installed

☐ 5. Remove EMU from aft EDDA
Transfer EMU to Node 1

☐ 6. Gather EV2 (RM) EMU crew-specific items and place in RM ECOK
Transfer ECOK to C Bag

☐ 7. Remove ISS Crew Specific Compartment from right side of EMU Equipment Bag and stow in RM ECOK Bag until after EVA 2

EMU 3004 (BW)

☐ 8. Transfer EMU from fwd to aft EDDA

EMU 3009 (G)

☐ 9. Transfer EMU and G ECOK to E-Lk

☐ 10. As required, remove LTA Restraint Bag and strap, stow in M-02 Bag (s/n 1010)

☐ 11. Install EMU on fwd EDDA

☐ 12. Remove Helmet, install Comm Cap (G1) from G ECOK

☐ 13. Install Helmet Lights and EMU TV
Perform pull test to verify all latches fully seated

☐ 14. √Sun visors down, cover installed

☐ 15. Install ISS EVA Cuff C/L (EV4) from EVA Sys Xfer Bag

G ECOK

☐ 16. Install Wrist Mirrors (2) from 132 EVA Stuff Bag on EMU Gloves (G1)

EMU 3009 (G)

☐ 17. Install on EMU from G ECOK:
- ☐ STS-132 Mission patch
- ☐ American flag
- ☐ Crew Identifier stripes (EV4)
- ☐ EMU Gloves (G1); stow EMU lower arm covers (4) in G ECOK

EMU SWAP FOR EVA 2 (50 min) (Cont)

☐ 18. Install temp stowed MWS on EMU

☐ 19. Unstow ISS Crew Specific Compartment from G ECOK; install on EMU Equipment Bag

NOD1 Ditch

☐ 20. Retrieve vent port plugs from C Bag

NOD3 Endcone/ EMU 3011 (Spare)

☐ 21. Remove LiOH and install vent port plugs
Transfer LiOH to E-Lk

Both Suits

☐ 22. Remove as applicable:
- ☐ Expended LiOH; stow in Xfer to Shuttle Bag
- ☐ Vent Port Plugs; stow in EMU Equipment Bag

☐ 23. Install for EVA 2:
- ☐ EMU Batteries from STS-132 Battery Bag
- ☐ Helmet Light Batteries from STS-132 Battery Bag
- ☐ LiOH from C Bag, record and report s/n to **MCC-H**
  s/n _____ in EMU 3009 (G)

Ref: STS-132 CONSUMABLES TRACKING CUE CARD
Ref: US SODF: EVA: ISS EVA Systems Checklist: EMU Maintenance: 1.515 EMU Metox/LIOH/Battery Replacement

☐ 24. Verify suit config for G using STS-132 NOMINAL EMU SIZING in section 12

EMU SWAP FOR EVA 3 (30 min)

NOTE

This procedure assumes the following procedures have been completed following EVA 2:
{1.240 POST EVA} (SODF: ISS EVA SYS: EVA PREP/POST)
{1.605 BSA BATTERY RECHARGE - term} (SODF: ISS EVA SYS: BATTERY OPS)
{1.605 BSA BATTERY RECHARGE - init} (SODF: ISS EVA SYS: BATTERY OPS)

Both EMUs ☐ 1. Connect:
- ☐ Boots to LTA
- ☐ LTA to HUT

EMU 3004 (BW) ☐ 2. Remove STS-132 Cuff C/L flight specific pages and stow ISS EVA Cuff C/L in Done Bag

☐ 3. Connect gloves to lower arms

☐ 4. Remove, temp stow:
- ☐ Remove Helmet Lights and EMU TV
- ☐ MWS

☐ 5. Remove helmet

☐ 6. Disconnect Comm Cap (BW1), stow in BW ECOK
√DIDB restraint bag in correct position

☐ 7. Install helmet; sun visors down, cover installed

☐ 8. Remove REBA from PLSS, stow in M-02 Bag (s/n 1038)

☐ 9. Verify LiOH installed and EMU battery for return per STS-132 CONSUMABLES TRACKING CUE CARD

☐ 10. Gather EV1 (BW) EMU crew-specific items and place in BW ECOK
Transfer ECOK to C Bag

A/L1AO ☐ 11. Remove from EMU Equipment Bag the Shuttle Crew Specific Compartment (left side of bag) and stow in EVA Sys Xfer Bag

EMU 3004 (BW) ☐ 12. Remove EMU from aft EDDA; transfer to Node 1

EMU 3009 (G) ☐ 13. Transfer EMU from fwd to aft EDDA

EMU 3018 (RM) ☐ 14. Transfer EMU and RM ECOK to E-Lk; install EMU on fwd EDDA

☐ 15. Install Helmet Lights and EMU TV
Perform pull test to verify all latches fully seated
√Sun visors down, cover installed

☐ 16. √Wrist Mirrors (two) installed

☐ 17. Install MWS

RM ECOK ☐ 18. Unstow ISS Crew Specific Compartment from RM ECOK and install on EMU Equipment Bag

Both EMUs ☐ 19. Install for EVA 3:
- ☐ Helmet Light Batteries from STS-132 Battery Bag per STS-132 CONSUMABLES TRACKING CUE CARD

EVA PREP FOR TRANSFER TO SHUTTLE (90 min)

EMU PRE-PACK

Both EMUs

☐ 1. Connect LTA to HUT

☐ 2. Remove helmet

☐ 3. Remove Comm Caps, stow in respective ECOKs
√DIDB restraint bags in correct position

☐ 4. Install helmet, sun visors down
For EMU 3018 (RM) only, remove Helmet Lights and EMU TV, temp stow
Install helmet covers on both

☐ 5. Remove MWS and stow in airlock

☐ 6. Remove EMU Batteries and stow in Done Bag to stay on ISS

EMU 3018 (RM)

☐ 7. Verify LiOH installed and install EMU battery for return per STS-132 CONSUMABLES TRACKING CUE CARD

☐ 8. Remove REBA from PLSS and stow in M-02 Bag (s/n 1038)

EMU 3009 (G)

☐ 9. Remove used LiOH and tape ports with Kapton tape; stow in Xfer to Shuttle Bag
Install vent port plugs on EMU from EMU Equipment Bag

Both EMUs

☐ 10. Remove STS-132 Cuff C/L flight specific pages and stow ISS EVA Cuff C/L in Done Bag

☐ 11. Gather EMU crew-specific items and place in respective ECOKs

EMU 3009 (G)

☐ 12. Remove and stow in G ECOK:
- ☐ STS-132 mission patch
- ☐ American flag
- ☐ Crew identifier stripes (EV4)
- ☐ EMU gloves (G1) – install lower arm covers (4) from G ECOK on gloves and suit arms

EMU 3018 (RM)

☐ 13. Connect gloves to lower arms

☐ 14. Remove EMU Boots (s/n 233) from EMU 3018 (RM) LTA; temp stow

☐ 15. Retrieve EMU Boots (s/n 221) from 132 EVA Stuff Bag and install; temp stow covers
Take Lock 1 → LOCK; √All locks (three per boot) are engaged

☐ 16. Install covers on EMU Boots (s/n 233), stow boots in M-02 bag (s/n 1010)

☐ 17. Verify suit config for RM Down Config using STS-132 NOMINAL EMU SIZING in section 12

EVA PREP FOR TRANSFER TO SHUTTLE (90 min) (Cont)

Both EMUs ☐ 18. √PWR – SCU
√PURGE vlv – op (up)
√O2 ACT – OFF
√WATER – OFF, switch guard installed

EVA Sys Xfer Bag ☐ 19. Swap EMU Servicing Kits:
☐ EMU Servicing Kit (s/n 5004) – Stays on ISS
☐ EMU Servicing Kit (s/n 5002) – Transfer to STS

EMU 3004 (BW) ☐ 20. √PWR – SCU
√PURGE vlv – op (up)
√O2 ACT – OFF
√WATER – OFF, switch guard installed

☐ 21. Verify/configure all items for transfer per table:

Verify items on EMU 3004 (BW)	**Verify items on EMU 3018 (RM)**
☐ Helmet (√sun visors down, cover installed) ☐ Valsalva ☐ Fresnel Lens ☐☐ EMU Gloves (BW1) ☐☐ Adjustable Equipment Tether (2) ☐☐ Wrist Mirror ☐ Waist tether (1) ☐ EMU Battery (s/n _____) ☐ LiOH (used) ☐ LTA	☐ Helmet (√sun visors down, cover installed) ☐ Valsalva ☐☐ EMU Gloves (RM1) ☐☐ Wrist Mirror ☐☐ Waist tether (2) ☐ EMU Battery (s/n 2085) ☐ LiOH (used) ☐ LTA
Verify items below in BW ECOK: ☐☐ BW EVA 1 & 2 ziplocks (each bag): ☐ TCUs (top & bottom) ☐ Spectra comfort gloves ☐ Tube socks ☐ Wristlets ☐ Croakie (1) EVA 2 bag also includes: ☐ Crew identifier stripes (EV1) ☐ STS-132 mission patch ☐ American flag ☐ LCVG (BW1) ☐ Comm Cap (BW1) ☐ Comm Cap (BW2)	**Verify items below in RM ECOK:** ☐☐ RM EVA 1 & 3 ziplocks (each bag): ☐ TCUs (top & bottom) ☐ Custom comfort gloves ☐ Thermal poly liners socks EVA 3 bag also includes: ☐ Crew identifier stripes (EV2) ☐ STS-132 mission patch ☐ American flag ☐ 1/8-in Heel Pad ☐ LCVG (RM1) ☐ Comm Cap (RM1) ☐ Comm Cap (RM2) ☐ Spare Mesh Bag (empty)

EVA PREP FOR TRANSFER TO SHUTTLE (90 min) (Cont)

Verify items below in G ECOK: ☐☐ G EVA 2 & 3 bag includes (each bag): ☐ TCUs (top & bottom) ☐ Spectra comfort gloves ☐ Thermal poly liners socks ☐ Croakie (1) ☐ Crew identifier stripes (EV4) ☐ STS-132 mission patch ☐ American flag ☐ LCVG (G1) ☐ Comm Cap (G1) ☐ Comm Cap (G2) ☐☐ EMU Gloves (G1) (with covers installed)	**Verify items below in Xfer to Shuttle Bag:** ☐☐☐☐ LiOH (4) (used) ☐☐ Old ISS MWS (2) (baseplate [-303], t-bar) **Gather and stow items below in Xfer to Shuttle Bag:** ☐ 85-ft Safety Tether (#25) ☐ 85-ft Safety Tether (#27) ☐ Old ISS EVA Systems Checklist (ISS copy, no stripe) ☐ STS-132 CONSUMABLES TRACKING CUE CARD ☐ STS-132 EVA BATTERY RECHARGE PLAN CUE CARD ☐ EMERGENCY UNDOCKING/EXPEDITED SUIT DOFFING CUE CARD ☐ 10.102 Joint Emergency Egress CC ☐ ISS EVA Systems Checklist (STS-132 copy with Red stripe) ☐ FDF STS-132 EVA CHECKLIST
Verify items below in EVA Systems Xfer Bag: ☐ EMU Servicing Kit (s/n 5002) ☐ SAFER Hardmount (s/n 04) ☐ EMU Battery (s/n 2078) ☐ EVA Helmet Light Assembly (s/n 1003) ☐ EVA Helmet Light Assembly (s/n 1005) ☐ Shuttle Shared Crew Compartment ☐ Ziplock with crew specific luggage tags	**Verify items below in C Bag:** ☐ EOTP Input Drive Bracket ☐☐ 7/16-in 2-in ext sockets (2) ☐ EOTP Contingency Socket ☐ MWS Key Strap Assembly

Shuttle Locker MF57G

☐ 22. Retrieve new ISS EVA Systems Checklist (no stripe) and stow in ISS A/L

EVA TRANSFER TO SHUTTLE (30 min)

NOTE

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

1. Transfer following EVA equipment to shuttle:

Item	**Destination**	**Transfer Status**
EMU 3004 (BW)	Temp stow in Middeck	
EMU 3018 (RM)	Temp stow in Middeck	
ECOK (BW)	Temp stow in Middeck	
ECOK (RM)	Temp stow in Middeck	
ECOK (G)	Temp stow in Middeck	
EVA Sys Xfer Bag	Temp stow in Middeck	
Xfer to Shuttle Bag	Temp stow in Middeck	
C Bag	Temp stow in Middeck	

2. Report transfer status to **MCC-H**

EVA UNPACK AND STOW (60 min)

NOTE

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

All ECOKs 1. Stow crew specific tags on drawstring inside ECOKs

2. Remove Comm Caps (6) from ECOKs; temp stow

3. Retrieve from RM & BW ECOKs the back-up set of patches/stripes. Remove from G ECOK both prime and back-up sets of patches/stripes. Stow all in Return to Houston bag. Each set contains:
   - ☐☐☐☐ EV stripes (4)
   - ☐ STS-132 mission patch
   - ☐ American flag

G ECOK 4. Remove EMU Gloves (G1); temp stow

Both EMUs 5. Remove prime EMU Gloves; temp stow

6. Remove from both EMUs the prime set of patches/stripes and stow in Return to Houston bag. Each set contains:
   - ☐☐☐☐ EV stripes (4)
   - ☐ STS-132 mission patch
   - ☐ American flag

Bag E 7. Gather backup EMU Gloves (BW2) & EMU Gloves (RM2); remove covers

8. Install covers onto prime gloves; stow prime gloves (4) in Bag E

9. Remove contingency LiOH canisters (4) and temp stow

Both EMUs 10. Install backup EMU gloves

11. Unpack and stow items per table below
    Report status to **MCC-H** when complete:

Current Location	Item	Final Stowage Location	Status
Middeck	ECOK (BW)	EMU 3004 (BW)	
	ECOK (RM)	EMU 3018 (RM)	
	EMU 3004 (BW)	External A/L (Stbd AAP), bundle with LTA Restraint Bag	
	EMU 3018 (RM)	External A/L (Port AAP), bundle with LTA Restraint Bag	
	Comm Cap (BW1)	EMU 3004 LTA Restraint Bag	
	Comm Cap (BW2)		
	Comm Cap (RM1)	EMU 3018 LTA Restraint Bag	
	Comm Cap (G1)		
	ECOK (G)	Bag _____	
	Comm Caps (G2)	Bag _____	
	Comm Caps (RM2)	Bag _____	
	Gloves (G1)	Bag _____	
	Contingency LiOH canisters (4)	External A/L Floor Bag	
Xfer to Shuttle Bag	Old ISS EVA Systems Checklist (ISS copy, no stripe)	Locker MF57G	
	STS-132 CONSUMABLES TRACKING CUE CARD		
	STS-132 BATTERY RECHARGE PLAN CUE CARD		

EVA UNPACK AND STOW (60 min) (Cont)

Current Location	Item	Final Stowage Location	Status
Xfer to Shuttle Bag (Cont)	EMERGENCY UNDOCKING/ EXPEDITED SUIT DOFFING CUE CARD	Locker MF57G	
	10.102 Joint Emergency Egress CC		
	ISS EVA Systems Checklist (STS-132 copy with Red stripe)		
	FDF STS-132 EVA CHECKLIST		
	LiOH (1) (used)	Bag B	
	Old ISS MWS (2) (baseplate [-303], t-bar)	Bag C	
	LiOH (3) (used)		
	85-ft Safety Tether (#25)	External A/L Floor Bag	
	85-ft Safety Tether (#27)		
	Empty Xfer to Shuttle Bag	Bag C	
EVA Sys Xfer Bag	'EVA Transfer' ziplock (empty)	Locker MF57G	
	EMU Servicing Kit (s/n 5002)	Vol H Inboard	
	EVA Helmet Light Assembly (s/n 1003)		
	EVA Helmet Light Assembly (s/n 1005)	Vol H Outboard	
	Shuttle Crew Specific Compartment (1)		
	SAFER Hardmount (s/n 04)	External A/L Floor Bag	
	EMU Battery (s/n 2078)		
	Empty EVA Sys Xfer Bag	Bag C	

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CHECKOUTS

EMU CHECKOUT ..... TEMP FS 3-2
SAFER CHECKOUT ..... FS 3-13
SELF TEST SEQUENCE ..... FS 3-14
SAFER CHECKOUT RESULTS ..... FS CC 3-16
SAFER STATUS TROUBLESHOOTING ..... FS CC 3-17
REBA POWERED HARDWARE CHECKOUT ..... FS 3-18

NOTE

Procedure is written for simultaneous C/O of two EMUs. Start checkout with two EMUs in A/L, then swap out EMU 3011 with the Middeck stowed EMU 3018 and continue checkout of third suit

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

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
PWR/BATT CHGR EMU 1,2 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
AUD CTR UHF A/A – T/R
R14:C ☐ 11. √cb MNA UHF EVA – cl
√cb MNC UHF EVA – cl
R10 ☐ 12. BIOMED CH 1– EVA 1
BIOMED CH 2 – EVA 2

EMU CHECKOUT (Cont)

MDDK or CDR ATU ☐ 13. √AUD PWR – AUD/TONE
AUD A/G 1,2 (two) – OFF
AUD A/A – T/R
AUD ICOM A,B (two) – OFF (as reqd)

O6 ☐ 14. UHF SPLX/EVA PWR AMP – OFF
√UHF MODE sel – EVA

BOTH ☐☐ 15. √Helmets disconnected
☐☐ 16. Don comm caps

NOTE
After the next step, be prepared to verify no missing segments on display and that all tones are audible

☐☐ 17. PWR – SCU
☐☐ 18. 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**

☐ 19. Perform onboard A/A comm check per table (shaded boxes are actions):

EMUs		IV O6:	
MODE	FREQ	EVA STRING	UHF SPLX/EVA XMIT FREQ
ALT	LOW	2	259.7/414.2
ALT	HIGH	2	296.8/417.1
PRI	HIGH	1	296.8/417.1
PRI	LOW	1	259.7/414.2

IV MDDK or CDR ATU ☐ 20. AUD A/G 1(2) – T/R

A1R ☐ 21. AUD CTR UHF A/G 1(2) – T/R
√AUD CTR UHF A/G 2(1) – OFF
AUD CTR UHF A/A – OFF

BOTH ☐☐ 22. Verify RF comm with **MCC-H**

IV A1R ☐ 23. AUD CTR UHF A/G 1(2) – OFF

☐☐ 24. Doff comm caps

BOTH ☐☐ 25. Stow comm cap in suit arm

DCM ☐☐ 26. DISP – STATUS, until DATA?COMBO displayed
DISP – YES (hold for 2 sec)
DISP – STATUS, until DATA EMU? displayed
DISP – YES (hold for 2 sec)
Verify DATA?EMU displayed

PRIMARY REGULATOR/FAN/PUMP CHECK (40 min)

MD(flr) ☐ 27. EMU O2 ISOL VLV – OP

DCM ☐☐ 28. √STATUS: O2 P = 850-950

EMU	1	2	3	4
28. O2 P				

EMU CHECKOUT (Cont)

AW82B ☐☐ 29. EV-1,EV-2 O2 vlv (two) – OP
☐☐ 30. Install helmet, lock
☐☐ 31. √Suit arms aligned
☐☐ 32. √Gloves locked
☐☐ 33. √Helmet purge vlv – cl, locked
DCM ☐☐ 34. PURGE vlv – cl (dn)
☐☐ 35. O2 ACT – IV
☐☐ 36. √STATUS: SUIT P = 0.4-1.4 and stable (compare w/gauge)

EMU	1	2	3	4
36. SUIT P (IV)				

☐☐ 37. O2 ACT – PRESS
☐☐ 38. √STATUS: SUIT P = 4.2-4.4 and stable (compare w/gauge)
STATUS: H2O TEMP = ambient
STATUS: H2O GP = 14.0-16.0
STATUS: H2O WP = 14.0-16.0

EMU	1	2	3	4
38. SUIT P (PRESS)				
H2O TEMP				
H2O GP				
H2O WP				

☐☐ 39. DISP – STATUS, until LEAK CHECK? displayed
DISP – YES (hold for 2 sec)
Follow displayed instructions

EMU	1	2	3	4
39. ΔP				

* If LEAKAGE HI/ SUIT P msg occurs (ΔP > 0.3 psi), *
* go to FAILED LEAK CHECK (14.7/10.2 PSI) *
* Cue Card, CC 6-4 *

☐☐ 40. O2 ACT – OFF
DCM ☐☐ 41. PURGE vlv – op (up)
☐☐ 42. √STATUS: SUIT P < 0.4 (compare w/gauge)
☐☐ 43. Disconnect glove
☐☐ 44. Reconnect glove
☐☐ 45. Disconnect helmet, temp stow
☐☐ 46. Disconnect waist ring – secure LTA to outer hatch handrail
☐☐ 47. Remove Multiple Water Connector cover, temp stow
☐☐ 48. Connect LCVG, √locked
DCM ☐☐ 49. √Temp control vlv – Max C

CAUTION
Minimize fan operation with O2 ACT – OFF (~2 min)

☐☐ 50. FAN – ON (PWR RESTART may occur)
Verify flow at neck ring vent port

EMU CHECKOUT (Cont)

AW18H ☐☐ 51. √EMU INPUT amps = 1.5-5.0 (1.5-4.7 at 10.2)

EMU	1	2	3	4
51. INPUT AMPS				

☐☐ 52. Install SCOF, lock

DCM ☐☐ 53. O2 ACT – IV, NO VENT FLOW msg, DISP – PRO
√Cooling flow in LCVG

☐☐ 54. √STATUS: H2O TEMP decrease from step 38

EMU	1	2	3	4
54. H2O TEMP				

* If no temp decrease, depress and hold pump priming *
* valve on back of EMU, while slowly cycling TCV *
* between 7 and Max C (30 sec minimum) *

AW18H ☐☐ 55. √EMU INPUT amps = 1.5-4.0 (1.5-3.6 at 10.2)
√EMU INPUT amps decrease from step 51

EMU	1	2	3	4
55. INPUT AMPS				

DCM ☐☐ 56. PWR – BATT, NO VENT FLOW message, DISP – PRO
☐☐ 57. √STATUS: BAT VDC ≥ 16.5
STATUS: BAT AMPS = 2.4-4.0 (2.3-3.7 at 10.2)
STATUS: RPM = 18.0-20.0 K

EMU	1	2	3	4
57. BAT VDC				
BAT AMPS				
RPM				

☐☐ 58. √Fan noise steady
☐☐ 59. O2 ACT – OFF
☐☐ 60. FAN – OFF
☐☐ 61. PWR – SCU

<u>SOP CHECK</u> (5 min)
☐☐ 62. Perform step 26 to reset data to EMU mode

DCM ☐☐ 63. √STATUS: SOP P = 5410-6800

EMU	1	2	3	4
63. SOP P				

SOP ☐☐ 64. √SOP gauge 5400-6800, note SOP interstage gauge

EMU	1	2	3	4
64. SOP GAUGE				
INT GAUGE				

EMU CHECKOUT (Cont)

DCM ☐☐ 65. DISP – STATUS until SUIT P displayed
DISP – YES (hold for 2 sec) to lock parameter

☐☐ 66. Depress SOP manual override (50 sec max):
√SOP interstage gauge < 600
DCM √STATUS: SUIT P = 3.4-3.9

EMU	1	2	3	4
66. SUIT P				
INT GAUGE				

☐☐ 67. √STATUS: SOP P = 5410-6800

EMU	1	2	3	4
67. SOP P				

☐☐ 68. Remove SCOF (2), temp stow
☐☐ 69. Disconnect LCVG
Stow BW1 LCVG in BW ECOK
Temp stow RM1 LCVG
☐☐ 70. Install Multiple Water Connector cover
EMU 3011 (Spare) ☐ 71. Disconnect comm cap labeled 'G1'; stow in EVA Sys Xfer Bag
☐ 72. Install helmet, lock
Both DCM ☐☐ 73. COMM mode – OFF
☐☐ 74. √Thermal cover clear of waist ring
☐☐ 75. Waist ring – engage position
EMU 3004 (BW) ☐ 76. Connect BW LTA to HUT, lock

POWER DOWN EMU
AW18H ☐☐ 77. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
PWR/BATT CH MODE (two) – OFF

EMU SWAP DURING CHECKOUT (30 min)
EMU 3011 (Spare) ☐ 78. Remove SCU, install DCM cover
☐ 79. Stow SCU on AAP, Velcro to wall
☐ 80. Remove upper half of EMU 3011(Spare) from Port AAP
Remove EMU Battery (s/n 2085) and temp stow
Check LiOH s/n and record (report at end of procedure)
s/n _____ in EMU 3011 (Spare)
Xfer upper half of EMU 3011 (Spare) to Middeck; temp stow
Middeck/LTA Restraint Bag ☐ 81. Unstow comm cap labeled 'G2' from kangaroo pouch; stow in EVA Sys Xfer Bag
☐ 82. Remove LTA Restraint Bag and temp stow
EMU 3018 (RM) ☐ 83. Disconnect waist ring, temp stow LTA labeled 'MM' (s/n 053) with no boots
☐ 84. Remove G ECOK (mesh bag) and G LCVG
☐ 85. Stow G LCVG inside G ECOK; temp stow G ECOK
☐ 86. √Thermal cover clear of waist ring
☐ 87. Waist ring – engage position
Middeck ☐ 88. Connect LTA labeled 'MM' (s/n 053) with no boots from Middeck onto upper half of EMU 3011 (Spare), lock

☐ 89. Remove from EMU 3011 and stow:
☐ Crew identifier labeled 'MM' from LTA
☐☐☐☐ EV3 stripes from PLSS/legs

EVA Sys Xfer Bag ☐ 90. Retrieve EMU Lower Arm Covers (4) and EVA Helmet Light Assembly (s/n 1008); temp stow

EMU 3011 (Spare) ☐ 91. Remove EMU Gloves (G1) and install Lower Arm Covers (2) on gloves and install Lower Arm Covers (2) on EMU
Stow EMU Gloves (G1) in G ECOK

☐ 92. Attach LTA Restraint Bag (from Middeck AAP) to LTA Restraint strap and bundle EMU (reference LTA Restraint Strap Installation, TEMP FS 2-6); stow EMU in Middeck

EMU 3018 (RM) ☐ 93. Install EVA Helmet Light Assembly (s/n 1008) on RM Helmet
Perform pull test to verify all latches fully seated

☐ 94. Remove upper half of EMU 3018 (RM) from Middeck AAP

☐ 95. Check LiOH s/n and record (report at end of procedure)
s/n _____ in EMU 3018 (RM)

☐ 96. Install temp stowed EMU Battery (s/n 2085)

☐ 97. Retrieve REBA battery from C Bag; install on EMU 3018 (RM)

☐ 98. Xfer upper half EMU 3018 (RM) into A/L; install on Port AAP

☐ 99. Disconnect helmet; temp stow

☐ 100. √DIDB restraint bag in correct position

☐ 101. Retrieve temp stowed comm cap labeled 'RM1'; connect to electrical harness on suit

NOTE
O2 vlv for SCU connected to EMU 3018 must be closed prior to checkout of EMU

AW82B ☐ 102. EV-2 O2 vlv (one) – CL

EMU POWERUP AND COMM CHECK (15 min)

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

EMU 3018 (RM) ☐ 103. Retrieve, position SCU; remove DCM cover

☐ 104. Connect SCU to DCM, √locked

BOTH DCM ☐☐ 105. PWR – BATT

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

AW18H ☐☐ 106. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
PWR/BATT CHGR EMU 1,2 BUS SEL (two) – MNA(MNB)

☐☐ 107. √EMU INPUT 1,2 volts = 18.0-20.0

EV AW18D ☐ 108. √AIRLK AUD PWR – OFF

BOTH DCM ☐☐ 109. COMM mode – ALT

EMU CHECKOUT (Cont)

☐☐110. √Comm FREQ – LOW
BOTH ☐☐111. √Helmets disconnected
☐☐112. Don comm caps

NOTE
After the next step, be prepared to verify no missing segments on display and that all tones are audible

☐☐113. PWR – SCU
☐☐114. 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**

BOTH ☐115. Perform onboard A/A comm check per table (shaded boxes are actions):

EMUs	
MODE	FREQ
ALT	LOW
ALT	HIGH
PRI	HIGH
PRI	LOW

EMU 3004 (BW) ☐116. Doff comm cap
☐117. Stow comm cap labeled 'BW1' in suit arm
☐118. Comm Mode → OFF
☐119. Install helmet, lock
AW18H ☐120. PWR/BATT CHGR EMU 1 BUS SEL – OFF
PWR/BATT CHGR EMU 1 MODE – OFF
IV A1R ☐121. AUD CTR UHF A/G 1(2) – T/R
√AUD CTR UHF A/G 2(1) – OFF
AUD CTR UHF A/A – OFF
EMU 3018 (RM) ☐122. Verify RF comm with **MCC-H**
IV A1R ☐123. AUD CTR UHF A/G 1(2) – OFF
EMU 3018 (RM) ☐124. Doff comm cap
☐125. Stow comm cap labeled 'RM1' in suit arm
☐126. √Thermal cover clear of waist ring
☐127. Waist ring – engage position
☐128. Connect LTA labeled 'RM1' to EMU 3018 (RM)
DCM ☐129. Perform step 26 to reset data to EMU mode

PRIMARY REGULATOR/FAN/PUMP CHECK (40 min)

NOTE
The rest of the checkout steps are for EMU 3018 (RM) only

DCM ☐130. √STATUS: O2 P = 850-950

EMU	1	2	3	4
130. O2 P				

AW82B ☐131. EV-2 O2 vlv (one) – OP
☐132. Install helmet, lock
☐133. √Suit arms aligned

EMU CHECKOUT (Cont)

☐ 134. √Gloves locked
☐ 135. √Helmet purge vlv – cl, locked
DCM ☐ 136. PURGE vlv – cl (dn)
☐ 137. O2 ACT – IV
☐ 138. √STATUS: SUIT P = 0.4-1.4 and stable (compare w/gauge)

EMU	1	2	3	4
138. SUIT P (IV)				

☐ 139. O2 ACT – PRESS
☐ 140. √STATUS: SUIT P = 4.2-4.4 and stable (compare w/gauge)
STATUS: H2O TEMP = ambient
STATUS: H2O GP = 14.0-16.0
STATUS: H2O WP = 14.0-16.0

EMU	1	2	3	4
140. SUIT P (PRESS)				
H2O TEMP				
H2O GP				
H2O WP				

☐ 141. DISP – STATUS, until LEAK CHECK? displayed
DISP – YES (hold for 2 sec)
Follow displayed instructions

EMU	1	2	3	4
141. ΔP				

* If LEAKAGE HI/ SUIT P msg occurs (ΔP > 0.3 psi), *
* go to FAILED LEAK CHECK (14.7/10.2 PSI) *
* Cue Card, CC 6-4 *

☐ 142. O2 ACT – OFF
DCM ☐ 143. PURGE vlv – op (up)
☐ 144. √STATUS: SUIT P < 0.4 (compare w/gauge)
☐ 145. Disconnect glove
☐ 146. Reconnect glove
☐ 147. Disconnect helmet, temp stow
☐ 148. Disconnect waist ring – secure LTA to outer hatch handrail
☐ 149. Remove Multiple Water Connector cover, temp stow
☐ 150. Connect temp stowed RM1 LCVG, √locked
DCM ☐ 151. √Temp control vlv – Max C

CAUTION
Minimize fan operation with O2 ACT – OFF (~2 min)

☐ 152. FAN – ON (PWR RESTART may occur)
Verify flow at neck ring vent port
AW18H ☐ 153. √EMU INPUT amps = 1.5-5.0 (1.5-4.7 at 10.2)

EMU	1	2	3	4
153. INPUT AMPS				

EMU CHECKOUT (Cont)

☐ 154. Install SCOF, lock

DCM ☐ 155. O2 ACT – IV, NO VENT FLOW msg, DISP – PRO
√Cooling flow in LCVG

☐ 156. √STATUS: H2O TEMP decrease from step 140

EMU	1	2	3	4
156. H2O TEMP				

* If no temp decrease, depress and hold pump priming *
* valve on back of EMU, while slowly cycling TCV *
* between 7 and Max C (30 sec minimum) *

AW18H ☐ 157. √EMU INPUT amps = 1.5-4.0 (1.5-3.6 at 10.2)
√EMU INPUT amps decrease from step 153

EMU	1	2	3	4
157. INPUT AMPS				

DCM ☐ 158. PWR – BATT, NO VENT FLOW message, DISP – PRO

☐ 159. √STATUS: BAT VDC ≥ 16.5
STATUS: BAT AMPS = 2.4-4.0 (2.3-3.7 at 10.2)
STATUS: RPM = 18.0-20.0 K

EMU	1	2	3	4
159. BAT VDC				
BAT AMPS				
RPM				

☐ 160. √Fan noise steady
☐ 161. O2 ACT – OFF
☐ 162. FAN – OFF
☐ 163. PWR – SCU

<u>SOP CHECK</u> (5 min)

☐ 164. Perform step 26 to reset data to EMU mode

DCM ☐ 165. √STATUS: SOP P = 5410-6800

EMU	1	2	3	4
165. SOP P				

SOP ☐ 166. √SOP gauge 5400-6800, note SOP interstage gauge

EMU	1	2	3	4
166. SOP GAUGE				
INT GAUGE				

DCM ☐ 167. DISP – STATUS until SUIT P displayed
DISP – YES (hold for 2 sec) to lock parameter

EMU CHECKOUT (Cont)

☐168. Depress SOP manual override (50 sec max):
√SOP interstage gauge < 600
DCM √STATUS: SUIT P = 3.4-3.9

EMU	1	2	3	4
168. SUIT P				
INT GAUGE				

☐169. √STATUS: SOP P = 5410-6800

EMU	1	2	3	4
169. SOP P				

☐170. Remove SCOF, temp stow
☐171. Disconnect RM1 LCVG, stow in RM ECOK
☐172. Install Multiple Water Connector cover
☐173. Install helmet, lock
☐174. √Thermal cover clear of waist ring
☐175. Waist ring – engage position
☐176. Connect LTA labeled 'RM1' to EMU 3018 (RM)
☐177. COMM mode – OFF
☐178. Stow in Vol H Inboard Bag:
☐☐ SCOFs (2)
☐☐ LTA Donning Handles (2)

BATTERY CHARGE CHECK INIT (15 min)
AW18H ☐179. PWR/BATT CHGR EMU 1, 2 BUS SEL (two) – OFF
PWR/BATT CHGR EMU 1, 2 MODE (two) – CHARGE
PWR/BATT CHGR EMU 1, 2 BUS SEL (two) – MNA(MNB)

☐180. Continue charge 15 min, minimum

BATTERY CHARGE CHECK TERM
When PWR/BATT CHGR EMU INPUT AMPS < 1 and 15 min minimum charge complete:
☐181. PWR/BATT CHGR EMU 1, 2 BUS SEL (two) – OFF
PWR/BATT CHGR EMU 1, 2 MODE (two) – OFF

EMU 3004 (BW) ☐182. Check LiOH s/n and record (report at end of procedure)
s/n _____ in EMU 3004 (BW)

☐183. Check EMU Battery (s/n 2078) installed for EVA 1

POST EMU C/O RECONFIG (5 min)
When EMU C/O for all EMUs complete:
IV O6 ☐184. UHF MODE sel – OFF
√UHF SPLX/EVA XMIT FREQ – 259.7/414.2
√UHF SPLX/EVA XMIT PWR AMP – OFF
√UHF SPLX SQUELCH – ON
R10 ☐☐185. √BIOMED CH 1 – EVA 1
√BIOMED CH 2 – EVA 2
AW82B ☐☐186. EV-1,EV-2 O2 vlv (two) – CL
BOTH DCM ☐☐187. Remove SCUs, install DCM covers
☐☐188. Stow SCU on AAP, Velcro to wall

EMU CHECKOUT (Cont)

EMU 3004 (BW)/
EMU 3018 (RM)

☐☐189. Verify suit config for BW and RM using STS-132 NOMINAL EMU SIZING in section 12

IV ML86B:C

☐☐190. cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – cl
(heaters will be deactivated on MCC call)

☐191. Contact **MCC-H** with LiOH s/ns from steps 80, 95 and 182

X: SM 60 SM TABLE MAINT

☐192. Contact **MCC-H** 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	145
EXT A/L LCG 2 SPLY ZN 1 T	0640182	49	145
EXT A/L H2O LINE T 2			
EXT A/L H2O SPLY ZN 2 T	0640184	48	145
EXT A/L LCG 2 SPLY ZN 2 T	0640185	45	145
EXT A/L O2 LN T			OSH
EXT A/L O2 SPLY ZN 2 T	0640186	OSL	

SAFER CHECKOUT (30 min if first checkout of SAFER unit,
20 min for subsequent checks)

NOTE
Procedures written for simultaneous C/O of two SAFERs

BOTH 1. Remove SAFER and SAFER CHECKOUT RESULTS Cue Card from Stowage Bag/FDF Locker

PM 2. √Inhibitor installed, properly engaged

If first SAFER CHECKOUT:

HCM 3. Remove power switch guard, stow in foam cutout

4. Stow HCM, refer to figure 1 for cable routing

5. Remove stowage straps from thruster towers, unfold towers

6. Remove SAFER latch guards from latches (leave lanyard straps attached to towers)

7. Inspect:
   - Thruster tower hinges
   - Tower latches
   - √TMG not blocking thrusters
   - √SAFER latch guard lanyard strap attached to SAFER towers above tower hinges

8. Peel back SAFER tower TMG on both towers and install SAFER latch guards over SAFER latches
   - √Latch guard lanyards routed under tower TMG
   - Re-attach tower TMG to secure latch guards in place

9. Fold thruster towers

10. Install stowage straps

PM 11. MAN ISOL vlv – OP (dn)

12. Deploy HCM; √proper deployment

CAUTION
Minimize time with SAFER powered (~1 min)

NOTE
Have SAFER CHECKOUT RESULTS Cue Card w/proper serial number ready to record status.

From power on to entry into Test Mode, the SAFER will be in Automatic Attitude Hold (AAH) (Green LED on). Try to hold SAFER steady against a wall. Changes in SAFER attitude may result in AAH-induced thruster firings

13. As reqd, review SELF TEST SEQUENCE (refer to box next page)

14. Perform Self Test:
    - Start timer

HCM
- PWR – TST/ON
- Wait until GN2 XX% PWR XX% displayed
- √AAH LED (green) on
- PWR – ON

Cont next page

NOTE

Be prepared to count thruster clicks (24) after PWR – TST/ON

PWR – TST/ON

Follow displayed instructions on HCM:

√ SELF TEST – WAIT displayed; if able, count thruster clicks (twenty four)

```
*  If NSI CIRCUIT OPEN or FAIL: ... msg  *
*  | displayed or non-responsive display:  *
*  |    Note failure msg                   *
*  |    Press DISP sw to resume test       *
*  If HC TO DETENT msg displayed:          *
*       Note msg                           *
*     √HC grip springs to center position  *
```

When RATE CHECK displayed, rotate SAFER at least + and - 3 deg/sec sequentially in each rotational axis

15. √ GO FOR EVA or FAILED TEST displayed
16. PWR – ON
17. DISP: Record GN2%, PWR%, BATT V (SAFER CHECKOUT RESULTS Cue Card)
18. PWR – OFF
19. Stop timer, record 'ON Time' (~1 min desired)
20. √GN2% ≥ 87
    √PWR% ≥ 45
    √BATT V ≥ 35
21. Report GN2%, PWR%, BATT V, and SAFER serial number to **MCC-H**

HCM 22. MODE – ROT

CAUTION

Do not stow HCM to be used for EVA with power switch guard installed (leave in foam cutout)

NOTE

When stowing HCM, verify that umbilical will not snag during deployment, refer to figure 1

23. Stow HCM
24. Stow SAFER and Cue Card in Stowage Bag
25. √Inhibitor installed
26. MAN ISOL vlv – CL (up)

SELF TEST SEQUENCE (for reference only; do not perform)

HCM

1. NSI circuit test
2. SELF TEST – WAIT; √Twenty-four thruster clicks and THR LED (red) flashing
3. DEPRESS AAH
4. MODE – ROT (if in TRAN)
   MODE – TRAN
5. HC grip detent test
6. HC +X (fwd), (-X, +Y (rt), -Y, +Z (dn), -Z, +P (twist up), -P)
7. RATE CHECK; rotate SAFER at least + and - 3 deg/sec sequentially in each rotational axis

Cont next page

Figure 1.- Front and top view of HCM cable routing.

TOP

HOOK VELCRO

HOOK VELCRO

SAFER CHECKOUT RESULTS

SAFER SERIAL #_____

	GMT	ON Time	GN2%	PWR%	BATT V		GMT	ON Time	GN2%	PWR%	BATT V
1						27					
2						28					
3						29					
4						30					
5						31					
6						32					
7						33					
8						34					
9						35					
10						36					
11						37					
12						38					
13						39					
14						40					
15						41					
16						42					
17						43					
18						44					
19						45					
20						46					
21						47					
22						48					
23						49					
24						50					
25						51					
26						52					

NOTE
SAFER battery expected to last for 52 1-min checkouts and have at least 45% PWR remaining

BATTERY CHANGEOUT

GMT	OLD BATT SERIAL #	NEW BATT SERIAL #

EVA-3a/O/C

(reduced copy)

TOP
(Back of 'SAFER CHECKOUT RESULTS')

HOOK VELCRO

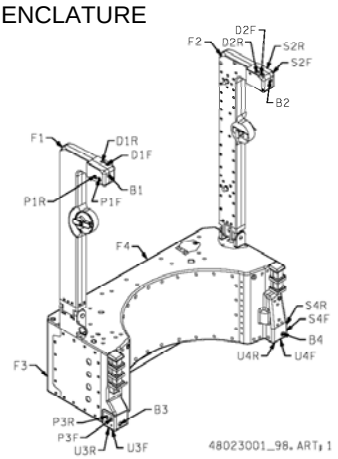
HOOK VELCRO

SAFER STATUS TROUBLESHOOTING

GMT					
Failure Message					NOMINAL STATUS
GN2%					87-99%
PWR%					45-99%
TANK P					> 6575 psia
TANK T					-40 to 140 degF
RATE R					± 30 deg/s
RATE P					± 30 deg/s
RATE Y					± 30 deg/s
DISPL R					± 99.9 deg
DISPL P					± 99.9 deg
DISPL Y					± 99.9 deg
BATT V					≥ 35.0 V
BATT T					50 to 90 degF
Leak					NO LEAK

GMT					
Failure Message					NOMINAL STATUS
GN2%					87-99%
PWR%					45-99%
TANK P					> 6575 psia
TANK T					-40 to 140 degF
RATE R					± 30 deg/s
RATE P					± 30 deg/s
RATE Y					± 30 deg/s
DISPL R					± 99.9 deg
DISPL P					± 99.9 deg
DISPL Y					± 99.9 deg
BATT V					≥ 35.0 V
BATT T					50 to 90 degF
Leak					NO LEAK

SAFER JET NOMENCLATURE



EVA-3b/O/D

(reduced copy)

REBA POWERED HARDWARE CHECKOUT (15 min)

NOTE

Procedure written for simultaneous C/O of 12 volt HDW on all EMUs

☐☐ 1. Perform REBA BATTERY INSTALL (EMU MAINT/RECHARGE), as reqd

All EMUs ☐☐ 2. √REBA sw (1 per EMU) – OFF (toward left arm of suit)

If EMU TV:

☐☐ 3. Install EMU TV on helmets 1,2; note camera addresses EV1 ___, EV2 ___ (see figure below)
Perform pull test to verify all latches fully seated

PLSS ☐☐ 4. Unstow EMU TV power cable, disconnect from ground plug

☐☐ 5. Mate EMU TV power cable to EMU TV

If no EMU TV:

PLSS ☐☐ 6. √EMU TV power cable mated to ground plug

☐☐ 7. √Upper arm connections mated

☐☐ 8. √Glove heater sw (one per glove) – OFF

☐☐ 9. Connect lower arm pwr harness to gloves

NOTE

To avoid excessive battery consumption
and heat buildup, deactivate heaters
once heat detected at fingertips

☐☐ 10. REBA sw (1 per EMU) – ON, pull tab toward right arm of suit

☐☐ 11. Glove heater sw (one per glove) – ON

When heat detected on all outside fingertips:

☐☐ 12. Glove heater sw (one per glove) – OFF

If EMU TV:

☐☐ 13. EMU TV power pb – press, √Green LED illuminated

☐☐ 14. EMU TV power pb – press, √Green LED not illuminated

☐☐ 15. REBA sw (1 per EMU) – OFF, pull tab toward left arm of suit

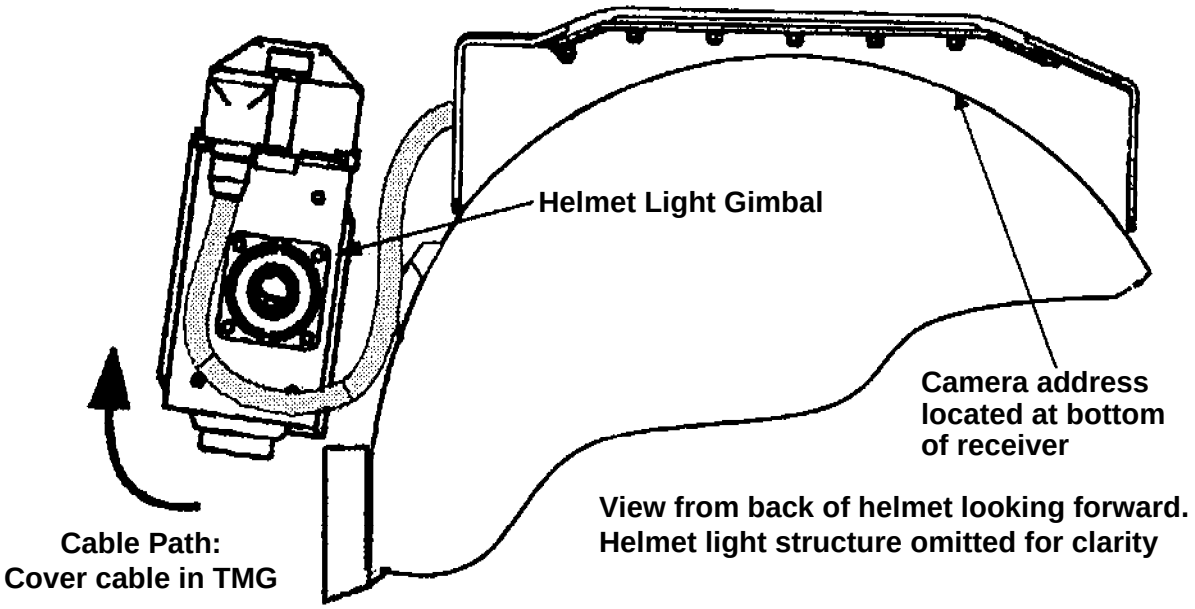
☐☐ 16. Disconnect lower arm pwr harness from gloves

☐☐ 17. Stow lower arm and glove pwr harness connectors under TMG

☐☐ 18. Disconnect EMU TV power cable from EMU TV

PLSS ☐☐ 19. Connect EMU TV power cable to ground plug

☐☐ 20. Attach LTA Restraint Bag, as reqd



STS-132 ULF4 EVA OVERVIEW TIMELINES ..... FS 7-2
EVA 1
EVA 1 SUMMARY TIMELINE ..... FS 7-3
EVA 1 INHIBIT PAD ..... FS 7-4
EVA 1 NOTES, CAUTIONS, WARNINGS ..... FS 7-6
EVA 1 TOOL CONFIGURATION ..... FS 7-9
EVA 1 EGRESS/SETUP ..... FS 7-12
EVA 1 PALLET PREP ..... FS 7-13
EVA 1 REDUNDANT SGANT INSTALL ..... FS 7-14
EVA 1 EOTP INSTALL ..... FS 7-18
EVA 1 SSRMS CLEANUP/BATTERY PREP ..... FS 7-21
EVA 1 CLEANUP/INGRESS ..... FS 7-22
EVA 2
EVA 2 SUMMARY TIMELINE ..... FS 7-27
EVA 2 INHIBIT PAD ..... FS 7-28
EVA 2 NOTES, CAUTIONS, WARNINGS ..... FS 7-30
EVA 2 TOOL CONFIGURATION ..... FS 7-32
EVA 2 EGRESS/SETUP ..... FS 7-35
EVA 2 WORKSITE PREP ..... FS 7-36
EVA 2 TEMP STOW BATTERY ..... FS 7-37
EVA 2 BATTERY A/2 R&R ..... FS 7-38
EVA 2 BATTERY B/3 R&R ..... FS 7-39
EVA 2 BATTERY C R&R ..... FS 7-40
EVA 2 INSTALL TEMP-STOWED BATTERY ON PALLET ..... FS 7-41
EVA 2 EVA 3 PREP/CLEANUP ..... FS 7-42
EVA 2 CLEANUP/INGRESS ..... FS 7-43
EVA 2 GET-AHEADS: BATTERY C/4 R&R ..... FS 7-52
EVA 2 GET-AHEADS: BATTERY D/5 R&R ..... FS 7-53
EVA 3
EVA 3 SUMMARY TIMELINE ..... FS 7-55
EVA 3 INHIBIT PAD ..... FS 7-56
EVA 3 NOTES, CAUTIONS, WARNINGS ..... FS 7-58
EVA 3 TOOL CONFIGURATION ..... FS 7-61
EVA 3 EGRESS/SETUP ..... FS 7-64
EVA 3 TEMP STOW BATTERY ..... FS 7-65
EVA 3 BATTERY D/5 R&R ..... FS 7-66
EVA 3 BATTERY E/6 R&R ..... FS 7-67
EVA 3 BATTERY F R&R ..... FS 7-68
EVA 3 INSTALL TEMP-STOWED BATTERY, P6 CLEANUP ..... FS 7-69
EVA 3 PDGF RETRIEVE GET-AHEAD ..... FS 7-70
EVA 3 CLEANUP/INGRESS ..... FS 7-71
GET-AHEADS
P4/P5 NH3 JUMPER INSTALL ..... FS 7-85
EVA 2 P3 CETA LIGHT INSTALL ..... FS 7-87

STS-132 ULF4 EVA OVERVIEW TIMELINES

EVA 1 — 00:00 01:00 02:00 03:00 04:00 05:00 06:00 6:30

EV1 (SSRMS) Reisman	Egress	Pallet Prep	SGANT Boom Install	SGANT Dish Install	EOTP Install		SSRMS Clean-up	Cleanup & Ingress
EV2 (FF) Bowen	Egress	Pallet Prep	SGANT Boom Install	SGANT Dish Install		EOTP Install	P6 Battery Prep	Cleanup & Ingress

EVA 2 — 00:00 01:00 02:00 03:00 04:00 05:00 06:00 6:30

EV1 (FF) Bowen	Egress	Setup	Worksite Prep	Battery Temp Stow	P6 Battery R&R (3)	Install Temp Stow Battery	EVA 3 Prep	Cleanup & Ingress
EV2 (FF) Good	Egress	Setup	Worksite Prep	Battery Temp Stow	P6 Battery R&R (3)	Install Temp Stow Battery	EVA 3 Prep	Cleanup & Ingress

EVA 3 — 00:00 01:00 02:00 03:00 04:00 05:00 06:00 6:30

EV1 (FF) Good	Egress	Setup	Battery Temp Stow	P6 Battery R&R (3)	Install Temp Stow Battery	P6 Clean-up	P6 Clean-up	Cleanup & Ingress	
EV2 (FF) Reisman	Egress	Setup	Battery Temp Stow	P6 Battery R&R (3)	Install Temp Stow Battery	P6 Clean-up	P6 Clean-up	Cleanup & Ingress	

- Cat 2
- Cat 3 or Get-ahead

EVA 1 SUMMARY TIMELINE

PET HR : MIN	IV/SSRMS	EV1 Reisman	EV2 Bowen	
00:00		EGRESS/SETUP (00:30) • Post Depress (00:05) • Egress/Setup (00:25)	EGRESS/SETUP (00:30) • Post Depress (00:05) • Egress/Setup (00:25)	00:00
		PALLET PREP (00:55) • SSRMS Setup (00:20) • Boom Bolts (00:15) • Release Boom (00:10) • Ingress APFR (00:10)	PALLET PREP (01:20) • Dish Bolts (00:15) • Boom LTA Cable (00:10) • Boom Bolts (00:15) • Ingress APFR (00:05) • Boom Handoff (00:15) • Hinge Pin Release, OSE Cover (00:10) • Tether/APFR Relocate (00:10)	
01:00				01:00
		REDUNDANT SGANT INSTALL (02:40) • Boom Handoff (00:15) • Manuever Boom to Z1 (00:30) • Install Boom (00:20) • Retrieve Dish (01:15) • Install Dish onto Boom (00:20)	REDUNDANT SGANT INSTALL (03:10) • Z1 Set-up (00:10) • Install Boom (00:20) • Z1 Connectors to Bracket (00:25) • Stowed Connectors to Boom Panel (00:30) • Remove Boom Box MLI (00:25) • Install Dish onto Boom (00:20) • Install Heat Shield on AGIT (00:05) • Remove Gimbal Locks (00:25) • SGANT Cleanup (00:30)	
02:00				02:00
03:00				03:00
04:00				04:00
		EOTP INSTALL (01:30) • Retrieve EOTP (00:55) • Soft Dock (00:10), drive EDFs and Hinge Pin (00:25)	EOTP INSTALL (00:35) • Soft Dock (00:10), drive EDFs and Hinge Pin (00:25)	
05:00				05:00
		SSRMS CLEANUP (00:25)	BATTERY PREP (00:25)	
06:00	EOTP Get-aheads Electrical Connections (00:15) Maintenance Tether Install (00:10) Input Drive Install (00:20)	CLEANUP/INGRESS (00:35) • Cleanup/Ingress (00:30) • Pre-Repress (00:05)	CLEANUP/INGRESS (00:35) • Cleanup/Ingress (00:30) • Pre-Repress (00:05)	06:00
06:30				06:30

EVA 1 INHIBIT PAD

Orbiter

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
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 INHIBIT

MRM1 In Payload Bay (On call, crew not expected in area)
If EV crew within 2 feet of MRM1 in the Payload Bay
R1 1. PL PRI MN C – OFF (tb-OFF)
SSP2 2. cb MRM CB4 – OP

Ground

ALL EVAs

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

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
POIC 2. √cb LINK 1,2 [two] – OPEN

LOCATION DEPENDENT INHIBITS

Lab Window (On call, crew not expected in area)
IV If EV crew less than 10 feet from window or in window FOV, close window shutter

Cupola Windows (Prior to Approach)
IV If EV crew less than 10 feet from window, coordinate shutter opening/closing with EV crew and minimize time shutter is open

FPMU (At egress)
MCC-H If EV crew working on Port Truss
1. FPMU power – Off

EVA 1 INHIBIT PAD (Cont)

USOS (2)

LOCATION DEPENDENT INHIBITS

Mobile Transporter (At egress)
MCC-H If EV crew < 1.5 meters from MT
1. √MT latched

ICC-VLD (At egress)
MCC-H – ROBO
1. √Verify CRPCM 2P RPC 2 Open
2. √Verify CRPCM 2R RPC 2 Open

Z1 (At egress for SGANT-2 Boom, SGANT-2 Installation)
1. √Verify RPCM Z1-4B-B RPC 02 – Open – Close Cmd Inhibit – power
2. √Verify RPCM Z1-3B-B RPC 02 – Open – Close Cmd Inhibit heater
3. √Verify RPCM Z1-4B-B RPC 03 – Open – Close Cmd Inhibit power
4. √Verify RPCM Z1-3B-B RPC 03 – Open – Close Cmd Inhibit heater

SPDM (Prior to EOTP Electrical connector and Fuse Installation)
MCC-H – ROBO
1. √Body Prime, Redundant (two) – OFF

Port SARJ (At egress)
MCC-H P3 SARJ locked at 120 deg
1. √DLA (1) – LOCKED
2. All motor setpoints set to zero
3. All motors deselected

Port TRRJ (At egress)
MCC-H Port TRRJ locked at 0 deg
1. √DLA (1) – LOCKED

SSPTS (At egress)
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

JEM

ALL EVAs

ICS-EF Antenna
SSIPC
1. ICS MOD – OFF
2. ICS UPC – OFF
3. ICS HPA – OFF
4. ICS Stored Commands Cleared

RSOS

ALL EVAs

SM Antennas
IV
1. GTS – Deactivate
2. ARISS (Ham Radio) – Deactivate

IMPULSE
MCC-M
1. IMPULSE (ИПИ-100) – Is not activated

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. 85-ft safety tether retract force may affect body positioning
5. Wire ties on Port CETA cart brake handles must be replaced if they are cycled or loaded

CAUTION

ISS Generic Constraints

A. Avoid inadvertent contact with
   1. Grapple fixture shafts (dry lube)
   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

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

C. 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

D. 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. Deployed TUS cable [Zenith and Nadir CETA rail]
   2. S0 aft face radiator
   3. Heat pipe radiators [Z1]
   4. PCU cathode and HCA ports [Z1]
   5. Ku-Band antenna (SGANT) dish [Z1]
   6. CMG cover/shells [Z1]
   7. SASA high and low gain antennas and radiator surfaces [Z1]

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

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

EVA 1 NOTES, CAUTIONS, WARNINGS (Cont)

CAUTION

ISS U.S. Pressurized Elements Constraints

A. Other
   1. WIS antennas: Do not use as handholds [NODE 1,LAB,P6,Z1]

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

C. 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. SPDM OTCM gripper jaws
   5. Keep hands away from SSRMS LEE/POA/SPDM LEE opening, snares, and PDGF curvic coupling (teeth)
   6. MMOD strikes on ISS exterior

WARNING

ISS Generic Constraints (Cont)

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

E. Electrical Shock
   1. Do not touch SPDM CLPA 1 electrical connector

EVA 1 NOTES, CAUTIONS, WARNINGS (Cont)

WARNING

ISS Truss Constraints

A. Avoid inadvertent contact
   1. Stay 2 ft from S1/P1 radiator beam rotational envelope when beam is free to rotate

B. Sharp Edges
   1. MMOD strikes on Z1 toolboxes

WARNING

ISS U.S. Pressurized Elements Constraints

A. Pinch
   1. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]

B. Sharp Edges
   1. Port/Aft portion of A/L circular HR [HR 0506]
   2. A/L HR 0537 (Eq Lock Zenith)

C. 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

EVA 1 TOOL CONFIGURATION

ISS Configuration
MT @ WS6 CETA Port/Stbd
Pallet on POA
SPDM on MBS PDGF 2

NOTE: Prior to use, inspect the following hardware:
- ❑ Use RED RETs only
- ❑ RET cords for fraying
- ❑ Inspect Load Alleviating Straps and D-ring Extenders; ref CREW TETHER INSPECTIONS, ISS EVA Tasks Checklist 2.230.105:
  1. MMOD/general damage
  2. Discoloration
  3. Tack Stitching
  4. Red Band
- ❑ ISS Trash Bag: Bristle deformation/damage, after having stowed tools in trash bag
- ❑ Shuttle Trash Bag: Inspect frame for damage
- ❑ Inspect MWS End Effector Attachment Screws

Tether counts:	used	available
RET sm-sm -381	16	16
RET lg-sm -385	4	8
RET PIP Pin -383	4	5
AET sm-sm	8 (2-Shuttle)	10
AET lg-sm	2	2
Fish Stringer	5	5

EV1 – Reisman

MWS √Tabs UP
- ☐☐ Shuttle Style Trash Bag
- ☐☐ 4 – Wire ties as tether loops
- ☐☐ RET w/PIP Pin
- ☐☐ RET w/PIP Pin
  - ☐■ WIF Adapter
- ☐☐ AET
- ☐☐ AET
- ☐☐ Swing Arm (right side)
  - ☐☐ RET sm-sm
    - ☐☐ PGT s/n _____ (√MTL 30.5)
      - ☐☐ 6-in ext
  - ■☐ Camera w/bracket
- ☐☐ BRT (left side) √Tab UP
  - ☐☐ RET sm-sm
  - ☐☐ 2 – long wire tie

EMU Right D-ring
- ☐☐ Waist Tether, √locked
- ☐☐ 55-ft RED hook, √locked
  YELLOW Hook on MWS

EMU Left D-ring
- ☐☐ D-ring Extender
  - ☐☐ 85-ft Green alleviator hook
  - ☐☐ Waist Tether (√locked)

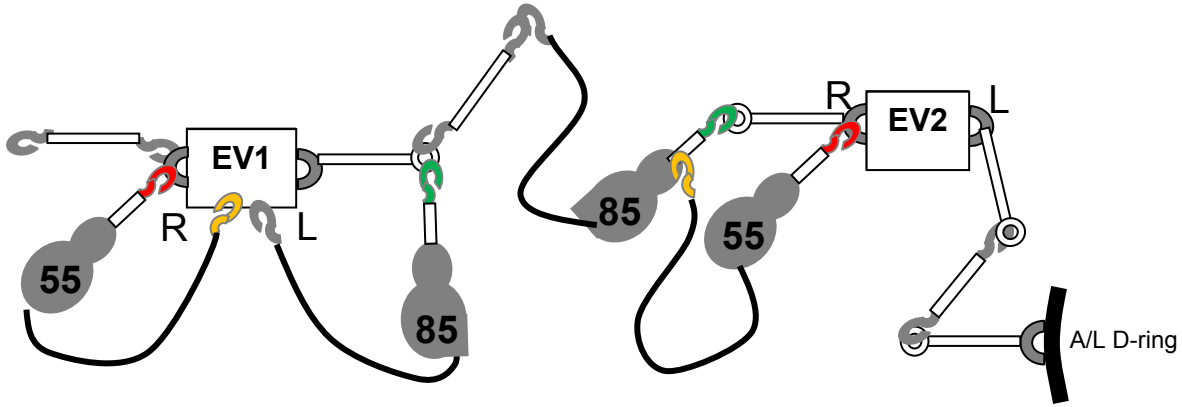
EV2 – Bowen

MWS √Tabs UP
- ☐☐ ISS Trash Bag
- ☐☐ 2 – Wire tie as tether loops
- ☐☐ RET w/PIP Pin
- ☐☐ RET w/PIP Pin
  - ☐■ 6-in ext (stow in trash bag)
- ☐☐ Swing Arm (right side)
  - ☐☐ RET sm-sm
    - ☐☐ PGT s/n _____ (√MTL 30.5)
      - ■☐ 6-in ext
- ☐☐ BRT (left side) √Tab UP
  - ☐☐ RET sm-sm
  - ☐☐ short wire tie
  - ☐☐ long wire tie

EMU Right D-ring
- ☐☐ 55-ft RED hook, √locked
  YELLOW hook to 85-ft ERCM
- ☐☐ D-ring Extender
  - ☐☐ 85-ft Green alleviator hook

EMU Left D-ring
- ☐☐ D-ring Extender
  - ☐☐ Waist Tether, √locked

Wrists (one each)
- ☐☐ AET
- ☐☐ AET



EVA 1 TOOL CONFIGURATION (Cont)

- ☐ RET Lg-sm (A/L stowage)
  - ☐☐ **Med ORU – EOTP Bag**

    Internal D-rings
    - ☐☐ RET sm-sm
      - ☐☐ Fish Stringer
        - ■☐ ERAD
          - ■☐ 2-in ext
        - ☐☐ Socket Caddy
          - ☐☐ DPTA (taped lever)
            - ☐☐ EOTP contingency socket
          - ☐☐ 2-in ext
        - ■☐ EOTP Shower Cap
        - ☐☐ Ratchet Wrench
          - ☐☐ 2-in ext
        - ☐☐ Ratchet Wrench
          - ☐☐ 2-in ext
        - ☐☐ RET sm-sm
          - ☐☐ C/L bag
            - ☐■ Fuse #1
            - ☐☐ Fuse #1 cap
            - ☐■ Fuse #2
            - ☐☐ Fuse #2 cap
            - ■☐ Elec cap from EOTP
            - ■☐ Elec cap from EOTP
            - ☐■ EOTP Tether both hooks on ext D-ring
        - ☐☐ Torque Multiplier w/7/16 rec
    - ☐☐ RET sm-sm
      - ☐■ Input Drive (w/o launch bracket)
      - ■☐ WIF Adapter
    - ☐☐ RET sm-sm
      - ☐☐ Prybar
    - ☐☐ RET sm-sm
      - ☐☐ Spare EDF

    External D-rings
    - ☐☐ AET sm-sm
    - ☐☐ AET lg-sm

- ☐ RET Lg-sm (A/L stowage)
  - ☐☐ **Med ORU – SGANT Bag**

    Internal D-rings
    - ☐☐ RET sm-sm
      - ☐☐ Fish Stringer #1
        - ☐☐ Round Scoop
        - ☐☐ RET sm-sm
          - ☐☐ AET
            - ■☐ Boom Box MLI
        - ☐☐
        - ■☐ Gimbal Lock #1
        - ■☐ Gimbal Lock #2
        - ☐■ AGIT Heat Shield
        - ☐■ ERAD
          - ☐■ 2-in ext
    - ☐☐ RET sm-sm
      - ☐☐ Fish Stringer #2
        - ■☐ Boom Cap
        - ■☐ Cable Cap
        - ■☐ Cable Cap
        - ■☐ Cable Cap
        - ■☐ Cable Cap
        - ☐☐ AET (to provide 2 tether points)
          - ■☐ Boom Cap
          - ■☐ Boom Cap
        - ☐☐ RET sm-sm
          - ☐☐ Cannon Connector Tool
        - ☐☐ RET sm-sm (same hook as above)
          - ☐☐ Cannon Connector Tool
    - ☐☐ RET sm-sm
      - ☐☐ Camera w/bracket

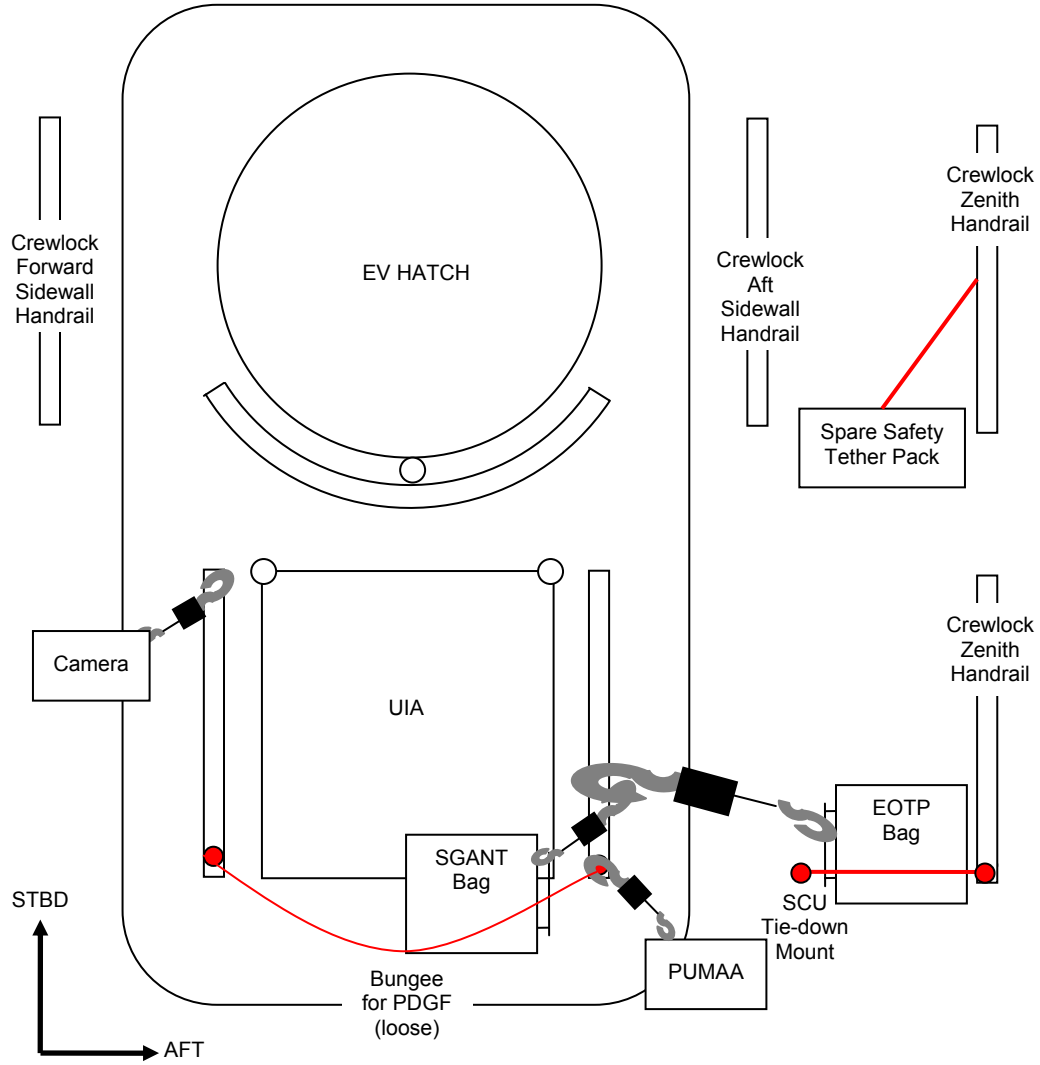
    External D-rings
    - ☐☐ AET sm-sm
    - ☐☐ AET lg-sm

Staging Bag
- ☐☐ Fish Stringer #1
  - ☐☐ Wire Tie Caddy (hook #1)
    - ☐☐ 9 wire ties
  - ☐☐ Velcro/Tape Caddy (hook #2)
  - ☐☐ PGT (hook #3) s/n _____
    - ☐☐ PGT Battery s/n _____
  - ☐☐ Vise Grips (hook #4)
  - ☐☐ Ratchet Wrench (hook #5)
    - ☐☐ 6-in (wobble) ext
  - ☐☐ 3 – Long duration tie down tethers, hooked together (hook #6)
  - ☐☐ WIF Adapter (hook #7)
- ☐☐ Fish Stringer #2
  - ☐☐ ERAD (hook #1) s/n _____
  - ☐☐ Connector Cleaner Tool Kit (hook #2)
  - ☐☐ Pin Straightener Assy (hook #3)
  - ☐☐ Probe (hook #4)
  - ☐☐ Torque Wrench w/bag s/n _____ (hook #5)
  - ☐☐ Needlenose Pliers (hook #6)
  - ☐☐ Cheater bar (hook #7)
  - ☐☐ MWS Key Strap Assy (on wire tie, to strap)

IV Bag
- ☐☐ Ammonia Contamination Cue Card
- ☐☐ 2 – Towels
- ☐☐ Contamination Detection Kit
- ☐☐ RET (sm-sm) (Black)
  - ☐☐ 2 – DCM Plug (SAFER Hardmount)
- ☐☐ RET (sm-sm) (Black)
  - ☐☐ 2 – GP Caddy
    - ☐☐ 2 – Thermal Mitten (pair)
- ☐☐ RET (sm-sm) (Black)
  - ☐☐ Socket Caddy
    - ☐☐ 1/2-in (wobble) Socket – 8 ext
    - ☐☐ 7/16-in (wobble) Socket – 6 ext

Crewlock
- ☐☐ RET Lg-sm (A/L stowage)
  - ☐■ Camera w/bracket (white tape on equipment hook)
- ☐☐ Spare Safety Tether Pack
- ☐☐ RET Lg-sm (A/L stowage)
  - ☐☐ Rnd Scoop
    - ☐☐ PUMAA
      - ☐☐ RET sm-sm
      - ■☐ PDGF

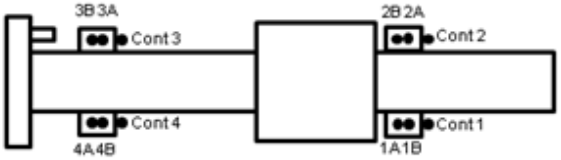
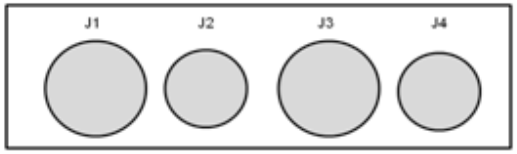
EVA 1 TOOL CONFIGURATION (Cont)



EVA 1 EGRESS/SETUP (00:25)

IV	EV1 (REISMAN)	EV2 (BOWEN)
	INITIAL CONFIGURATION 1. EV2 85-ft blank hook to EV1 left waist tether ❑❑ √Gates closed ❑❑ √Hooks locked	INITIAL CONFIGURATION 1. Left waist tether to A/L D-ring extender ❑ √Gate closed ❑ √Hook locked 2. 85-ft GREEN alleviator hook to right D-ring extender ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked
	WARNING Sharp Edges: Port/Aft portion of A/L circular HR [HR 0506]	
1. WVS Software: Select page – RF camera Sel 'Advanced Controls' S-Band Level (two) – Max	EGRESS/SETUP (00:25) 2. Open thermal cover, egress ____:____ 3. Receive camera, stow on right swing arm 4. Verify EV2 55-ft RED alleviator hook to right EMU D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 5. Verify EV2 55-ft YELLOW anchor to 85-ft ERCM ❑ √Gate closed ❑ √Hook locked 6. Verify EV2 SAFER config ❑ √L handle down (MAN ISO Vlv-Open) ❑ √R handle down (HCM-Closed) 7. √EV2 MWS tabs up 8. Translate to P1 HR 3651 9. Drop EV1 blank hook ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 10. Translate to P1 HR 3650 11. Drop EV2 blank hook ❑ √Gate closed ❑ √Hook locked 12. Give EV2 GO to release waist tether 13. Translate to to starboard CETA cart WIF2; retrieve APFR with ingress AID 14. Stow APFR on BRT	EGRESS/SETUP (00:25) 3. Pass camera to EV1 4. Egress 5. Verify EV1 55-ft RED alleviator hook to right EMU D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 6. Verify EV1 85-ft GREEN alleviator hook to left D-ring extender ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 7. Verify EV1 SAFER config ❑ √L handle down (MAN ISO Vlv-Open) ❑ √R handle down (HCM-Closed) 8. √EV1 MWS tabs up 9. Temp stow SGANT bag on port A/L toolbox 10. Retrieve EOTP bag, stow on BRT 11. On EV1 GO, release left waist tether from A/L D-ring 12. Close thermal cover ____:____ 13. Translate to MBS, stay nadir 14. Temp stow EOTP bag on MBS HR 8402 15. Deploy Fish Stringer from EOTP to WIF extender handrail 16. Retrieve Torque Multiplier, stow on MWS 17. Retrieve APFR from starboard CETA WIF 1 18. Stow APFR on BRT
	CAUTION Avoid inadvertent contact with PDGF grapple pin and RMS targets	

EVA 1 PALLET PREP (00:55/01:20)

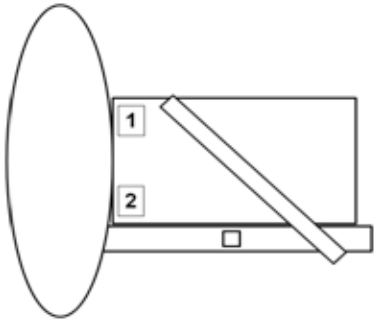
IV	EV1 (REISMAN)	EV2 (BOWEN)
1. On EV2 GO, give **MCC-H GO** to remove ICC-VLD inhibits   Boom Connector Panel	PALLET PREP (00:55) 1. Translate to Pallet 2. GCA SSRMS to APFR setup position 3. Drop YELLOW hook to SSRMS on LEE fwd stanchion ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 4. Install WIF adapter in LEE, tether point toward LEE Install Pip pin ❑ √Pull test 5. Install APFR [12,PP,F,6] in SSRMS WIF adapter ❑ Verify lock collar black on black ❑ Pull/twist test 6. GCA SSRMS for APFR Ingress 7. Fairlead at Pallet HR 0017, temp stow GREEN hook on Pallet HR 0015 8. Glove inspection 9. **PGT[B7 (25.5), CCW2]-6-in ext-7/16**, 17 turns: Release Boom mounting bolts (use manual ratchet to break torque if required) ❑ 2A ❑ 2B ❑ 1A ❑ 1B RELEASE BOOM FROM FSE 10. Translate to HR 0015 for Boom release position 11. Give EV2 GO to release last FSE bolt 12. Release Boom from FSE WARNING If APFR Ingress Aid handle left extended for more than 1.5 hr, limit contact 13. On EV2 GO, ingress APFR 14. GCA to Boom Handoff posn 15. Tether to Boom 16. Check temp, gloves, visor 17. Confirm positive control of Boom; give EV2 GO to release RET	PALLET PREP (01:20) 1. Translate to Pallet 2. Disconnect Boom LTA cable P10 from Boom J3 3. Connect Boom cable P10 to dummy connector J10 on Pallet 4. Give IV GO to remove Pallet inhibits 5. Install APFR into Pallet WIF 2 [4,LL,F,12] ❑ Verify lock collar black on black ❑ Pull/twist test 6. Translate to Dish FSE bolts 7. Open Bolt 1 MLI 8. **PGT w/TM [A7, CCW2**] 2.5 turns; verify TM neutral; break torque on Dish FSE bolt #1 9. Open Bolt 2 MLI 10. **PGT w/TM [A7, CCW2**] 5 turns; verify TM neutral; break torque on Dish FSE bolt #2 11. Return to Bolt 1 12. **PGT w/TM [A7, CCW2**] 2.5 turns; verify TM neutral; break torque on Dish FSE bolt #1 13. Stow TM on MWS 14. Ingress APFR 15. RET to Boom 16. Install 6-in socket onto PGT ❑ √Pull test 17. **PGT[B7 (25.5), CCW2]-6-in ext-7/16**, 17 turns: Release Boom mounting bolts (use manual ratchet to break torque if required) ❑ 4A ❑ 4B ❑ 3A 18. Glove inspection RELEASE BOOM FROM FSE 19. On EV1 GO, release last launch restraint 20. **PGT[B7 (25.5), CCW2] 6-in ext-7/16, 17 turns:** Release (use manual ratchet to break torque if required) ❑ Bolt 3B 21. Release boom from FSE 22. Confirm positive control of Boom 23. Give EV1 GO to ingress APFR 24. Reposition Boom for handoff 25. Hand off Boom to EV1 26. Release RET from Boom 27. Egress APFR

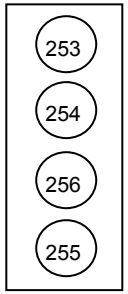
EVA 1 REDUNDANT SGANT INSTALL (02:40/03:10)

IV	EV1 (REISMAN)	EV2 (BOWEN)
2. Verify Z1 inhibits in place √Verify RPCM Z1-4B-B RPC 02 – Open – Close Cmd Inhibit – power √Verify RPCM Z1-3B-B RPC 02 – Open – Close Cmd Inhibit heater √Verify RPCM Z1-4B-B RPC 03 – Open – Close Cmd Inhibit power √Verify RPCM Z1-3B-B RPC 03 – Open – Close Cmd Inhibit heater	REDUNDANT SGANT INSTALL (02:40) 18. GCA SSRMS to clear the ICC 19. On M1 GO, rotate Boom 20. Give SSRMS GO to maneuver to Z1 INSTALL BOOM ON Z1 21. Stabilize Boom while EV2 drives mounting bolts 22. After 1 bolt installed, release RET from Boom 23. GCA clear of the boom 24. Give SSRMS GO to maneuver to Pallet for Dish retrieval 25. Stow camera on left side of MWS 26. Inspect gloves	28. Translate to EOTP 29. RET to, and remove EOTP shower cap; temp stow behind MWS 30. Fold back Hinge Pin MLI flap, secure velcro 31. **PGT [B4 (19.4), CCW2]-6-in ext 7/16**; ~10 turns: Release Hinge pin 32. Pull Hinge Pin to soft dock position 33. Translate to Pallet HR 0015, retrieve EV1 GREEN hook 34. Retrieve APFR, stow on BRT 35. Verify Port CETA cart config for SARJ clearance at WS8 ❑ Outboard WIFs tilted back ❑ Brake handles folded down and tilted inboard ❑ TFR rotated nadir of cart 36. Drop EV1 GREEN hook on P1 HR 3530 (nadir of starboard CETA cart) 37. Translate to starboard CETA cart 38. Install APFR in WIF 1 [6,OO,E,6], swing arm [0,GG,12] ❑ Verify lock collar black on black ❑ Pull/twist test 39. Stow Torque Multiplier and EOTP shower cap on EOTP Fish Stringer 40. Inspect gloves REDUNDANT SGANT INSTALL (03:10) 41. Translate to A/L Tool Box 42. Retrieve SGANT bag, stow on BRT 43. Translate to A/L HR 0541, drop GREEN CAUTION Avoid inadvertent contact with S0 aft face radiator 44. Translate to Z1 forward 45. Temp stow SGANT bag on Z1 HR 6042, between Boom install location and Connector panel 46. Deploy fish stringer with cannon connector tools, attach to Z1 HR 6044 INSTALL BOOM ON Z1 47. Verify install site clear of FOD 48. GCA EV1 to Boom install position 49. **PGT[A7 (9.2), CW2] 6-in ext-7/16**, 29-32 turns total: Drive mounting bolts (2) to torque Bolt | Torque | Turns 1 fwd | | 2 aft | | 50. Inspect gloves

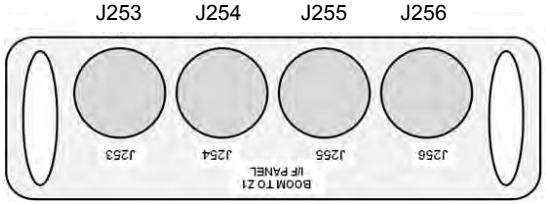
EVA 1 REDUNDANT SGANT INSTALL (02:40/03:10) (Cont)

IV

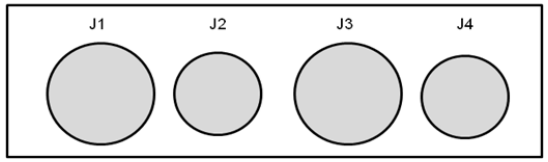




Z1 Connector order



Boom to Z1 Interface Panel



Boom Connector Panel

EV1 (REISMAN)

REMOVE DISH FROM PALLET

27. Verify ingress aid position, check MWS config
28. GCA SSRMS to SGANT bolt removal position
29. **PGT[B7 (25.5), CCW2] – 6-in ext-7/16**, 32+ turns until hard stop: Release Dish restraint bolt
    - ❑ Bolt #1
30. GCA to second bolt position
31. Attach RET to Dish
32. Check temp, gloves, visor
33. **PGT[B7 (25.5), CCW2] – 6-in ext-7/16**, 32+ turns until hard stop: Release Dish restraint bolt
    - ❑ Bolt #2
34. Verify swing arm clear after PGT stow
35. GCA SSRMS to remove Dish from FSE
36. On M1 GO, rotate Dish as required for installation
37. Give SSRMS GO to translate to Z1

EV2 (BOWEN)

CAUTION
On demated cannon connectors, do not rotate collar or manipulate cable/connector using collar or connector tool
Electrical cables: Avoid bend radii < 10 times cable diameter

Z1 CONNECTORS TO Z1 INTERFACE CONNECTOR PANEL

51. Deploy fish stringer with AGIT heat shield, attach to Boom handrail 0004
52. Retrieve Cannon connector tool
53. Release TA-clamps on Z1 cables
54. Using the Cannon connector tool, demate following connectors from Z1 stowage positions and mate to interface connector panel; √FOD, pins, EMI band

Remove Cap from Connector Panel	Demate Connector from Z1	Install Cap on Z1	√FOD, pins, EMI band	Mate to Connector Panel
J254	P254/W704	P254		J254
J253	P253/W204	P253		J253

55. WVS survey

STOWED CONNECTORS TO BOOM CONNECTOR PANEL

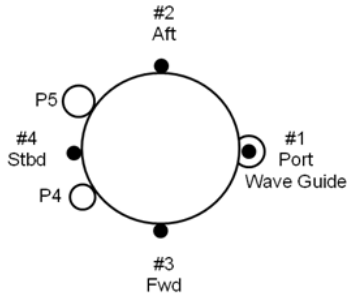
56. Retrieve cable bundle from HR 6052
57. Relocate fish stringer from HR 6044 to HR 6042
58. Remove caps from Boom base Connector Panel (3); stow caps on fish stringer ❑ ❑ ❑
59. Remove caps from previously routed cables (4); stow on fish stringer ❑ ❑ ❑ ❑
60. Mate connectors to boom connector panel
    √FOD, pins, EMI band:

√FOD, pins, EMI band	Mate	
	Plug/Cable	Boom Panel
	P1/W4052	J1
	P2/W4049	J2
	P3/W4051	J3
	P4/W4050	J4

EVA 1 REDUNDANT SGANT INSTALL (02:40/03:10) (Cont)

IV

SGANT Bag
Internal D-ring
- ☐ RET sm-sm
  - ☐ Fish Stringer #2
  - ☐ Boom Cap
  - ☐ Cable Cap
  - ☐ Cable Cap
  - ☐ Cable Cap
  - ☐ Cable Cap
  - ☐ AET (to provide 2 tether points)
    - ☐ Boom Cap
    - ☐ Boom Cap
  - ☐ RET sm-sm
    - ☐ Cannon Connector Tool
  - ☐ RET sm-sm
    - ☐ Cannon Connector Tool



EV1 (REISMAN)

INSTALL DISH ONTO BOOM
38. Stabilize Dish

39. Stow camera on swing arm

40. Remove 6-in socket from PGT, stow in trash bag
41. Receive ERAD from EV2, install on PGT
    - ❑ Pull test
42. **PGT[A5 (7.0), CW2] – ERAD 2-in ext-7/16:** Secure bolt 4; expect 4 turns at PGT
    Torque: _____ Turns: _____
43. Stow PGT
44. Release RET from Dish

CAUTION
Electrical cables: Avoid bend radii < 10 times cable diameter

CONNECT DISH CABLES TO BOOM
45. Turn 5 cable fasteners to release P4 and P5
46. Demate P4 and P5 from Dish dummy receptacles
47. Mate Dish cables to Boom. √FOD, pins, EMI band, mate

√s	Mate		
	SGANT	Boom	Dummy
	P4 (fwd)	J1	J6
	P5 (aft)	J2	J7

48. Stow caps on dummy receptacles J7 and J6

EV2 (BOWEN)

61. Inventory fish stringer
62. Stow fish stringer in SGANT bag

REMOVE BOOM BOX MLI (Get-ahead)
63. RET to Boom Box MLI
64. Attach AET from fish stringer to Boom Box MLI
65. Release grounding bolt cable TA-clamps (2)
66. **PGT[A5 (7.0), CCW2] – 6-in ext-7/16, 13 turns:** Release grounding bolt
67. Remove Boom Box MLI
68. Roll MLI and secure with AET
69. Inspect gloves

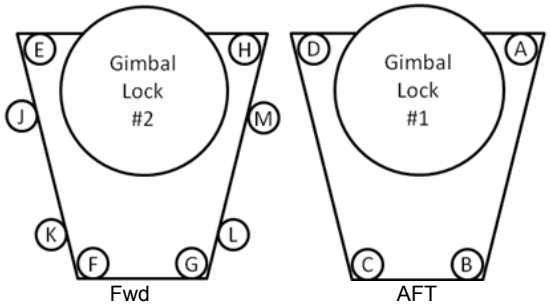
INSTALL DISH ONTO BOOM
70. GCA EV1 to install position
71. Assist EV1 with fine alignment of dish
72. Hand tighten bolt 1, wave guide bolt

73. **PGT[B1 (12.0), CW2] – 6-in ext-7/16:** Drive bolts to hard stop; expect 8 turns
    - ❑ Bolt 1 Torque: _____ Turns: _____
    - ❑ Bolt 3 Torque: _____ Turns: _____
    - ❑ Bolt 2 Torque: _____ Turns: _____

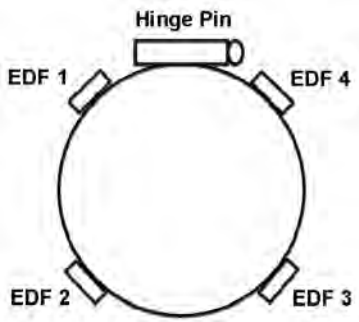
74. Transfer ERAD to EV1

CONNECT DISH CABLES TO BOOM
75. Remove connector caps from boom J1 and J2

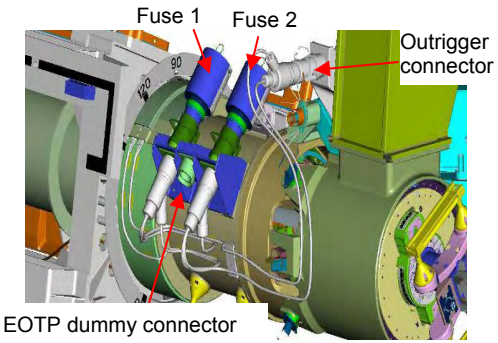
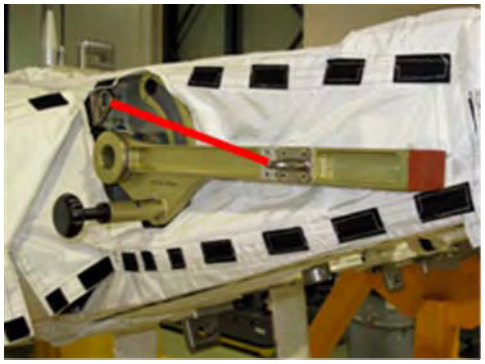
EVA 1 REDUNDANT SGANT INSTALL (02:40/03:10) (Cont)

IV	EV1 (REISMAN)	EV2 (BOWEN)
3. When all connectors mated, remove Z1 inhibits  SGANT Bag Internal D-rings ☐ RET sm-sm ☐ Fish Stringer #2 (inventory taken previously) ☐ RET sm-sm ☐ Fish Stringer #1 ☐ Round Scoop ☐ RET sm-sm ☐ AET ☐ Boom Box MLI ☐ Gimbal Lock #1 ☐ Gimbal Lock #2 ☐ RET sm-sm ☐ Camera w/Bracket External D-rings ☐ AET sm-sm ☐ AET lg-sm	INSTALL HEAT SHIELD ON AGIT (Get-ahead) 49. Assist EV2 with install EOTP INSTALLATION (01:30) 50. Give SSRMS GO to maneuver to SGANT Clear position 51. Remove ERAD, stow on BRT 52. Install 6-in ext on PGT ❑ Pull test 53. Glove inspection	INSTALL HEAT SHIELD ON AGIT (Get-ahead) 76. Retrieve heat shield from fish stringer, RET to chin strap 77. Install heat shield, verify √Teflon tabs tucked in √¼-turn fasteners and Velcro secure √Snug fit around edges and pockets √Strap under wave guide bolt REMOVE GIMBAL LOCKS (Get-ahead) 78. Attach RET to Gimbal Lock #2 79. **PGT[B1(12.0), CCW2] – 6-in ext-7/16, 7-8 turns:** Release Gimbal Lock #2 bolts bolts (8); release by diagonal opposites 80. Stow Gimbal Lock #2 on fish stringer 81. Attach RET to Gimbal Lock #1 82. **PGT[B1(12.0), CCW2] – 6-in ext-7/16, 7-8 turns:** Release Gimbal Lock #1 bolts (4; release by diagonal opposites 83. Stow Gimbal Lock #1 on fish stringer 84. WVS survey SGANT CLEANUP 85. Perform bag inventory 86. Stow fish stringer in SGANT bag 87. Stow SGANT bag on BRT 88. Retrieve Green hook from AL HR 0541 89. Translate to A/L, stow SGANT bag 90. Inspect gloves

EVA 1 EOTP INSTALL (01:30/00:35)

IV	EV1 (REISMAN)	EV2 (BOWEN)
	REMOVE EOTP FROM FSE 1. GCA to EOTP release position 2. **PGT [A4 (6.3), CCW3]-6-in ext 7/16**; release FSE bolts to a hard stop, ~33 turns ❑ Bolt #4 ❑ Bolt #2 3. RET to EOTP 4. Check temp, gloves, visor 5. **PGT [A4 (6.3), CCW3]-6-in ext 7/16**; release FSE bolts to a hard stop, ~33 turns ❑ Bolt #1 ❑ Bolt #3 6. GCA clear of Pallet 7. On M1 GO, rotate EOTP as required for installation 8. Give SSRMS GO to maneuver to EOTP install location	
	WARNING Avoid contact with exposed spline teeth and grounding fingers on input drive and EOTP spline drive shaft due to presence of sharp edges and dry lube	
		EOTP INSTALLATION (00:35) 1. Translate to starboard CETA cart
	INSTALL EOTP ON SPDM 9. GCA to softdock position 10. Present EOTP lug interface to EV2 11. Soft dock EOTP onto SPDM	INSTALL EOTP ON SPDM 2. Release EDF #s 1-3 to soft dock position; temp stow EDF #4 on MLI 3. Verify EOTP MLI clear for install to SPDM 4. Soft dock EOTP onto SPDM; verify soft dock latches engaged 5. Insert EDFs into lug-clevis interface 6. Fully insert hinge pin, engage bolt
	TORQUE EOTP EDFs 12. Release RET from EOTP 13. GCA to EDF torque position 14. On M1 GO, ready for APFR reconfiguration: Adjust APFR to EDF torque position [12,PP,G,6] roll 1 click right 15. Swap ERAD to PGT ❑ √Pull test	TORQUE EOTP EDFs 7. Ingress APFR WIF 1 [6,OO,E,6] 8. RET to EOTP 9. **PGT [B4 (19.4), CW2]-6-in ext 7/16**; drive EDF to torque ~4.5 turns, re-trigger PGT ~7 times until no further EDF rotation is observed (turn count threshold < 0.1 turns) ❑ **EDF #4 Torque:** _____ **Turns:** _____ ❑ **EDF #2 Torque:** _____ **Turns:** _____ ❑ **EDF #3 Torque:** _____ **Turns:** _____ 10. **PGT [B7 (25.5), CW2]-6-in ext 7/16**; drive EDF to torque ~0.5 turns, re-trigger PGT at each EDF location until no further EDF rotation is observed (turn count threshold < 0.1 turns) ❑ **EDF #3 Torque:** _____ **Turns:** _____ Perform light tug test on EDF

EVA 1 EOTP INSTALL (01:30/00:35) (Cont)

IV	EV1 (REISMAN)	EV2 (BOWEN)
1. Verify SPDM inhibits in place **MCC-H** – ROBO √Body Prime, Redundant (two) – OFF	16. **PGT [B1 (12.0), CW2]-ERAD 2-in ext 7/16**; drive EDF to torque ~2.5 turns, re-trigger PGT ~7 times until no further EDF rotations observed (turn count threshold < 0.1 turns) **EDF #1 Torque: _____ Turns: _____** ❑ Perform light tug test on EDF 17. Swap 6-in onto PGT ❑ √Pull test	❑ **EDF #2 Torque: _____ Turns: _____** Perform light tug test on EDF ❑ **EDF #4 Torque: _____ Turns: _____** Perform light tug test on EDF 11. **PGT [B4 (19.4), CW2]-6-in ext 7/16; ~10.5 turns**, drive hinge pin **Torque: _____ Turns: _____** 12. Egress APFR 13. Perform light tug test on all four EDFs
 	18. Transfer ERAD to EV2 If no time for EOTP Get-Aheads, go to EOTP CLOSEOUT <u>EOTP ELECTRICAL CONNECTIONS (Get-ahead)</u> (00:15) 19. Receive crewlock bag from EV2, stow on BRT 20. On MCC-H GO, remove connector cap from SPDM outrigger; temp stow 21. Disconnect EOTP power connector from dummy; mate to SPDM outrigger connector ❑ √FOD, pins, EMI band 22. Install connector cap on EOTP dummy connector 23. Remove cap from Fuse connector install location, temp stow on MWS 24. Remove cap, install EOTP Fuse #1 ❑ √FOD, pins, EMI band 25. Use crewlock bag ret, remove cap from second Fuse connector install location 26. Remove cap, install EOTP Fuse #2 ❑ √FOD, pins, EMI band 27. Stow cap from MWS onto crewlock bag hook	14. Receive ERAD from EV1, stow on fish stringer 15. Transfer crewlock bag to EV1 (as required) 16. Inspect gloves
	<u>EOTP MAINTENANCE TETHER INSTALL (Get-ahead)</u> (00:10) 28. Retrieve EOTP tether from crewlock bag 29. Egress APFR 30. Open Brace and Tether Flap 31. Install EOTP tether 32. Close Brace and Tether Flap <u>EOTP CLOSEOUT</u> 33. Fold EDF MLI (4) over EDF interfaces; check 7 pull tabs 34. WVS survey 35. Stow crewlock bag in EOTP bag (as required) 36. Translate to P1 HR 3530 37. Attach GREEN alleviator hook to right D-ring extender ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked	

EVA 1 EOTP INSTALL (01:30/00:35) (Cont)

IV	EV1 (REISMAN)	EV2 (BOWEN)
	38. Translate back to the arm 39. Retrieve 55-ft YELLOW anchor; stow on MWS, stow ingress aid 40. GCA SSRMS to clear EOTP <u>EOTP INPUT DRIVE INSTALL (Get-ahead)</u> (00:20) 41. Retrieve input drive from EOTP bag 42. BRT to WIF extender handrail 43. Open MLI flap, Velcro 44. Align lobes in EOTP input drive with slots in the SPDM outrigger back-plate (such that lobe A aligns with slot A and lobe B aligns with slot B) 45. Partially insert input drive body into housing; do not insert past dashed line 46. Rotate input drive to 90 deg posn 47. Fully insert input drive to hard stop (soft dock) 48. **PGT [A7 (9.2), CW2]-6 ext 7/16;** ~10 turns: Drive bolts (2) to torque Bolt A Torque: _____ Turns: _____ Bolt B Torque: _____ Turns: _____	

EVA 1 SSRMS CLEANUP/BATTERY PREP (00:25)

IV

☐ **Med ORU – EOTP Bag**

Internal D-rings

- ☐ RET sm-sm
  - ☐ Fish Stringer
    - ☐ ERAD
      - ☐ 2-in ext
    - ☐ Socket Caddy
      - ☐ DPTA
        - ☐ EOTP Contingency socket
      - ☐ 2-in ext
    - ☐ EOTP Shower Cap
    - ☐ Ratchet Wrench
      - ☐ 2-in ext
    - ☐ Ratchet Wrench
      - ☐ 2-in ext
    - ☐ RET sm-sm
      - ☐ C/L bag
        - ☐ Fuse #1 cap
        - ☐ Fuse #2 cap
        - ☐ Elec cap from EOTP
        - ☐ Elec cap from EOTP
    - ☐ Torque Multiplier w/7/16 rec
- ☐ RET sm-sm
  - ☐ WIF Adapter
- ☐ RET sm-sm
  - ☐ Prybar
- ☐ RET sm-sm
  - ☐ Spare EDF

External D-rings

- ☐ AET sm-sm
- ☐ AET lg-sm

EV1 (REISMAN)

SSRMS CLEANUP (00:25)

1. GCA SSRMS for APFR removal
2. Remove APFR from SSRMS, stow in starboard CETA cart WIF 3 [6,PP,F,6]
   - ❑ Verify lock collar black on black
   - ❑ Pull/twist test
3. Retrieve WIF adapter from SSRMS LEE, stow on RET in EOTP bag
4. Give SSRMS GO to maneuver to Truss Clearance posn
5. Verify tether is clear of MT translation path
6. Inspect gloves
7. Translate to A/L

EV2 (BOWEN)

BATTERY PREP (00:25)

1. Retrieve ratchet wrench from EOTP bag
2. Translate to Batteries on Pallet
3. Release all 1/4-turn fasteners
4. Using the ratchet wrench, break torque on Batteries
   a. Open MLI
   b. Break torque, H1 first
   c. Using palm wheel, hand tighten H2
   d. Close MLI (1/4-turn fasteners not required)

	A	B	C	D	E	F
Open MLI						
Break Torque	❑H1 ❑H2	❑H1 ❑H2	❑H1 ❑H2	❑H1 ❑H2	❑H1 ❑H2	❑H1 ❑H2
Set H2 Torque	❑H2	❑H2	❑H2	❑H2	❑H2	❑H2
Close MLI						

5. Translate to EOTP bag
6. Stow ratchet wrench on fish stringer
7. Perform bag inventory
8. Stow fish stringer in EOTP bag
9. Stow EOTP bag on BRT
10. Verify tether is clear of MT translation path
11. Inspect gloves
12. Translate to A/L
13. Perform tool inventory

EVA 1 CLEANUP/INGRESS (00:35)

IV	EV1 (REISMAN)	EV2 (BOWEN)
	CLEANUP/INGRESS (00:35)	CLEANUP/INGRESS (00:35) 1. Open thermal cover _____:_____ 2. Stow EOTP bag in A/L 3. Stow SGANT bag in A/L 4. Attach left waist tether to A/L D-ring extender ❑ √Gate closed ❑ √Hook locked 5. Attach GREEN alleviator hook to aft external A/L D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 6. Release YELLOW anchor, stow on MWS 7. Ingress A/L 8. Connect SCU to DCM; √SCU Locked
1. Perform WVS PWRDN (PHOTO/TV, <u>WVS CUE CARD</u>) **<u>EV1</u>** MWS ❑ Shuttle Style Trash Bag ❑ 4 – Wire ties as tether loops ❑ RET w/PIP Pin ❑ RET w/PIP Pin ❑❑ 2 – AETs ❑ Swing Arm (right side) ❑ RET sm-sm ❑ PGT ❑ 6-in ext ❑ Camera w/Bracket ❑ BRT (left side) ❑ RET sm-sm ❑ 2 – long wire tie **<u>EV2</u>** MWS ❑ Small Trash Bag ❑ 2 – Wire tie as tether loops ❑ RET w/PIP Pin ❑ RET w/PIP Pin ❑ Swing Arm (right side) ❑ RET sm-sm ❑ PGT ❑ 6-in ext ❑ BRT (left side) ❑ 1 – short wire tie ❑ 1 – long wire tie ❑ RET sm-sm Wrists ❑❑ 2 – AET	1. Attach waist tether to A/L D-ring extender ❑ √Gate closed ❑ √Hook locked 2. Attach GREEN alleviator hook to forward external A/L D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 3. Perform tool inventory 4. Ingress A/L with camera 5. Close thermal cover; attach Velcro strap _____:_____ 6. Connect SCU to DCM; √SCU Locked	
	<u>NOTE</u> A TCV setting 8 – Max C minimizes time for SCU cooling	
	7. WATER – OFF (fwd), expect H2O IS OFF msg	9. WATER – OFF (fwd), expect H2O IS OFF msg
	<u>CAUTION</u> Do not close hatch until EMU Water OFF for 2 min. Verify outer hatch clear of hardware	
	8. Verify outer hatch clear of hardware 9. EV Hatch – verify handle position per hatch decal; close and lock 10. Go to PRE-REPRESS (<u>DEPRESS/REPRESS</u> Cue Card)	10. Go to PRE-REPRESS (<u>DEPRESS/REPRESS</u> Cue Card)

EVA 1 SGANT – TASK DATA

Estimated Task Duration:

	With SSRMS	Without SSRMS
One EV Crew		
Two EV Crew	02:40	

Tools:

EV1 (SSRMS)	EV2 (FF)
PGT	PGT
7/16" 6-in socket	7/16" 6-in socket
ERAD	
7/16" 2-in socket	
WIF Adapter with PIP pin	
APFR	

Foot Restraints:

Task	WIF	APFR Setting
Retrieve Boom	Pallet WIF 2	4,LL,F,12
SSRMS		12,PP,F,6

ORU Mass:

SGANT Dish	**197 lb (731 with FSE)**
SGANT Boom	**397 lb**

EVA Fasteners: (All settings at 30 rpm)

Fastener Name	Label	Head Size (Inch)	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	PGT Torque
Boom FSE Bolts	1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B	7/16	8		30.5	51.88	13-17	B7
Boom FSE Cont. Bolts	1-4	7/16	4		24	145	13-17	B7
Z1 Mounting Bolts (Boom)	Bolt 1 Bolt 2	7/16	2	9.2		84.75	29-32	A7
SGANT FSE Drive Bolts (micro square)		7/16	2	N/A	43.3/25.5	60	33	A7 w/TM B7
SGANT Installation Bolts		7/16	4	12.0	30.5	39	6-8 3-4 w/ERAD	B1 A5 w/ERAD
Gimbal Lock Bolts		7/16	12		12	23.53	6-8 3-4 w/ERAD	B1 A5 w/ERAD
SGTRC Grounding Bolt		7/16	1		7.0	11.3	9-13	A5

SGANT on ICC-VLD Thermal Clock: 3.0 hr
Boom Thermal Clock: 6 hr
SGANT Dish Transfer: 3.5 hr (-65 to -20 and +20 to +65 beta), 3 hr (-20 to +20 beta)

Acronyms:
AGIT: Antenna Group Interface Tube
RF Feed Assembly: Radio Frequency Feed Assembly
SGANT: Space-to-Ground Antenna
SGS Reflector Assembly: Space-to-Ground Subsystem Reflector Assembly
SGTRC: Space-to-Ground Transmitter-Receiver-Controller, aka Boom Box

Z1 to Connector Panel Connections:

Z1 Wire Harness Ku-Band Cable	Connector From Z1 Dummy	To Z1 Connector Panel	Connector Panel Caps	Wire Harness Ku-Band Cable	Function
W204	P253/J153	J253	S22698-006-373	W4050	1553A
W704	P254/J154	J254	S22698-006-331	W4049	1553B
W140	P256/J156	J256	S22698-006-331	W4051	Ops Power
W120	P255/J155	J255	S22698-006-331	W4051	Htr Power

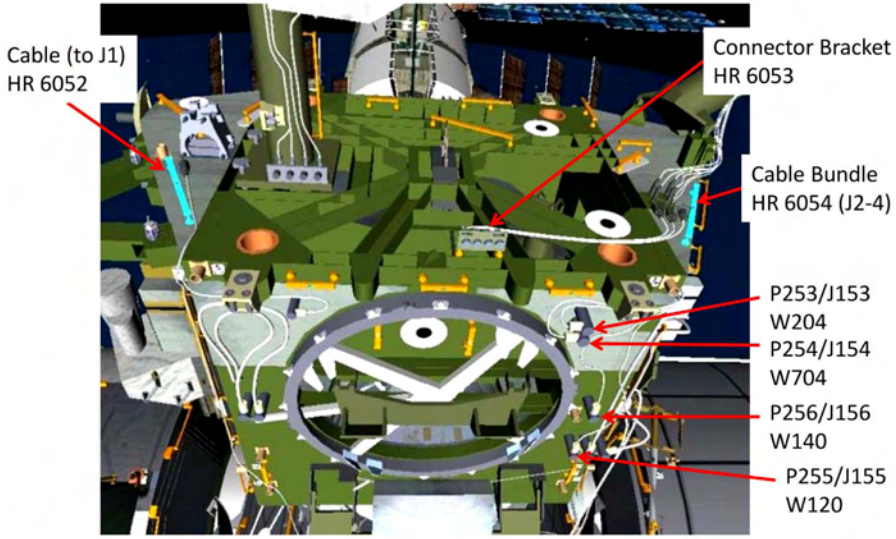
Z1 Interface Connector Panel to Boom Connections:

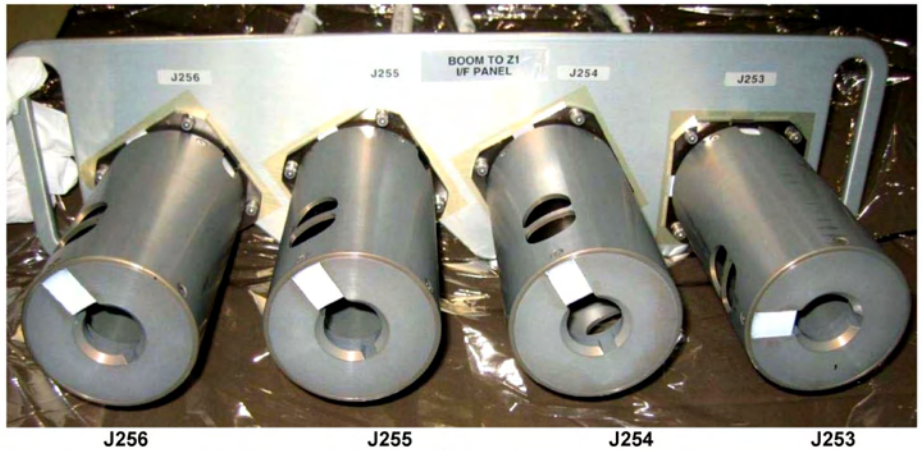
Wire Harness Ku-Band Cable	From Harness	Harness Caps	To Boom Panel	Boom Panel Caps	Conn Size	Function
W4052	P1	NZGL-PPC-N-21-R	J1	NZGL-RPC-N-21-MS	NZGL 21	Ku-Band Coax
W4049	P2	NZGL-PPC-N-15-R	J2	NZGL-RPC-N-15-MS	NZGL 15	1553B
W4051	P3	NZGL-PPC-N-21-R	J3		NZGL 21	Ops & Heater Power
W4050	P4	NZGL-PPC-N-15-R	J4	NZGL-RPC-N-15-MS	NZGL 15	1553A

Dish to Boom EVA Connectors:

Wire Harness Ku-Band Cable	Antenna I/F Plate, Boom	Antenna I/F Plate SGANT	TA-Clamps (#)	Conn Size	Caps	Function
W4031	J1	P4	Release 2	NZGL 15	NZGL-RPC-N-15-0-MS	Ops & Heater Power
W4037	J2	P5	Release 3	NZGL 25	NZGL-RPC-N-25-0-MS	1553A

EVA 1 SGANT – TASK DATA (Cont)

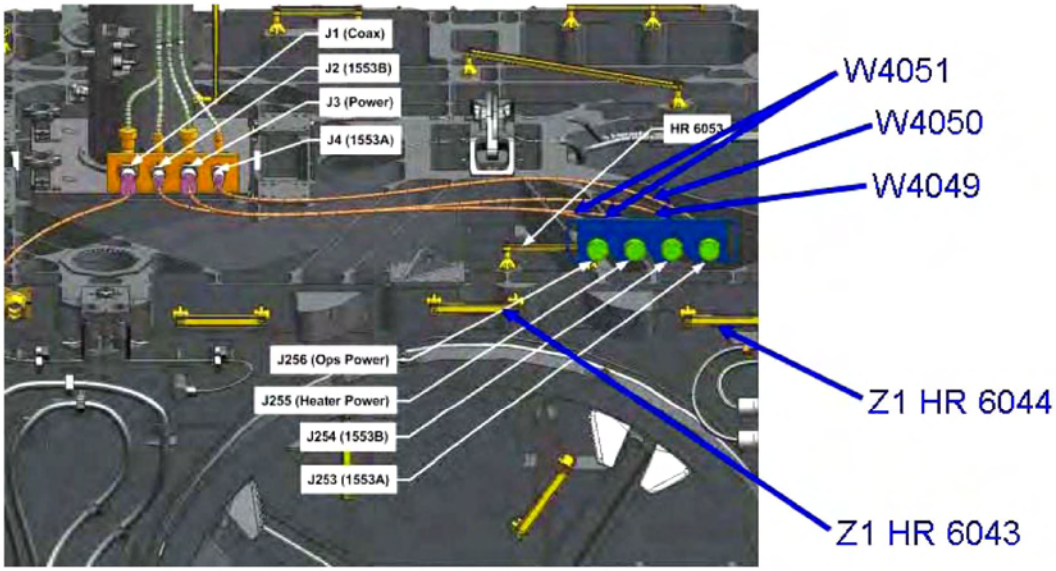




J256 J255 J254 J253

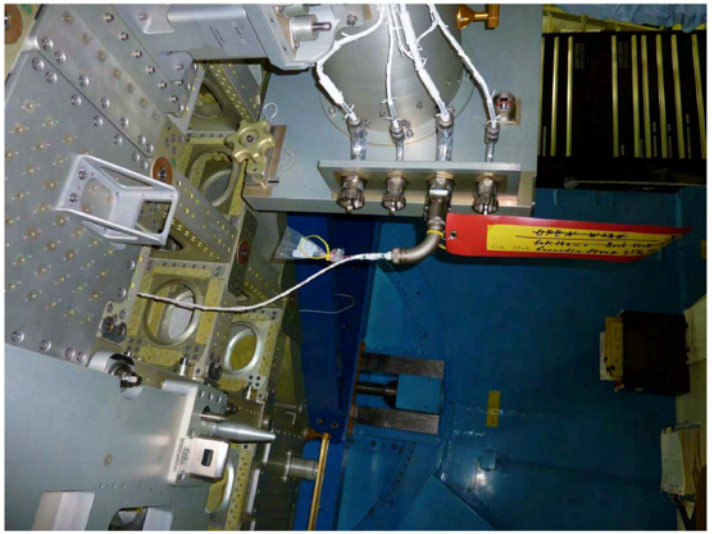
Boom to Z1 I/F Panel

Boom Panel Connectors



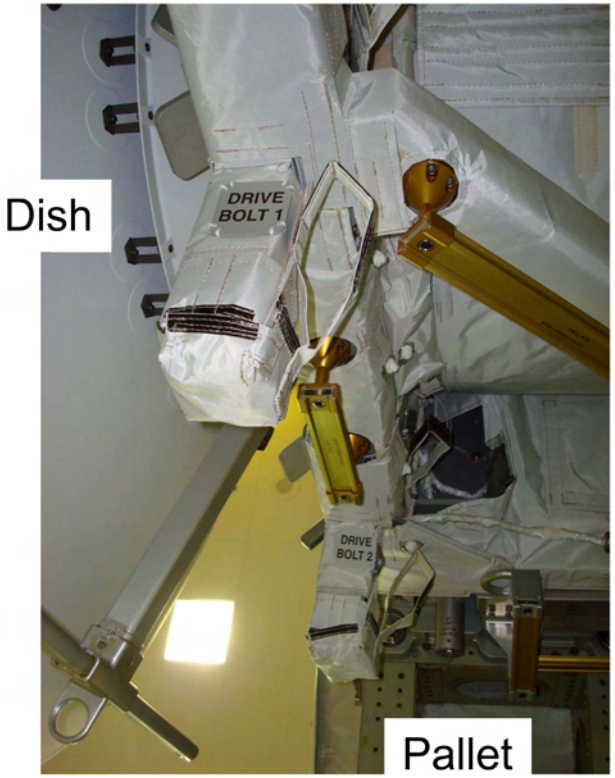
Redundant Boom Panel Connections

EVA 1 SGANT – TASK DATA (Cont)



Boom LTA Cable in Launch Configuration

Dish FSE



Dish FSE Bolts 1 and 2

EVA 1 EOTP – TASK DATA

EVA Fasteners: (All settings at 30 RPM unless noted)

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	PGT Torque
EOTP EDFs	1-4	7/16	4	19.4 25.5	25.5	33.0	4-5 ~0.5	B4 B7
EOTP Hinge Pin	N/A	7/16	1	19.4	19.4	35	10.5	B4
FSE Primary Bolts	1-4	7/16	4	6.3	6.3	10.9	33	A4**
FSE Back-up Bolt (Contingnecy)	1-4	1.125	4		25.5*/ 8.3	20.6	16	B7* A6
FSE Anti-Rotation	1-4	7/16	4		9.2	30.1	3	A7
Input Drive Bolts	A, B	7/16	2	9.2	9.2	30.1	10.25	A7

* 25.5 ft-lb to break torque for less than one turn then return to 8.3 ft-lb
** 60 RPM allowed

Foot Restraints:

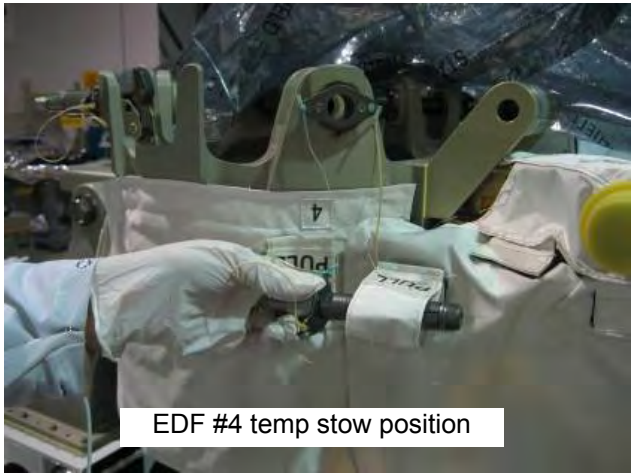
Task	WIF	APFR Setting
Install EOTP	Stbd CETA WIF 1	6,OO,E,6 swing arm (0,GG,12)
SSRMS Retrieve EOTP		12,PP,F,6
SSRMS Install EOTP EDFs		12,PP,G,6
WIFEX	MBS WIF 12	2,A,1

Notes:
If an EDF is released more that 5 turns, captive head can back off threads. Re-engage head with threads before driving with PGT

The FSE back up contingency bolt turn count is up to 16 CLOCK-WISE (depending at which point jamming of primary locking bolt occurs), to a hard stop

The lanyard on EDF #4 was extended to resolve the interference issue between the EDF and the hinge bolt. The lanyard will allow the EDF to pull out of the lug/clevis interface

Cautions:
Avoid applying off-axis loads to EDF EVA nut when the EDF is unfastened. Fastener damage may result



Brace and Tether Flap – Closed

EVA 2 SUMMARY TIMELINE

PET HR : MIN	IV/SSRMS	EV1 Bowen	EV2 Good	
00:00		EGRESS/SETUP (00:30) • Post-Depress (00:05) • Egress (00:15) & Setup (00:10)	EGRESS/SETUP (00:30) • Post-Depress (00:05) • Egress (00:15) & Setup (00:10)	00:00
01:00		WORKSITE PREP (01:00) • Crewlock Bag/Tool Set-up • APFR/Gap Spanner Relocate	WORKSITE PREP (01:00) • Crewlock Bag/Tool Set-up • Truss Battery Torque Break	01:00
02:00		TEMP-STOW BATTERY (00:35) • Remove Battery 1 – Truss • Temp-stow battery on truss	TEMP-STOW BATTERY (00:35) • Remove Battery 1 – Truss • Temp-stow battery on truss	02:00
03:00		BATTERY A/2 R&R (01:05) • Remove Battery A – Pallet • Install Battery A – Truss • Remove Battery 2 – Truss • Install Battery 2 – Pallet	BATTERY A/2 R&R (01:05) • Remove Battery A – Pallet • Install Battery A – Truss • Remove Battery 2 – Truss • Install Battery 2 – Pallet	03:00
04:00		BATTERY B/3 R&R (01:05) • Remove Battery B – Pallet • Install Battery B – Truss • Remove Battery 3 – Truss • Install Battery 3 – Pallet	BATTERY B/3 R&R (01:05) • Remove Battery B – Pallet • Install Battery B – Truss • Remove Battery 3 – Truss • Install Battery 3 – Pallet	04:00
		BATTERY C R&R (00:35) • Remove Battery C – Pallet • Install Battery C – Truss	BATTERY C R&R (00:35) • Remove Battery C – Pallet • Install Battery C – Truss	
05:00		INSTALL TEMP-STOWED BATTERY ON PALLET (00:35) • Retrieve battery 1 from temp-stow • Install Battery 1 – Pallet	INSTALL TEMP-STOWED BATTERY ON PALLET (00:35) • Retrieve battery 1 from temp-stow • Install Battery 1 – Pallet	05:00
06:00		CLEANUP/INGRESS (01:00) • EVA 3 Prep and Cleanup (00:30) • Translate/Ingress (00:30)	CLEANUP/INGRESS (01:00) • EVA 3 Prep (00:30) • Translate/Ingress (00:30)	06:00
06:30		PRE-REPRESS (00:05)	PRE-REPRESS (00:05)	06:30

EVA 2 INHIBIT PAD

Orbiter

ALL EVAs

TCS
L12 1. √TCS POWER – OFF

KU-Band Antenna (Not expected)
MCC-H 1. √KU-BAND Mask – active
2. √KU-BAND EVA Protect Box – active

RCS (On call, crew not expected in area)
If EV crew < 27 feet 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 (*)

Ground

ALL EVAs

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

RSOS

ALL EVAs

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

IMPULSE
MCC-M 1. IMPULSE (ИПИ-100) – Deactivate

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
POIC IV/(LAB1O4) 1. √cb POWER A, B [two] – OPEN
2. √cb LINK 1,2 [two] – OPEN

EVA 2 INHIBIT PAD (Cont)

USOS (2)

LOCATION DEPENDENT INHIBITS

Lab Window (On call, crew not expected in area)
IV If EV crew less than 10 feet from window or in window FOV, close window shutter

Cupola Windows (Prior to Approach)
IV If EV crew less than 10 feet from window, coordinate shutter opening/closing with EV crew and minimize time shutter is open

P3 SARJ (At egress for Battery R&R)
MCC-H P3 SARJ locked at 225
1. √DLA (1) – LOCKED
2. All motor setpoints set to zero
3. All motors deselected

BGAs
MCC-H 4B locked at 130 deg
1. √Latch (L1) – LATCHED

MCC-H 2A locked at 65 deg
1. √Latch (L2) – LATCHED

MCC-H 2B locked at any angle
1. √Latch – LATCHED

Port TRRJ (At egress)
MCC-H Port TRRJ locked at 0 deg
1. √DLA (1) – LOCKED

Mobile Transporter (At egress)
MCC-H If EV crew < 1.5 meters from MT
1. √MT latched

SSPTS (At egress)
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

FPMU (At egress)
MCC-H If EV crew working on Port Truss
1. FPMU power – Off

USOS (3)

LOCATION DEPENDENT INHIBITS

IEA (At egress for Battery R&R)
Battery Set 1 (Batteries 4B1A and 4B1B)
MCC-H
1. DCSU 4B RBI 2 Open
2. BCDU 4B1 Converter Off and FI Open
3. BCDU 4B1 CP RBI Open
4. BCDU 4B1 BSCCM A Power Off
5. BCDU 4B1 BSCCM B Power Off
6. BCDU 4B1 Heater Switch A Open
7. BCDU 4B1 Heater Switch B Open

Battery Set 2 (Batteries 4B2A and 4B2B)
MCC-H
1. DCSU 4B RBI 3 Open
2. BCDU 4B2 Converter Off and FI Open
3. BCDU 4B2 CP RBI Open
4. BCDU 4B2 BSCCM A Power Off
5. BCDU 4B2 BSCCM B Power Off
6. BCDU 4B2 Heater Switch A Open
7. BCDU 4B2 Heater Switch B Open

Battery Set 3 (Batteries 4B3A and 4B3B)
MCC-H
1. DCSU 4B RBI 4 Open
2. BCDU 4B3 Converter Off and FI Open
3. BCDU 4B3 CP RBI Open
4. BCDU 4B3 BSCCM A Power Off
5. BCDU 4B3 BSCCM B Power Off
6. BCDU 4B3 Heater Switch A Open
7. BCDU 4B3 Heater Switch B Open

JEM

ALL EVAs

ICS-EF Antenna
SSIPC
1. ICS MOD – OFF
2. ICS UPC – OFF
3. ICS HPA – OFF
4. ICS Stored Commands Cleared

EVA 2 NOTES, CAUTIONS, WARNINGS

NOTES

1. Bolt install: Report torque and turns
2. Bolt release: Report torque and turns if different from published range
3. 85-ft safety tether retract force may affect body positioning
4. Wire ties on Port CETA cart brake handles must be replaced if they are cycled or loaded
5. EV on Pallet is required to be static when SSRMS is in motion due to loads constraints
6. SSRMS brakes should be applied while the EV crew is performing Pallet ops

CAUTION

ISS Generic Constraints

A. Avoid inadvertent contact with
   1. Grapple fixture shafts (dry lube)
   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. ETCS radiator flexhoses and panels [S1,P1]
   7. EETCS/PV radiator flexhoses, bellows and panels [P6,P4,S4,S6]

B. 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

C. Other
   1. MLI handholds are not rated for crewmember translation loads

ISS Truss Constraints

A. Avoid inadvertent contact with
   1. CETA lights (Z-93 paint)
   2. Deployed TUS cable [Zenith and Nadir CETA rail]

B. Other
   1. WIS antennas: Do not use as handholds [NODE 1,LAB,P6,Z1]

CAUTION

ISS U.S. Pressurized Elements Constraints

A. Avoid inadvertent contact with
   1. TCS reflectors [PMA2,PMA3]
   2. APAS hardware [PMA2,PMA3]
   3. CETA lights (Z-93 paint) [LAB,S1,NODE 1]
   4. LAB and Cupola window shutters
   5. 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]

WARNING

ISS Generic Constraints

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

B. Sharp Edges
   1. Inner edges of WIF sockets
   2. APFR active WIF probes
   3. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM, RTAS, SARJ Covers); the end of the spring may protrude
   4. Keep hands away from SSRMS LEE/POA/SPDM LEE opening, snares, and PDGF curvic coupling (teeth)
   5. MMOD strikes on ISS exterior

C Thermal
   1. Turn off glove heaters when comfortable temperature reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on
   2. Uncovered trunnion pins may be hot
   3. SSRMS/MBS/SPDM operating cameras and lights may radiate large amounts of heat
   4. Do not touch EMU protective visor if temperature has been < -134 degF for > 15 min
   5. No EMU boot contact with foot restraint when temperature < -120 degF or > 200 degF
   6. 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

B. RF radiation exposure
   1. Stay 3.6 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. Nickel coated braided copper ground straps may contain frayed wires [P6,P4,S4,S6]

WARNING

ISS U.S. Pressurized Elements Constraints

A. Pinch
   1. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]
   2. LAB window shutter linkages during operation

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

C. Sharp Edges
   1. Port/Aft portion of A/L circular HR [HR 0506]
   2. A/L HR 0537 (Eq Lock Zenith)

D. 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
   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

E 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

EVA 2 TOOL CONFIGURATION

ISS Configuration
MT @ WS8 CETA Port/Stbd (Port reconfigured)
PALLET on SSRMS at P6
SSRMS on PDGF 3

Pre-EVA External 85-ft Safety Tether Configuration

EV1 blank anchor at P1 HR 3651, green at A/L FWD ext D-ring
EV2 blank anchor at P1 HR 3650, green at A/L AFT ext D-ring

NOTE: Prior to use, inspect the following hardware:
- ❑ Use RED RETs only
- ❑ RET cords for fraying
- ❑ Inspect Load Alleviating Straps and D-ring Extenders; ref CREW TETHER INSPECTIONS, ISS EVA Tasks Checklist 2.230.105:
  1. MMOD/general damage
  2. Discoloration
  3. Tack Stitching
  4. Red Band
- ❑ ISS Trash Bag: Bristle deformation/damage, after having stowed tools in trash bag
- ❑ Shuttle Trash Bag: Inspect frame for damage
- ❑ Inspect MWS End Effector Attachment Screws

Tether counts:	used	available
RET sm-sm (-381)	12	16
RET lg-sm (-385)	1	8
RET sm-sm pp (-383)	3	5
AET sm-sm	4 (2-Shuttle)	10
AET lg-sm	2	2
Fish Stringer	2	5

EV1 – Bowen
MWS √Tabs UP
- ☐☐ ISS Trash Bag
- ☐☐ 2 – Wire ties as tether loops
- ☐☐ RET w/PIP Pin
- ☐☐ RET w/PIP Pin
- ☐☐ Swing Arm (right side)
  - ☐☐ RET sm-sm
    - ☐☐ PGT s/n _____ (√MTL 30.5)
      - ☐☐ 6-in ext
- ☐☐ BRT (left side) √Tab UP
  - ☐☐ RET sm-sm
  - ☐☐ 2 – short wire ties

EMU Right D-ring
- ☐☐ 55-ft RED hook on D-ring, √locked
- ☐☐ D-ring Extender

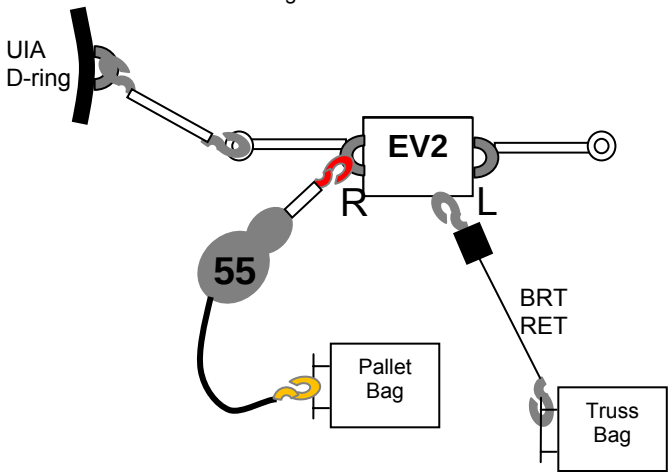
EMU Left D-ring
- ☐☐ D-ring Extender
  - ☐☐ Waist Tether (√locked)

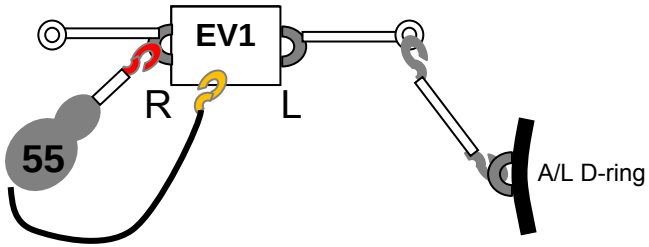
Wrists (one each)
- ☐☐ AET
- ☐☐ AET

EV2 – Bueno
MWS √Tabs UP
- ☐☐ 2 – Wire ties as tether loops
- ☐☐ RET w/PIP Pin
- ☐☐ RET sm-sm
- ☐☐ AET
- ☐☐ Swing Arm (right side)
  - ☐☐ RET sm-sm
    - ☐☐ PGT s/n _____ (√MTL 30.5)
      - ☐☐ 6-in ext
    - ■☐ Camera w/Bracket
- ☐☐ BRT (left side) √Tab UP
  - ☐☐ RET sm-sm
    - ☐■ C/L Bag – Truss
  - ☐☐ 2 – short wire ties

EMU Right D-ring
- ☐☐ 55-ft RED hook on D-ring, √locked
  - ☐■ C/L Bag – Pallet (on YELLOW hook)
- ☐☐ D-ring Extender
  - ☐☐ Waist Tether (√locked)

EMU Left D-ring
- ☐☐ D-ring Extender





EVA 2 TOOL CONFIGURATION (Cont)

EV2 BRT RET

- ☐■ **C/L Bag – Truss (T)**
  - Integral RETs
    - ☐■ MUT EE
    - ☐■ MUT EE
    - ☐■ Camera w/Bracket
  - Internal D-rings
    - ☐■ RET sm-sm
      - ☐■ Ballstack
        - ☐■ AET(both hooks on tether loop)
    - ☐☐ RET sm-sm
      - ☐☐ ISS trash bag
  - External D-rings
    - ☐☐ AET (Lg-sm)

EV2 Yellow Anchor Hook

- ☐■ **C/L Bag – Pallet (P)**
  - Integral RETs
    - ☐☐ Ratchet wrench w/o palm wheel
      - ☐☐ 2-in ext
    - ☐■ Square scoop
    - ☐■ Square scoop
    - ☐■ Square scoop
  - Internal D-rings
    - ☐☐ RET sm-sm
      - ☐☐ Sq Torque Multiplier w/7/16 rec
    - ☐☐ RET sm-sm
      - ☐■ Square scoop
    - ☐☐ RET sm-sm
      - ☐☐ Socket Caddy
        - ☐☐ 2-in ext
  - External D-rings
    - ☐☐ AET Lg-sm
    - ☐☐ RET sm-sm

P6 HR 5329

- ■☐ **C/L Bag – Truss**

P6 HR 5328

- ■☐ **C/L Bag – Pallet**

ICC-VLD Battery

- ■☐ Square Scoop
- ■☐ Square Scoop

P6 IEA Battery

- ■☐ Square Scoop
- ■☐ Square Scoop

P6 HR 5329 or 5355

- ■☐ MUT EE
  - ■☐ Ballstack
    - ■☐ MUT EE
    - ■☐ RET sm-sm
    - ■☐ AET (attached to HR)

Crewlock

- ☐☐ Spare Safety Tether Pack
- ☐☐ RET Lg-sm (A/L stowage)
  - ☐☐ Rnd Scoop
    - ☐☐ PUMAA
      - ☐☐ RET sm-sm
      - ■☐ PDGF
- ☐☐ RET Lg-sm
  - ☐☐ camera w/bracket
- ☐☐ RET Lg-sm

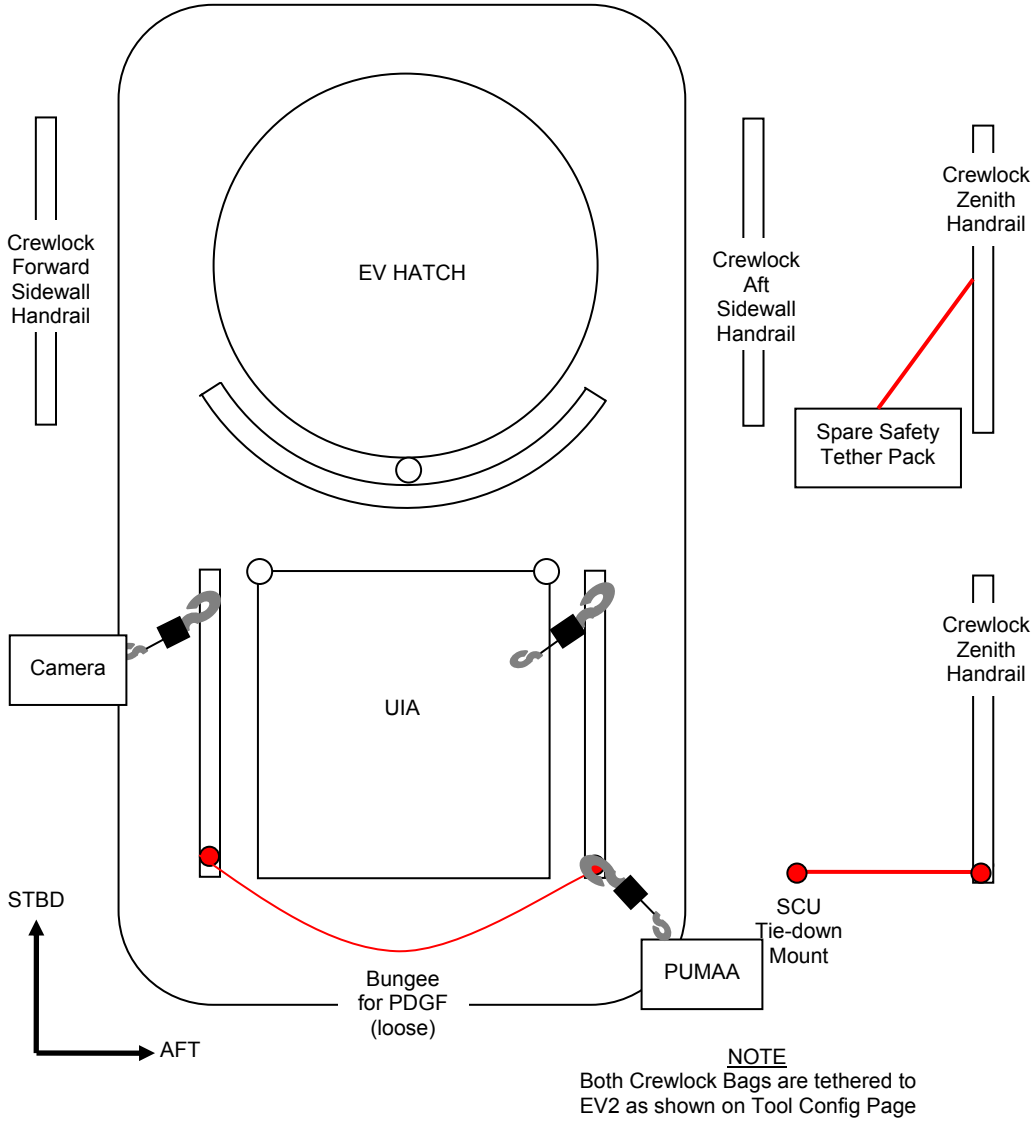
Staging Bag

- ☐☐ Fish Stringer #1
  - ☐☐ Wire Tie Caddy (hook #1)
    - ☐☐ 9 wire ties
  - ☐☐ Velcro/Tape Caddy (hook #2)
  - ☐☐ PGT (hook #3) s/n _____
    - ☐☐ PGT Battery s/n _____
  - ☐☐ Vise Grips (hook #4)
  - ☐☐ Ratchet Wrench (hook #5)
    - ☐☐ 6-in (wobble) ext
  - ☐☐ 3 – Long duration tie down tethers, hooked together (hook #6)
  - ☐☐ WIF Adapter (hook #7)
- ☐☐ Fish Stringer #2
  - ☐☐ ERAD (hook #1) s/n _____
  - ☐☐ Connector Cleaner Tool Kit (hook #2)
  - ☐☐ Pin Straightener Assy (hook #3)
  - ☐☐ Probe (hook #4)
  - ☐☐ **Prybar** (hook #5)
  - ☐☐ Needle-nose Pliers (hook #6)
  - ☐☐ Cheater bar (hook #7)
  - ☐☐ MWS Key Strap Assy (on wire tie, to strap)

IV Bag

- ☐☐ Ammonia Contamination Cue Card
- ☐☐ 2 – Towels
- ☐☐ Contamination Detection Kit
- ☐☐ RET (sm-sm) (Black)
  - ☐☐ 2 – DCM Plug (SAFER Hardmount)
- ☐☐ RET (sm-sm) (Black)
  - ☐☐ 2 – GP Caddy
    - ☐☐ 2 – Thermal Mitten (pair)
- ☐☐ RET (sm-sm) (Black)
  - ☐☐ Socket Caddy
    - ☐☐ 1/2-in (wobble) Socket – 8 ext
    - ☐☐ 7/16-in (wobble) Socket – 6 ext

EVA 2 TOOL CONFIGURATION (Cont)



EVA 2 EGRESS/SETUP (00:25)

IV	EV1 (BOWEN)	EV2 (GOOD)
	INITIAL CONFIGURATION – POST DEPRESS (00:05) 1. Waist tether (on left D-ring ext) to A/L D-ring ❑ √Gate closed ❑ √Hook locked	INITIAL CONFIGURATION – POST DEPRESS (00:05) 1. Waist tether (on right D-ring ext) to UIA D-ring ❑ √Gate closed ❑ √Hook locked
	WARNING Sharp Edges: Port/Aft portion of A/L circular HR [HR 0506]	
1. WVS Software: Select page – RF camera Sel 'Advanced Controls' S-Band Level (two) – Max	EGRESS/SETUP (00:25) 2. Open hatch thermal cover ____ : ____ 3. Egress airlock 4. Attach 55-ft **YELLOW** anchor hook to 85-ft ERCM on FWD D-ring ❑ √Gate closed ❑ √Hook locked 5. Attach FWD 85-ft **GREEN** alleviator hook to D-ring EXT (R) ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked ❑ Inspect load alleviator strap 6. Give EV2 GO to transfer EV1's waist tether from A/L D-ring 7. Receive Pallet Bag: Stow on BRT 8. Attach EV2 55-ft **YELLOW** anchor hook to 85-ft ERCM on AFT D-ring ❑ √Gate closed ❑ √Hook locked 9. Attach AFT 85-ft **GREEN** alleviator hook to EV2's right D-ring extender ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked ❑ Inspect load alleviator strap 10. Give EV2 GO to release EV2's waist tether from UIA D-ring 11. Check EV2 55-ft **RED** alleviator hook to right D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 12. Check EV2 SAFER config ❑ √L handle down (MAN ISO Vlv-Open) ❑ √R handle down (HCM-Closed) 13. Check EV2 MWS tabs up 14. Translate to P1 HR 3651 15. Verify blank anchor ❑ √Gate closed ❑ √Hook locked 16. Verify EV2 blank anchor (P1 HR 3650) ❑ √Gate closed ❑ √Hook locked	EGRESS/SETUP (00:25) 2. On EV1 GO, transfer EV1's waist tether from A/L D-ring to EV1 3. Transfer Pallet Bag to EV1 4. On EV1 GO, retrieve waist tether from UIA 5. Egress crewlock with Truss bag 6. Retrieve Truss Bag; stow on BRT 7. Check EV1 55-ft **RED** alleviator hook to right D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 8. Check EV1 SAFER config ❑ √L handle down (MAN ISO Vlv-Open) ❑ √R handle down (HCM-Closed) 9. Check EV1 MWS tabs up 10. Close hatch thermal cover ____ : ____

EVA 2 WORKSITE PREP (01:00)

IV	EV1 (BOWEN)	EV2 (GOOD)
	WARNING Uncovered trunnion pins may be hot Verify gauntlets in place prior to translating outboard of SARJ Maintain 2-ft KOZ from rotating Solar array beta gimbal If APFR Ingress Aid handle left extended for more than 1.5 hr, limit contact	
	CAUTION Avoid inadvertent contact with grapple fixture shafts Avoid contact with PALLET keel camera target Keep Battery fins away from structure	
	WORKSITE PREP (01:00) 1. Translate to P6 5386; drop **GREEN** hook 2. Stow Pallet bag P6 5328 3. Fairlead at P6 5328 with AET 4. **Glove and gauntlet inspection** 5. Reconfigure the following hardware: ❑ Move APFR in WIF 10 to WIF 12 [6,NN,F,6] ❑ Inspect WIF 12 adapter plate ❑ Verify 4 bolts present ❑ Verify bolt/washers flush to plate ❑ Verify lock collar black on black ❑ Perform pull/twist test, verify no WIF motion ❑ Move APFR in WIF 22 to WIF 17 [12,QQ,F,12] ❑ Verify lock collar black on black ❑ Perform pull/twist test ❑❑ Move 2 gap spanner chains 6. Retrieve sq scoops (2) from Pallet bag 7. Install scoops on Batt 1	WORKSITE PREP (01:00) 1. Translate to P6 HR 5316; drop **GREEN** hook 2. Fairlead (weave between) P6 HRs 5336, 5337, 5338; Fairlead at P6 5338 with AET 3. Stow Truss bag P6 HR 5329 4. **Glove and gauntlet inspection** 5. Install MUT EE (2) and ballstack on HR 5329 ❑ √AET from Ballstack to HR 5329 ❑ √MUT 1 paddles out ❑ √MUT 1 locked ❑ √MUT 1 black on black ❑ √MUT 2 black on black ❑ √RET on ballstack ❑ √Verify pull test 6. Retrieve ratchet w/2-in ext from Pallet bag 7. Break torques on truss batteries Batt 1: ☐H1 ☐H2 ☐retorque H2 Batt 2: ☐H1 ☐H2 ☐retorque H2 Batt 3: ☐H1 ☐H2 ☐retorque H2 Batt 4: ☐H1 ☐H2 ☐retorque H2 Batt 5: ☐H1 ☐H2 ☐retorque H2 Batt 6: ☐H1 ☐H2 ☐retorque H2 8. Stow ratchet in Pallet bag
 1. Give **MCC-H** GO to unlock 2B BGA when gap spanner and APFR retrieval complete		

EVA 2 TEMP STOW BATTERY (00:35)

IV	EV1 (BOWEN)	EV2 (GOOD)
	WARNING Battery fins are sharp and should be avoided	
	CAUTION Minimize loads into Battery H1 fixture	
	MOVE BATT IN SLOT 1 TO TEMP STOW LOCATION (00:35) 1. Check gap spanner position 2. Assist EV2 as required 3. Reconfigure APFR [12,QQ,H,11] YAW 1 click left ROLL 2 clicks left 4. Install H2 scoop on MUT2 ❑ √MUT 2 paddles out ❑ √MUT 2 locked ❑ RET from MUT 2 to battery tether point ❑ Release EV2's RET from battery ❑ √Verify fins pointing nadir, clear of structure 5. Translate to WIF 12; ingress APFR	MOVE BATT IN SLOT 1 TO TEMP STOW LOCATION (00:35) 1. Verify P6 WIF 17 APFR [12,QQ,F,12]; ingress 2. **RET to Battery** 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 5-6 turns Turns: _____ Release H2 16-17 turns Turns: _____ 4. Remove Battery 5. Present H2 scoop to EV1 6. Guide Battery while EV1 stows 7. Egress APFR; reconfigure to [12,QQ,F,12] 8. Retrieve camera from Truss bag; temp stow on HR 5335 9. Retrieve Pallet Bag
	NOTE EV on Pallet is required to be static when SSRMS is in motion due to loads constraints. SSRMS brakes should be applied while the EV crew is performing Pallet ops	
	6. GCA pallet to Battery A 7. If required: **PGT [A7 (9.2), CCW2]**,TM; break torque H1 and H2, 5 turns at PGT	10. Translate onto Pallet when in range; stow pallet bag 11. Open battery MLI

EVA 2 BATTERY A/2 R&R (01:05)

IV	EV1 (BOWEN)	EV2 (GOOD)
Truss APFR Settings: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4: WIF 25 [4,QQ,L,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 6 (Big G): WIF 21 [12,QQ,J,12] (roll 5 clicks left)	REMOVE BATTERY **A** FROM PALLET 1. Install scoops (per diagram) 2. RET to battery 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 4. Remove battery 5. Transfer battery to EV2 6. √Gold stanchion inserts present 7. Shepherd to install location	REMOVE BATTERY **A** FROM PALLET 1. Open MLI on **next** battery 2. If required: **PGT [A7 (9.1), CCW2]**, TM; break torque on batteries not completed on previous EVA; √TM locked, anti-back drive in neutral 3. Translate off of Pallet 4. Check tethers clear, GCA Pallet away to clearance position 5. Receive battery from EV1 6. Shepherd battery to install location
Pallet APFR Settings: Slot A: WIF 12 [6,NN,F,6] Slot B to F: WIF 12 [6,QQ,H,6]	INSTALL BATTERY **A** INTO TRUSS SLOT **1** 8. Transfer control of battery to EV2 9. **FOD check battery** 10. **Glove/gauntlet/configuration inspection** 11. Check gap spanner position on **next** battery 12. Relocate scoops to next battery	INSTALL BATTERY **A** INTO TRUSS SLOT **1** 7. Ingress APFR 8. **FOD check Truss** 9. RET to battery; receive control from EV1 10. Soft dock battery 11. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 12. **Glove/gauntlet/configuration inspection** 13. Reconfig APFR to WIF 29, settings: [12,QQ,F,12] Verify locking collar black on black; perform pull/twist test; ingress
	REMOVE BATTERY **2** FROM TRUSS 13. Assist EV2 as required; GCA battery removal 14. Receive battery from EV2 15. Shepherd battery to pallet APFR	REMOVE BATTERY **2** FROM TRUSS 14. RET to battery 15. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 16. Remove battery; transfer to EV1 17. Shepherd battery to pallet APFR
	INSTALL BATTERY **2** INTO PALLET SLOT **A** 16. Verify Pallet APFR configuration; ingress 17. **FOD check Pallet** 18. RET to battery; receive control from EV2 19. Soft dock battery 20. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 21. Remove scoops and fold over MLI flap 22. Check ingress aid. After Pallet maneuvers to Battery B setup, GCA for battery removal	INSTALL BATTERY **2** INTO PALLET SLOT **A** 18. Transfer control of battery to EV1 19. **FOD check battery** 20. GCA Pallet to install position; translate onto Pallet 21. Translate off of Pallet, check tethers clear 22. Reconfigure APFR WIF 12 for Battery B, settings [6,QQ,H,6] 23. Translate back onto pallet after GCA

EVA 2 BATTERY B/3 R&R (01:05)

IV	EV1 (BOWEN)	EV2 (GOOD)
Truss APFR Settings: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4: WIF 25 [4,QQ,L,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 6 (Big G): WIF 21 [12,QQ,J,12] (roll 5 clicks left) **Pallet APFR Settings:** Slot A: WIF 12 [6,NN,F,6] Slot B to F: WIF 12 [6,QQ,H,6]	REMOVE BATTERY **B** FROM PALLET 1. Install scoops (per diagram) 2. RET to battery 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 4. Remove battery 5. Transfer battery to EV2 6. √Gold stanchion inserts present 7. Shepherd to install location	REMOVE BATTERY **B** FROM PALLET 1. Open MLI on **next** battery 2. If required: **PGT [A7 (9.1), CCW2]**, TM; break torque on batteries not completed on previous EVA; √TM locked, anti-back drive in neutral 3. Translate off of Pallet 4. Check tethers clear, GCA Pallet away to clearance position 5. Receive battery from EV1 6. Shepherd battery to install location
	INSTALL BATTERY **B** INTO TRUSS SLOT **2** 8. Transfer control of battery to EV2 9. **FOD check battery** 10. **Glove/gauntlet/configuration inspection** 11. Check gap spanner position on **next** battery 12. Relocate scoops to next battery	INSTALL BATTERY **B** INTO TRUSS SLOT **2** 7. Ingress APFR 8. **FOD check Truss** 9. RET to battery; receive control from EV1 10. Soft dock battery 11. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 12. **Glove/gauntlet/configuration inspection** 13. Reconfig APFR to WIF 25, settings: [12,QQ,F,12] Verify locking collar black on black; perform pull/twist test; ingress
	REMOVE BATTERY **3** FROM TRUSS 13. Assist EV2 as required; GCA battery removal 14. Receive battery from EV2 15. Shepherd battery to pallet APFR	REMOVE BATTERY **3** FROM TRUSS 14. RET to battery 15. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16, Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 16. Remove battery; transfer to EV1 17. Shepherd battery to pallet APFR
	INSTALL BATTERY **3** INTO PALLET SLOT **B** 16. Verify Pallet APFR configuration; ingress 17. **FOD check Pallet** 18. RET to battery; receive control from EV2 19. Soft dock battery 20. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 21. Remove scoops and fold over MLI flap 22. Check ingress aid, GCA Pallet to next battery	INSTALL BATTERY **3** INTO PALLET SLOT **B** 18. Transfer control of battery to EV1 19. **FOD check battery** 20. GCA Pallet to install position; translate onto Pallet 21. Check tethers clear 22. Close MLI and ¼-turn fasteners

EVA 2 BATTERY C R&R (00:35)

IV	EV1 (BOWEN)	EV2 (GOOD)
Truss APFR Settings: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4: WIF 25 [4,QQ,L,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 6 (Big G): WIF 21 [12,QQ,J,12] (roll 5 clicks left) **Pallet APFR Settings:** Slot A: WIF 12 [6,NN,F,6] Slot B to F: WIF 12 [6,QQ,H,6]	<u>REMOVE BATTERY **C** FROM PALLET</u> 1. Install scoops (per diagram) 2. RET to battery 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 4. Remove battery 5. Transfer battery to EV2 6. √Gold stanchion inserts present 7. Shepherd to install location	<u>REMOVE BATTERY **C** FROM PALLET</u> 1. If required: **PGT [A7 (9.1), CCW2]**, TM; break torque on batteries not completed on previous EVA; √TM locked, anti-back drive in neutral 2. Translate off of Pallet 3. Check tethers clear, GCA Pallet away to clearance position 4. Receive battery from EV1 5. Shepherd battery to install location
	<u>INSTALL BATTERY **C** INTO TRUSS SLOT **3**</u> 8. Transfer control of battery to EV2 9. **FOD check battery** 10. **Glove/gauntlet/configuration inspection**	<u>INSTALL BATTERY **C** INTO TRUSS SLOT **3**</u> 6. Ingress APFR 7. **FOD check Truss** 8. RET to battery; receive control from EV1 9. Soft dock battery 10. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 11. **Glove/gauntlet/configuration inspection**

EVA 2 INSTALL TEMP-STOWED BATTERY ON PALLET (00:35)

IV	EV1 (BOWEN)	EV2 (GOOD)
	INSTALL TEMP-STOWED BATTERY ON PALLET (00:35) 1. Attach EV2's RET to battery 2. Release Ballstack RET from battery, stow on MUT 2 3. Unlock MUT 2; release from scoop 4. Shepherd battery to Pallet APFR 5. Ingress APFR; **FOD check pallet** 6. RET to battery 7. Soft dock battery 8. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____	INSTALL TEMP-STOWED BATTERY ON PALLET (00:35) 1. Transfer RET to EV1 2. Shepherd battery to Pallet APFR 3. Transfer control of battery to EV1; remove RET 4. **FOD check battery** 5. GCA Pallet to install position 6. Translate to pallet when in range 7. Assist EV1 with install

EVA 2 EVA 3 PREP/CLEANUP (00:30)

IV	EV1 (BOWEN)	EV2 (GOOD)
Truss bag – stowed on P6 HR 5329 Internal D-rings ☐ RET sm-sm ☐ ISS trash bag External D-rings ☐ AET Lg-Sm Pallet bag – stowed on P6 HR 5328 Integral RETs ☐ Ratchet wrench ☐ 2-in ext Internal D-rings ☐ RET sm-sm ☐ Sq Torque Multiplier w/7/16 in rec ☐ RET sm-sm ☐ Socket Caddy ☐ 2-in ext ☐ RET sm-sm External D-rings ☐ AET Lg-Sm ☐ RET sm-sm P6 HR 5329 or 5355 ☐ MUT EE #1 ☐ Ballstack ☐ MUT EE #2 ☐ RET sm-sm (from ballstack to MUT #2) ☐ AET (from ballstack to HR 5329 or 5355) ICC-VLD Battery ☐☐ Square Scoops (2) P6 IEA Battery ☐☐ Square Scoops (2)	EVA 3 PREP AND CLEANUP (00:30) 1. Remove scoops and transfer to EV2 2. Receive Pallet bag from EV2; stow on BRT 3. Perform Pallet bag tool inventory 4. Egress APFR; verify APFR ingress aid stowed ❑ Handle retracted ❑ Stowed against boot plate 5. Stow Pallet bag at P6 HR 5328 ❑ √Pallet bag secure between HRs 5328 and 5336 ❑ √Doors facing structure 6. Check all tethers clear, GCA Pallet to clearance position 7. Give IV GO to maneuver pallet to “Overnight Park” 8. Assist EV2 with EVA 3 prep 9. Retrieve fairlead(s) 10. **Glove and gauntlet inspection** 11. **Perform personal tool inventory:** MWS ☐ ISS Trash Bag ☐☐ 2 – Wire ties as tether loops ☐☐ 2 – RET w/PIP Pin ☐ Swing Arm (right side) ☐ RET sm-sm ☐ PGT ☐ 6-in ext ☐ BRT (left side) ☐ RET sm-sm ☐☐ 2 – short wire ties Wrists ☐☐ 2 – AET 12. Translate to P6 5386, retrieve **GREEN** alleviator hook	EVA 3 PREP AND CLEANUP (00:30) 1. Open MLI on next battery; install scoops 2. Transfer Pallet bag to EV1 3. Break torque on remaining batteries (as applicable) 4. Close MLI on all batteries and 1/4-turn fasteners (as applicable) 5. Translate off Pallet 6. Perform Truss bag inventory 7. Verify Truss bag at P6 HR 5329 ❑ √Truss bag secure between HRs 5329 and 5338 ❑ √Doors facing structure 8. Relocate MUT-Ballstack-MUT to HR 5355 (get-ahead) ❑ √AET from Ballstack to HR 5355 ❑ √MUT 1 paddles out ❑ √MUT 1 locked ❑ √MUT 1 black on black ❑ √MUT 2 black on black ❑ √RET on Ballstack for Battery ❑ √Verify pull test 9. Configure Truss APFR for EVA 3 (get-ahead) 10. Retrieve fairlead(s) 11. Retrieve camera; stow on swing arm 12. **Glove and gauntlet inspection** 13. **Perform personal tool inventory:** MWS ☐☐ 2 – Wire ties as tether loops ☐ RET w/PIP Pin ☐ RET sm-sm ☐ AET ☐ Swing Arm (right side) ☐ RET sm-sm ☐ PGT ☐ 6-in ext ☐ Camera w/bracket ☐ BRT (left side) ☐ RET sm-sm ☐☐ 2 – short wire ties 14. Translate to P6 HR 5316, retrieve **GREEN** alleviator hook

EVA 2 CLEANUP/INGRESS (00:30)

IV	EV1 (BOWEN)	EV2 (GOOD)
	TRANSLATE/INGRESS (00:30) 1. Translate to A/L	TRANSLATE/INGRESS (00:30) 1. Translate to A/L 2. Open thermal cover _____:_____ 3. Attach waist tether to UIA D-ring ext ❑ √Gate closed ❑ √Hook locked 4. Attach EV2 85-ft **GREEN** hook to AFT external A/L D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked
1. Pre crew ingress: Perform WVS PWRDN (PHOTO/TV, WVS CUE CARD)	2. Attach left waist tether to A/L D-ring extender ❑ √Gate closed ❑ √Hook locked 3. Attach 85-ft **GREEN** hook to FWD external A/L D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 4. Release 55-ft **YELLOW** anchor, stow on MWS 5. Ingress A/L 6. Close thermal cover; attach Velcro strap _____ : _____ 7. Connect SCU to DCM; √SCU locked	5. Release 55-ft **YELLOW** anchor, stow on MWS 6. Ingress A/L 7. Connect SCU to DCM; √SCU locked
	NOTE A Thermal Control Valve setting of 8 – Max C minimizes time for SCU cooling	
	8. WATER – OFF (fwd), expect H2O IS OFF msg	8. WATER – OFF (fwd), expect H2O IS OFF msg
	CAUTION Do not close hatch until EMU Water OFF for 2 min. Verify outer hatch clear of hardware	
	9. Verify outer hatch clear of hardware 10. EV Hatch – verify handle position per hatch decal; close and lock 11. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card)	9. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card)

EVA 2 – TASK DATA

Estimated Task Duration:

	With SSRMS	Without RMS
One EV Crew	N/A	N/A
Two EV Crew	N/A	05:00 for 3 batteries

ORU Identification:

ORU	Mass	Part number	Serial Number
Battery	367.38	RE1804-12	See layout below

Tools:

EV1 (FF)	EV2 (FF)
PGT	PGT
TM w/7/16 rec	TM w/7/16 rec
6-in wobble ext	6-in wobble ext
Sq Scoops (2)	Sq Scoops (2)
MUTEE/BS/MUTEE	Ratchet wrench w/2-in ext

Foot Restraints (APFR):

Task	WIF	APFR Setting
Battery R&R	Ref cue card	Ref cue card
For Truss:		
Slot 1:	WIF 17	[12,QQ,F,12]
Slot 2:	WIF 29	[12,QQ,F,12]
Slot 3:	WIF 25	[12,QQ,F,12]
Slot 4 (Bueno):	WIF 25	[4,QQ,L,12]
Slot 4 (Big G):	WIF 32	[9,PP,A,12]
Slot 5 (Big G):	WIF 21	[12,QQ,D,12]
Slot 5 (Bueno):	WIF 29	[9,PP,C,12]
Slot 6 (Big G):	WIF 21	[12,QQ,J,12]
Slot 6 (Bueno):	WIF 21	[9,PP,C,12]
For Pallet:		
A	WIF 12	[6,NN,F,6]
B thru F	WIF 12	[6,QQ,H,6]

Note:

Truss APFR settings only apply to nominally planned crewmember unless stated. Alternate WIF and/or APFR setting may be required for other crewmember performing Truss battery install/removal

Warning:

Battery fins are sharp and should be avoided

Caution:

Keep Battery fins away from structure

Fasteners: All settings at 30 RPM

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque Inst/Rmvl (ft-lb)	Turns	PGT Setting
IEA							
H1	7/16	6	25.5	29.2/9.2	84.6/93.2	5-6	B7 REL B7 INST
H2 (jacking)	7/16	6	25.5	31/9.2	69.8/93.2	16-17	B7 REL B7 INST
ICC-VLD							
H1	7/16	6	25.5	29.2/9.2	70	5-6	A7W/TM/ B7 REL B7 INST
H2 (jacking)	7/16	6	25.5	31/9.2	70	18	A7W/TM/ B7 REL B7 INST

TOP

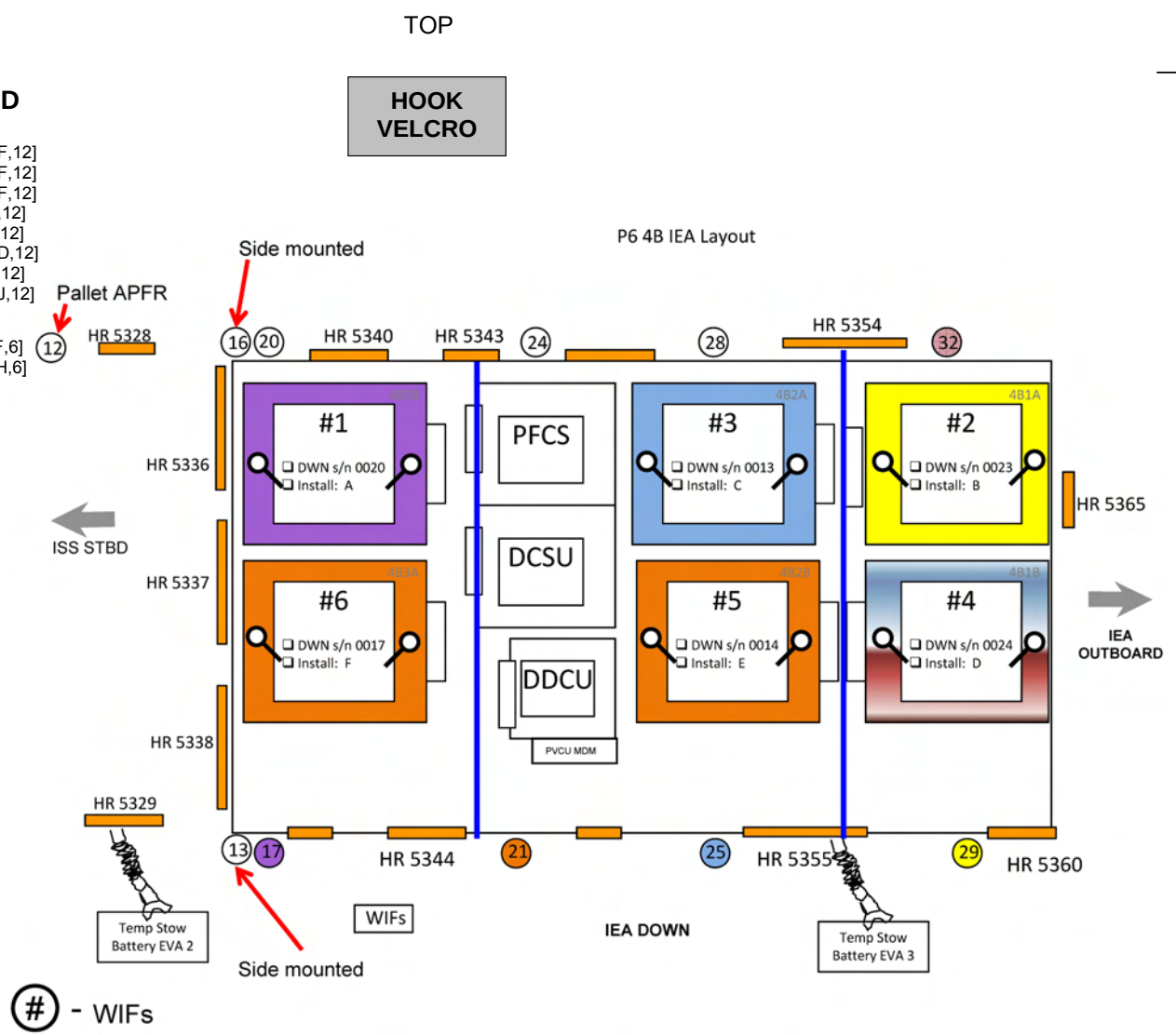
BATTERY R&R CUE CARD

FOR TRUSS:

SLOT 1:	WIF 17	[12,QQ,F,12]
SLOT 2:	WIF 29	[12,QQ,F,12]
SLOT 3:	WIF 25	[12,QQ,F,12]
SLOT 4 (BUENO):	WIF 25	[4,QQ,L,12]
SLOT 4 (BIG G):	WIF 32	[9,PP,A,12]
SLOT 5 (BIG G):	WIF 21	[12,QQ,D,12]
SLOT 5 (BUENO):	WIF 29	[9,PP,C,12]
SLOT 6:	WIF 21	[12,QQ,J,12]

FOR PALLET:

A	WIF 12	[6,NN,F,6]
B thru F	WIF 12	[6,QQ,H,6]



EVA-6a/132/O/A

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TOP
BACK OF 'BATTERY R&R CUE CARD'

HOOK VELCRO

Pallet Break Torque [A7,CCW2]:

H1: ☐A ☐B ☐C ☐D ☐E ☐F

H2: ☐A ☐B ☐C ☐D ☐E ☐F

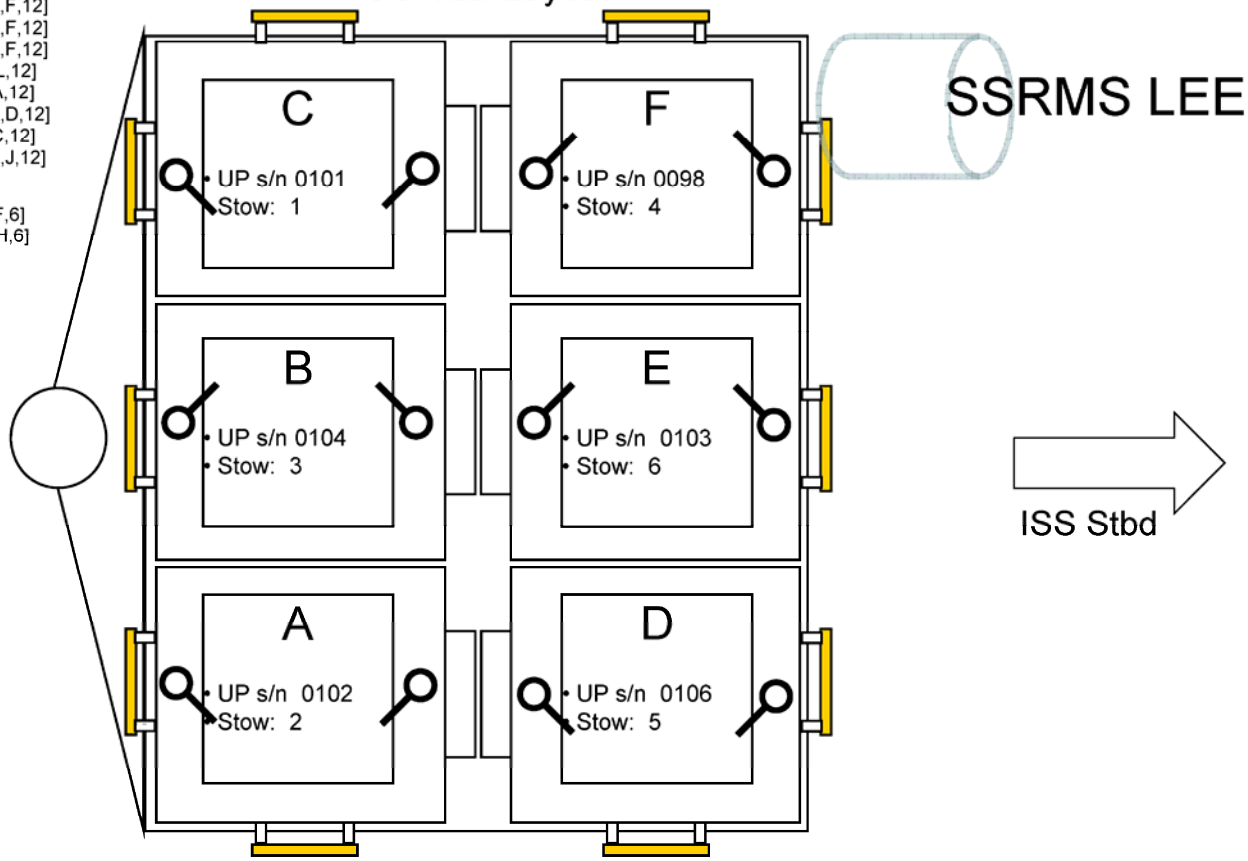
FOR TRUSS:

SLOT 1:	WIF 17	[12,QQ,F,12]
SLOT 2:	WIF 29	[12,QQ,F,12]
SLOT 3:	WIF 25	[12,QQ,F,12]
SLOT 4 (BUENO):	WIF 25	[4,QQ,L,12]
SLOT 4 (BIG G):	WIF 32	[9,PP,A,12]
SLOT 5 (BIG G):	WIF 21	[12,QQ,D,12]
SLOT 5 (BUENO):	WIF 29	[9,PP,C,12]
SLOT 6:	WIF 21	[12,QQ,J,12]

FOR PALLET:

A	WIF 12	[6,NN,F,6]
B thru F	WIF 12	[6,QQ,H,6]

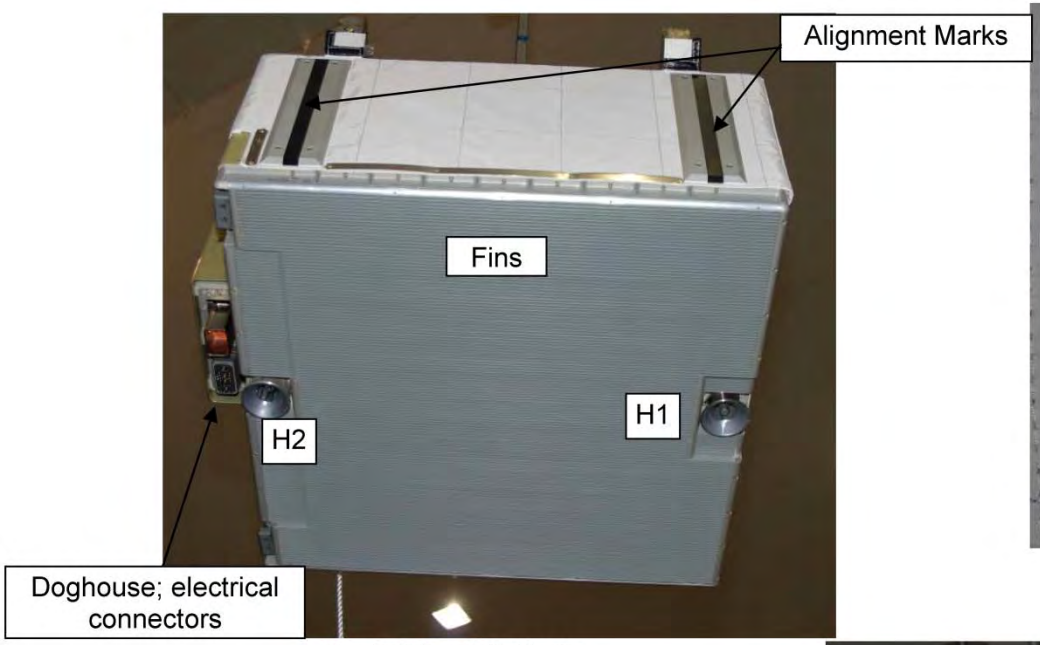
ICC-VLD Layout



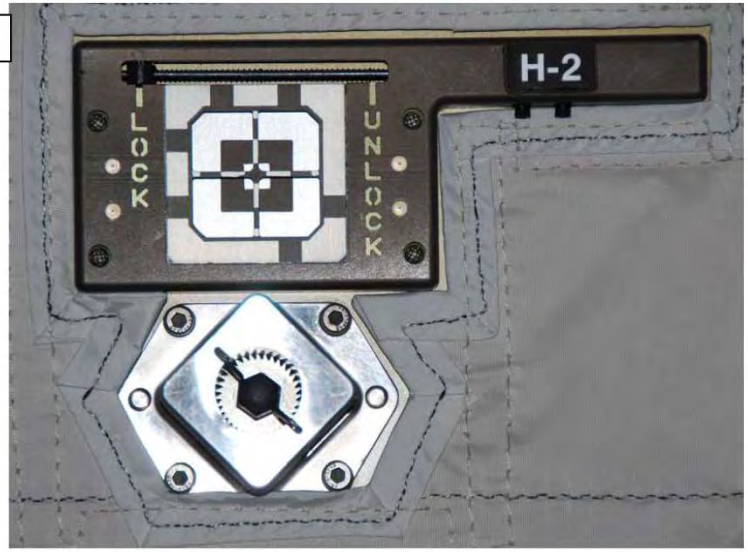
EVA-6b/132/O/A

(reduced copy)

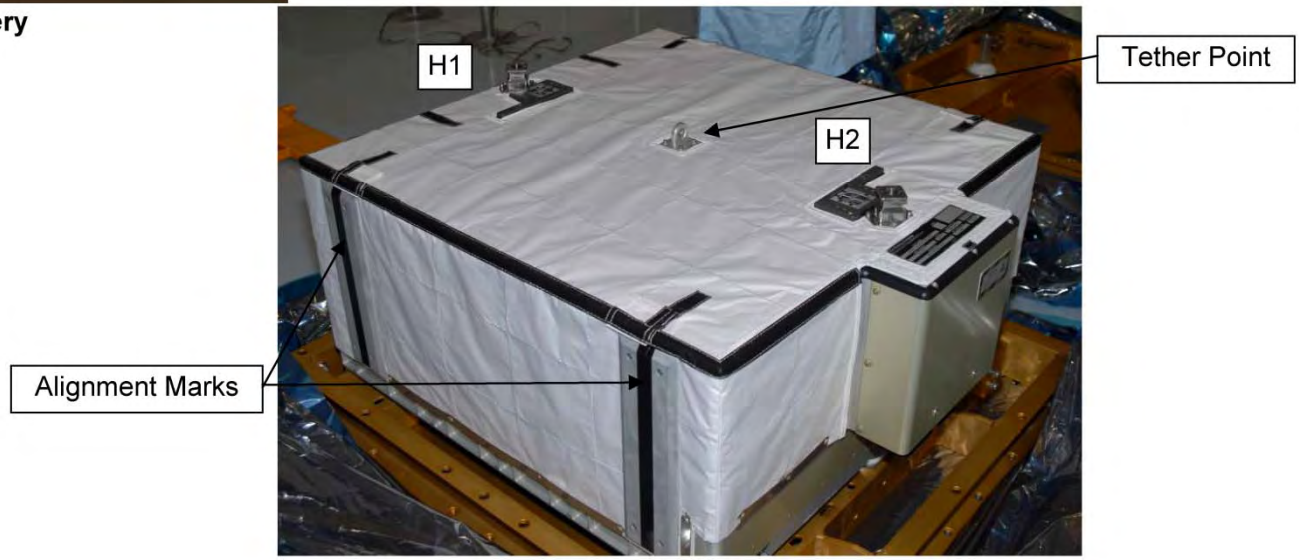
EVA 2 – TASK DATA (Cont)



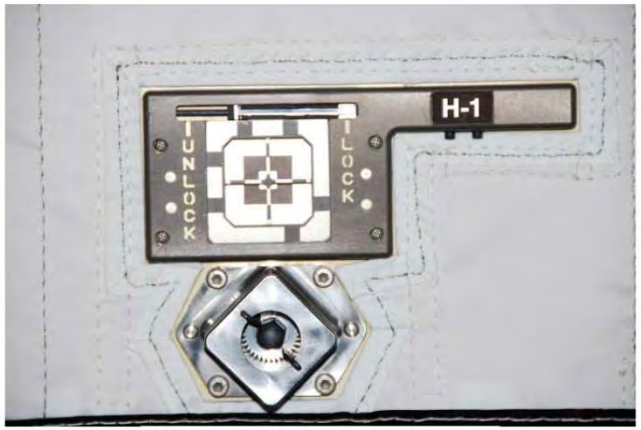
Backside of Battery (to Structure)



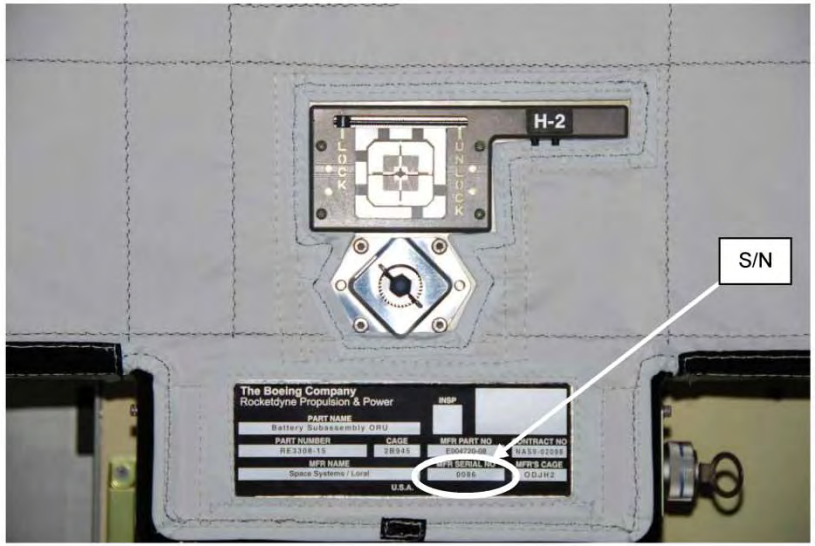
Lock/Unlock Indicator



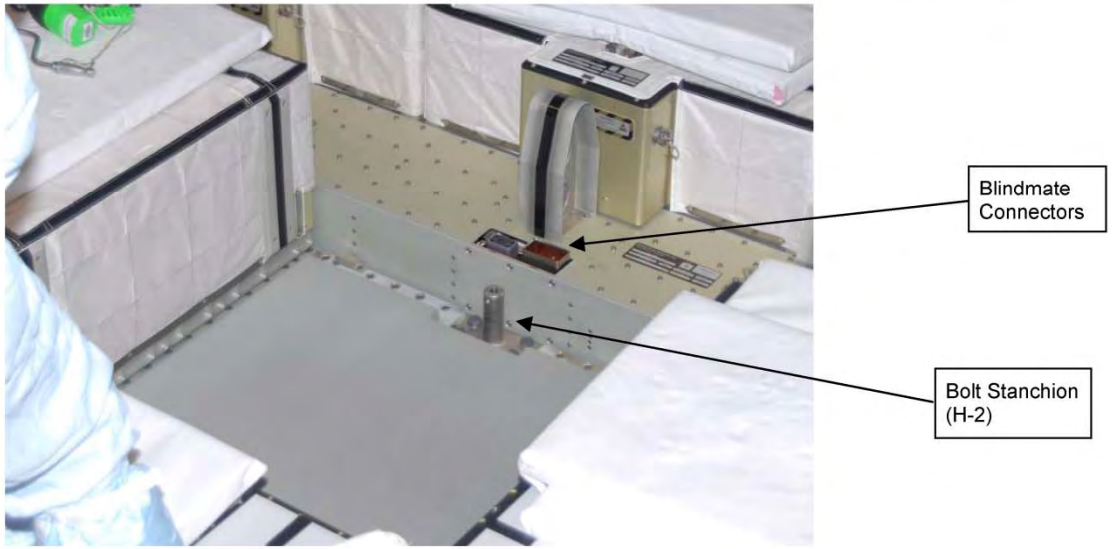
Top of Battery



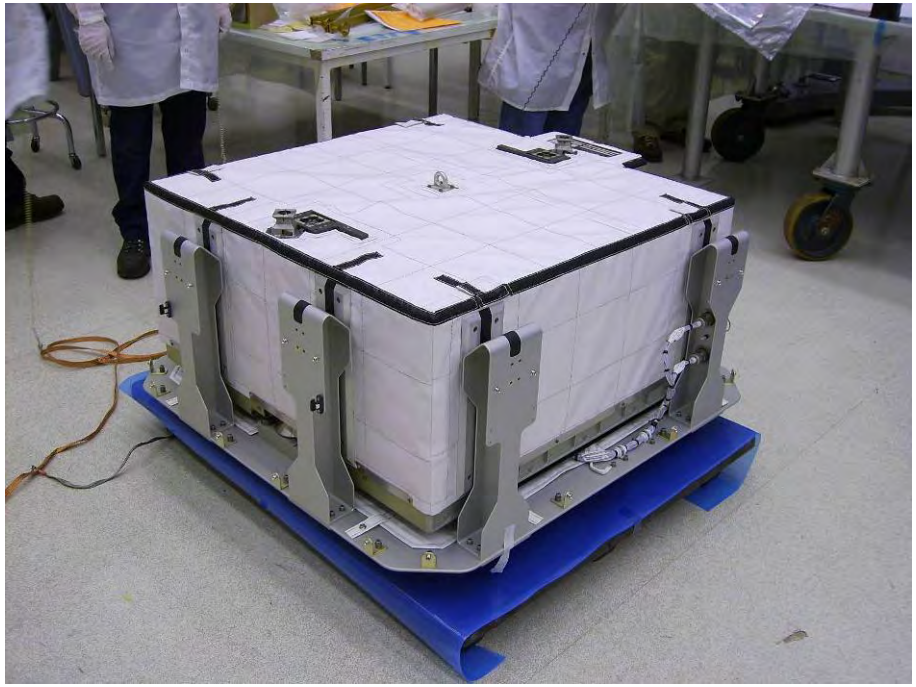
H-1



H-2 Lock/Unlock Indicator



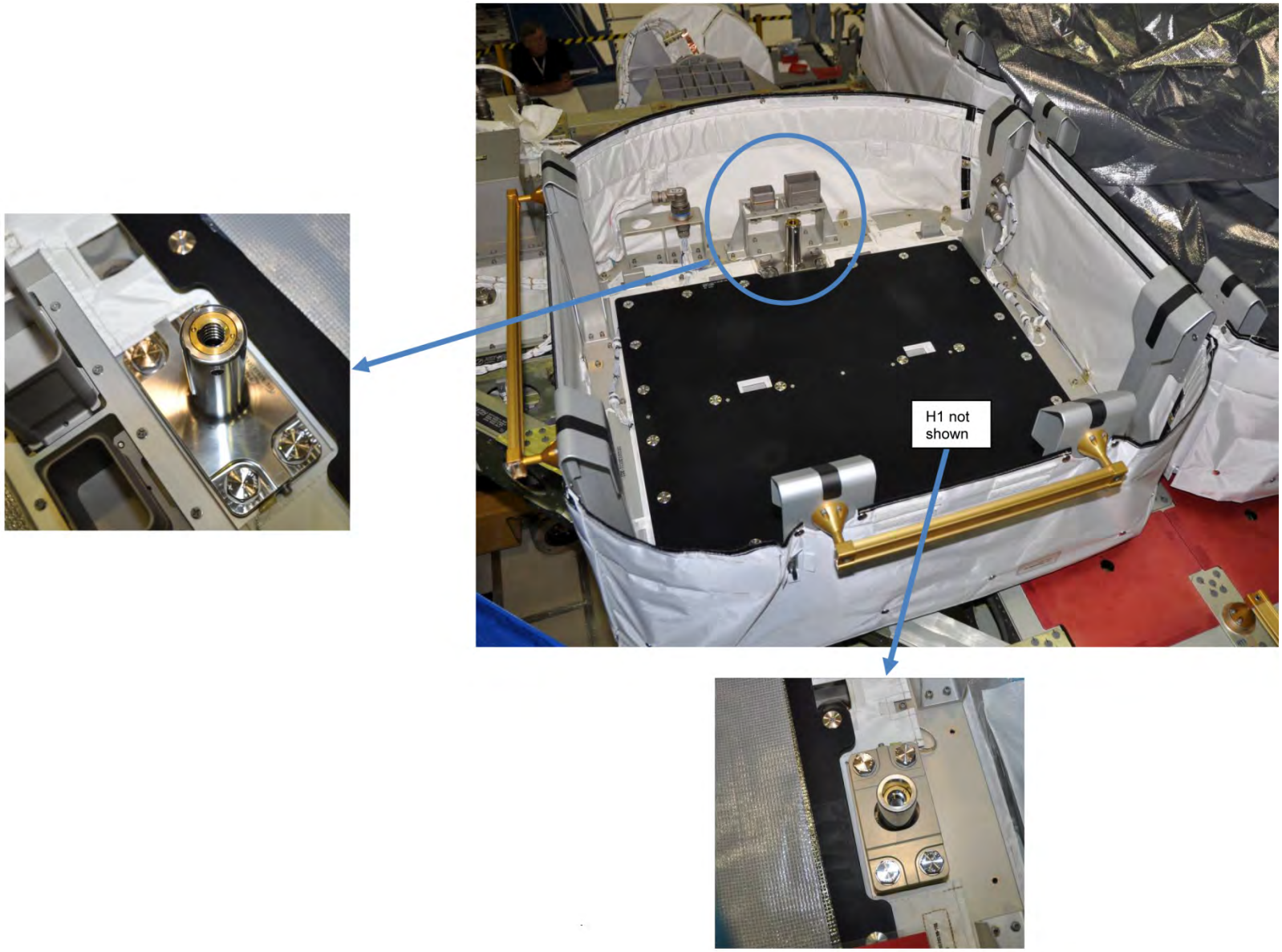
IEA Interface



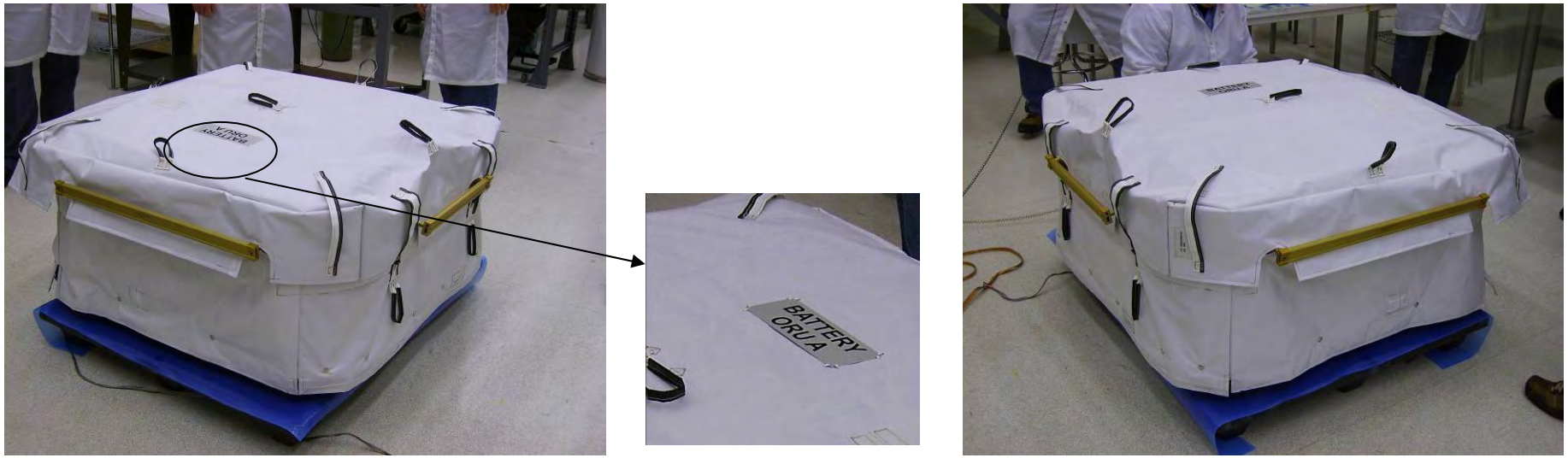
Battery Installed on FSE

EVA 2 – TASK DATA (Cont)

BATTERY FSE SHEAR PIN YELLOW STANCHION



EVA 2 – TASK DATA (Cont)



FSE MLI

EVA 2 GET-AHEADS: BATTERY C/4 R&R (01:05)

IV	EV1 (BOWEN)	EV2 (GOOD)
Truss APFR Settings: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4 (Bueno): WIF 25 [4,QQ,L,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 6 (Big G): WIF 21 [12,QQ,J,12] (roll 5 clicks left) **Pallet APFR Settings:** Slot A: WIF 12 [6,NN,F,6] Slot B to F: WIF 12 [6,QQ,H,6]	REMOVE BATTERY **C** FROM PALLET 1. Install scoops (per diagram) 2. RET to battery 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 4. Remove battery 5. Transfer battery to EV2 6. √Gold stanchion inserts present 7. Shepherd to install location	REMOVE BATTERY **C** FROM PALLET 1. Open MLI on **next** battery 2. If required: **PGT [A7 (9.1), CCW2]**, TM; break torque on batteries not completed on previous EVA; √TM locked, anti-back drive in neutral 3. Translate off of Pallet 4. Check tethers clear, GCA Pallet away to clearance position 5. Receive battery from EV1 6. Shepherd battery to install location
	INSTALL BATTERY **C** INTO TRUSS SLOT **3** 8. Transfer control of battery to EV2 9. **FOD check battery** 10. **Glove/gauntlet/configuration inspection** 11. Check gap spanner position on **next** battery 12. Relocate scoops to next battery	INSTALL BATTERY **C** INTO TRUSS SLOT **3** 7. Ingress APFR 8. **FOD check Truss** 9. RET to battery; receive control from EV1 10. Soft dock battery 11. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 12. **Glove/gauntlet/configuration inspection** 13. Reconfig APFR to WIF 25, settings: [4,QQ,L,12] Perform pull/twist test if installed in new WIF; ingress
	REMOVE BATTERY **4** FROM TRUSS 13. Assist EV2 as required; GCA battery removal 14. Receive battery from EV2 15. Shepherd battery to pallet APFR	REMOVE BATTERY **4** FROM TRUSS 14. RET to battery 15. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 16. Remove battery; transfer to EV1 17. Shepherd battery to pallet APFR
	INSTALL BATTERY **4** INTO PALLET SLOT **C** 16. Verify Pallet APFR configuration; ingress 17. **FOD check Pallet** 18. RET to battery; receive control from EV2 19. Soft dock battery 20. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 21. Remove scoops and fold over MLI flap 22. Check ingress aid, GCA Pallet to next battery	INSTALL BATTERY **4** INTO PALLET SLOT **C** 18. Transfer control of battery to EV1 19. **FOD check battery** 20. GCA Pallet to install position; translate onto Pallet 21. Check tethers clear 22. Close MLI and ¼-turn fasteners

EVA 2 GET-AHEADS: BATTERY D/5 R&R (01:05)

IV	EV1 (BOWEN)	EV2 (GOOD)
Truss APFR Settings: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4 (Bueno): WIF 25 [4,QQ,L,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 6 (Big G): WIF 21 [12,QQ,J,12] (roll 5 clicks left) **Pallet APFR Settings:** Slot A: WIF 12 [6,NN,F,6] Slot B to F: WIF 12 [6,QQ,H,6]	REMOVE BATTERY **D** FROM PALLET 1. Install scoops (per diagram) 2. RET to battery 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 4. Remove battery 5. Transfer battery to EV2 6. √Gold stanchion inserts present 7. Shepherd to install location	REMOVE BATTERY **D** FROM PALLET 1. Open MLI on **next** battery 2. If required: **PGT [A7 (9.1), CCW2]**, TM; break torque on batteries not completed on previous EVA; √TM locked, anti-back drive in neutral 3. Translate off of Pallet 4. Check tethers clear, GCA Pallet to clearance position 5. Receive battery from EV1 6. Shepherd battery to install location
	INSTALL BATTERY **D** INTO TRUSS SLOT **4** 8. Transfer control of battery to EV2 9. **FOD check battery** 10. **Glove/gauntlet/configuration inspection** 11. Check gap spanner position on **next** battery 12. Relocate scoops to next battery	INSTALL BATTERY **D** INTO TRUSS SLOT **4** 7. Ingress APFR 8. **FOD check Truss** 9. RET to battery; receive control from EV1 10. Soft dock battery 11. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 12. **Glove/gauntlet/configuration inspection** 13. Reconfig APFR to WIF 29, settings: [9,PP,C,12] Verify locking collar black on black; perform pull/twist test; ingress
	REMOVE BATTERY **5** FROM TRUSS 13. Assist EV2 as required; GCA battery removal 14. Receive battery from EV2 15. Shepherd battery to pallet APFR	REMOVE BATTERY **5** FROM TRUSS 14. RET to battery 15. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 16. Remove battery; transfer to EV1 17. Shepherd battery to pallet APFR
	INSTALL BATTERY **5** INTO PALLET SLOT **D** 16. Verify Pallet APFR configuration; ingress 17. **FOD check Pallet** 18. RET to battery; receive control from EV2 19. Soft dock battery 20. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 21. Remove scoops and fold over MLI flap 22. Check ingress aid, GCA Pallet to next battery	INSTALL BATTERY **5** INTO PALLET SLOT **D** 18. Transfer control of battery to EV1 19. **FOD check battery** 20. GCA Pallet to install position; translate onto Pallet 21. Check tethers clear 22. Close MLI and ¼-turn fasteners

EVA 2 GET-AHEADS: BATTERY __/__ R&R (01:05) (Cont)

IV	EV1 (BOWEN)	EV2 (GOOD)
Truss APFR Settings: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4 (Bueno): WIF 25 [4,QQ,L,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 6 (Big G): WIF 21 [12,QQ,J,12] (roll 5 clicks left) **Pallet APFR Settings:** Slot A: WIF 12 [6,NN,F,6] Slot B to F: WIF 12 [6,QQ,H,6]	REMOVE BATTERY FROM PALLET 23. Install scoops (per diagram) 24. RET to battery 25. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 26. Remove battery 27. Transfer battery to EV2 28. √Gold stanchion inserts present 29. Shepherd to install location	REMOVE BATTERY FROM PALLET 23. Open MLI on **next** battery 24. If required: **PGT [A7 (9.1), CCW2]**, TM; break torque on batteries not completed on previous EVA; √TM locked, anti-back drive in neutral 25. Translate off of Pallet 26. Check tethers clear, GCA Pallet to clearance position 27. Receive battery from EV1 28. Shepherd battery to install location
	INSTALL BATTERY INTO TRUSS SLOT 30. Transfer control of battery to EV2 31. **FOD check battery** 32. **Glove/gauntlet/configuration inspection** 33. Check gap spanner position on **next** battery 34. Relocate scoops to next battery	INSTALL BATTERY INTO TRUSS SLOT 29. Ingress APFR 30. **FOD check Truss** 31. RET to battery; receive control from EV1 32. Soft dock battery 33. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 34. **Glove/gauntlet/configuration inspection** 35. Reconfig APFR to WIF ___, settings: [___,___,___,___] If installed in new WIF, verify black on black; perform pull/twist test; ingress
	REMOVE BATTERY FROM TRUSS 35. Assist EV2 as required; GCA battery removal 36. Receive battery from EV2 37. Shepherd battery to pallet APFR	REMOVE BATTERY FROM TRUSS 36. RET to battery 37. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1 6 turns Turns: _____ Release H2 17 turns Turns: _____ 38. Remove battery; transfer to EV1 39. Shepherd battery to pallet APFR
	INSTALL BATTERY INTO PALLET SLOT 38. Verify Pallet APFR configuration; ingress 39. **FOD check Pallet** 40. RET to battery; receive control from EV2 41. Soft dock battery 42. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2 16-17 turns Torque: _____, Turns: _____ Install H1 5-6 turns Torque: _____, Turns: _____ 43. Remove scoops and fold over MLI flap 44. Check ingress aid, GCA Pallet to next battery	INSTALL BATTERY INTO PALLET SLOT 40. Transfer control of battery to EV1 41. **FOD check battery** 42. GCA Pallet to install position; translate onto Pallet 43. Check tethers clear 44. Close MLI and ¼-turn fasteners

EVA 3 SUMMARY TIMELINE

PET HR : MIN	IV/SSRMS	EV1 (Good)	EV2 (Reisman)	
00:00		EGRESS/SETUP (00:35) Post Depress (00:05) Egress (00:15) Setup (00:15)	EGRESS/SETUP (00:35) Post Depress (00:05) Egress (00:15) Setup (00:15)	00:00
		TEMP STOW BATTERY (00:35)	TEMP STOW BATTERY (00:35)	
01:00				01:00
		BATTERY D/5 R&R (01:05) • Remove Battery D – Pallet • Install Battery D – Truss • Remove Battery 5 – Truss • Install Battery 5 – Pallet	BATTERY D/5 R&R (01:05) • Remove Battery D – Pallet • Install Battery D – Truss • Remove Battery 5 – Truss • Install Battery 5 – Pallet	
02:00				02:00
		BATTERY E/6 R&R (01:05) • Remove Battery E – Pallet • Install Battery E – Truss • Remove Battery 6 – Truss • Install Battery 6 – Pallet	BATTERY E/6 R&R (01:05) • Remove Battery E – Pallet • Install Battery E – Truss • Remove Battery 6 – Truss • Install Battery 6 – Pallet	
03:00				03:00
		BATTERY F R&R (00:35) • Remove Battery F – Pallet • Install Battery F – Truss	BATTERY F R&R (00:35) • Remove Battery F – Pallet • Install Battery F – Truss	
04:00		INSTALL TEMP STOWED BATTERY (00:35)	INSTALL TEMP STOWED BATTERY (00:35)	04:00
		P6 CLEANUP (01:00)	P6 CLEANUP (01:00)	
05:00	Get-aheads Orbiter PDGF Retrieval (01:00) P3 CETA Light Install (00:30) P4/P5 Jumper Install (00:15)			05:00
		CLEANUP/INGRESS (00:40) Cleanup (00:30) Ingress (00:10)	CLEANUP/INGRESS (00:40) Cleanup (00:30) Ingress (00:10)	
06:00				06:00
		PRE-REPRESS (00:05)	PRE-REPRESS (00:05)	
06:30				06:30

EVA 3 INHIBIT PAD

Orbiter

ALL EVAs

TCS
L12 1. √TCS POWER – OFF

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

RCS
If EV crew < 27 ft from FRCS
IV 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 (*****)

Ground

ALL EVAs

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

RSOS

ALL EVAs

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

IMPULSE
MCC-M 1. IMPULSE (ИПИ-100) – Deactivate

USOS (1)

ALL EVAs

PCU

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. 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
POIC IV/(LAB1O4) 1. √cb POWER A, B [two] – OPEN
2. √cb LINK 1,2 [two] – OPEN

EVA 3 INHIBIT PAD (Cont)

USOS (2)

LOCATION DEPENDENT INHIBITS

Lab Window (On call, crew not expected in area)
IV If EV crew less than 10 ft from window or in window FOV, close window shutter

Cupola Windows (Prior to Approach)
IV If EV crew less than 10 ft from window, coordinate shutter opening/closing with EV crew and minimize time shutter is open

Port TRRJ (At egress)
MCC-H Port TRRJ locked at 0 deg
1. √DLA (1) – LOCKED

P3 SARJ (At egress for Battery R&R)
MCC-H P3 SARJ locked at 225
1. √DLA (1) – LOCKED
2. All motor setpoints set to zero
3. All motors deselected

BGAs
MCC-H 4B locked at 130 deg
1. √Latch (L1) – LATCHED

MCC-H 2A locked at 65 deg
1. √Latch (L2) – LATCHED

Mobile Transporter (At egress)
MCC-H If EV crew < 1.5 meters from MT
1. √MT latched

SSPTS (At egress)
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

P3 CETA Light Install (Get-ahead – prior to install)
MCC-H – RPC Position – Op and Close command inhibited
√P3-1A_A RPC 3
√P3-2B_A RPC 2

USOS (3)

LOCATION DEPENDENT INHIBITS

IEA (At egress for Battery R&R)
Battery Set 1 (Batteries 4B1A and 4B1B)
MCC-H
1. DCSU 4B RBI 2 Open
2. BCDU 4B1 Converter Off and FI Open
3. BCDU 4B1 CP RBI Open
4. BCDU 4B1 BSCCM A Power Off
5. BCDU 4B1 BSCCM B Power Off
6. BCDU 4B1 Heater Switch A Open
7. BCDU 4B1 Heater Switch B Open

Battery Set 2 (Batteries 4B2A and 4B2B)
MCC-H
1. DCSU 4B RBI 3 Open
2. BCDU 4B2 Converter Off and FI Open
3. BCDU 4B2 CP RBI Open
4. BCDU 4B2 BSCCM A Power Off
5. BCDU 4B2 BSCCM B Power Off
6. BCDU 4B2 Heater Switch A Open
7. BCDU 4B2 Heater Switch B Open

Battery Set 3 (Batteries 4B3A and 4B3B)
MCC-H
1. DCSU 4B RBI 4 Open
2. BCDU 4B3 Converter Off and FI Open
3. BCDU 4B3 CP RBI Open
4. BCDU 4B3 BSCCM A Power Off
5. BCDU 4B3 BSCCM B Power Off
6. BCDU 4B3 Heater Switch A Open
7. BCDU 4B3 Heater Switch B Open

FPMU (At egress)
MCC-H If EV crew working on Port Truss
1. FPMU power – Off

JEM

ALL EVAs

ICS-EF Antenna
SSIPC
1. ICS MOD – OFF
2. ICS UPC – OFF
3. ICS HPA – OFF
4. ICS Stored Commands Cleared

EVA 3 NOTES, CAUTIONS, WARNINGS

NOTES

1. Bolt install: Report torque and turns
2. Bolt release: Report torque and turns if different from published range
3. 85-ft safety tether retract force may affect body positioning
4. Wire ties on Port CETA cart brake handles must be replaced if they are cycled or loaded
5. EV on Pallet is required to be static when SSRMS is in motion due to loads constraints
6. SSRMS brakes should be applied while the EV crew is performing Pallet ops

CAUTION

ISS Generic Constraints

A. Avoid inadvertent contact with
   1. Grapple fixture shafts (dry lube)
   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. ETCS radiator flexhoses and panels [S1,P1]
   7. EETCS/PV radiator flexhoses, bellows and panels [P6,P4,S4,S6]

B. 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

C. Other
   1. MLI handholds are not rated for crewmember translation loads

ISS Truss Constraints

A. Avoid inadvertent contact with
   1. CETA lights (Z-93 paint)
   2. Deployed TUS cable [Zenith and Nadir CETA rails]

B. Other
   1. WIS Antennas: Do not use as handholds [NODE 1,LAB,P6,Z1]

CAUTION

ISS U.S. Pressurized Elements Constraints

A. Avoid inadvertent contact with
   1. TCS reflectors [PMA2,PMA3]
   2. APAS hardware [PMA2,PMA3]
   3. CETA lights (Z-93 paint) [LAB,S1,NODE 1]
   4. LAB and Cupola window shutters
   5. 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]

Shuttle Constraints

A. Avoid inadvertent contact with
   1. WVS antenna [ODS truss and PLB sill]
   2. Payload bay and camera wire harnesses, cables, cable guides, and connectors

B. No touch
   1. Monkey fur [PLB]

WARNING

ISS Generic Constraints

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

B. Sharp Edges
   1. Inner edges of WIF sockets
   2. APFR active WIF probes
   3. Spring loaded captive EVA fasteners (e.g., 6B-boxes, BMRRM, RTAS, SARJ Covers); the end of the spring may protrude
   4. Keep hands away from SSRMS LEE/POA/SPDM LEE opening, snares, and PDGF curvic coupling (teeth)
   5. MMOD strikes on ISS exterior

C. Thermal
   1. Turn off glove heaters when comfortable temperature reached to prevent bladder damage. Do not pull fingers out of gloves when heaters are on
   2. Uncovered trunnion pins may be hot
   3. SSRMS/MBS/SPDM operating cameras and lights may radiate large amounts of heat
   4. Do not touch EMU protective visor if temperature has been < -134 degF for > 15 min
   5. No EMU boot contact with foot restraint when temperature < -120 degF or > 200 degF
   6. 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

B. RF radiation exposure
   1. Stay 3.6 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. Nickel coated braided copper ground straps may contain frayed wires [P6,P4,S4,S6]

WARNING

ISS U.S. Pressurized Elements Constraints

A. Pinch
   1. EV side of IV Hatch during Hatch operation (also snag hazard) [A/L]
   2. LAB window shutter linkages during operation

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

C. Sharp Edges
   1. Port/Aft portion of A/L circular HR [HR 0506]
   2. A/L HR 0537 (Eq Lock Zenith)

D. Thermal
   1. PMA handrails may be hot. Handling may need to be limited
   2. Stay $\geq$ 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
   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

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

WARNING

ISS I.P. Elements Constraints

JEM

A. Thermal
   1. JPM Port End Cones and JLP Port Nadir may violate touch temperature constraints when β > 60 deg

WARNING

Shuttle Constraints

A. Arcing/Molten Debris
   1. Stay ≥ 2 ft from exposed Stbd Fwd MPM contacts [PLB]

B. 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 sill handrails for first 20 ft Aft of Fwd bulkhead when Ku-Band antenna powered [PLB]

C. Sharp Edges
   1. PRLA grounding wipers [PLB]

D. Thermal
   1. Illuminated PLB lights; do not touch
   2. Stay 27 ft from PRCS when powered
   3. Stay 3 ft from VRCS when powered
   4. Stay 3 ft from APU when operating

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

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

EVA 3 TOOL CONFIGURATION

ISS Configuration

MT @ WS8 CETA Port/Stbd
PALLET on SSRMS at P6
SSRMS on PDGF 3

Safety Tether config (STP = safety tether pack, 55+85)

EV1 ST pack (55+85) **85-ft** anchor at P1 HR 3651 **FWD** D-ring
EV2 ST pack (55+85) **85-ft** anchor at P1 HR 3650 **AFT** D-ring

NOTE: Prior to use, inspect the following hardware:

- ❑ Use RED RETs only
- ❑ RET cords for fraying
- ❑ Inspect Load Alleviating Straps and D-ring Extenders; ref CREW TETHER INSPECTIONS, ISS EVA Tasks Checklist 2.230.105:
  1. MMOD/general damage
  2. Discoloration
  3. Tack Stitching
  4. Red Band
- ❑ ISS Trash Bag: Bristle deformation/damage, after having stowed tools in trash bag
- ❑ Shuttle Trash Bag: Inspect frame for damage
- ❑ Inspect MWS End Effector Attachment Screws

Tether counts:	**used**	**total available**
RET sm-sm -381	12	16
RET lg-sm -385	3	8
RET sm-sm pp -383	3	5
AET sm-sm	4 (2-Shuttle)	10
AET lg-sm	2	2
Fish Stringer	2	5

EV1 – Good

MWS √Tabs UP

- ☐☐ 2 – Wire ties as tether loops
- ☐☐ RET w/PIP Pin
- ☐☐ RET sm-sm
- ☐☐ AET
- ☐☐ Swing Arm (right side)
  - ☐☐ RET sm-sm
    - ☐☐ PGT s/n _____ (√MTL 30.5)
      - ☐■ 6-in ext
      - ■☐ 2-in ext
- ☐☐ BRT (left side) √Tab UP
  - ☐☐ RET sm-sm
    - ☐■ Rnd Scoop
      - ☐■ PUMAA
        - ☐■ RET sm-sm
  - ☐☐ 2 – short wire ties

EMU Right D-ring

- ☐☐ 55-ft RED hook, √locked
- ☐☐ D-ring Extender
  - ☐☐ Waist Tether, √locked

EMU Left D-ring

- ☐☐ D-ring Extender

EV2 – Reisman

MWS √Tabs UP

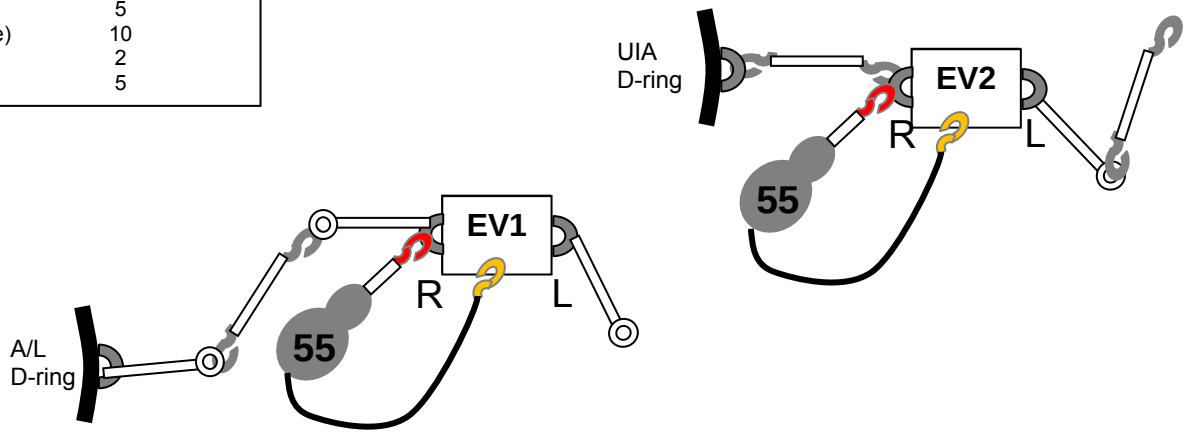
- ☐☐ 4 – Wire ties as tether loops
- ☐☐ Shuttle Style Trash Bag
- ☐☐ RET w/PIP Pin
- ☐☐ RET w/PIP Pin
- ☐☐ 2 – AET
- ☐☐ Swing Arm (right side)
  - ☐☐ RET sm-sm
    - ☐☐ PGT s/n _____ (√MTL 30.5)
      - ☐☐ 6-in ext
  - ☐☐ Camera w/bracket
- ☐☐ BRT (left side) √Tab UP
  - ☐☐ RET sm-sm
  - ☐☐ 2 – short wire ties

EMU Right D-ring

- ☐☐ 55-ft RED hook, √locked
- ☐☐ Waist Tether, √locked

EMU Left D-ring

- ☐☐ D-ring Extender
  - ☐☐ Waist Tether, √locked



EVA 3 TOOL CONFIGURATION (Cont)

P6 HR 5329

■ □ **C/L Bag – Truss (T)**

Integral RETs

■ □ MUT EE
■ □ MUT EE
■ □ Square Scoop
■ □ Square Scoop

Internal D-rings

■ □ RET sm-sm
■ □ Ballstack
■ □ AET
□ □ RET sm-sm
□ □ ISS Trash Bag
■ □ Gap spanners (4)

External D-rings

□ □ AET lg-sm

P6 HR 5328

■ □ **C/L Bag – Pallet (P)**

Integral RETs

□ □ Ratchet wrench w/o palm wheel
□ □ 2-in ext
■ □ Square Scoop
■ □ Square Scoop

Internal D-rings

□ □ RET sm-sm
□ □ Sq Torque Multiplier
□ □ 7/16-in rec socket
□ □ RET sm-sm
□ □ socket caddy
□ ■ 2-in ext
■ □ 6-in ext
□ □ RET sm-sm

External D-rings

□ □ AET Lg-sm
□ □ RET sm-sm

ICC-VLD Battery

□ ■ Square Scoop
□ ■ Square Scoop

P6 IEA Battery

□ ■ Square Scoop
□ ■ Square Scoop

P6 HR 5329 or 5355

□ ■ MUT EE
□ ■ Ballstack
□ ■ MUT EE
□ ■ RET sm-sm
□ ■ AET (attached to HR)

Crewlock

□ □ Spare safety tether pack
□ □ RET Lg-sm (A/L stowage)
■ □ Rnd Scoop
■ □ PUMAA
■ □ RET sm-sm
■ □ PDGF
□ □ RET Lg-sm (A/L stowage)
■ □ **C/L Bag – Truss**
■ □ **C/L Bag – Pallet**
□ □ RET Lg-sm (A/L stowage)
□ □ Camera w/bracket

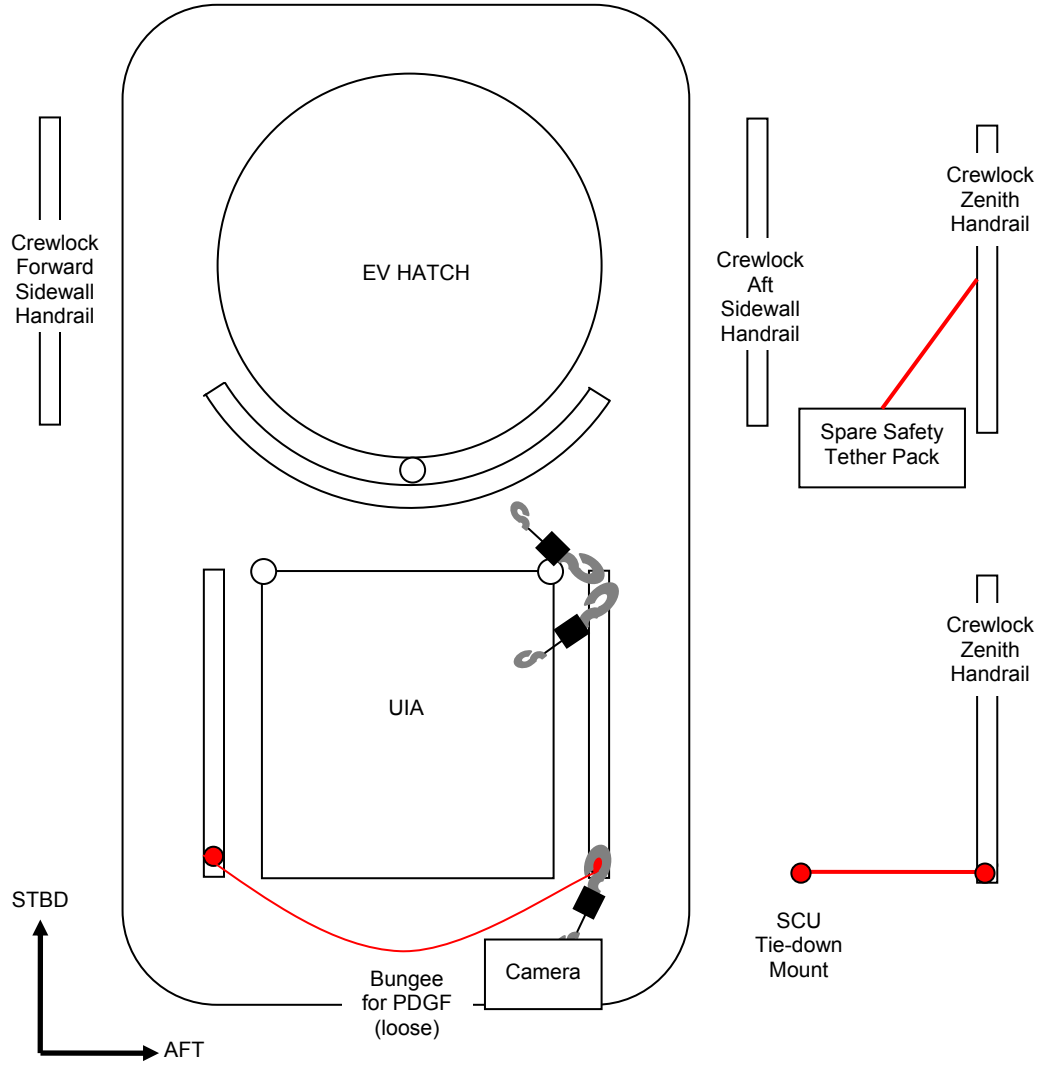
Staging Bag

□ □ Fish Stringer #1
□ □ Wire Tie Caddy (hook #1)
□ □ 9 wire ties
□ □ Velcro/Tape Caddy (hook #2)
□ □ PGT (hook #3) s/n _____
□ □ PGT Battery s/n _____
□ □ Vise Grips (hook #4)
□ □ Ratchet Wrench (hook #5)
□ □ 6-in (wobble) ext
□ □ 3 – Long duration tie down tethers, hooked together (hook #6)
□ □ WIF Adapter (hook #7)
□ □ Fish Stringer #2
□ □ ERAD (hook #1) s/n _____
□ □ Connector Cleaner Tool Kit (hook #2)
□ □ Pin Straightener Assy (hook #3)
□ □ Probe (hook #4)
□ □ Prybar (hook #5)
□ □ Needlenose Pliers (hook #6)
□ □ Cheater bar (hook #7)
□ □ MWS Key Strap Assy (on wire tie, to strap)

IV Bag

□ □ Ammonia Contamination Cue Card
□ □ 2 – Towels
□ □ Contamination Detection Kit
□ □ RET (sm-sm) (Black)
□ □ 2 – DCM Plug (SAFER Hardmount)
□ □ RET (sm-sm) (Black)
□ □ 2 – GP Caddy
□ □ 2 – Thermal Mitten (pair)
□ □ RET (sm-sm) (Black)
□ □ Socket Caddy
□ □ 1/2-in (wobble) Socket – 8 ext
□ □ 7/16-in (wobble) Socket – 6 ext

EVA 3 TOOL CONFIGURATION (Cont)



EVA 3 EGRESS/SETUP (00:30)

IV	EV1 (GOOD)	EV2 (REISMAN)
	INITIAL CONFIGURATION 1. Waist tether to A/L D-ring extender ❑ √Gates closed ❑ √Hooks locked	INITIAL CONFIGURATION 1. Right Waist tether to UIA fwd D-ring ❑ √Gate closed ❑ √Hook locked
	WARNING Sharp Edges: Port/Aft portion of A/L circular HR [HR 0506]	
1. WVS Software: Select page – RF camera Sel 'Advanced Controls' S-Band Level (two) – Max	EGRESS/SETUP (00:30) 2. Open hatch thermal cover _____ : _____ 3. Egress airlock 4. Attach EV1 55-ft **YELLOW** anchor hook to 85-ft ERCM on FWD D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked ❑ Inspect load alleviating strap 5. Attach FWD 85-ft **GREEN** alleviator hook to EV1 right D-ring extender ❑ √Green gate closed ❑ √Hook locked 6. Give EV2 GO to transfer waist tether from A/L D-ring extender 7. Attach EV2 55-ft **YELLOW** anchor hook to 85-ft ERCM on AFT D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked ❑ Inspect load alleviating strap 8. Attach AFT 85-ft **GREEN** alleviator hook to EV2's left D-ring extender ❑ √Gate closed ❑ √Hook locked 9. Give EV2 GO to release waist tether from UIA D-ring 10. Check EV2 55-ft **RED** alleviator hook to right D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 11. Check EV2 SAFER config ❑ √L handle down (MAN ISO Vlv-Open) ❑ √R handle down (HCM-Closed) 12. Check EV2 MWS tabs up 13. Translate to inboard Port LAB strut HR 14. Temp stow PUMAA/Scoop	EGRESS/SETUP (00:30) 2. On EV1 GO, transfer EV1's waist tether from A/L D-ring extender to EV1 3. Relocate small hooks of lg-sm A/L RETs to A/L D-ring extender 4. On EV1 GO, retrieve waist tether from UIA 5. Egress crewlock with camera 6. Stow camera on swing arm 7. Check EV1 55-ft **RED** alleviator hook to right D-ring ❑ √Gate closed ❑ √Hook locked ❑ √Reel unlocked 8. Check EV1 SAFER config ❑ √L handle down (MAN ISO Vlv-Open) ❑ √R handle down (HCM-Closed) 9. Check EV1 MWS tabs up 10. Close hatch thermal cover _____ : _____ 11. Translate to P1 HR 3651/3650 12. Verify blank anchor hooks ❑ ❑ √Gate closed ❑ ❑ √Hook locked

EVA 3 TEMP STOW BATTERY (00:35)

IV	EV1 (GOOD)	EV2 (REISMAN)
	CAUTION Avoid inadvertent contact with grapple fixture shafts Avoid contact with PALLET keel camera target Keep Battery fins away from structure Minimize loads into Battery H1 fixture	
	WARNING Uncovered trunnion pins may be hot Verify gauntlets in place prior to translating outboard of SARJ Maintain 2-ft KOZ from rotating Solar array beta gimbal If APFR Ingress Aid handle left extended for more than 1.5 hr, limit contact Battery fins are sharp and should be avoided	
	TEMP STOW BATTERY (00:35) 1. Translate to P6 spacer HR 5386 (zenith); drop **GREEN** hook 2. Glove, gauntlet and configuration inspection 3. Fairlead at P6 HR 5328 4. If required, relocate MUT-Ballstack-MUT to HR 5355 ❑ √AET from Ballstack to HR 5355 ❑ √MUT 1 paddles out ❑ √MUT 1 locked ❑ √MUT 1 black on black ❑ √MUT 2 black on black ❑ √RET on Ballstack for Battery ❑ √Verify pull test 5. Check gap spanner position 6. Assist EV2 as required; GCA battery removal 7. Translate to APFR P6 WIF 12 8. Verify APFR [6,QQ,H,6] 9. Ingress APFR 10. GCA pallet to **Battery D** removal position	TEMP STOW BATTERY (00:35) 1. Translate to P6 HR 5316; drop **GREEN** hook 2. Temp stow camera on HR 5335 3. Fairlead (weave between) P6 HRs 5336, 5337, 5338; Fairlead at P6 5338 with AET 4. Verify APFR WIF32 settings [9,PP,A,12] 5. Ingress APFR 6. Glove, gauntlet and configuration inspection 7. RET to H1 scoop 8. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 ❑ Release H1 6 turns _____ ❑ Release H2 17 turns _____ 9. Remove Battery 10. Stow battery, H2 scoop, on MUT2 ❑ √MUT 2 paddles out ❑ √MUT 2 locked ❑ √Verify fins pointing nadir ❑ √RET from MUT 2 to Battery ❑ Remove EV2 RET 11. Egress APFR 12. Retrieve Pallet Bag from P6 HR 5328
	NOTE EV on Pallet is required to be static when SSRMS is in motion due to loads constraints. SSRMS brakes should be applied while the EV crew is performing Pallet ops	
		13. Translate to Pallet 14. Open battery MLI 15. Stow Pallet Bag

EVA 3 BATTERY D/5 R&R (01:05)

IV	EV1 (GOOD)	EV2 (REISMAN)
For Truss: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4 (Bueno): WIF 25 [4,QQ,L,12] Slot 4 (Big G): WIF 32 [9,PP,A,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 6: WIF 21 [12,QQ,J,12] FOR PALLET: A WIF 12 [6,NN,F,6] B thru F WIF 12 [6,QQ,H,6]	REMOVE BATTERY **D** FROM PALLET 1. Install scoops (per diagram) 2. RET to battery 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1, 6 turns Turns: _____ Release H2, 17 turns Turns: _____ 4. Remove battery 5. Transfer battery to EV2 6. √Gold stanchion inserts present 7. Shepherd to install location	REMOVE BATTERY **D** FROM PALLET 1. Open MLI on **next** battery 2. If required: **PGT [A7 (9.1), CCW2]**, TM; break torque on batteries not completed on previous EVA; √TM locked, anti-back drive in neutral 3. Translate off of Pallet 4. Check tethers clear, GCA Pallet to clearance position 5. Receive battery from EV1 6. Shepherd battery to install location
	INSTALL BATTERY **D** INTO TRUSS SLOT **4** 8. Transfer control of battery to EV2 9. **FOD check battery** 10. **Glove/gauntlet/configuration inspection** 11. Check gap spanner position on **next** battery 12. Relocate scoops to next battery	INSTALL BATTERY **D** INTO TRUSS SLOT **4** 7. Ingress APFR 8. **FOD check Truss** 9. RET to battery; receive control from EV1 10. Soft dock battery 11. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2, 16-17 turns Torque: _____ Turns: _____ Install H1, 5-6 turns Torque: _____ Turns: _____ 12. **Glove/gauntlet/configuration inspection** 13. Reconfig APFR to WIF 21 settings [12,QQ,D,12] Verify locking collar black on black; perform pull/twist test; ingress
	REMOVE BATTERY **5** FROM TRUSS 13. Assist EV2 as required; GCA battery removal 14. Receive battery from EV2 15. Shepherd battery to pallet APFR	REMOVE BATTERY **5** FROM TRUSS 14. RET to battery 15. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1, 6 turns Turns: _____ Release H2, 17 turns Turns: _____ 16. Remove battery; transfer to EV1 17. Shepherd battery to pallet APFR
	INSTALL BATTERY **5** INTO PALLET SLOT **D** 16. Verify Pallet APFR configuration; ingress 17. **FOD check Pallet** 18. RET to battery; receive control from EV2 19. Soft dock battery 20. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2, 16-17 turns Torque: _____ Turns: _____ Install H1, 5-6 turns Torque: _____ Turns: _____ 21. Remove scoops and fold over MLI flap 22. Check ingress aid, GCA Pallet to next battery	INSTALL BATTERY **5** INTO PALLET SLOT **D** 18. Transfer control of battery to EV1 19. **FOD check battery** 20. GCA Pallet to install position; translate onto Pallet 21. Check tethers clear 22. Close MLI and ¼-turn fasteners

EVA 3 BATTERY E/6 R&R (01:05)

IV	EV1 (GOOD)	EV2 (REISMAN)
For Truss: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4 (Bueno): WIF 25 [4,QQ,L,12] Slot 4 (Big G): WIF 32 [9,PP,A,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 6: WIF 21 [12,QQ,J,12] For Pallet: A WIF 12 [6,NN,F,6] B thru F WIF 12 [6,QQ,H,6]	REMOVE BATTERY **E** FROM PALLET 1. Install scoops (per diagram) 2. RET to battery 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1, 6 turns Turns: _____ Release H2, 17 turns Turns: _____ 4. Remove battery 5. Transfer battery to EV2 6. √Gold stanchion inserts present 7. Shepherd to install location	REMOVE BATTERY **E** FROM PALLET 1. Open MLI on **next** battery 2. If required: **PGT [A7 (9.1), CCW2]**, TM; break torque on batteries not completed on previous EVA; √TM locked, anti-back drive in neutral 3. Translate off of Pallet 4. Check tethers clear, GCA Pallet to clearance position 5. Receive battery from EV1 6. Shepherd battery to install location
	INSTALL BATTERY **E** INTO TRUSS SLOT **5** 8. Transfer control of battery to EV2 9. **FOD check battery** 10. **Glove/gauntlet/configuration inspection** 11. Check gap spanner position on **next** battery 12. Relocate scoops to next battery	INSTALL BATTERY **E** INTO TRUSS SLOT **5** 7. Ingress APFR 8. **FOD check Truss** 9. RET to battery; receive control from EV1 10. Soft dock battery 11. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2, 16-17 turns Torque: _____ Turns: _____ Install H1, 5-6 turns Torque: _____ Turns: _____ 12. **Glove/gauntlet/configuration inspection** 13. Reconfig APFR to WIF 21 settings [12,QQ,J,12]; ingress
	REMOVE BATTERY **6** FROM TRUSS 13. Assist EV2 as required; GCA battery removal 14. Receive battery from EV2 15. Shepherd battery to pallet APFR	REMOVE BATTERY **6** FROM TRUSS 14. RET to battery 15. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1, 6 turns Turns: _____ Release H2, 17 turns Turns: _____ 16. Remove battery; transfer to EV1 17. Shepherd battery to pallet APFR
	INSTALL BATTERY **6** INTO PALLET E 16. Verify Pallet APFR configuration; ingress 17. **FOD check Pallet** 18. RET to battery; receive control from EV2 19. Soft dock battery 20. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2, 16-17 turns Torque: _____ Turns: _____ Install H1, 5-6 turns Torque: _____ Turns: _____ 21. Remove scoops and fold over MLI flap 22. Check ingress aid, GCA Pallet to next battery	INSTALL BATTERY **6** INTO PALLET E 18. Transfer control of battery to EV1 19. **FOD check battery** 20. GCA Pallet to install position; translate onto Pallet 21. Check tethers clear 22. Close MLI and ¼-turn fasteners

EVA 3 BATTERY F R&R (00:35)

IV	EV1 (GOOD)	EV2 (REISMAN)
For Truss: Slot 1: WIF 17 [12,QQ,F,12] Slot 2: WIF 29 [12,QQ,F,12] Slot 3: WIF 25 [12,QQ,F,12] Slot 4 (Bueno): WIF 25 [4,QQ,L,12] Slot 4 (Big G): WIF 32 [9,PP,A,12] Slot 5 (Big G): WIF 21 [12,QQ,D,12] Slot 5 (Bueno): WIF 29 [9,PP,C,12] Slot 6: WIF 21 [12,QQ,J,12] FOR PALLET: A WIF 12 [6,NN,F,6] B THRU F WIF 12 [6,QQ,H,6]	REMOVE BATTERY **F** FROM PALLET 1. Install scoops (per diagram) 2. RET to battery 3. **PGT [B7 (25.5), CCW2]**, 6-in ext 7/16 Release H1, 6 turns Turns: _____ Release H2, 17 turns Turns: _____ 4. Remove battery 5. Transfer battery to EV2 6. √Gold stanchion inserts present 7. Shepherd to install location	REMOVE BATTERY **F** FROM PALLET 1. Translate off of Pallet 2. Check tethers clear, GCA Pallet to clearance position 3. Receive battery from EV1 4. Shepherd battery to install location
	INSTALL BATTERY **F** INTO TRUSS SLOT **6** 8. Transfer control of battery to EV2 9. **FOD check battery** 10. **Glove/gauntlet/configuration inspection**	INSTALL BATTERY **F** INTO TRUSS SLOT **6** 5. Ingress APFR 6. **FOD check Truss** 7. RET to battery; receive control from EV1 8. Soft dock battery 9. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2, 16-17 turns Torque: _____ Turns: _____ Install H1, 5-6 turns Torque: _____ Turns: _____ 10. **Glove/gauntlet/configuration inspection**

EVA 3 INSTALL TEMP-STOWED BATTERY (00:35), P6 CLEANUP (01:00)

IV	EV1 (GOOD)	EV2 (REISMAN)
C/L Bag – Pallet Integral RETs ☐ Ratchet wrench w/o palm wheel ☐ 2-in ext ☐ Square Scoop ☐ Square Scoop Internal D-rings ☐ RET sm-sm ☐ Sq Torque Multiplier w/7/16 rec socket ☐ RET sm-sm ☐ socket caddy ☐ 6-in ext ☐ RET sm-sm External D-rings ☐ AET Lg-sm ☐ RET sm-sm **C/L Bag – Truss** Integral RETs ☐ MUT EE ☐ MUT EE ☐ Square Scoop ☐ Square Scoop Internal D-rings ☐ RET sm-sm ☐ Ballstack ☐ AET ☐ RET sm-sm ☐ ISS Trash Bag ☐ Gap spanners (4) External D-rings ☐ AET lg-sm	INSTALL TEMP STOWED BATTERY (00:35) 1. Unlock MUT 2; release from scoop 2. Release Ballstack RET from battery 3. Shepherd battery to Pallet APFR 4. Ingress APFR 5. FOD check Pallet 6. Soft dock battery 7. **PGT [B7 (25.5), CW2]**, 6-in ext 7/16 Install H2, 16-17 turns Torque: _____, Turns: _____ Install H1, 5-6 turns Torque: _____, Turns: _____ P6 CLEANUP (00:40) 8. Retrieve Pallet bag from EV2 9. Stow: ❑ ❑ Square Scoops (2) from Battery F 10. Retrieve socket caddy 11. Socket swap PGT 6-in ext and caddy 2-in ext √Pull test 2 inch on PGT √Pull test 6 inch on socket caddy 12. Perform Pallet bag inventory 13. Stow Pallet bag on BRT 14. Close MLI on installed battery 15. Egress APFR 16. Verify 1/4-turn fasteners closed on all batteries 17. Translate off Pallet to Truss 18. Stow ingress aid, configure APFR [3,OO,F,12] ❑ Handle retracted ❑ Stowed against boot plate 19. Ensure tethers are clear of pallet 20. Give SSRMS GO to mnvr Pallet to clearance position 21. Transfer Pallet bag to EV2 22. Assist EV2 as required 23. Stow WIF 21 APFR on BRT 24. Retrieve fairlead from HR 5328 25. Glove and gauntlet inspection 26. MWS tool inventory 27. Retrieve **GREEN** hook from HR 5386 28. Translate to port CETA cart WIF 2 (nadir-inboard) 29. Stow APFR low profile [9,QQ,F,12] Perform pull/twist check 30. Translate to port inboard LAB strut HR 31. Retrieve Round Scoop/PUMAA; stow on BRT If no time for PDGF retrieval, GO to CLEAN-UP/INGRESS	INSTALL TEMP STOWED BATTERY (00:35) 1. RET to temp stowed battery 2. Shepherd battery to Pallet APFR 3. Transfer control of battery to EV1 4. FOD check battery 5. Check tethers and ingress aid, GCA Pallet to install position 6. Translate to Pallet when in range 7. Assist EV1 with install P6 CLEANUP (00:40) 8. Transfer Pallet bag to EV1 9. Translate off Pallet to HR 5329 10. Retrieve Truss bag 11. Stow in Truss bag ❑ Square Scoops (2) from Battery 6 ❑ MUT EE (2) ❑ Ballstack w/RET & AET 12. Gap Spanner Cleanup (get-ahead) a) Retrieve trash bag b) Retrieve 2 Gap spanner chains (4 total); stow in trash bag ❑ HR 5343-5344 ❑ HR 5354-5355 c) Perform Truss bag inventory d) Stow trash bag in Truss bag 13. Receive Pallet bag from EV1 14. Stow Pallet bag and Truss bag on BRT 15. Retrieve fairlead from HR 5338 16. Retrieve camera from HR 5335, stow on swingarm 17. Glove and gauntlet inspection 18. MWS tool inventory 19. Retrieve **GREEN** hook from HR 5316 20. Translate to port CETA cart WIF 2 (nadir-inboard) 21. Assist EV1 with APFR stow If no time for PDGF retrieval, GO to CLEAN-UP/INGRESS

EVA 3 PDGF RETRIEVE GET-AHEAD (01:00)

IV	EV1 (GOOD)	EV2 (REISMAN)
	CAUTION Avoid inadvertent contact with WVS antenna [ODS truss and PLB sill] Do not touch the monkey fur	
	WARNING Stay 0.33 ft from top and side of UHF PLB Antenna radome surface [ODS truss]	
	PDGF RETRIEVE (01:00) 1. Translate to NOD2 HR 0356 drop **GREEN** hook 2. Translate to Payload Bay/PDGF 3. Inspect gloves 4. Assist EV2 with PUMAA Install on fwd PDGF attach point	PDGF RETRIEVE (01:00) 1. Translate to port outboard LAB strut HR, set fairlead 2. Temp stow crewlock bag bundle 3. Translate to NOD2 HR 0363, drop **GREEN** hook 4. Translate to Payload Bay, aft of PDGF 5. Fairlead at port ODS handrail, and along sill 6. BRT to bracket handrail (strong side) 7. Inspect gloves 8. Drive PUMAA bolt to torque **PGT [B3 (18.4 ft-lb), CW2] 6-in ext 7/16**, 10 turns Torque: _____ Turns: _____
	NOTE Verify EDF has at least 1 lanyard intact before release	
	5. Attach RET from PUMAA to PDGF aft tether point 6. **PGT [B7 (25.5), CCW2] 2-in ext 7/16** Release EDF bolts (2), 4-6 turns ❑ Fwd, lower (first) ❑ Fwd, upper 7. Ensure all four EDFs fully retracted; remove PDGF from sidewall carrier 8. Stow PUMAA/PDGF on BRT 9. Translate to NOD2 HR 0356, retrieve **GREEN** hook	9. **PGT [B7 (25.5), CCW2] 2-in ext 7/16** Release EDF bolts (2), 4-6 turns ❑ Aft, lower ❑ Aft, upper 10. Assist EV1 as required 11. Retrieve fairlead 12. Translate to NOD2 HR 0363 retrieve **GREEN** hook 13. Translate to port outboard LAB strut HR 14. Retrieve crewlock bag bundle

EVA 3 CLEANUP/INGRESS (00:40)

IV	EV1 (GOOD)	EV2 (REISMAN)
EV1 (Good) MWS ☐ 2 – wire ties as tether loops ☐ RET w/PIP Pin ☐ RET sm-sm ☐ AET ☐ Swing Arm (right side) ☐ RET sm-sm ☐ PGT ☐ 2-in ext ☐ BRT (left side) ☐ RET sm-sm ☐☐ 2 – short wire ties **EV2 (Reisman)** MWS ☐ Shuttle Style Trash Bag ☐ 4 – wire ties as tether points ☐☐ 2 – RET w/PIP Pin ☐☐ 2 – AET ☐ Swing Arm (right side) ☐ Camera w/bracket ☐ RET sm-sm ☐ PGT ☐ 6-in ext ☐ BRT (left side) ☐ RET sm-sm ☐☐ 2 – short wire ties 1. **Perform WVS PWRDN (PHOTO/TV, WVS CUE CARD)**	CLEANUP/INGRESS (00:40) 1. Translate to A/L 2. Open thermal cover _____:_____ 3. If required, stow PDGF in A/L	CLEANUP/INGRESS (00:40) 1. Translate to A/L 2. If required, assist EV1 with PDGF stow 3. Stow Pallet/Truss bag bundle in A/L
	CAUTION Maintain 2-ft keep out zone from P1 thermal radiator rotation envelope Maintain 10-ft keep out zone from open Cupola windows	
	4. If GO for photo ops • Close thermal cover _____:_____ • Check SAFER handles • Drop green hook on airlock HR 0540	4. If GO for photo ops • Check SAFER handles • Drop green hook on airlock HR 0541 When complete with photo ops: • Translate to A/L • Open thermal cover _____:_____
	5. Translate to P1 HR 3650	5. Attach waist tether to A/L D-ring extender ❑ √Gate closed ❑ √Hook locked 6. Give EV1 GO to release 85-ft blank
	6. On EV2 GO, attach EV2 Blank hook to EV1 right waist tether ❑ ❑ √Gates closed ❑ ❑ √Hooks locked 7. Retrieve Blank anchor from HR 3651; stow on MWS 8. Translate to A/L	7. Perform tool inventory 8. Ingress A/L 9. Connect SCU to DCM; √SCU locked
	9. Perform tool inventory 10. Ingress A/L 11. Close thermal cover; attach Velcro strap _____:_____ 12. Connect SCU to DCM; √SCU locked	
	NOTE A TCV setting 8 – Max C minimizes time for SCU cooling	
	13. WATER – OFF (fwd), expect H2O IS OFF msg	10. WATER – OFF (fwd), expect H2O IS OFF msg
	CAUTION Do not close hatch until EMU Water OFF for 2 min	
	14. Verify outer hatch clear of hardware 15. EV Hatch – verify handle position per hatch decal; close and lock 16. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card)	11. Go to PRE-REPRESS (DEPRESS/REPRESS Cue Card)

EVA 3 BATTERY R&R – TASK DATA

Estimated Task Duration:

	With SSRMS	Without RMS
ONE EV CREW	N/A	N/A
TWO EV CREW	N/A	05:00 FOR 3 BATTERIES

ORU Identification:

ORU	MASS	Part number	Serial Number
BATTERY	367.38	RE1804-12	See layout below

Tools:

EV1 (FF)	EV2 (FF)
PGT TM W/7/16 REC 6-IN WOBBLE EXT SQ SCOOPS (2) MUTEE/BS/MUTEE	PGT TM W/7/16 REC 6-IN WOBBLE EXT SQ SCOOPS (2) RATCHET WRENCH W/2-IN EXT

Foot Restraints (APFR):

Task	WIF	APFR Setting
BATTERY R&R	REF CUE CARD	REF CUE CARD
For Truss:		
Slot 1:	WIF 17	[12,QQ,F,12]
Slot 2:	WIF 29	[12,QQ,F,12]
Slot 3:	WIF 25	[12,QQ,F,12]
Slot 4 (Bueno):	WIF 25	[4,QQ,L,12]
Slot 4 (Big G):	WIF 32	[9,PP,A,12]
Slot 5 (Big G):	WIF 21	[12,QQ,D,12]
Slot 5 (Bueno):	WIF 29	[9,PP,C,12]
Slot 6 (Big G):	WIF 21	[12,QQ,J,12]
Slot 6 (Bueno):	WIF 21	[9,PP,C,12]
FOR PALLET:		
A	WIF 12	[6,NN,F,6]
B THRU F	WIF 12	[6,QQ,H,6]

Note:
Truss APFR settings only apply to nominally planned crewmember unless stated. Alternate WIF and/or APFR setting may be required for other crewmember performing Truss battery install/removal

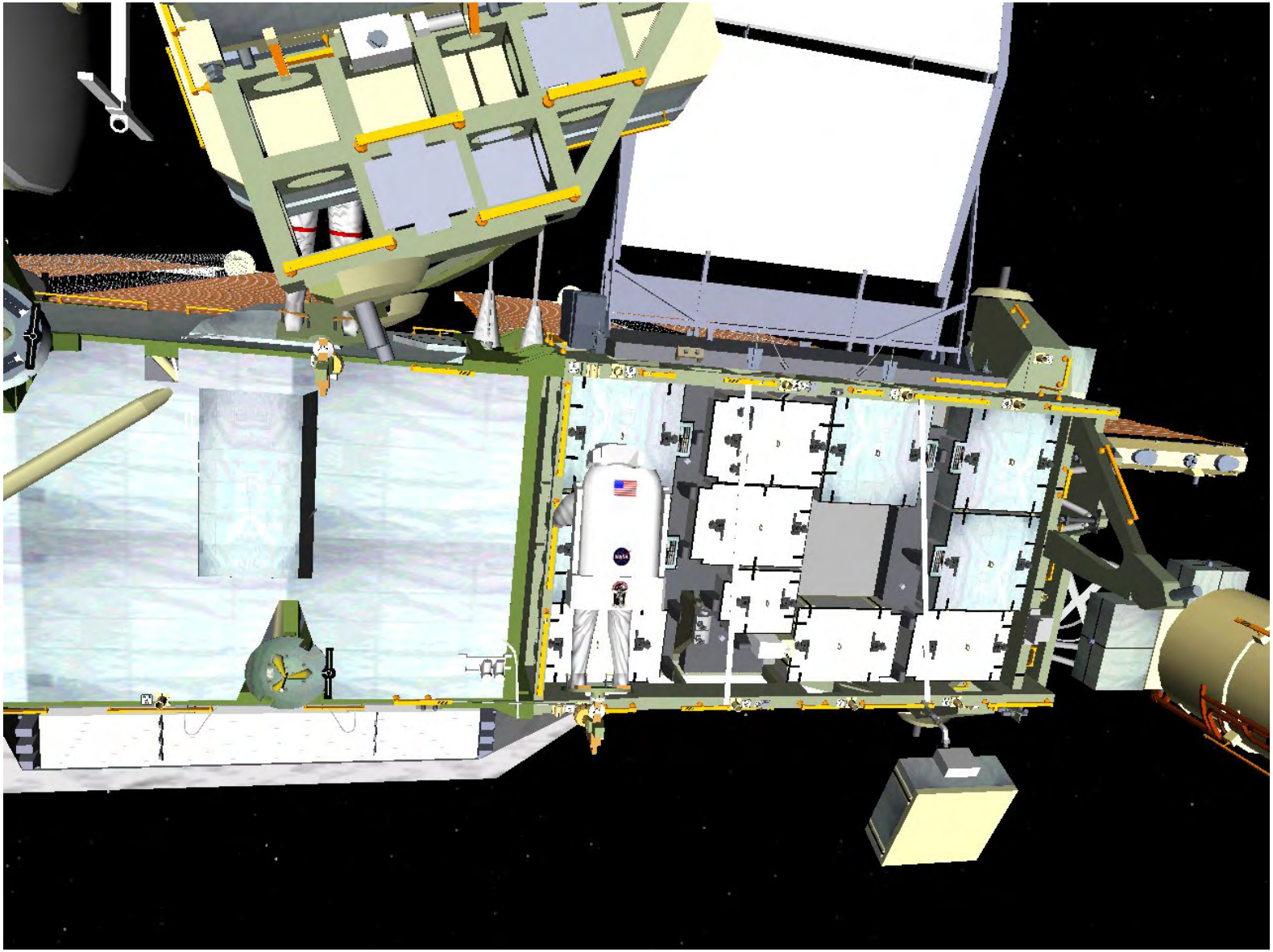
Warning:
Battery fins are sharp and should be avoided

Caution:
Keep Battery fins away from structure

Fasteners: All settings at 30 RPM

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque Inst/Rmvl (ft-lb)	Turns	PGT Setting
IEA							
H1	7/16	6	25.5	29.2/9.2	84.6/93.2	5-6	B7 REL B7 INST
H2 (JACKING)	7/16	6	25.5	31/9.2	69.8/93.2	16-17	B7 REL B7 INST
ICC-VLD							
H1	7/16	6	25.5	29.2/9.2	70	5-6	A7W/TM/ B7 REL B7 INST
H2 (JACKING)	7/16	6	25.5	31/9.2	70	18	A7W/TM/ B7 REL B7 INST

EVA 3 BATTERY R&R – TASK DATA (Cont)



TOP

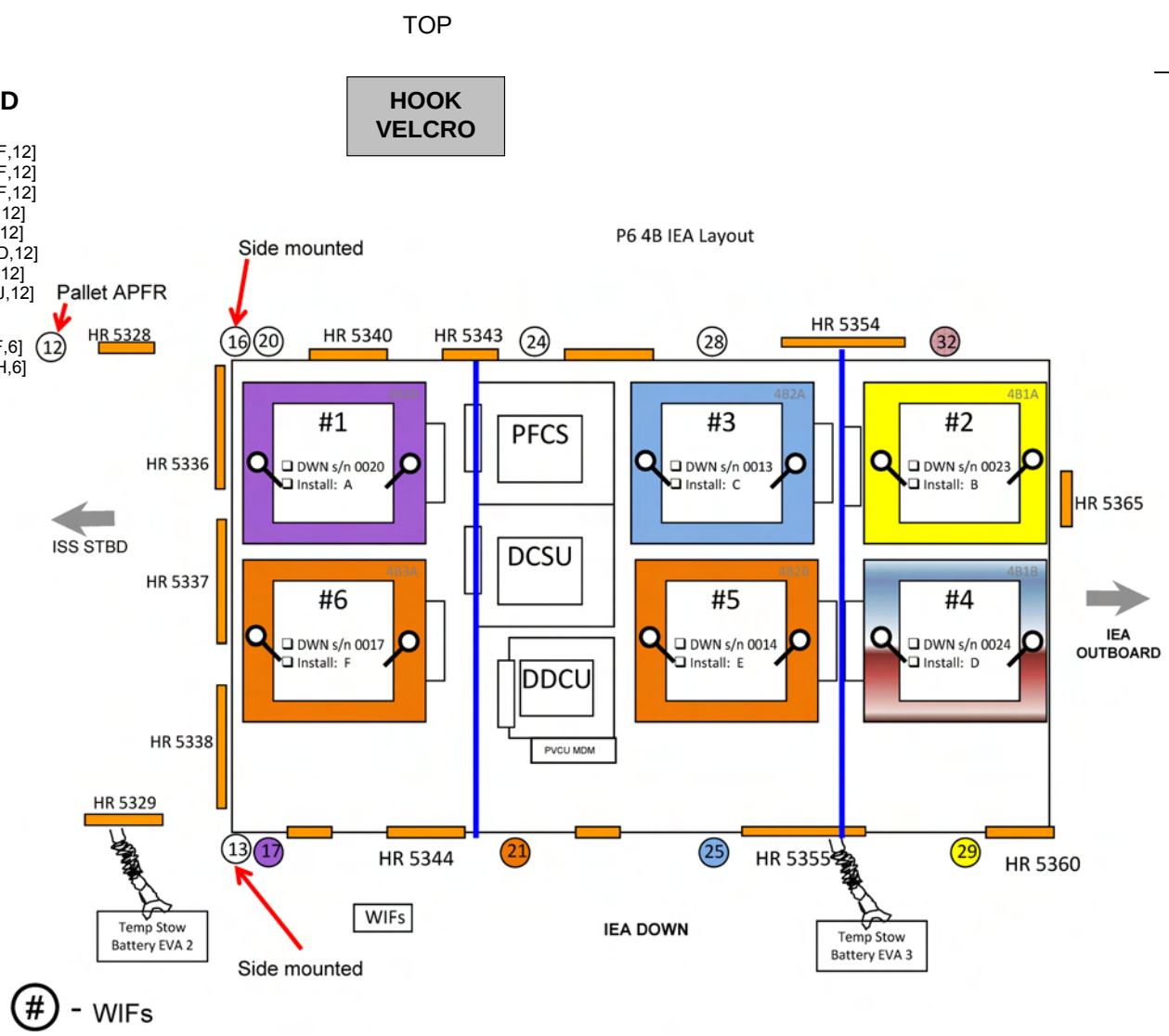
BATTERY R&R CUE CARD

FOR TRUSS:

SLOT 1:	WIF 17	[12,QQ,F,12]
SLOT 2:	WIF 29	[12,QQ,F,12]
SLOT 3:	WIF 25	[12,QQ,F,12]
SLOT 4 (BUENO):	WIF 25	[4,QQ,L,12]
SLOT 4 (BIG G):	WIF 32	[9,PP,A,12]
SLOT 5 (BIG G):	WIF 21	[12,QQ,D,12]
SLOT 5 (BUENO):	WIF 29	[9,PP,C,12]
SLOT 6:	WIF 21	[12,QQ,J,12]

FOR PALLET:

A	WIF 12	[6,NN,F,6]
B thru F	WIF 12	[6,QQ,H,6]



EVA-6a/132/O/A

(reduced copy)

TOP
BACK OF 'BATTERY R&R CUE CARD'

HOOK VELCRO

Pallet Break Torque [A7,CCW2]:

H1: ☐A ☐B ☐C ☐D ☐E ☐F

H2: ☐A ☐B ☐C ☐D ☐E ☐F

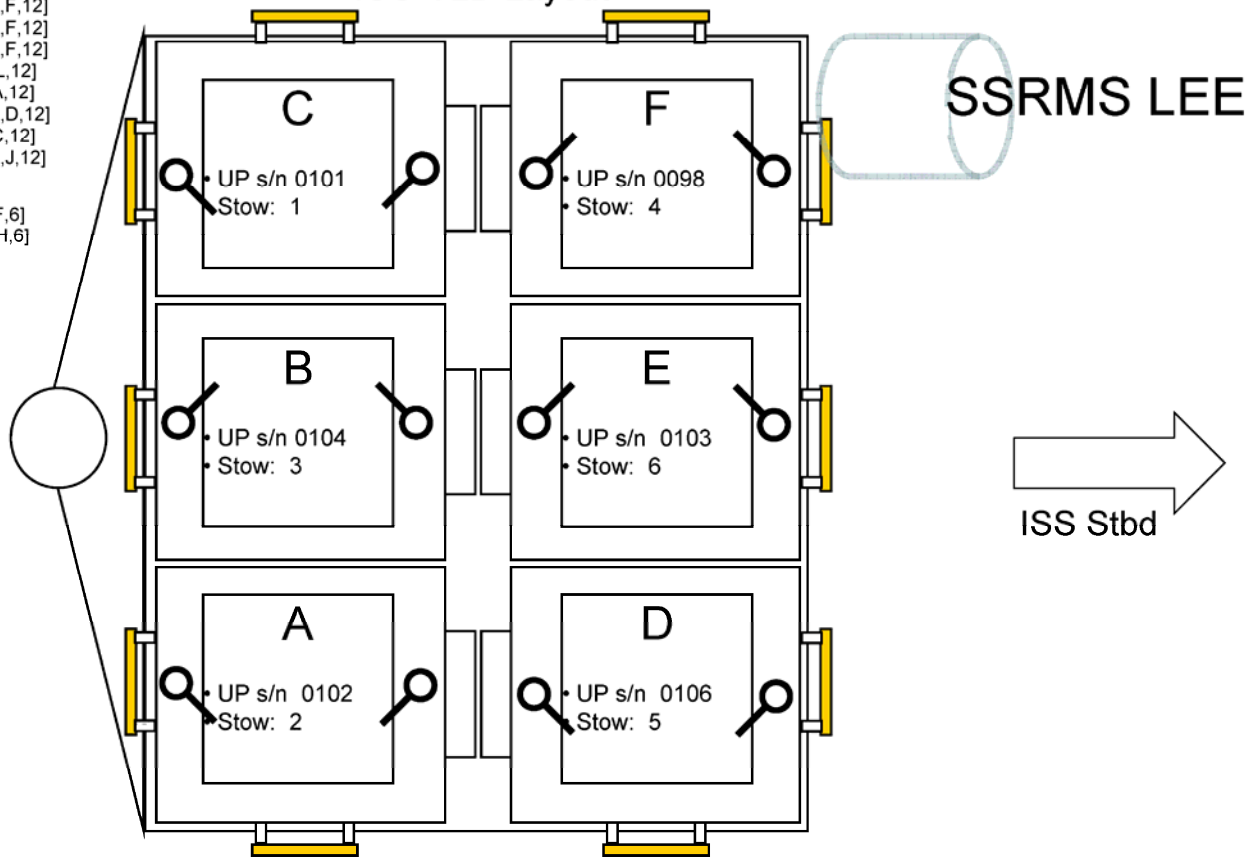
FOR TRUSS:

SLOT 1:	WIF 17	[12,QQ,F,12]
SLOT 2:	WIF 29	[12,QQ,F,12]
SLOT 3:	WIF 25	[12,QQ,F,12]
SLOT 4 (BUENO):	WIF 25	[4,QQ,L,12]
SLOT 4 (BIG G):	WIF 32	[9,PP,A,12]
SLOT 5 (BIG G):	WIF 21	[12,QQ,D,12]
SLOT 5 (BUENO):	WIF 29	[9,PP,C,12]
SLOT 6:	WIF 21	[12,QQ,J,12]

FOR PALLET:

A	WIF 12	[6,NN,F,6]
B thru F	WIF 12	[6,QQ,H,6]

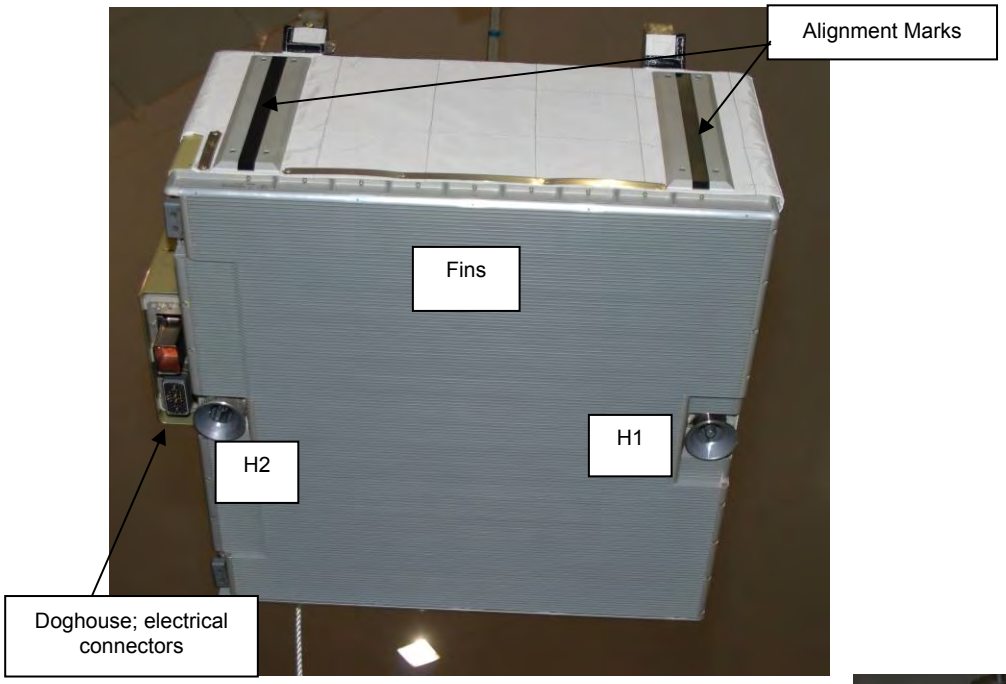
ICC-VLD Layout



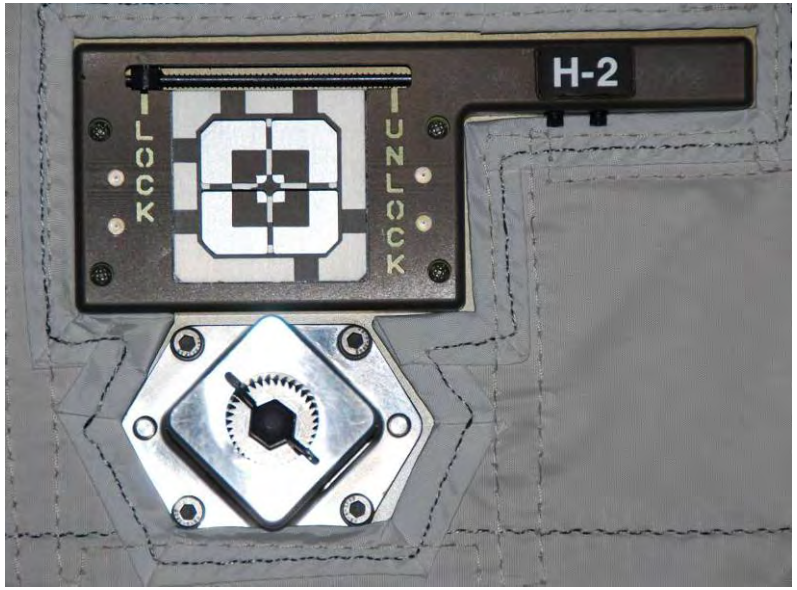
EVA-6b/132/O/A

(reduced copy)

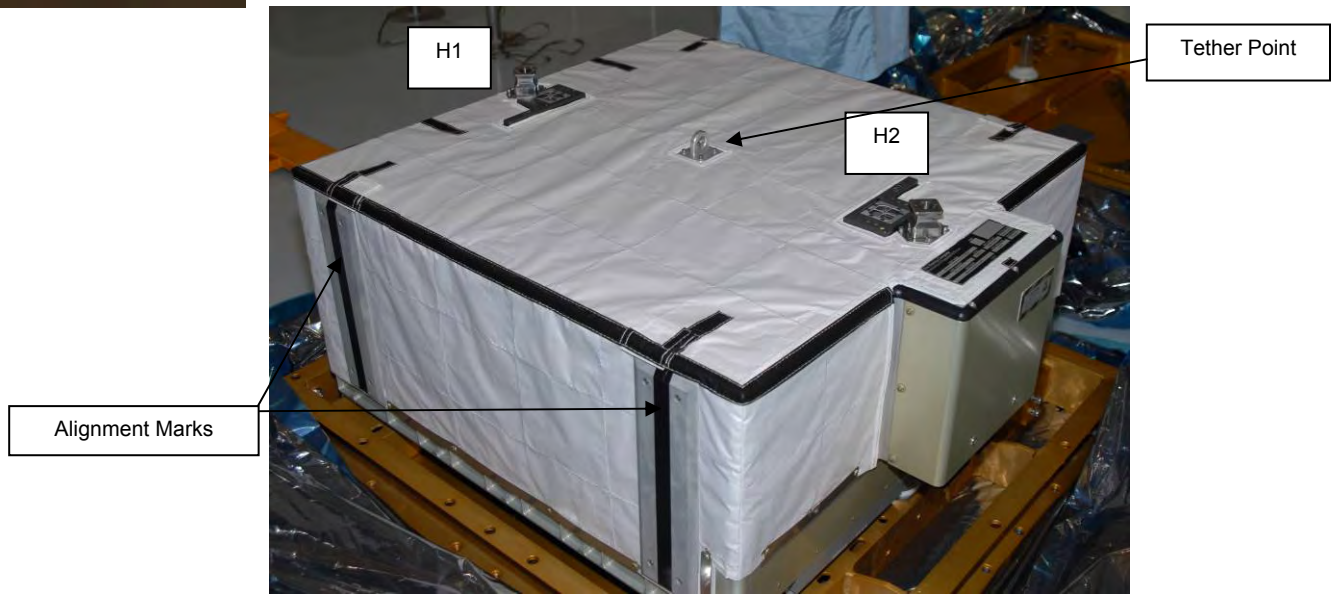
EVA 3 BATTERY R&R – TASK DATA



Backside of Battery (to Structure)

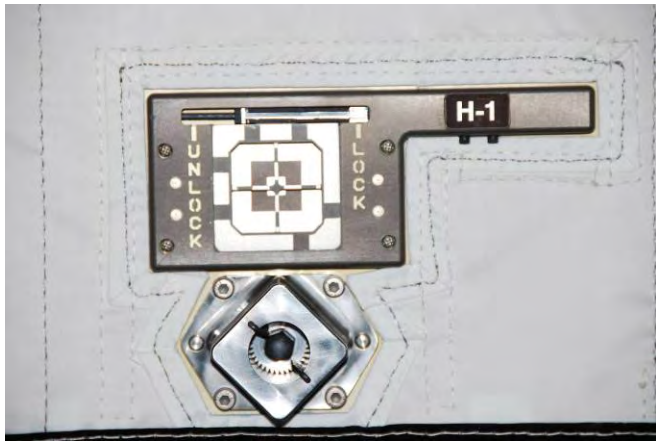


Lock/Unlock Indicator

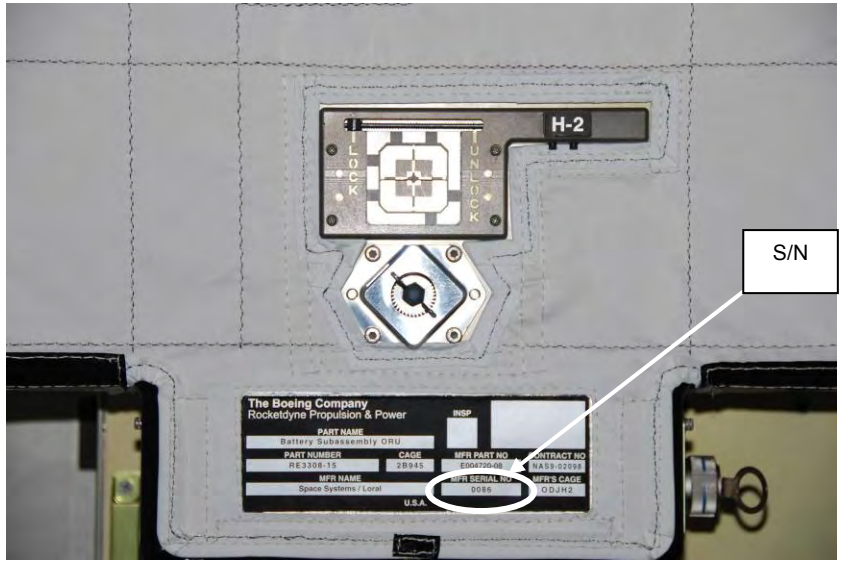


Top of Battery

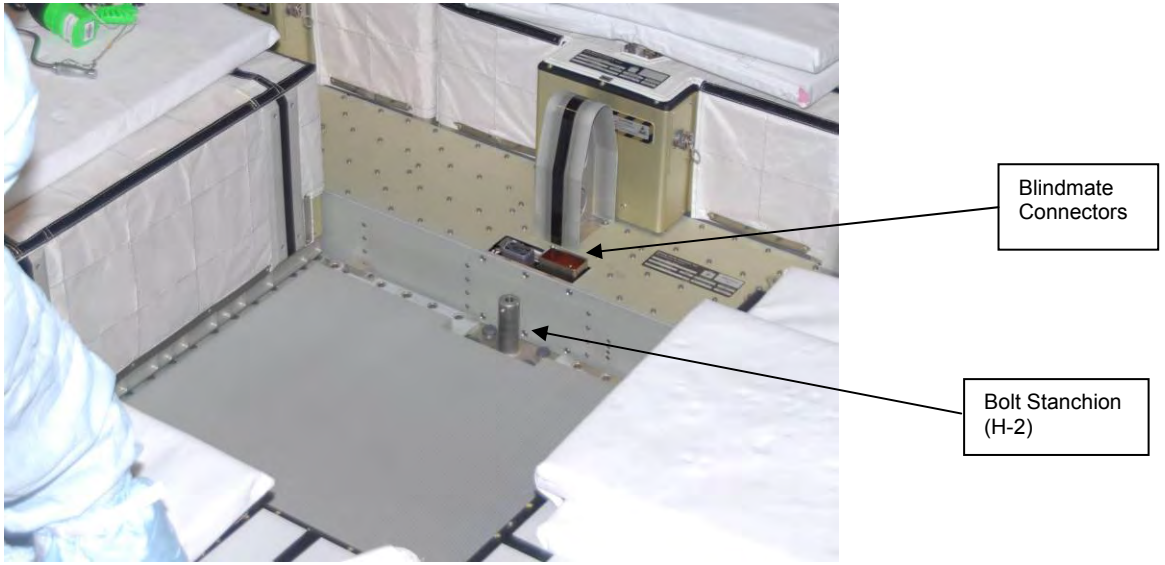
EVA 3 BATTERY R&R – TASK DATA (Cont)



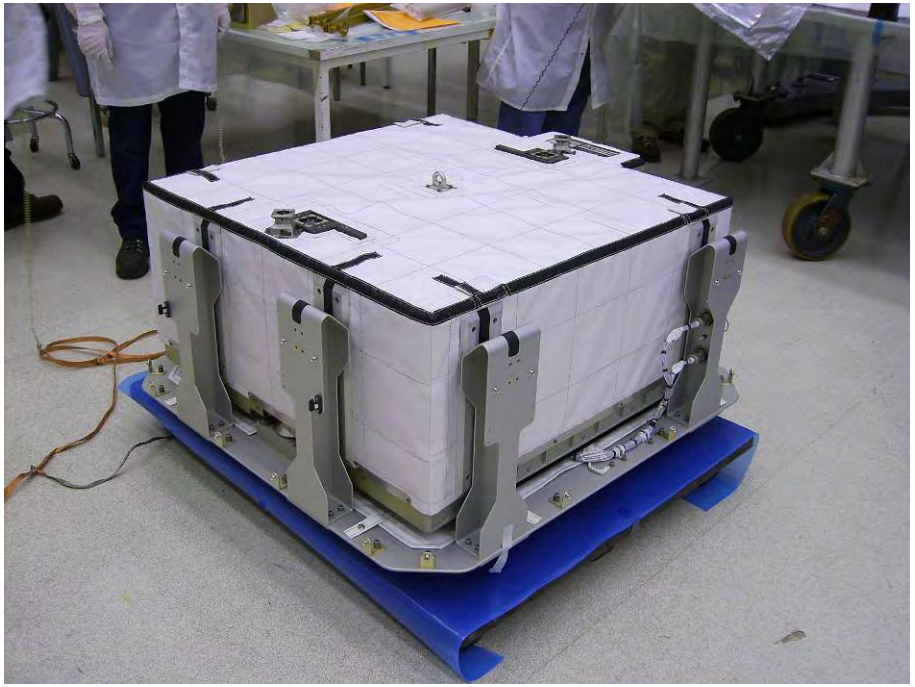
H-1



H-2 Lock/Unlock Indicator



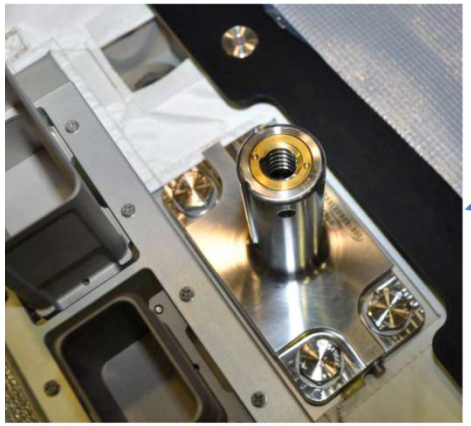
IEA Interface

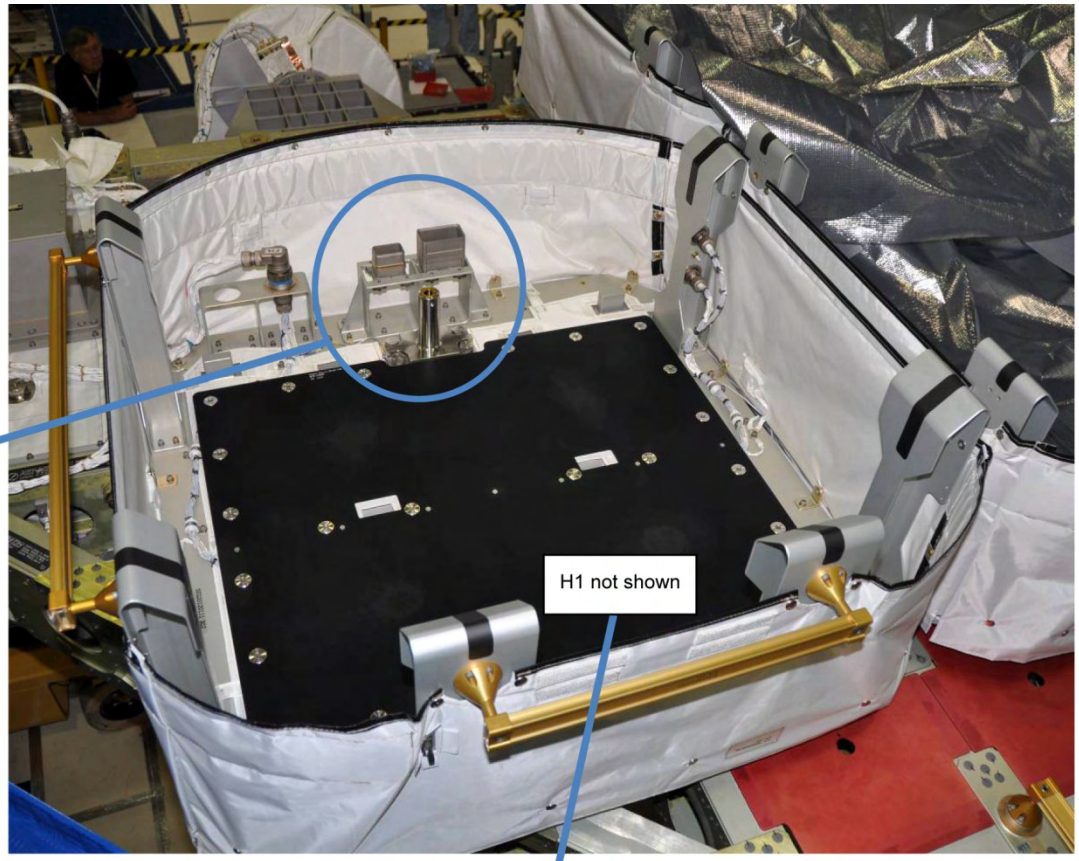


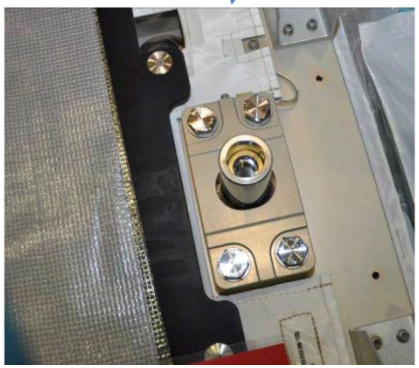
Battery Installed on FSE

EVA 3 BATTERY R&R – TASK DATA (Cont)

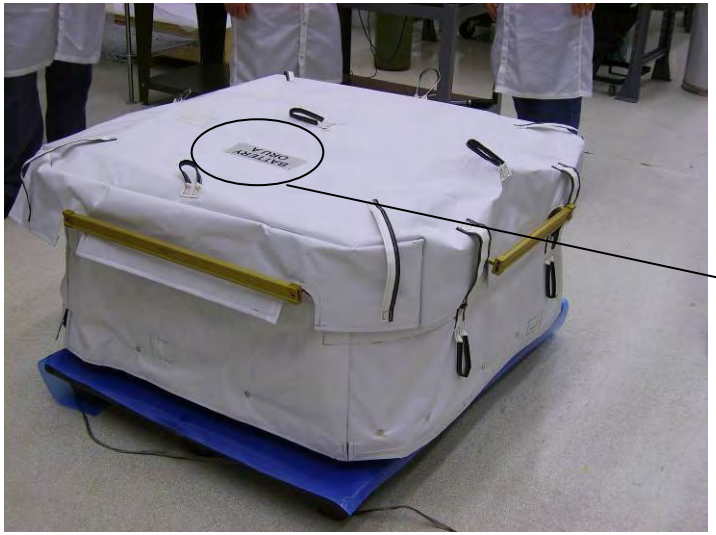
Battery FSE Shear Pin Yellow Stanchion

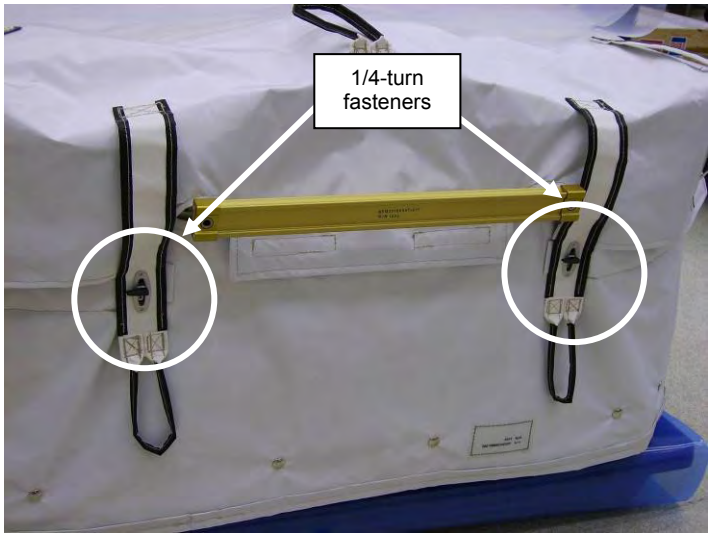






EVA 3 BATTERY R&R – TASK DATA (Cont)





FSE MLI

EVA 3 PDGF RETRIEVAL – TASK DATA

Estimated Task Duration:

	With SSRMS	Without SSRMS
One EV Crew	N/A	N/A
Two EV Crew	N/A	(01:00)

Tools:

EV1	EV2
• PGT 2-in ext 7/16 • PUMAA • RND SCOOP	• PGT 6-in ext 7/16

EVA Fasteners: All settings at 30 RPM

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	PGT Settings
PDGF EDF	7/16	4	10 init 25.8 fin	25.8	33	4-6	B7
PUMAA	7/16	1	18.4	25.5 2-turns 9.2	27.3	10	B3

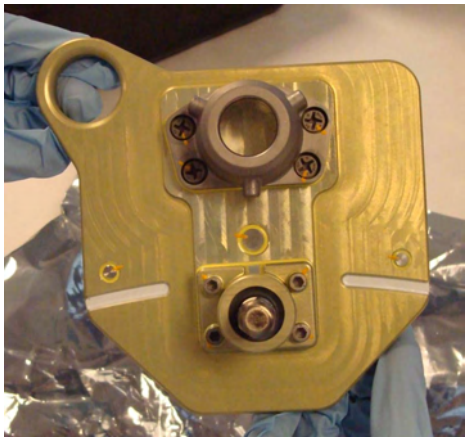
ORU Identification:

ORU	Part number	Mass
PDGF	51618-1000-1	72 LB

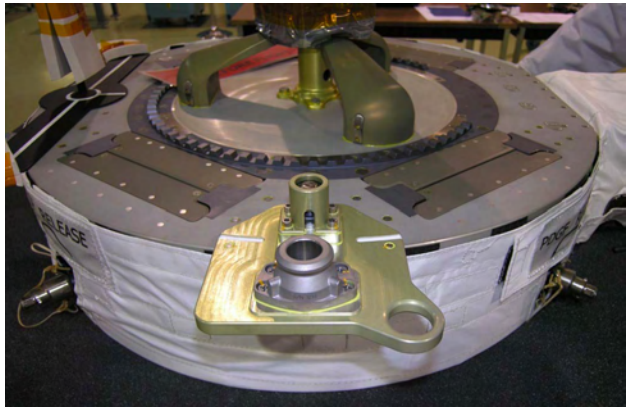
Notes:

1. Verify EDF has at least 1 lanyard intact before release
2. Avoid turning EDF more than 5 turns during release. The EVA nut can be released from the EDF core causing it to free spin

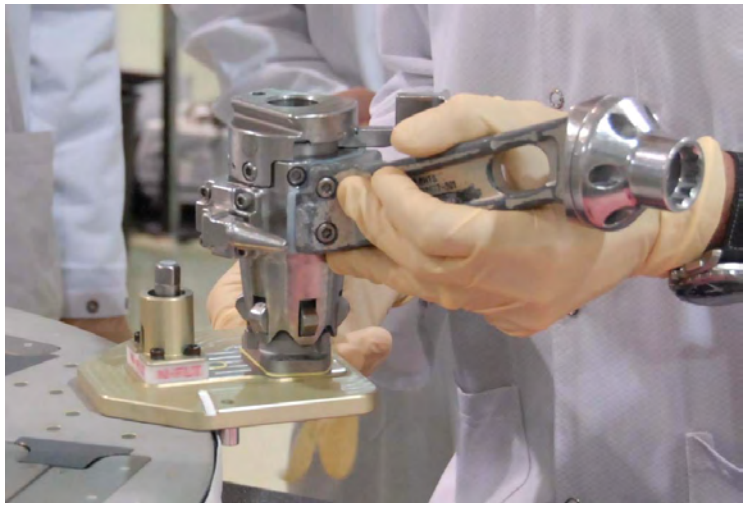
EVA 3 PDGF RETRIEVAL – TASK DATA (Cont)



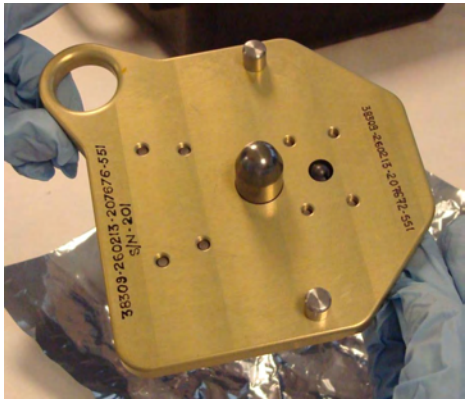
PUMAA

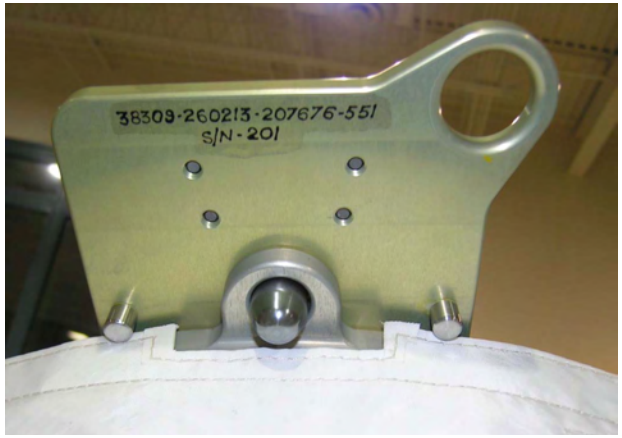


PUMAA installed on PDGF

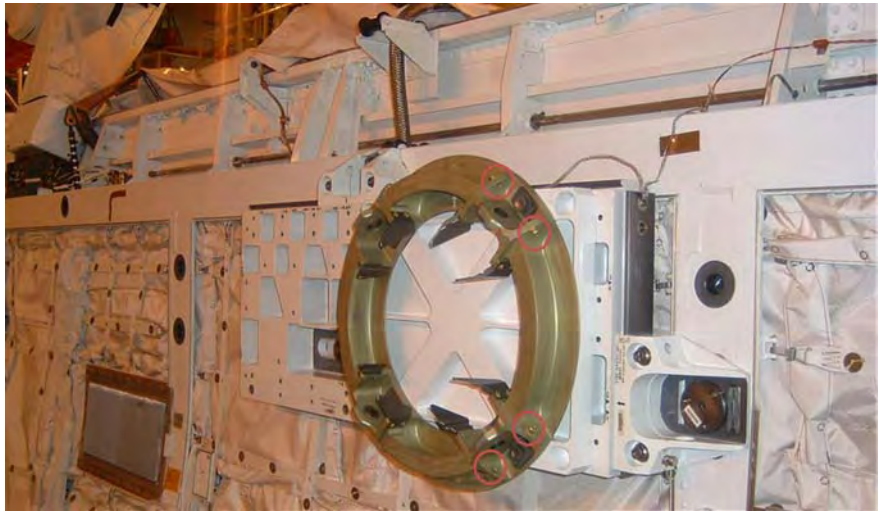


Scoop on PUMAA

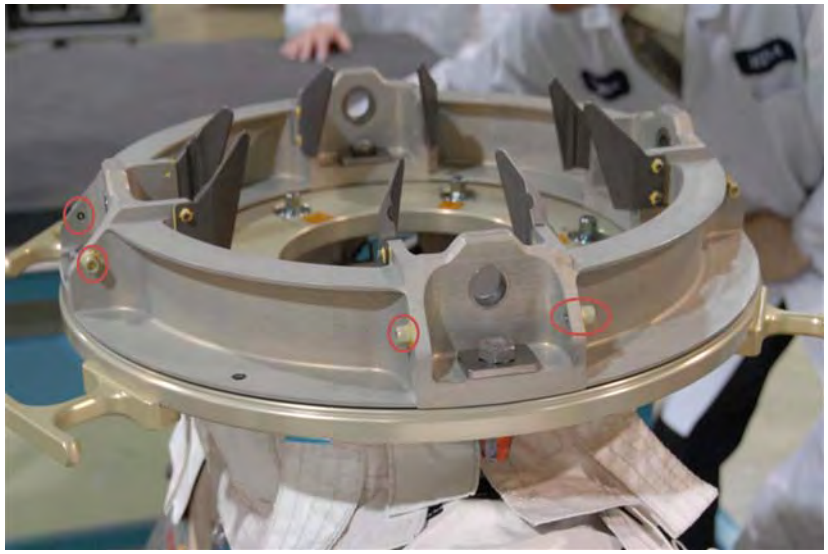




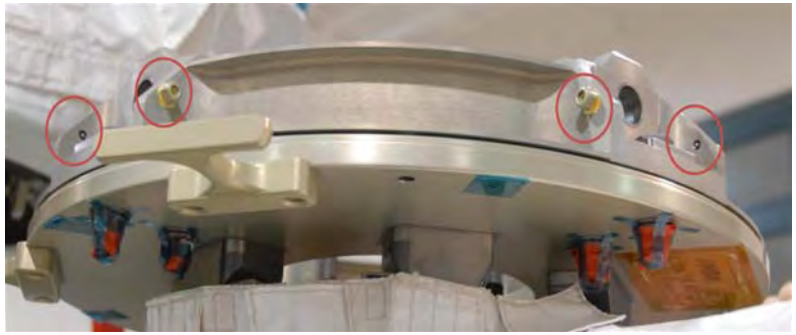
EVA 3 PDGF RETRIEVAL – TASK DATA (Cont)



Sidewall Carrier

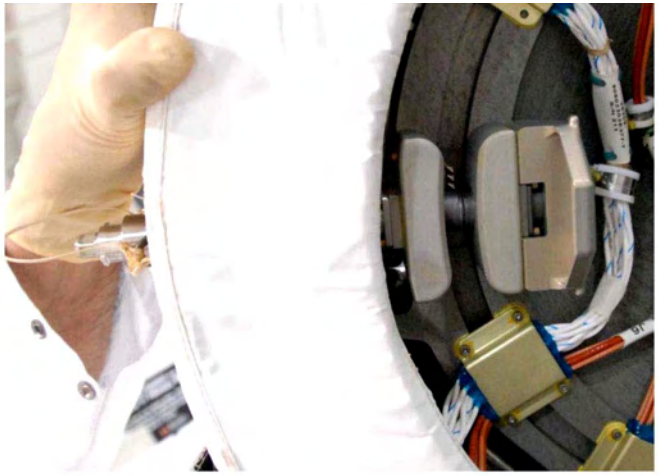


PDGF Mounting Ring Soft Docks

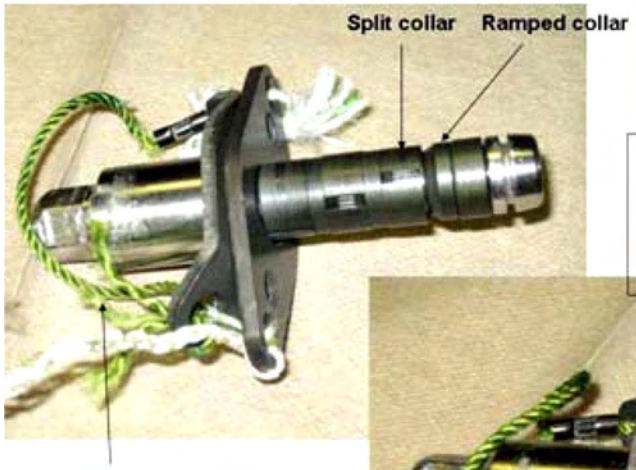


EVA 3 PDGF RETRIEVAL – TASK DATA (Cont)

PDGF EDF



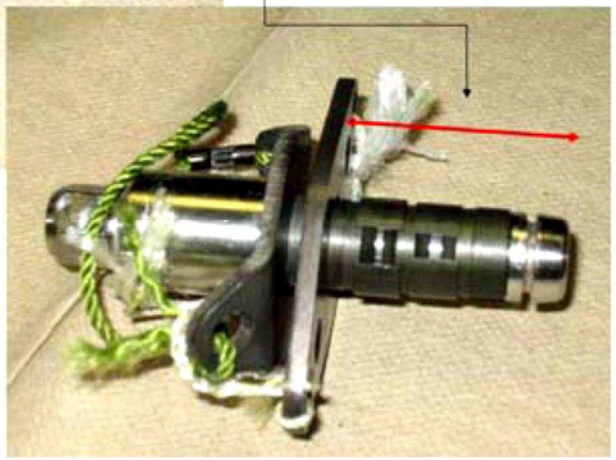
EDF inserted (above), retracted to soft dock (below)



The lanyards restrain the bolt from coming free when the bolt is driven out and the collars will slip through the bolt hole

EDF Bolt

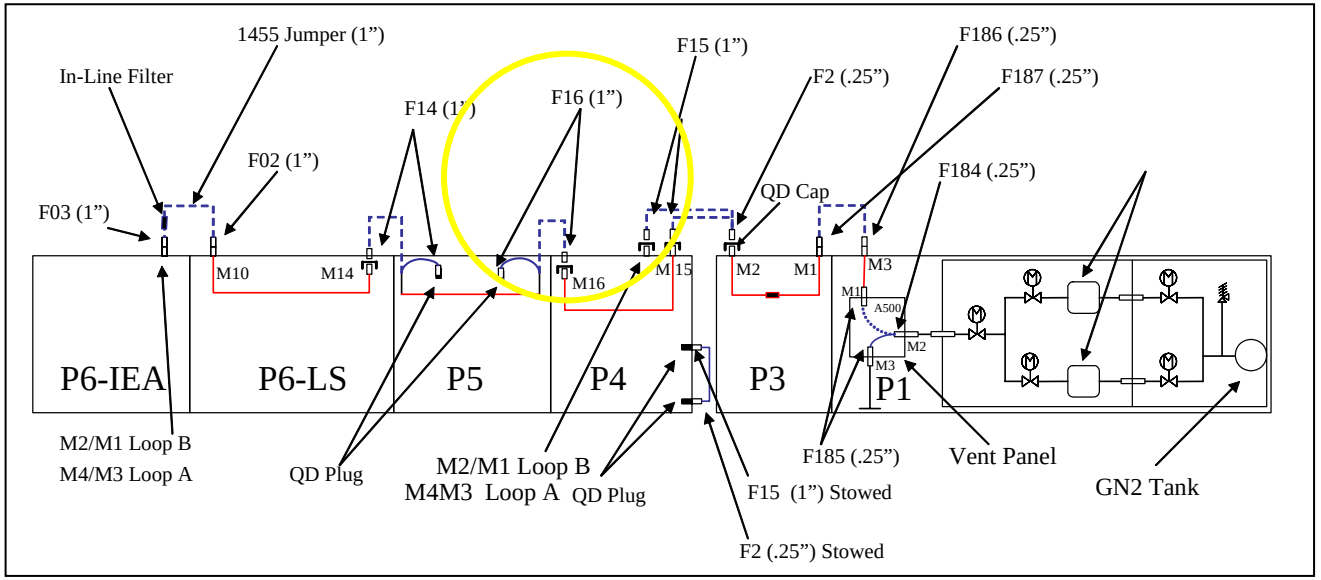
When bolt is driven, this distance is shortened. The ramped collars are driven under the split collars, forcing them to expand. The bolt can no longer be pulled free

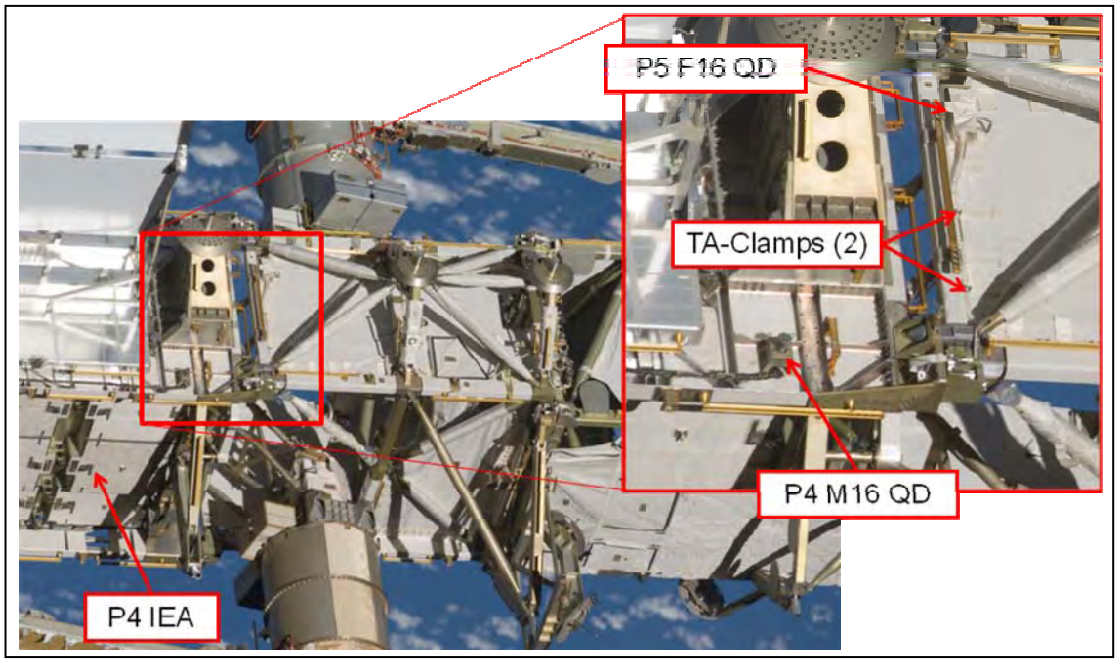


GET-AHEAD: P4/P5 NH3 JUMPER INSTALL (00:15)

IV	EV1	EV2
1. Verify Port SARJ locked **BLOCK A – DEMATE QD** 1. Open thermal bootie (as reqd) 2. √Detent button – up 3. Assess & counteract side loads 4. Pull back on release ring 5. Demate QD 6. √Fwd white band not visible (√Release ring – retracted) **BLOCK B – MATE QD** 1. Inspect QDs for FOD or damage 2. √Detent button – up 3. √Fwd white band – not visible 4. Assess & counteract side loads 5. Mate QD 6. √Fwd white band – visible 7. Snapback test (√Fwd white band still visible) 8. Pull test 9. Visual gap test **BLOCK C – Open Valve** 1. Assess Side loads before Valve Open 2. Press detent button – down, move bail fwd 3. √Aft white band visible; √Detent button – up 4. Verify detent button can be depressed 5. Rotate locking collar, if installed 6. Close thermal bootie as reqd	WARNING QDs exposed to direct sun can overtemp in 20 min. Shading by EMU or thermal shrouds can lengthen acceptable time with bootie removed P4/P5 JUMPER INSTALL 1. Assist EV1 as required	P4/P5 JUMPER INSTALL 1. Translate to P5 inboard 2. Open thermal bootie on QD F16 and demate QD per BLOCK A 3. Remove cap from P4 QD M16 (1" QD) 4. Mate F16 to M16 per BLOCK B 5. Open QD F16 per BLOCK C 6. Reinstall thermal bootie 7. **Gauntlet and Glove Check**

GET-AHEAD: P4/P5 NH3 JUMPER INSTALL – TASK DATA





GET-AHEAD: P3 CETA LIGHT INSTALL (00:30)

IV	EV1	EV2
1. Verify CETA Light inhibits in place **MCC** – Complete CETA light power inhibits Verify RPC Position – Op and Close command inhibited √P3-1A_A RPC 3 √P3-2B_A RPC 2 **MCC** – Give EV GO for connector ops IV: Record CETA Light bolt Data Turns: _____ Torque: _____ **MCC** – On EV GO, perform P3 CETA light powerup	WARNING Avoid inadvertent contact with CETA light (Z-93 paint) P3 CETA LIGHT INSTALL 1. Translate to P3, Face 1 2. Assist EV1 as required	P3 CETA LIGHT INSTALL 1. Translate to P3, Face 4 2. Ingress truss, translate to CETA light bracket 3. Remove light from small ORU Bag 4. Install light onto empty (inner) light bracket (A29) 5. PGT: 7/16 – 6 in ext **B1, CW2, 30.5** (12.0 ft-lb, 30 rpm) 6. Engage light bolt ~11.5-13 turns cw to hardstop (push light past soft dock to ensure bolt engagement) 7. Report torque and turns to **MCC** 8. Check **MCC** for GO to mate connectors: **Light Stanchion PNL A2** | | **CETA Light A29** | | Remove dust cap from J1 P401 demate from J401 | → | J1 Stow dust cap | → | J401 9. Remove round scoop from light, stow 10. Give **MCC** GO to for heater powerup 11. Egress truss ❑ √Safer handles down

P3 CETA LIGHT INSTALL – TASK DATA

Estimated Task Duration:

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

Tools:

EV3
PGT w/7/16 – 6"ext
Rd Scoop
Med ORU bag

EVA Fasteners:

Fastener Name	Label	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns
CETA Light Bolt		716	1	12.0		73.4	11-15

EVA Connectors:

Harness	From	To	Clamps (#)	Conn Size	Function
A29	P401	J1	1	15	Power

Foot Restraints:

Task	WIF	APFR Setting

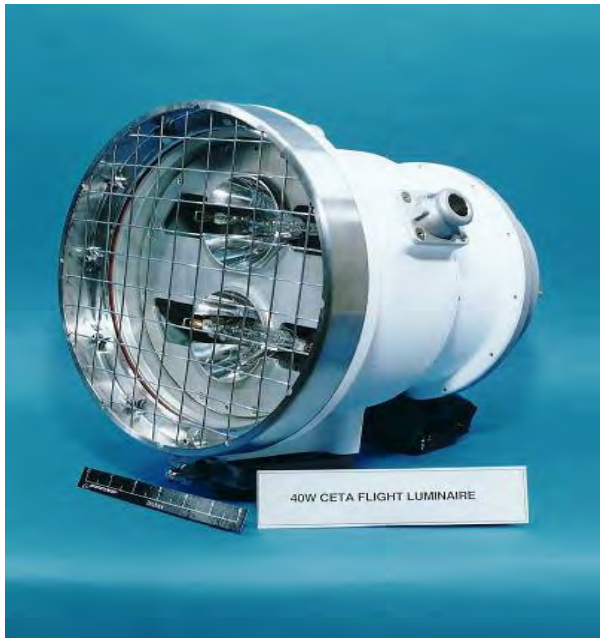
Notes:

1. CETA Lights are covered with Z-93 paint, avoid impact/inadvetant contact
2. If light turned on during EVA, do not touch (possible hot touch temp violation)
3. EVA connectors present a pinch hazard. Caution should be used when mating/locking connectors

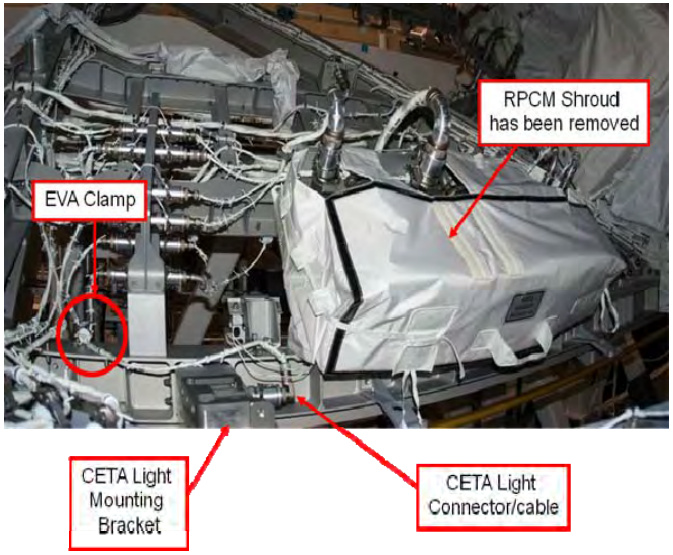
Timeline Considerations:

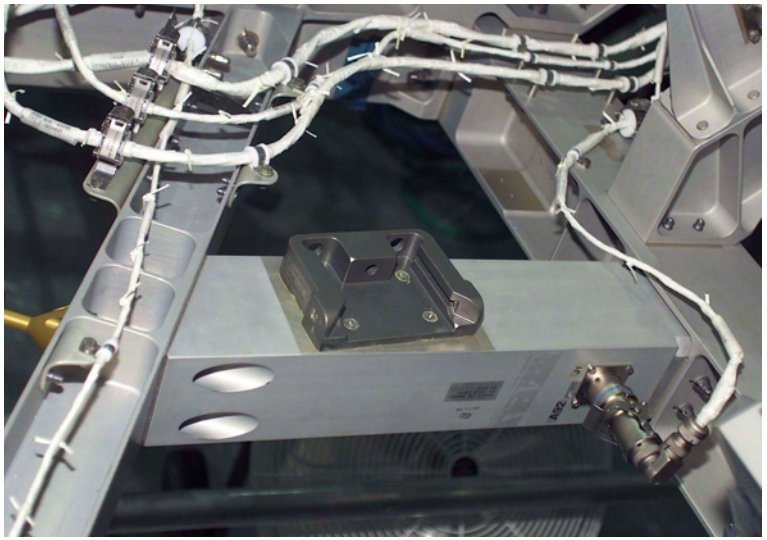
1. CETA light has a thermal clock of 3.5 hr from removal from Airlock

P3 CETA LIGHT INSTALL – TASK DATA (Cont)



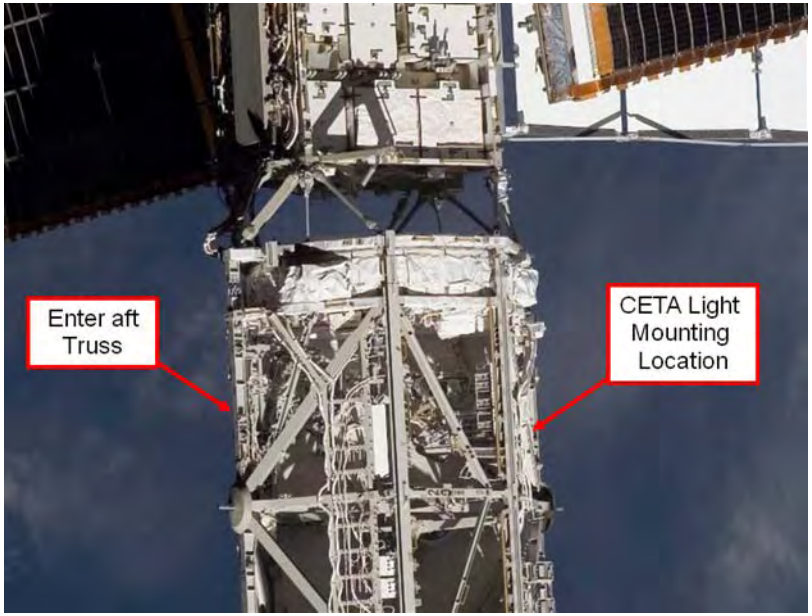
J1 non-flight dust cap, will have EVA dust cap



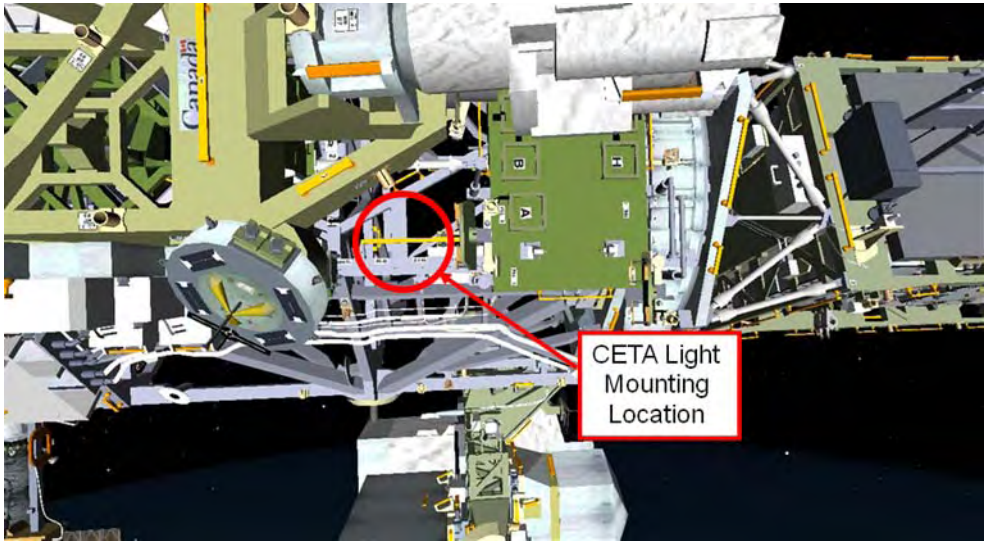


Bracket, connector mated to dummy panel, TA-clamp

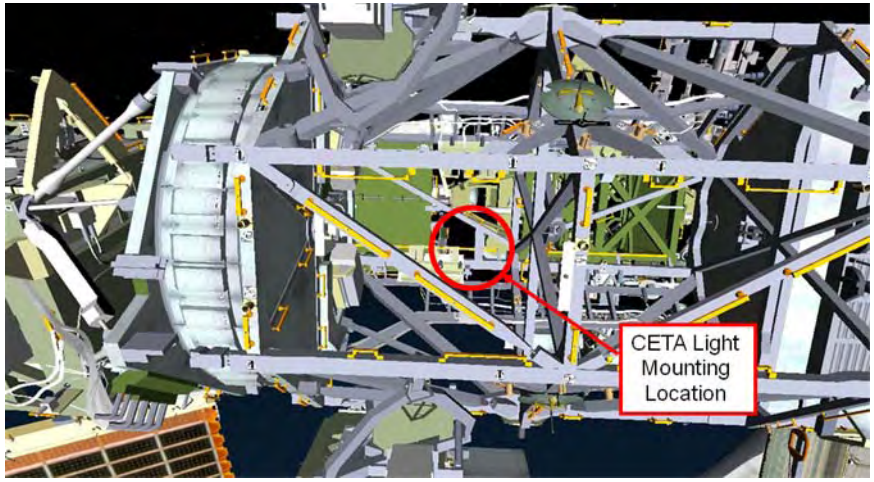
P3 CETA LIGHT INSTALL – TASK DATA (Cont)



MT at WS8, port CETA cart will be over worksite



Limited access through face 1



Through Face 4

TOOLBOX STOWAGE – PRE/POST STS-132 (ULF4)..... TEMP FS 8-2
TOOLBOX PANEL AND SLOT LABELS ..... TEMP FS 8-3
Z1 TOOLBOX INTERNAL LAYOUT ..... TEMP FS 8-4
AIRLOCK TOOLBOX INTERNAL LAYOUT..... TEMP FS 8-5
APFR MANAGEMENT – STS-132 (ULF4) ..... TEMP FS 8-6
PORT LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (LWTSA)..... TEMP FS 8-7
PGT STANDARD SETTINGS..... FS 8-9
EOTP INPUT DRIVE BRACKET BREAK TORQUE..... FS 8-10

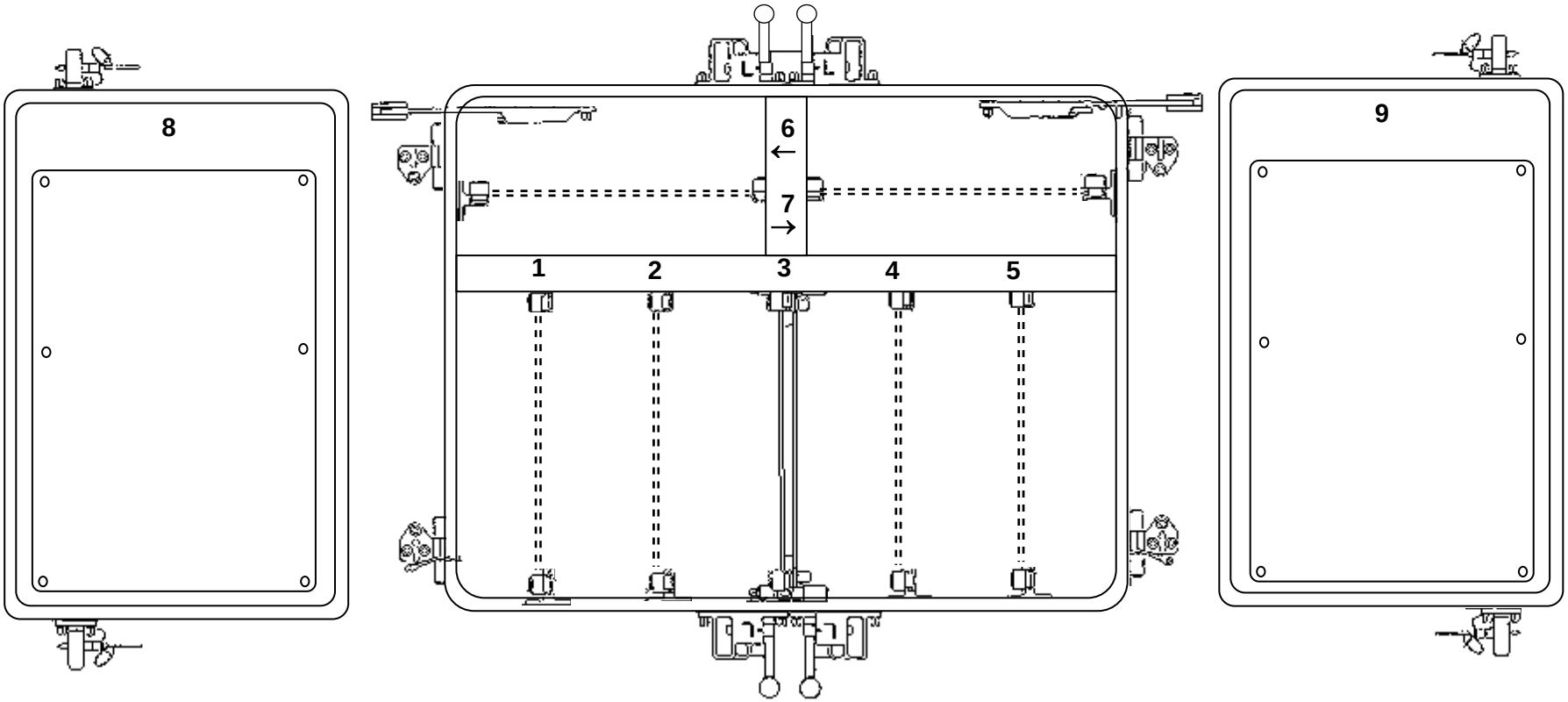
TOOLBOX STOWAGE – PRE/POST STS-132 (ULF4)

	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	SQUARE TM BOARD {stbd door} 7/16" FLUSH SQ SOCKET 7/16" PROUD 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	{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 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}	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		

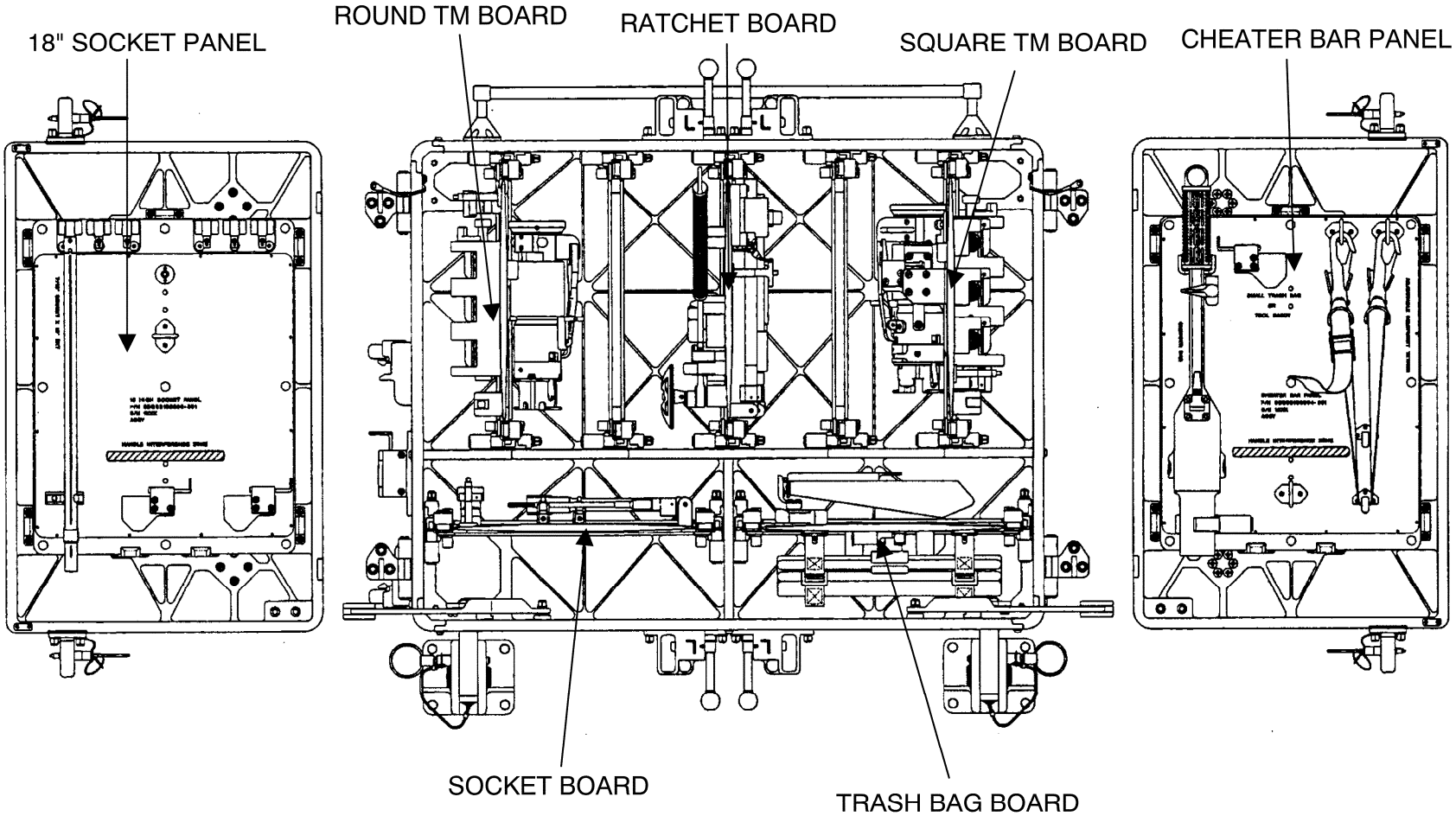
TOOLBOX PANEL AND SLOT LABELS

NOTE

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

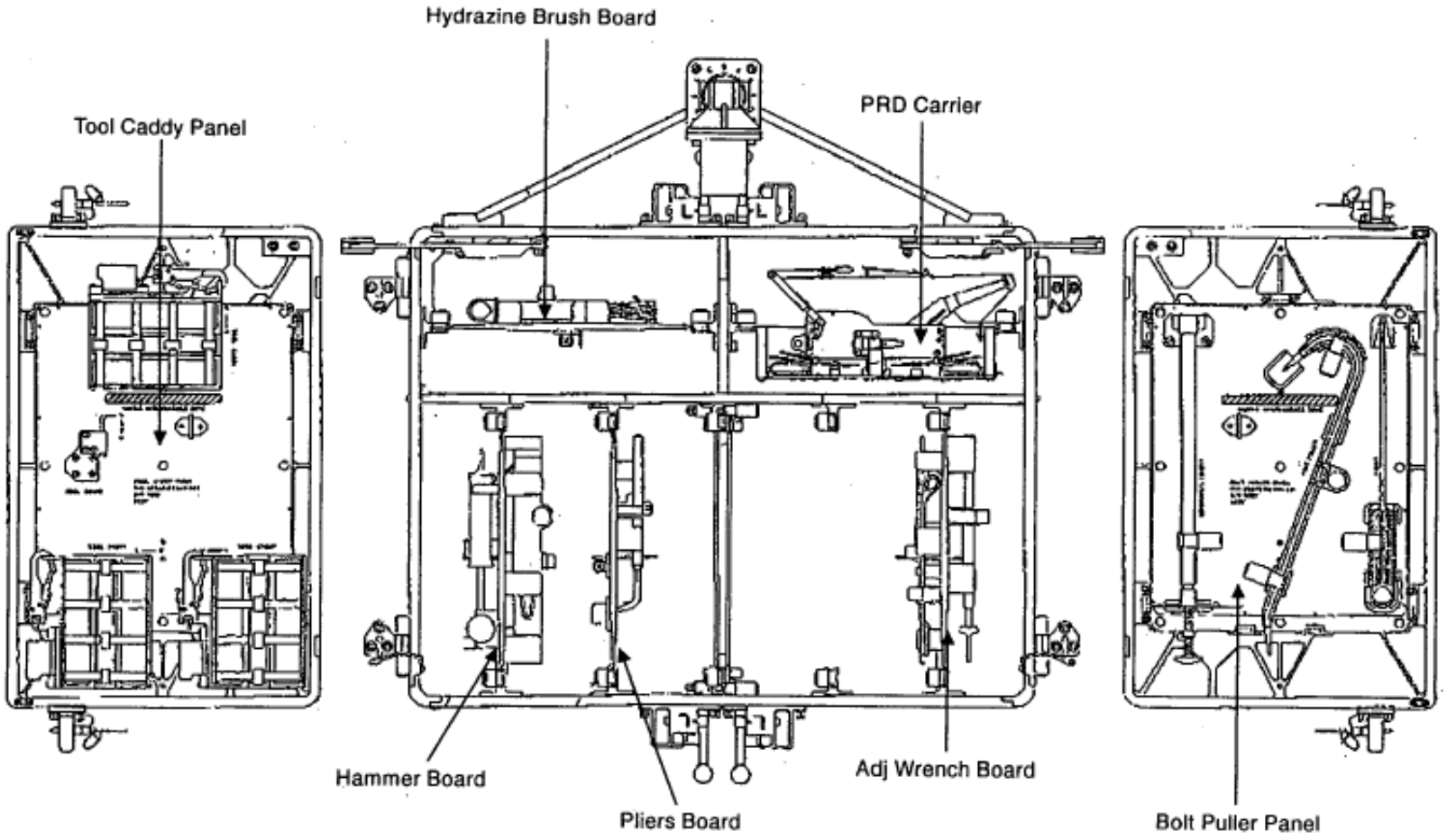


Z1 TOOLBOX INTERNAL LAYOUT



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

AIRLOCK TOOLBOX INTERNAL LAYOUT



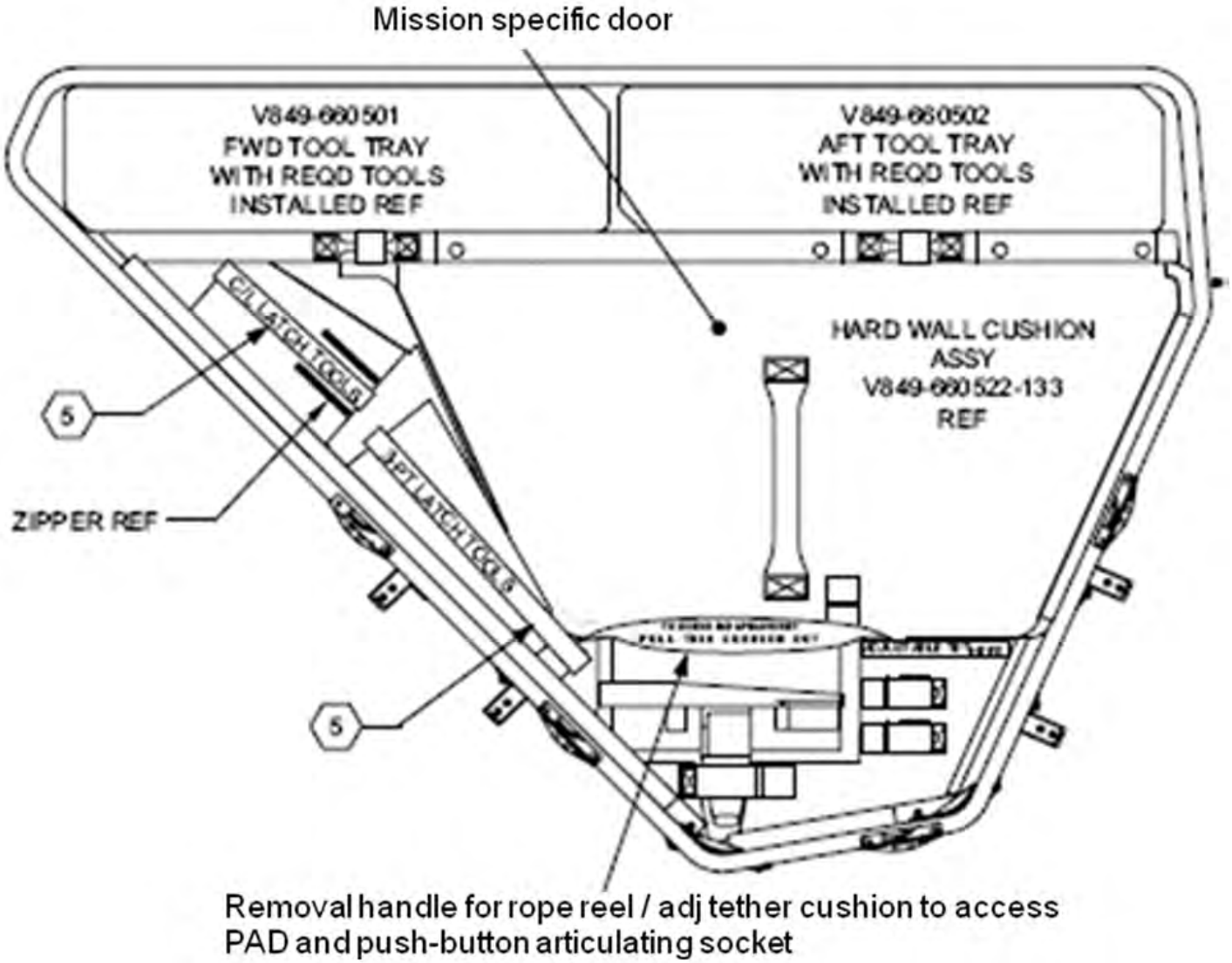
APFR MANAGEMENT – STS-132 (ULF4)

APFR DESIGNATOR	APFR 1 s/n 1004 (8A, 13A.1 Pitch knob problem)	APFR 2 s/n 1006 (US EVA 9 Pitch knob problem, 10A sticky locking collar)	APFR 3 s/n 1005 (no pitch knob prob 9A-inc12 suspected sharp edge on locking collar and possible sticky locking collar)	APFR 4 s/n 1002 (heat shield)	APFR 5 s/n 1003 (heat shield removed on ULF-3)	APFR 6 s/n 1007 (heat shield removed on 12A.1 stage)	APFR 7 s/n 1008	IAPFR 1	IAPFR 2	OTSD	WIF Extender
Post STS-131	P6 WIF 22 [12,QQ,C,1] Yaw & Roll Settings are Approximate	P1 WIF 3 [6,PP,F,11] TS	Stbd CETA Cart WIF 2 [8,RR,E,6] Ingress Aid	Z1 WIF 10 [3,LL,B,6] TS	Stbd CETA Cart WIF 1 [6,OO,E,6]	NODE 2 WIF 7 [12,NN,F,6] Ingress Aid	P6 WIF 10 [12,GG,E,6] Ingress Aid	Z1 WIF 5 [12,PP,F,12]	Z1 WIF 3 [6,PP,F,12]	S0 WIF 7 CL=7	MBS WIF 12 [2,A,1]
Post EVA 1	P6 WIF 22 [12,QQ,C,1] Yaw & Roll Settings are Approximate	…	Stbd CETA Cart WIF 3 [6,PP,F,6] Ingress Aid	…	Stbd CETA Cart WIF 1 [6,OO,E,6]	…	P6 WIF 12 [6,QQ,H,6] Ingress Aid	…	…	…	MBS WIF 12 [2,A,1]
Post EVA 2	P6 WIF 21 [12,QQ,D,12]	…	Stbd CETA Cart WIF 3 [6,PP,F,6] Ingress Aid	…	Stbd CETA Cart WIF 1 [6,OO,E,6]	…	P6 WIF 12 [6,QQ,H,6] Ingress Aid	…	…	…	MBS WIF 12 [2,A,1]
Post EVA 3	Port CETA Cart WIF 2 [9,QQ,F,12]	P1 WIF 3 [6,PP,F,11] TS	Stbd CETA Cart WIF 3 [6,PP,F,6] Ingress Aid	Z1 WIF 10 [3,LL,B,6] TS	Stbd CETA Cart WIF 1 [6,OO,E,6]	NODE 2 WIF 7 [12,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	MBS WIF 12 [2,A,1]

NOTE: APFRs which are not used at any time during STS-132 have settings for each EVA marked with "…", indicating that the settings will not change from the STS-131 settings during STS-132. Cells colored yellow designate that the APFR is used during the indicated EVA, regardless of whether or not the settings change

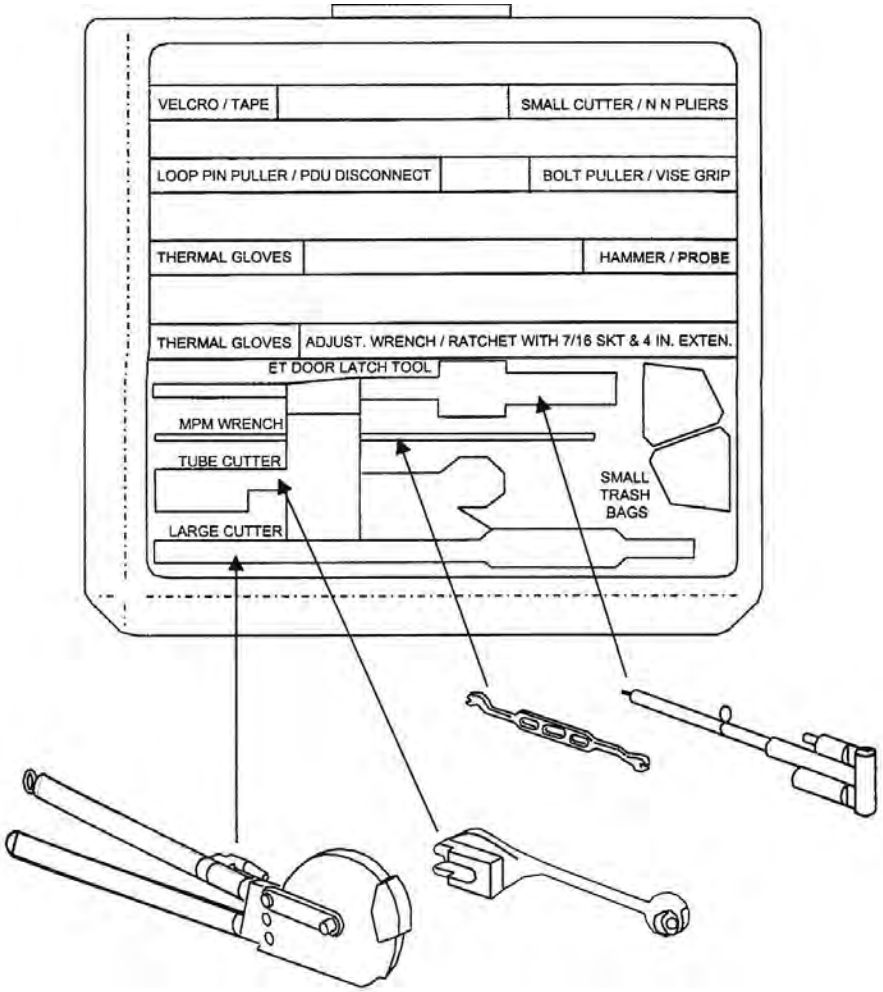
Crane (old ORU tether)	ORU Stanchion/TERA Headless	APFR 2 Tool Stanchion	APFR 4 Tool Stanchion	Tool Stanchion
PMA1 WIF 5	S0 port wedge face	Hex pointed ISS zenith, tool head pointed ISS stbd, and oriented ISS Zenith/Nadir	Tool stanchion aft pointed zenith	S0 port wedge face

PORT LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (LWTSA)

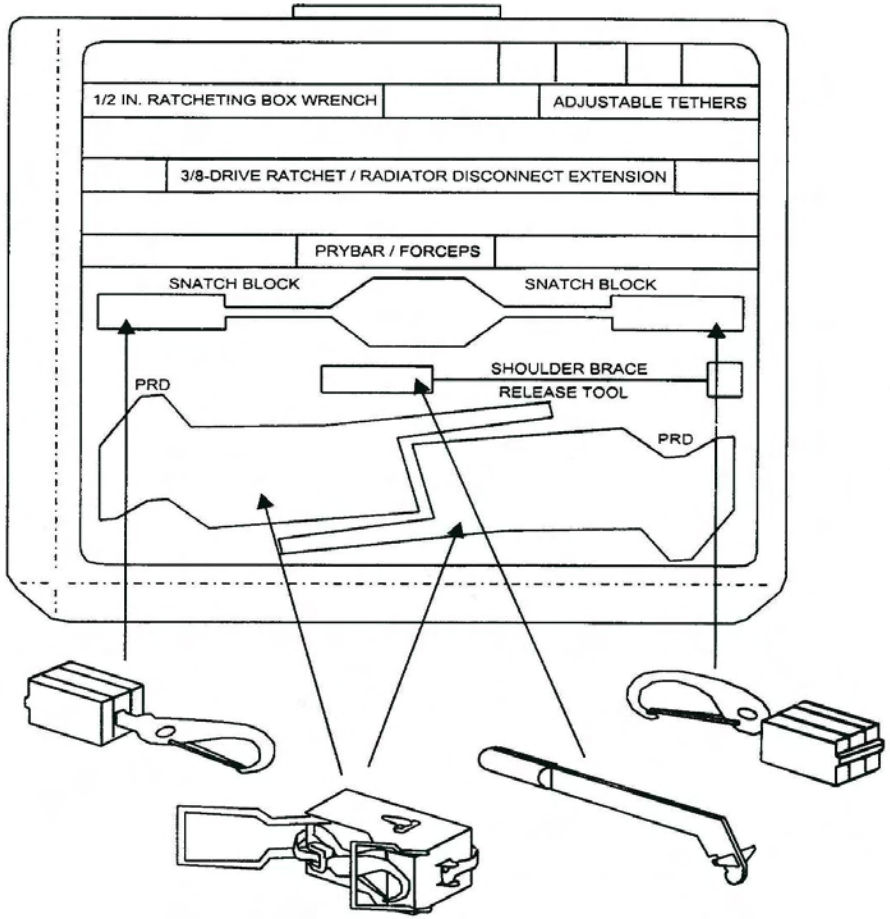


Port LWTSA Layout

PORT LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (LWTSA) (Cont)



LWTSA Layout – Forward Tray



LWTSA Layout – Aft Tray

PGT STANDARD SETTINGS

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

SETTINGS	CCW1	CCW2	CCW3	CW3	CW2	CW1
SPEED (RPM)	10	30	60	60	30	10

SLEEP TIME	15 min
AUTO – OFF TIME	30 min

MULTI-SETTING TORQUE LIMITER (MTL) SETTINGS
2.5
5.5
10.5
15.5
23.5
30.5

EOTP INPUT DRIVE LAUNCH BRACKET BREAK TORQUE

> WARNING
> Avoid contact with exposed spline teeth and grounding fingers on input drive and EOTP spline drive shaft due to sharp edges and dry lube

1. Retrieve the following from Bag C:
   EOTP Input Drive with launch bracket
2. Retrieve the following from EVA Accessory Bag in Volume H:
   3/8-in Ratchet with 7/16-in socket

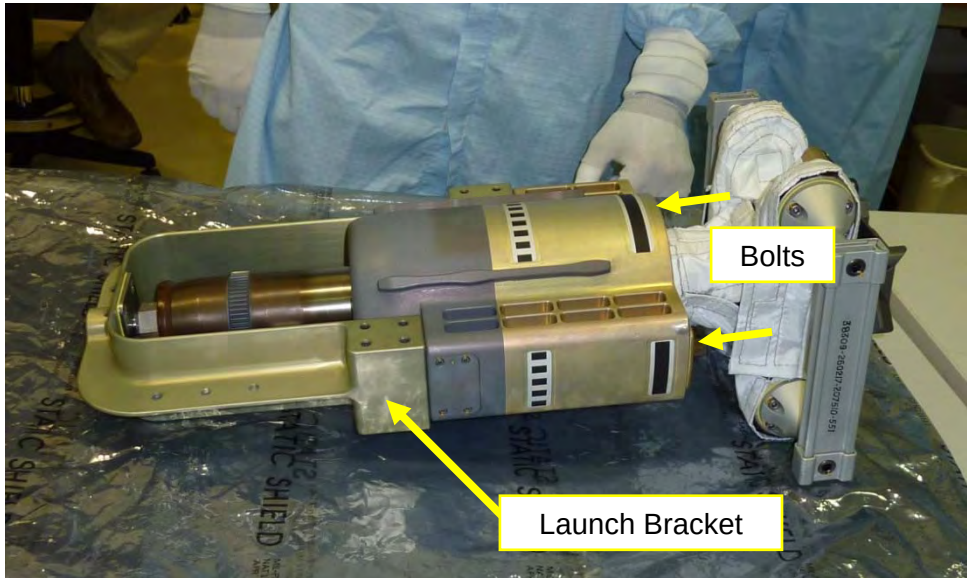


Figure 1.- Thermal Shield Location on APFR

3. Break torque on EOTP Input Drive bolts A and B. Expect a breaking torque of 7-10 ft-lb
   Refer to figure 1

4. Stow EOTP with launch bracket in Bag C

5. Stow 3/8-in Ratchet with 7/16-in socket in EVA Accessory Bag in Volume H Outboard

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-132 CONSUMABLES TRACKING CUE CARD ..... FS CC 10-15
STS-132 EVA BATTERY RECHARGE PLAN ..... FS CC 10-16

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

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STS-132 CONSUMABLES TRACKING CUE CARD

METOX for Campout & 10.2 Ops	Serial Numbers	EVA 1	EVA 2	EVA 3
		05 & 22	19 & 21	15 & 16

PWR Usage: Use 1032, 1015, 1007 in that order until drained

Dump CWC: 1059 for all EVAs

	EV	EMU	LiOH (s/n)	Metox (s/n)	EMU Batt (s/n)	REBA (s/n)	EHIP Batts (s/n)	ERCA (address)	Helmet Light (s/n)	SAFER (s/n)	PGT Batt (s/n)	PGT Batt Spare (s/n)
EVA 1 (FD 4)	EV1 RM	3018	s/n _____ ~launched in suit	N/A	2085 ~in suit post EMU C/O	s/n _____ ~in suit post EMU C/O	1022 1025	19	1008	1005	1009	1004
	EV2 BW	3004	s/n _____ ~launched in suit	N/A	2078 ~launched in suit	1008	1026 1028	20	1006	1006	1005	1004
EVA 2 (FD 6)	EV1 BW	3004	s/n _____ ~from EMU 3011	N/A	s/n _____	1008	1029 1030	20	1006	1005	1006	1004
	EV2 G	3009	s/n _____	N/A	2086	1009	1031 1035	19	1008	1006	1008	1004
EVA 3 (FD 8)	EV1 G	3009	s/n _____	N/A	2088	1009	1022 1025	19	1008	1005	1009	1004
	EV2 RM	3018	s/n _____	N/A	2087	s/n _____	1026 1028	20	1006	1006	1005	1004
Return Config	EV1 BW	3004	s/n _____ ~from EVA 2	N/A	s/n _____	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	EV2 RM	3018	s/n _____ ~from EVA 3	N/A	2085	N/A	N/A	N/A	N/A	N/A	N/A	N/A

EVA-4a/132/O/B

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TOP
BACK OF 'STS-132 CONSUMABLES TRACKING CUE CARD'

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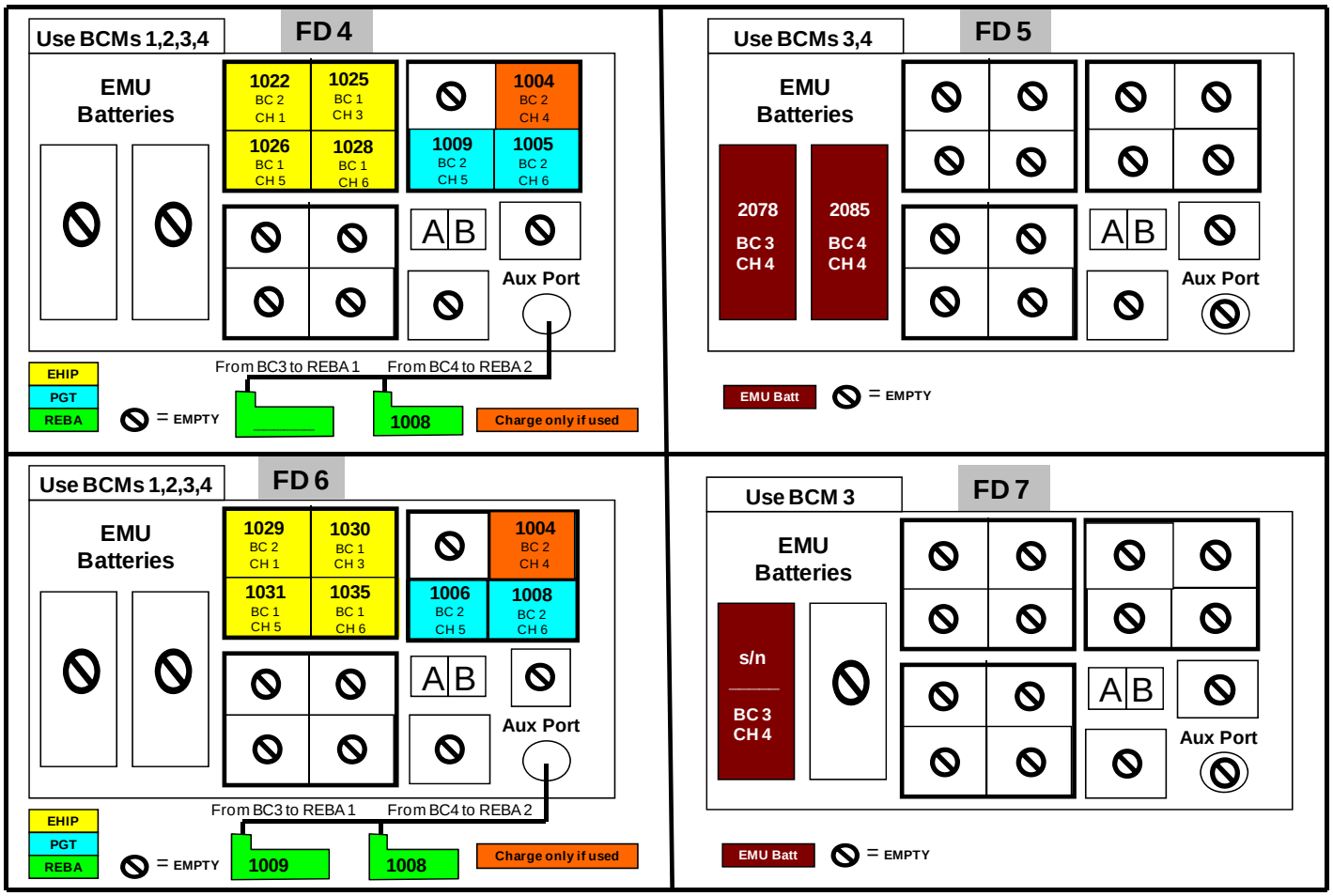
STS-132 EVA BATTERY RECHARGE PLAN



EVA-4b/132/O/B

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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
BENDS TREATMENT ADAPTER (BTA) INSTALLATION (IN-SUIT) 12-19
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 CUE CARD ..... FS CC 12-27
EXPEDITED SUIT DOFFING CUE CARD ..... FS CC 12-28
STS-132 NOMINAL EMU SIZING ..... FS 12-29
STS-132 EMU CONTINGENCY RESIZE MATRIX..... 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

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EMERGENCY UNDOCKING CUE CARD

Critical:

- **EMUs 3018 (RM) & 3004 (BW)**
  - **LTAs, Helmets installed**
- **EMU Batteries (2) – if not installed in EMUs, gather 2 charged batteries**
- **Comm Caps (BW & RM)**
- **85-ft Safety Tethers (2)**
- **Gloves (BW & RM)**
- **LCVGs (BW & RM)**

Highly Desired:

- **Remove in order from EMUs (leave on ISS):**
  - **MWS w/ISS Tools**
    - **Take old ISS MWS (2), stowed in Xfer to Shuttle Bag**
  - **ISS EVA Cuff C/Ls**
  - **Helmet Lights/EMU TV**
  - **REBA**
- **ECOKs (BW & RM)**

Desired:

- **EMU Servicing Kit (s/n 5002) labeled 'Use and Return on 132'**
- **EVA Sys Xfer Bag**
  - **Remove and leave EMU Servicing Kit (s/n 5004)**
- **Xfer to Shuttle Bag**
- **LiOH in ISS EMU**
  - **Remove LiOH (1) from EMU 3009 (G) or EMU 3011 (Spare); cap LiOH**
- **Good's ECOK, LCVG, Comm Cap & Gloves (remove from EMU 3009 (G))**
- **Shuttle Crew Specific Compartment**

NOTE: Highlighted Items may be stowed in C Bag

EVA-5a/132/O/B

(reduced copy)

TOP
BACK OF 'EMERGENCY UNDOCKING CUE CARD'

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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. Doff EMU

If taking EMUs to shuttle:

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

DCM
19. SCU ←|→ DCM
20. LTA →|← HUT
21. Gloves →|← EMU
22. Helmet →|← EMU
23. Go to **EMERGENCY UNDOCKING CUE CARD** on reverse side

EVA-5b/132/O/A

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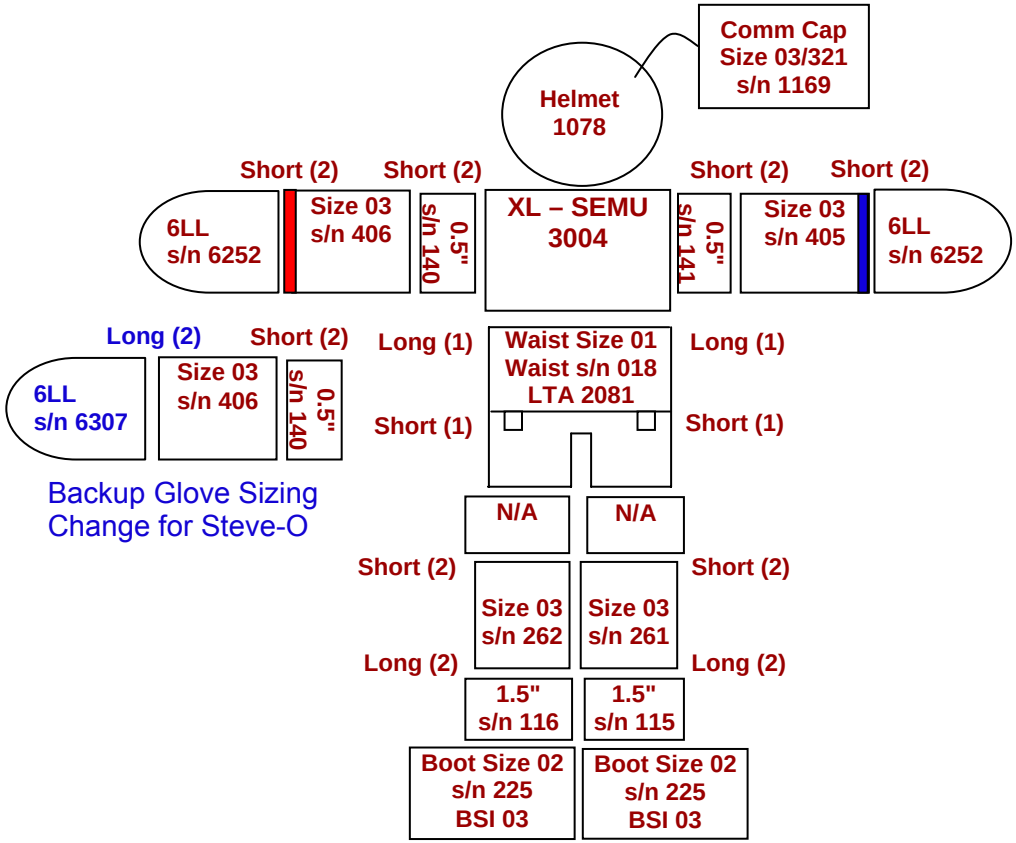
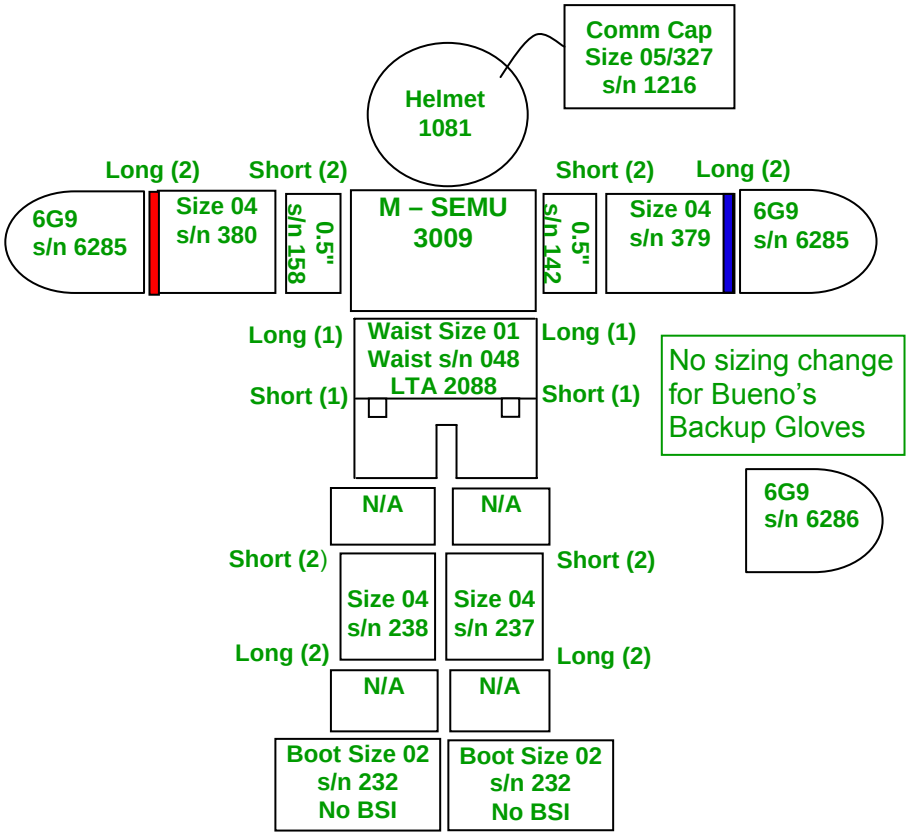
STS-132 NOMINAL EMU SIZING



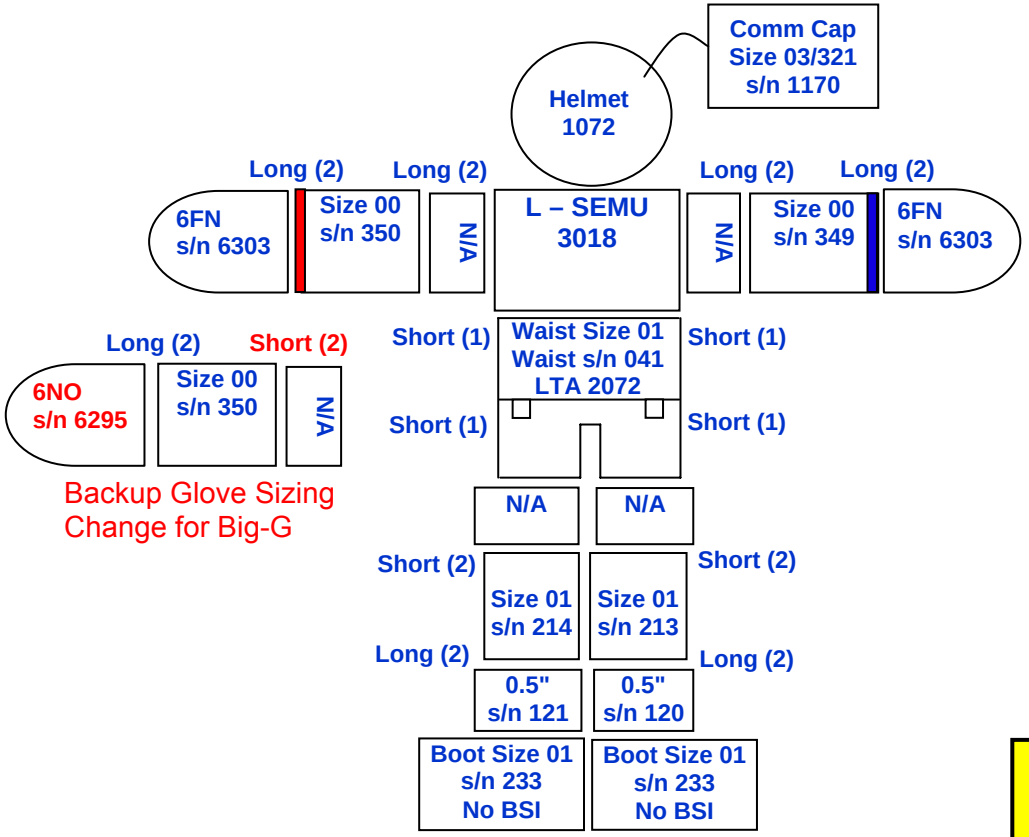
EMU 3004 for BW



EMU 3009 for G

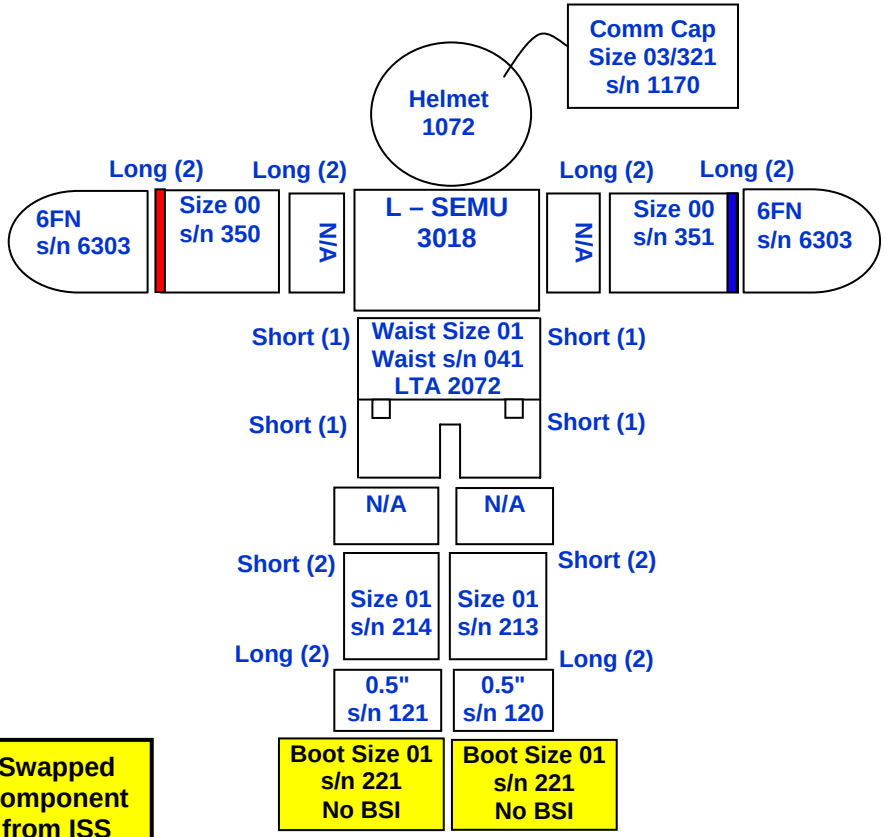
	TCU Top/Bottom/MAG	Socks	LCVG	Signal Conditioner	Comfort Gloves/Wristlets	Valsalva	Fresnel Lens/Croakie
Bowen	XL/L/711	Therm Slips: N/A Tube	05 (s/n 3176)	pr: 103 b/u: 124	Lg, Thin, Spectra/Yes	Original	Yes, 2.0 diopter/Yes
Good	L/M/709	Therm Slips: 07 Thermal (Poly Liners) [L]	06 (s/n 3205)	pr: 117 b/u: 124	Spectra [G1]/No	Original	No/Yes

STS-132 NOMINAL EMU SIZING (Cont)



EMU 3018 for RM (Up Config/Nominal EVA)

Swapped component from ISS



EMU 3018 for RM (Down Config)

	TCU Top/Bottom/MAG	Socks	LCVG	Signal Conditioner	Comfort Gloves/Wristlets	Valsalva	Fresnel Lens/Croakie
Reisman	M/S/709	Therm Slips: 04 Thermal (Poly Liners) [L]	02 (s/n 3153)	pr: 106 b/u: 114	Custom Comfort Gloves [LE]/No	Modified	No/No

STS-132 EMU CONTINGENCY RESIZE MATRIX

LOSS OF:	EV1 – Bowen (BW)	EV2 – Reisman (RM)	EV4 – Good (G)
Helmet	(1078) 1. Use Helmet s/n 1074 from EMU 3011 2. Install original valsalva from EMU Servicing Kit (s/n 5002)	(1072) 1. Use Helmet s/n 1074 from EMU 3011 2. Install modified valsalva from EMU Servicing Kit (s/n 5002)	(1081) 1. Use Helmet s/n 1074 from EMU 3011 2. Install original valsalva from EMU Servicing Kit (s/n 5002)
Comm Cap	(03/321 – s/n 1169) 1. Use shared BW b/u Comm Cap 03/321, s/n 1178 2. Install MBEDs from EMU Servicing Kit (s/n 5002)	(03/321 – s/n 1170) 1. Use shared RM b/u Comm Cap 03/321, s/n 1180 2. Install MBEDs from EMU Servicing Kit (s/n 5002)	(05/327 – s/n 1216) 1. Use G b/u Comm Cap 05/327, s/n 1217 2. Install MBEDs from EMU Servicing Kit (s/n 5002)
LCVG	(05 – s/n 3176) 1. Use BW b/u LCVG 05 – s/n 3177 2. Transfer: Biomed, signal conditioner, and dosimeter	(02 – s/n 3153) 1. Use RM b/u LCVG 02 – s/n 3179 2. Transfer: Biomed, signal conditioner, and dosimeter	(06 – s/n 3205) 1. Use G b/u LCVG 06 – s/n 3182 2. Transfer: Biomed, signal conditioner, and dosimeter
Signal Conditioner	(s/n 103) 1. Use shared BW/G b/u Signal Conditioner s/n 124 from OBS/IVA Kit (MA16L)	(s/n 106) 1. Use RM b/u Signal Conditioner s/n 114 from Bag E	(s/n 117) 1. Use shared BW/G b/u Signal Conditioner s/n 124 from OBS/IVA Kit (MA16L)
HUT/PLSS	(XL – EMU 3004) 1. Use on-orbit XL EMU 3005 2. Remove gloves and LTA from EMU 3004 3. Install gloves and LTA onto EMU 3005 4. √Locks, √cams 5. Use prime BW CCA and Helmet 6. Swap EMU PLSS identifier stripes, mission patch, and national flag	(L – EMU 3018) 1. Use on-orbit L EMU 3010 2. Remove gloves and LTA from EMU 3018 3. Install gloves and LTA onto EMU 3010 4. √Locks, √cams 5. Use prime RM CCA and Helmet 6. Swap EMU PLSS identifier stripes, mission patch, and national flag	(M – EMU 3009) 1. Use launched M EMU 3011 2. Remove gloves and LTA EMU 3009 3. Install gloves and LTA on EMU 3011 4. √Locks, √cams 5. Use prime G CCA and Helmet 6. Swap EMU PLSS identifier stripes, mission patch, and national flag
Arm Sizing Ring	(0.5" – s/n 140/141) 1. Use on-orbit arm sizing rings 0.5" – 145/146 from EMU 3005	N/A	(0.5" – s/n 158/142) 1. Use on-orbit arm sizing rings 0.5" – 171/172 from EMU 3011
Lower Arm Segment and cams	(03, S/S – 406/405) 1. Use on-orbit lower arm segments 03 – s/n 378/377 2. Verify cams: S/S 3. √Locks, √cams	(00, L/L – 350/349) 1. Use on-orbit lower arm segments 00 – 430/429 2. Verify cams: L/L 3. √Locks, √cams	(04, S/L – 380/379) 1. Use on-orbit lower arm segments 04 – 409/410 from EMU 3011 2. Configure arm cams: S/L 3. √Locks, √cams

STS-132 EMU CONTINGENCY RESIZE MATRIX (Cont)

LOSS OF:	EV1 – Bowen (BW)	EV2 – Reisman (RM)	EV4 – Good (G)
Gloves	For loss of Prime (6LL/6252): 1. Use BW b/u gloves 6LL/6307 2. Configure arm cams: S/L	For loss of Prime (6FN/6303): 1. Use RM b/u gloves 6NO/6295 2. Configure arm cams: S/L	For loss of Prime (6G9/6285): 1. Use G b/u gloves 6G9/6286
Waist Brief and cams	(01, L/S – s/n 018/2081) 1. Use on-orbit waist brief 01 – s/n 029/2075 2. Verify waist brief cams: L/S 3. Install BW leg segments, leg sizing rings and boots 4. √Locks, √cams	(01, S/S – s/n 041/2072) 1. Use on-orbit waist brief 01 – s/n 045/2076 2. Verify waist brief cams: S/S 3. Install RM leg segments, leg sizing rings and boots 4. √Locks, √cams	(01, L/S – s/n 048/2088) 1. Use on-orbit waist brief 01 – s/n 053/2092 2. Configure waist brief cams: L/S 3. Install G leg segments and boots 4. √Locks, √cams
Thigh Sizing Ring	N/A	N/A	N/A
Leg Segment and cams	(03, S/L – s/n 262/261) 1. Use on-orbit leg segments 03 – s/n 244/243 2. Verify cams: S/L 3. √Locks, √cams	(01, S/L – s/n 214/213) 1. Use on-orbit leg segments 01 – s/n 268/267 2. Verify cams: S/L 3. √Locks, √cams	(04, S/L – s/n 238/237) 1. Use leg segments 04 – s/n 254/253 launched on EMU 3011 [no boots] 2. Configure leg cams: S/L 3. √Locks, √cams
Leg Sizing Ring	(1.5" – s/n 116/115) 1. Use on-orbit leg rings 1.5" – s/n 122/121 2. √Locks	(0.5" – s/n 121/120) 1. Use on-orbit leg rings 0.5" – s/n 134/135 2. √Locks	N/A
Boot	(02 – s/n 225) 1. Use on-orbit boots 02 – s/n 234 2. Remove 03 BSI/Toe Caps from prime boots (s/n 225) 3. Install 03 BSI/Toe Caps in Boots s/n 225 4. √Locks	(01 – s/n 233) 1. Use on-orbit boots 01– s/n 221 2. √Locks	(02 – s/n 232) 1. Use on-orbit boots 02 – s/n 234 2. √Locks

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-132 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-132/ULF4 WORKAROUNDS CRIBSHEET

TASK	FAILURE	ACTION
BATTERY BOLTS	A. IEA Bolt Removal: H1, H2	1. PGT: Manual ratchet 2. PGT w/TM A7,CCW2 3. Check **MCC-H** for tie-down plan
	B. IEA Bolt Installation: H1	1. Back out and reattempt installation If no joy: 2. PGT: Manual ratchet 3. Check **MCC-H** for tie-down plan
	C. IEA Bolt Installation: H2	1. Verify pushing PGT while installing (to overcome antirotation device) 2. Verify relieving side loading, verify battery level 3. If high running torque, backout and reattempt installation 4. If still no joy, back out completely and inspect surfaces (IEA and battery) for FOD; reattempt installation 5. If still no joy: Check **MCC-H** for tie-down plan
	D. ICC-VLD Removal: Torque Break H1	**PGT A7 w/TM, CCW2 (don't expect shear pin to fail)**
	E. ICC-VLD Removal: Torque Break H2	**PGT A7 w/TM, CCW2 (don't expect shear pin to fail)**
	F. ICC-VLD Removal: Bolt release H1	1. If no joy releasing bolt, attempt to reinstall bolt using nominal settings; report torque and turns 2. If no joy, reinstall bolt **PGT A7 w/TM, CW2** 3. Re-release at **PGT A7, CCW2 w/TM** 4. If no joy, reinstall bolt **PGT A7 CW2 w/TM** and leave on pallet 5. If no joy with reinstallation PGT setting (shear pin expected to fail): **PGT: [B2 (16.0), CCW2, 30.5], TM Rec 7/16, 1 turn at bolt (5 turns on PGT)** 6. If shear pin breaks, remove TM 7. **PGT: [A7 (9.2), CCW2, 30.5], 7/16 - 6 ext** Expect 8-9 turns to remove insert 8. Check **MCC-H** for tie-down plan
	G. ICC-VLD Removal: Bolt release H2	1. Verify relieving side loading; verify battery level 2. If no joy releasing bolt, attempt to reinstall bolt using nominal settings; report torque and turns 3. If no joy, reinstall bolt **PGT A7 w/TM, CW2** 4. Re-release at **PGT A7, CCW2 w/TM** 5. If no joy, reinstall bolt **PGT A7 CW2 w/TM** and leave on pallet 6. If no joy with reinstallation PGT setting (shear pin expected to fail): **PGT: [B2 (16.0), CCW2, 30.5], TM Rec 7/16, 1 turn at bolt (5 turns on PGT)** 7. If shear pin breaks, remove TM 8. **PGT: [A7 (9.2), CCW2, 30.5], 7/16 - 6 ext** Expect 8-9 turns to remove insert 9. Check **MCC-H** for tie-down plan

TASK	FAILURE	ACTION
	H. ICC-VLD Installation H2	1. Verify pushing while installing (to overcome antirotation device) 2. Verify relieving side loading; verify battery level 3. If high running torque, back out and reattempt installation 4. If still no joy, back out completely and inspect surfaces (ICC-VLD and battery) for FOD; reattempt installation 5. If still no joy: Check **MCC-H** for tie-down plan
	I. ICC-VLD Installation: H1	1. Back out and reattempt installation 2. Increase PGT setting: **PGT: [A7 (9.2), CW2 w/TM, 30.5], 7/16 - 6-ext** 3. If no joy: Check **MCC-H** for tie-down plan
EOTP	A. Cannot untorque EOTP hinge pin	1. Increase torque to **PGT: [B7 (25.5), CCW2], 1 turn only** 2. Increase torque to 30.5 ft-lb (PGT ratchet mode), one turn only
	B. Cannot break torque on EOTP FSE bolts (1-4)	FSE EOTP 1-4: 1. Increase torque to **PGT: [B7 (25.5), CCW2],** one turn only 2. Increase torque to 30.5 ft-lb (PGT manual ratchet mode), one turn only 3. Use ratchet wrench to break torque
	C. Cannot release EOTP FSE bolt (1-4)	1. Release ARD, **PGT: [A7 (9.2), CCW2], 3 turns** a. If no joy, increase torque **PGT: [B7 (25.5), CCW2], 3 turns** b. If ARD still won't release, increase torque to 30.5 ft-lb (PGT ratchet mode), one turn only 2. Break torque on contingency bolt **PGT: [B7 (25.5), CW2], EOTP contingency socket w/DPTA, 1 turn** 3. Release contingency bolt **PGT: [A6 (8.3), CW2], EOTP contingency socket w/DPTA, 16 turns to hard stop**
	D. Cannot soft dock EOTP to SPDM	1. Verify MLI, hinge pin and EDFs are clear 2. Verify soft dock tab deflection ("wiggle" EOTP to align in soft docks) 3. Engage EOTP hinge pin, and reattempt soft dock 4. If no joy, check **MCC-H**
	E. Cannot insert hinge pin	1. Verify lanyard not wrapped around shaft 2. Wiggle hinge pin to work into place 3. Lightly tap on pin in axial direction
	F. Cannot drive hinge pin	1. Wiggle to engage threads 2. Increase torque to **PGT: [B7 (25.5), CW2], ~10 turns to torque** 3. Increase torque to 30.5 ft-lb (PGT manual ratchet mode), until fully installed, ~10 turns

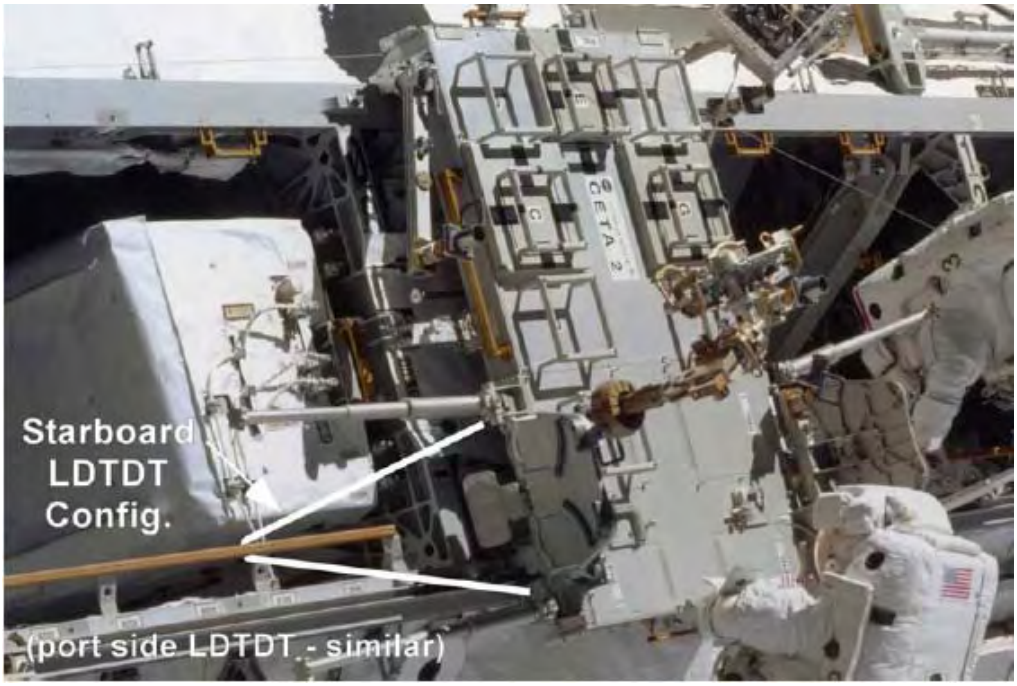
TASK	FAILURE	ACTION
	G. Cannot drive input drive bolt	1. Remove input drive and inspect for debris on thread and in housing 2. Reinstall input drive into SPDM housing and verify it is fully seated (oriented within 90 deg position band and inserted until solid black line around Input Drive body aligns with SPDM housing) 3. Attempt to drive input drive bolt using original PGT setting **PGT [A7 (9.2), CW2] - 6 ext 7/16;** ~10 turns 4. If still no joy, proceed to second Input Drive Bolt at nominal settings **PGT [A7 (9.2), CW2] - 6 ext 7/16;** ~10 turns 5. If no joy, increase torque to **PGT [B2 (16.0), CW2] - 6 ext 7/16;** ~10 turns 6. If no joy, increase torque to **PGT [B5 (22.0), CW2] - 6 ext 7/16;** ~10 turns 7. If second bolt does not fully install, remove input drive or check **MCC-H** for tie-down plan
PDGF REMOVAL FROM SIDEWALL CARRIER	A. Both EDF retaining lanyards missing/ not intact	Tether to EDF prior to releasing fastener. After release, fully remove EDF and stow EDF in trash bag
	B. PDGF cannot be removed from sidewall carrier mounting ring soft dock	1. Ensure all four EDFs are released and retracted; twist PDGF while pulling to work it off (avoid curvic coupling) 2. On **MCC GO**: Retrieve prybar from ISS A/L (staging bag) 3. On **MCC GO**: Reinstall EDFs
PUMAA INSTALL	A. Primary bolt (1)	1. Release and attempt to reinstall 2. Try to install on other tether point
SGANT BOOM	A. ICC VLD Removal: Primary FSE Bolts (8)	1. Reinstall primary bolt, **PGT: [A5 (7.0), CW2]**; try release again 2. Increase torque to 30.5 ft-lb (PGT manual ratchet mode), one turn only 3. Reinstall primary bolt, **PGT: [A5 (7.0), CW2],** then release contingency bolt, **PGT: [B7 (25.5), CCW2] (may require PGT manual ratchet, MTL 30.5)**
	B. Contingency FSE Bolts (4)	1. Reinstall contingency bolt, **PGT: [A5 (7.0), CW2]**; try release again 2. Increase torque to 30.5 ft-lb (PGT manual ratchet mode), one turn only 3. Attempt release with ratchet wrench 4. If no joy, release primary bolts if not yet tried; otherwise, reinstall, **PGT: [A5 (7.0), CW2]**
	C. FSE soft dock release	1. Verify no side loads 2. If no joy, reinstall primary bolts then release contingency bolts
	D. Z1 Installation: Bolts (2)	1. Check static pin alignment 2. Back out bolt, try reinstall 3. Attempt to install other bolt at nominal PGT setting 4. Increase torque **PGT: [B7 (25.5), CCW2], 29-32 turns to hardstop** 5. If neither bolt installed, check **MCC-H** for tie-down plan
	E. SGTRC MLI Removal: Grounding bolt	1. Increase torque to **PGT: [A7 (9.2), CCW2, 30.5], 7/16 – 6 ext** 2. Cut grounding wire w/EMU scissors

TASK	FAILURE	ACTION
SGANT DISH	A. Break Torque on FSE Bolt (2)	1. Try other bolt 2. Increase torque to **PGT: [B1 (12.00), CCW2 w/TM], 1 turn** 3. Increase torque to **PGT: [B2 (16.00), CCW2 w/TM], 1 turn** **<u>NOTE</u>: This setting will require FSE inspection upon return as potential damage may occur** 4. If still no joy: Check MCC-H for increase torque setting or to remove SGANT IA from ICC and stow on EOTP
	B. Release FSE Bolt (2)	1. Reinstall and back out 2. Increase torque to **PGT: [B7 (25.5), CCW2], 29-32 turns to hard stop** 3. If no joy, reinstall bolts, remove SGANT IA from ICC and stow on EOTP
	C. SGANT Removal from FSE	1. Verify bolts backed out all the way 2. Try rocking side to side to slide off static pins 3. Consider using ISS pry bar to release from static pins 4. If no joy, reinstall bolts, remove SGANT IA from ICC and stow on EOTP
	D. SGANT to Boom Install Bolt Installation (4)	1. Back out and reinstall 2. If less than four of four bolts, contact **MCC-H** for tie-down plan
	E. Gimbal lock removal: Bolt Release (12)	1. Reinstall, and re-release 2. If not using ERAD, increase torque to **PGT: [B4 (19.4), CCW2]** 3. If using the ERAD, increase torque to **PGT: [A7 (9.2), CCW2]** 4. If no joy, reinstall at least one bolt and check **MCC-H** for tie-down plan
	F. Gimbal lock soft dock release	1. Pry apart, avoiding silver areas 2. If no joy, reinstall at least one bolt on each gimbal lock 3. Install scoop on gimbal lock and reattempt release

TASK	FAILURE	ACTION
I. Generic	**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. If no joy, attempt APFR install in alternate WIF 5. If no joy, 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 knob – 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** five turns
	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** four turns
	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 soft dock	1. Verify collar unlocked. (White on connector shell tip should align with white on receptacle backplate) 2. Check for FOD or damage

TASK	FAILURE	ACTION
	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
	B. Wheel bogie fails to install on truss	There is no spare wheel bogie on-orbit. Four of four bogies are required. Real time call on whether MT couple or CETA cart tie down required. For tie down 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. If at least one CETA cart is stbd of the MT, swap active couplers 3. On **MCC-H GO**: Tie down CETA cart. See block G

TASK	FAILURE	ACTION
	G. CETA cart tie down	On **MCC-H GO**: Perform the following tie-down procedure (see figure 1) a. Translate CETA cart to TBD location (not over truss segment joint) b. Engage parking brake c. Retrieve two Long Duration Tie Down (LDTD) tethers from P6 AUX Bag (fwd face of Z1) d. Route 1 LDTD tether on stbd side of CETA cart as follows: 1. Attach one 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 wire ties (2) (reinstall of wire ties not required) and PIP pins (2) 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**
	K. Swing arm fails to lock	Restrain in stowed position with wire ties

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. Release other EDFs at nominal PGT settings to relieve loading on stuck EDF 4. Remove EDF with prybar (only if head not free spinning)

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 two turns (If re-installing, start EDF by hand) 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. Remove EDF and verify collets not expanded 4. Drive EDF two turns ccw; retry insertion; verify head not free spinning 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 reinsert (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 for debris, damage, or crystals 2. Verify release ring is retracted. (Fwd white band is not visible) 3. Check alignment and verify no side loads
	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; demate QD, verify fwd white band not visible, and remate QD
	C. Gap check fails (visual or FID gauge)	Retract release ring, demate QD, verify fwd white band not visible, and remate QD

TASK	FAILURE	ACTION
	Valve Ops	
	A. Detent button is partially unthreaded	Rethread detent button a. Load bail handle. (Button will free spin if not loaded) – If valve is open, pull bail handle aft – If valve is closed, push bail handle fwd b. Rotate button cw (8 turns max)
	B. Detent button is missing NOTE Detent button is only required for BDT ops and one 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)
	C. Bail fails to travel fwd	1. Check for debris, damage, or crystals 2. Retrieve and use QD bail drive lever (3/4, 1, & 1-1/2 in only); notify **MCC-H**
	D. Bail fails to travel to full fwd (valve open) position (button does not pop up)	1. Neutralize sideloads 2. Apply greater opening force to QD bail handle 3. Retrieve and use QD bail drive lever (3/4, 1, & 1-1/2 in only); notify **MCC-H** 4. If applicable, retrieve and install SPD; notify **MCC-H**
	E. Detent button fails to depress during valve closing WARNING Bail may kick back and contact crew when button is depressed if a leaking primary seal allowed pressure build-up in spring cavity	1. Verify locking collar fully rotated (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 pulling bail aft until release ring covers aft white band – Push bail fwd to valve open and check button depresses 3. Retrieve QD bail drive lever and repeat step 2 (3/4, 1, & 1-1/2 in only); notify **MCC-H** 4. Contact **MCC** to reduce NH3 temperature if possible 5. On **MCC-H GO**: Retrieve and install QD button depress tool (BDT) (1/4, 3/4, & 1 in only)
	F. Bail fails to travel to full aft (valve closed) position (button does not pop up)	1. Inspect QD for retaining wire protrusion 2. Neutralize possible side loading 3. Depress button and increase force on bail 4. Retrieve and use QD bail drive lever (3/4, 1, & 1-1/2 in only); notify **MCC-H**

TASK	FAILURE	ACTION
	Demating Ops	
	A. Female QD fails to demate	1. Verify release ring is fully retracted while attempting to demate 2. Verify TA or P clamps are released 3. Verify detent button is up. (Locking collar can be rotated under button) 4. Verify trigger linkage is still attached to release ring (1-1/2 in only) 5. Neutralize sideloads or manipulate flexhose to relieve mating forces on female QD 6. Apply greater force to release ring and female QD 7. Retrieve and use QD Release Tool (QRT) to apply greater force; notify **MCC-H**
	B. Thermal bootie fails to remain securely closed	Install wire tie around bootie to keep QD fully covered
	C. Cap will not demate	1. Verify pulling out on cap before rotating to ensure locking tab is disengaged 2. Wait for day pass if possible and reattempt cap removal 3. If force is too great for hand actuation or crystals visible around the QD, male may be leaking; notify **MCC-H** – Prepare for quick mate on **MCC-H GO** 4. Retrieve QD cap tool (1/4, 1/2, & 1 in only) – Use QD cap tool to turn stuck cap a maximum of two turns (cap vents at ~two turns). Finish removal of cap by hand (~one additional turn)
	Leaks	
	A. Mated QD leaks in valve open position (bail fwd)	1. Remove SPD and fully open valve (bail fwd) 2. If leak continues close valve (bail aft)
	B. Male QD leaks after cap removal	Reinstall cap; notify **MCC-H** – Prepare for quick QD mate on **MCC-H GO**
	C. Female QD leaks during or after bail actuation to fwd position (valve open)	1. Return bail to aft position (valve closed) 2. Perform release ring snap back test – If FID is observed, demate and remate QD – If no FID, neutralize sideloads and cycle bail to fwd position (valve open)
	D. Leaking QD after SPD install	1. Remove SPD, open valve fully (bail fwd), verify detent button is up, and aft white line is visible – If leak stops rotate locking collar to lock 2. Close valve (bail aft), verify detent button is up, fwd white line is visible, and rotate locking collar to lock 3. If applicable, close valve of appropriate QD in flowpath, verify detent button is up, and fwd white line is visible
	E. Female QD leaks after demate	Fully mate to destination male as quickly as possible

TASK	FAILURE	ACTION
	F. Male QD leaks after demate (male sleeve may be visibly stuck open)	1. 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 back and forth, up and down directions c. Attempt to close valve (bail aft) d. Demate QD and inspect 2. If applicable, close valve of appropriate QD in flowpath, verify detent button is up, and fwd white line is visible 3. Install cap (1/4, 1/2, & 1 in only)
	G. Leak detected by **MCC-H** after valve ops (possible male sleeve stuck open)	1. Cycle QD to open position (bail fwd) a. Depress button and use significant force to push bail forward; release button b. With QD in valve open (bail fwd) position apply significant force to aft end of the female QD in back and forth, up and down directions c. Attempt to close valve (bail aft) d. Demate QD and inspect 2. If applicable, close valve of appropriate QD in flowpath, verify detent button is up, and fwd white line is visible
	H. 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

TASK	FAILURE	ACTION
	QD Blocks	

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 side load potential 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
   - √For FID

Open Valve

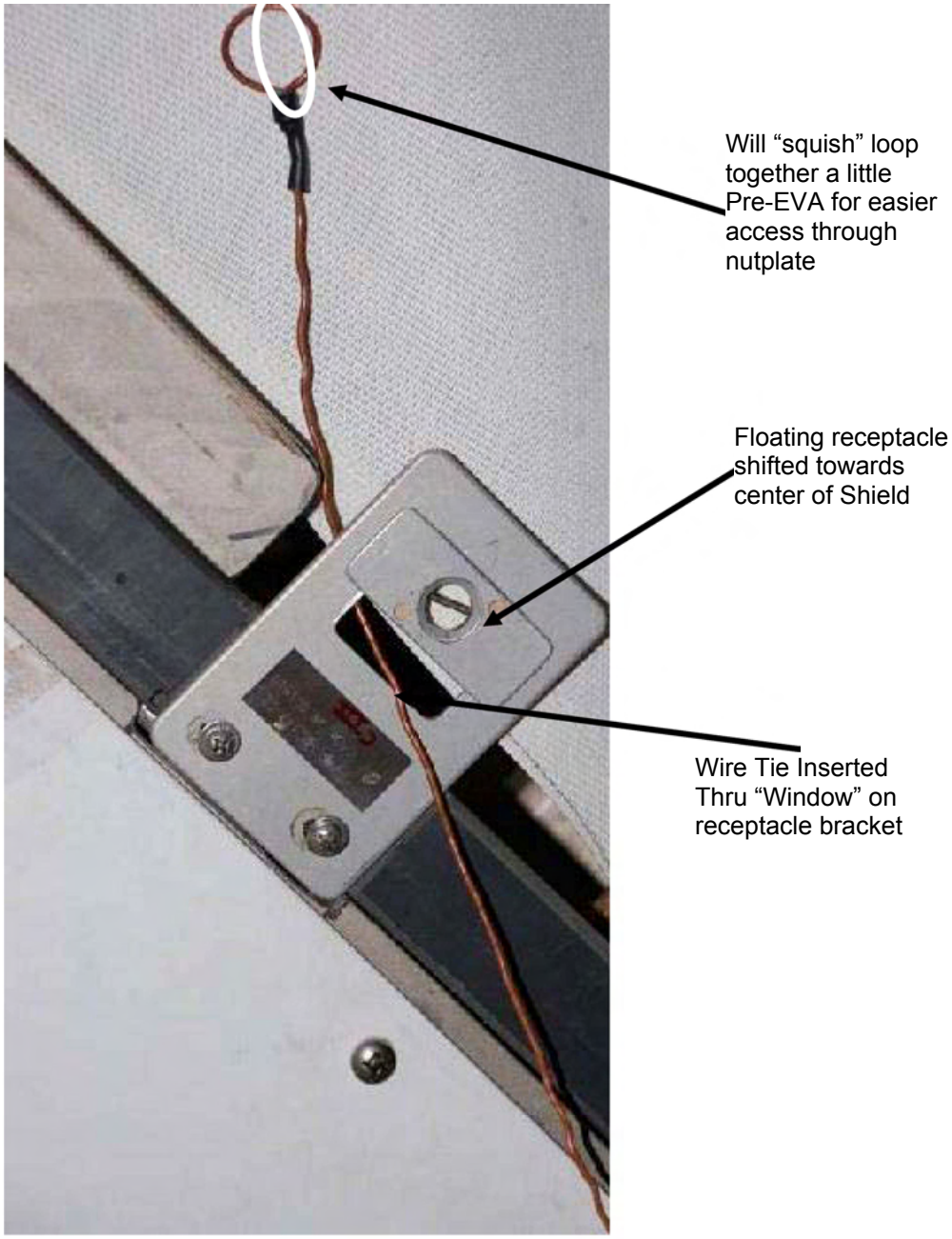
1. Assess side loads
2. Rotate locking collar to unlocked position
3. Depress detent button
4. Push bail to forward position
5. √Aft white band visible
6. √Detent button – up
7. Rotate locking collar to locked position

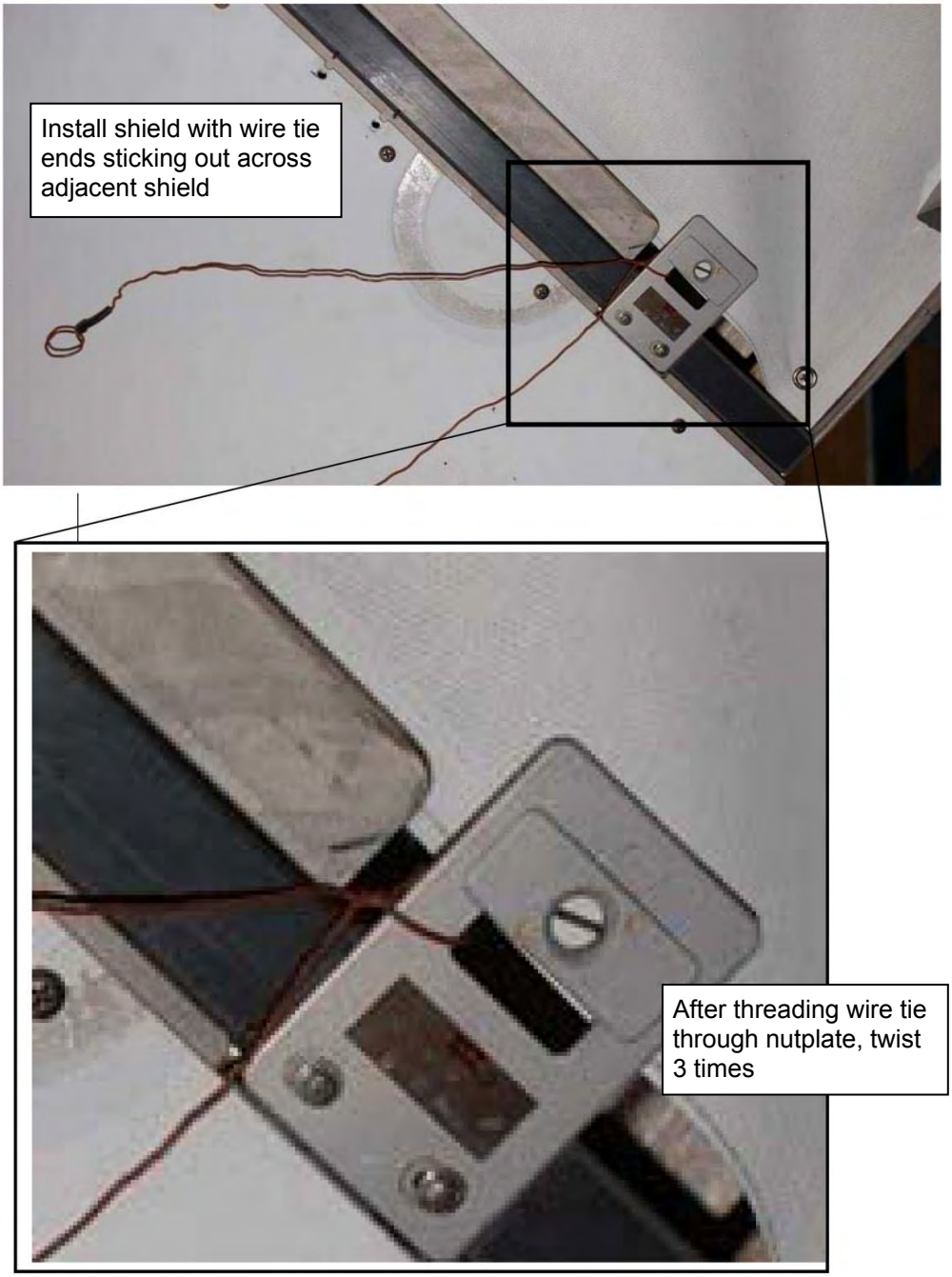
Close Valve, Demate QD

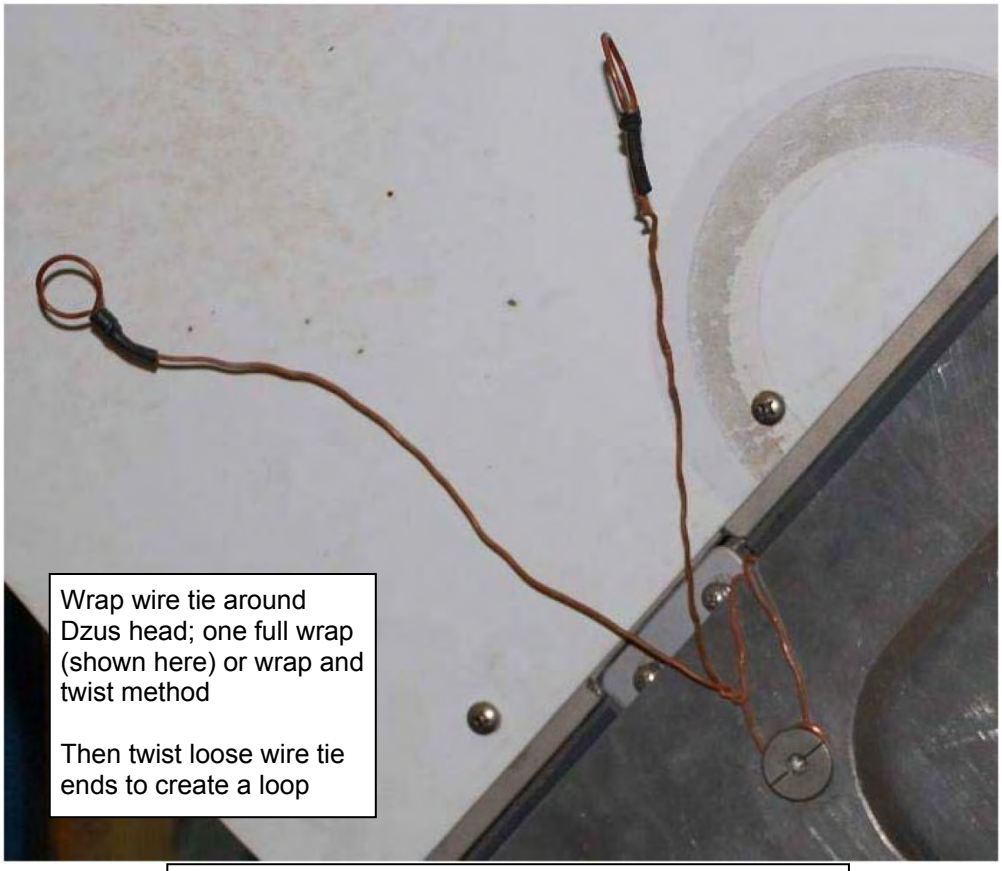
1. √Aft white band visible
2. √Detent button fully installed
3. √Detent button up
4. Rotate locking collar to unlocked position
5. √Detent button can be depressed
6. Assess side loads prior to bail movement
7. Push bail toward open position with significant force while depressing detent button (unstick male sleeve seals)
8. Depress detent button, move bail aft (close valve)
9. √Fwd white band visible
10. √Detent button up
11. Rotate locking collar to locked position
12. Assess side loads prior to demate
13. Pull back on release ring and demate QD
14. √Release ring – retracted (FWD white band not visible)
15. Inspect male and female QD for debris, damage, or anomalous conditions (ammonia crystals)
16. Install QD caps as required; verify lock tab engaged

TASK	FAILURE	ACTION
	FRAM	
	A. Primary FRAM bolt fails to release	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** for one turn only, then return to nominal settings 3. On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (19.4), CCW2, 30.5], 7/16 - 6-ext** for one turn only, then return to nominal settings
	B. Active FRAM fails to seat on passive FRAM	1. Check alignment. (Engage two forward shear pins first to ensure connector door is not jamming) 2. Check for FOD in mechanism
	C. Primary FRAM bolt fails to engage	1. Verify FRAM seated 2. Check for FOD 3. Back out primary bolt fully 4. Reattempt engagement 5. Increase PGT setting: **PGT: [B2 (12.0), CW2, 30.5], 7/16 - 6-ext** 6. On **MCC-H GO**: Increase PGT setting: **PGT: [B4 (16.0), CW2, 30.5], 7/16 - 6-ext** 7. Consider hold for thermal stabilization between active and passive FRAM 8. 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 – If less than 6.5 turns on primary bolt: 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 ~3.5** turns – Aft pins for MAPA and LAPA **PGT: [A4 (6.3), CW2, 30.5], 7/16 - 6-ext** 16.858 – (1.25*Turns on Primary Bolt) turns – Aft pins for LMC FRAM – Prep CPK by disengaging J-hook on locking mechanism; ensure J-hook fully seated in unlock position – Slide T-handle until contingency pin contacts primary FRAM pin (# on locking mechanism counter = # of turns on primary FRAM bolt) – Disengage J-hook from unlock position. J-hook is spring loaded and will “pop” into place if not precisely aligned with numbered slot. Fully seat J-hook in lock position
	D. Latch dogs fail to retract during FRAM removal from Square Grid Interface	Lift FRAM so that latch dogs contact square grid Cycle primary drive bolt
	E. Latch dogs not retracted prior to installation onto Square Grid Interface	Push latch dogs to retracted position with tool or tether hook

TASK	FAILURE	ACTION
	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	1. On **MCC-H GO**: Retrieve pry bar and emptied med ORU bag 2. Release other Dzus fasteners 3. Assess clearance between MMOD shield and tools 4. If possible, rotate fastener to position tangs off of tools 5. Place med ORU bag over failed fastener 6. 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): One properly secured wire tie = one 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 one adj (attach to tether point on T tool and to structure HR) and one 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

TASK	FAILURE	ACTION
	 Figure 2.- MMOD Shield Wire Tie Option.	

TASK	FAILURE	ACTION
	 Figure 3.- MMOD Shield Wire Tie Option. (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)

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 two 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 two 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 toward 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

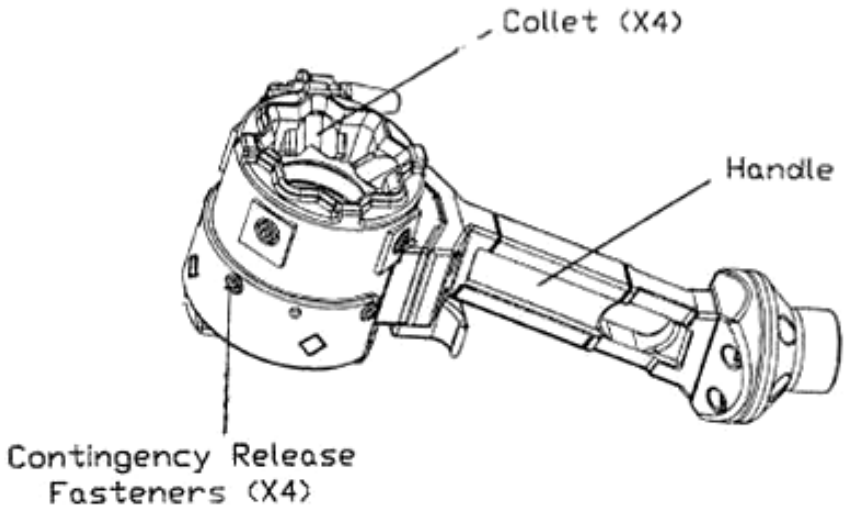
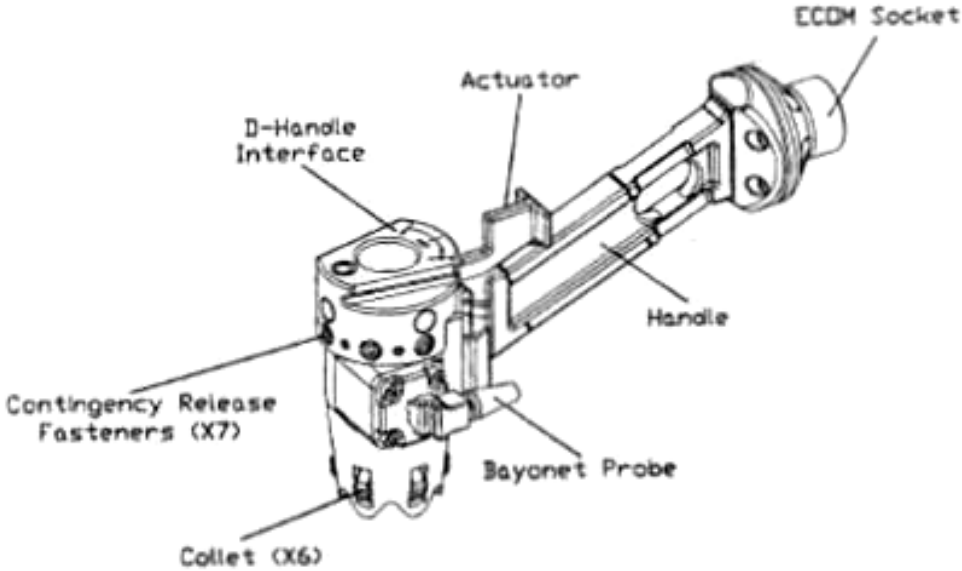
TASK	FAILURE	ACTION
	E. Connector fails to mate	1. Verify half shells are fully seated on both sides 2. Verify cable and backshell free to move (no clamps) 3. Push forward on connector backshell while actuating bail 4. Detach from soft dock and inspect: – Pins – FOD – EMI band – Bend radius – TA clamps – 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 3. On **MCC-H GO**: Retrieve needle nose pliers and attempt pin repair – **MCC-H** will verify pin size prior to retrieving tools 4. Inspect plug and jack prior to re-mating
	G. Connector FOD	1. On **MCC-H GO**: 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 2. 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

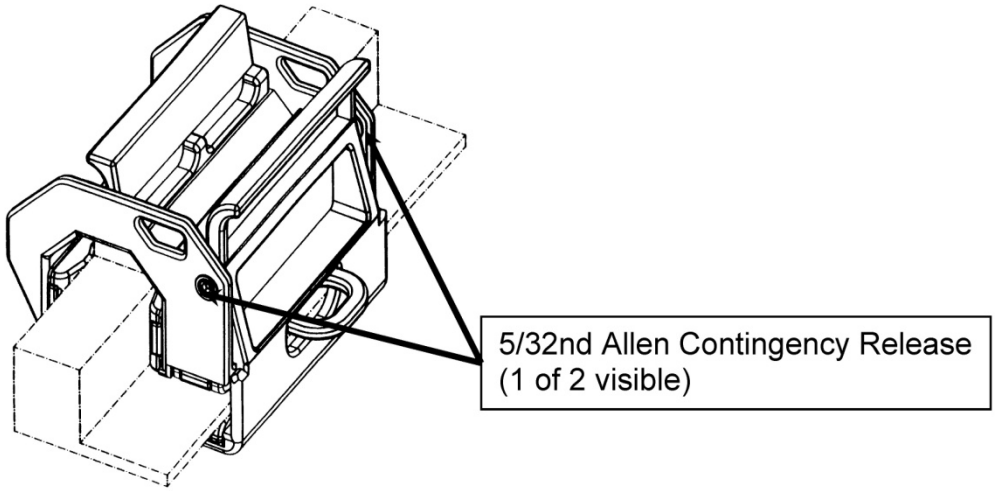
TASK	FAILURE	ACTION
	I. Connector bail linkage failure	1. On **MCC-H GO**: Reattempt connector mate/demate with broken bail – Impart load through undamaged side of bail linkage – Assist bail motion with hand on backshell once bail linkage has passed over-center – May take multiple pushes on the bail to mate/demate connector 2. Tether hook or vise grips may be used for additional leverage
	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 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

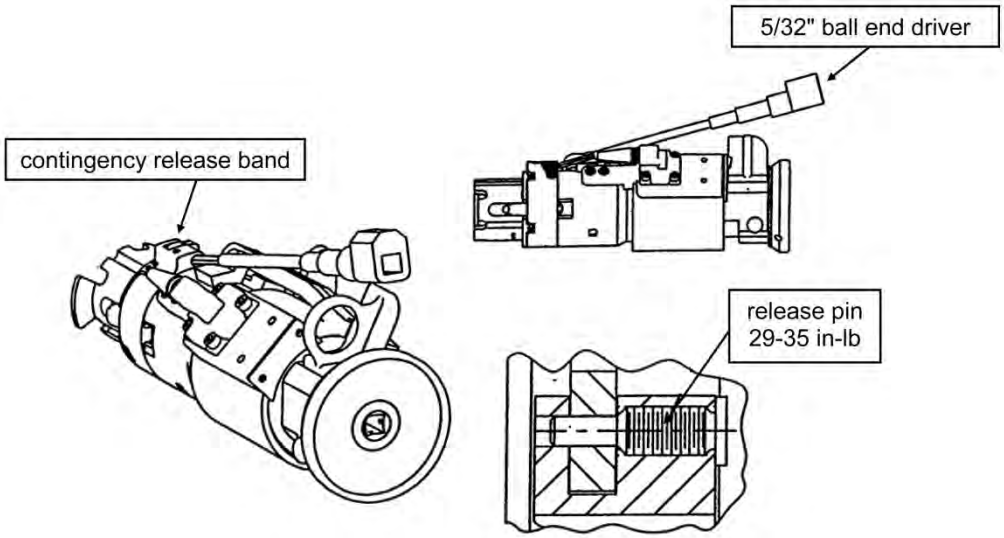
TASK	FAILURE	ACTION
	PAD	
	A. Release knob fails to rotate open	1. Verify knob in release position. (J-hook not locked) 2. Attempt to rotate knob using ratchet on knob's 7/16-in hex stud 3. Release contingency release bar captive bolts (2) **PGT [A6 (8.3), CCW2, 30.5], 7/16 - 6 ext** five turns (Verify 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
	LCD Messages	
	A. BATTRY HITEMP	1. Power off PGT 2. If alternate battery available, change battery 3. Retrieve spare PGT 4. Switch to ratchet mode
	B. 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
	C. 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
	D. 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
	E. 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
	F. 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
	G. 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
	H. 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

TASK	FAILURE	ACTION
	I. HICURR	1. Reattempt operation – Can be caused by excessive rotation of PGT body while torquing 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	J. LO TORQ (Expected during bolt release)	1. Reattempt operation until desired torque reached 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	K. LOCURR	1. Reattempt operation 2. Power cycle and calibrate 3. Retrieve spare PGT 4. Power off and switch to ratchet mode
	L. LOG IS FULL (blinking)	1. Cycle torque and speed collars to clear message 2. Continue operation
	M. 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 unlocked 2. Verify tether reel and/or cable guide (for 85-ft tethers) clear of FOD 3. Pull out small amount of cable and allow reel to retract while holding light tension on 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
	B. Safety tether red stripe showing (any length)	Safety tether cannot be used – Report ID # of faulty tether to **MCC-H** – Use alternate safety tether

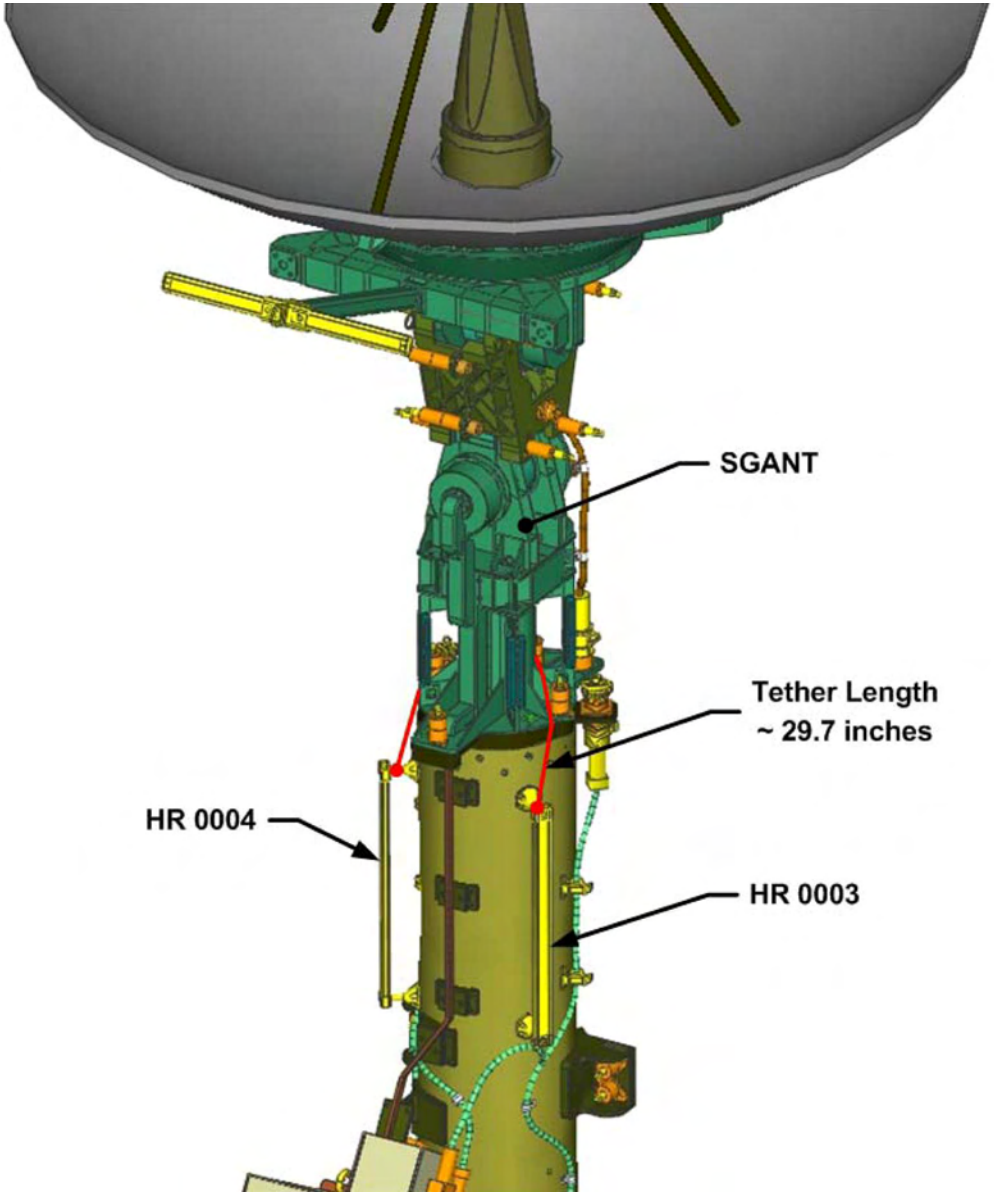
TASK	FAILURE	ACTION
	C. Crew hook fails	1. On load alleviating end: Use waist tether to replace alleviating strap – Report ID # of faulty tether to **MCC-H** – Retrieve replacement safety tether 2. On anchor end: Report ID # of faulty tether to **MCC-H** and use an alternate safety tether
	Scoops	
	A. 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; five 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)

TASK	FAILURE	ACTION
	 Figure 5.- Square Scoop.  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

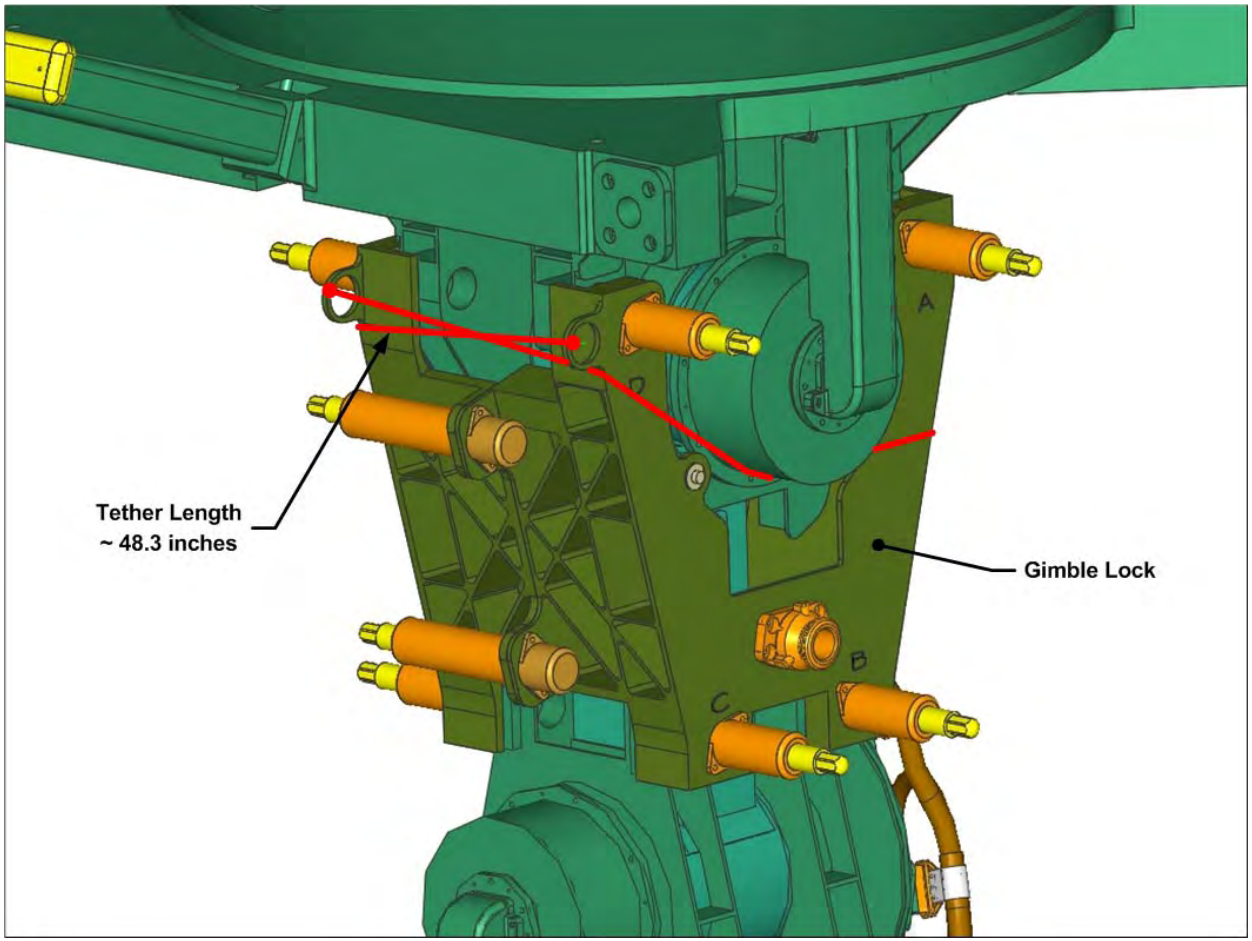
TASK	FAILURE	ACTION
	TA Clamp	
	A. TA clamp fails to release	1. With handle up, press down on top of rounded clamp 2. With handle up, use tether hook to pry drawhook from capture pin
	Tether Shuttle	
	A. Tether shuttle will not release from CETA/ MT rail	1. Verify slider in unlock and no obstructions 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**
	 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

TASK	FAILURE	ACTION
	 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)

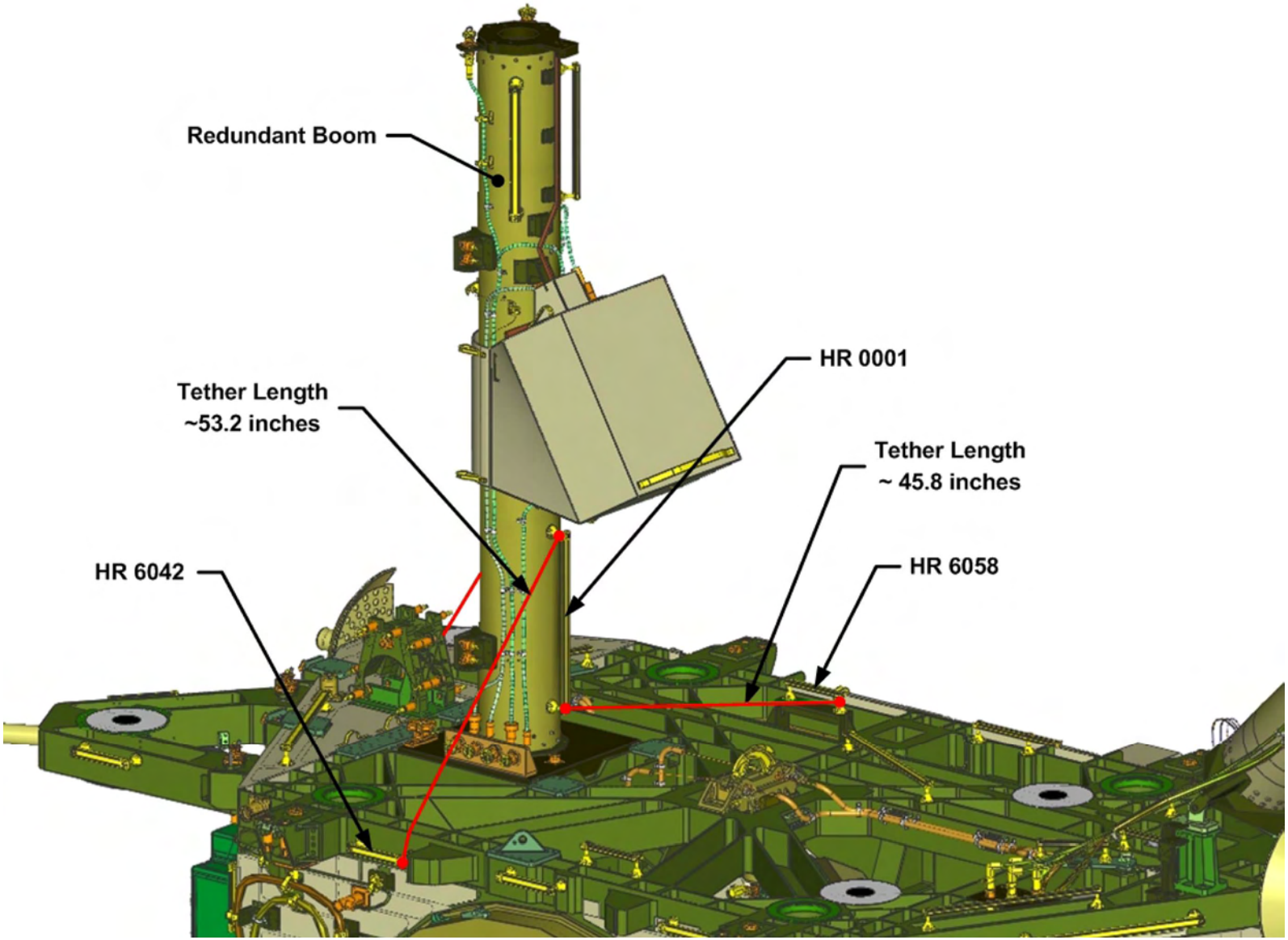
SGANT DISH TIE DOWN



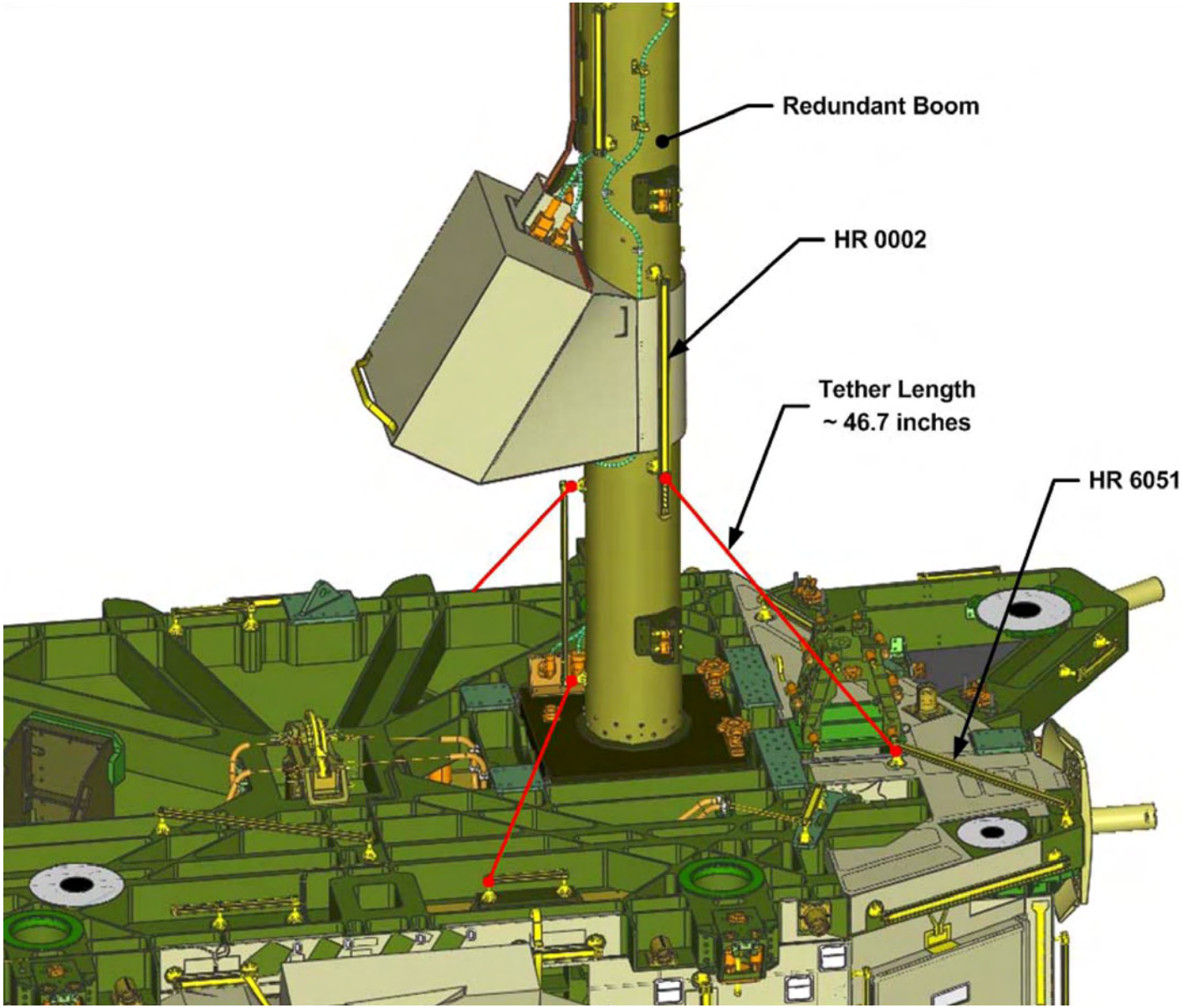
SGANT GIMBAL LOCK TIE DOWN



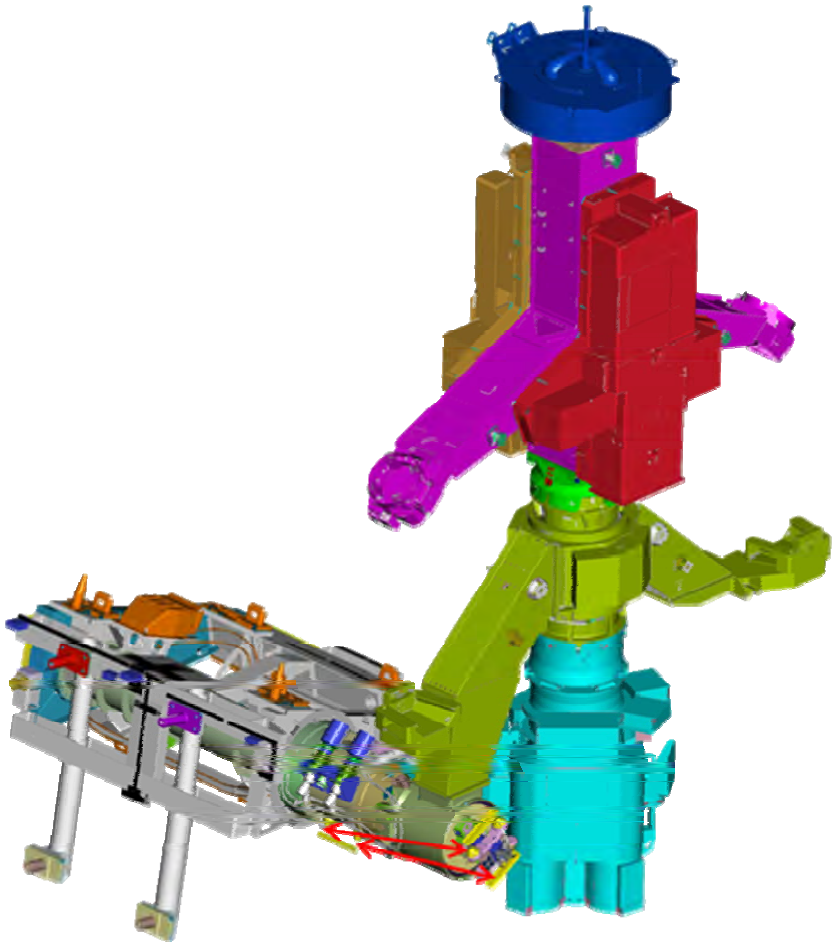
REDUNDANT BOOM TIE DOWNS



REDUNDANT BOOM TIE DOWNS (Cont)

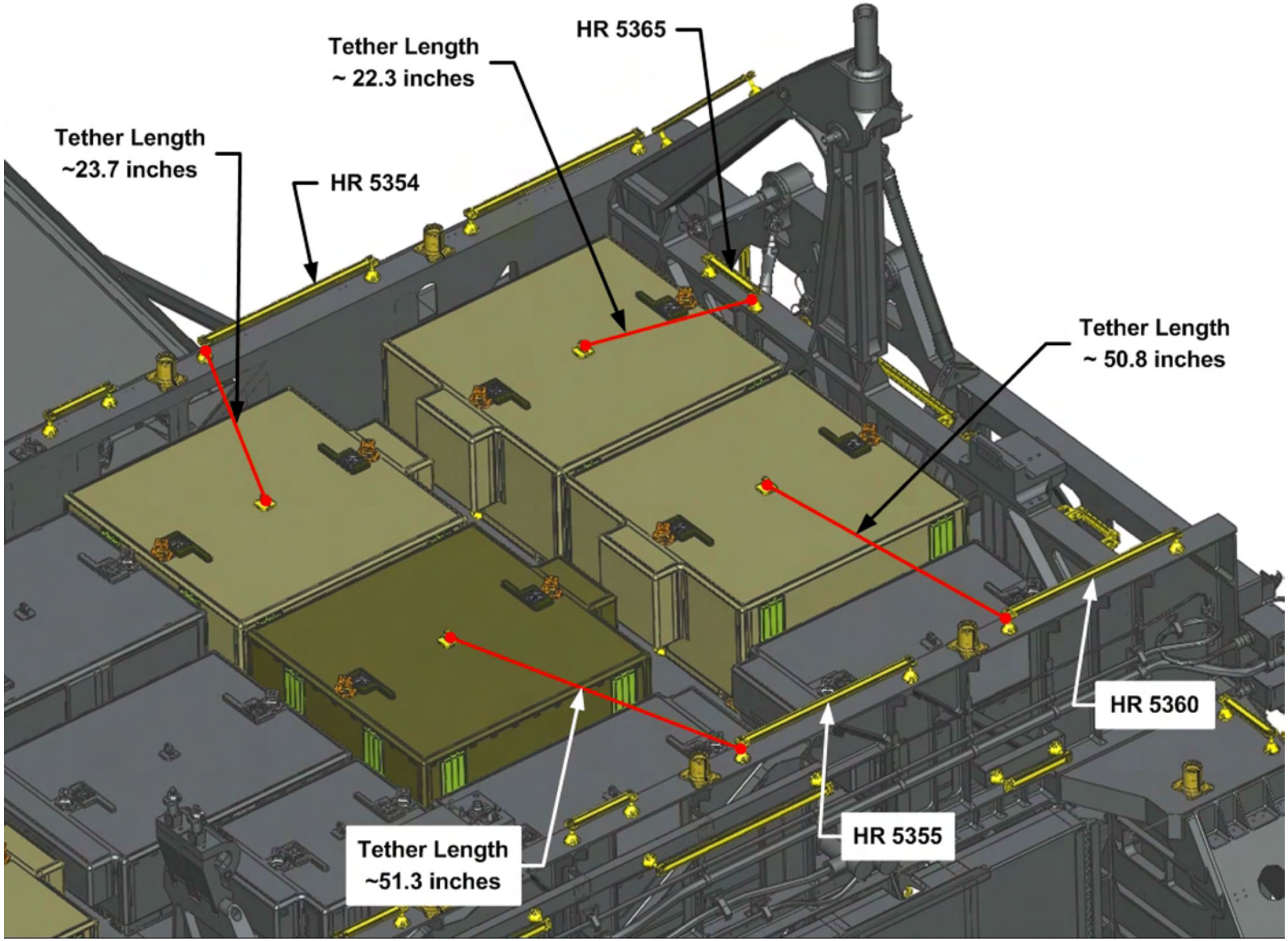


EOTP INPUT DRIVE TIE DOWN

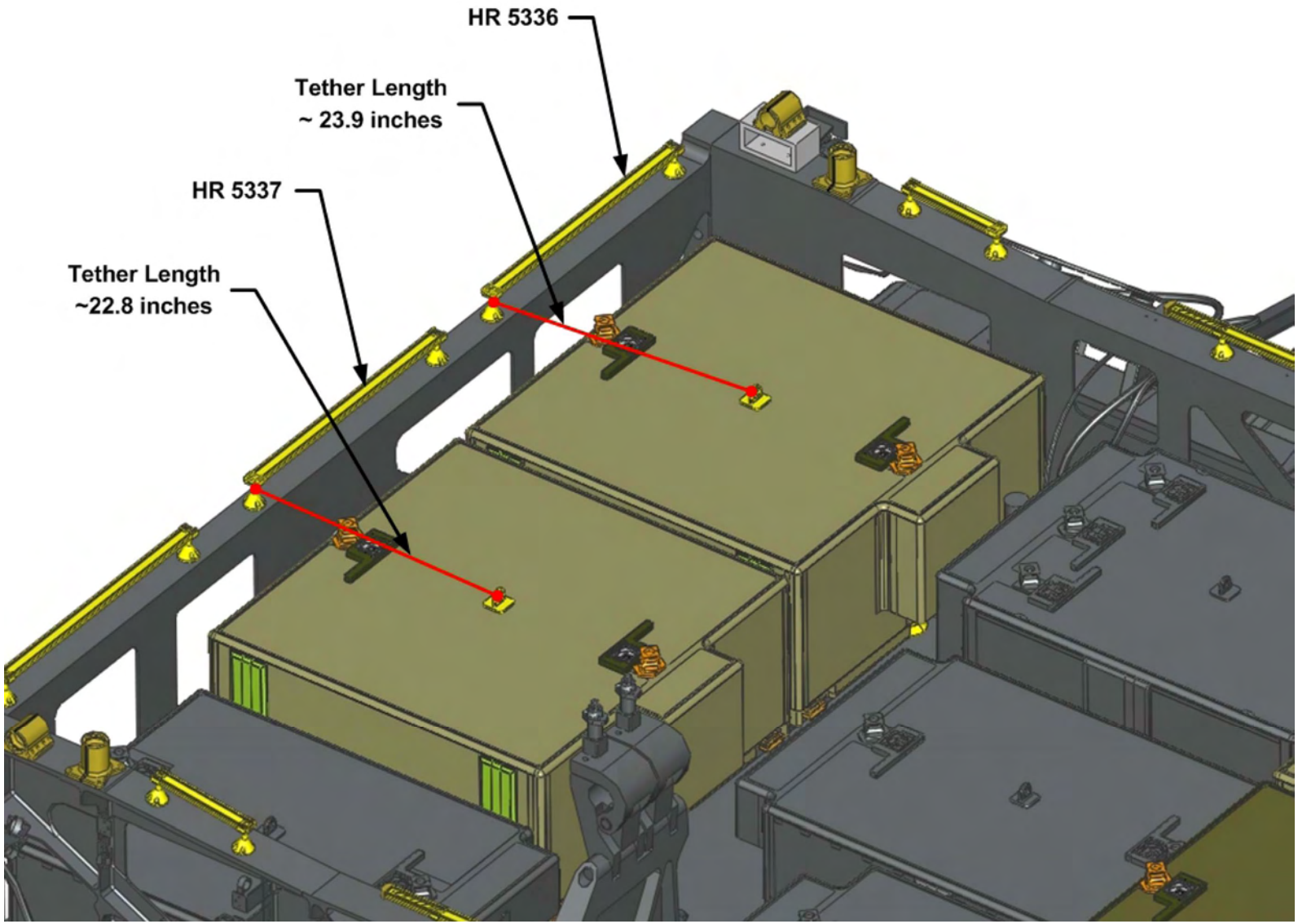


- Input Drive constrained by housing in 5 of 6 deg of freedom
  – Tie-down plan only requires additional constraint along axial direction
- Install long-duration tether(s) from Input Drive handrails to BJU handrail

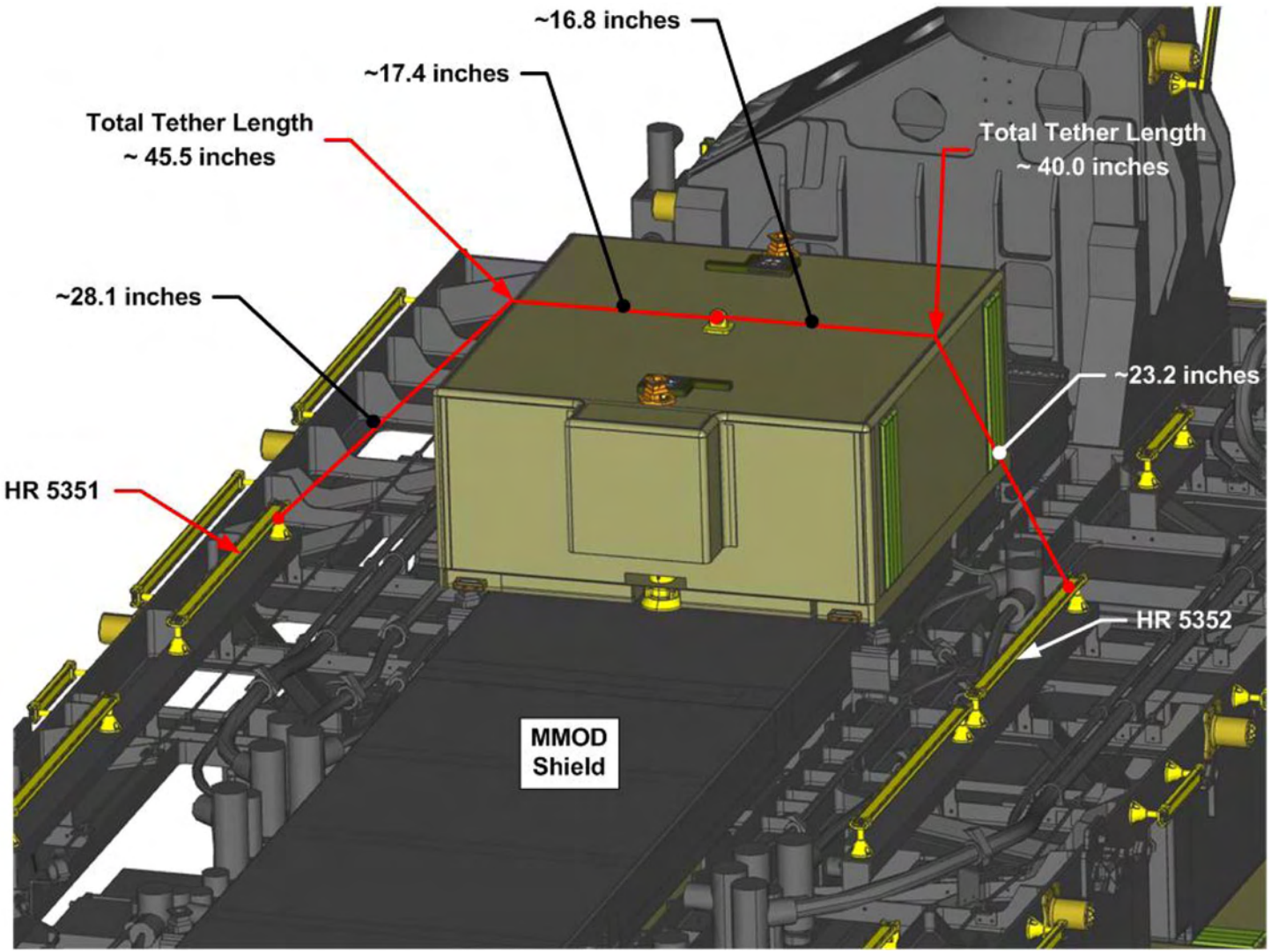
P6 IEA BATTERY TIE DOWNS ON LOWER DECK



P6 IEA BATTERY TIE DOWNS ON LOWER DECK (Cont)



P6 IEA BATTERY TIE DOWN ON MMOD SHIELD



NOTE: If necessary, a second battery could be positioned on inboard side of battery shown here

SGANT CONTINGENCY – INSTALL W/FSE ONTO EOTP

<table>
<tr><th>IV/RMS</th><th>EV1 (SSRMS)</th><th>EV2 (FF)</th></tr>
<tr>
<td>
<table>
<tr><td>Primary FRAM Bolt (Install)</td><td>Torque</td><td>Turns</td></tr>
<tr><td>SGANT</td><td></td><td></td></tr>
</table>
</td>
<td>
<u>RETRIEVE OF SGANTW/FSE FROM ICC-VLD</u>

1. GCA SSRMS to Retrieve SGANT
2. Perform the following before SGANT is released:
❑ Attach RET to FRAM
❑ √Cooling, glove heaters, visor, tools, tethers
3. On IV and EV1 GO:
PGT [A4 (6.3 ft-lb), CCW2, MTL 30.5], 6-ext 7/16
Release primary FRAM bolt ~11 turns to hard stop
(push ~10 lb to release locking tabs)

4. Give GO to SSRMS Operator to back away and maneuver to Pre-Install

<u>INSTALL SGANT TO EOTP</u>

5. After EV2 is in position for viewing, GCA SSRMS to install
6. Position for soft dock

7. PGT [A4 (6.3 ft-lb), CW2, MTL 30.5], 6-ext 7/16
Engage primary FRAM bolt ~ 11 turns to hard stop
(push ~10 lb to release locking tabs)
Verify FRAM Visual Indicator

8. Verify from EV2 FRAM installed, remove RET

9. Give GO to SSRMS Operator to back away and maneuver to APFR Egress

10. Perform Glove Inspection
</td>
<td>
<u>RETRIEVE OF SGANT W/FSE FROM ICC-VLD</u>
1. Translate to Pallet
2. Assist EV1 as required

<u>INSTALL SGANT TO EOTP</u>
3. Translate to inboard side of EOTP
4. Before GCA start, position body to provide clearance views during install
5. Provide GCA calls as necessary
</td>
</tr>
</table>

SGANT CONTINGENCY – INSTALL W/FSE ONTO EOTP – TASK DATA

Tools:

EV1 (SSRMS)	EV2 (FF)
PGT	
7/16 (wobble) socket-6 ext	

Fasteners:

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	PGT Setting
SGANT – FRAM Bolt (Primary)	7/16	1	TBD	6.3	TBD	11	A4 (6.3 ft-lb), CCW2, MTL 30.5

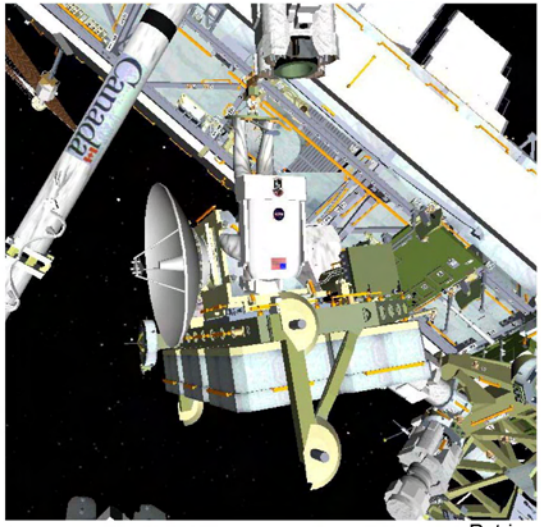
General Notes:

Cautions:

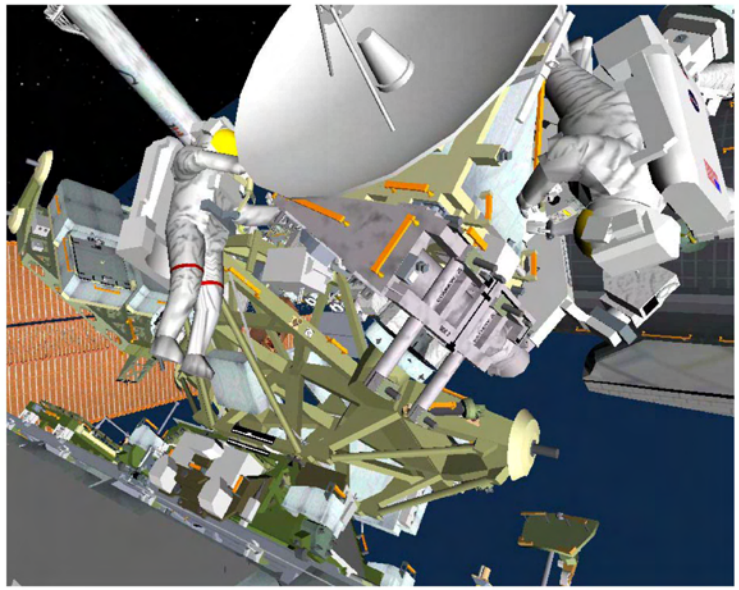
Warnings:

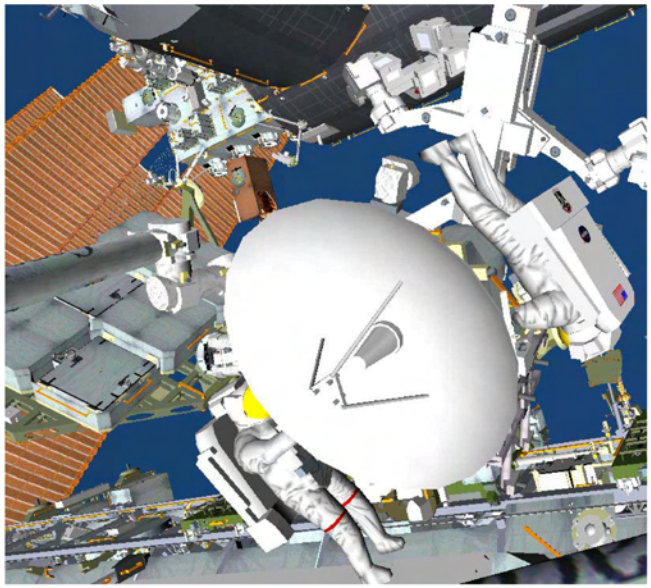
1. Keel Target on ICC-VLD does not meet kick loads

SGANT CONTINGENCY – INSTALL W/FSE ONTO EOTP – TASK DATA (Cont)



Retrieve SGANT w/FSE from Pallet



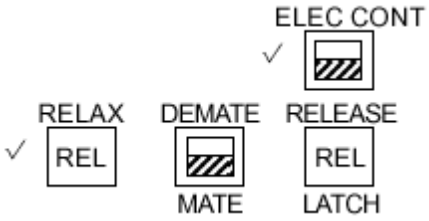
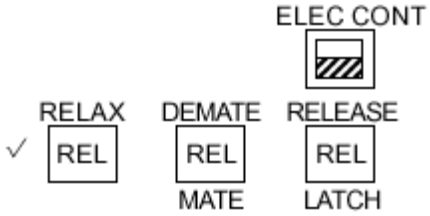


Install SGANT in FSE onto EOTP
(EV2 in picture will be in APFR on SSRMS)

RELEASE ROEU LATCHES

IV	EV
CAUTION After step 1, 2 hr LCS Thermal Clock starts	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. DEADFACE ROEU R1 √PRI PL MNC – OFF (tb-OFF) SSP2 √MRM PWR 1,2 (two) – OFF (tb-bp)	
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	
	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

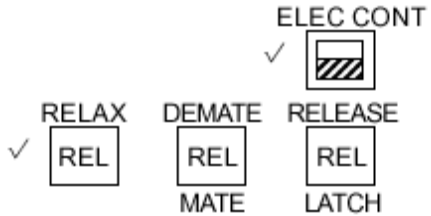
RELEASE ROEU LATCHES (Cont)

IV	EV
3. VERIFY TALKBACKS A6U Install ROEU A6U PANEL OVERLAY PL RETEN PL SEL – 2  R13L PL BAY MECH PWR SYS 1,2 (two) – ON A6U 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	WARNING For release, remain clear of latches during access cover closing. Latches may snap back to closed posn

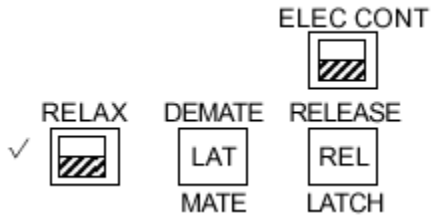
RELEASE ROEU LATCHES (Cont)

IV	EV
A15 4. <u>ENABLE POWER</u> √APCU 2 OUTPUT – ON APCU 2 CONV – ON 5. End Thermal Clock ____:____	2. Reengage latch actuator: Rotate control lever to neutral posn Close, secure access cover (3/4 turn cw) Clear worksite

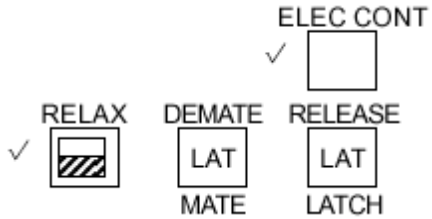
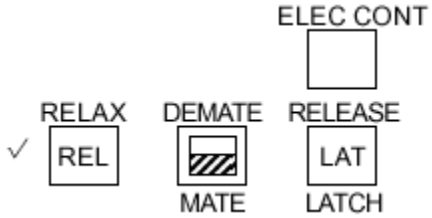
LATCH ROEU LATCHES

IV	EV
1. 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 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 * A6U  R1 √PRI PL MNC – OFF (tb-OFF) SSP2 √MRM PWR 1,2 (two) – OFF (tb-bp)	Tools reqd: Ratchet with 3-in Ext (Airlock)

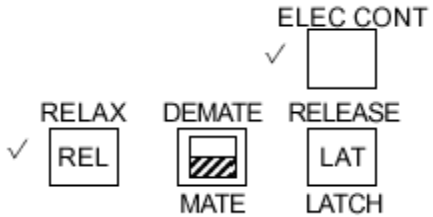
LATCH ROEU LATCHES (Cont)

IV	EV
2. <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  3. <u>ROEU SAFING</u> R13L PL BAY MECH PWR SYS 1,2 (two) – OFF A6U PL 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

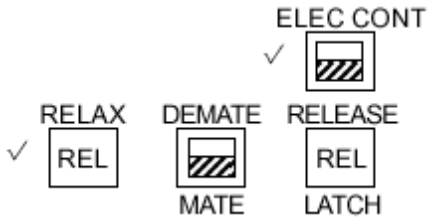
LATCH ROEU LATCHES (Cont)

IV	EV
4. <u>VERIFY TALKBACKS</u> A6U PL RETEN PL SEL – 2  5. <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

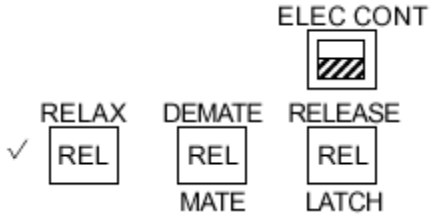
STOW ROEU ARM

IV	EV
CAUTION After step 1, 2 hr LCS Thermal Clock starts 1. RELEASE ROEU LATCHES R1 √PRI PL MNC – OFF (tb-OFF) SSP2 √MRM PWR 1,2 (two) – OFF (tb-bp) 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)

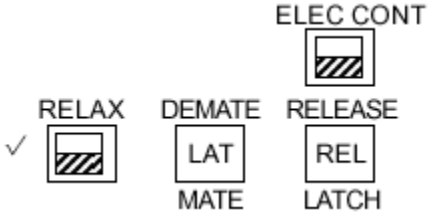
STOW ROEU ARM (Cont)

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 PL 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

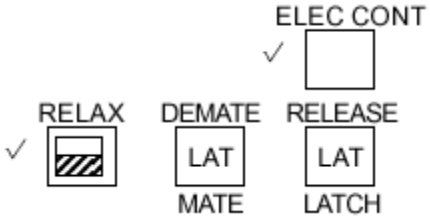
STOW ROEU ARM (Cont)

IV	EV
4. <u>VERIFY TALKBACKS</u> A6U PL RETEN PL SEL – 2  5. <u>ENABLE POWER</u> A15 √APCU 2 OUTPUT – ON APCU 2 CONV – ON 6. End Thermal Clock ____:____	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. <u>CONFIGURE ROEU</u> A6U Install <u>ROEU A6U PANEL OVERLAY</u> 2. <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 SSP2 √MRM PWR 1,2 (two) – OFF (tb-bp) R1 PRI PL MNC – OFF (tb-OFF) Give EV GO to mate ROEU 3. <u>VERIFY TALKBACKS</u> 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	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

MRM1 DOCKING MECH REMOVAL

IV/SRMS	EV1	EV2
1. SRMS: Maneuver MRM1 to Docking Mech Removal Position 2. SRMS: GCA as reqd	1. Retrieve large cutter from port A/L toolbox panel #9 (zenith door) 2. Translate to Payload Bay bulkhead 3. Retrieve PFR from fwd bulkhead 4. Translate to starboard sill 5. Install PFR [2.5,12,A] into PBAS [P=2.5,Y=9] ❑ √Black on black ❑ √Good pull/twist test 6. Ingress PFR 7. Install handrail handling aid over probe and orient as desired. Tighten wing bolt hand tight 8. Install socket/adapter onto PGT 9. GCA SRMS as reqd for bolt removal 10. **PGT[A3 4.8 ft-lb, CCW2 30PRM, MTL 30.5] 6 ext/adapter**: Release 17 bolts in three gangs. ~8-9 turns until released 11. Tether to each gang before last bolt is released in each gang and stow in trash bag 12. Assist with removal as reqd 13. Disconnect three cables from MRM1 hatch; if required, cut cables with large cutters 14. Wire tie cables as low profile as possible 15. Egress PFR 16. Retrieve PFR and stow in fwd bulkhead 17. Relocate forward HSBC back to its launch location; retrieve APFR 18. Translate to NOD2 WIF 07 and stow APFR [12,NN,F,6] 19. Stow large cutters in port A/L toolbox 20. Translate to docking mechanism tie-down location 21. Assist EV2 as required	1. Retrieve APFR with ingress aid from NOD2 WIF 07 2. Translate to Payload Bay starboard sill 3. Relocate forward HSBC forward of the forward MRM1 PRLA, about 4 ft from the aft HSBC 4. Install WIF adapter into HSBC ❑ √Good pull test 5. Install APFR [12,FF,F,6] ❑ √Black on black ❑ √Good pull/twist test 6. Ingress APFR 7. Install socket/adapter onto PGT 8. GCA SRMS as reqd for bolt removal 9. **PGT[A3 4.8 ft-lb, CCW2 30PRM, MTL 30.5] 6 ext/adapter**: Release 17 bolts in three gangs. ~8-9 turns until released 10. Tether to each gang before last bolt is released in each gang and stow in trash bag 11. Tether to docking mechanism before last bolt is released 12. Remove docking mechanism and position for cable disconnection 13. BRT to docking mechanism 14. Egress APFR 15. Translate to docking mechanism tie-down location

MRM1 DOCKING MECH REMOVAL – TASK DATA

Tools:

EV1	EV2
PGT	PGT
7/16 wobble socket 6-in ext	7/16 wobble socket 6-in ext
7mm Russian socket	7mm Russian socket
HSBC	HSBC
PBAS	APFR
PFR	

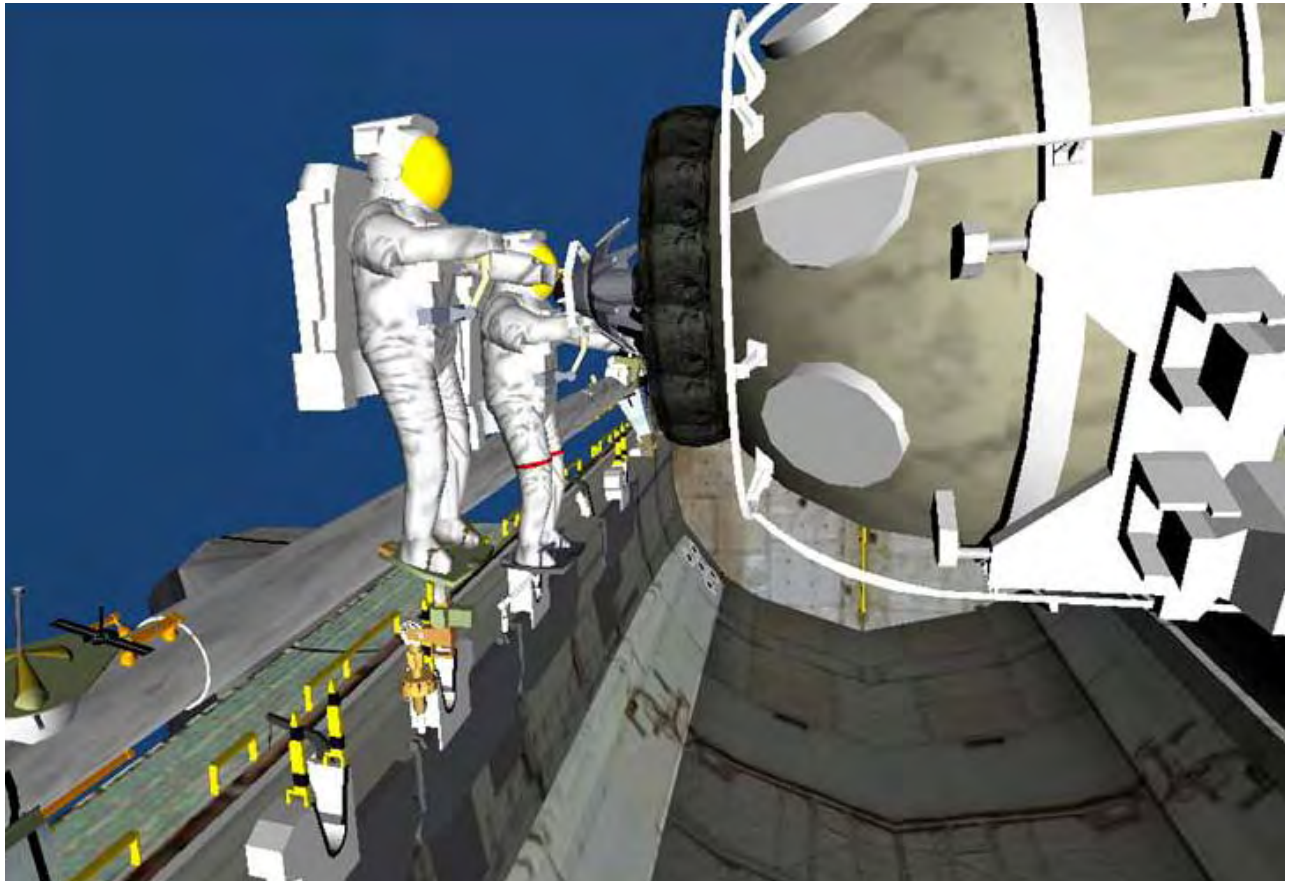
Fasteners:

Fastener Name	Head Size	Qty	Install Torque (ft-lb)	Release Torque (ft-lb)	Failure Torque (ft-lb)	Turns	PGT Setting
MRM1 Docking Probe Bolts	**7mm**	**17**	**TBD**	**4**	**TBD**	**~8-9**	**A3 (4.8 ft-lb), CCW2, MTL 30.5**

Foot Restraints:

Task	Foot Restraint	Setting
EV1 Remove MRM1 Probe	PFR in PBAS	[2.5,12,A] [P=2.5,Y=9]
EV2 Remove MRM1 Probe	APFR	[12,FF,F,6]

MRM1 DOCKING MECH REMOVAL – TASK DATA (Cont)

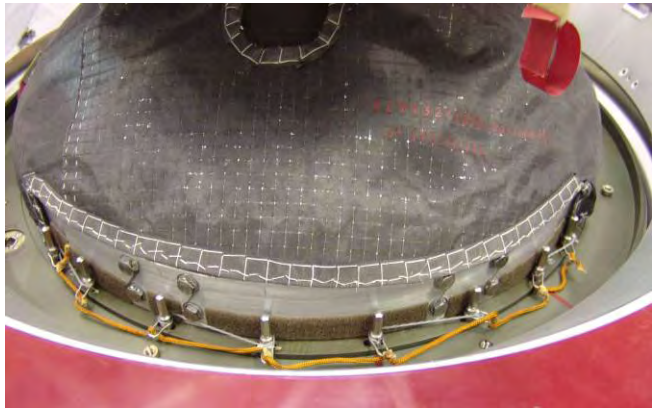


MRM1 DOCKING MECH REMOVAL – TASK DATA (Cont)

Docking Probe Assembly

Docking Probe Assembly, backside

Docking Probe, extended

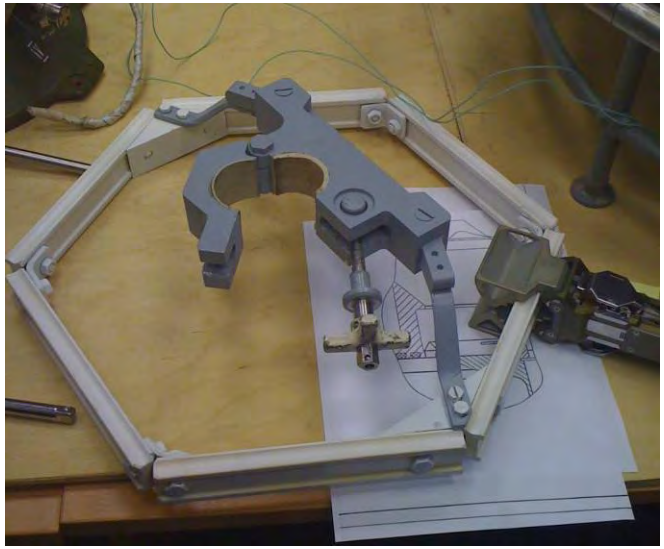


Docking Probe Bolts

Bolts released with lanyard

Russian 7mm socket taped to 6-in wobble socket

MRM1 DOCKING MECH REMOVAL – TASK DATA (Cont)



Handrail Handling Aid

Handrail Handling Aid Installed

Electrical Cables

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. Avoid contact with OBSS striker bars (Vitrolube coating)
7. 85-ft safety tether retract force may affect body positioning

CAUTION

ISS Generic Constraints

A. Avoid inadvertent contact with
   1. Grapple fixture shafts (dry lube)
   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,NODE 1]
   2. Deployed TUS cable [Zenith and Nadir CETA rail]
   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 [S1]
   14. SASA high and low gain antennas and radiator surfaces [Z1]
   15. Deployed MISSEs
   16. OTP on HAB Tray [S0]

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 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,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

GENERIC NOTES, CAUTIONS, WARNINGS (Cont)

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

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

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

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); end of 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 $\beta \geq 70$

F. Electrical Shock
   1. Do not touch SPDM CLPA 1 electrical connector prior to camera installation

WARNING

ISS Truss Constraints

A. Avoid inadvertent contact
   1. SSU, ECU, beta gimbal platform, mast canister, SAW blanket boxes unless beta gimbal locked and motor 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

B. RF radiation exposure
   1. Stay 3.6 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]
   5. Nickel coated braided copper ground straps may contain frayed wires [P6,P4,S4,S6]
   6. MMOD strikes on Z1 toolboxes

WARNING

ISS Truss Constraints (Cont)

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 $\beta > 75$ deg

GENERIC NOTES, CAUTIONS, WARNINGS (Cont)

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)

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
   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

WARNING

ISS U.S. Pressurized Elements Constraints (Cont)

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 $60 \leq \beta \leq 75$

C. Sharp Edges
   1. LWAPA PIP pins [COL EPF]

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]

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

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).

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).
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

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 < 3.6 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

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

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) – LOCKED

MCC-H If EV crew working within 2 feet of S1 TRRJ rotation envelope

1. √DLA (1) – LOCKED

FPMU

MCC-H If EV crew working on Port Truss

1. FPMU power – Off

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.

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.

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

RSOS (1)

ALL EVAs

SM Antennas
IV
1. GTS – Deactivate
2. ARISS (Ham Radio) – Deactivate

IMPULSE
MCC-M
1. IMPULSE (ИПИ-100) – Is not activated

EVAs ON PMA1 OR RSOS (LOCATION DEPENDENT)

FGB Thrusters
MCC-M
1. √FGB MCS unpowered
2. √All FGB Attitude Control Thruster Valves (eighty) – closed
3. √FGB Attitude Control Manifold Valves – closed
   КШК1, КШК2, КШК4, КШК5, КШК9,ОКО3, ОКГ3, ОКО6, ОКГ6, ОКО7, ОКГ 7, ОКО8, ОКГ8

Soyuz Thrusters
MCC-M
1. √Soyuz manifolds (four) – closed
   ЭКО1, ЭКО2, ЭКГ1, ЭКГ2
2. √Soyuz MCS unpowered
3. √Soyuz Attitude Control Thruster Valves (fifty-six) – closed
4. √Soyuz Main Engine Valves (K1, K2, K3, K4, K5, K6) – closed

FGB Antennas
MCC-M
1. √FGB KURS P [КУРС P] – Deactivated

Soyuz Antennas
MCC-M
1. √Soyuz KURS A [КУРС A] – Deactivated

GENERIC EVA INHIBIT PAD (Cont)

RSOS (2)

ADDITIONAL ANTENNA INHIBITS FOR EVAS ON RSOS
(LOCATION DEPENDENT)

FGB Antennas

MCC-M	1. √TORU [ТОРУ]	– Deactivated
	2. √TV System [ТВС]	– Deactivated
	3. √KURS A [КУРС А]	– Deactivated
	4. Radiotelemetry [БР-9ЦУ-8]	– Deactivate
	5. √TV System [КЛ-108А]	– Deactivated
	6. √CNPMS [СИТНП]	– Deactivated
	7. √KOMPARUS [КИС]	– Deactivated
IV	8. √Sirius (VHF Ham Radio)	– Deactivated

SM Antennas

MCC-M	1. VHF-1, VHF-2 [СТТС]	– Deactivate
	2. BITS [БИТС2-12]	– Deactivate
	3. √TV System [ТВС]	– Deactivated
	4. REGUL [РЕГУЛ]	– Deactivate
	5. √LIRA [ОНА]	– Deactivated
	6. √Orbit Radio Tracking System [РКО]	– Deactivated
	7. √Kurs P [КУРС Р]	– Deactivated
IV	8. 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
	6. √KURS A [КУРС А]	– Deactivated

ADDITIONAL THRUSTER INHIBITS FOR EVAS ON RSOS
(LOCATION DEPENDENT)

SM Thrusters

MCC-M

1. √SM MCS – INDICATOR MODE or CMGTA with Thrusters Disabled
2. √SM Manifold valves (four) closed
   ККГ1, ККГ2, ККО1, ККО2
3. √SM Attitude Control Thruster Valves (sixty-four) – closed
4. √SM Main Engine Thruster Valves (four) – closed
5. √SM Reboost manifold valves (four) – closed
   КМГ1, КМГ2, КМО1, КМО2

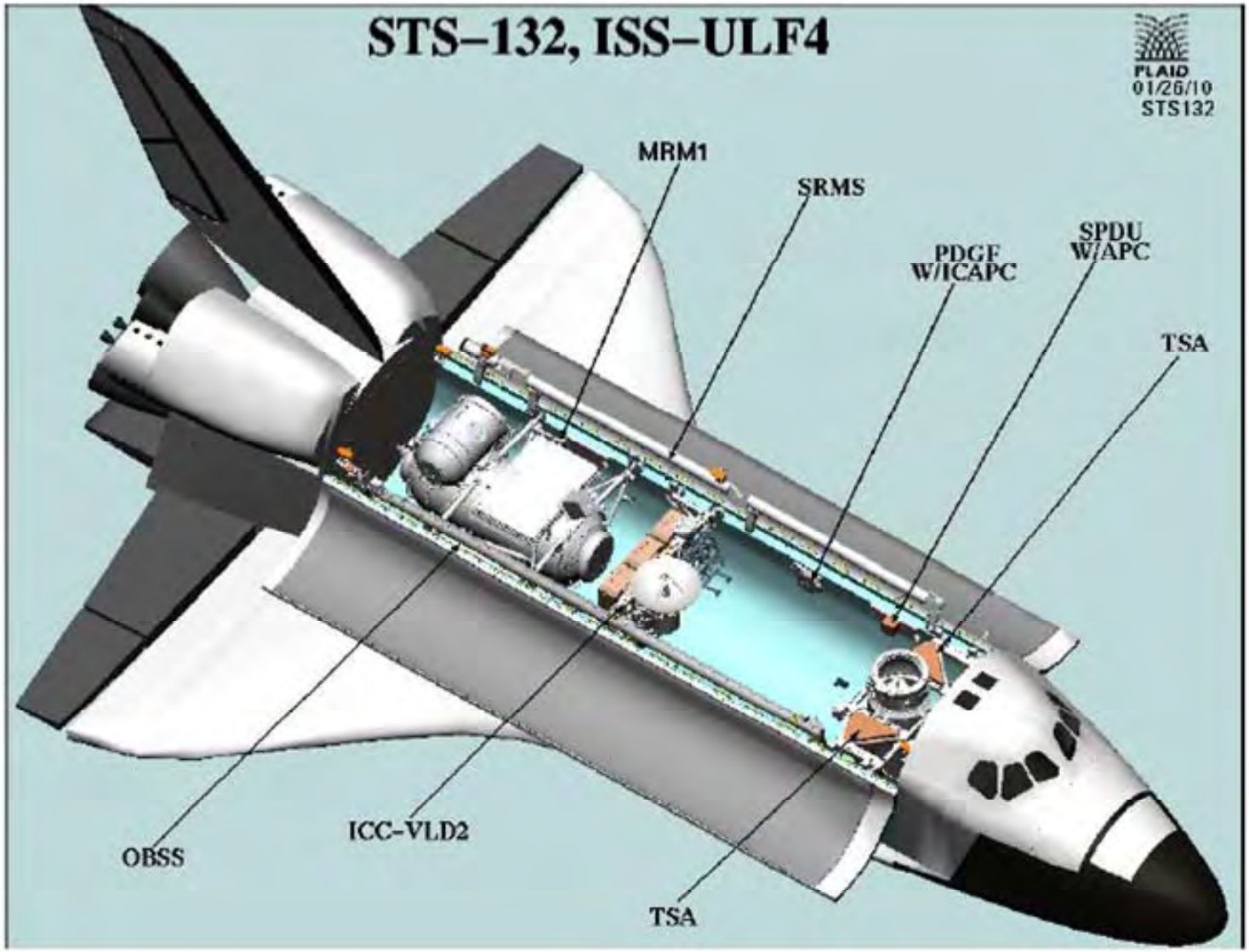
Progress Thrusters

MCC-M

1. √Progress Manifold Valves (four) – closed
   ЭКО1, ЭКО2, ЭКГ1, ЭКГ2
2. √Progress Attitude Control Thruster Valves (fifty-six) – closed
3. √Progress Main Engine Valves (K1, K2, K3, K4, K5, K6) – closed

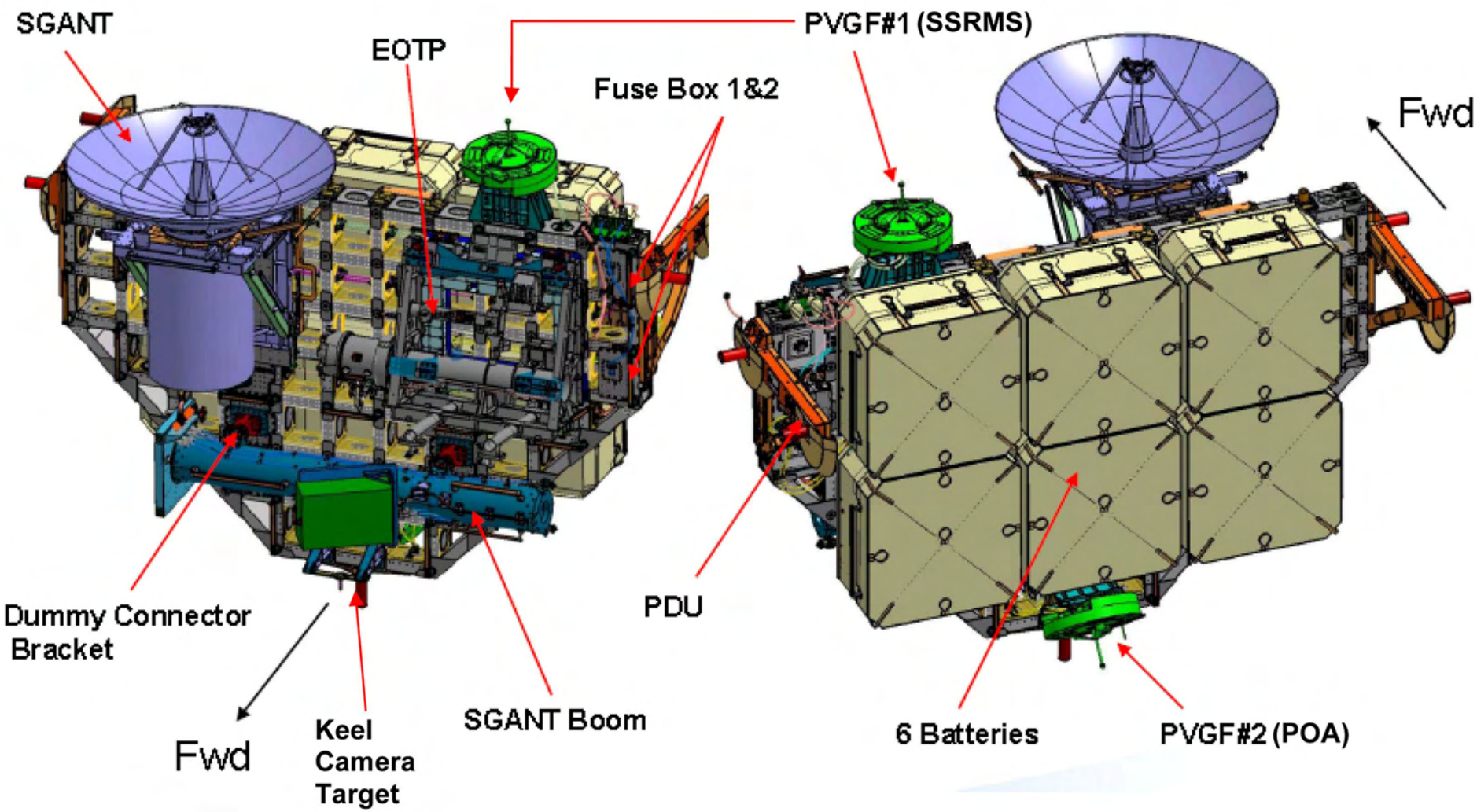
PAYLOAD BAY LAYOUT ..... FS 18-2
ICC-VLD ..... FS 18-3
SGANT FSE ..... FS 18-6
SGANT FSE – GIMBAL LOCKS ..... FS 18-7
SGANT FSE – AGIT HEAT SHIELD ..... FS 18-8
BOOM FSE – LTA ..... FS 18-10
BOOM FSE – BOLTS ..... FS 18-11
BOOM FSE – SGRTC GROUNDING BOLT ..... FS 18-12
EOTP FSE ..... FS 18-13
BATTERY FSE ..... FS 18-16
SIDEWALL CARRIER ..... FS 18-20
BATTERY ..... FS 18-23
BOOM ..... FS 18-25
SGANT ..... FS 18-26
EOTP ..... FS 18-28
EOTP – INPUT DRIVE ..... FS 18-34
EOTP – CONTINGENCY SOCKET ..... FS 18-35
EOTP – TETHER ..... FS 18-36
PDGF ..... FS 18-37
PUMAA ..... FS 18-40
MRM1 ..... FS 18-42
MRM1 CONTINGENCY TOOLS ..... FS 18-46
MRM HANDRAIL HANDLING AID ..... FS 18-47
FRAM ..... FS 18-48
ROEU ..... FS 18-53
PRLA ..... FS 18-55
CONNECTOR PIN OUT DRAWINGS ..... FS 18-59
Z1 FWD ..... FS 18-71

PAYLOAD BAY LAYOUT



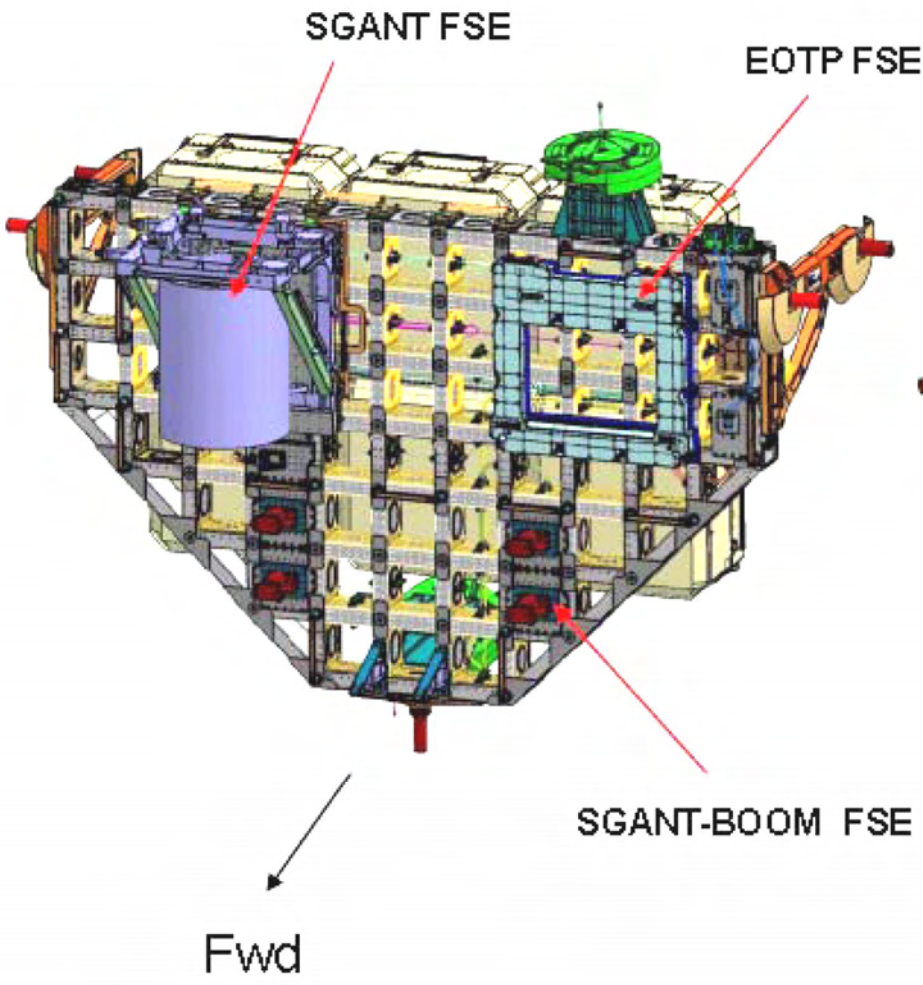
ICC-VLD

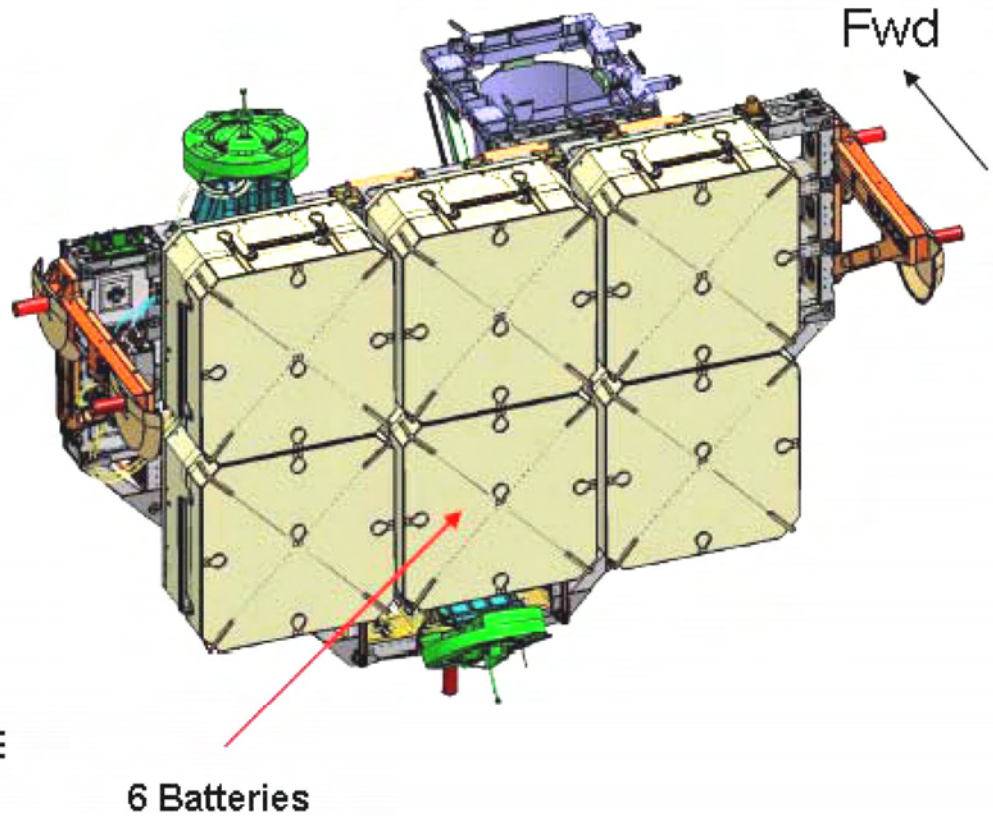
ICC-VLD LAUNCH CONFIG



ICC-VLD (Cont)

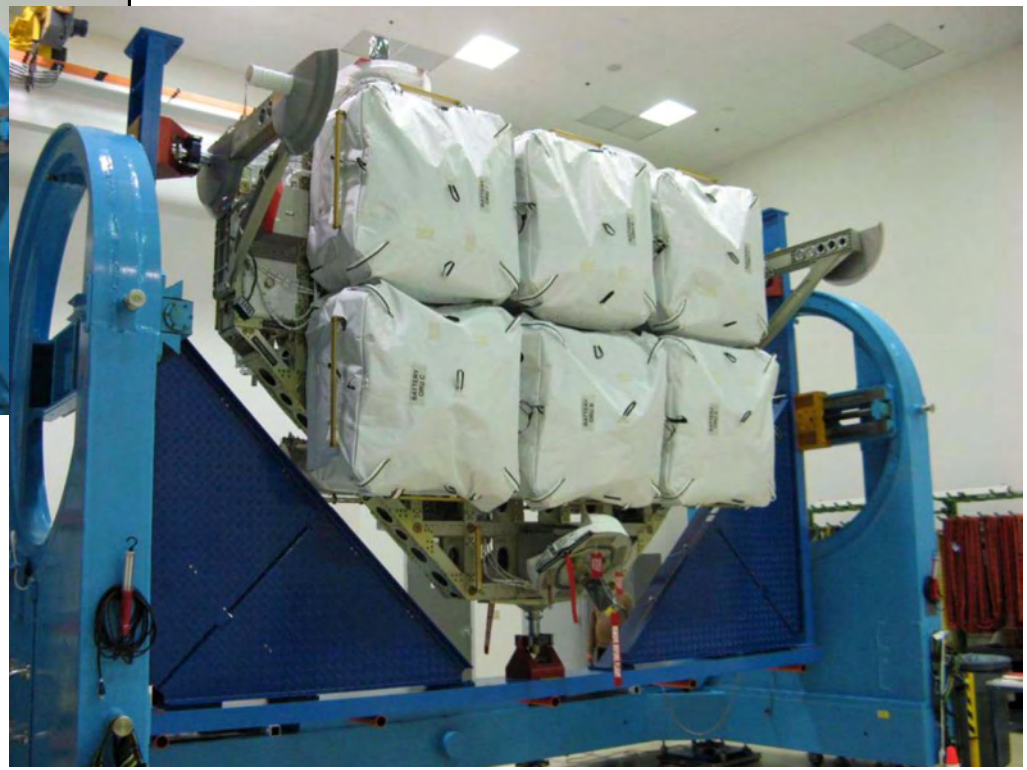
ICC-VLD LANDING CONFIG



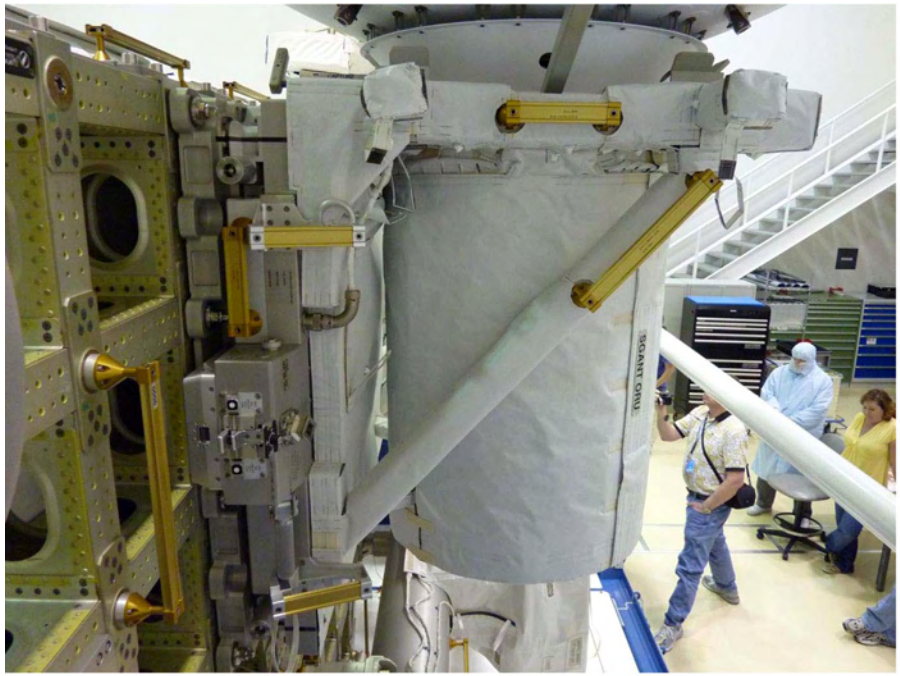


ICC-VLD (Cont)

ICC-VLD LAUNCH CONFIG



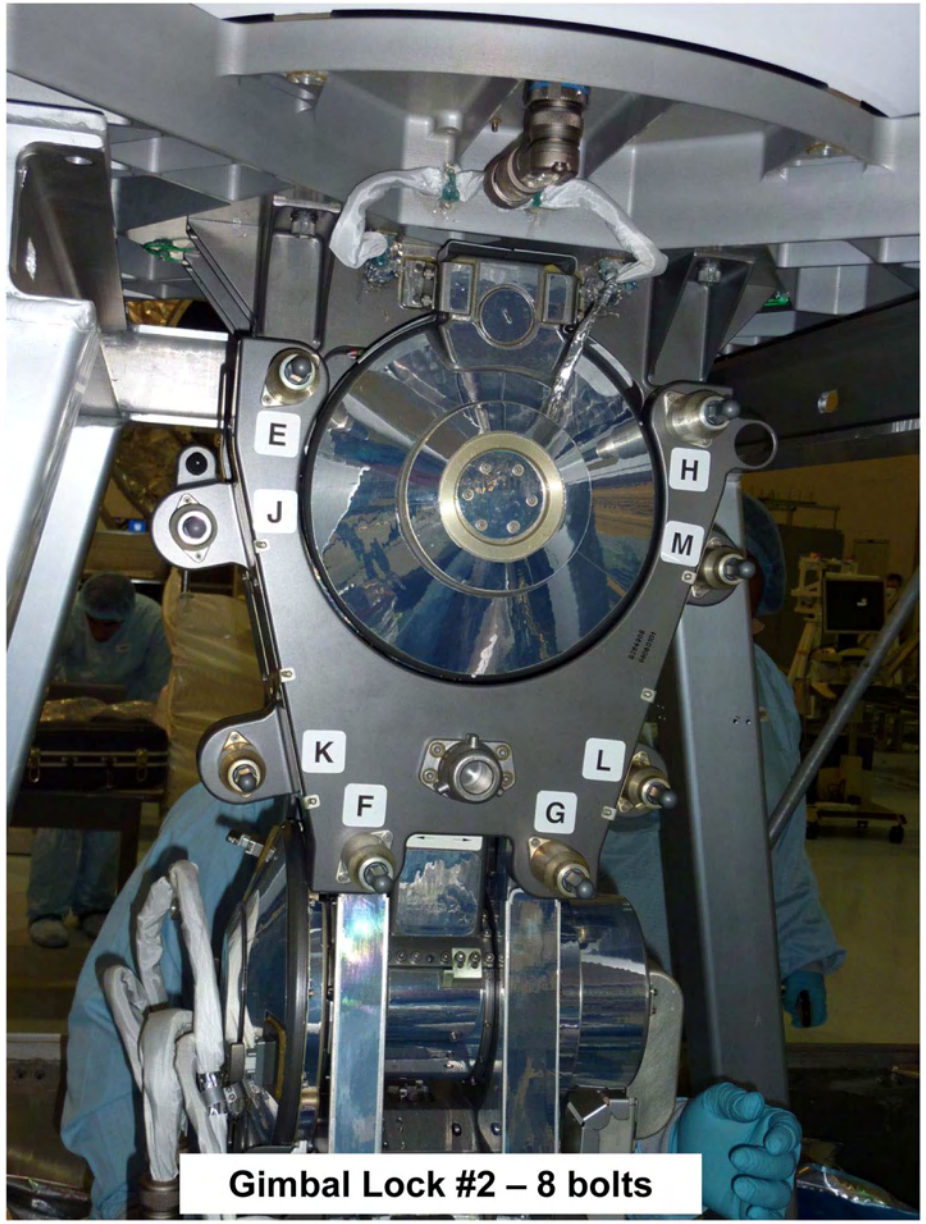
SGANT FSE


SGANT ORU

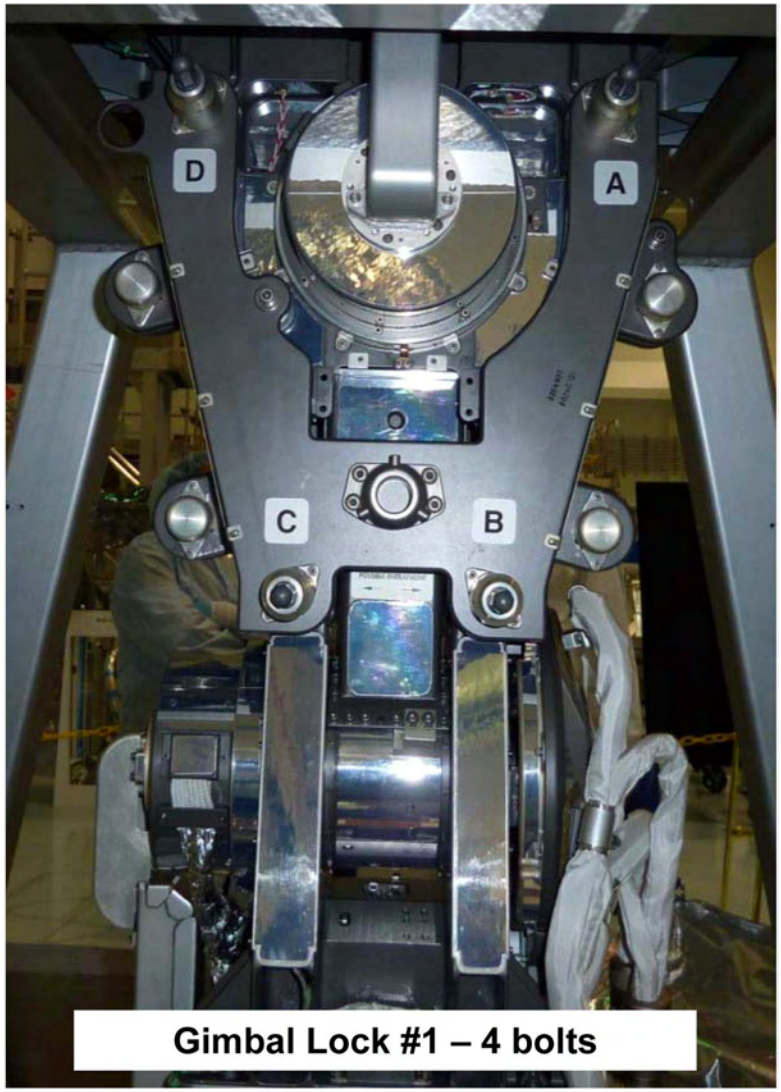
CONTINGENCY ACCESS FLAP 1

CONTINGENCY ACCESS FLAP 1
CONTINGENCY ACCESS FLAP 2

SGANT FSE – GIMBAL LOCKS



Gimbal Lock #2 – 8 bolts



Gimbal Lock #1 – 4 bolts

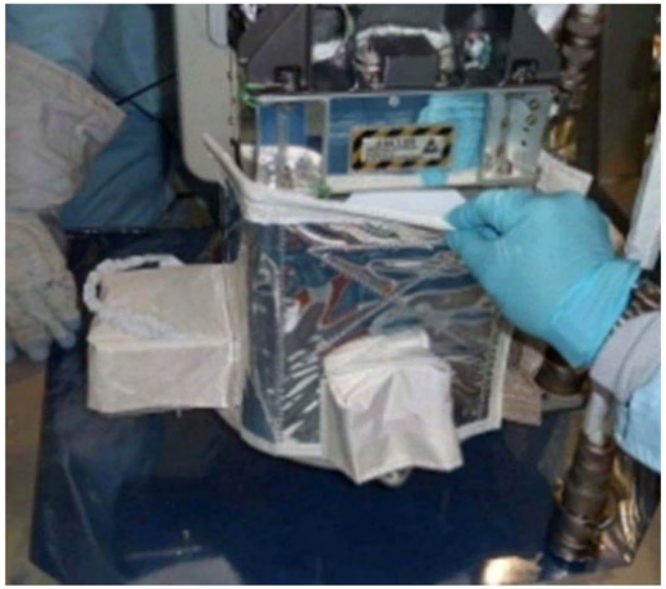
Release bolts in a crosswise pattern, Gimbal Lock #2 first

SGANT FSE – AGIT HEAT SHIELD

Goes around base of SGANT

2 – quarter turn fasteners and velcro to close
Pockets go over bolts and wave guide
Wave guide pocket has a "chin strap"

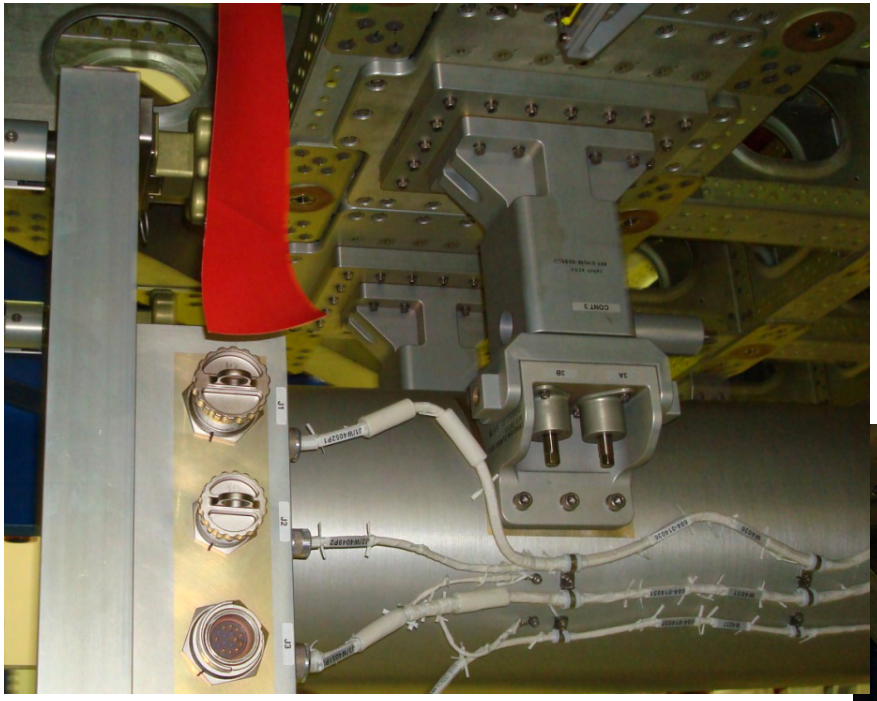
Ensure plastic tabs (on two sides) are under top plate and that the fit around the AGIT is snug to keep light out

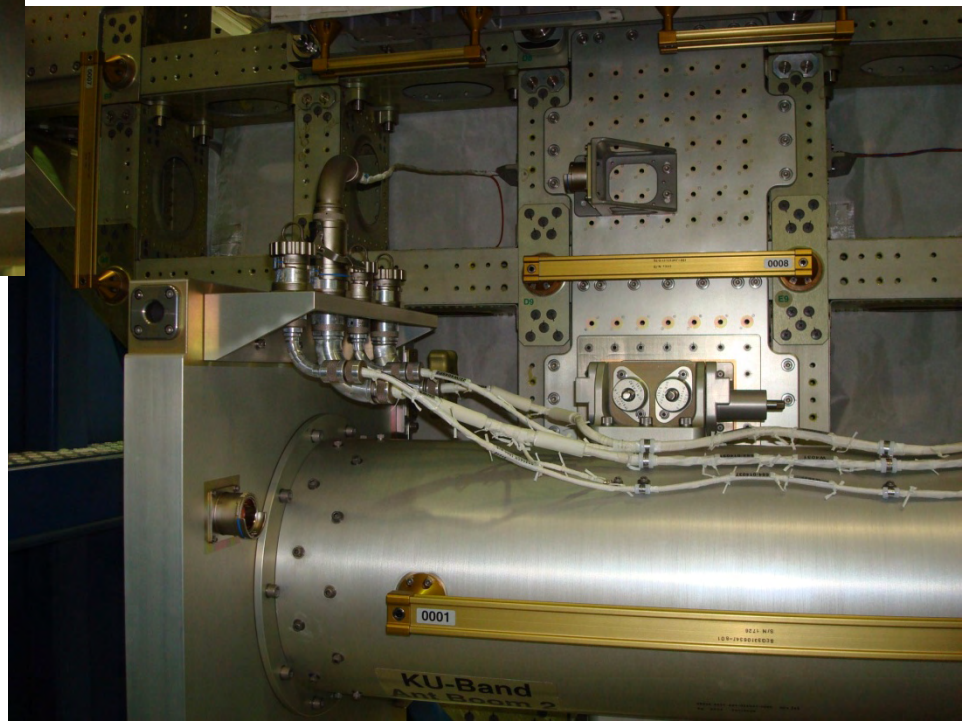


SGANT FSE – AGIT HEAT SHIELD (Cont)

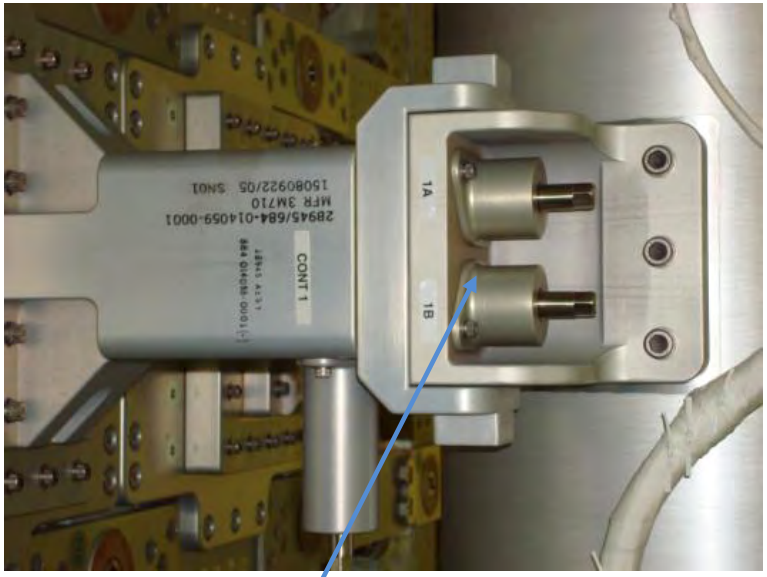
BOOM FSE – LTA

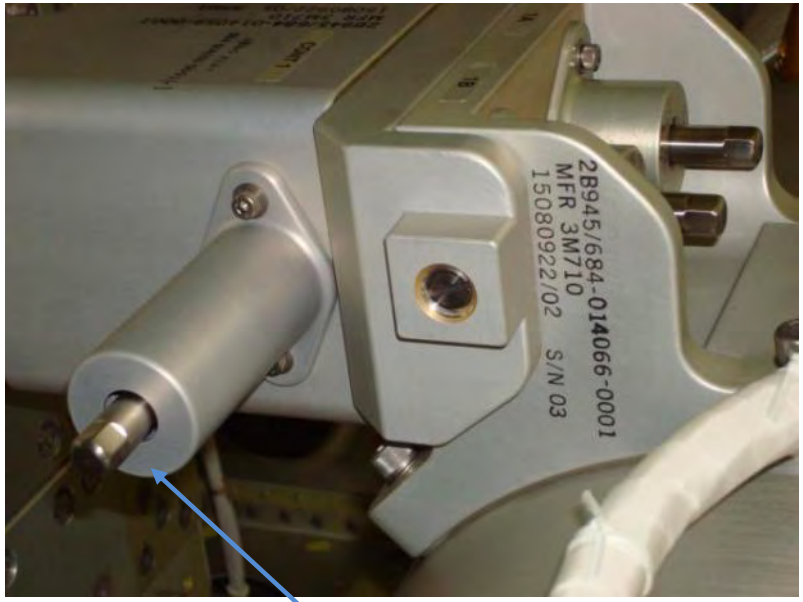
LTA ON PALLET

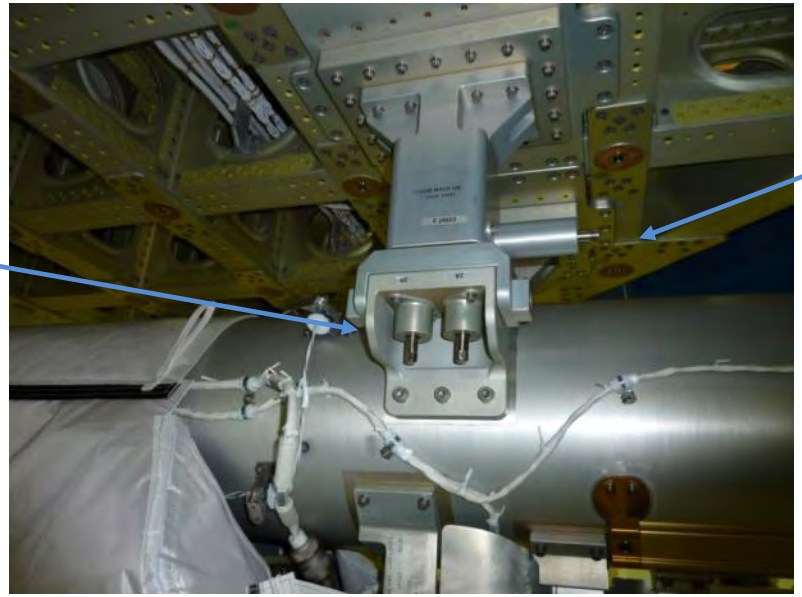




BOOM FSE – BOLTS



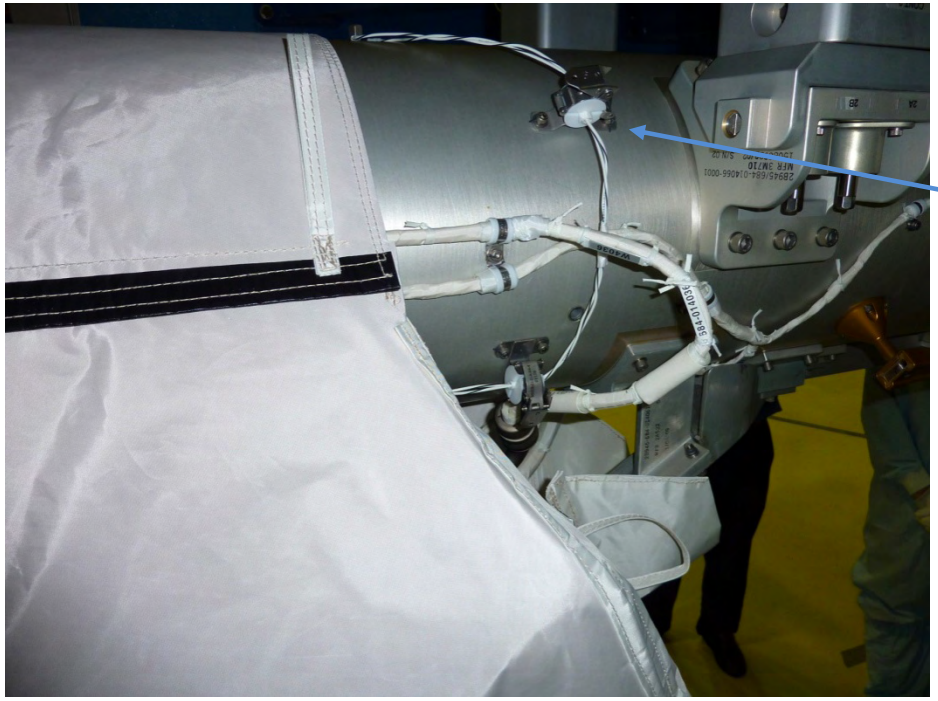




Nominal Bolts

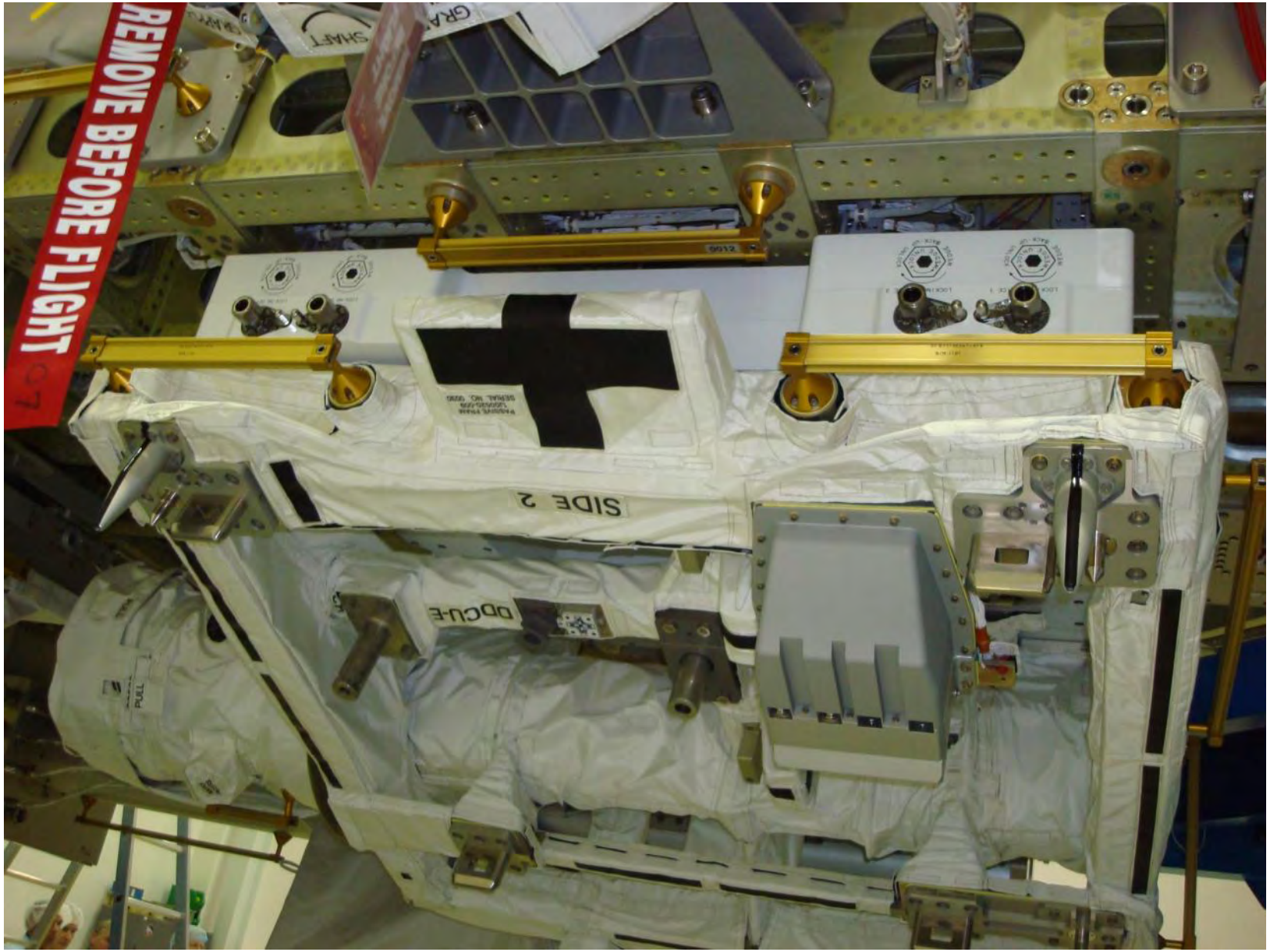
Contingency Bolt

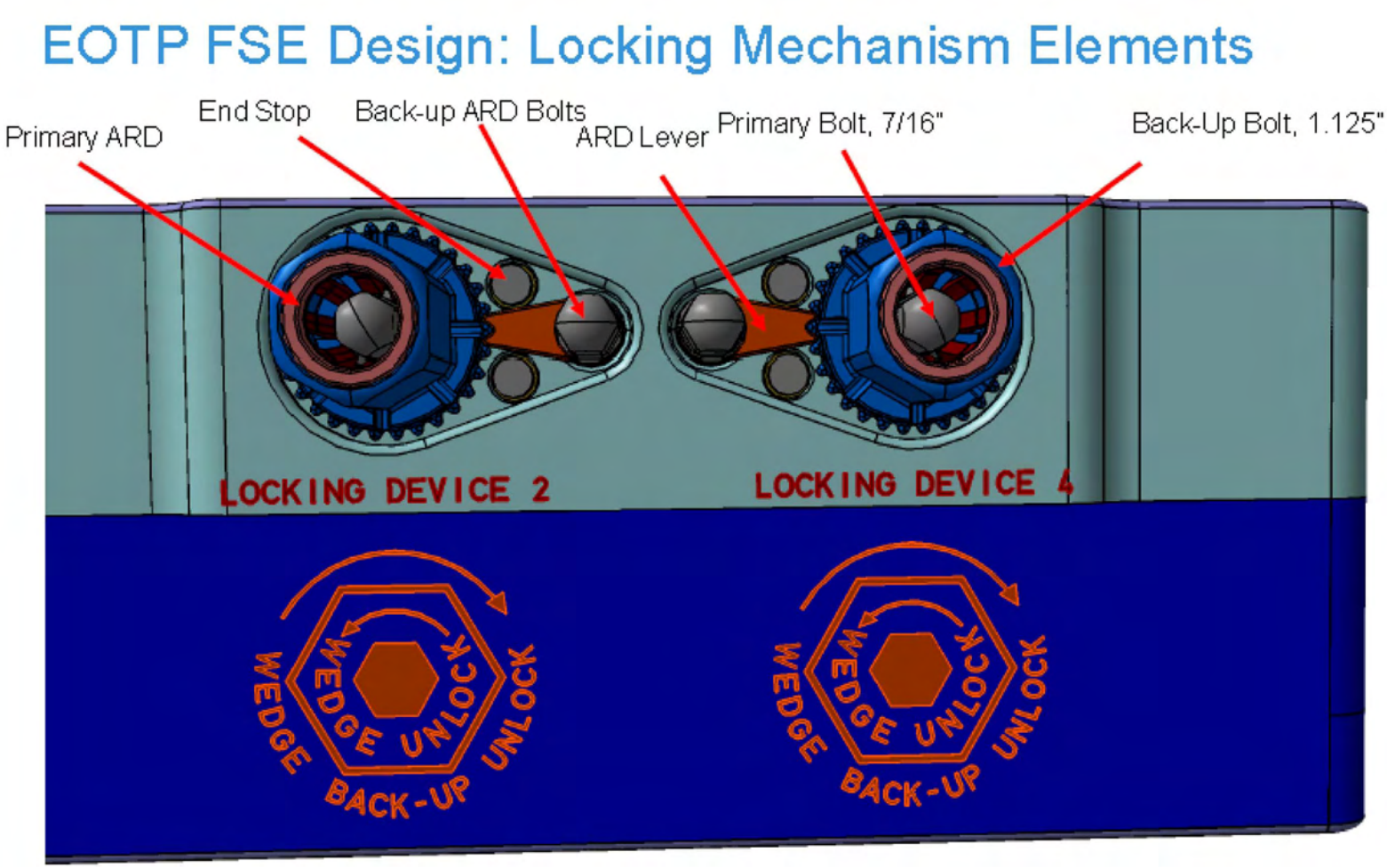
BOOM FSE – SGTRC GROUNDING BOLT



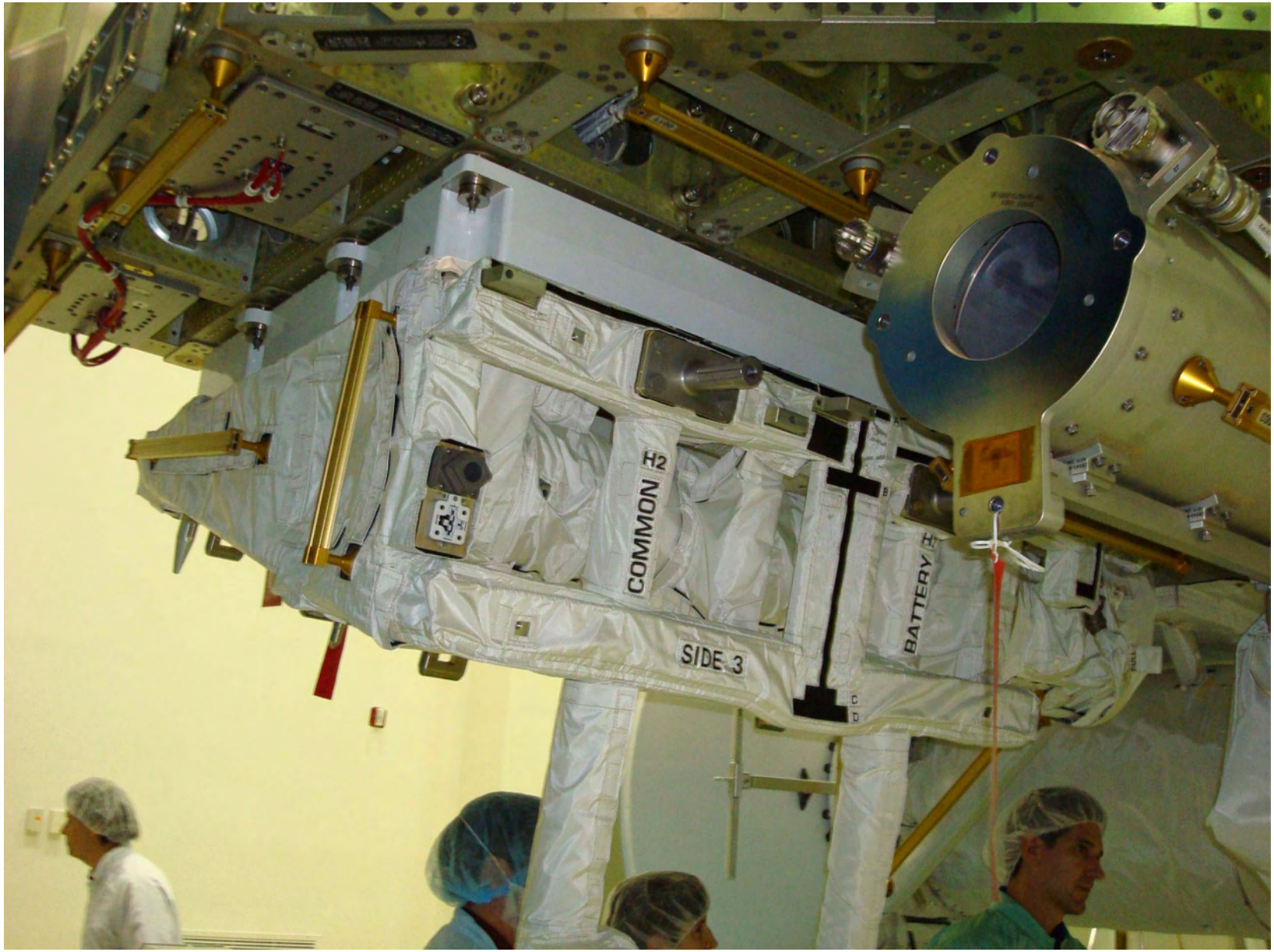
TA Clamps

EOTP FSE




EOTP FSE Design: Locking Mechanism Elements
Primary ARD
End Stop
Back-up ARD Bolts
ARD Lever
Primary Bolt, 7/16"
Back-Up Bolt, 1.125"
LOCKING DEVICE 2
LOCKING DEVICE 4
WEDGE
UNLOCK
BACK-UP
WEDGE
UNLOCK
WEDGE
UNLOCK
BACK-UP
WEDGE
UNLOCK

EOTP FSE (Cont)

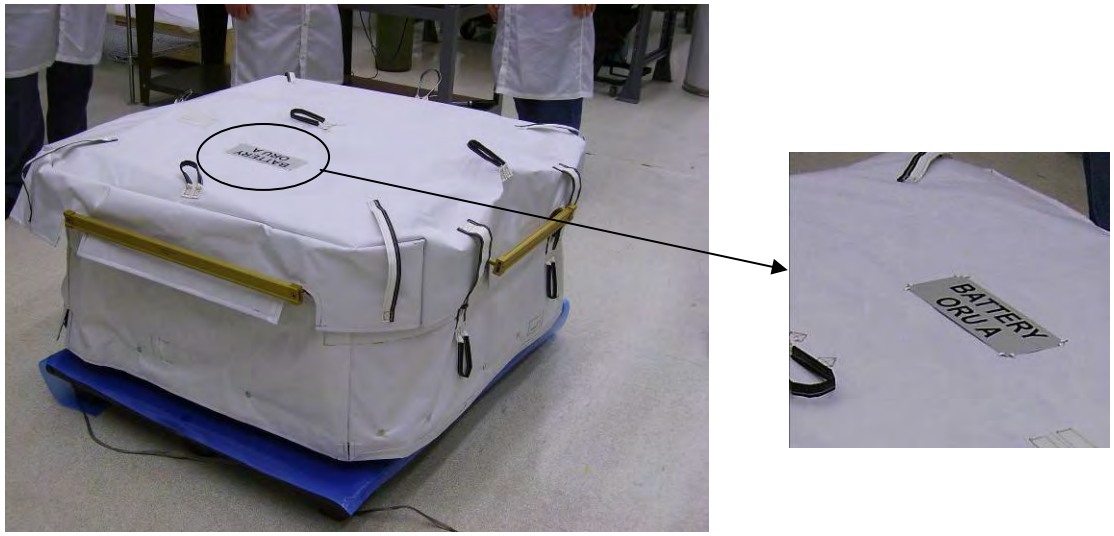


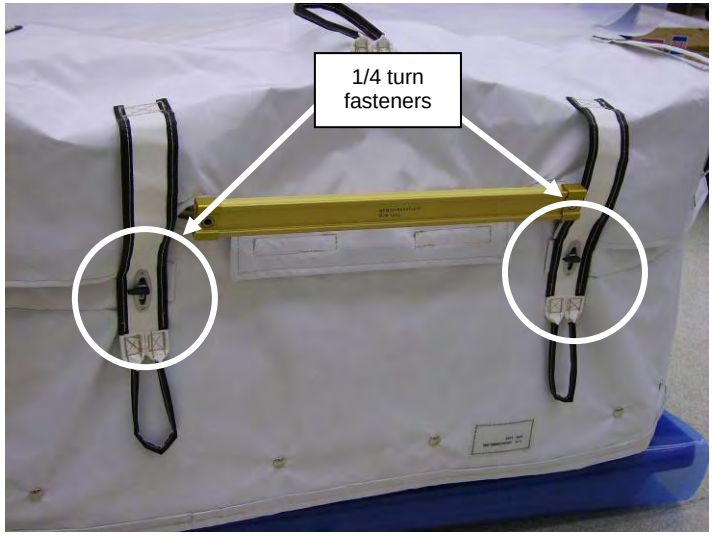
BATTERY FSE

SHI-ICC-D50
FLIGHT HARDWARE S/N
BATTERY ORU C
BATTERY ORU D
BATTERY ORU B
BATTERY ORU A
REMOVE BEFORE FLIGHT

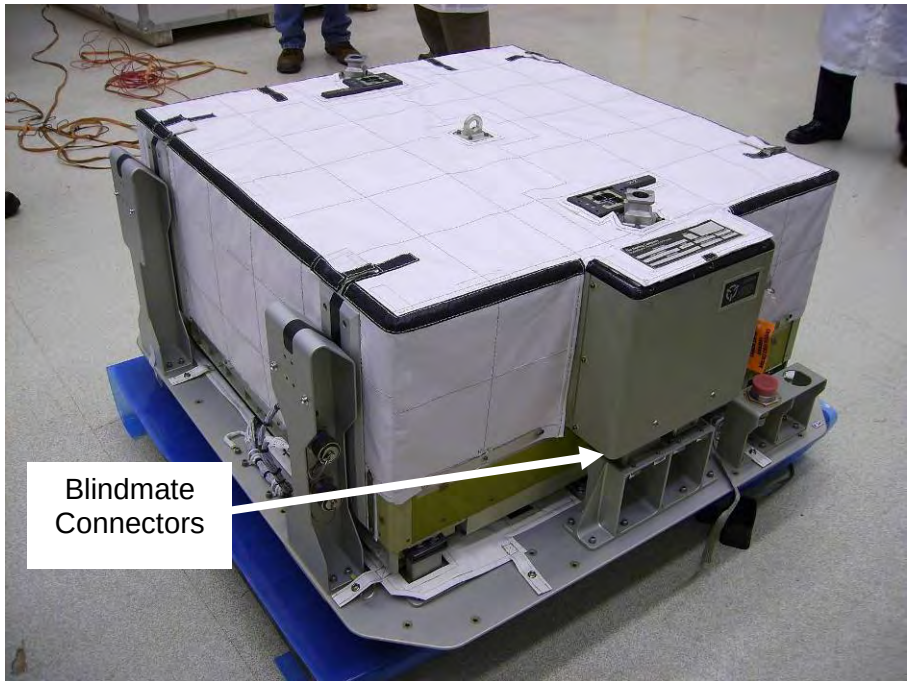
BATTERY FSE (Cont)

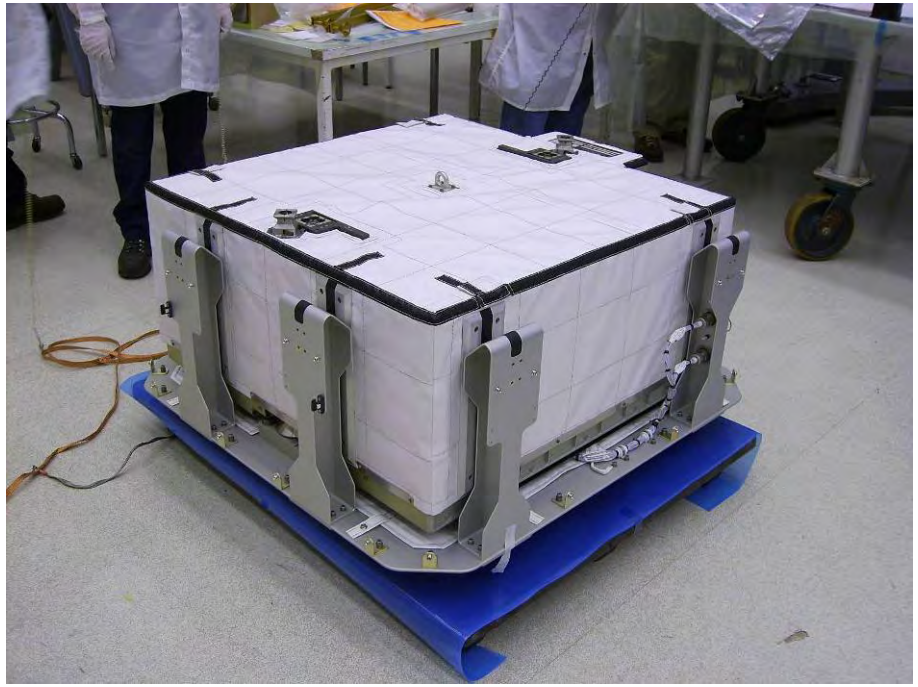
FSE MLI



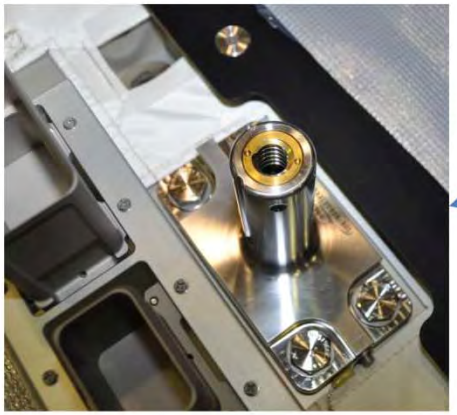


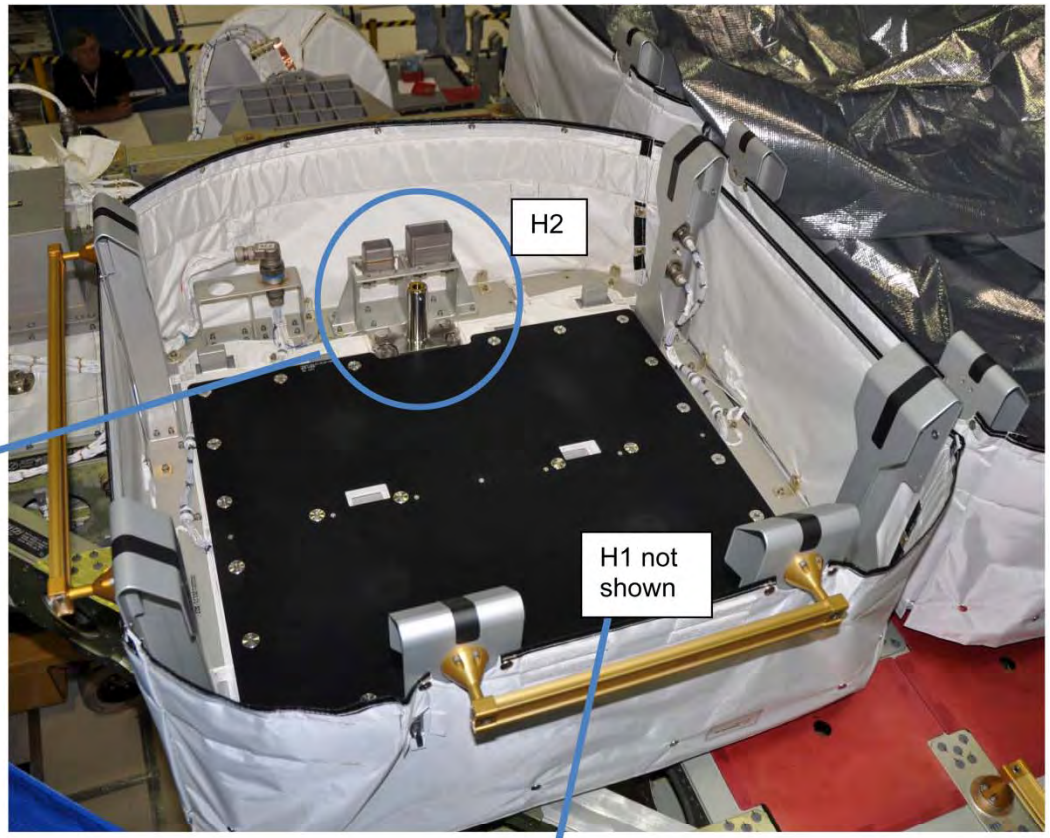
BATTERY FSE (Cont)



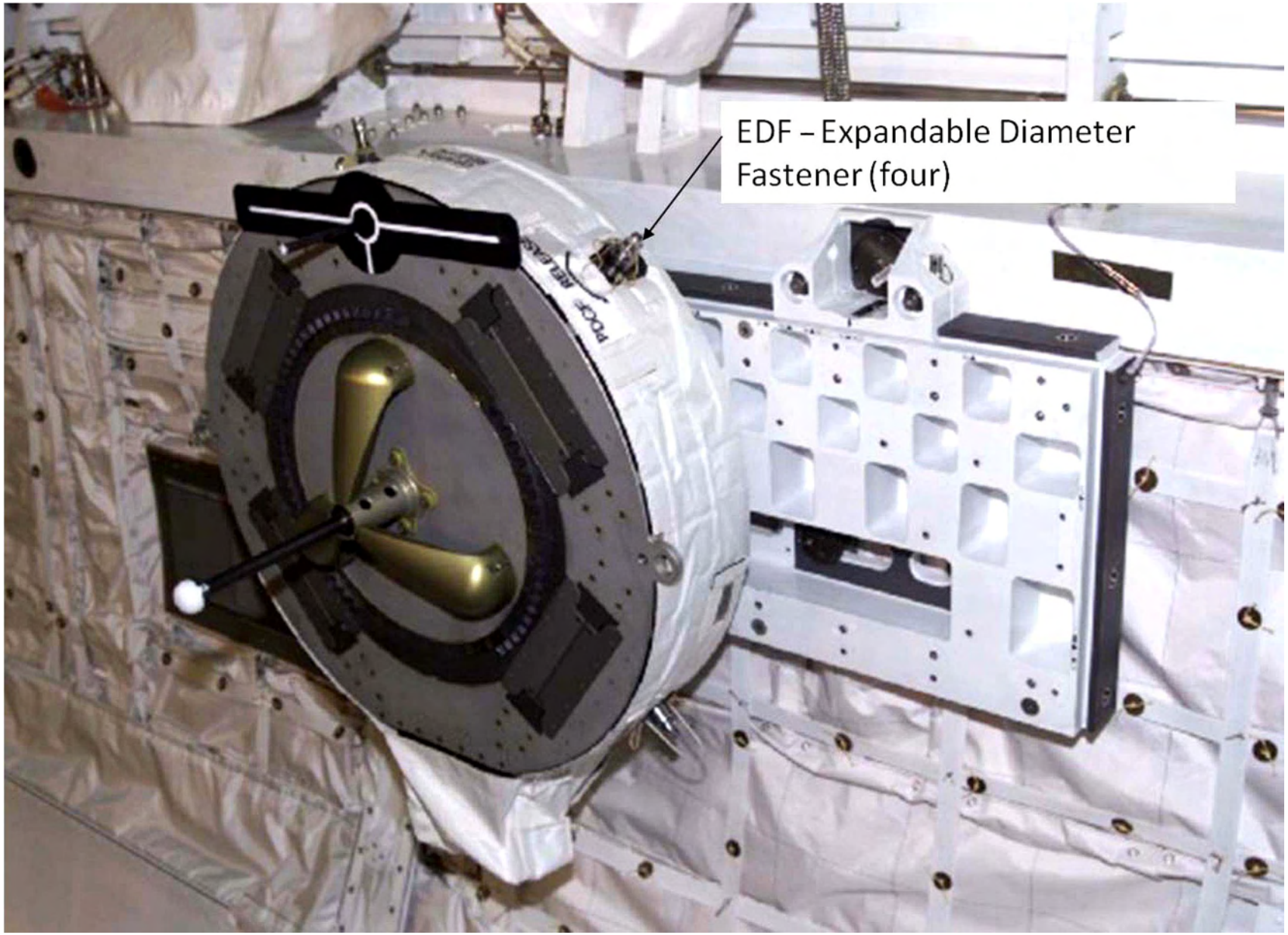


BATTERY FSE (Cont)

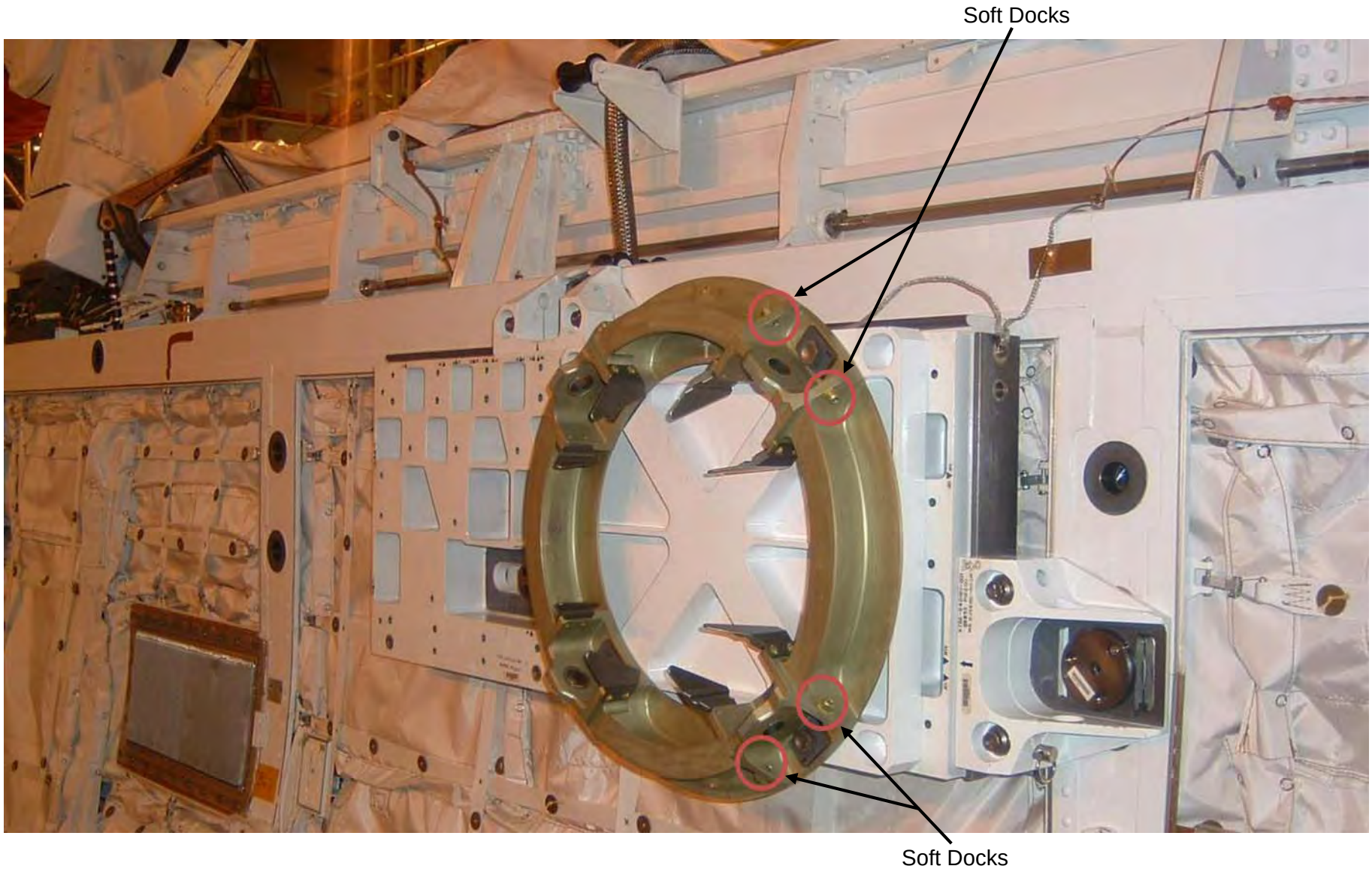




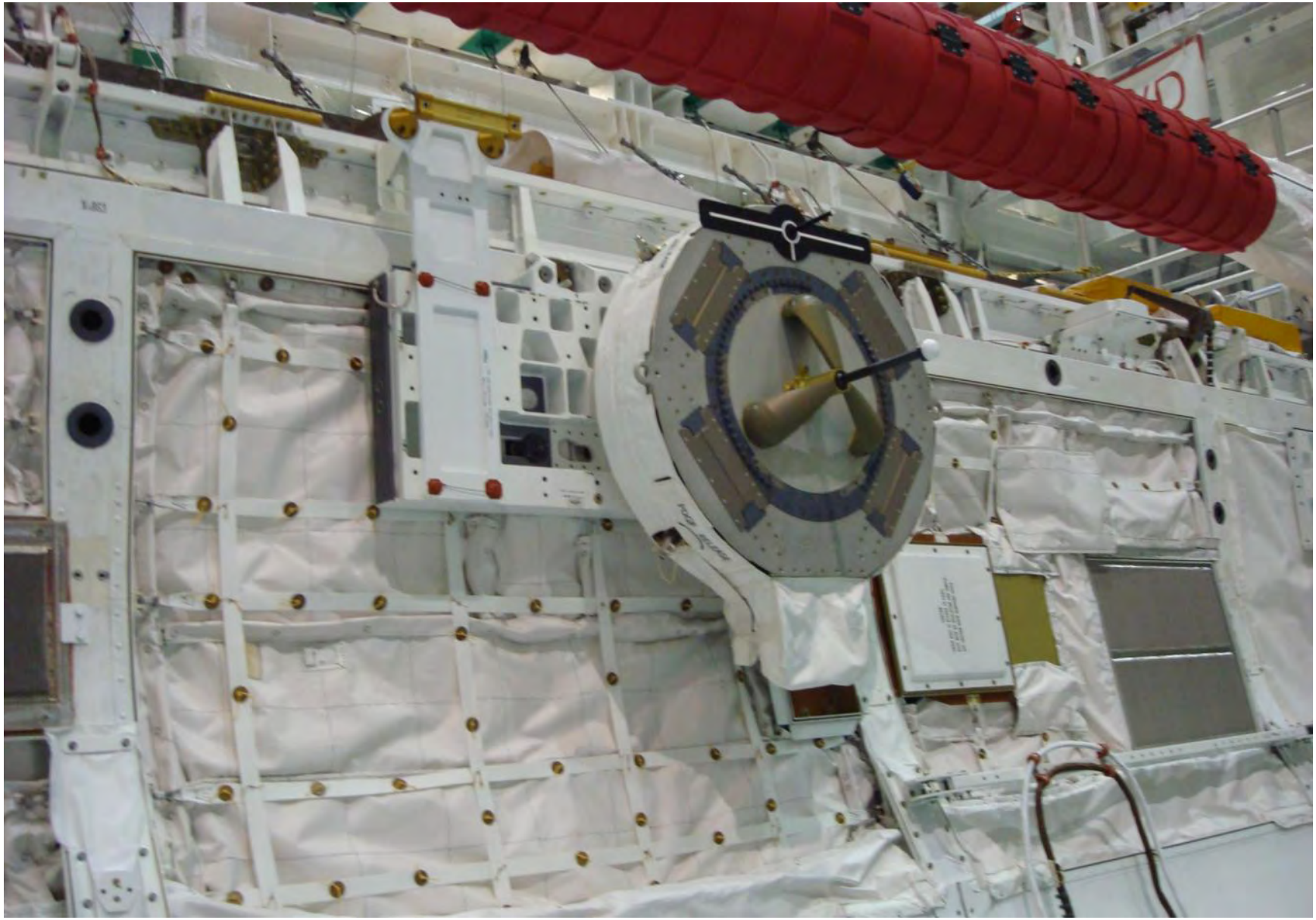
SIDEWALL CARRIER



SIDEWALL CARRIER (Cont)

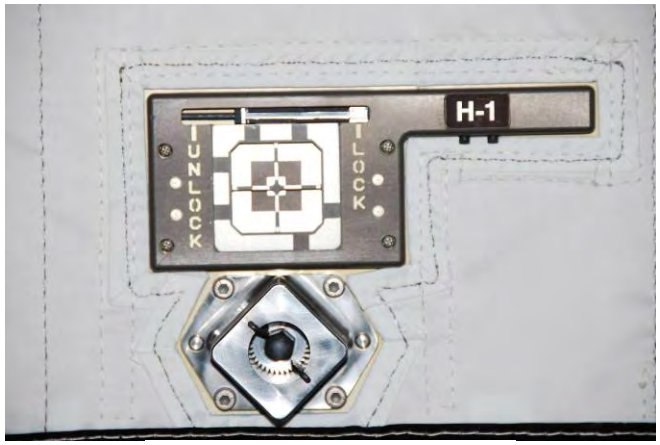


SIDEWALL CARRIER (Cont)

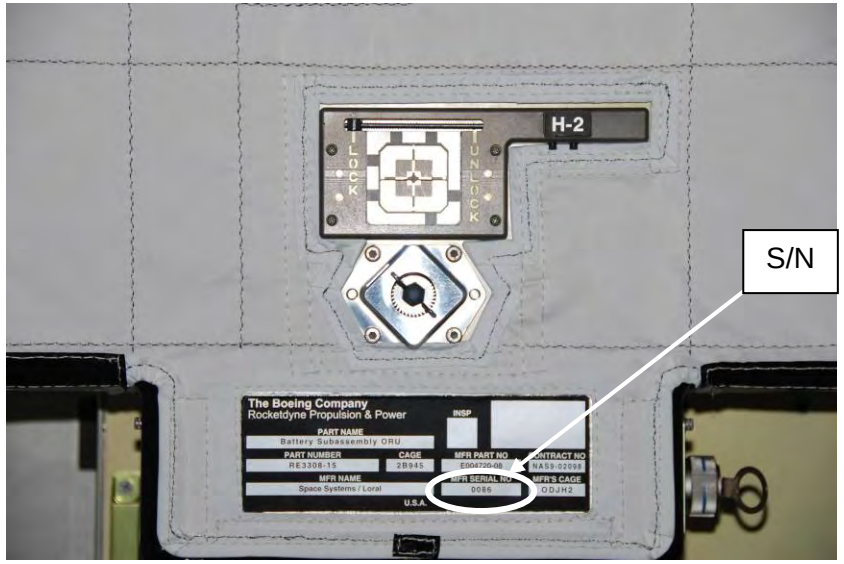


BATTERY

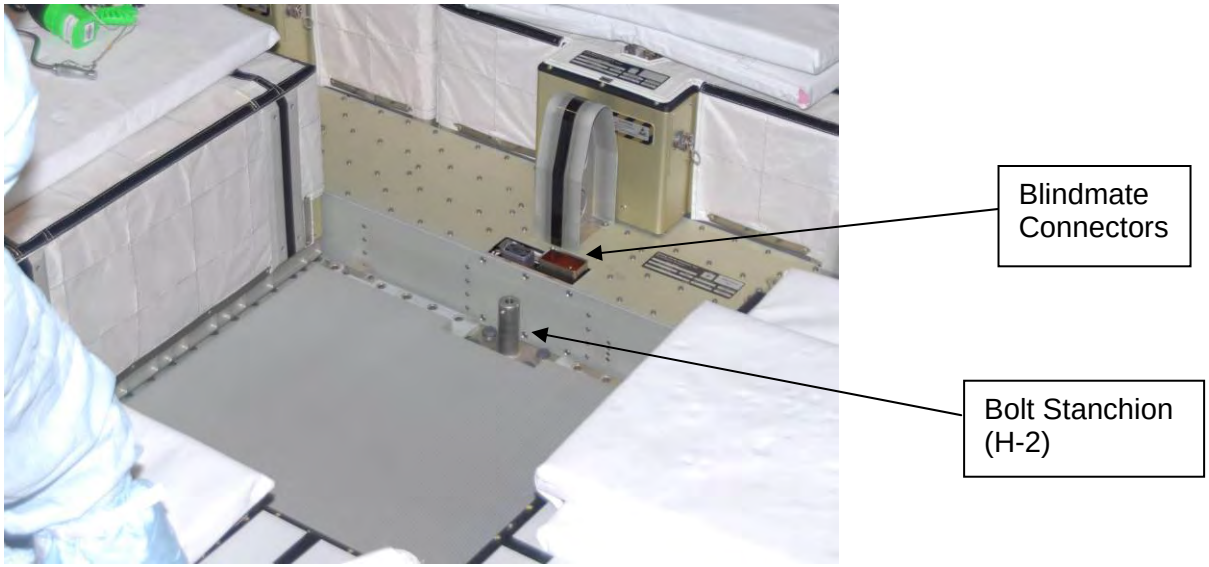
BATTERY ORU



H-1

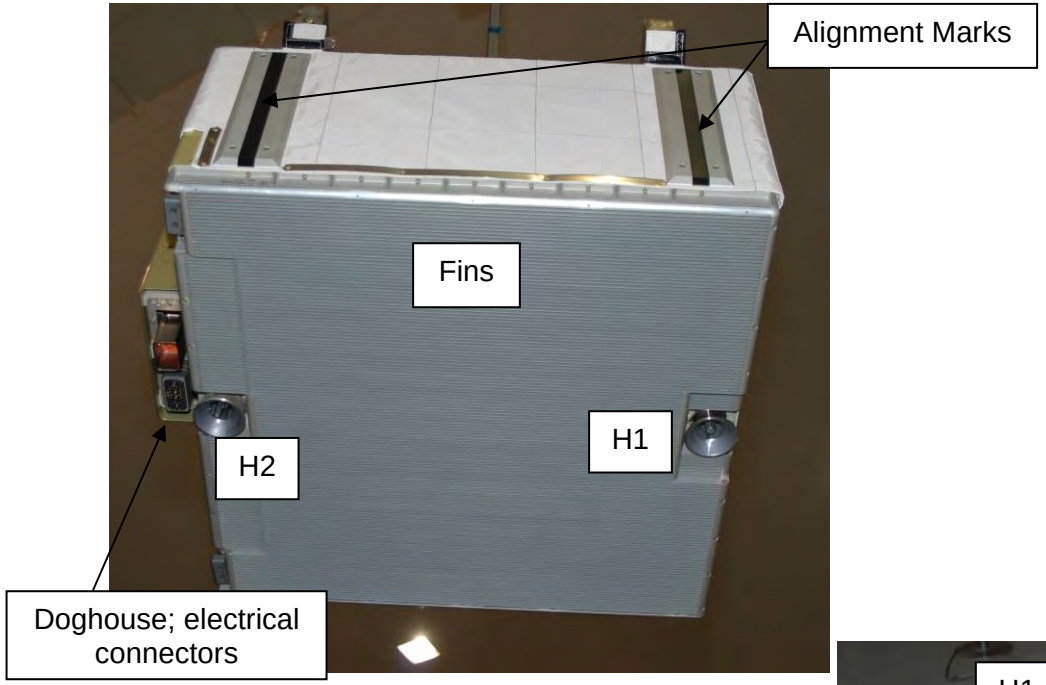


H-2 Lock/Unlock Indicator

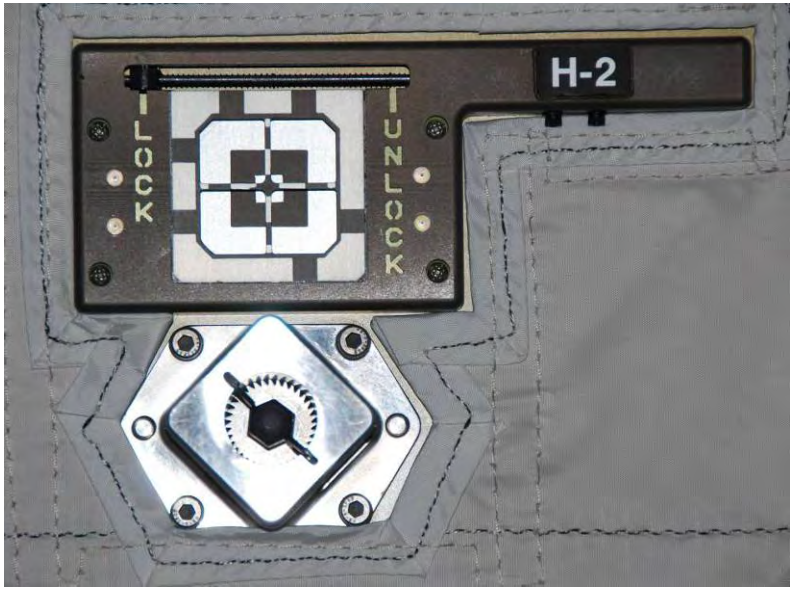


IEA Interface

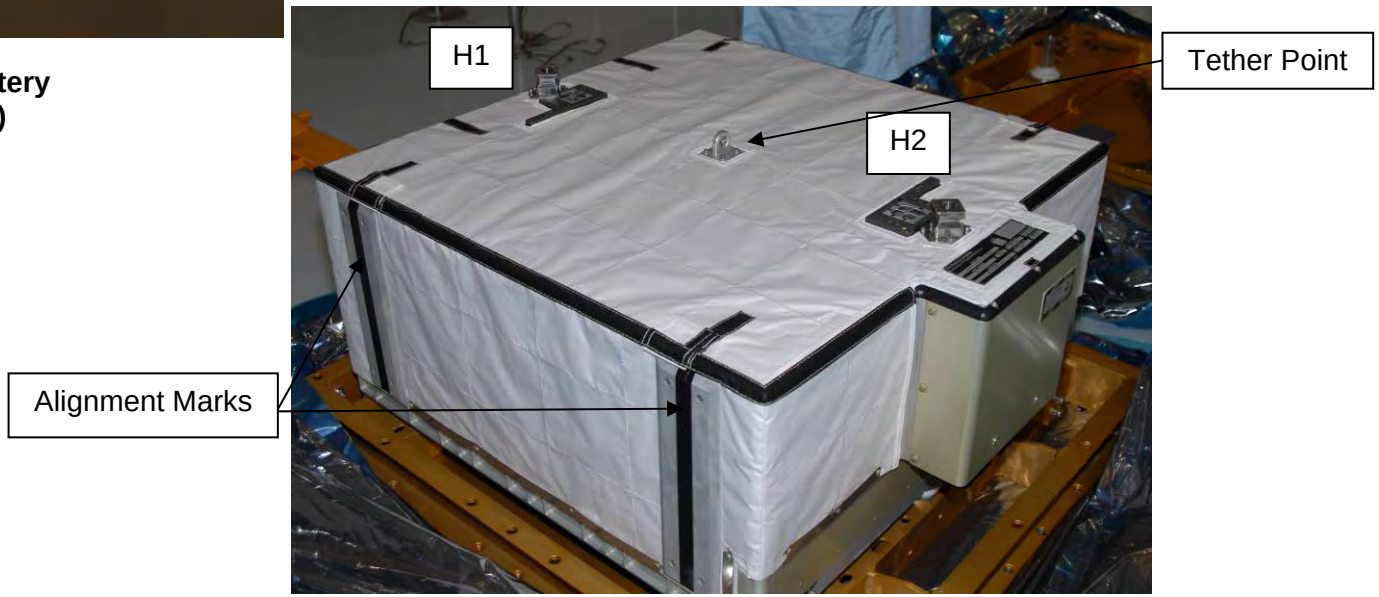
BATTERY (Cont)



Backside of Battery (to Structure)



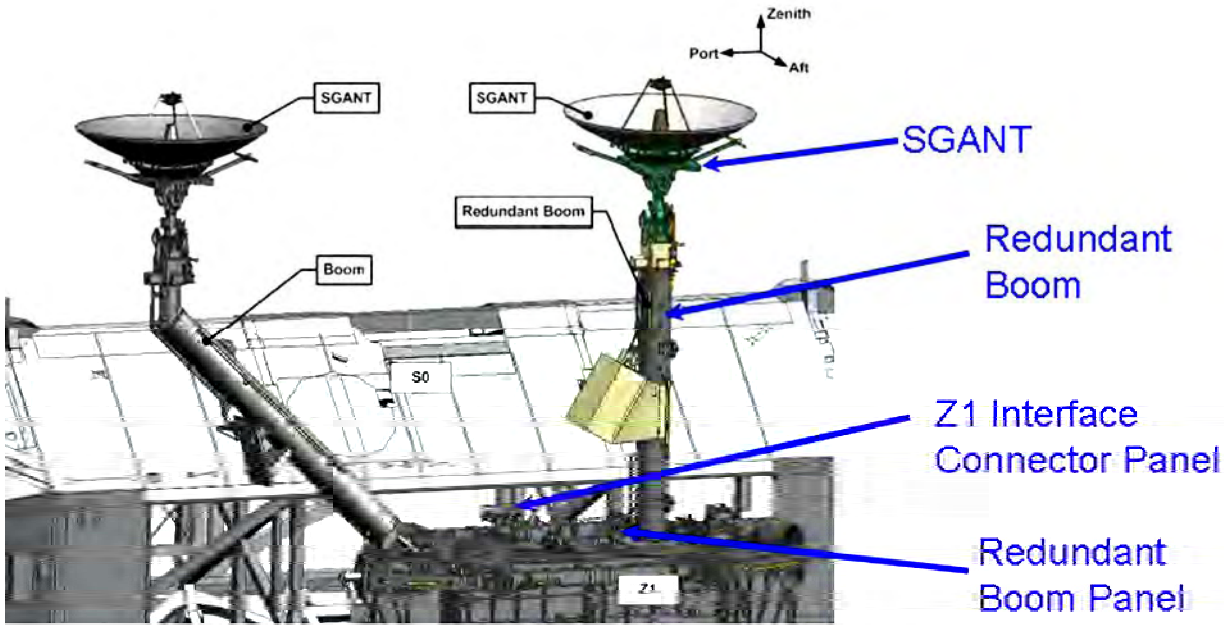
Lock/Unlock Indicator

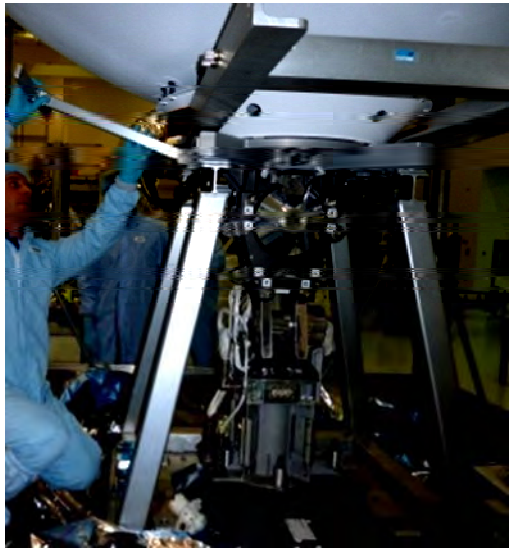


Top of Battery

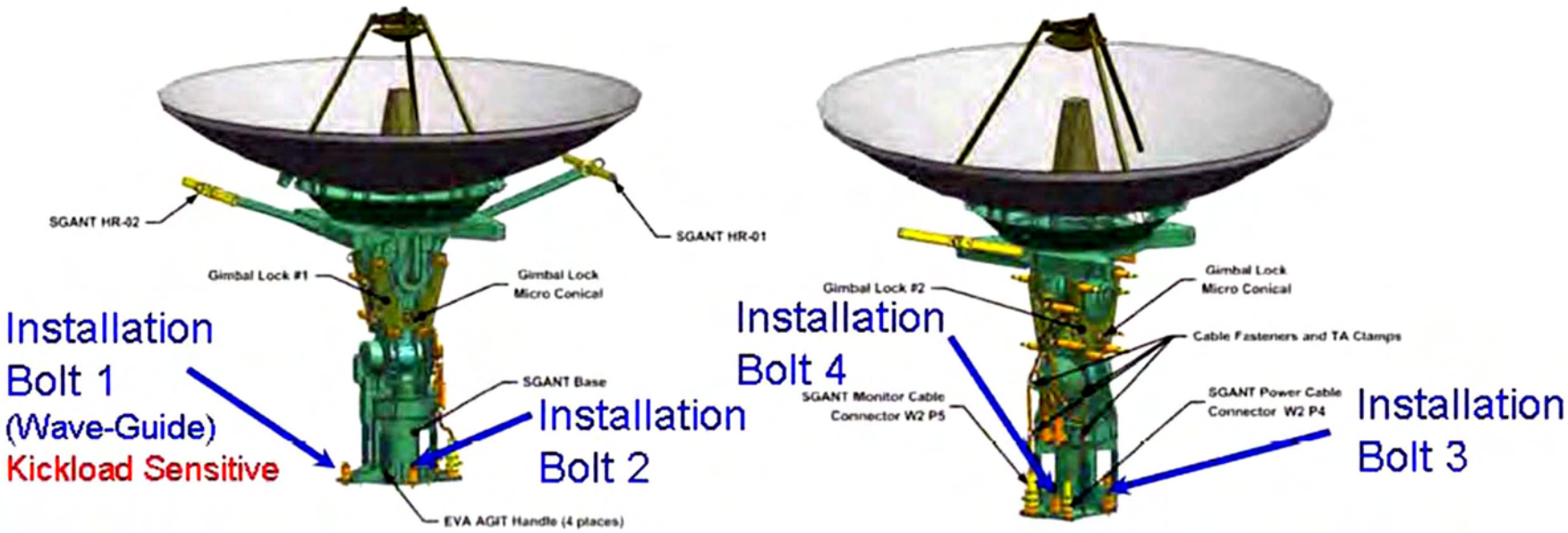
BOOM

SGANT

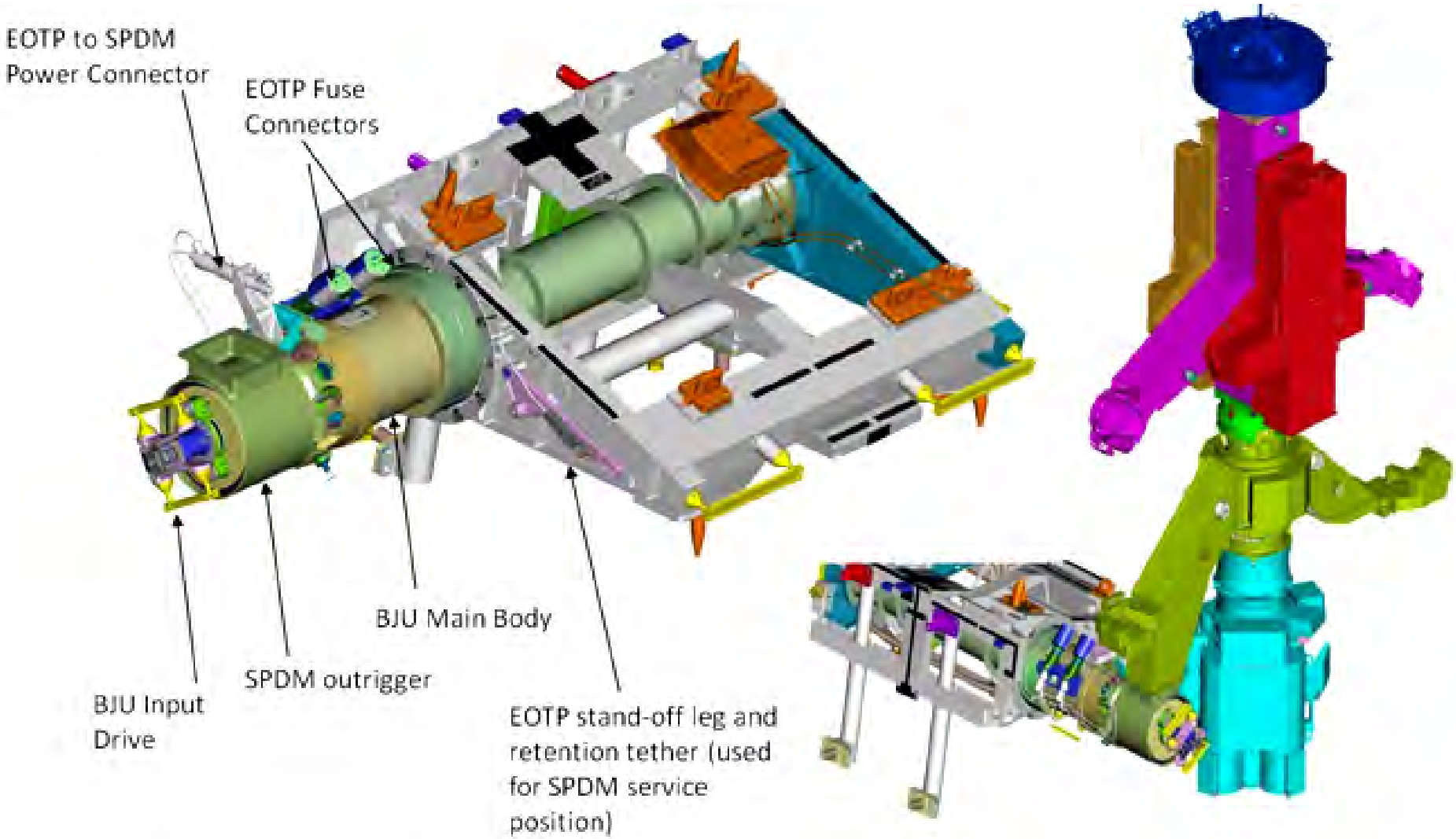

Zenith
Port
Aft
SGANT
SGANT
SGANT
Redundant Boom
Redundant Boom
Boom
S0
Z1 Interface Connector Panel
Redundant Boom Panel
Z1



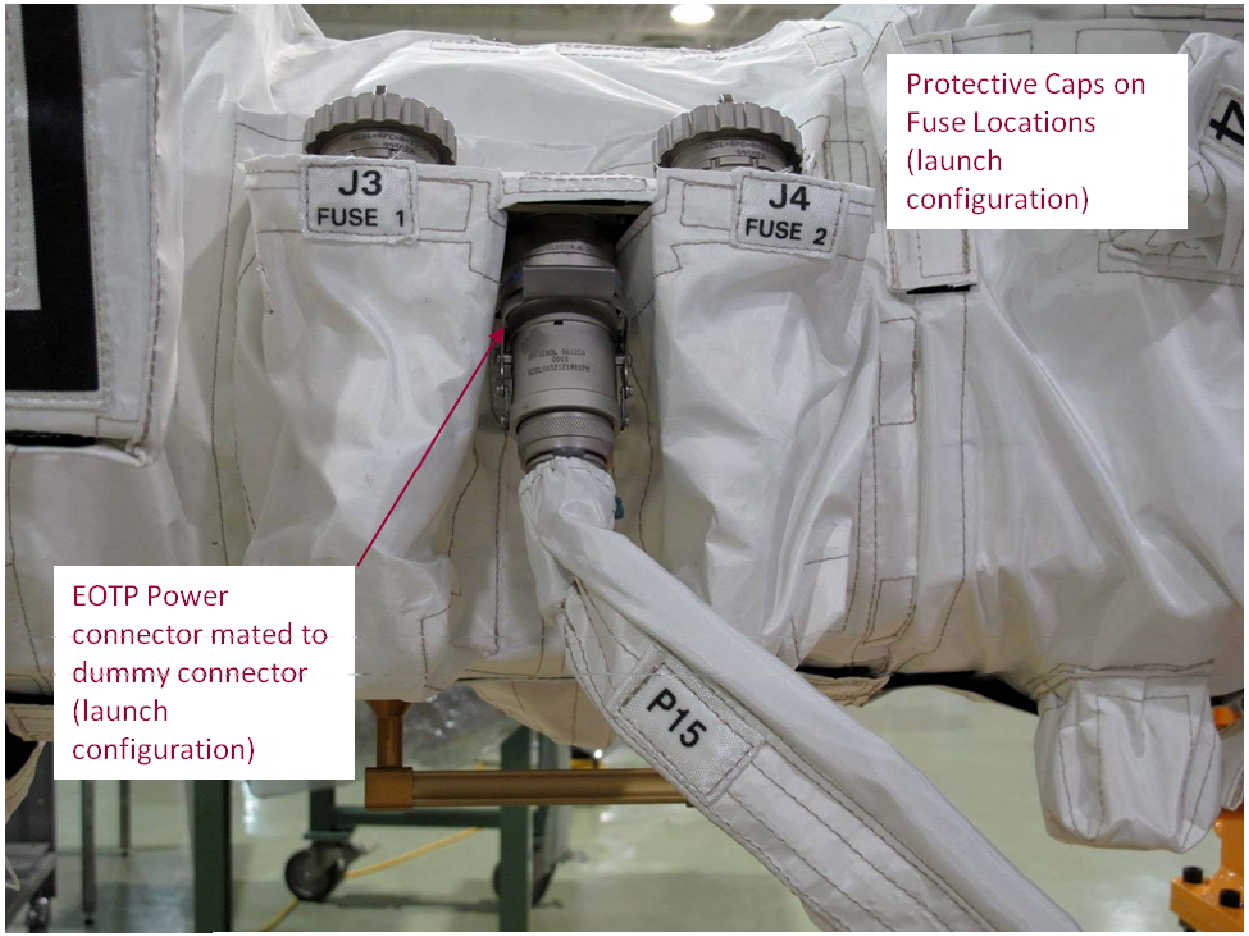
SGANT (Cont)

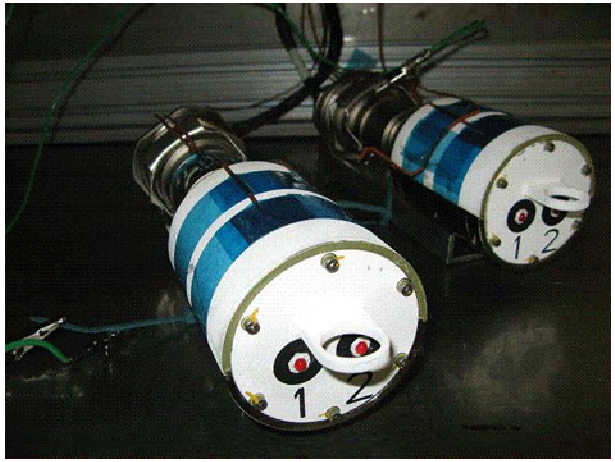

SGANT HR-02
SGANT HR-01
Gimbal Lock #1
Gimbal Lock
Micro Conical
Installation
Bolt 1
(Wave-Guide)
Kickload Sensitive
SGANT Base
Installation
Bolt 2
EVA AGIT Handle (4 places)
Gimbal Lock #2
Gimbal Lock
Micro Conical
Installation
Bolt 4
Cable Fasteners and TA Clamps
SGANT Monitor Cable
Connector W2 P5
SGANT Power Cable
Connector W2 P4
Installation
Bolt 3

EOTP


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

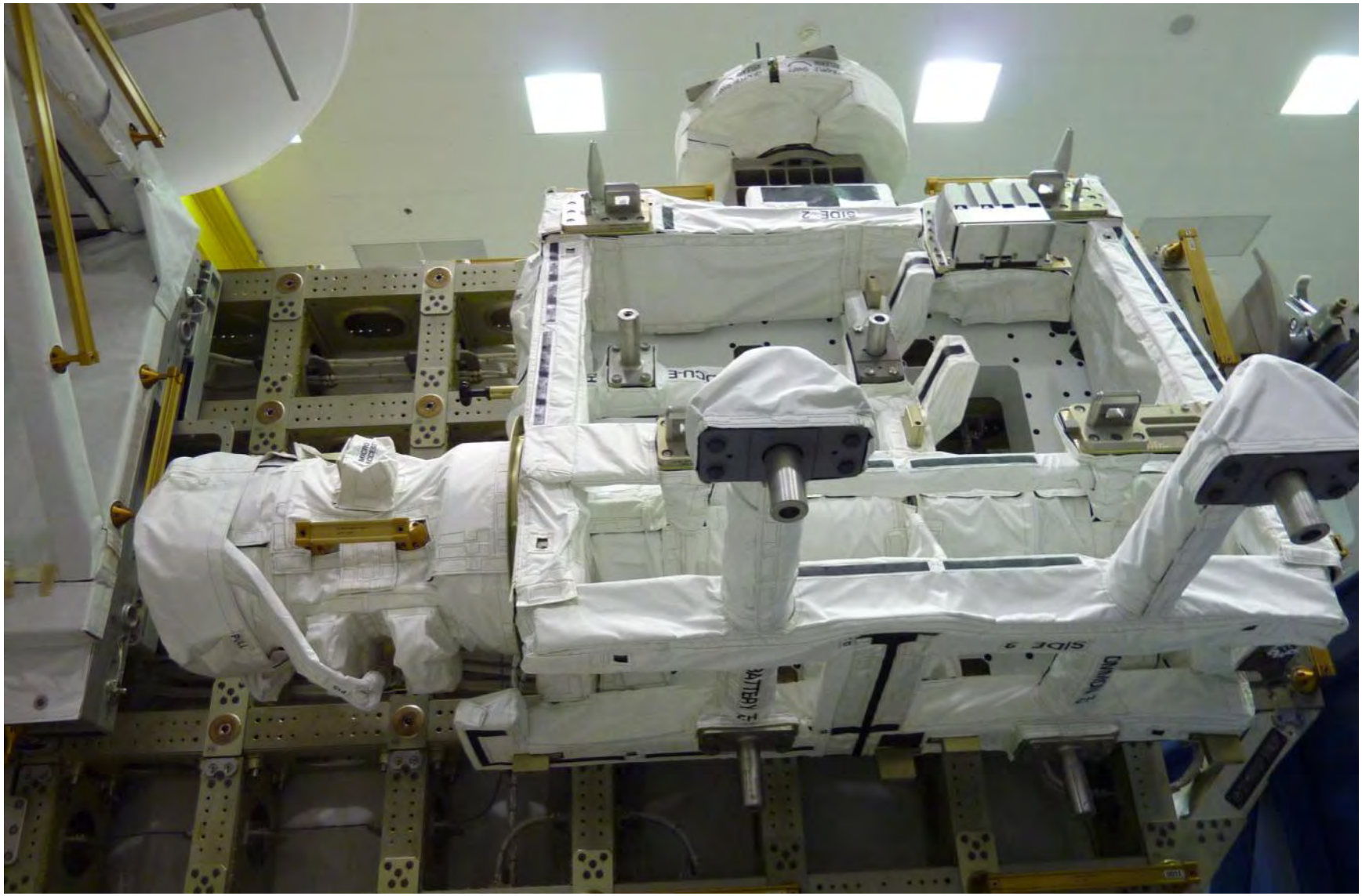
EOTP (Cont)



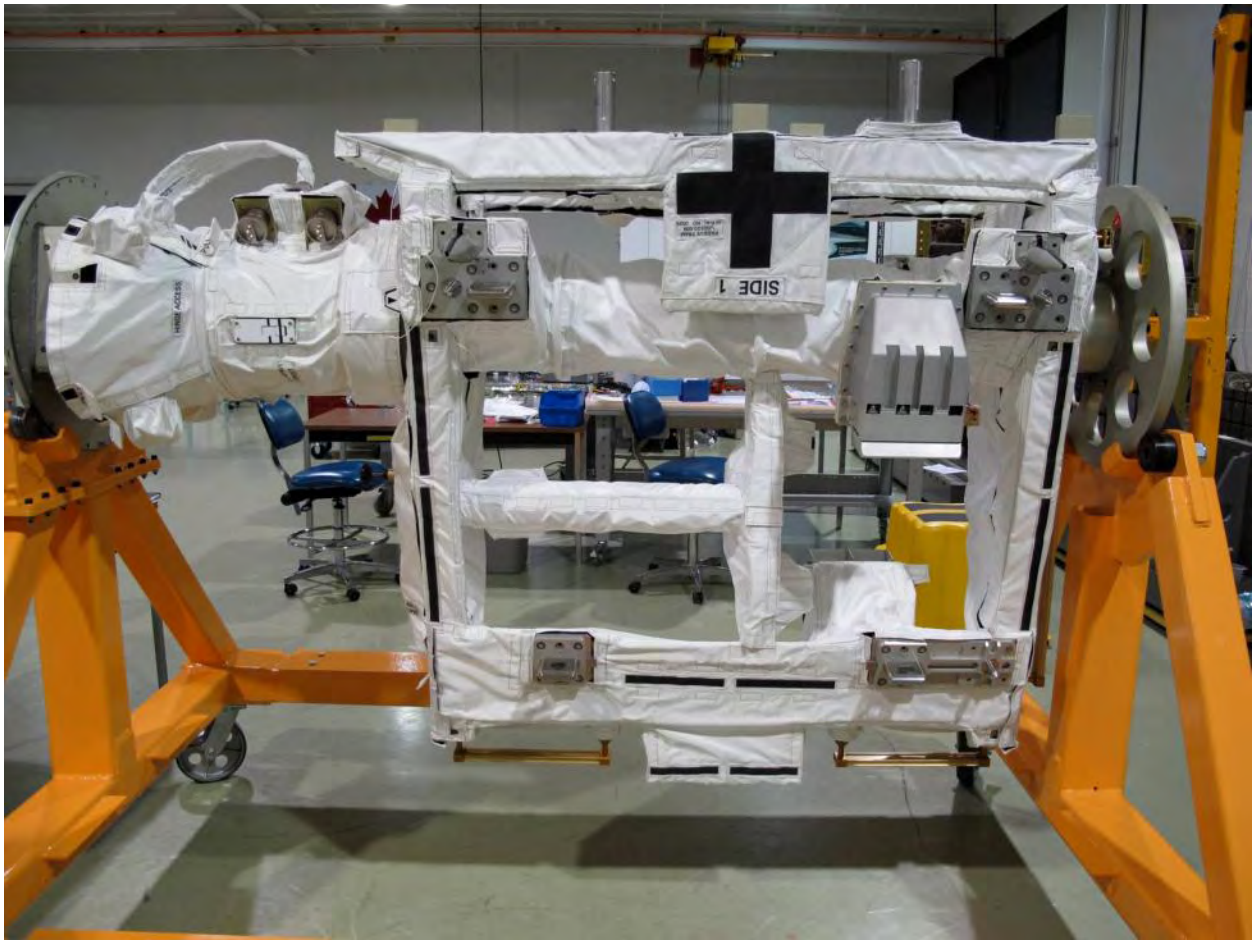


Fuse Connectors have thermal paint on ½ of the fuse body and on the end of the fuse

EOTP (Cont)



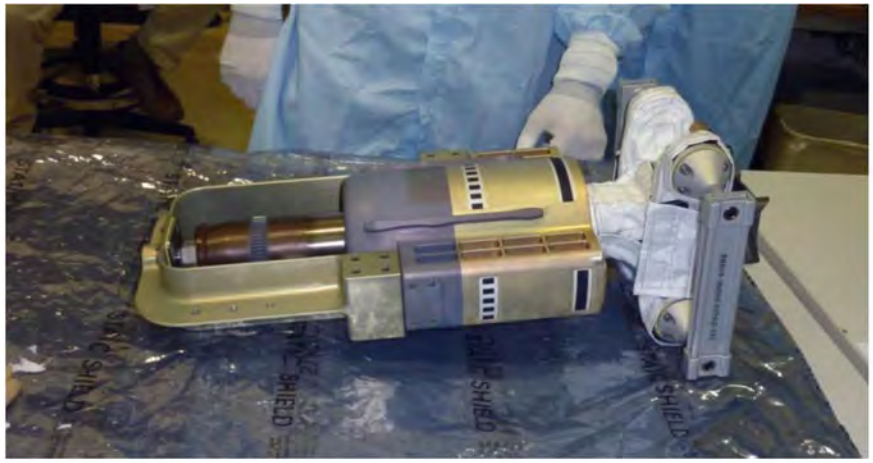
EOTP (Cont)

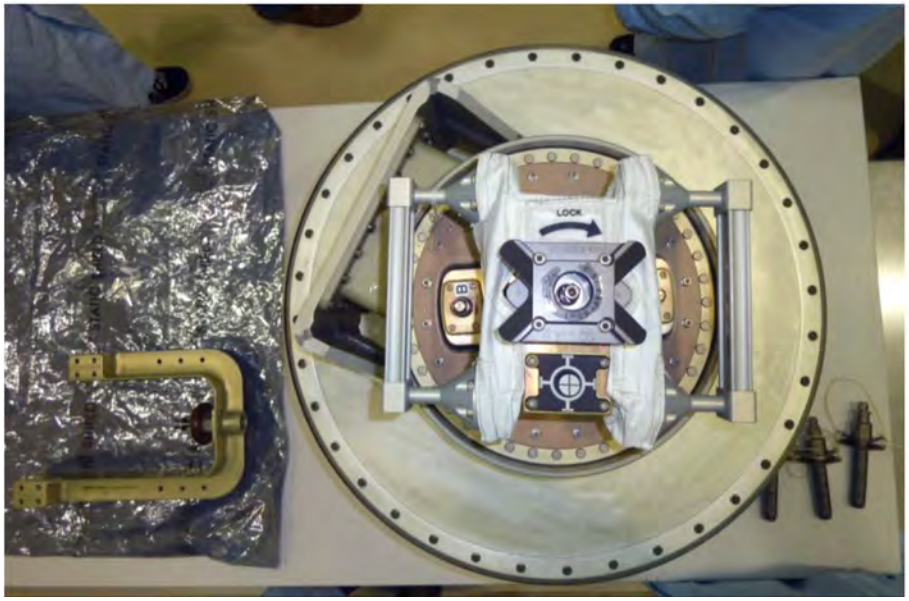


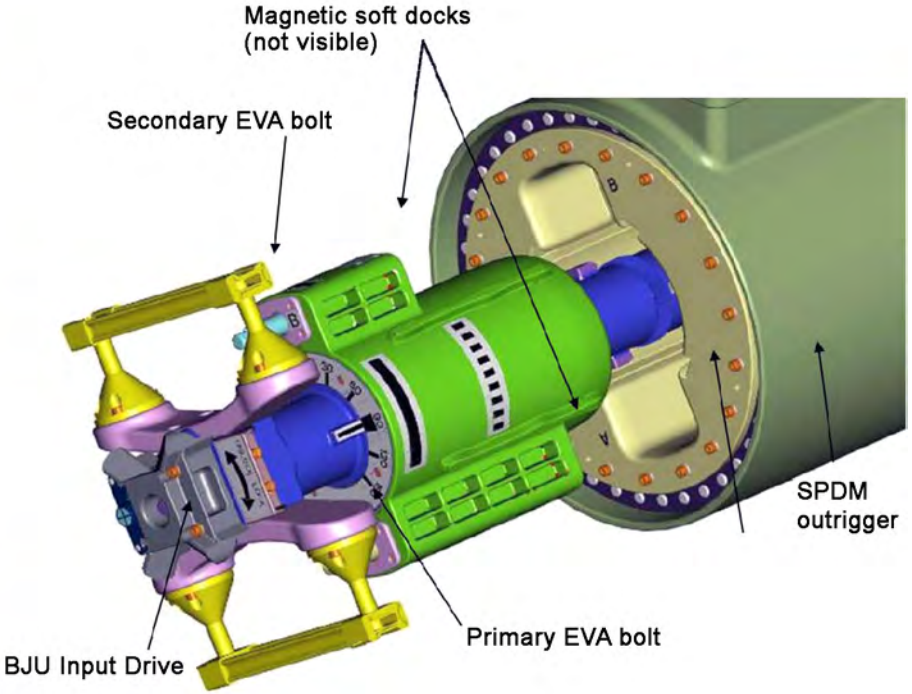
EOTP (Cont)

EOTP (Cont)

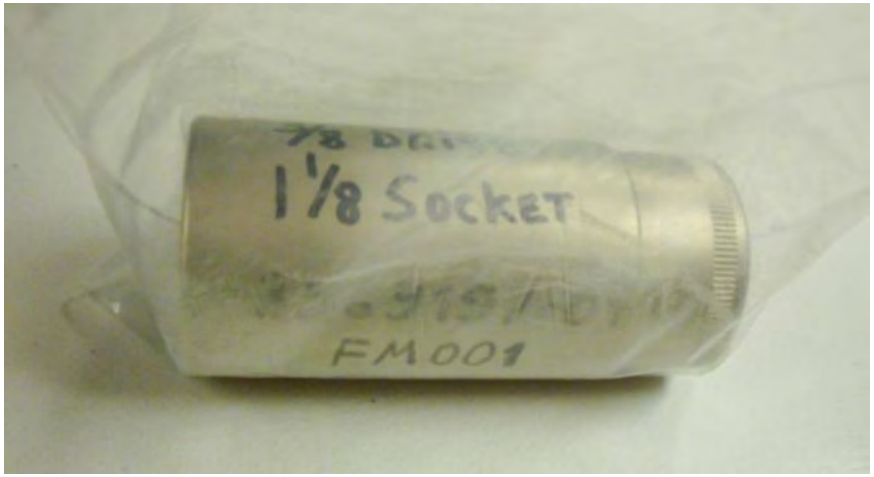
EOTP – INPUT DRIVE

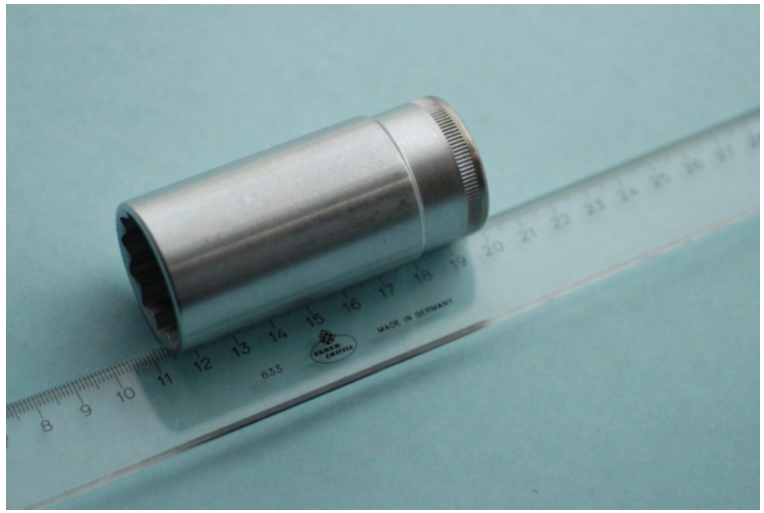






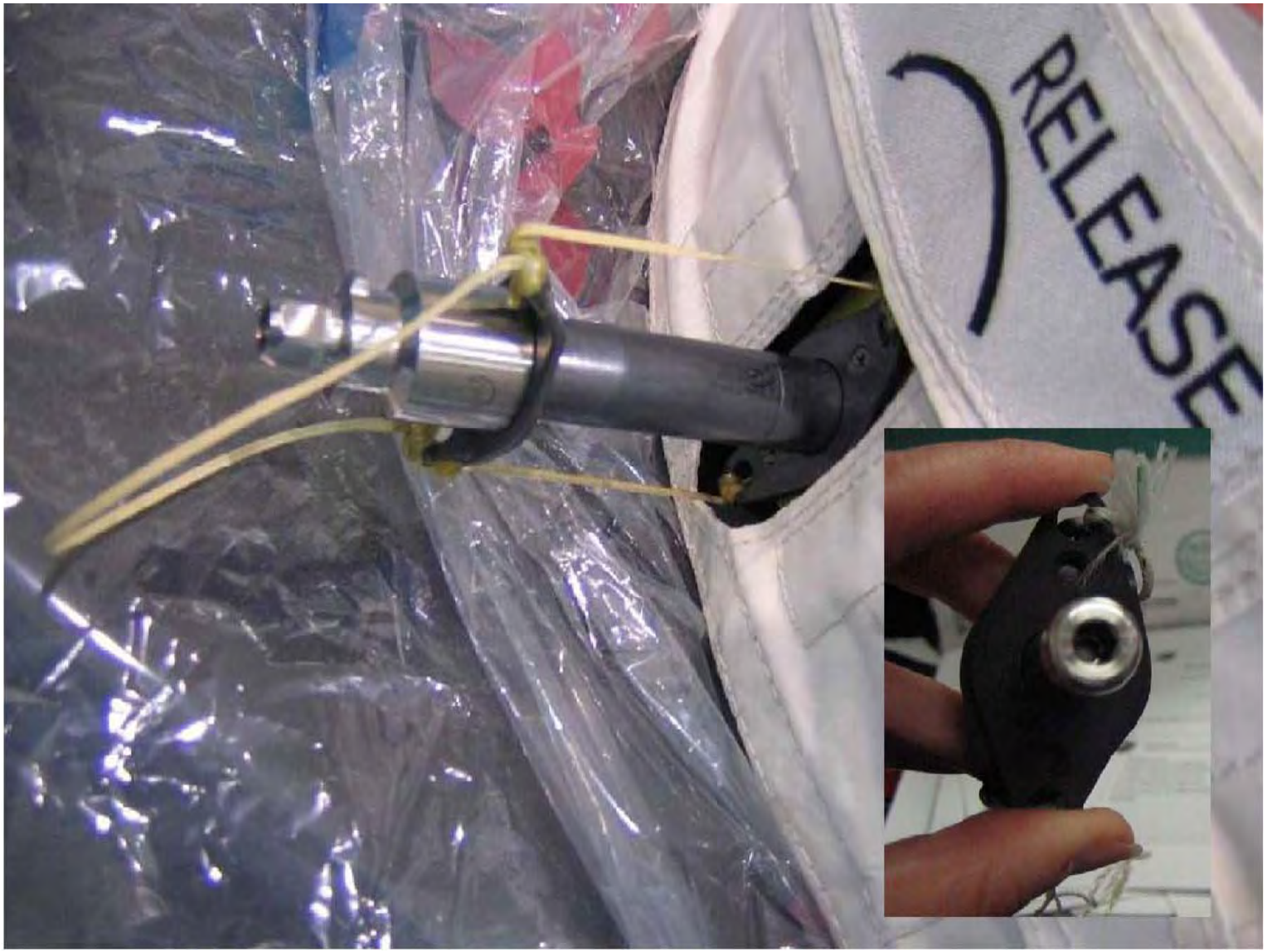
EOTP – CONTINGENCY SOCKET



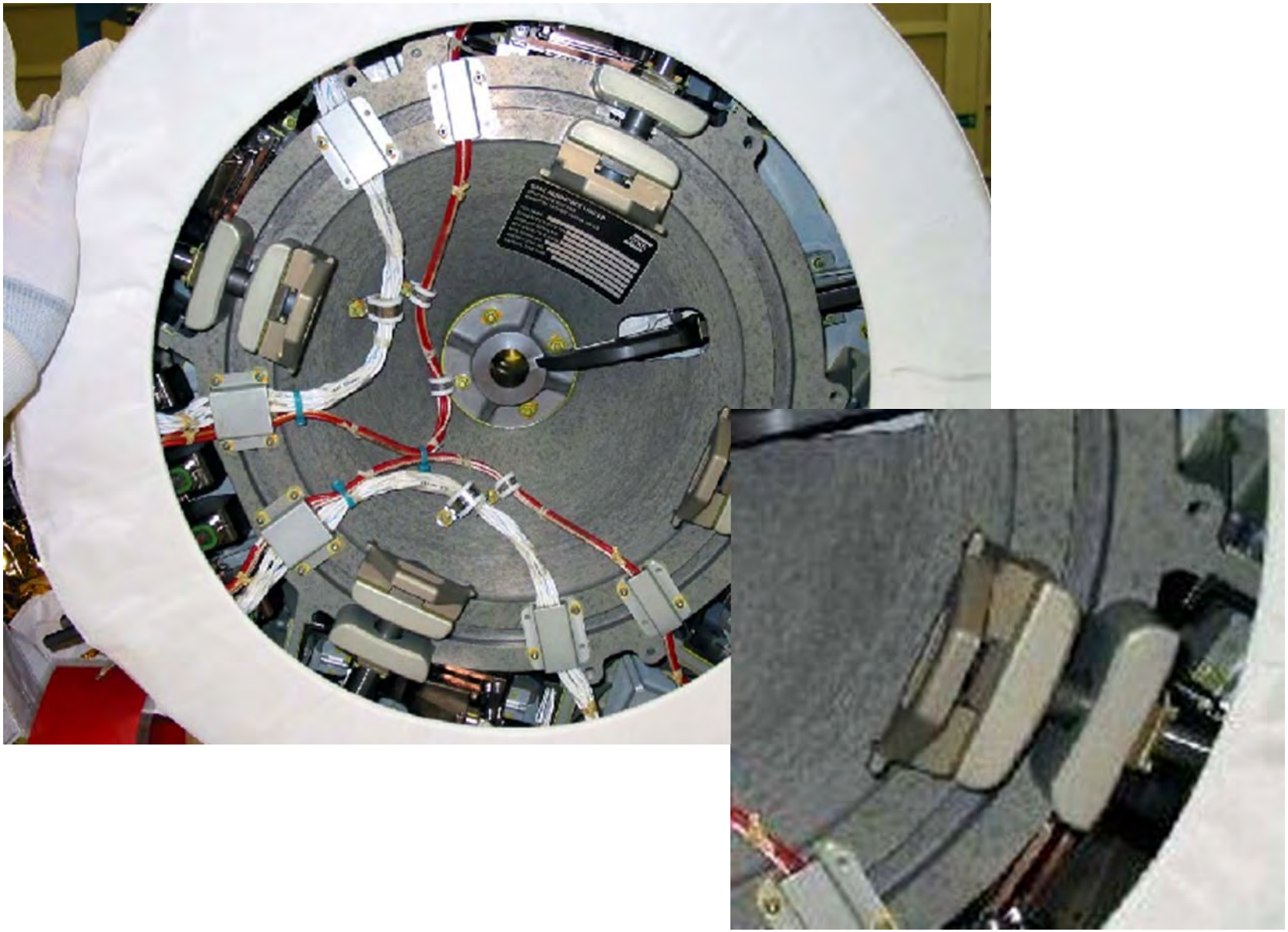


EOTP – TETHER

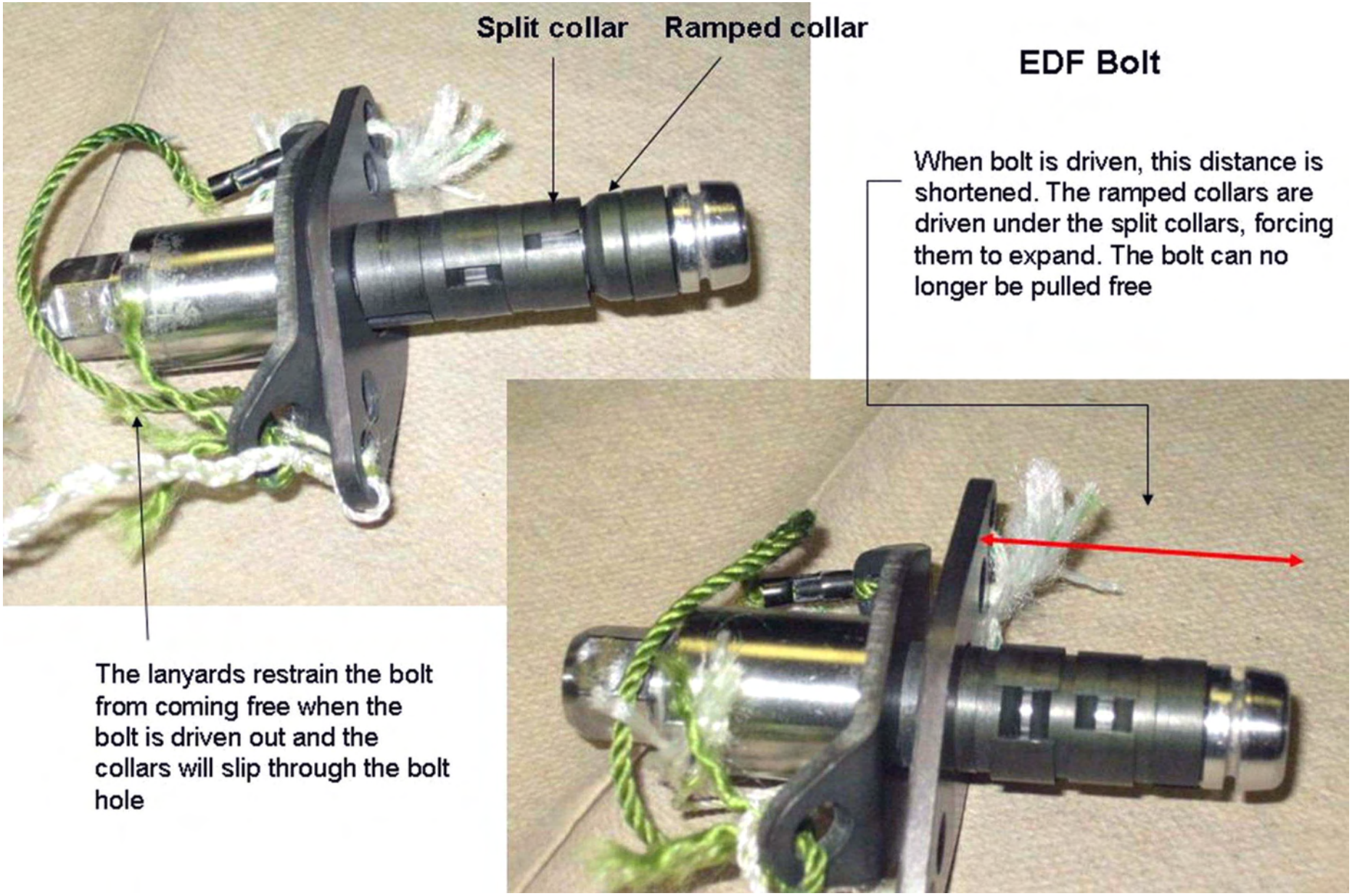
PDGF

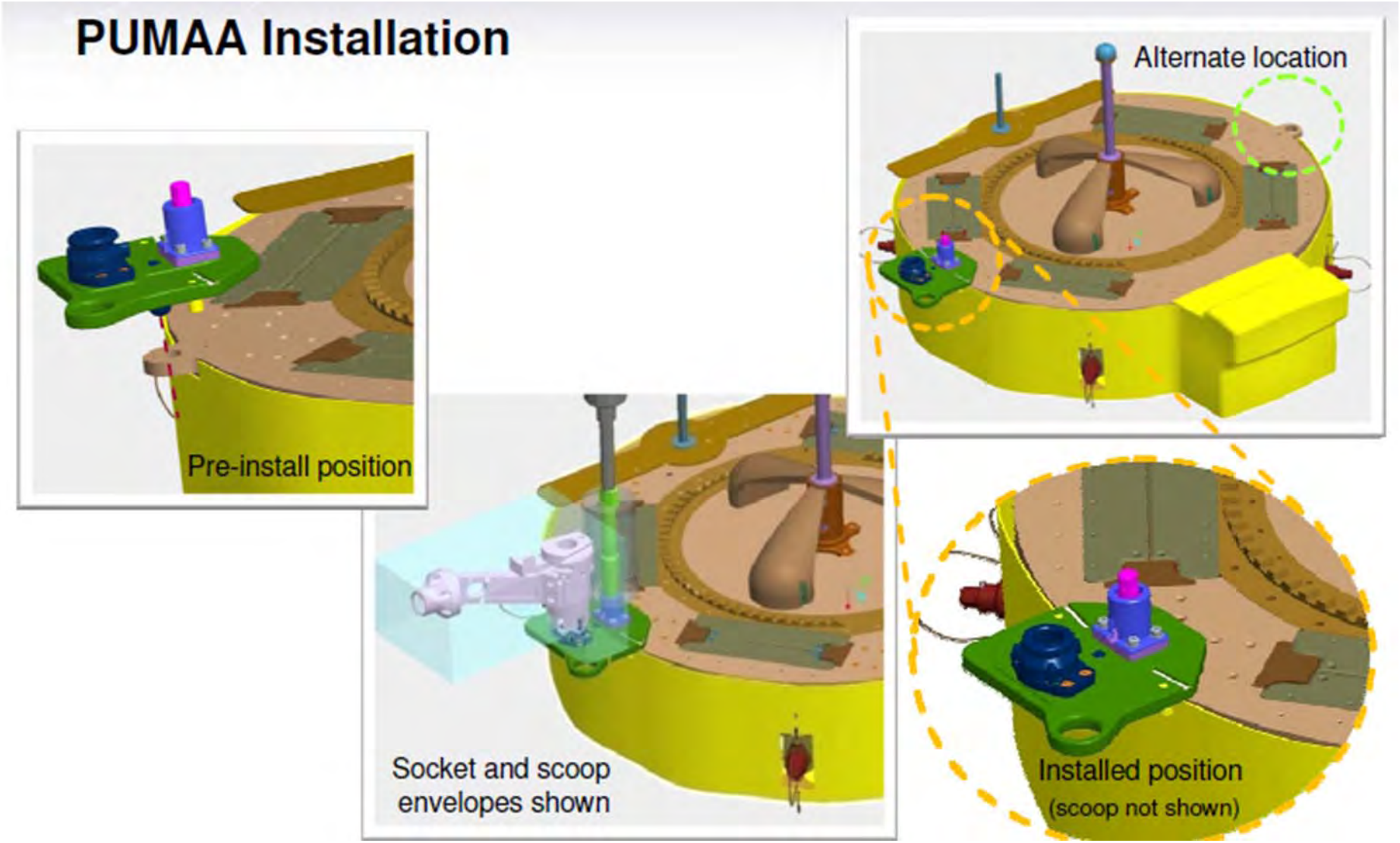


PDGF (Cont)



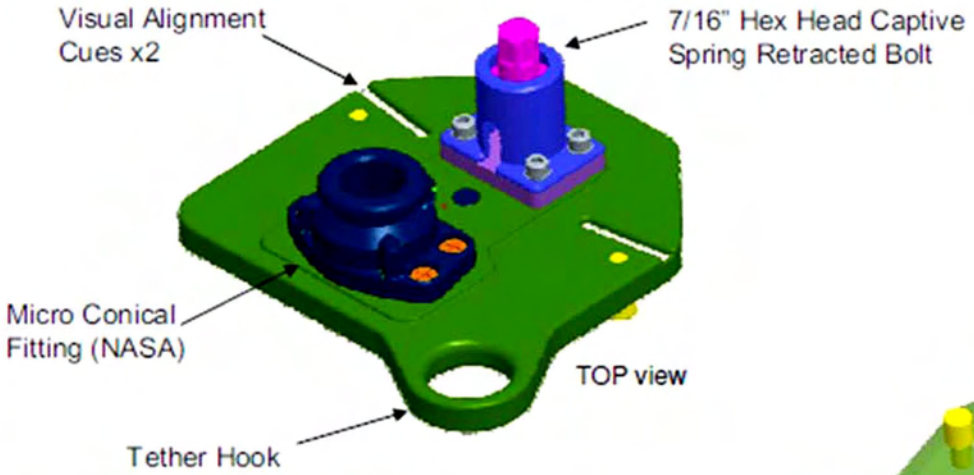
PDGF (Cont)

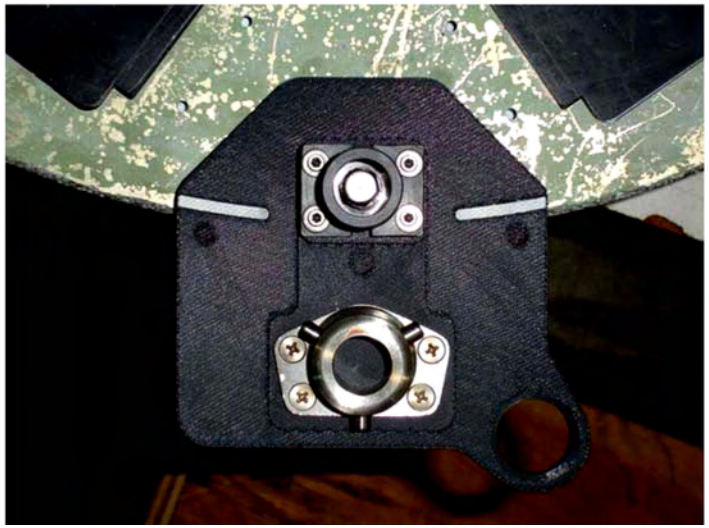

Split collar
Ramped collar
EDF Bolt
When bolt is driven, this distance is shortened. The ramped collars are driven under the split collars, forcing them to expand. The bolt can no longer be pulled free
The lanyards restrain the bolt from coming free when the bolt is driven out and the collars will slip through the bolt hole

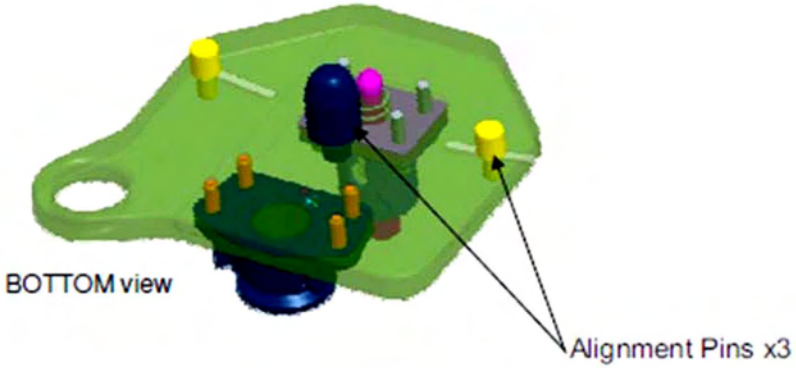

PUMAA Installation
Alternate location
Pre-install position
Socket and scoop
envelopes shown
Installed position
(scoop not shown)

PUMMA (Cont)

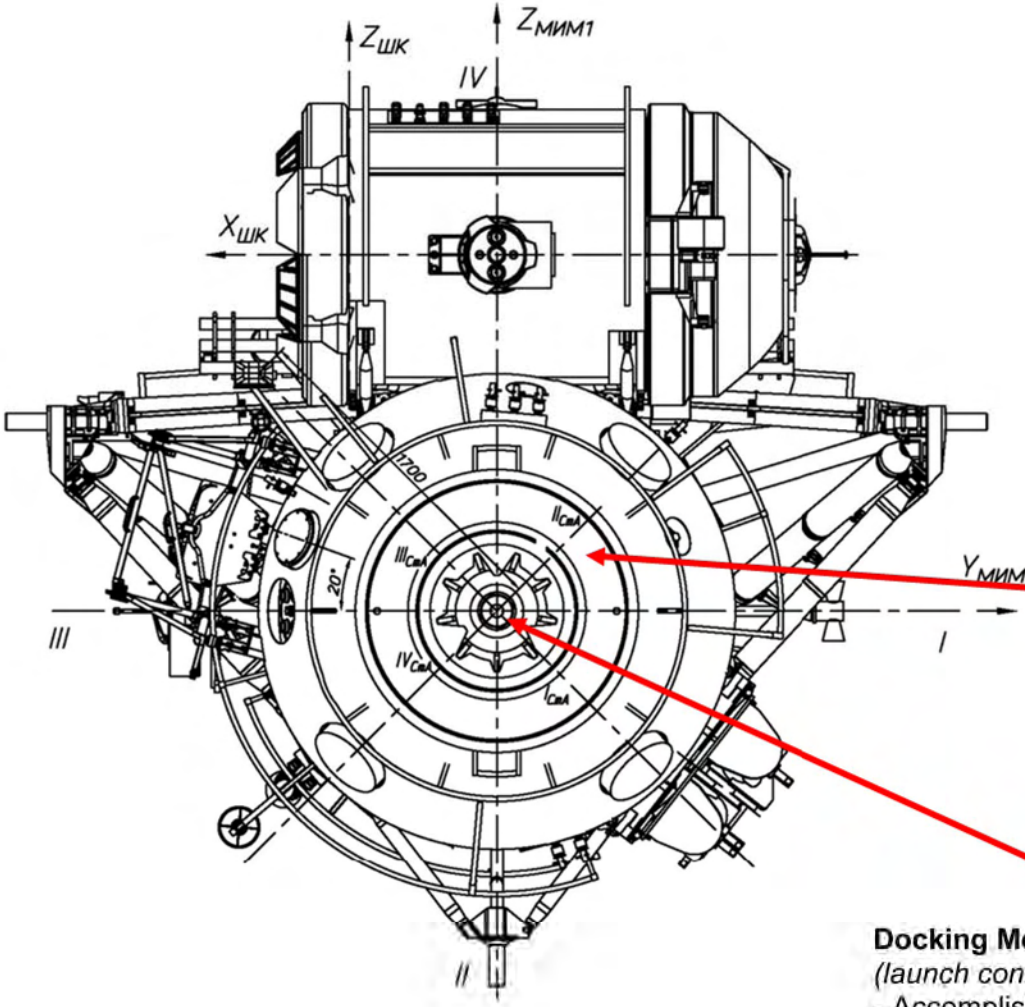
PUMAA Features

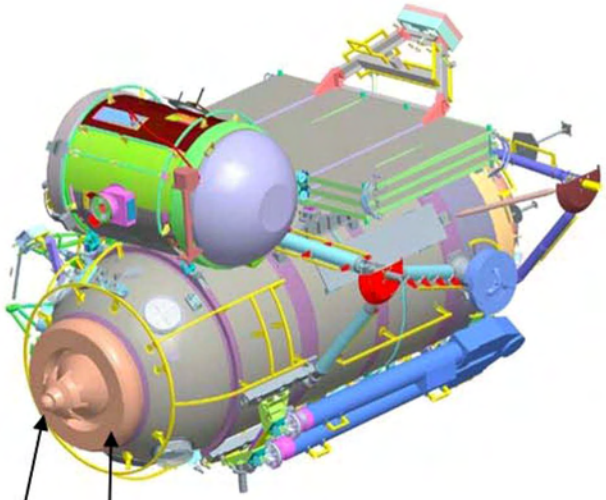






MRM1

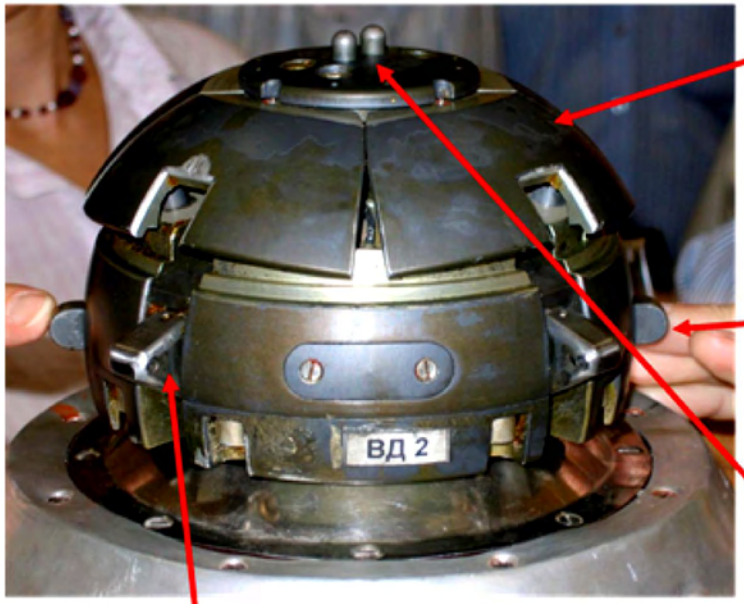




Docking Interface Ring
(launch config: active hooks open)
- Accomplishes the "second mechanical link"
- Comprised of ready-to-hook sensors, interface sealed sensors, hook assemblies, associated drive)

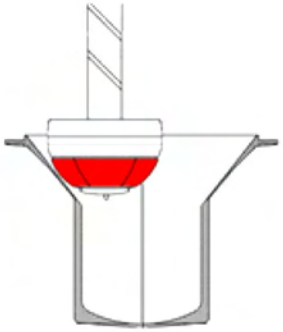
Docking Mechanism/Probe
(launch config: probe fully retracted, latches extended)
- Accomplishes the "first mechanical link"
- Comprised of Probe Head (contact sensors, capture sensors, latches), Probe Shaft, associated drives

Docking Mechanism/Probe



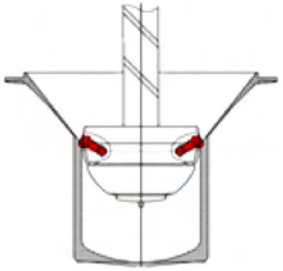
Contact Sensor 1, ДК-1

- Four petals mechanically linked to depress together, four independent switches actuated when petals depressed, each switch are distributed to all four RDS control unit logical subchannels
- Indication: Probe Head has contacted the side of the receiving cone



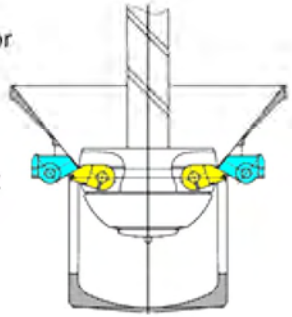
Capture Sensor, ДЗГ

- Two lateral levers actuates two parallel switches, each switch are distributed to all four RDS control unit logical subchannels
- Indication: Probe Head has entering the receiving cone socket



Latches

- Four latches
- Latch Drive is a single-motor drive
- Latch Position sensors to indicate extended or retracted
- To accomplish "first mechanical link":
  - Initial position is fully extended
  - "Collapse" into probe as Probe Head first enters Socket
  - Extend once in respective slot of Socket



Contact Sensor 2, ДК-2

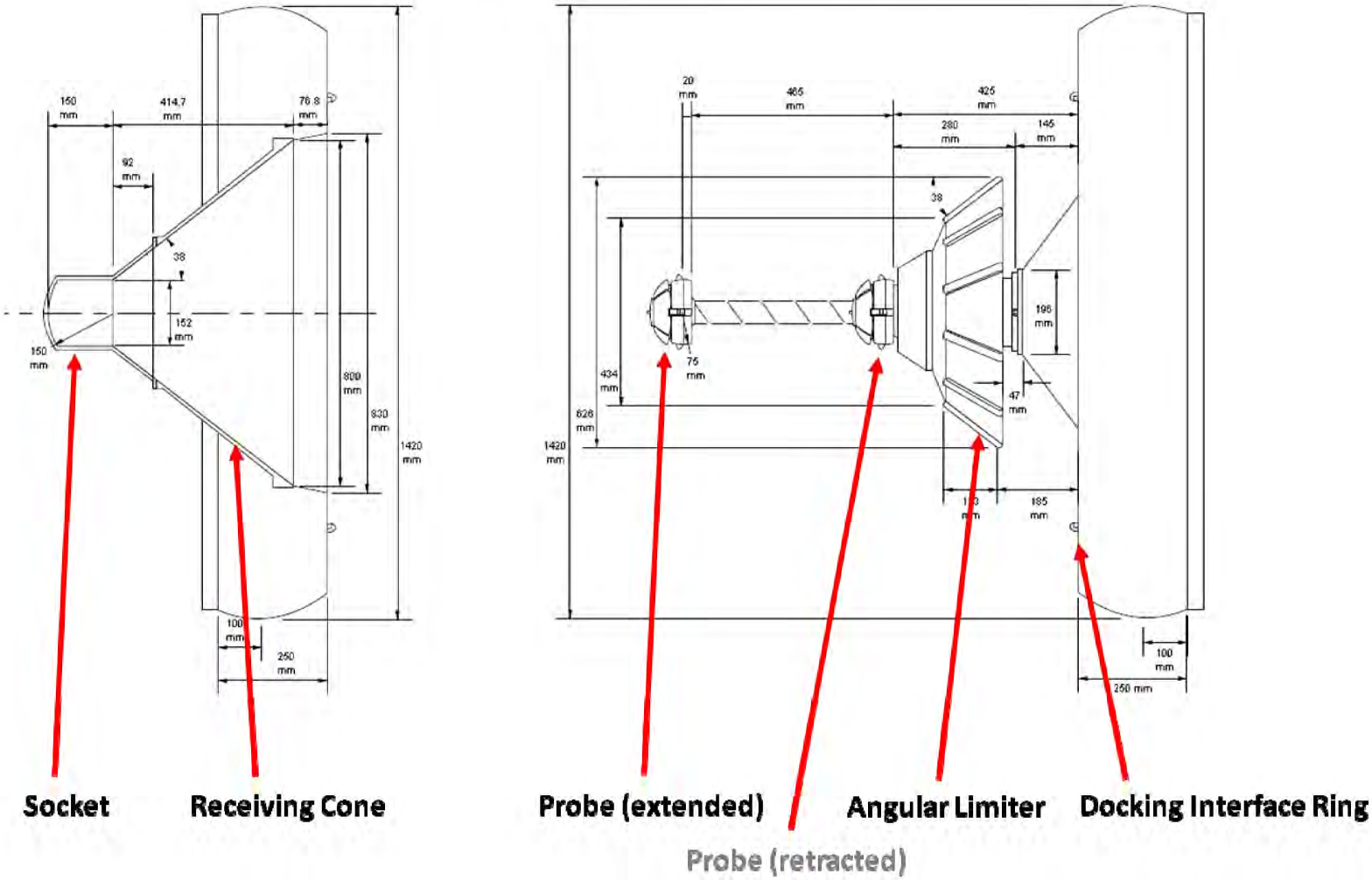
- Two top pins actuates two parallel switches, each switch are distributed to all four RDS control unit logical subchannels
- Indication: Probe Head has reach bottom of receiving cone socket

MRM1 (Cont)

Passive RDS (FGB)

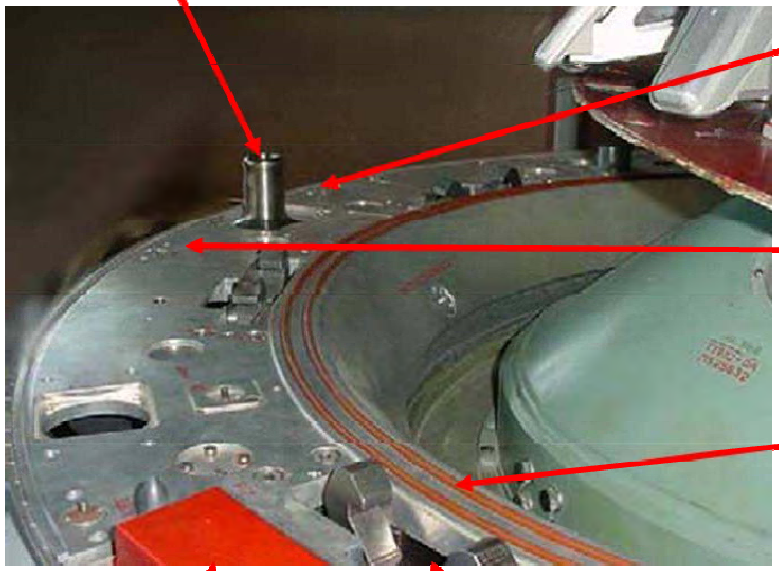
Active RDS (MRM1)

(ATV/SM RDS shown below for illustration only)



Docking Interface Ring

Alignment Pin/Socket



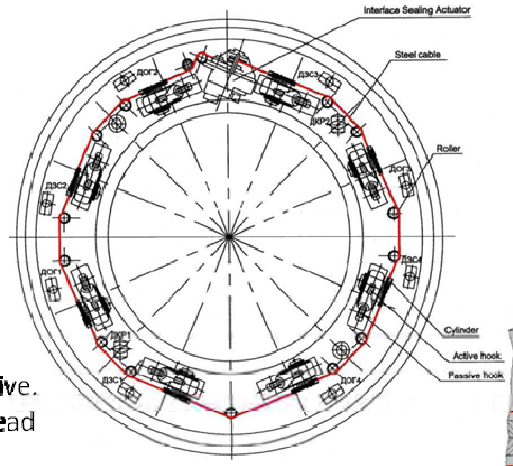
Interface Aligned ("Ready-to-Hook") Sensors, ДЗС
-Four sensors
- Indication: interface is close enough to drive hooks; initiation of hook closure is an automatic RDS response to this indication.

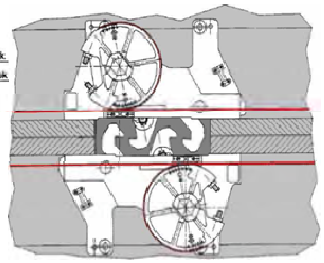
Interface Sealed Sensors, ДОГ
-Four sensors
- Indication: interface is sealed; hooks continue to drive until Hooks Closed sensors annunciate.

Interface Seals
- Two redundant seals

X-connectors
- Four connectors
(one above shown capped)
- X1 and X2 (sockets) are high power feeds.
- X3 and X4 (pins) are low power feeds and 1553 data.

Hook Assembly
- 8 hook assemblies (active/passive hook pairs)
- Hook Drive is now a dual-motor drive.
- Hook Drive directly connected to lead Active hook.
- Lead Active hook is connected to other active hooks by cable.



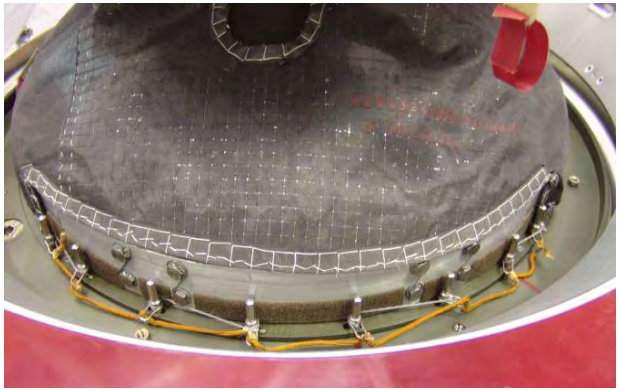


MRM1 CONTINGENCY TOOLS

Docking Probe Assembly

Docking Probe Assembly, backside

Docking Probe, extended

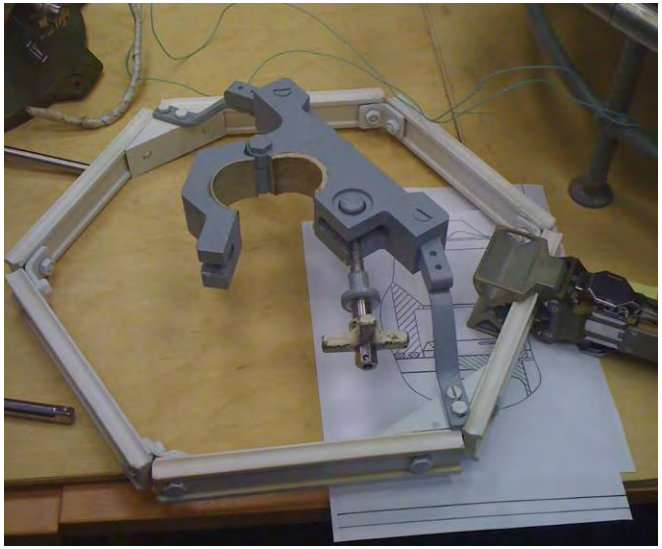


Docking Probe Bolts

Bolts released with lanyard

Russian 7mm socket taped to 6-in wobble socket

MRM HANDRAIL HANDLING AID

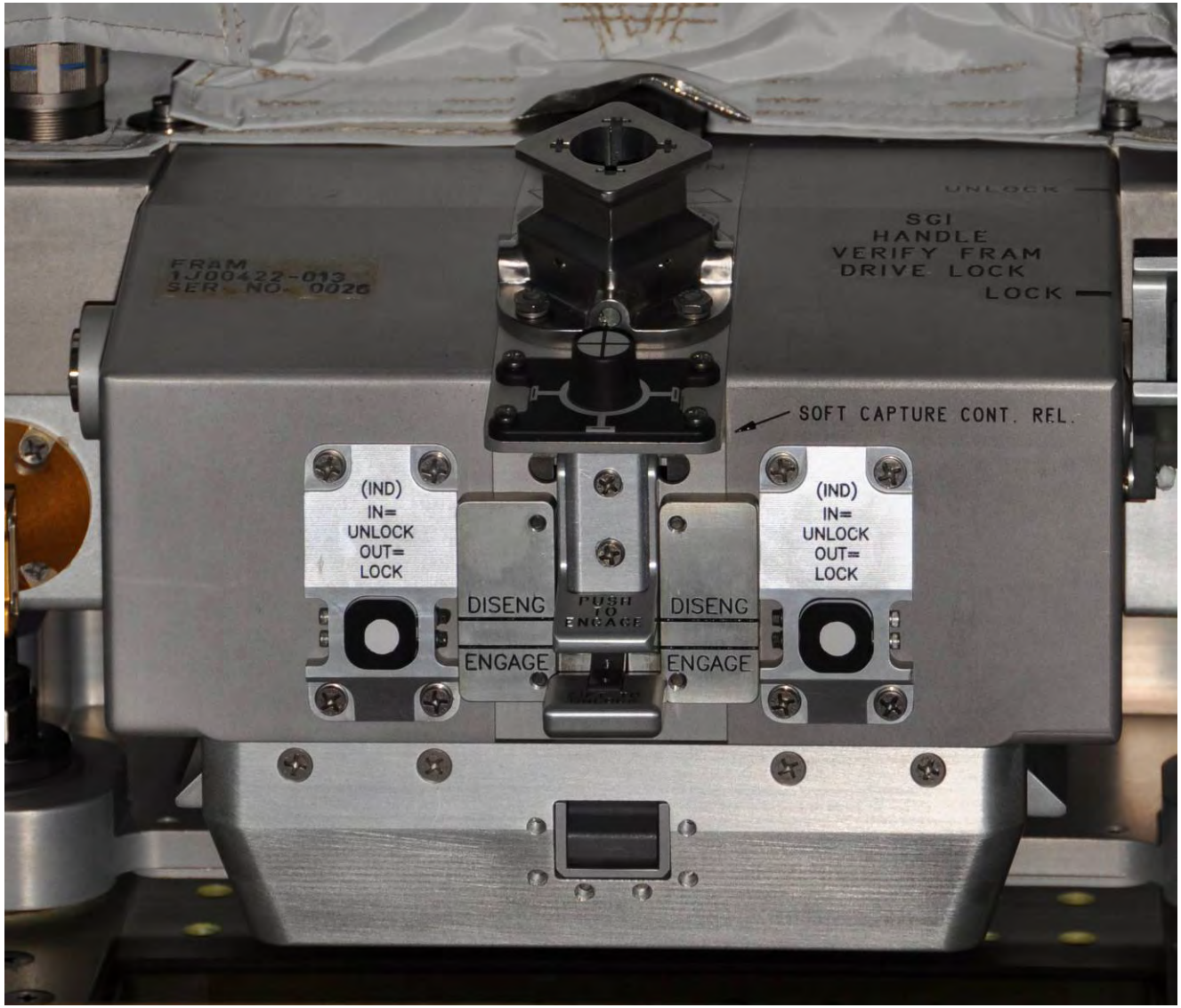


Handrail Handling Aid

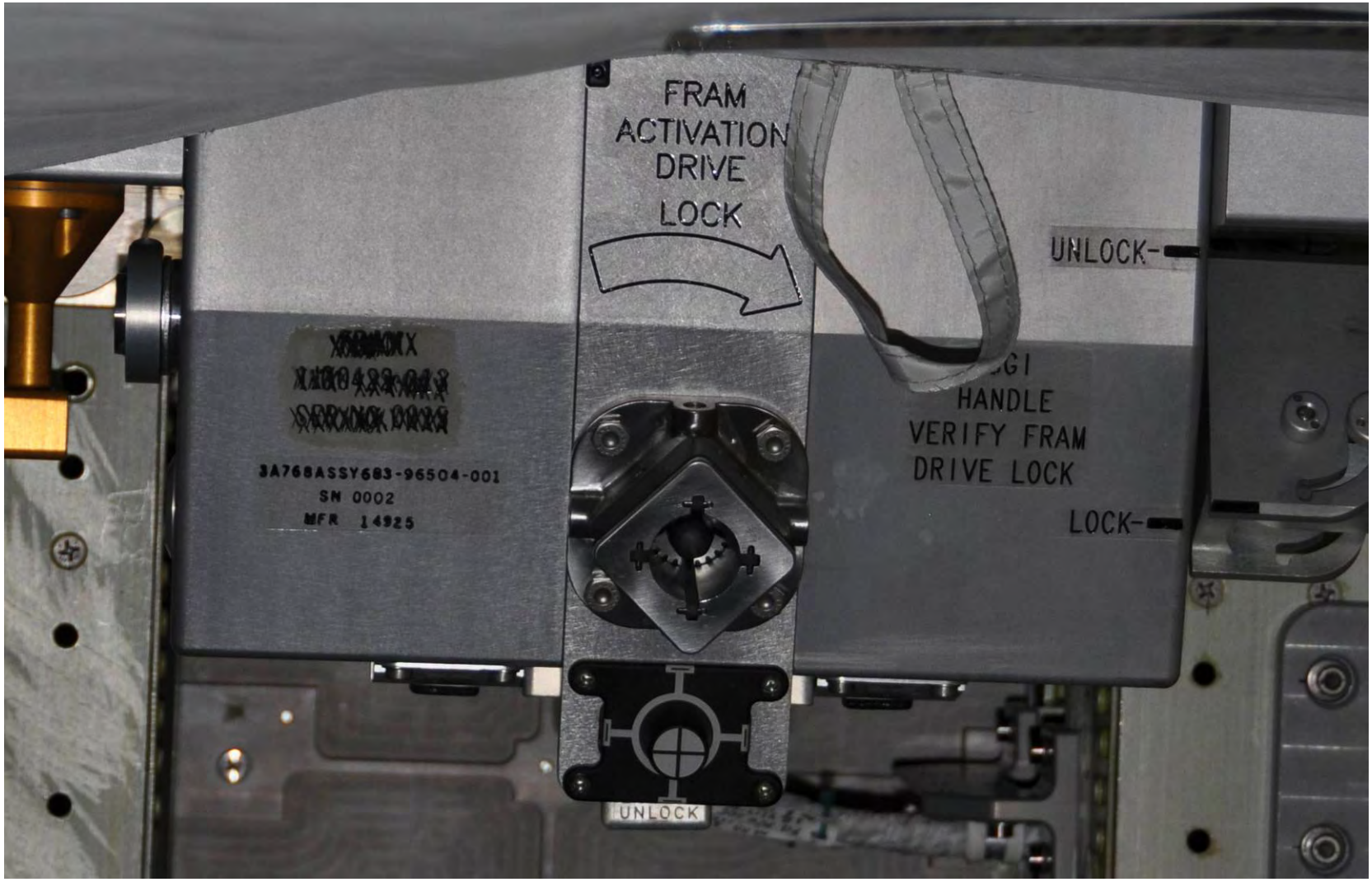
Handrail Handling Aid Installed

Electrical Cables

FRAM

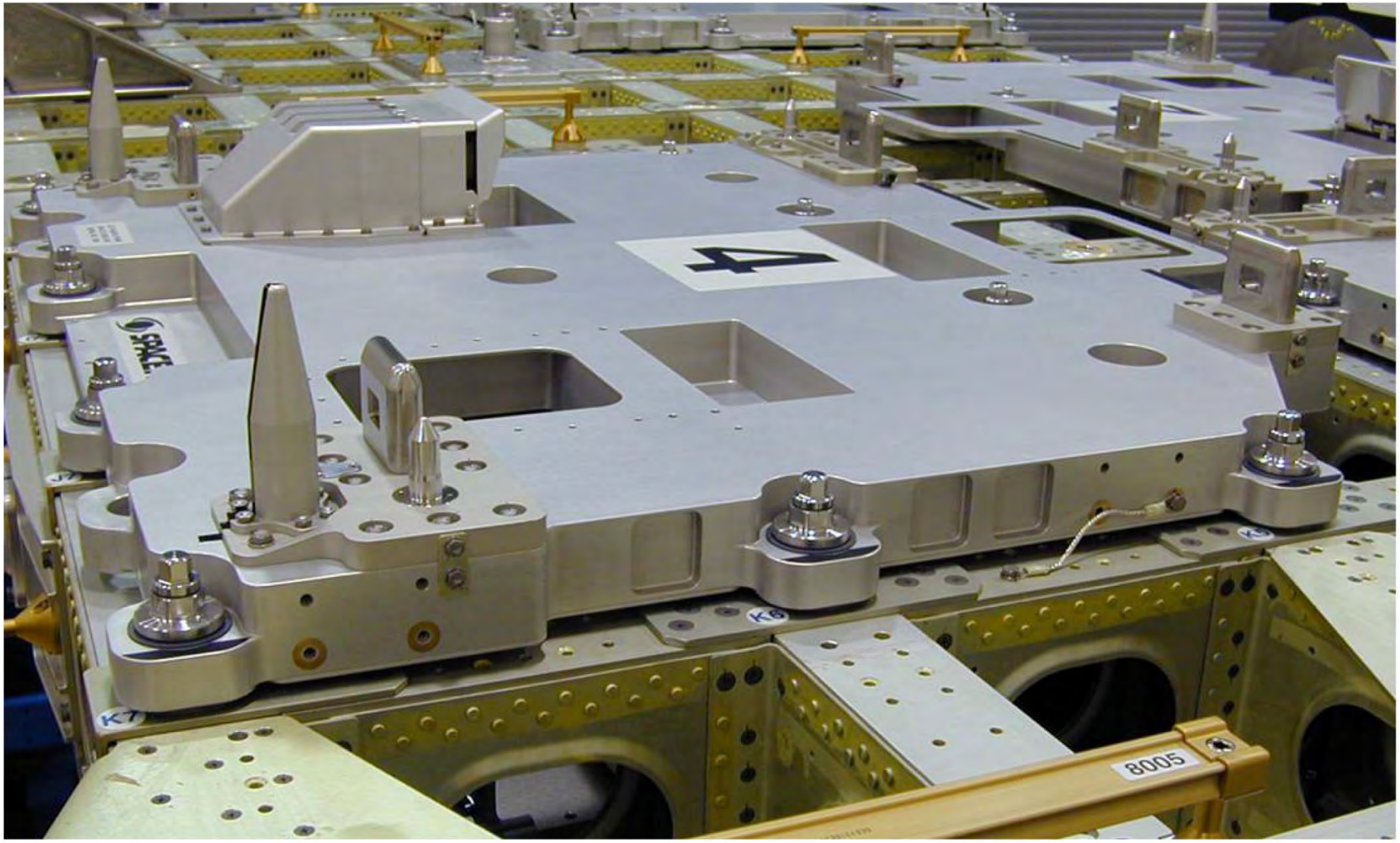

FRAM
1J00422-013
SER NO. 0026
UNLOCK
SGI
HANDLE
VERIFY FRAM
DRIVE LOCK
LOCK
SOFT CAPTURE CONT. REL.
(IND)
IN=
UNLOCK
OUT=
LOCK
DISENG
ENGAGE
PUSH
TO
ENGAGE
DISENG
ENGAGE
(IND)
IN=
UNLOCK
OUT=
LOCK

FRAM (Cont)


FRAM
ACTIVATION
DRIVE
LOCK
UNLOCK-
HANDLE
VERIFY FRAM
DRIVE LOCK
LOCK-
3A768ASSY683-96504-001
SN 0002
MFR 14925
UNLOCK

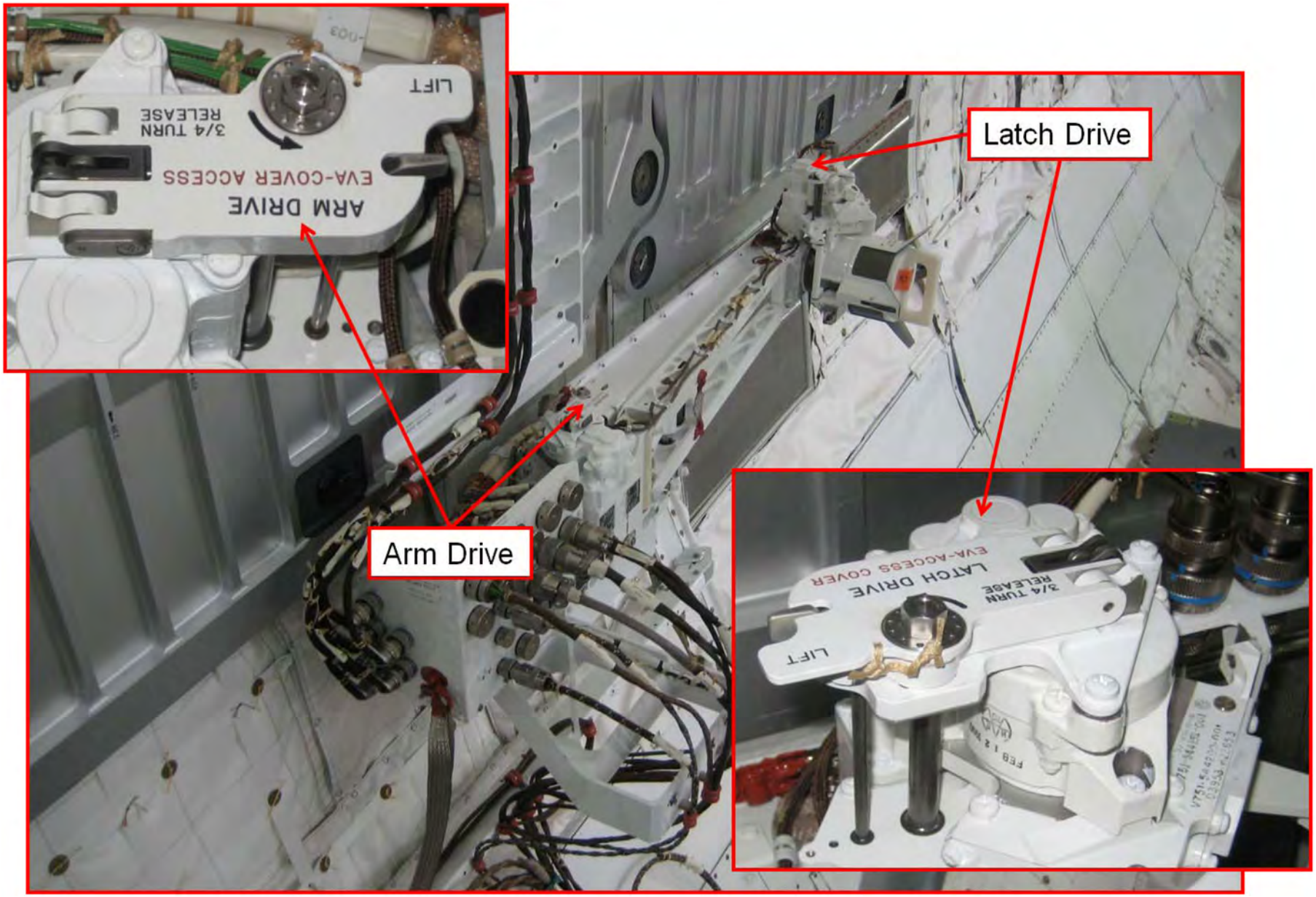
FRAM (Cont)

FRAM (Cont)

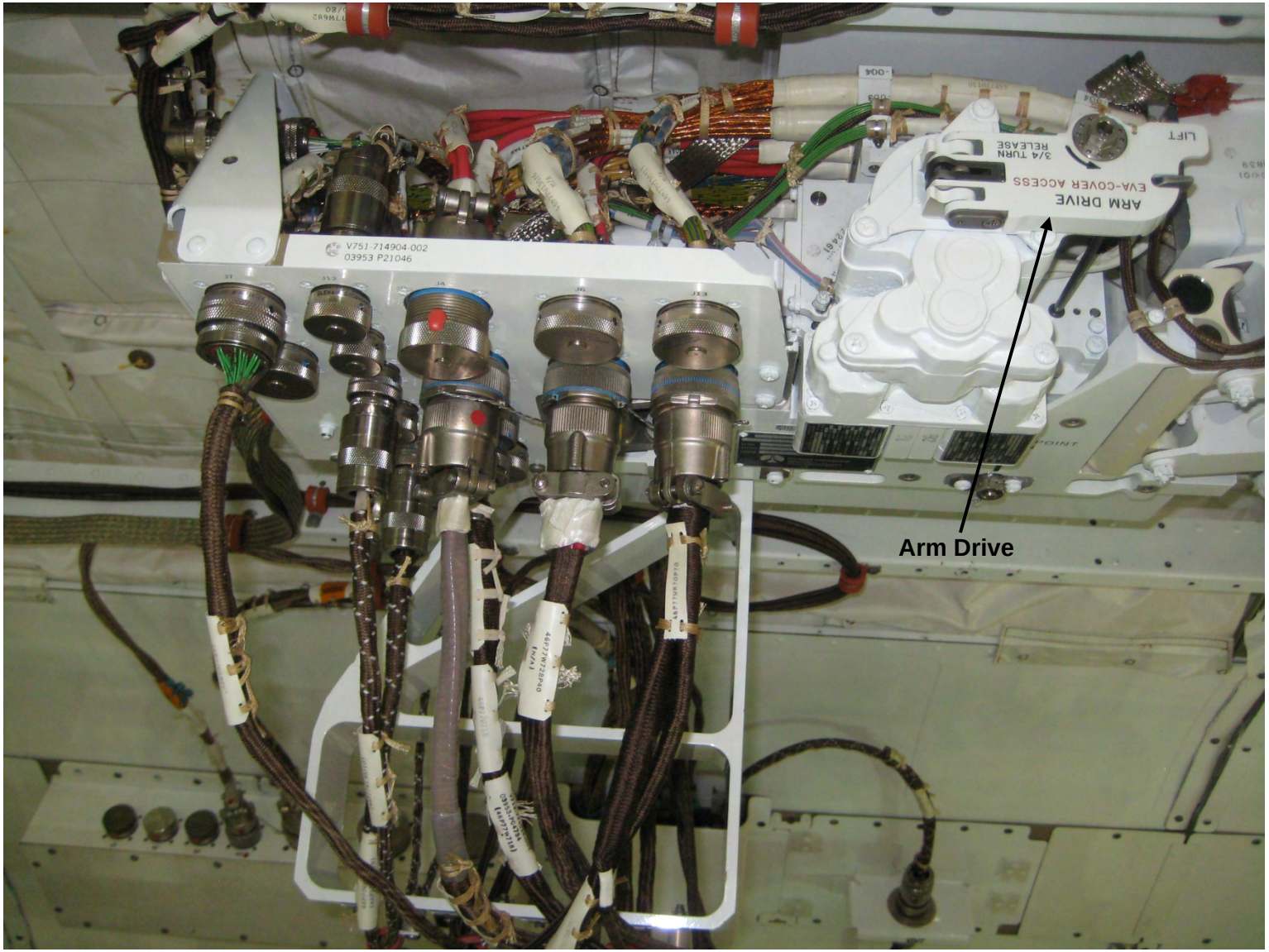


FRAM (Cont)

ROEU

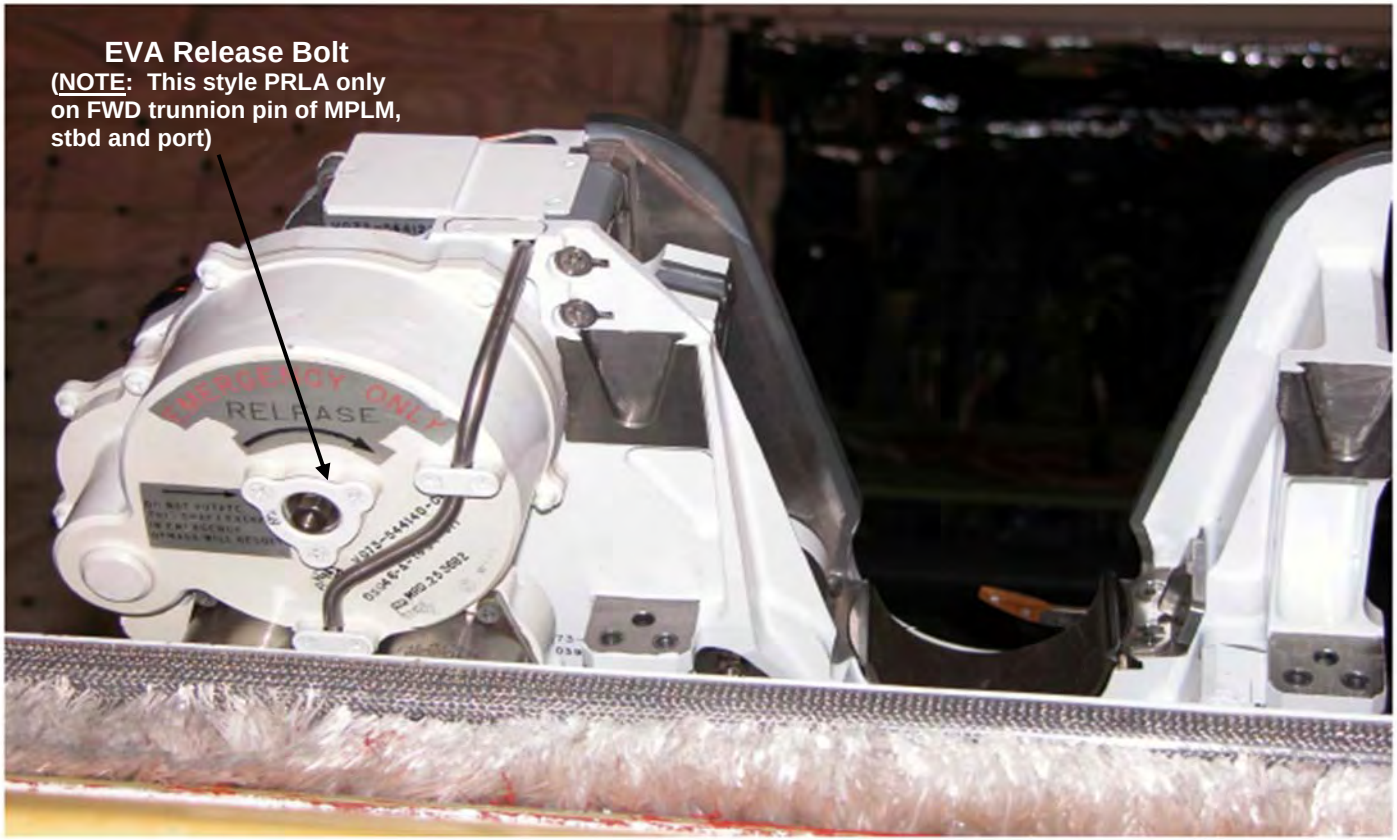

Latch Drive
Arm Drive
ARM DRIVE
EVA-COVER ACCESS
3/4 TURN
RELEASE
LIFT
LATCH DRIVE
EVA-ACCESS COVER
3/4 TURN
RELEASE
LIFT

ROEU (Cont)


Arm Drive
ARM DRIVE
EVA-COVER ACCESS
3/4 TURN
RELEASE
LIFT
V751-714904-002
03953 P21046

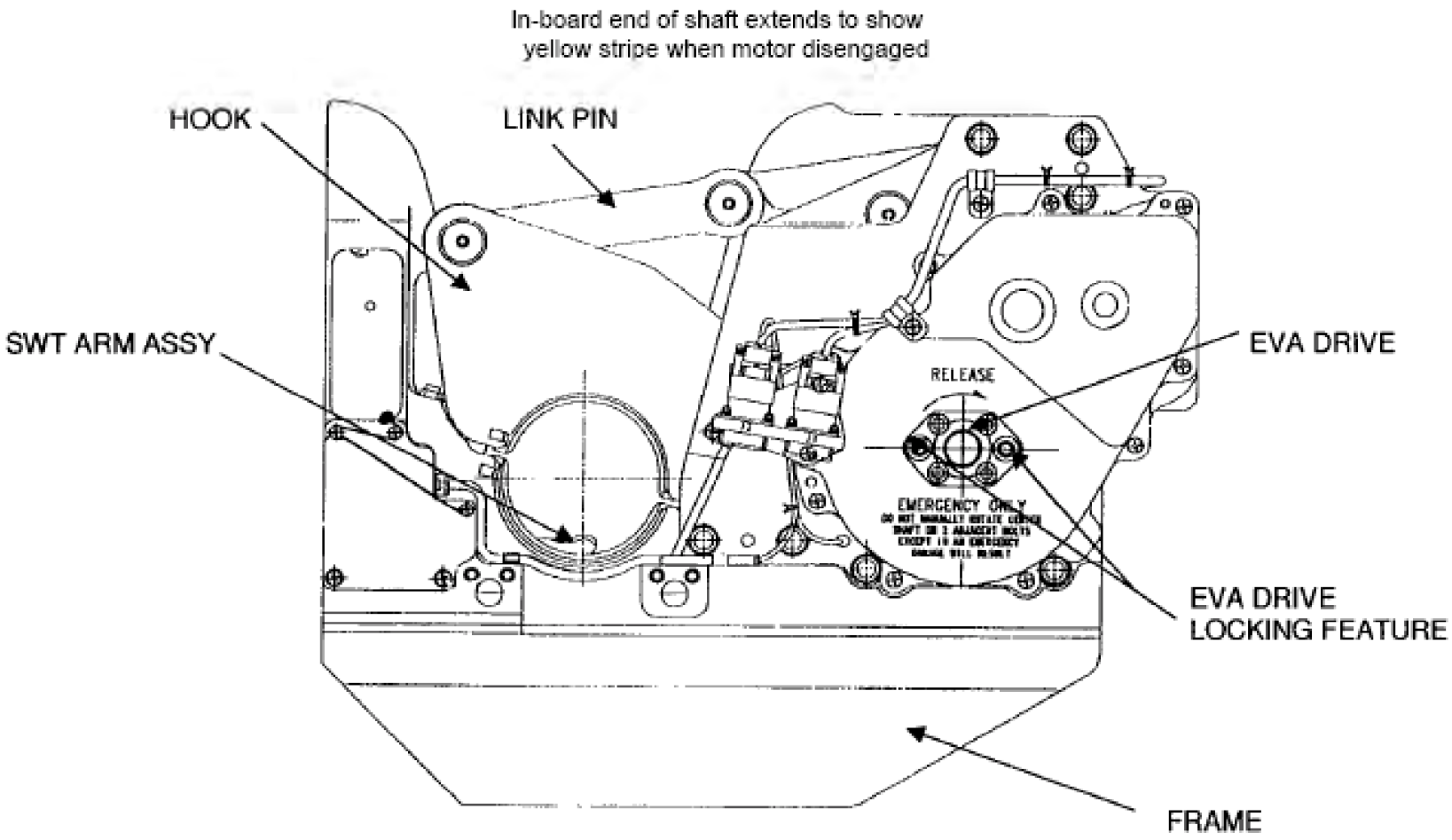
PRLA

<u>LIGHT/MIDDLE WEIGHT PRLA</u>
(MRM and AFT Pallet trunnions)



PRLA (Cont)

STANDARD WEIGHT PRLA
(Fwd Pallet trunnions)

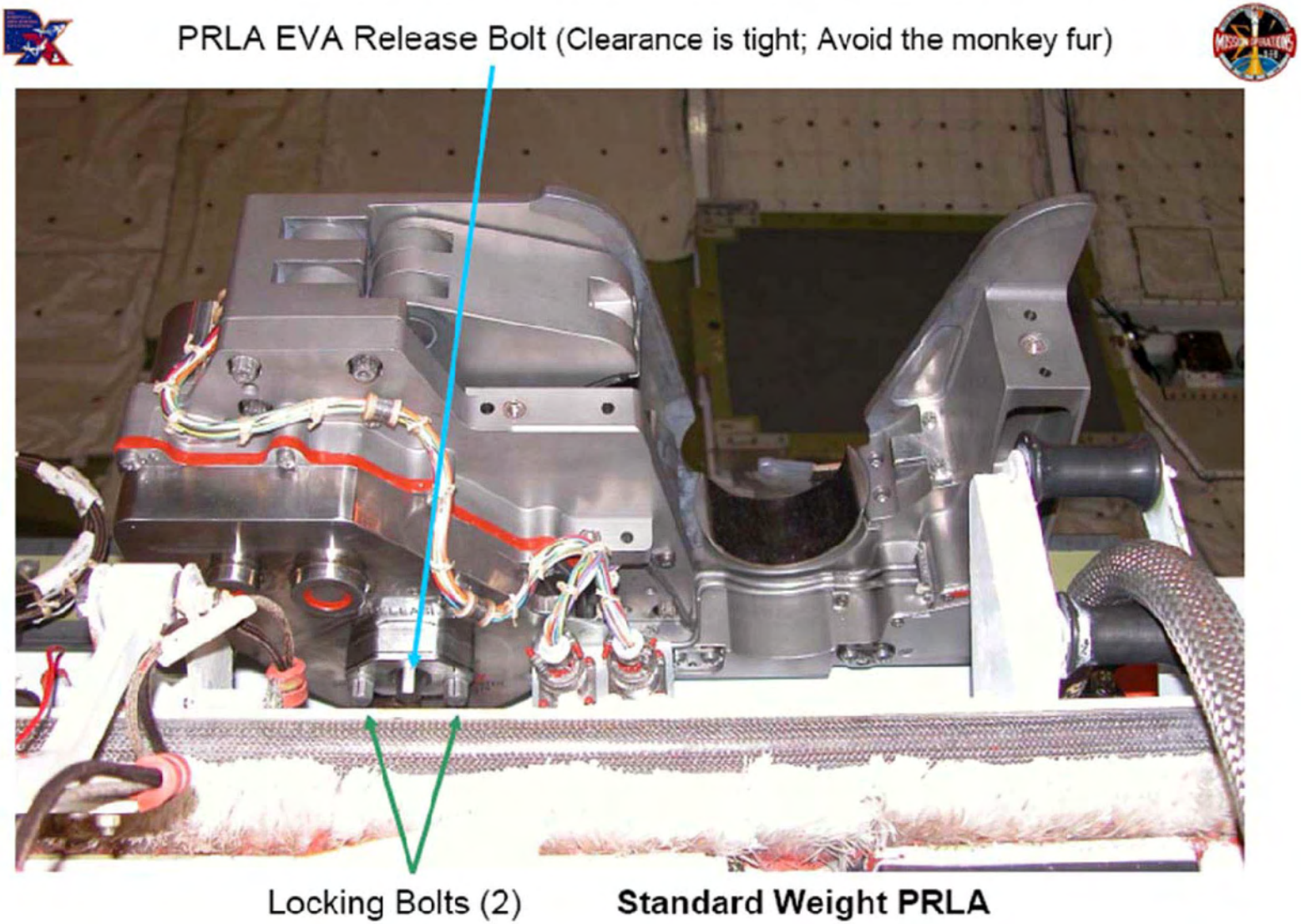


STANDARD WEIGHT LATCH

EVA RELEASABLE PAYLOAD RETENTION LATCHES (Cont)

PRLA (Cont)

<u>STANDARD WEIGHT PRLA</u>
(FWD Pallet trunnions)



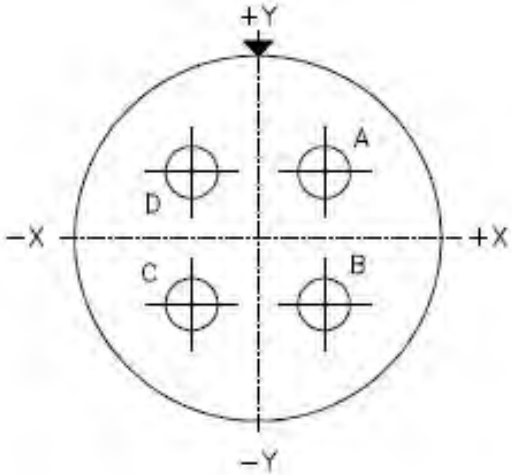
PRLA (Cont)

PRLA Grounding Wiper: Listed as a sharp edge warning in Notes/Cautions/Warnings

They are installed as needed based on testing after payload installation. They have passed swatch tests, but EV crew should be aware and take precaution

CONNECTOR PIN OUT DRAWINGS

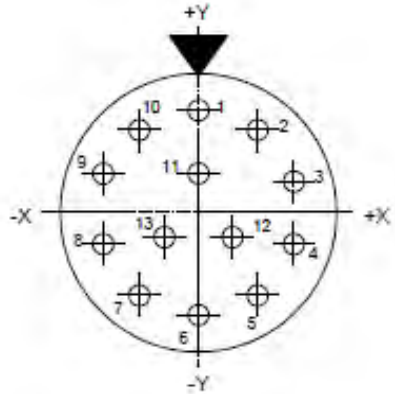
BOOM BASEPLATE CONNECTOR PANEL – J1
p/n NZGL07T2121N75PA



INSERT ARRANGEMENT 21-75
(REF. MIL-STD-1560)
CONTACT LOCATION
4 size 8 Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
A	8 Coax	+.180	+.180
B	8 Coax	+.180	-.180
C	8 Coax	-.180	-.180
D	8 Coax	-.180	+.180

BOOM BASEPLATE CONNECTOR PANEL – J2
p/n NZGL07T1511N35PA

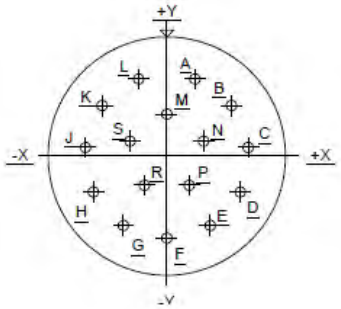


INSERT ARRANGEMENT 11-35
CONTACT LOCATION
(Ref. MIL-STD-1560)
13 size 22D Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
1	22	.000	+.146
2	22	+.085	+.118
3	22	+.138	+.045
4	22	+.138	-.045
5	22	+.085	-.118
6	22	.000	-.146
7	22	-.085	-.118
8	22	-.138	-.045
9	22	-.138	+.045
10	22	-.085	+.118
11	22	.000	+.056
12	22	+.049	-.035
13	22	-.049	-.035

CONNECTOR PIN OUT DRAWINGS (Cont)

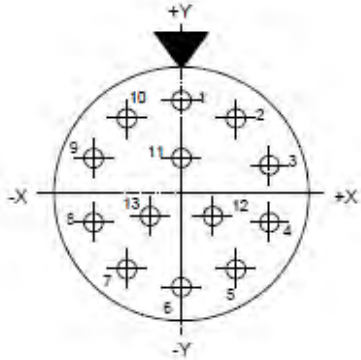
BOOM BASEPLATE CONNECTOR PANEL – J3
p/n NZGL07T2121N16PN



INSERT ARRANGEMENT 21-16
CONTACT LOCATION
(Ref. MIL-STD-1560)
16 size 16 Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
A	16	+.118	+.322
B	16	+.271	+.211
C	16	+.341	+.036
D	16	+.308	-.150
E	16	+.182	-.290
F	16	.000	-.343
G	16	-.182	-.290
H	16	-.308	-.150
J	16	-.341	+.036
K	16	-.271	+.211
L	16	-.118	+.322
M	16	.000	+.175
N	16	+.154	+.062
P	16	+.094	-.122
R	16	-.094	-.122
S	16	-.154	+.062

BOOM BASEPLATE CONNECTOR PANEL – J4
p/n NZGL07T1511N35PN

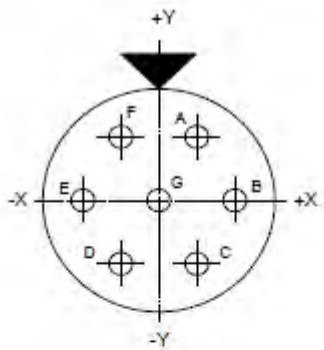


INSERT ARRANGEMENT 11-35
CONTACT LOCATION
(Ref. MIL-STD-1560)
13 size 22D Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
1	22	.000	+.146
2	22	+.085	+.118
3	22	+.138	+.045
4	22	+.138	-.045
5	22	+.085	-.118
6	22	.000	-.146
7	22	-.085	-.118
8	22	-.138	-.045
9	22	-.138	+.045
10	22	-.085	+.118
11	22	.000	+.056
12	22	+.049	-.035
13	22	-.049	-.035

CONNECTOR PIN OUT DRAWINGS (Cont)

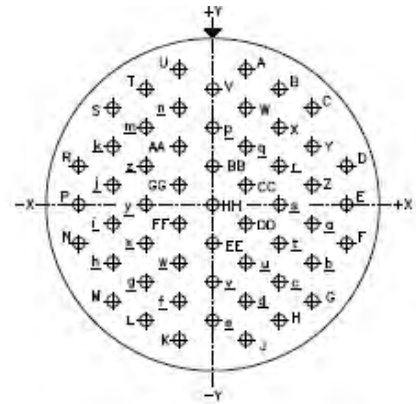
BOOM TO SGANT CONNECTOR – J1
p/n NZGL03G1511N99SN-1



INSERT ARRANGEMENT 11-99
CONTACT LOCATION
(Ref. MIL-STD-1560)
7 size 20 Contacts

CONT NO.	CONT SIZE	LOCATION	
		X AXIS	Y AXIS
A	20	+.065	+.113
B	20	+.130	.000
C	20	+.065	-.113
D	20	-.065	-.113
E	20	-.130	.000
F	20	-.065	+.113
G	20	.000	.000

BOOM TO SGANT CONNECTOR – J2
p/n NZGL03G2523N55SN

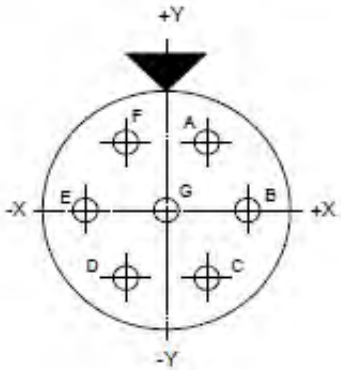


INSERT ARRANGEMENT 23-55 CONTACT LOCATION
(Ref. MIL-STD-1560)
55 size 20 Contacts

CONT. NO.	CONT. SIZE	LOCATION		CONT. NO.	CONT. SIZE	LOCATION		CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS			X AXIS	Y AXIS			X AXIS	Y AXIS
A	20	+.112	+.455	W	20	+.112	+.325	r	20	+.225	+.130
B	20	+.225	+.390	X	20	+.225	+.260	s	20	+.225	.000
C	20	+.336	+.325	Y	20	+.336	+.195	t	20	+.225	-.130
D	20	+.450	+.130	Z	20	+.336	+.065	u	20	+.112	-.195
E	20	+.450	.000	a	20	+.336	-.065	v	20	.000	-.260
F	20	+.450	-.130	b	20	+.336	-.195	w	20	-.112	-.195
G	20	+.336	-.325	c	20	+.225	-.260	x	20	-.225	-.130
H	20	+.225	-.390	d	20	+.112	-.325	y	20	-.225	.000
J	20	+.112	-.455	e	20	.000	-.390	z	20	-.225	+.130
K	20	-.112	-.455	f	20	-.112	-.325	AA	20	-.112	+.195
L	20	-.225	-.390	g	20	-.225	-.260	BB	20	.000	+.130
M	20	-.336	-.325	h	20	-.336	-.195	CC	20	+.112	+.065
N	20	-.450	-.130	i	20	-.336	-.065	DD	20	+.112	-.065
P	20	-.450	.000	j	20	-.336	+.065	EE	20	.000	-.130
R	20	-.450	+.130	k	20	-.336	+.195	FF	20	-.112	-.065
S	20	-.336	+.325	m	20	-.225	+.260	GG	20	-.112	+.065
T	20	-.225	+.390	n	20	-.112	+.325	HH	20	.000	.000
U	20	-.112	+.455	p	20	.000	+.260				
V	20	.000	+.390	q	20	+.112	+.195				

CONNECTOR PIN OUT DRAWINGS (Cont)

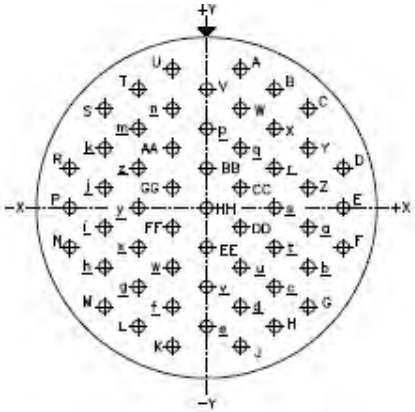
SGANT P4
p/n NZGL06G1511N99PN-1



INSERT ARRANGEMENT 11-99
CONTACT LOCATION
(Ref. MIL-STD-1560)
7 size 20 Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
A	20	+.065	+.113
B	20	+.130	.000
C	20	+.065	-.113
D	20	-.065	-.113
E	20	-.130	.000
F	20	-.065	+.113
G	20	.000	.000

SGANT P5
p/n NZGL06G2523N55PN

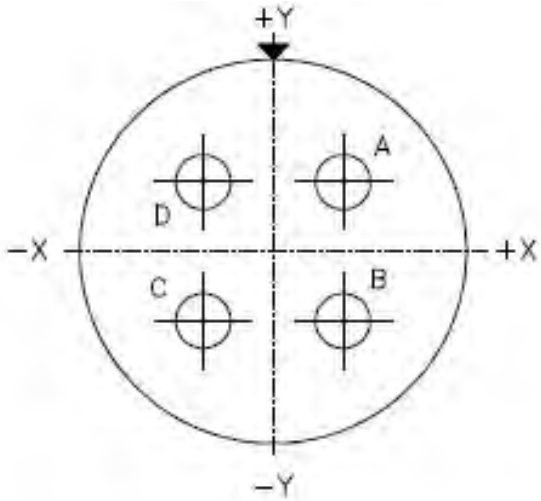


INSERT ARRANGEMENT 23-55 CONTACT LOCATION
(Ref. MIL-STD-1560)
55 size 20 Contacts

CONT. NO.	CONT. SIZE	LOCATION		CONT. NO.	CONT. SIZE	LOCATION		CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS			X AXIS	Y AXIS			X AXIS	Y AXIS
A	20	+.112	+.455	W	20	+.112	+.325	r	20	+.225	+.130
B	20	+.225	+.390	X	20	+.225	+.260	s	20	+.225	.000
C	20	+.336	+.325	Y	20	+.336	+.195	t	20	+.225	-.130
D	20	+.450	+.130	Z	20	+.336	+.065	u	20	+.112	-.195
E	20	+.450	.000	a	20	+.336	-.065	v	20	.000	-.260
F	20	+.450	-.130	b	20	+.336	-.195	w	20	-.112	-.195
G	20	+.336	-.325	c	20	+.225	-.260	x	20	-.225	-.130
H	20	+.225	-.390	d	20	+.112	-.325	y	20	-.225	.000
J	20	+.112	-.455	e	20	.000	-.390	z	20	-.225	+.130
K	20	-.112	-.455	f	20	-.112	-.325	AA	20	-.112	+.195
L	20	-.225	-.390	g	20	-.225	-.260	BB	20	.000	+.130
M	20	-.336	-.325	h	20	-.336	-.195	CC	20	+.112	+.065
N	20	-.450	-.130	i	20	-.336	-.065	DD	20	+.112	-.065
P	20	-.450	.000	j	20	-.336	+.065	EE	20	.000	-.130
R	20	-.450	+.130	k	20	-.336	+.195	FF	20	-.112	-.065
S	20	-.336	+.325	m	20	-.225	+.260	GG	20	-.112	+.065
T	20	-.225	+.390	n	20	-.112	+.325	HH	20	.000	.000
U	20	-.112	+.455	p	20	.000	+.260				
V	20	.000	+.390	q	20	+.112	+.195				

CONNECTOR PIN OUT DRAWINGS (Cont)

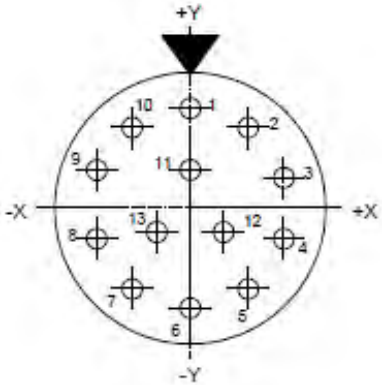
W4052 – P1
p/n NZGL06G2121N75SA



INSERT ARRANGEMENT 21-75
(REF. MIL-STD-1560)
CONTACT LOCATION
4 size 8 Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
A	8 Coax	+.180	+.180
B	8 Coax	+.180	-.180
C	8 Coax	-.180	-.180
D	8 Coax	-.180	+.180

W4049 – P2
p/n NZGL06G1511N35SA-1

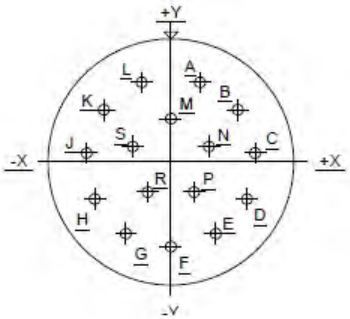


INSERT ARRANGEMENT 11-35
CONTACT LOCATION
(Ref. MIL-STD-1560)
13 size 22D Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
1	22	.000	+.146
2	22	+.085	+.118
3	22	+.138	+.045
4	22	+.138	-.045
5	22	+.085	-.118
6	22	.000	-.146
7	22	-.085	-.118
8	22	-.138	-.045
9	22	-.138	+.045
10	22	-.085	+.118
11	22	.000	+.056
12	22	+.049	-.035
13	22	-.049	-.035

CONNECTOR PIN OUT DRAWINGS (Cont)

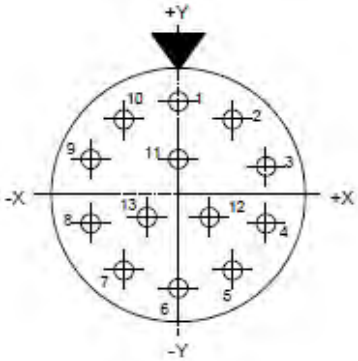
W4051 – P3
p/n NZGL06G2121N16SN



INSERT ARRANGEMENT 21-16
CONTACT LOCATION
(Ref. MIL-STD-1560)
16 size 16 Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
A	16	+.118	+.322
B	16	+.271	+.211
C	16	+.341	+.036
D	16	+.308	-.150
E	16	+.182	-.290
F	16	.000	-.343
G	16	-.182	-.290
H	16	-.308	-.150
J	16	-.341	+.036
K	16	-.271	+.211
L	16	-.118	+.322
M	16	.000	+.175
N	16	+.154	+.062
P	16	+.094	-.122
R	16	-.094	-.122
S	16	-.154	+.062

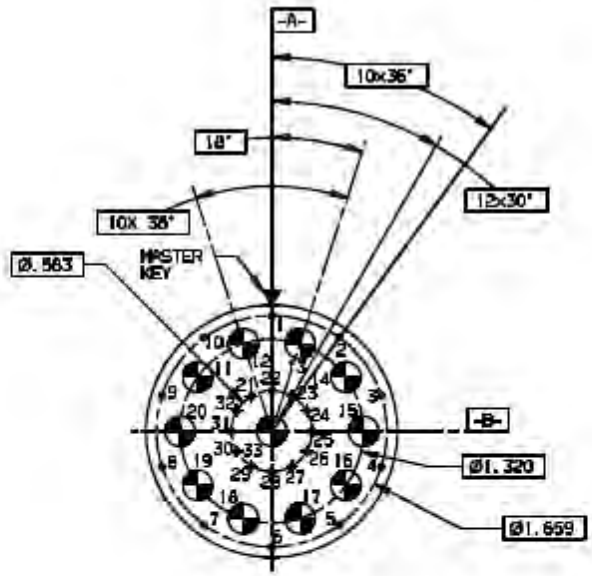
W4050 – P4
p/n NZGL06G1511N35SN-1



INSERT ARRANGEMENT 11-35
CONTACT LOCATION
(Ref. MIL-STD-1560)
13 size 22D Contacts

CONT. NO.	CONT. SIZE	LOCATION	
		X AXIS	Y AXIS
1	22	.000	+.146
2	22	+.085	+.118
3	22	+.138	+.045
4	22	+.138	-.045
5	22	+.085	-.118
6	22	.000	-.146
7	22	-.085	-.118
8	22	-.138	-.045
9	22	-.138	+.045
10	22	-.085	+.118
11	22	.000	+.056
12	22	+.049	-.035
13	22	-.049	-.035

W4050 – J253
p/n S22698-022-S004B

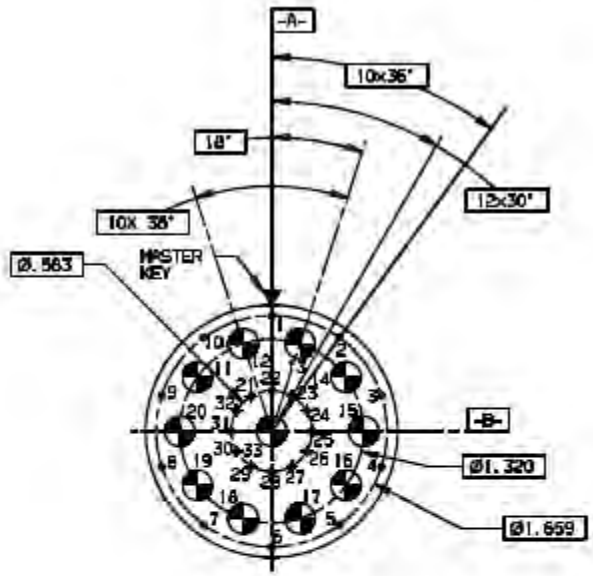


SHELL SIZE	ARRANGEMENT NUMBER	SERVICE RATING	NUMBER OF CONTACTS	CONTACT MATING END SIZE	CONTACT BARREL SIZE	SYMBOL
37	04	1	11	TWX	TWX	
			22	22	22	

Note:
Size 22 AWG contacts only will be reversed from electrical contact type identifier
See exception in paragraph B.1.2 and paragraph C.1.2.

9919-103

W4050 – J254
p/n S22698-022-S004K

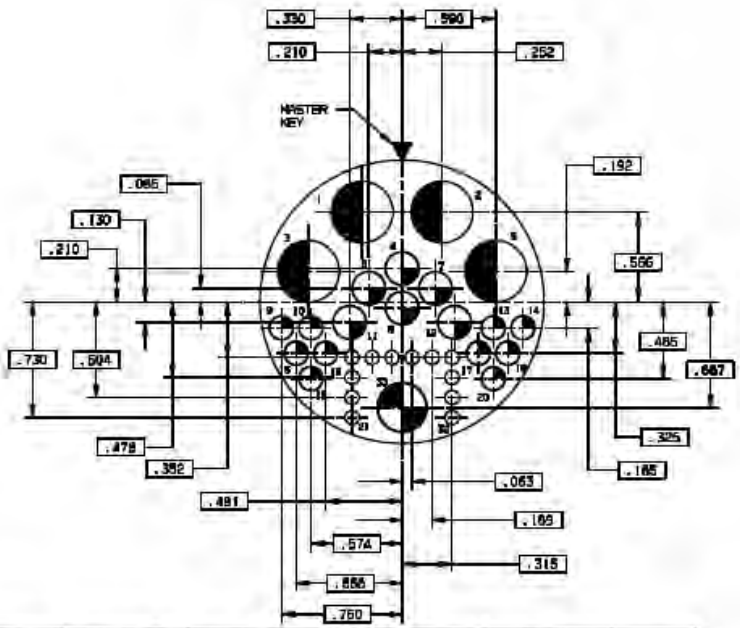


SHELL SIZE	ARRANGEMENT NUMBER	SERVICE RATING	NUMBER OF CONTACTS	CONTACT MATING END SIZE	CONTACT BARREL SIZE	SYMBOL
37	04	1	11	TWX	TWX	
			22	22	22	

Note:
Size 22 AWG contacts only will be reversed from electrical contact type identifier
See exception in paragraph B.1.2 and paragraph C.1.2.

9919-103

W4051 – J255
p/n S22698-011-P002F

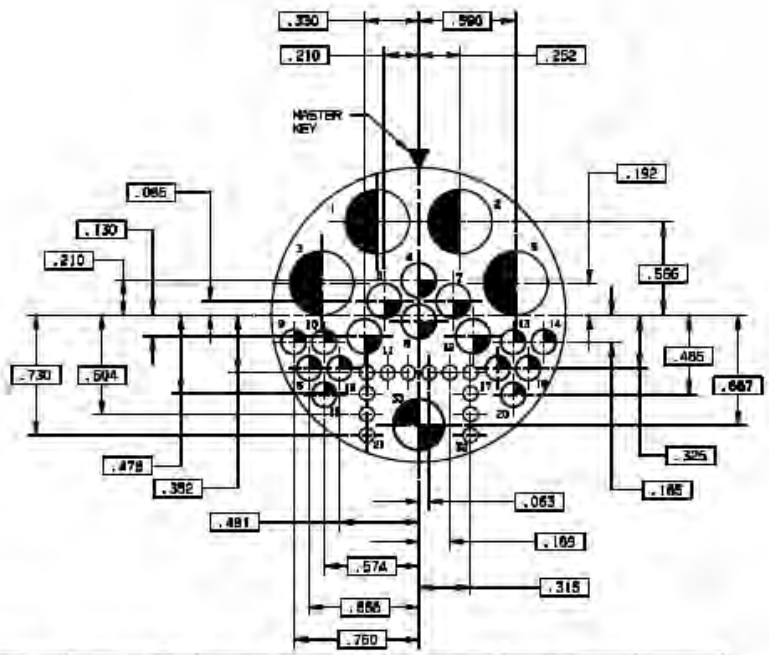


SHELL SIZE	ARRANGEMENT NUMBER	SERVICE RATING	NUMBER OF CONTACTS	CONTACT MATING END SIZE	CONTACT BARREL SIZE	SYMBOL
37	02	I	1	TWX	TWX	
			4	4	4	
			5	12	12	
			10	16	16	
			12	22	22	

Note:
Size 22 AWG contacts only will be reversed from electrical contact type identifier.
See exception in paragraph B.1.2 and paragraph C.1.2.

S319-101

W4051 – J256
p/n S22698-022-P002R



SHELL SIZE	ARRANGEMENT NUMBER	SERVICE RATING	NUMBER OF CONTACTS	CONTACT MATING END SIZE	CONTACT BARREL SIZE	SYMBOL
37	02	I	1	TWX	TWX	
			4	4	4	
			5	12	12	
			10	16	16	
			12	22	22	

Note:
Size 22 AWG contacts only will be reversed from electrical contact type identifier.
See exception in paragraph 5.1.2 and paragraph C.1.2.

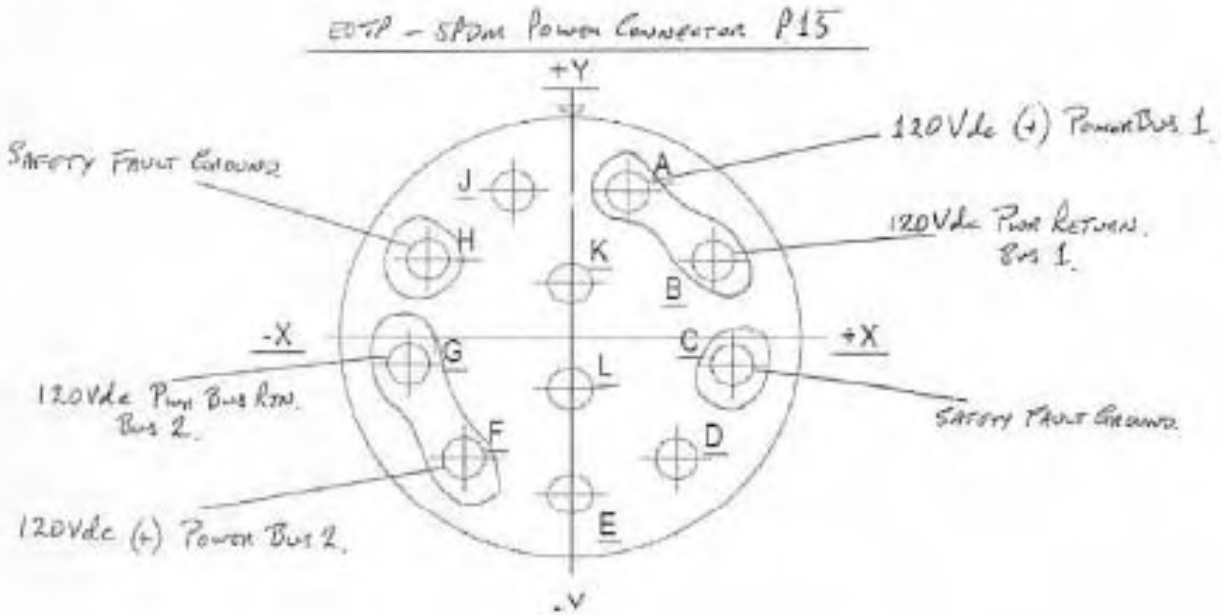
E319-101

Connector "P15".

EOTP / SPDM Interface.

Connector Spec: SSQ21635.

Pt. No: NZGL06G2121N11PN.



INSERT ARRANGEMENT 21-11
CONTACT LOCATION
(Ref. MIL-STD-1560)
11 size 12 Contacts

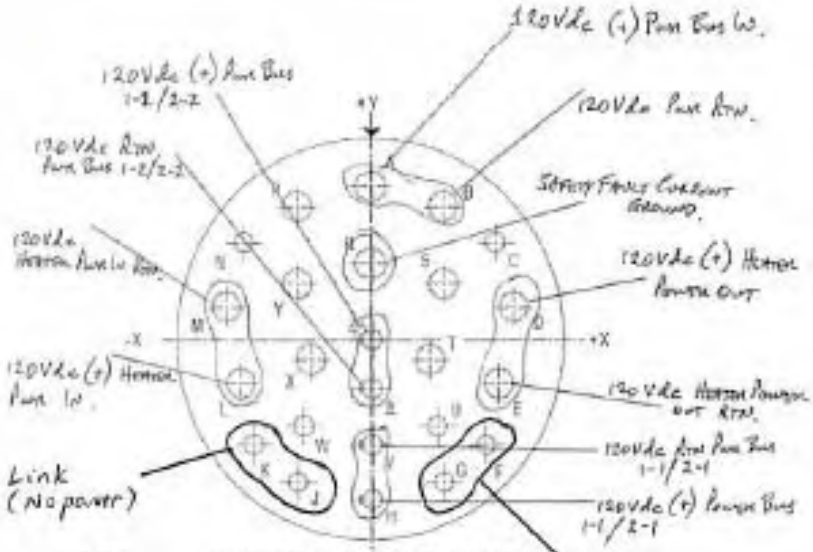
Connectors "J3"and "J4".

Fuse Connectors.

(Harness side)

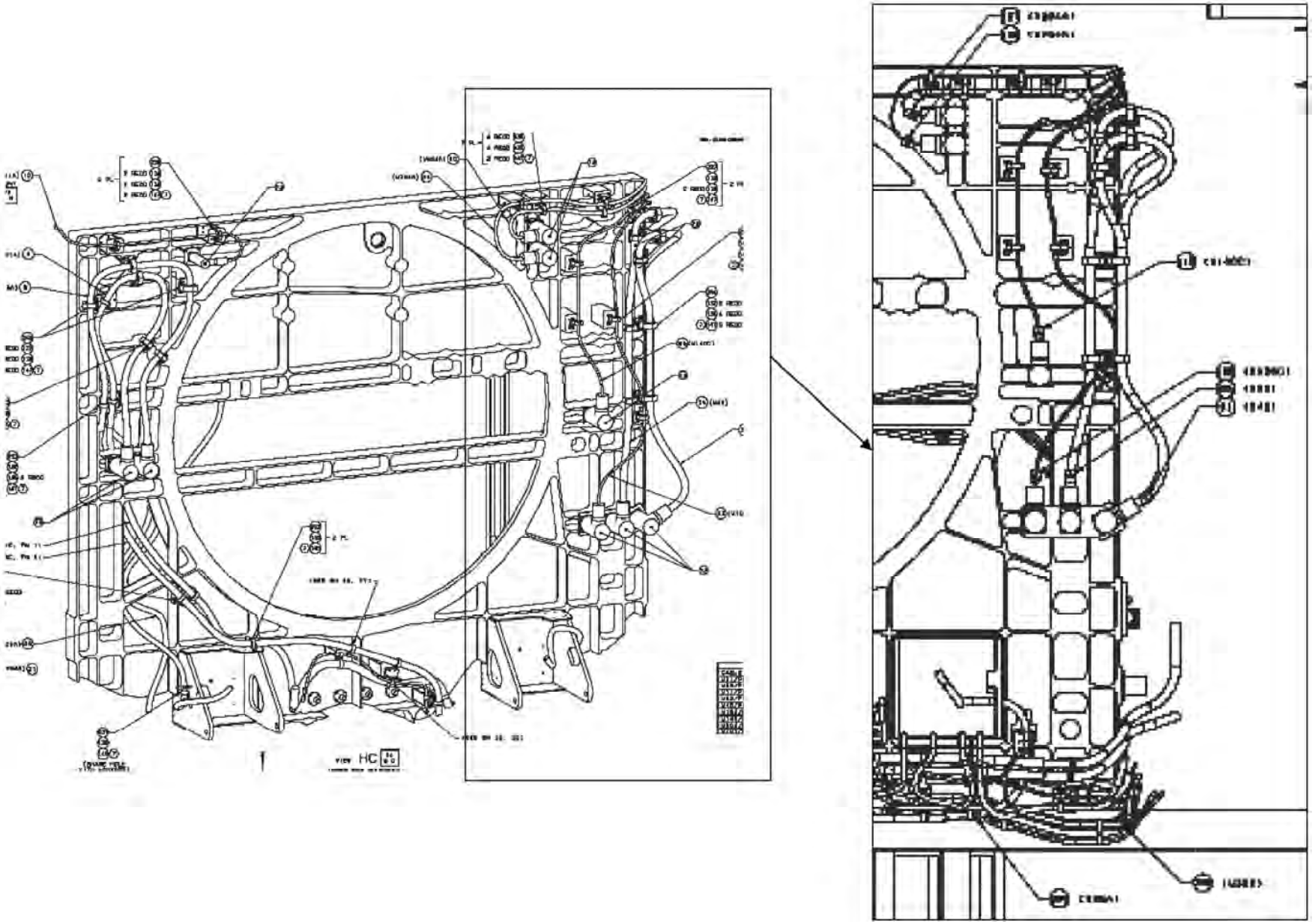
Connector Spec: SSQ21635.
Pt. No: NZGL00T2525N24SN.

FUSE CONNECTOR P1.



5-20 INSERT ARRANGEMENT 25-24
CONTACT LOCATION
(Ref. MIL-STD-1560)
12 size 16 & 12 size 12 Contacts

Z1 FWD



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Space Shuttle Program
FLIGHT DATA FILE

JSC-48024-132
FINAL

EVA CHECKLIST

STS 132

Flight Cover (trim bottom to expose tabs)